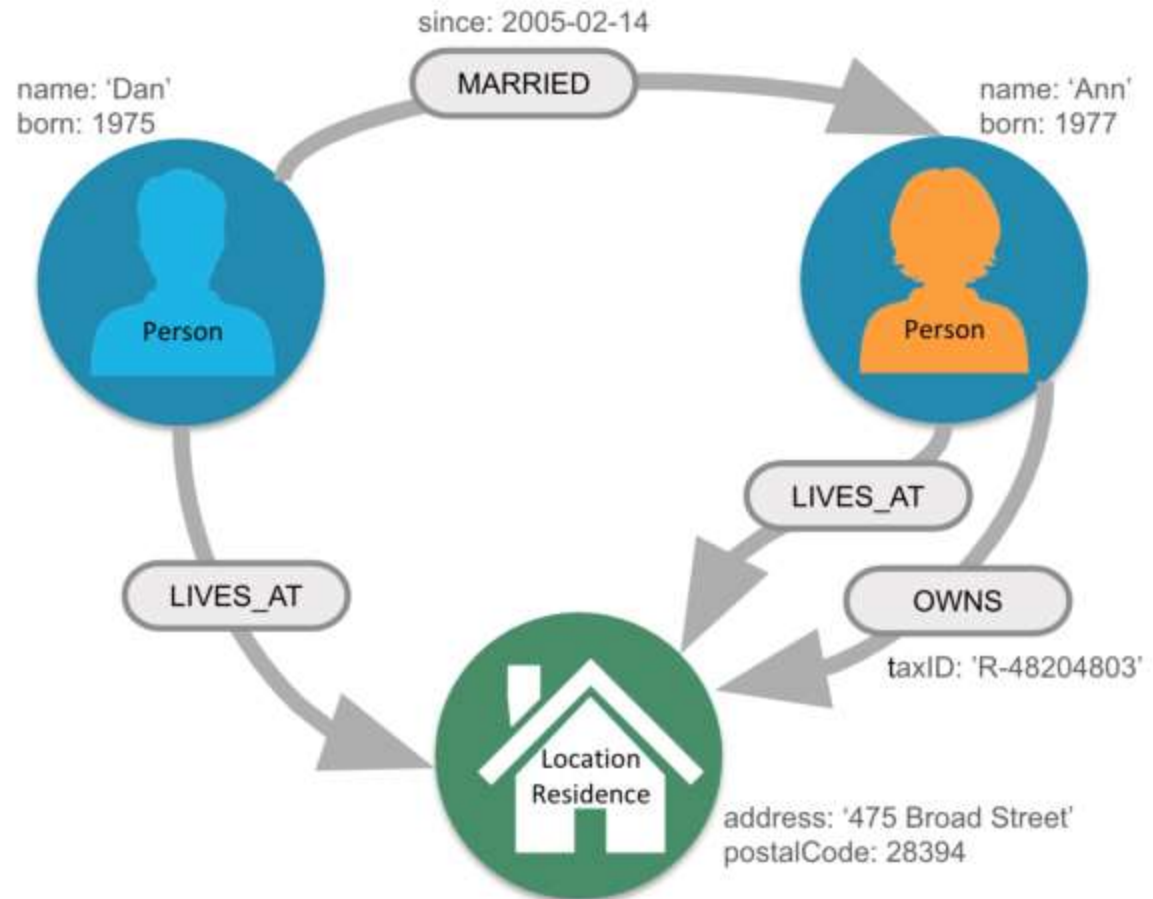


Labeled Property Graph

- Enthält Knoten (Nodes) und Beziehungen (Relationships)
- Knoten haben Eigenschaften (Properties, Key Value Pairs)
- Knoten sind markiert (labeled, one ore more Labels)
- Beziehungen haben Typen, sind markiert, gerichtet und haben einen Start- und Endknoten
- Beziehungen haben Eigenschaften

