

Neo4J: Building Your Own Graphs

CMPSC 305 – Database Systems



ALLEGHENY COLLEGE

Databases, Visually



- A visual database system using methods from graph theory to use networks to determine relationships (edges) and discover meaning from connected data-points (nodes). Users are able to interact with the data in a network.

- <https://neo4j.com/>
- Graphgists Projects: <https://neo4j.com/graphgists/>

Getting started with Neo4j in Docker

These files are located in sandbox/

Windows

```
build_neo4j_windows.bat
```

MacOS and Linux

```
sh build_neo4j_macOSAndLinux.sh
```

You can **build** and **start** the container with this script.
You will have to manually stop the container, as necessary.

Getting started with Neo4j in Docker

Specific Terminal commands

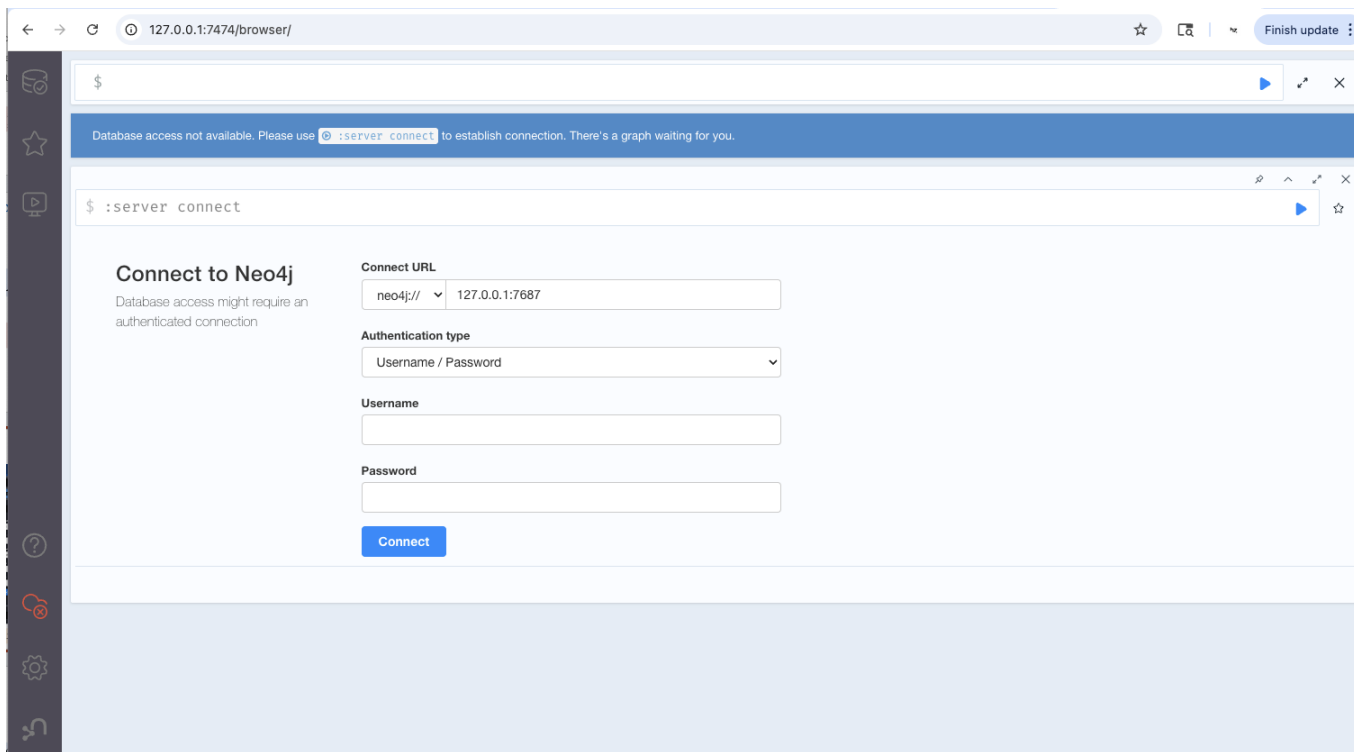
Terminal Command to START Neo4j

```
docker start testneo4j # windows  
sudo docker start testneo4j # MacOS and Linux
```

Terminal Command to STOP Neo4j

```
docker stop testneo4j # windows  
sudo docker stop testneo4j # MacOS and Linux
```

Login



- Open your browser and head to: <http://127.0.0.1:7474/browser/>

User and Password

Note: The user and password variables are defined in the build files we used to create the Docker container.

