LAB 4 NEO4J

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Module : ADIF82

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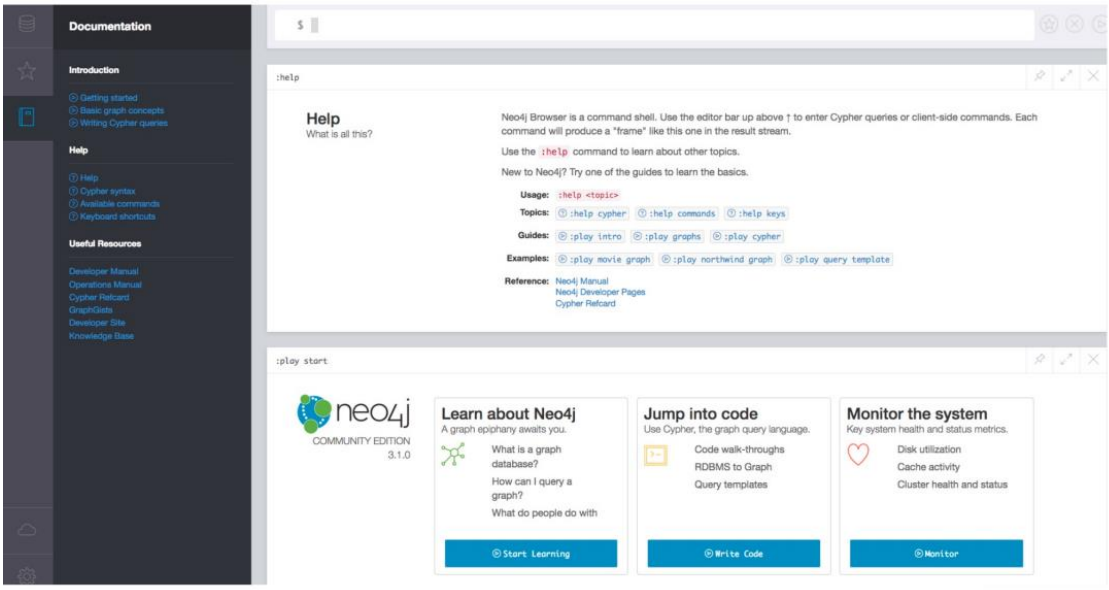
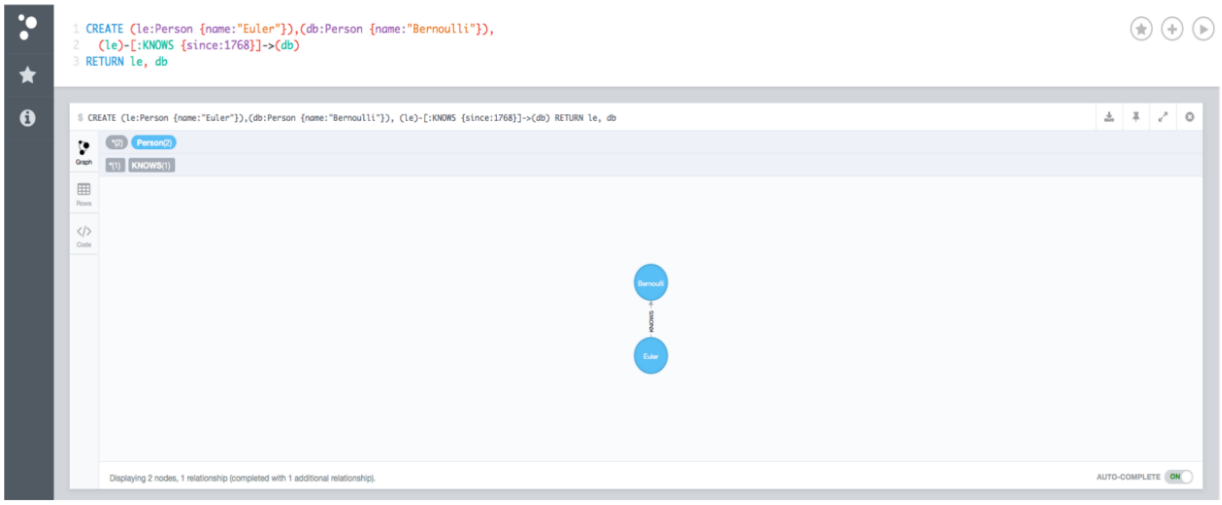
NEO4J Browser

