Methods of Importing into Neo4j

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https://neo4j.com/

Agenda

- Recommended precognition
- Motivation Import
- Methods of importing
  - `$ ./bin/neo4j-admin import`
  - Cypher via `LOAD CSV` & APOC
  - Procedures
  - BatchInserter
  - Driver via BOLT

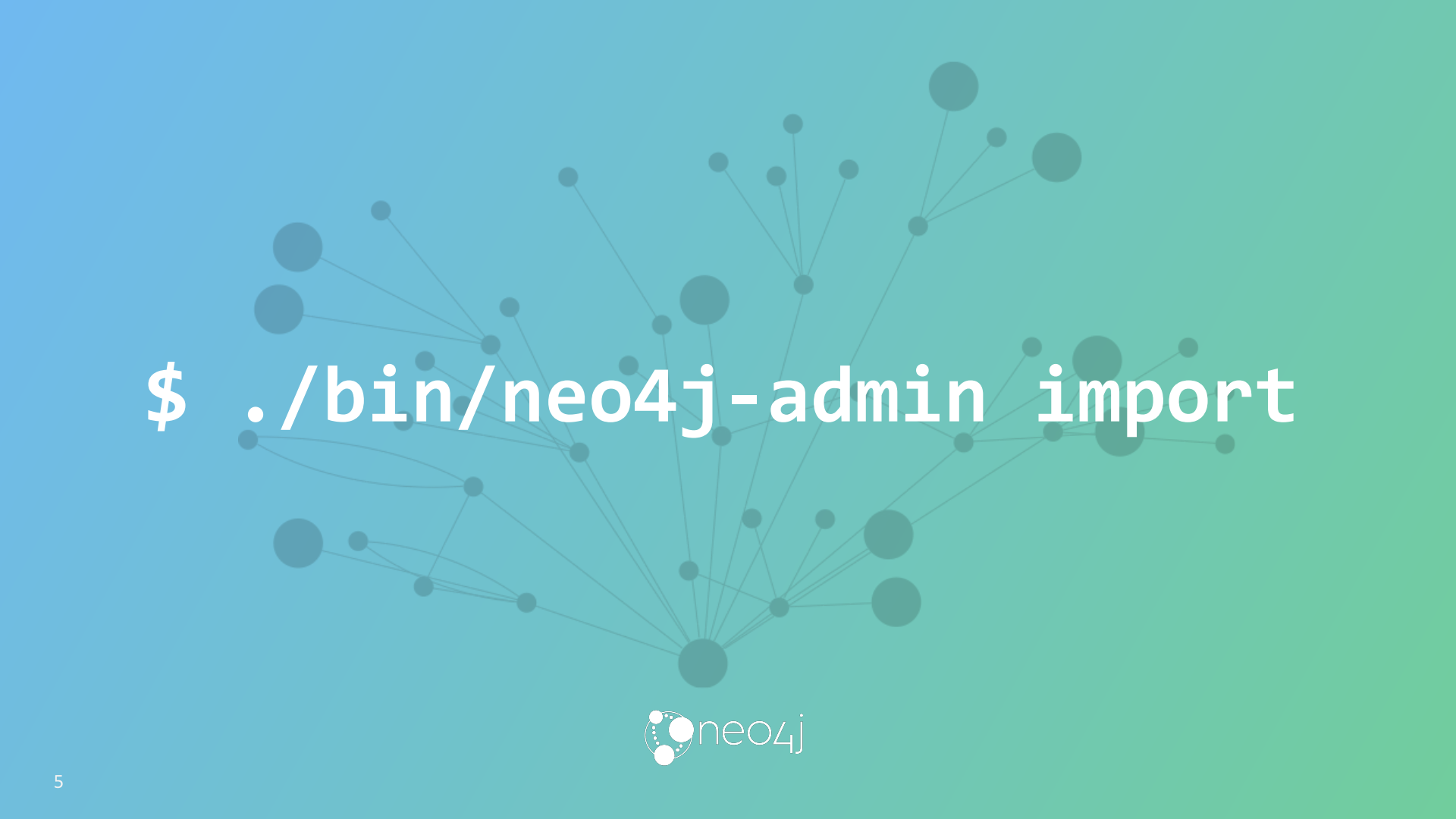
Recommended precognition

- Neo4j basics
  - Native, ACID compliant graph database
  - Property-graph model
  - Indexes / constraints
  - Installation, starting & stopping Neo4j
- Cypher and APOC basics
- Simple command line executions

https://neo4j.com/

Motivation

- Play with Neo4j
- Evaluation of a project idea
- PoC (Proof of Concept)
- Initializing the Neo4j graph at project kick-off
- Regular updates to the graph
- Eureka! That’s how my data is connected