Your first login

User: neo4j

Password: password

Parameter in the build file

```
--env NEO4J_AUTH=neo4j/password
```

Add Nodes

File: sandbox/classroomBuild.txt

Destroy all nodes in the graph and erase the graph

MATCH (n) DETACH DELETE (n)

Add Nodes

File: sandbox/classroomBuild.txt

Add the nodes

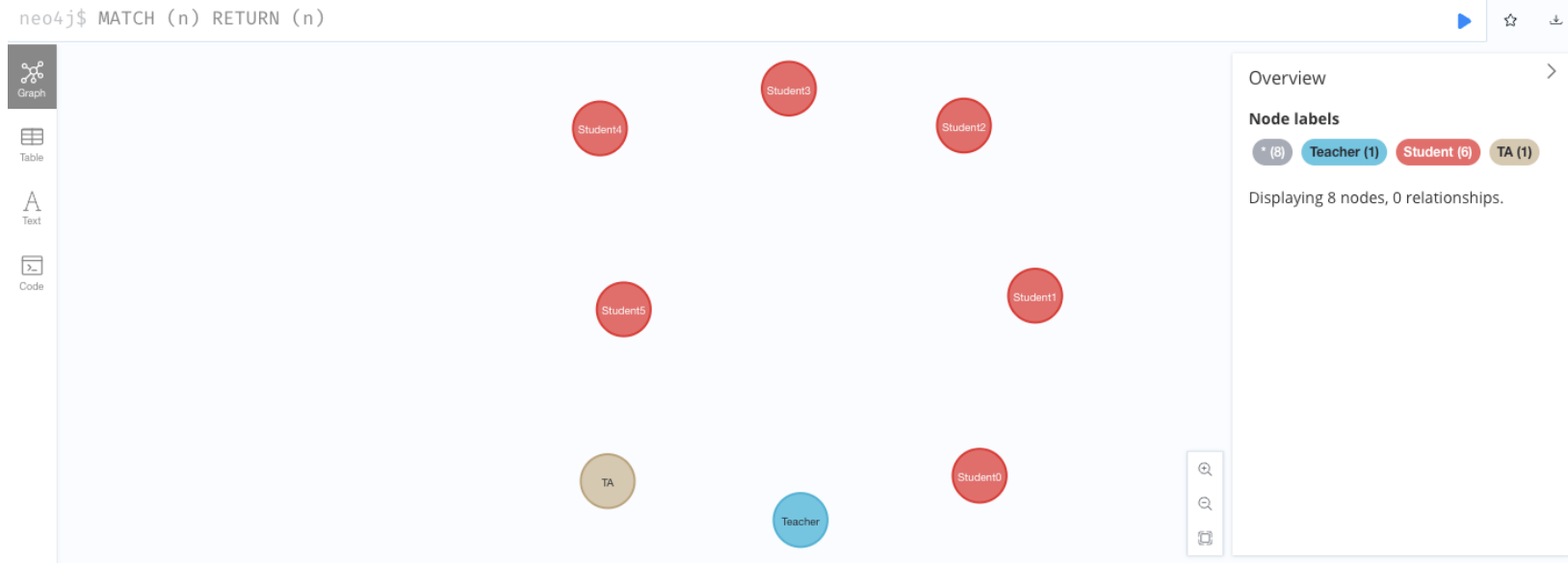
```
CREATE (  
    :Teacher {  
        name: "Teacher",  
        Jackjet: "green",  
        Jeans: "blue",  
        MarkerCol: "red"}  
)  
FOREACH (r IN range(0,5)|  
    CREATE (  
        :Student { name:"Student" + r,  
                    extraUtility: "backpack" + r,  
                    lastTestScore:tan(rand())*100 }  
    )  
CREATE (:TA { name: "TA", Machine: "Laptop"}))
```