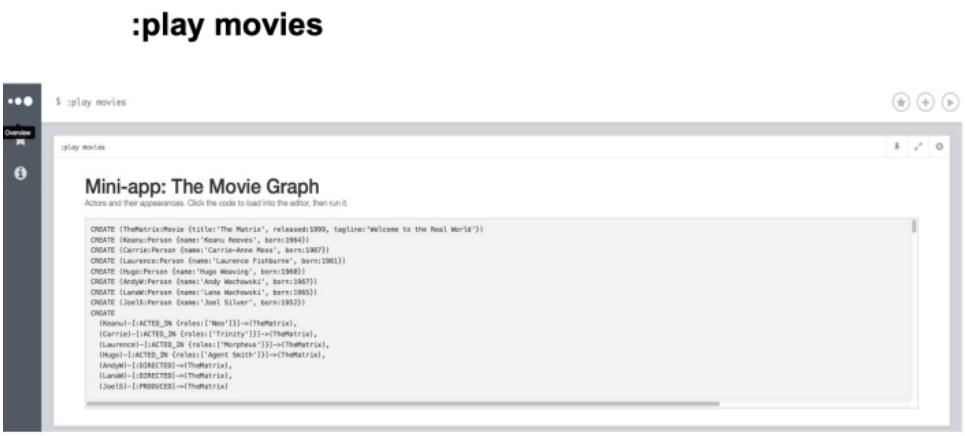
Help



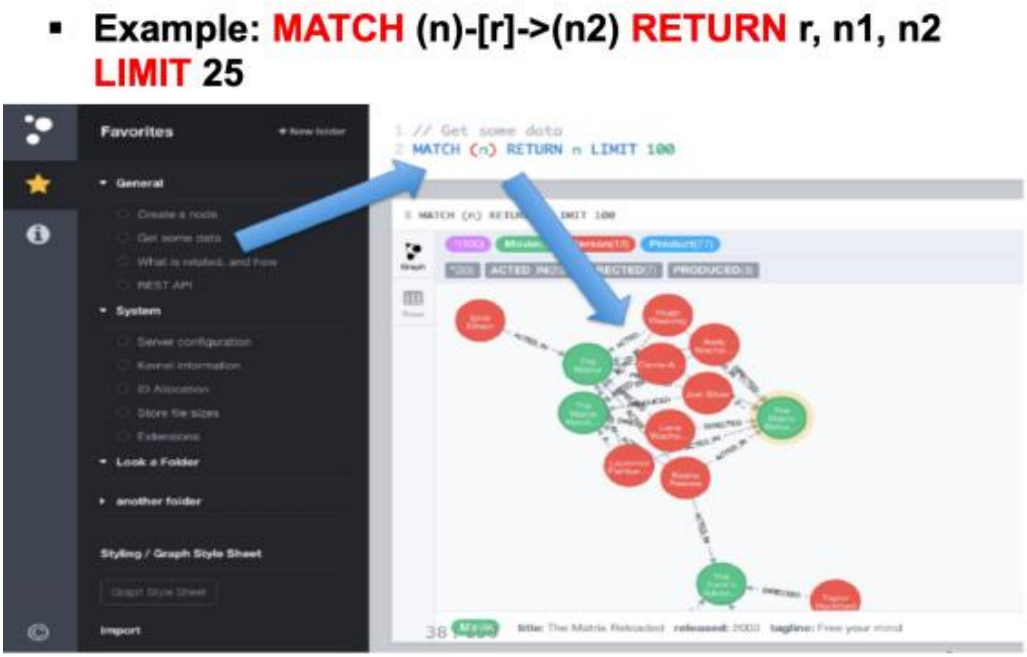
Queries And Visualization



Import dataset



Neo4J browser – Display Data



MATCH (n)-[r]->(n2) RETURN r, n, n2 LIMIT 25

MATCH est une clause utilisée pour spécifier un motif dans le graphique Neo4J. Le motif ici (n)-[r]->(n2) cherche des relations r où un nœud n est connecté à un autre nœud n2. Le -[]-> indique une relation dirigée partant de n et allant vers n2.