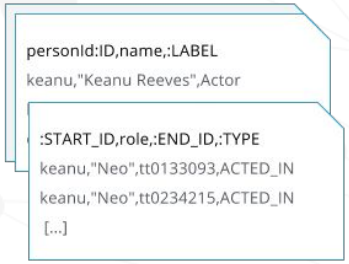

$ ./bin/neo4j-admin import
neo4j

`$ ./bin/neo4j-admin import`

- Fastest method *(w.r.t. writes/second)*
- Initial import; a new database is being created
- Database is offline during import
- No need to create indexes *in advance*
- The cluster needs to be synchronized after the import

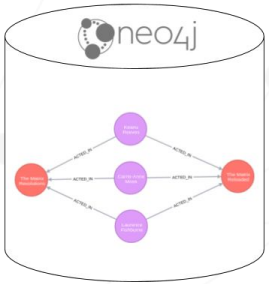
Two Modes

--mode=CSV



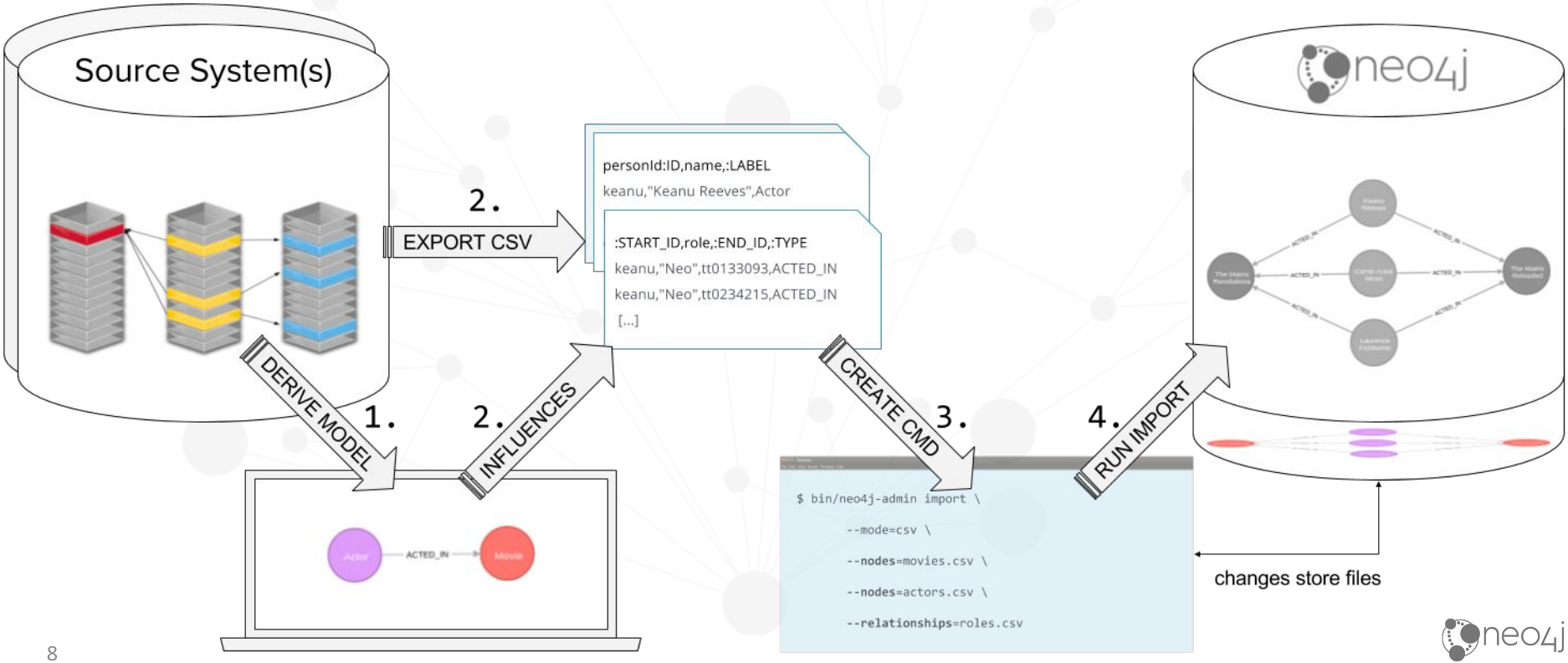
Import from CSV files

--mode=DATABASE



Import from a Neo4j graph

Import Approach



Our simple example schema

movies.csv (nodes)