- Adds nodes with some meta data: a Teacher, a TA and five Student

Show the Nodes

Show the unconnected graph

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



Add Edges

Add some connectivity to nodes

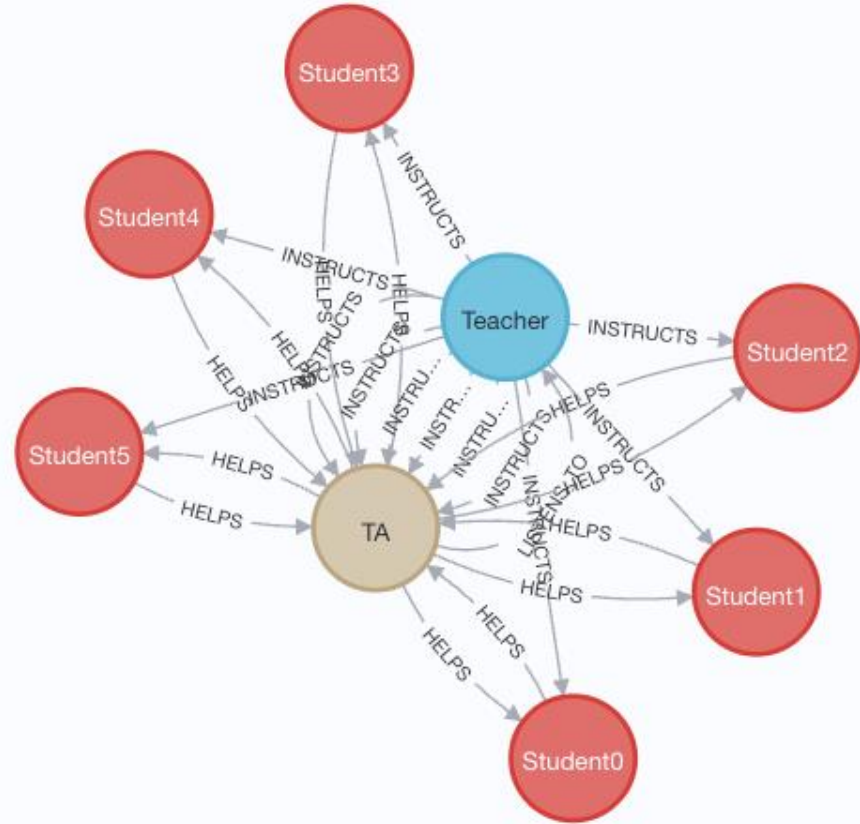
```
MATCH (t:Teacher), (s:Student), (a:TA)
MERGE (t) - [:INSTRUCTS] -> (s) <-[:HELPS] - (a)
MERGE (a) - [:LISTENS_TO] -> (t)
MERGE (t) - [:INSTRUCTS] -> (a) <-[:HELPS] - (s)
```

- The Teacher (t) and Student (s) nodes are linked by INSTRUCTS and an arrow to show direction, – >
- The TA (a) and Student (s) nodes are linked by HELPS and an arrow to show direction, <–
- The TA (a) and TEACHER (t) nodes are linked by LISTENS TO and an arrow to show direction, – >
- The Teacher (t) and TA (a) nodes are linked by INSTRUCTS and an arrow to show direction, – >
- The Student (s) and TA (a) nodes are linked by HELPS and an arrow to show direction, <–