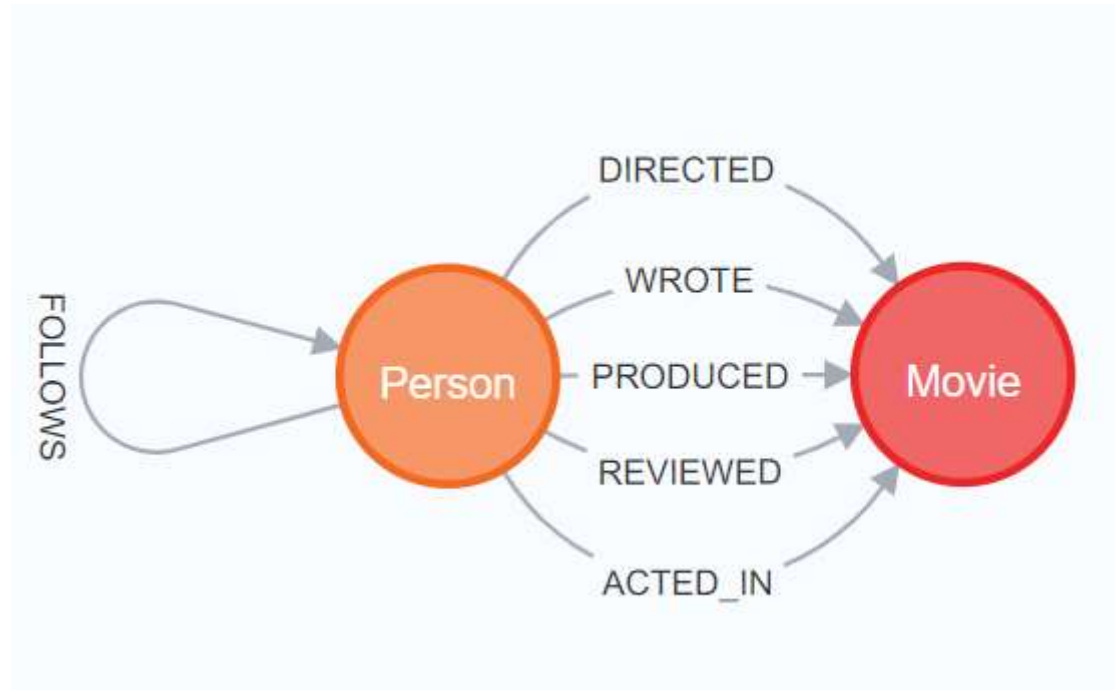


Übernommen aus:

Ian Robinson, Jim Webber & Emil Eifrem
Graph Databases, Second Edition,
O'Reilly, 2015

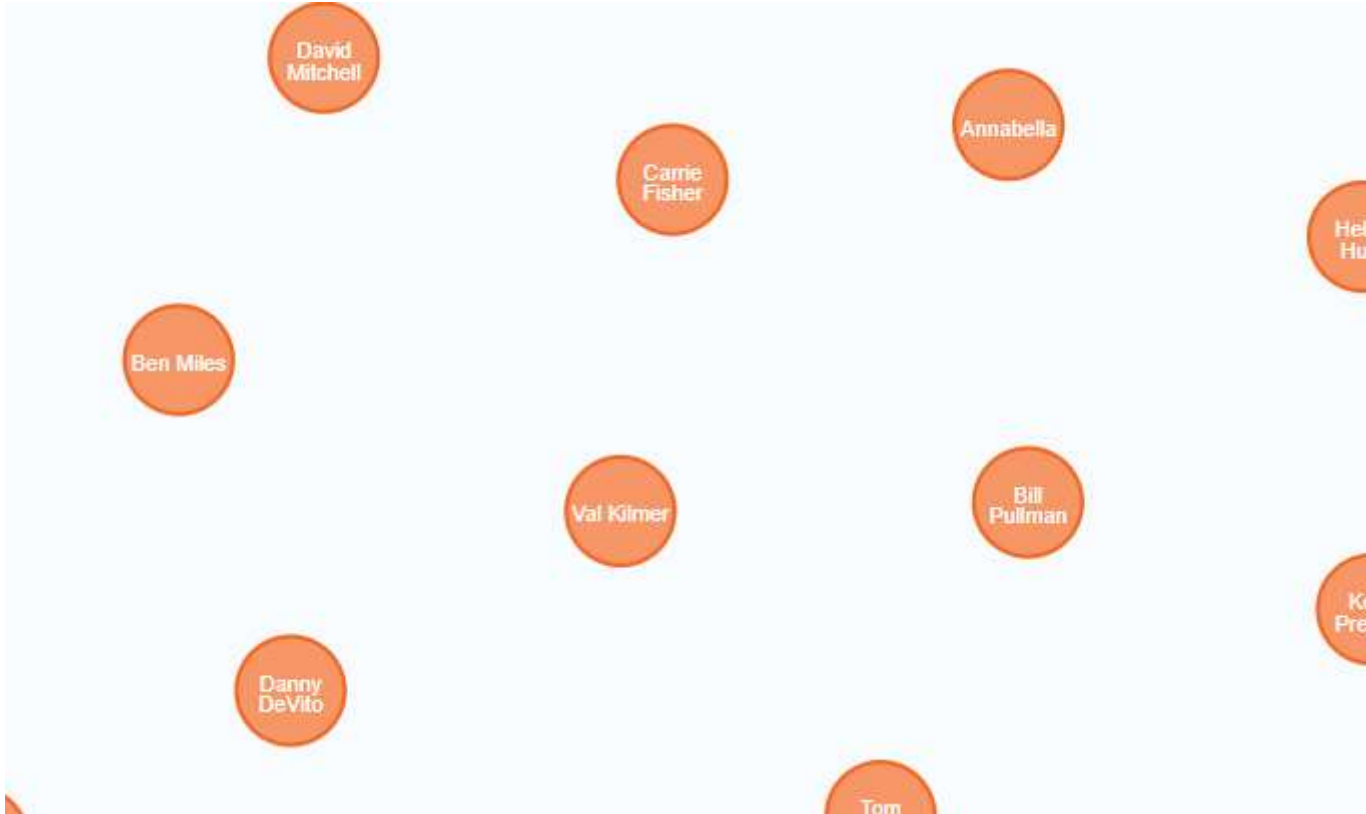
Die folgenden Folien basieren auf Material von Neo4j, welches unter folgender Lizenz zur Verfügung gestellt wird:

<https://neo4j.com/docs/license/>



MATCH (p:Person)

RETURN p



```
{  
  "identity": 41,  
  "labels": [  
    "Person"  
  ],  
  "properties": {  
    "name": "Val Kilmer",  
    "born": 1959  
  }  
}
```

```
MATCH (p:Person {born: 1970})  
RETURN p
```



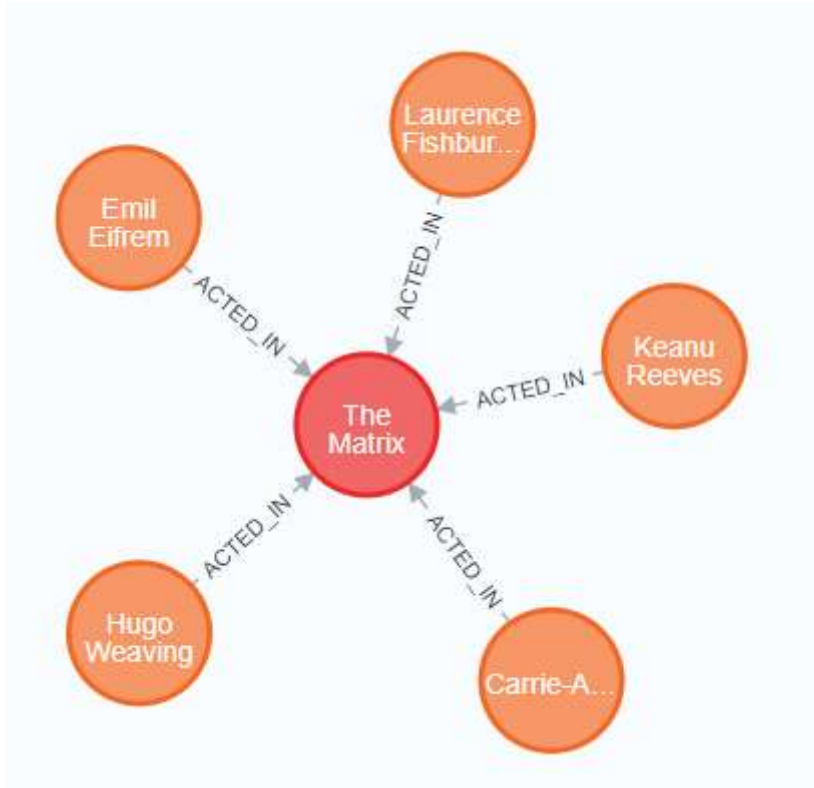
```
MATCH (m:Movie {released: 2003, tagline: 'Free your mind'})  
RETURN m
```



MATCH (p:Person {born: 1965})
RETURN p.name AS name, p.born AS birthyear

"name"	"birthyear"
"Lana Wachowski"	1965
"Tom Tykwer"	1965
"John C. Reilly"	1965

```
MATCH (p:Person)-[rel:ACTED_IN]->(m:Movie {title: 'The Matrix'})  
RETURN p, rel, m
```



```
MATCH (p:Person)-->(m:Movie {title: 'The Matrix'})  
RETURN p, m
```



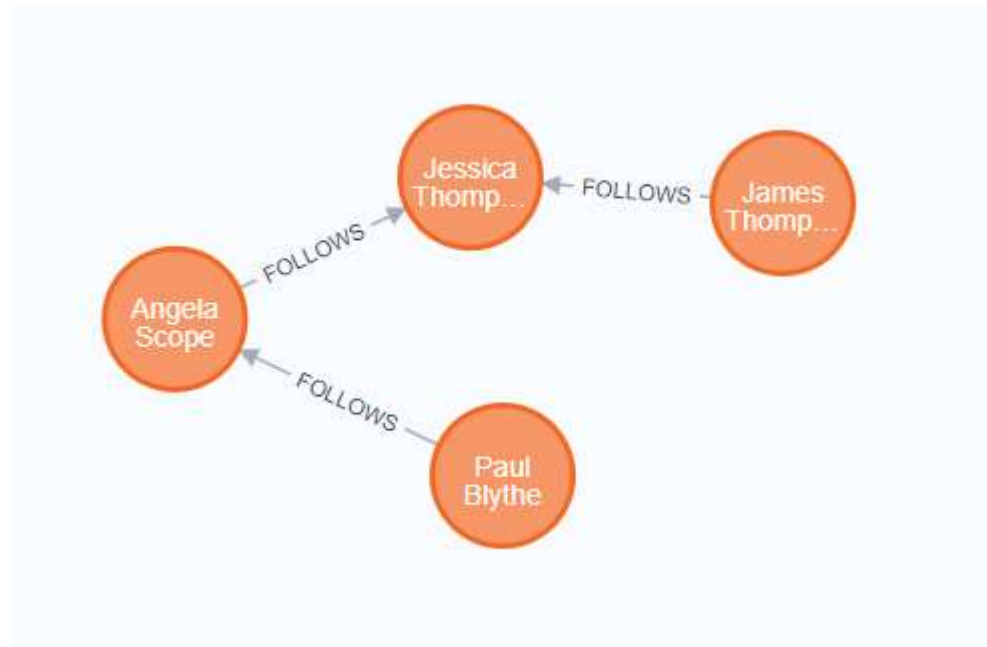

```
MATCH (p:Person {name: 'Tom Hanks'})-[r:ACTED_IN|DIRECTED]->(m:Movie)
RETURN p.name, m.title, type(r)
```