movieId**:ID**,title,year**:int**,**:LABEL**

tt0133093,"The Matrix",1999,Movie

tt0234215,"The Matrix Reloaded",2003,**Movie;Sequel**

tt0242653,"The Matrix Revolutions",2003,**Movie;Sequel**

actors.csv (nodes)

```
personId:ID,name,:LABEL
keanu,"Keanu Reeves",Actor
laurence,"Laurence Fishburne",Actor
carrieanne,"Carrie-Anne Moss",Actor
```

roles.csv (relationships)

```
:START_ID,role,:END_ID,:TYPE
keanu,"Neo",tt0133093,ACTED_IN
keanu,"Neo",tt0234215,ACTED_IN
keanu,"Neo",tt0242653,ACTED_IN
laurence,"Morpheus",tt0133093,ACTED_IN
laurence,"Morpheus",tt0234215,ACTED_IN
 [...]
```

Links between the CSV Files

personId:ID,name,:LABEL
keanu,"Keanu Reeves",Actor
laurence,"Laurence Fishburne",Actor
carrieanne,"Carrie-Anne Moss",Actor

movieId**:ID**,title,year**:int**,**:LABEL**
tt0133093,"The Matrix",1999,Movie
tt0234215,"The Matrix Reloaded",2003,**Movie;Sequel**
tt0242653,"The Matrix Revolutions",2003,**Movie;Sequel**

:START_ID,role,**:END_ID**,**:TYPE**
keanu,"Neo",tt0133093,ACTED_IN
keanu,"Neo",tt0234215,ACTED_IN
keanu,"Neo",tt0242653,ACTED_IN
laurence,"Morpheus",tt0133093,ACTED_IN
laurence,"Morpheus",tt0234215,ACTED_IN
[...]

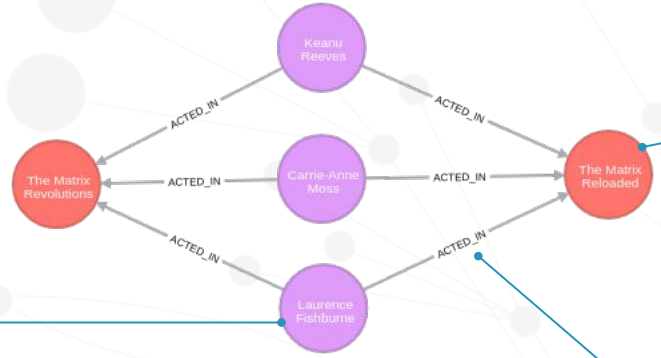
The Import Command

Terminal

File Edit View Search Terminal Help

```
$ bin/neo4j-admin import \
        --mode=csv \
        --nodes=movies.csv \
        --nodes=actors.csv \
        --relationships=roles.csv
```

The Resulting Graph



movieId:ID,title,year:int,:LABEL
tt0133093,"The Matrix",1999,Movie
tt0234215,"The Matrix Reloaded",2003,Movie;Sequel
tt0242653,"The Matrix Revolutions",2003,Movie;Sequel

personId:ID,name,:LABEL
keanu,"Keanu Reeves",Actor
laurence,"Laurence Fishburne",Actor
carrieanne,"Carrie-Anne Moss",Actor

:START_ID,role,:END_ID,:TYPE
keanu,"Neo",tt0133093,ACTED_IN
keanu,"Neo",tt0234215,ACTED_IN
keanu,"Neo",tt0242653,ACTED_IN
laurence,"Morpheus",tt0133093,ACTED_IN
laurence,"Morpheus",tt0234215,ACTED_IN
[...]