Show The Edges

Show the connected graph

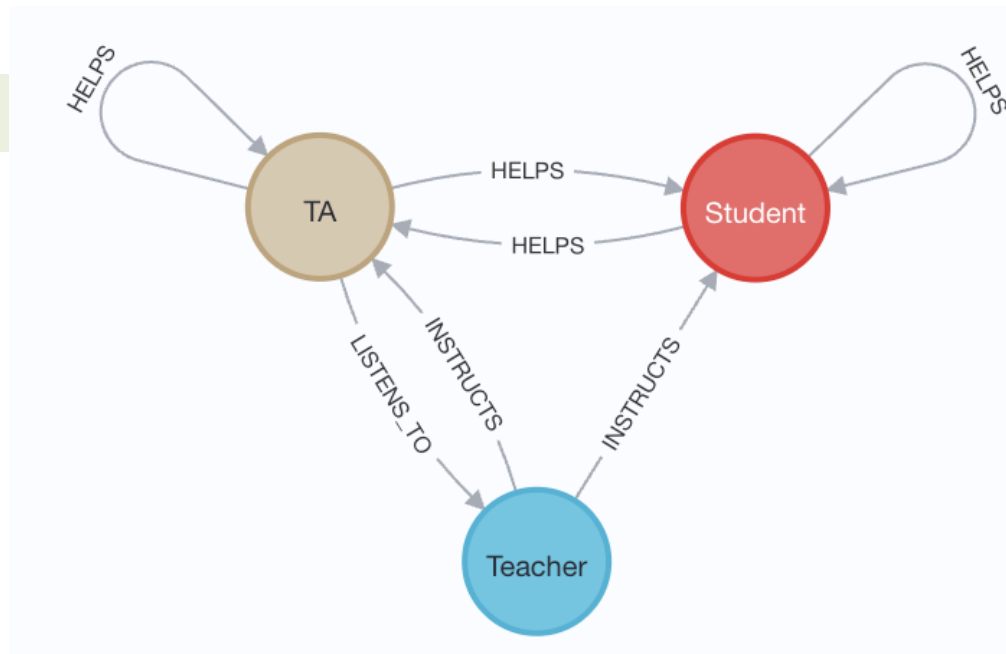
MATCH (n) RETURN (n)



Schema

Show the schema

call `db.schema.visualization`

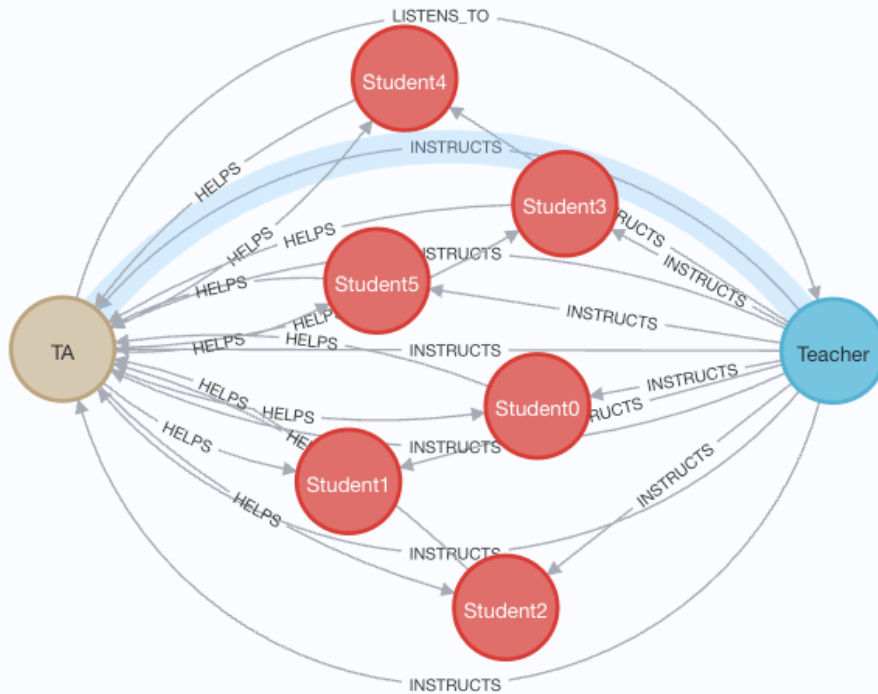


- The Teacher Instructs each Student
- The Student is Instructed and Helped by Teacher
- The TA is Instructed by Teacher and Listens to Teacher, Helps Student and self.