"p.name"	"m.title"	"type(r)"
"Tom Hanks"	"You've Got Mail"	"ACTED_IN"
"Tom Hanks"	"Charlie Wilson's War"	"ACTED_IN"
"Tom Hanks"	"Cast Away"	"ACTED_IN"
"Tom Hanks"	"The Green Mile"	"ACTED_IN"
"Tom Hanks"	"A League of Their Own"	"ACTED_IN"
"Tom Hanks"	"That Thing You Do"	"ACTED_IN"
"Tom Hanks"	"Apollo 13"	"ACTED_IN"
"Tom Hanks"	"The Da Vinci Code"	"ACTED_IN"
"Tom Hanks"	"Sleepless in Seattle"	"ACTED_IN"
"Tom Hanks"	"The Polar Express"	"ACTED_IN"
"Tom Hanks"	"Cloud Atlas"	"ACTED_IN"
"Tom Hanks"	"Joe Versus the Volcano"	"ACTED_IN"
"Tom Hanks"	"That Thing You Do"	"DIRECTED"

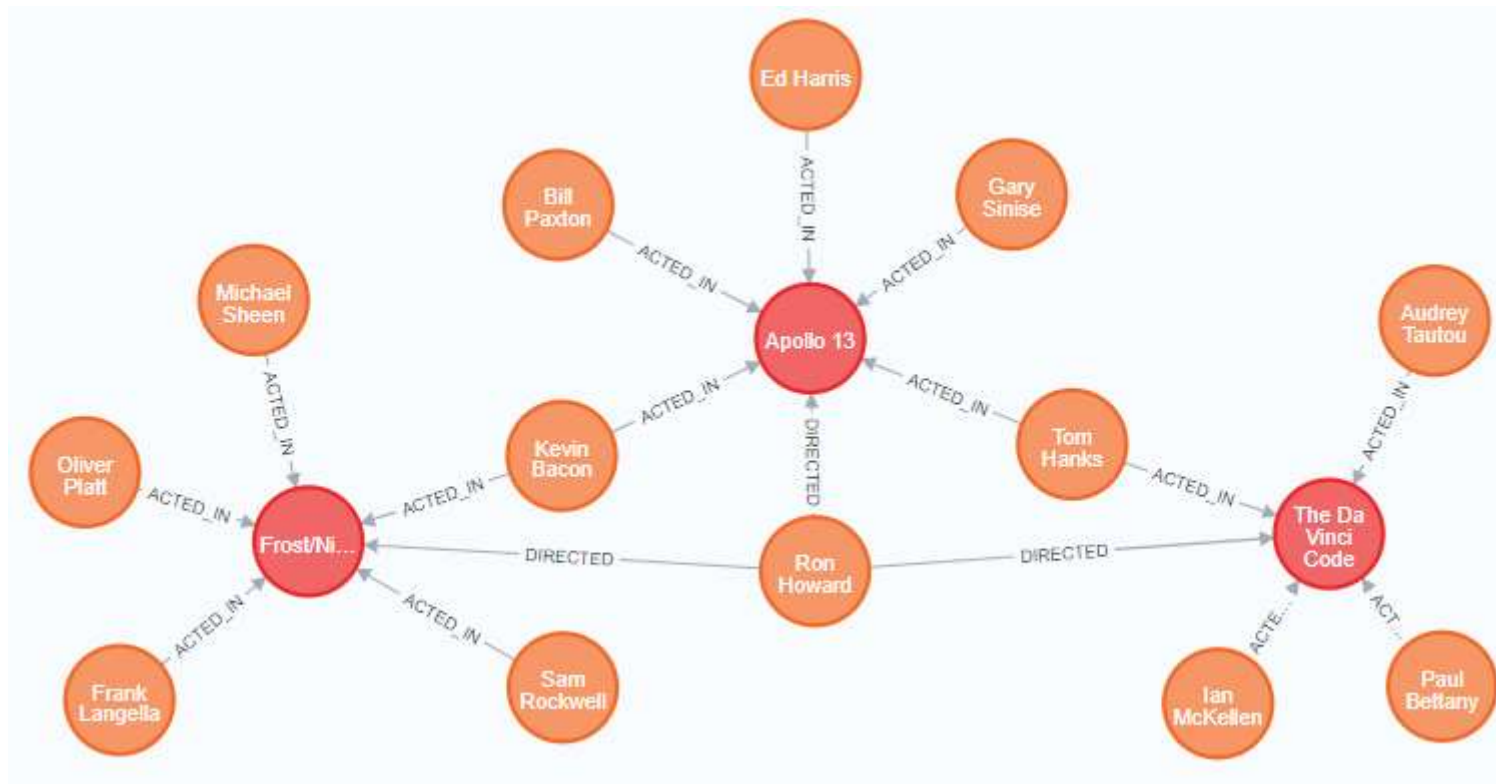
```
MATCH (p:Person)-[:REVIEWED {rating: 65}]->(m:Movie {title: 'The Da Vinci Code'})  
RETURN p.name
```