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Further Notes

- **Check the quality of your CSV files!**
- Separate header and data lines
- Use further options like…

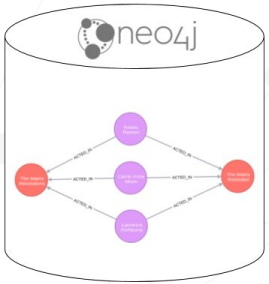
```
--additional-config
--ignore-extra-columns
--ignore-duplicate-nodes
--ignore-missing-nodes
--max-memory
```

Remember: Two Modes

--mode=CSV

Import from CSV files

--mode=DATABASE



Import from a Neo4j graph

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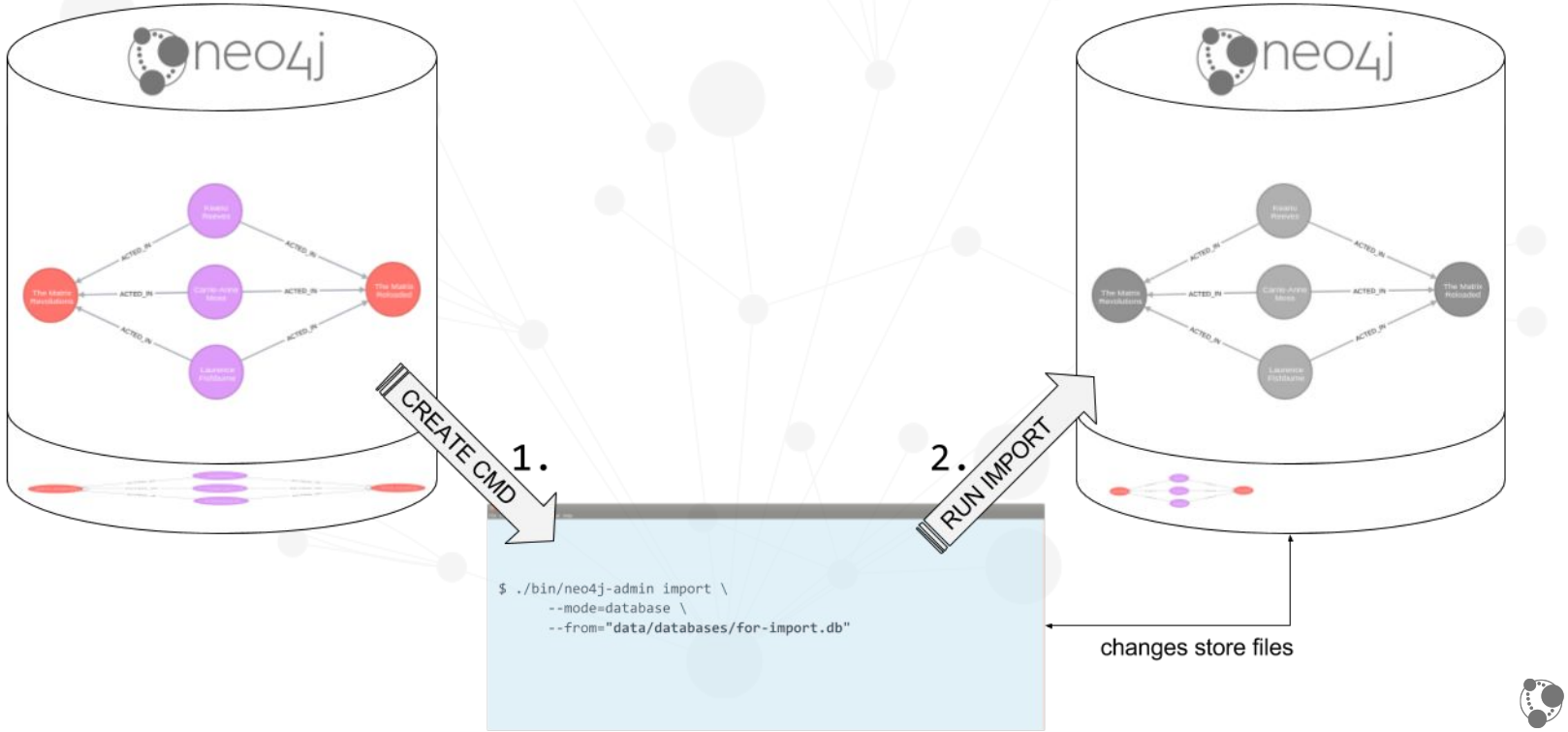
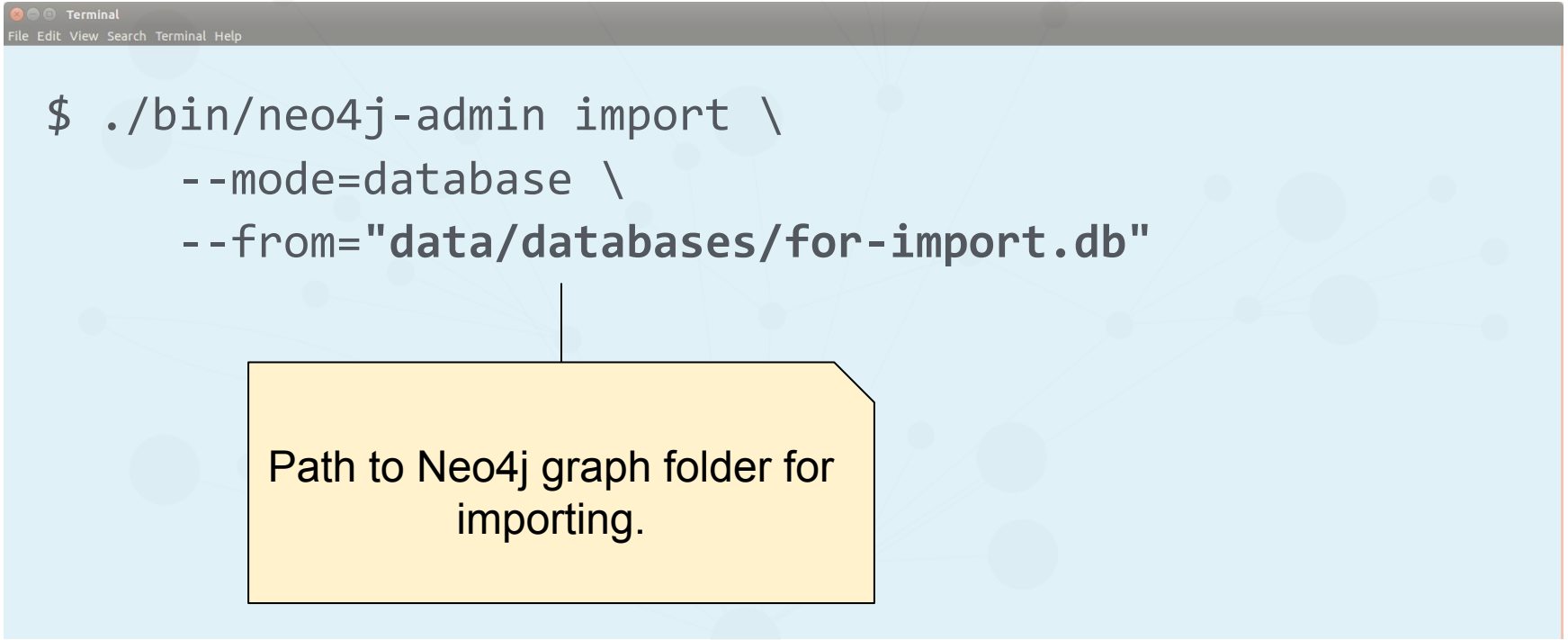
$ ./bin/neo4j-admin import database