Relationship Queries

Who instructs whom?

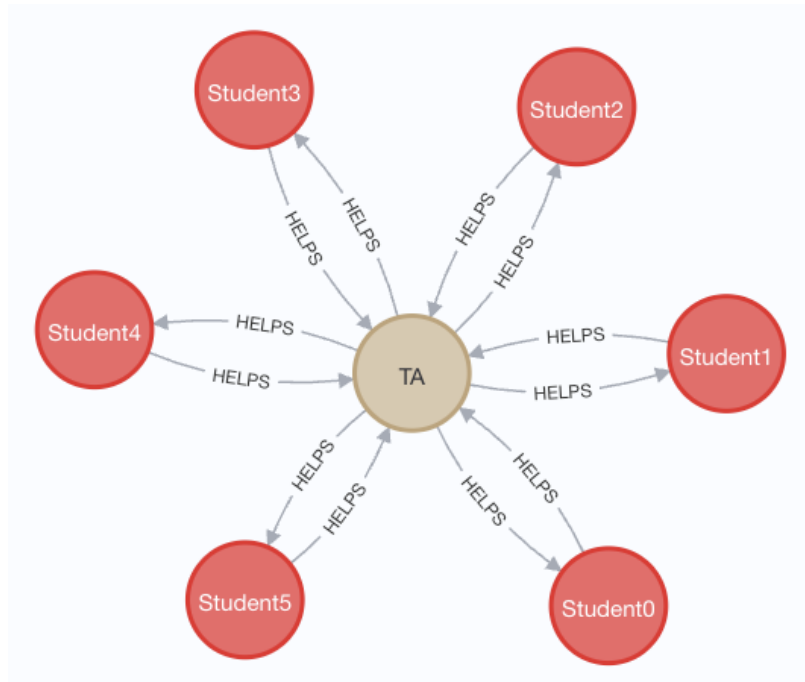
```
MATCH t=()-[s:INSTRUCTS]->() RETURN t
```



Relationship Queries

Who helps whom?

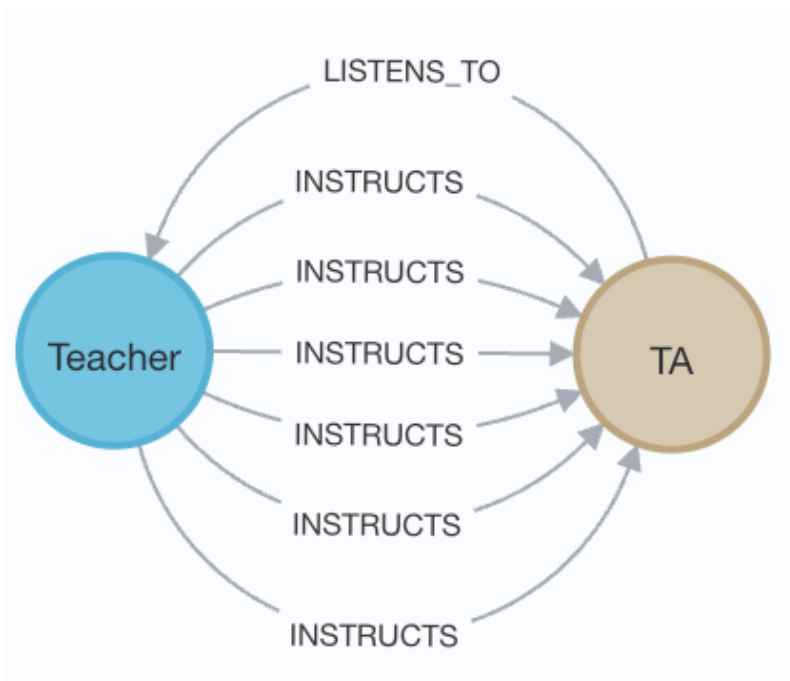
```
MATCH t=()-[s:HELPS]->>() RETURN t
```