RETURN spécifie ce qui doit être retourné par la requête. Dans ce cas, r, n1, et n2 devraient être retournés.

LIMIT 25 est une clause qui limite le nombre de résultats retournés par la requête. Ici, elle est configurée pour retourner seulement les 25 premières relations trouvées qui correspondent au motif.

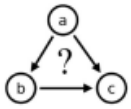
Cours

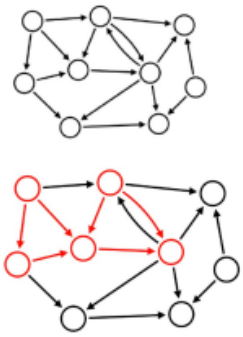
Introduction to Cypher

Cypher - definition

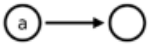
- Neo4j Query language
- Pattern-Matching Declarative Language
- SQL-Like
- Suitable for graphs

Principle



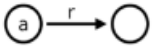


Two Nodes, One Relationship



(a)--> ()

```
MATCH (a) --> ()
RETURN a.name
```



(a)-[r]-> ()

```
MATCH (a) –[r]-> ()
RETURN a.name, type(r)
```

Optional Match

- We look for the node a with its relationships if they exist

```
OPTIONAL MATCH (a) –[r]-> ()
RETURN a.name, type(r)
```

Two Nodes, A Known Relatioship

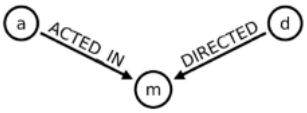
(a)-[:ACTED_IN]-> (m)

MATCH (a) –[:ACTED_IN]-> (m)
RETURN a.name, m.title

- **Returning the properties of the relations**

MATCH (a) –[r:ACTED_IN]-> (m)
RETURN a.name,r.roles, m.title

Paths



- **MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)**
- **RETURN a.name, m.title, d.name**

Queries On « Movies » Example (1/3)

- **Display the actor « Tom Hanks »**

MATCH (tom {name: "Tom Hanks"}) RETURN tom

- **Display the movie which title is « Cloud Atlas »**

MATCH (cloudAtlas {title: "Cloud Atlas"}) RETURN cloudAtlas

- **Display 10 persons**

MATCH (people:Person) RETURN people.name LIMIT 10

- **Display movies released in the '90s**

MATCH (nineties:Movie) WHERE nineties.released > 1990 AND nineties.released < 2000 RETURN nineties.title

- **Which actors have played in the same movie as Tom Hanks?**

MATCH (tom:Person {name:"Tom Hanks"})-[:ACTED_IN]->(m)<-[:ACTED_IN]-(coActors) RETURN coActors.name

Queries on « Movies »

- **Display Tom Hanks' movies**
- **Who directed the film "Cloud Atlas"?**
- **Which director also played in a movie?**

```
MATCH (tom:Person {name: "Tom Hanks"})-[:ACTED_IN]->(tomHanksMovies)
    RETURN tom,tomHanksMovies

MATCH (cloudAtlas {title: "Cloud Atlas"})<-[:DIRECTED]-(directors) RETURN
    directors.name

MATCH (tom:Person {name:"Tom Hanks"})-[:ACTED_IN]->(m)<-[:ACTED_IN]-
    (coActors) RETURN coActors.name

MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (a)
RETURN a.name, m.title

How people are related to "Cloud Atlas"...
MATCH (people:Person)-[relatedTo]-(:Movie {title: "Cloud Atlas"}) RETURN
    people.name, Type(relatedTo), relatedTo
```

Queries On « Movies » Example (2/3)

```
MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)
RETURN a.name, m.title, d.name
```

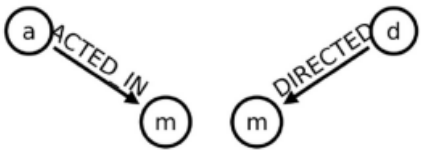
a.name	m.title	d.name
"Keanu Reeves"	"The Matrix"	"Andy Wachowski"
"Keanu Reeves"	"The Matrix Reloaded"	"Andy Wachowski"
"Noah Wyle"	"A Few Good Men"	"Rob Reiner"
"Tom Hanks"	"Cloud Atlas"	"Andy Wachowski"