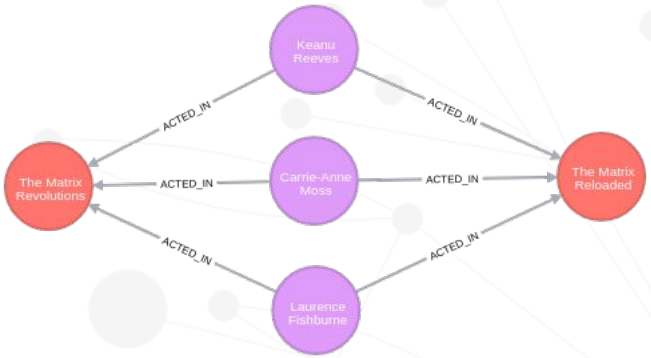


Mini Example



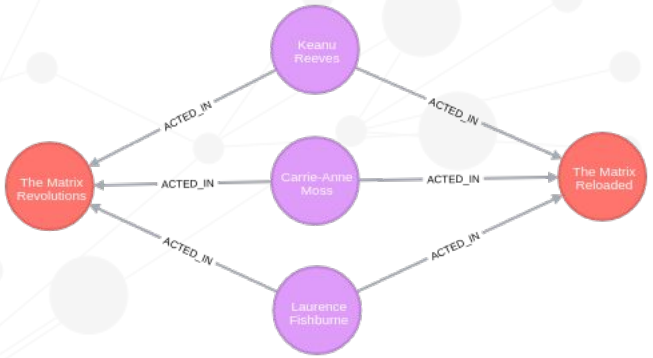
The Resulting Graph

Existing Neo4j graph



=

Newly imported Neo4j graph




```
import --mode=database
```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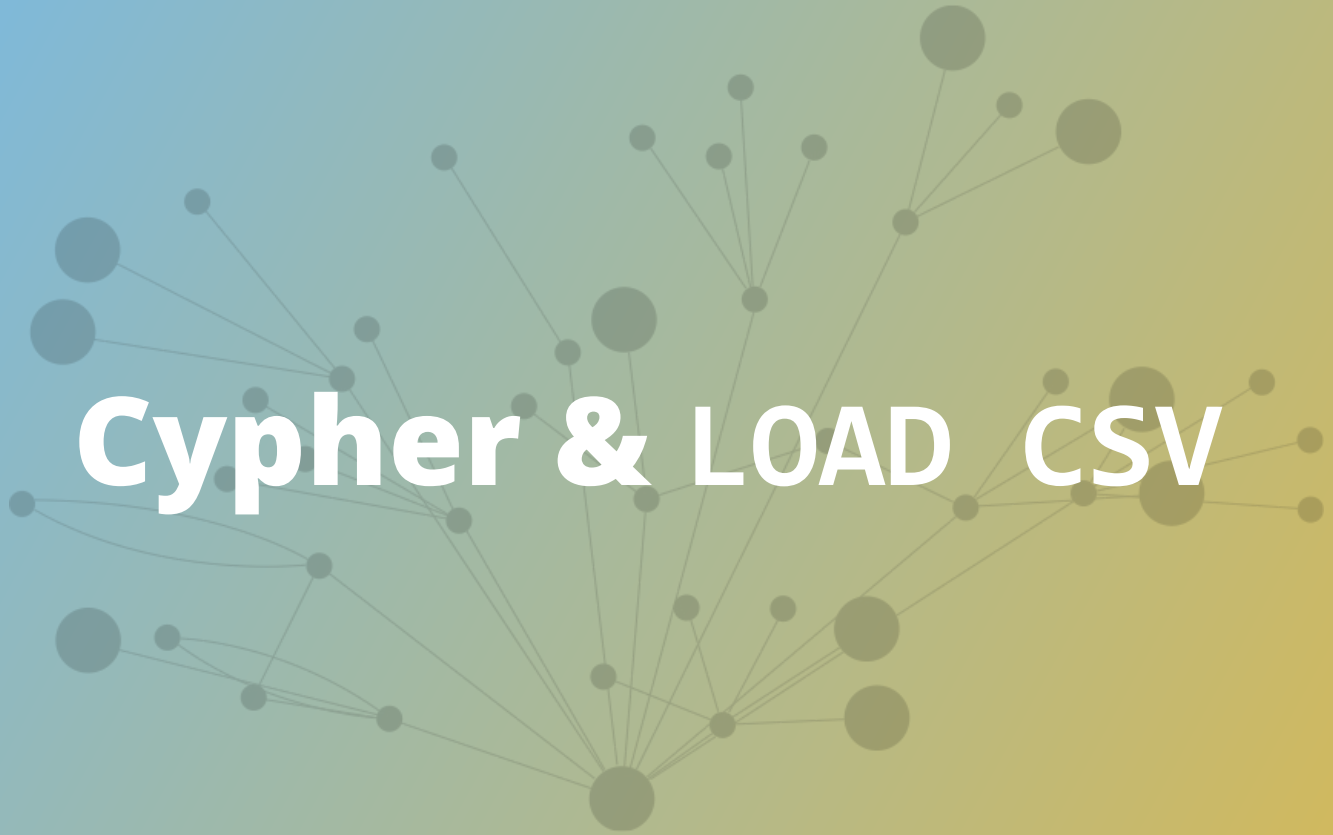