Relationship Queries

Who listens to whom?

```
MATCH t=()-[s:LISTENS_TO]->>() RETURN t
```



Commonly Used Commands

Sample code in Cypher script

What is the Schema?

```
CALL db.schema.visualization
```

What are the relationship types?

```
CALL db.relationshipTypes()
```

Display all nodes with their relationships (I)

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

Display all nodes with their relationships (II)

```
MATCH (a)-[r]-() RETURN a, r
```

Commonly Used Commands

From last time

What are the node types?

```
CALL db.schema.nodeTypeProperties
```

What are the relationship types?

```
CALL db.relationshipTypes()
```

Display all nodes

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

Who reviewed what?

```
MATCH p=()-[r:LISTENS_TO]->() RETURN p
```

Who produced what?

```
MATCH p=()-[r:HELPS]->() RETURN p
```

Orchestral Connections

New Example!

Do not copy and paste this code all at once into Neo4j. All node creation code goes in own field in Neo4j, then the edge creation code follows in the next field.

Or just copy and paste from the build file ...

Build file: sandbox/orchestralBuild.txt

Orchestral Connections

Note: all node and edge code is to be in a single copy-paste

Clear away previous graph: past into own field in Neo4j

```
MATCH (n) DETACH DELETE (n)
```

Create nodes!

```
CREATE(  
  :Woodwinds {  
    name:"windPlayer",  
    instrument:"clarinet"} )
```

```
CREATE(  
  :Percussions {  
    name:"PercussionPlayer",  
    instrument:"Drum"} )
```

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

Orchestral Connections

Create more nodes!!

```
CREATE(  
  :Strings {  
    name:"StringPlayers",  
    instrument_1:"guitar",  
    instrument_2:"violin"} )
```

```
CREATE(  
  :Audience {  
    name:"Listener"} )
```

```
CREATE(  
  :Conductor {  
    name: "Conductor",  
    instrument_1:"baton"} )
```

MATCH (n) RETURN n

Orchestral Connections

Define Node Variables and Edges

MATCH (w:Woodwinds), (p:Percussions),
(s:Strings), (a:Audience), (c:Conductor)

MERGE (w) - [:FOLLOWS] -> (p) <-[:DIRECTS] - (c)

MERGE (p) - [:LEADS] -> (s) <-[:DIRECTS] - (c)

MERGE (s) - [:WATCHES] -> (c)

MERGE (w) - [:PLAYS_For] -> (a)

MERGE (p) - [:PLAYS_For] -> (a)

MERGE (s) - [:PLAYS_For] -> (a)

MERGE (a) - [:CLAPS_FOR] -> (w)

MERGE (a) - [:CLAPS_FOR] -> (p)

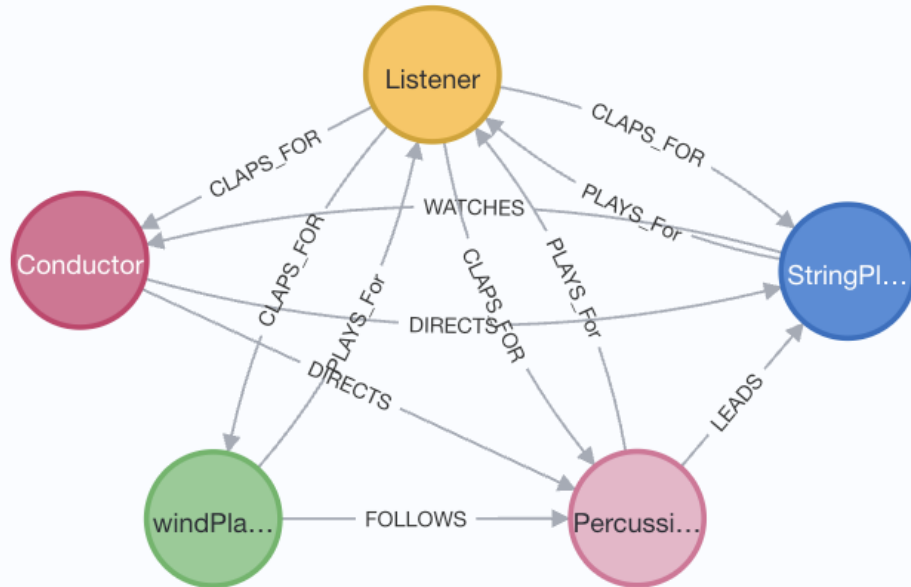
MERGE (a) - [:CLAPS_FOR] -> (s)