"p.name"
"James Thompson"

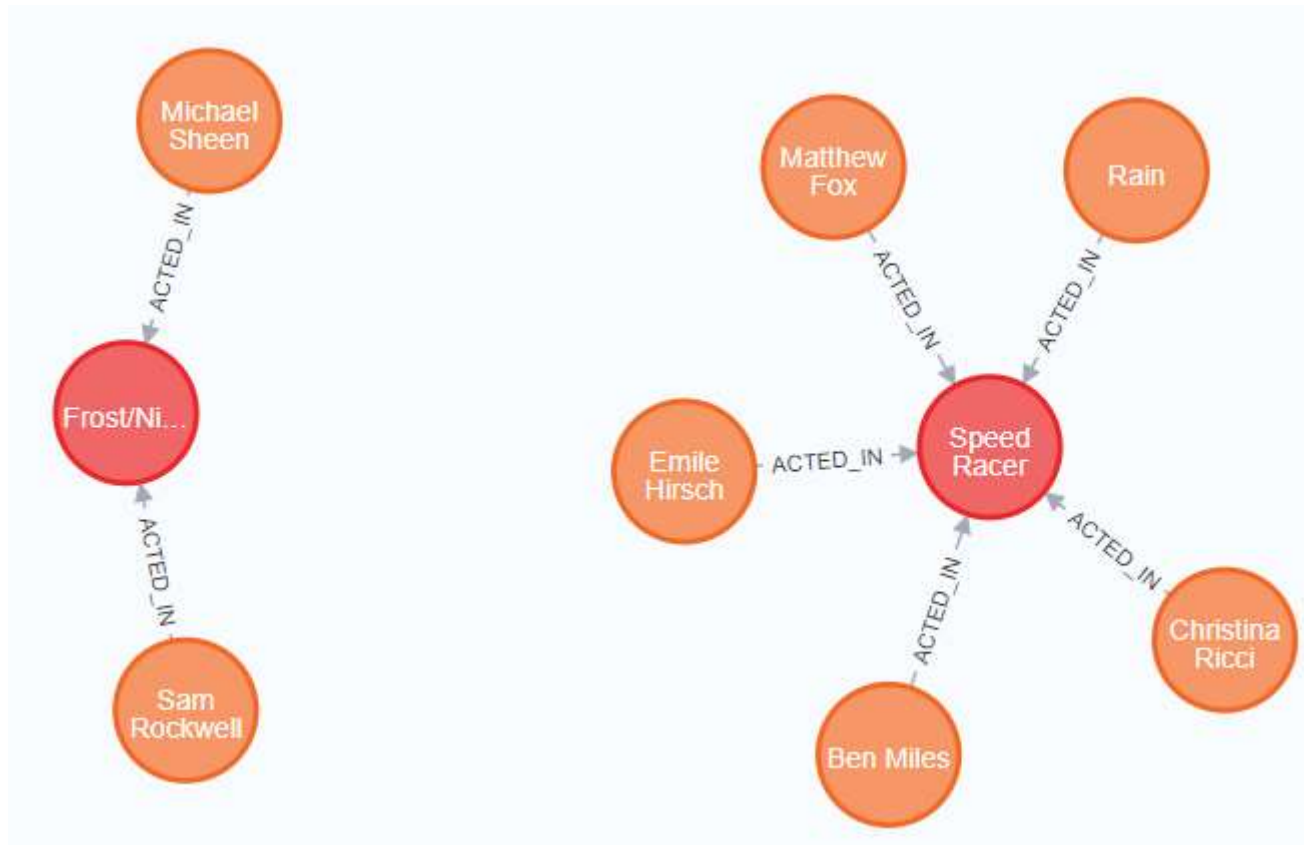
```
match path = (jt:Person {name:'James Thompson'})-[:FOLLOWS*]- (pb:Person {name:'Paul Blythe'})  
return path
```



```
MATCH path = (:Person)-[:ACTED_IN]->(:Movie)<-[:DIRECTED]-(:Person {name:'Ron Howard'})  
RETURN path
```



```
MATCH (p:Person)-[:ACTED_IN]->(m:Movie)
WHERE m.released = 2008 AND p.born > 1960
RETURN p, m
```