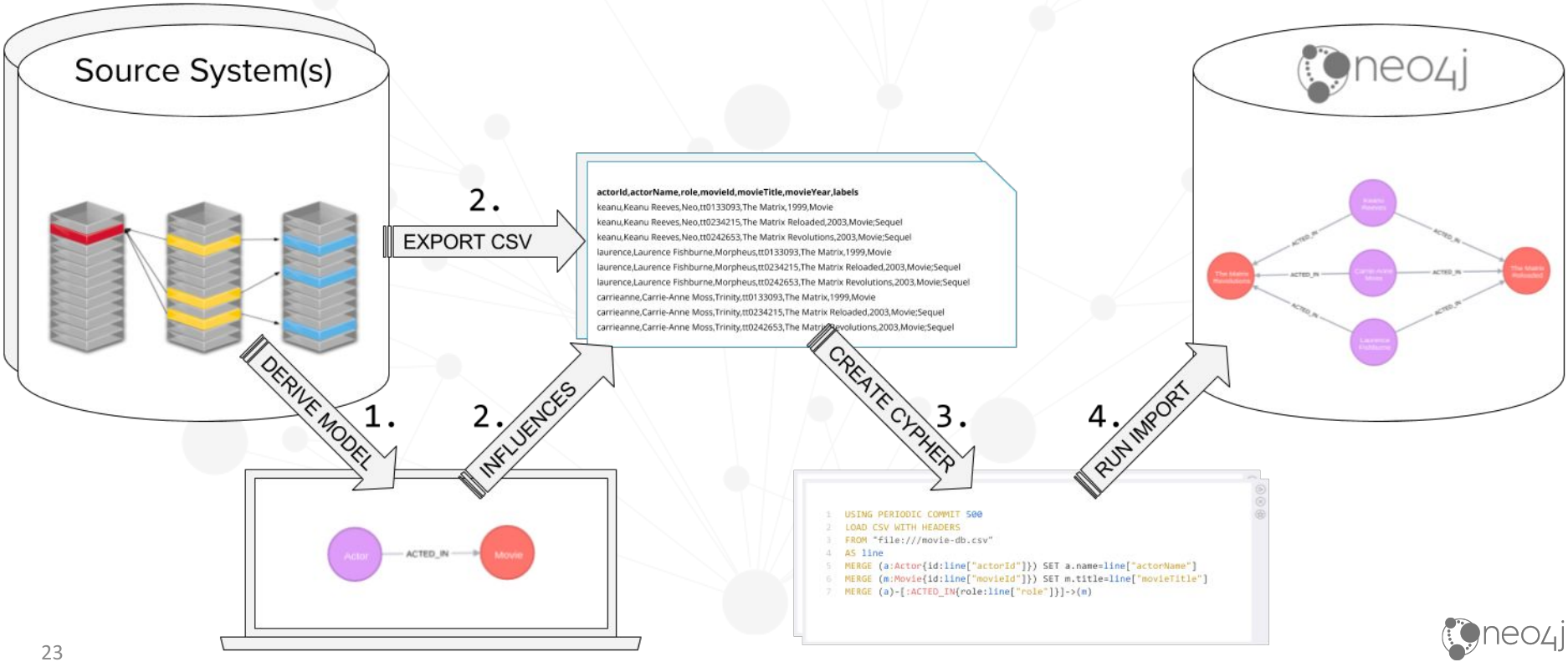
Cypher & LOAD CSV



Cypher & LOAD CSV

- May be the simplest method
- Initial import or update
- Database is online during import, transactional!
- Create indexes upfront
- The cluster is being synchronized automatically