Alias

```
MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)
RETURN a.name AS actor , m.title AS movie, d.name
AS director
```

actor	movie	director
"Keanu Reeves"	"The Matrix"	"Andy Wachowski"
"Keanu Reeves"	"The Matrix Reloaded"	"Andy Wachowski"
"Noah Wyle"	"A Few Good Men"	"Rob Reiner"
"Tom Hanks"	"Cloud Atlas"	"Andy Wachowski"

More Queries



1st way

```
MATCH (a) –[:ACTED_IN]-> (m), (m) <-[:DIRECTED] – (d)
RETURN a.name, m.title, d.name
```

2nd way:

```
MATCH (a) –[:ACTED_IN]-> (m), (d) -[:DIRECTED] –> (m)
RETURN a.name, m.title, d.name
```

Aggregation Functions

- **Count(x) – The number of occurrences**
- **Min(x) – minimum value**
- **Max(x) – maximum value**
- **Avg(x) – average**
- **Sum(x) – sum**
- **Collect(x) – Aggregates data in a table**

Example – count(*)

```
MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)
RETURN a.name, d.name, count(*)
```

a.name	d.name	count(*)
"Aaron Sorkin"	"Rob Reiner"	2
"Keanu Reeves"	"Andy Wachowski"	3
"Hugo Weaving"	"Tom Tykwer"	1

```
MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)
RETURN a.name AS actor, d.name AS director , count(m)
AS count
```

SORT And limit

```
MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)
RETURN a.name AS actor, d.name AS director ,
count(m) AS count
ORDER BY count DESC
LIMIT 5
```

Aggregation- collect

Aggregation - collect

```
MATCH (a) –[:ACTED_IN]-> (m) <-[:DIRECTED] – (d)
RETURN a.name AS actor, d.name AS director ,
collect (m.title) AS list
```

Find all the nodes

```
MATCH (n)
RETURN n
```

Directors who directed movies with Tom Hanks as actor

```
MATCH (tom:Person) – [:ACTED_IN] ->
(movie:Movie), (director:Person) – [:DIRECTED] ->
(movie:Movie)
WHERE tom.name="Tom Hanks"
RETURN director.name
```

director.name
Mike Nichols
Robert Zemeckis
Penny Marshall
Robert Zemeckis
Ron Howard
Frank Darabont
Ron Howard

DISTINCT

```
MATCH (tom:Person) – [:ACTED_IN] ->
(movie:Movie), (director:Person) – [:DIRECTED] ->
(movie:Movie)
WHERE tom.name="Tom Hanks"
RETURN DISTINCT director.name
```

Index Creation

- The 'Person' nodes, indexed by their 'name'

```
CREATE INDEX ON :Person(name)
```

- The nodes 'Movie', indexed by their 'title'

```
CREATE INDEX ON :Movie(title)
```

Conditions

- Find movies where Tom Hanks and Kevin Bacon played

- MATCH (tom:Person) –[:ACTED_IN] -> (movie), (kevin:Person)-[:ACTED_IN]->(movie)
- WHERE tom.name="Tom Hanks " AND kevin.name= "Kevin Bacon"
- RETURN movie.title

Conditions on the properties

- The films where Keanu Rives played the role of "Neo »

```
MATCH (actor:Person) –[r:ACTED_IN] -> (movie)
WHERE actor.name= ”Keanu Reeves " AND  ”Neo ”
   IN (r.roles)
RETURN movie.title
```

- 2nd solution:

```
MATCH (actor:Person) –[r:ACTED_IN] -> (movie)
WHERE actor.name= ”Keanu Reeves " AND ANY( x
   IN r.roles WHERE x=‘’Neo”)
RETURN movie.title
```

Conditions with comparison

- **Find actors who have played with Tom Hanks and who are older than him**

```
MATCH (tom:Person) –[r:ACTED_IN] -> (movie),
   (a:Person)-[:ACTED_IN]->(movie)
WHERE tom.name= ”Tom Hanks "
   AND a.born < tom.born
RETURN DISTINCT a.name, (tom.born-a.born) AS
   diff
```

Conditions on patterns (1/2)