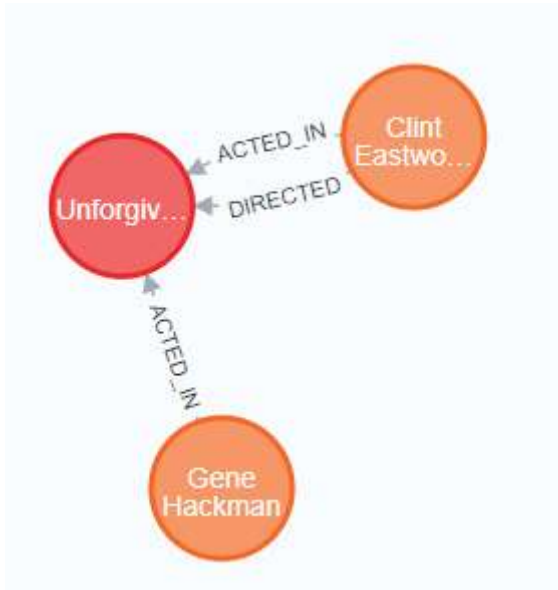
```
MATCH (p:Person)-[:ACTED_IN]->(m:Movie)
WHERE p.name='Jack Nicholson' AND m.tagline IS NOT NULL
RETURN m.title
```

"m.title"	
"A Few Good Men"	
"As Good as It Gets"	
"Hoffa"	
"One Flew Over the Cuckoo's Nest"	

```
MATCH (p:Person)
WHERE p.name =~ 'Tom.*'
RETURN p.name
```

"p.name"
"Tom Cruise"
"Tom Skerritt"
"Tom Hanks"
"Tom Tykwer"

```
MATCH (gene:Person)-[:ACTED_IN]->(m:Movie)<-[:ACTED_IN]-(other:Person)
WHERE gene.name= 'Gene Hackman'
AND exists( (other)-[:DIRECTED]->(m) )
RETURN gene, other, m
```




```
MATCH (p:Person)-[r:ACTED_IN]->(m:Movie)
WHERE 'Neo' IN r.roles AND m.title='The Matrix'
RETURN p.name
```

"p.name"
"Keanu Reeves"

```
MATCH (p:Person)-[r:ACTED_IN]->(m:Movie)
WHERE size(r.roles)=3
RETURN p.name, m.title, r.roles
```

"p.name"	"m.title"	"r.roles"
"Meg Ryan"	"Joe Versus the Volcano"	["DeDe", "Angelica Graynamore", "Patricia Graynamore"]
"Jim Broadbent"	"Cloud Atlas"	["Vyvyan Ayr", "Captain Molyneux", "Timothy Cavendish"]

MATCH

```
(meg:Person)-[:ACTED_IN]->(m:Movie)<-[:DIRECTED]-(d:Person),  
(other:Person)-[:ACTED_IN]->(m)
```

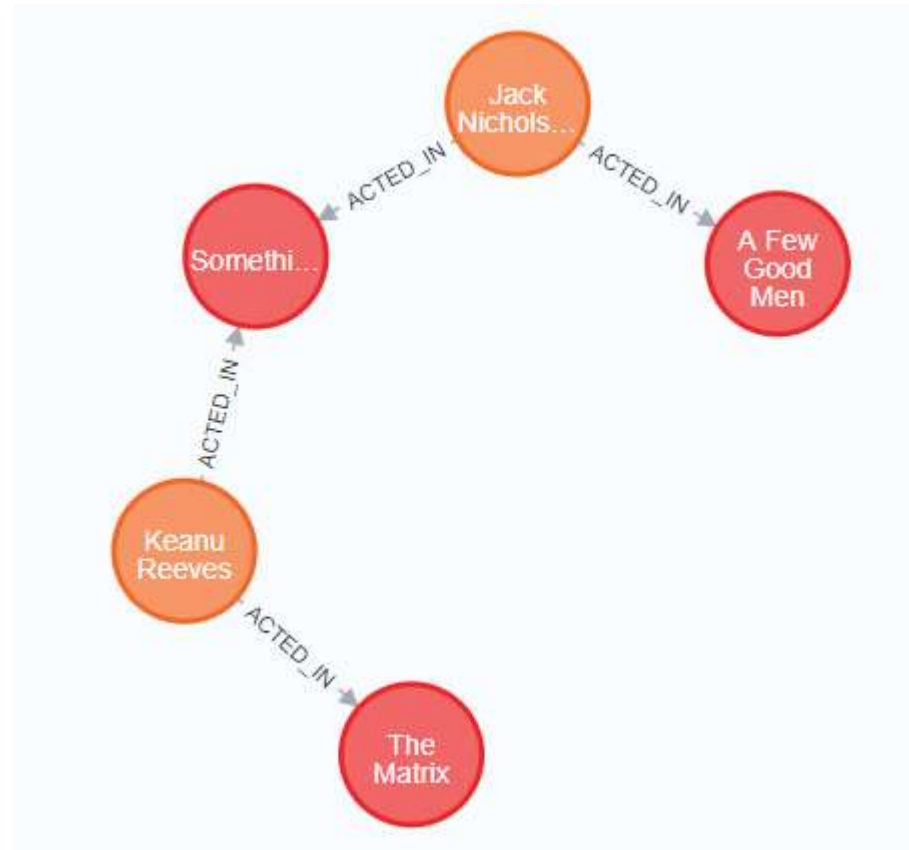
```
WHERE meg.name = 'Meg Ryan'
```

```
RETURN m.title as movie, d.name AS director , other.name AS `co-actors`
```