MERGE (a) - [:CLAPS_FOR] -> (c)

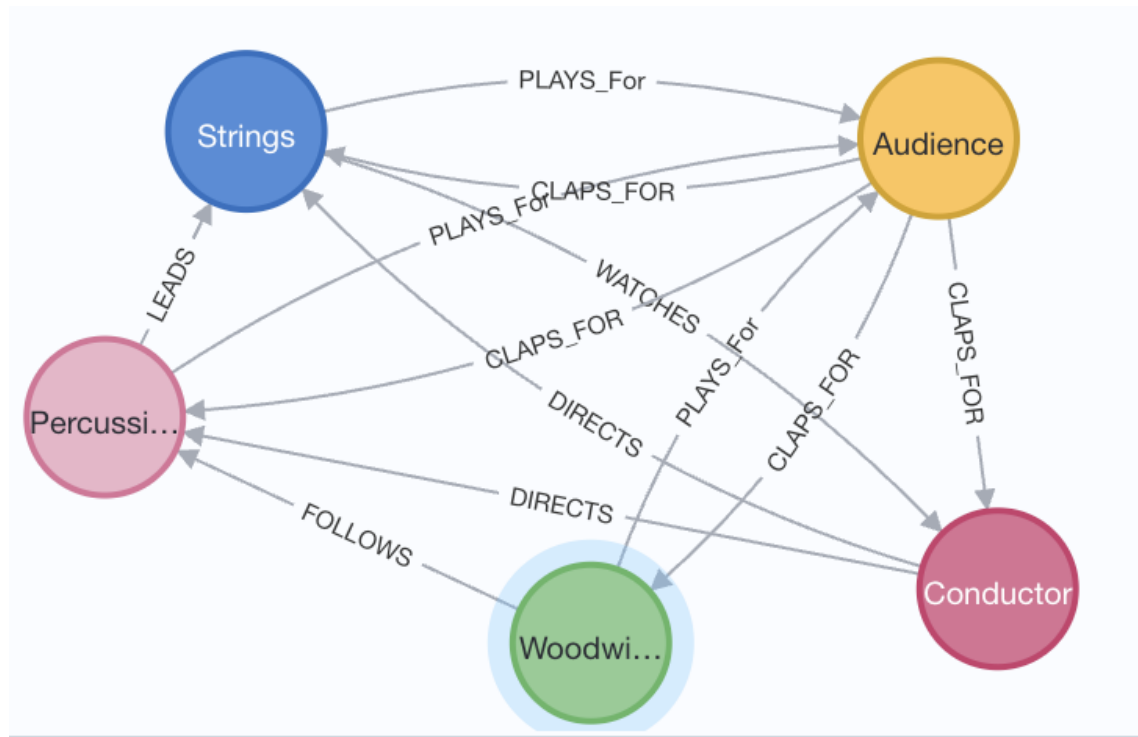
Orchestral Connections

Show the graph

MATCH (n) RETURN (n)



Orchestral Connections



What is the Schema?

CALL db.schema.visualization

Check out this tutorial ...

First Steps with Cypher

<https://neo4j.com/graphgists/first-steps-with-cypher/>

Note: Be sure to use your local installation of Neo4J at <http://localhost:7474/browser/> to run your experiments by copying and pasting code from the tutorial.

Spend Some Time Playing With Other Graphs ...

- See What the community has done with Neo4j
- Graphgists Projects: <https://neo4j.com/graphgists/>

How To Shut Down a Session

Stop Neo4j container

- `docker stop testneo4j` # Windows
- `sudo docker stop testneo4j` # MacOS and Linux

Consider This ...



- Can you work with data as nodes and edges in your own network?
- Can you discover new relationships between your nodes?