- **Actors who have worked with Gene Hackman and who have previously directed films (are also directors)**

```
MATCH (gene:Person)-[:ACTED_IN]->(movie),
        (n)-[:ACTED_IN]->(movie)
WHERE gene.name=“Gene Hackman”
        AND (n)-[:DIRECTED]->()
RETURN DISTINCT n.name
```

Conditions on patterns (2/2)

- **Actors who worked with " Keanu Rives ", but not when he played with " Hugo Weaving ”**

```
MATCH (keanu:Person)-[:ACTED_IN]->(movie),
        (n)-[:ACTED_IN]->(movie),
        (hugo:Person)
WHERE keanu.name=« Keanu Reeves » AND
        hugo.name=« Hugo Weaving »
        AND NOT (hugo)-[:ACTED_IN]->(movie)
RETURN DISTINCT n.name
```

String Comparison

```
MATCH (a) –[:ACTED_IN]-> (matrix:Movie)
WHERE matrix.title='The Matrix' AND a.name
CONTAINS 'Emil'
RETURN a.name
```

- **=~ "regexp »**

CONTAINS
STARTS WITH
ENDS WITH

Exercise 1

- **Display 5 directors who have directed the largest number of films**

Table

```
MATCH (d:Person)-[:DIRECTED]->(m:Movie)
RETURN d.name, count(m) as films_directed
ORDER BY films_directed DESC
LIMIT 5
```

	d.name	films_directed
1	"Lilly Wachowski"	25
2	"Lana Wachowski"	25
3	"Ron Howard"	15
4	"Rob Reiner"	15
5	"Nora Ephron"	10

Started streaming 5 records after 2 ms and completed after 3 ms.

Text

d.name	films_directed
"Lilly Wachowski"	25
"Lana Wachowski"	25
"Ron Howard"	15
"Rob Reiner"	15
"Nora Ephron"	10

Explication de la requête

MATCH (d:Person)-[:DIRECTED]->(m:Movie)

RETURN d.name, count(m) as films_directed

ORDER BY films_directed DESC

LIMIT 5

Recherche les nœuds avec le label Person qui ont une relation DIRECTED vers un nœud avec le label Movie. Cela correspond aux réalisateurs et aux films qu'ils ont dirigés.

Retourne le nom du réalisateur et le nombre de films qu'ils ont dirigés, avec une variable films_directed.

Ordonne les résultats par films_directed en ordre décroissant.

Limite le nombre de résultats à 5 pour ne retourner que les cinq premiers réalisateurs.

Cours 2

Update With CYPHER

Node creation

```
CREATE (p:Person {name: 'Me'})
```

```
MATCH (p:Person)
WHERE p.name='Me'
RETURN p
```

▪Example with 2 properties:

```
CREATE (m:Movie {title: 'Mystic River', released:
1993})
```

Creation with MERGE

```
MERGE (p:Person {name: 'Me'})
RETURN p
```

•Guarantees unique creation
With some options:

```
MERGE (p:Person {name: 'Me'})
ON CREATE SET p.created=timestamp()
ON MATCH SET p.accessed= colaesce(p.accessed,0)+1
RETURN p
```

ON CREATE SET – Executed when creating
ON MATCH SET – Executed when Matching

Adding properties

```
MATCH (p:Person)
WHERE p.name='Me'
//Add property
SET p.born='1980'
RETURN p
```

Modifying properties

```
MATCH (p:Person)
WHERE p.name='Me'
//ajout de la propriété
SET p.born='1985'
RETURN p
```

Adding Relationships

```
MATCH (movie:Movie),(kevin:Person)
WHERE movie.title='Mystic River' AND kevin.name='Kevin Bacon'
//creation of relationship
MERGE (kevin) –[:ACTED_IN {roles:['Sean']}]-> (movie)
```

```
MATCH (kevin)-[:ACTED_IN] -> (movie)
WHERE kevin.name ='Kevin Bacon'
RETURN movie.title
```

Modifying a Relationship Property

- Change the role of Kevin Bacon in the movie Mystic River from "Sean" to "Sean Devine »

```
MATCH (kevin:Person)-[r:ACTED_IN] -> (movie:Movie)
WHERE kevin.name ='Kevin Bacon' and movie.title='Mystic River'
SET r.roles=['Sean Devine']
RETURN r.roles
```