	movie	director	co-actors
1	"When Harry Met Sally"	"Rob Reiner"	"Billy Crystal"
2	"When Harry Met Sally"	"Rob Reiner"	"Bruno Kirby"
3	"When Harry Met Sally"	"Rob Reiner"	"Carrie Fisher"
4	"Joe Versus the Volcano"	"John Patrick Stanley"	"Nathan Lane"
5	"Joe Versus the Volcano"	"John Patrick Stanley"	"Tom Hanks"
6	"You've Got Mail"	"Nora Ephron"	"Tom Hanks"

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```
MATCH p = shortestPath((m1:Movie)-[*]-(m2:Movie))  
WHERE m1.title = 'A Few Good Men' AND  
m2.title = 'The Matrix'  
RETURN p
```



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

"a.name"	"d.name"	"count(m)"
"Carrie-Anne Moss"	"Lilly Wachowski"	3
"Keanu Reeves"	"Lilly Wachowski"	3
"Laurence Fishburne"	"Lilly Wachowski"	3
"Emil Eifrem"	"Lilly Wachowski"	1
"Hugo Weaving"	"Lilly Wachowski"	4
"Carrie-Anne Moss"	"Lana Wachowski"	3
"Keanu Reeves"	"Lana Wachowski"	3
"Laurence Fishburne"	"Lana Wachowski"	3
"Emil Eifrem"	"Lana Wachowski"	1
...

```
MATCH (p:Person)-[:ACTED_IN]->(m:Movie)
WHERE p.name ='Tom Cruise'
RETURN collect(m.title) AS `movies for Tom Cruise`
```

	movies for Tom Cruise
1	["Jerry Maguire", "A Few Good Men", "Top Gun"]

```
MATCH (actor:Person)-[:ACTED_IN]->(m:Movie)<-[:DIRECTED]-(director:Person)
RETURN actor.name, director.name,
count(m) AS collaborations, collect(m.title) AS movies
```

	actor.name	director.name	collaborations	movies
1	"Carrie-Anne Moss"	"Lilly Wachowski"	3	["The Matrix", "The Matrix Reloaded", "The Matrix Revolutions"]
2	"Keanu Reeves"	"Lilly Wachowski"	3	["The Matrix", "The Matrix Reloaded", "The Matrix Revolutions"]
3	"Laurence Fishburne"	"Lilly Wachowski"	3	["The Matrix", "The Matrix Reloaded", "The Matrix Revolutions"]
4	"Emil Eifrem"	"Lilly Wachowski"	1	["The Matrix"]
5	"Hugo Weaving"	"Lilly Wachowski"	4	["The Matrix", "The Matrix Reloaded", "The Matrix Revolutions", "Cloud Atlas"]
6	"Carrie-Anne Moss"	"Lilly Wachowski"	3	["The Matrix", "The Matrix Reloaded", "The Matrix Revolutions"]

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```
MATCH (p:Person)-[:ACTED_IN]->(m:Movie)
WHERE p.name = 'Tom Cruise'
RETURN collect(m) AS `movies for Tom Cruise`
```



```
[
{
  "identity": 47,
  "labels": [
    "Movie"
  ],
  "properties": {
    "tagline": "The rest of his life begins now.",
    "title": "Jerry Maguire",
    "released": 2000
  }
},
{
  "identity": 25,
  "labels": [
    "Movie"
  ],
  "properties": {
    "tagline": "...",
    "title": "A Few Good Men",
    "released": 1992
  }
}
...
]
```

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

RETURN m.title, collect(a.name) **as** cast, size(collect(a.name)) **as** castSize