Delete a Node

```
MATCH (emil:Person)
WHERE emil.name = 'Emil Eifrem'
DELETE emil
```

- The relationships still exist

```
MATCH (emil:Person) –[r]-()
WHERE emil.name = 'Emil Eifrem'
DELETE r
```

Deleting nodes and all relationships

```
OPTIONAL MATCH (emil) –[r]-()
where emil.name = "Emil Eifrem"
DELETE emil, r
```

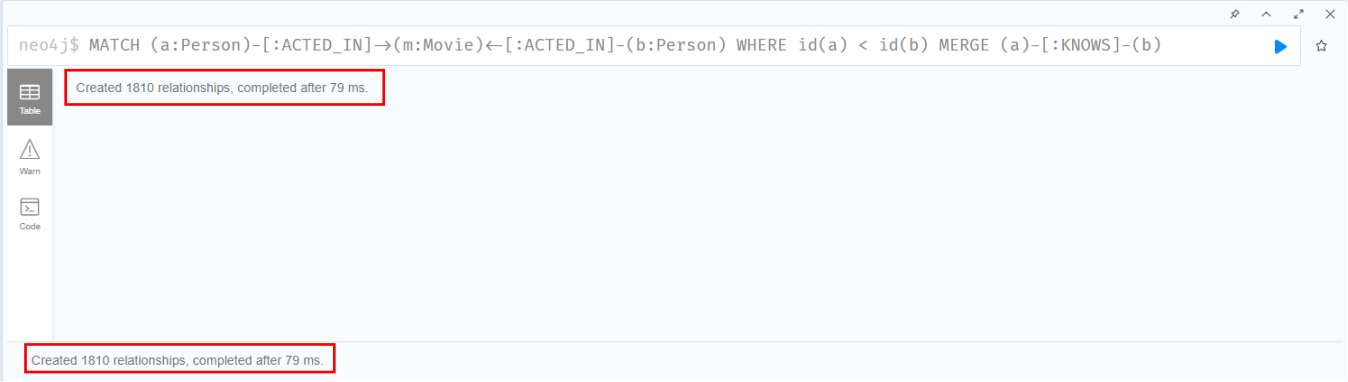
- Deleting all content from the database

```
MATCH (n)
OPTIONAL MATCH (n) –[r]-()
DELETE n, r
```

Exercise 2

- **Add the KNOWS relationship between all the actors in the same movie**

Table



Explication de la requête

MATCH (a:Person)-[:ACTED_IN]->(m:Movie)<-[:ACTED_IN]-(b:Person)

WHERE id(a) < id(b)

MERGE (a)-[:KNOWS]-(b)

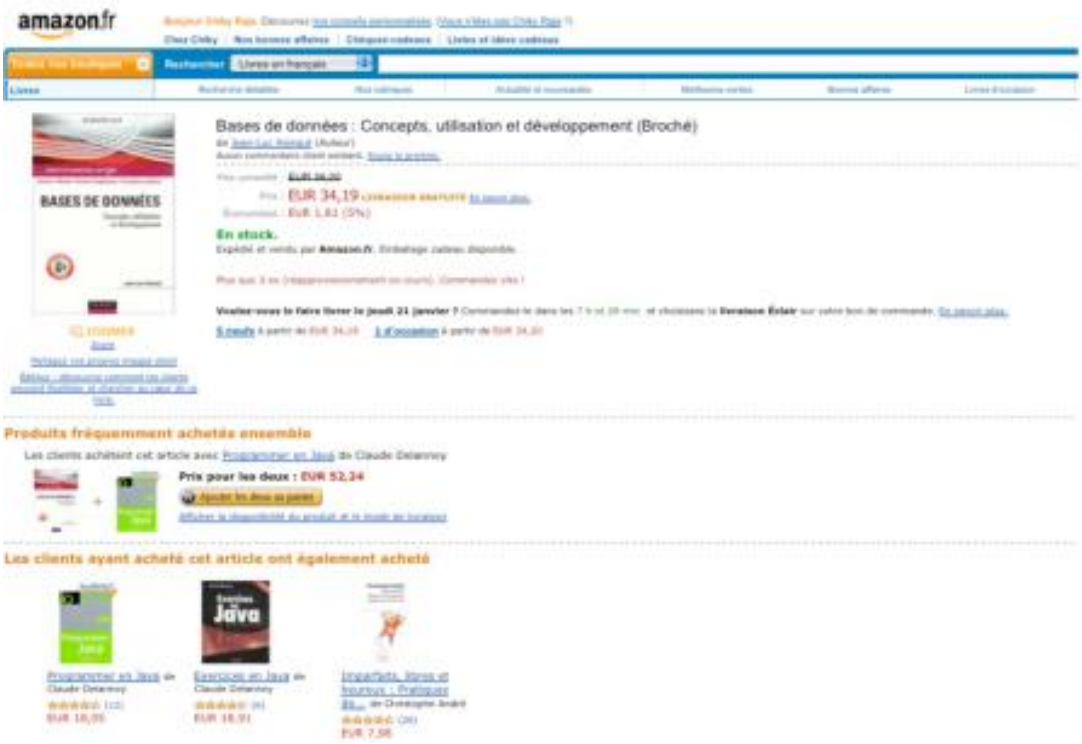
MATCH (a:Person)-[:ACTED_IN]->(m:Movie)<-[:ACTED_IN]-(b:Person) trouve toutes les paires d'acteurs (a) et (b) qui ont joué dans le même film (m).