"m.title"	"cast"	"castSize"
"The Matrix"	["Carrie-Anne Moss", "Keanu Reeves", "Laurence Fishburne", "Emil Eifrem", "Hugo Weaving"]	5
"The Matrix Reloaded"	["Carrie-Anne Moss", "Keanu Reeves", "Laurence Fishburne", "Hugo Weaving"]	4
"The Matrix Revolutions"	["Keanu Reeves", "Carrie-Anne Moss", "Laurence Fishburne", "Hugo Weaving"]	4
"The Devil's Advocate"	["Charlize Theron", "Keanu Reeves", "Al Pacino"]	3
"A Few Good Men"	["Kevin Pollak", "Noah Wyle", "Aaron Sorkin", "Demi Moore", "J.T. Walsh", "Cuba Gooding Jr.", "Tom Cruise", "Christopher Guest", "Jack Nicholson", "James Marshall", "Kiefer Sutherland", "Kevin Bacon"]	12
"Top Gun"	["Tom Cruise", "Tom Skerritt", "Val Kilmer", "Kelly McGillis", "Anthony Ed"]	6

```
MATCH (m:Movie)
WHERE m.title CONTAINS 'Matrix'
RETURN m { .title, .released } AS movie
```

"movie"	
{ "released":1999,"title":"The Matrix" }	
{ "released":2003,"title":"The Matrix Reloaded" }	
{ "released":2003,"title":"The Matrix Revolutions" }	

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```
MATCH (a:Person)-[:ACTED_IN]->(m:Movie)
WITH a, count(a) AS numMovies, collect(m.title)[0..3] as movies
WHERE numMovies = 5
RETURN a.name, numMovies, movies
```

"a.name"	"numMovies"	"movies"
"Hugo Weaving"	5	["The Matrix", "The Matrix Reloaded", "The Matrix Revolutions"]
"Jack Nicholson"	5	["A Few Good Men", "As Good as It Gets", "Hoffa"]
"Meg Ryan"	5	["Top Gun", "You've Got Mail", "Sleepless in Seattle"]

```
MATCH (a:Person)-[:ACTED_IN]->(m:Movie)
WITH a, count(a) AS numMovies, collect(m.title)[0..3] as movies
WHERE numMovies = 5
UNWIND movies as movie
RETURN a.name, numMovies, movie
```

"a.name"	"numMovies"	"movie"
"Hugo Weaving"	5	"The Matrix"
"Hugo Weaving"	5	"The Matrix Reloaded"
"Hugo Weaving"	5	"The Matrix Revolutions"
"Jack Nicholson"	5	"A Few Good Men"
"Jack Nicholson"	5	"As Good as It Gets"
"Jack Nicholson"	5	"Hoffa"
"Meg Ryan"	5	"Top Gun"
"Meg Ryan"	5	"You've Got Mail"
"Meg Ryan"	5	"Sleepless in Seattle"

Erzeugung von Knoten

```
CREATE (m:Movie:Action {title: 'Batman Begins'})
```

```
CREATE
```

```
(:Person {name: 'Michael Caine', born: 1933}),
```

```
(:Person {name: 'Liam Neeson', born: 1952}),
```

```
(:Person {name: 'Katie Holmes', born: 1978}),
```

```
(:Person {name: 'Benjamin Melniker', born: 1913})
```

Labels hinzufügen

```
MATCH (m:Movie)
```

```
WHERE m.title = 'Batman Begins'
```

```
SET m:Fantasy
```

```
RETURN labels(m)
```

Properties hinzufügen

```
MATCH (m:Movie)
```

```
WHERE m.title = 'Batman Begins'
```

```
SET m.released = 2005, m.lengthInMinutes = 140
```

```
RETURN m
```

Löschen von Knoten

```
MATCH (p:Person)
```

```
WHERE p.name = 'Jane Doe'
```

```
DELETE p
```

Löschen von Knoten eines Labels

```
match (p:Person) detach delete p
```

Löschen alle Knoten

```
match (n) detach delete n
```

Erzeugung von Kanten

```
MATCH (a:Person), (m:Movie)
WHERE
  a.name = 'Michael Caine' AND
  m.title = 'Batman Begins'
CREATE (a)-[:ACTED_IN]->(m)
```

```
MATCH (a:Person), (m:Movie), (p:Person)
WHERE a.name = 'Liam Neeson' AND
  m.title = 'Batman Begins' AND
  p.name = 'Benjamin Melniker'
CREATE (a)-[:ACTED_IN]->(m)<-[:PRODUCED]-(p)
```

Kanten mit Properties

```
MATCH (a:Person), (m:Movie)
WHERE a.name = 'Katie Holmes' AND m.title = 'Batman Begins'
CREATE (a)-[rel:ACTED_IN {roles: ['Rachel', 'Rachel Dawes']}]>(m)
```

Knoten und Kanten zusammen

```
MATCH (m:Movie)
WHERE m.title = 'Batman Begins'
CREATE (a:Person)-[:ACTED_IN]->(m)
SET a.name = 'Gary Oldman', a.born=1958
```

Löschen von Kanten

```
MATCH (a:Person)-[rel:WROTE | DIRECTED]->(m:Movie)
WHERE a.name = 'Katie Holmes' AND m.title = 'Batman Begins'
DELETE rel
```