WHERE id(a) < id(b) s'assure que chaque paire est traitée une seule fois et évite de créer des doublons de relations (car sans cette condition, vous créeriez deux relations KNOWS entre les mêmes acteurs, une dans chaque direction).

MERGE (a)-[:KNOWS]-(b) crée la relation KNOWS entre les acteurs s'il n'en existe pas déjà une.

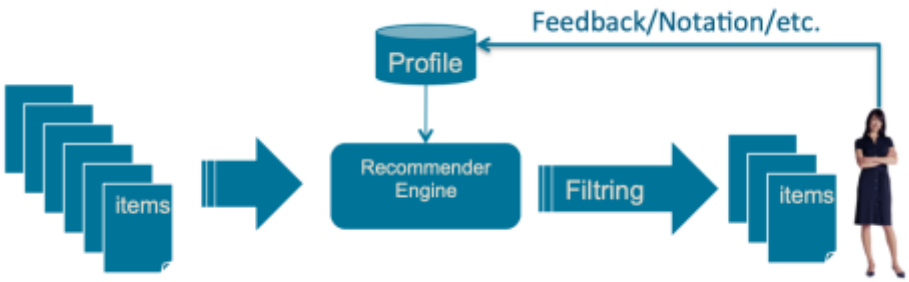
Recommandation

Recommendations : Overview

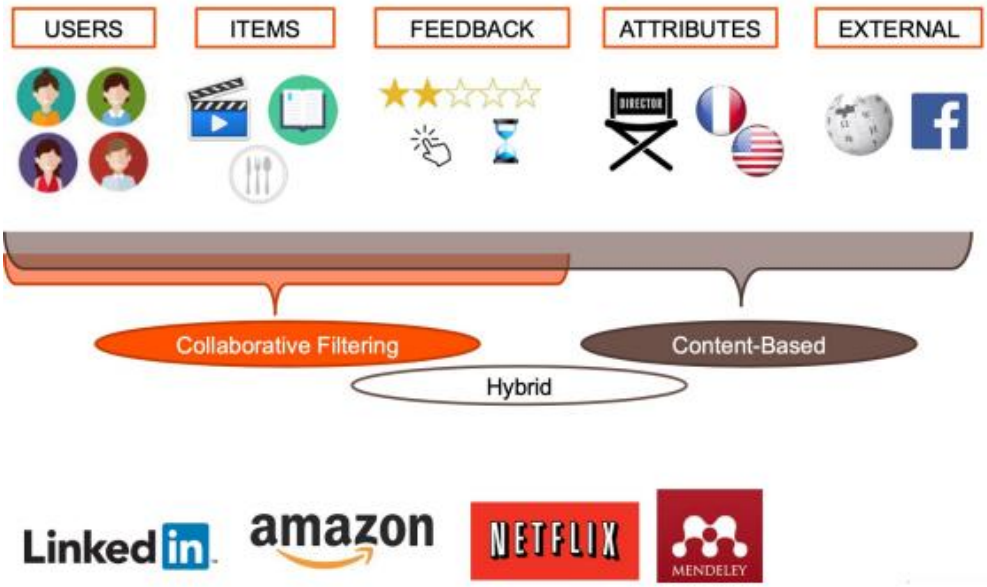


Definition

- **Recommend= "strongly advise something to someone"**
  Recommnder system system: a variety of processes aimed at providing information to people in line with their interests.



Recommender Systems



Two categories

- **Content-based systems**
  - It is based on the content of the elements visited and look for similarities. The content (documents, articles, etc.) are composed of feature vectors and the similarity calculations are done according to these vectors
- **Collaborative filtering systems**
  - Predict the preferences of articles / objects of users taking into account opinions (notes, votes, etc.) made by "similar" users

Recommendation and graphs

- **Items / users and their characteristics can be represented by nodes**
- **The relations between the users, the items, the users-items can be represented naturally by the relationships in a graph**
- **The recommendation logic can be implemented in a graph DB**

Exercice 3

- **Recommend 3 actors with whom Keanu Reeves could work but this has never been the case**

Table

```
MATCH (keanu:Person {name: 'Keanu Reeves'})-[:ACTED_IN]→(m:Movie)
WITH keanu, collect(m) AS keanuMovies
MATCH (actor:Person)-[:ACTED_IN]→(m2:Movie)
WHERE NOT m2 IN keanuMovies AND actor <> keanu
WITH actor, COUNT(m2) AS moviesCount
RETURN actor.name AS Recommended_Actor
ORDER BY moviesCount DESC
LIMIT 3
```

	Recommended_Actor
1	"Tom Hanks"
2	"Tom Hanks"
3	"Tom Hanks"

Started streaming 3 records after 1 ms and completed after 6 ms.

Text

```
╒═══════════════════╕
│Recommended_Actor  │
├───────────────────┤
│"Tom Hanks"        │
├───────────────────┤
│"Tom Hanks"        │
├───────────────────┤
│"Tom Hanks"        │
└───────────────────┘
```

Explication de la requête

MATCH (keanu:Person {name: 'Keanu Reeves'})-[:ACTED_IN]->(m:Movie)

WITH keanu, collect(m) AS keanuMovies

MATCH (actor:Person)-[:ACTED_IN]->(m2:Movie)

WHERE NOT m2 IN keanuMovies AND actor <> keanu

WITH actor, COUNT(m2) AS moviesCount

RETURN actor.name AS Recommended_Actor

ORDER BY moviesCount DESC

LIMIT 3

D'abord, elle trouve tous les films dans lesquels Keanu Reeves a joué et les collecte dans une liste.

Ensuite, elle trouve tous les autres acteurs qui ont joué dans des films, en excluant les films dans lesquels Keanu Reeves a joué.

Puis, elle regroupe les résultats par acteur et compte le nombre de films pour chaque acteur.

Elle retourne les noms des acteurs qui ont joué dans le plus grand nombre de films distincts de ceux de Keanu Reeves.

Enfin, elle limite les résultats aux trois premiers acteurs.

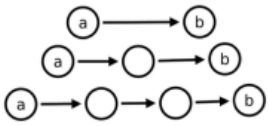
Go futher

Matching many relationships

```
MATCH (a)-[:ACTED_IN|:DIRECTED]->()<-
[:ACTED_IN|:DIRECTED]-(b)
MERGE (a)-[:KNOWS]-(b);
```

(Creation of the KNOWS relationship between the actors and directors who worked together)

Path with variable length



(a)-[*n]->(b)

- **Friends of friends:**

```
MATCH (keanu:Person)-[:KNOWS*]->(fof)
WHERE keanu.name="Keanu Reeves" AND NOT
(keanu)-[:KNOWS]-(fof)
RETURN DISTINCT fof.name;
```

Length of the relationship

```
MATCH p=shortestpath((keanu:Person)-[:KNOWS*]-
>(demi:Person))
WHERE keanu.name="Keanu Reeves" AND NOT
demi.name="Demi moore"
RETURN length(rels(p));
```