Cypher (LOAD CSV)



movie-db.csv (nodes & relationships)

actorId,actorName,role,movieId,movieTitle,movieYear,labels

keanu,Keanu Reeves,Neo,tt0133093,The Matrix,1999,Movie

keanu,Keanu Reeves,Neo,tt0234215,The Matrix Reloaded,2003,Movie;Sequel

keanu,Keanu Reeves,Neo,tt0242653,The Matrix Revolutions,2003,Movie;Sequel

laurence,Laurence Fishburne,Morpheus,tt0133093,The Matrix,1999,Movie

laurence,Laurence Fishburne,Morpheus,tt0234215,The Matrix Reloaded,2003,Movie;Sequel

laurence,Laurence Fishburne,Morpheus,tt0242653,The Matrix Revolutions,2003,Movie;Sequel

carrieanne,Carrie-Anne Moss,Trinity,tt0133093,The Matrix,1999,Movie

carrieanne,Carrie-Anne Moss,Trinity,tt0234215,The Matrix Reloaded,2003,Movie;Sequel

carrieanne,Carrie-Anne Moss,Trinity,tt0242653,The Matrix Revolutions,2003,Movie;Sequel

LOAD CSV - Initial Test

```
1 LOAD CSV WITH HEADERS
2 FROM "file:///movie-db.csv"
3 AS line
4 RETURN line
5 LIMIT 1
```

Relative to the *import* folder of the Neo4j installation

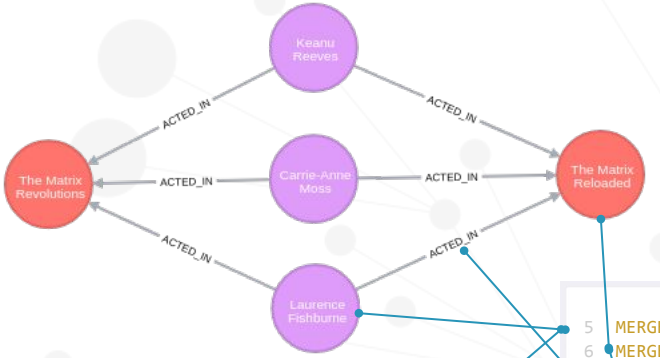
(if not changed in neo4j.conf)


```
{
 "role": "Neo",
 "actorName": "Keanu Reeves",
 "actorId": "keanu",
 "labels": "Movie",
 "movieId": "tt0133093",
 "movieYear": "1999",
 "movieTitle": "The Matrix"
}
```

LOAD CSV - Mini Example

```
1  USING PERIODIC COMMIT 500
2  LOAD CSV WITH HEADERS
3  FROM "file:///movie-db.csv"
4  AS line
5  MERGE (a:Actor{id:line["actorId"]}) SET a.name=line["actorName"]
6  MERGE (m:Movie{id:line["movieId"]}) SET m.title=line["movieTitle"]
7  MERGE (a)-[:ACTED_IN{role:line["role"]}]->(m)
```

The Resulting Graph




```
5 MERGE (a:Actor{id:line["actorId"]}) SET a.name=line["actorName"]
6 MERGE (m:Movie{id:line["movieId"]}) SET a.title=line["movieTitle"]
7 MERGE (a)-[:ACTED_IN{role:line["role"]}]->(m)
```

actorId,actorName,role,movieId,movieTitle,movieYear,labels

keanu,Keanu Reeves,Neo,tt0133093,The Matrix,1999,Movie

[..]

laurence,Laurence Fishburne,Morpheus,tt0234215,The Matrix Reloaded,2003,Movie;Sequel

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Further Notes

- **Check the quality of your CSV files!**
- Create indexes
- Avoid the *Eager* operator, e.g.
  - With `PROFILE LOAD CSV` … or
  - Check for warnings in the Neo4j Browser
- Choose size of your transactions, e.g. by
  - `USING PERIODIC COMMIT` or
  - `CALL apoc.periodic.iterate`

Cypher & APOC

Cypher & APOC

- Iterate / batching
- Plenty of procedures and functions
- GraphML
- JDBC
- .. and others (e.g. XML, JSON, ...)

apoc.periodic.iterate

```
1
2    LOAD CSV WITH HEADERS
3    FROM "file:///movie-db.csv"
4    AS line
5    MERGE (a:Actor{id:line["actorId"]}) SET a.name=line["actorName"]
6    MERGE (m:Movie{id:line["movieId"]}) SET m.title=line["movieTitle"]
7    MERGE (a)-[:ACTED_IN{role:line["role"]}]->(m)
8
9
```

apoc.periodic.iterate

```
CALL apoc.periodic.iterate(
  'LOAD CSV WITH HEADERS
   FROM "file:///movie-db.csv"
   AS line RETURN line',
  'MERGE (a:Actor{id:line["actorId"]}) SET a.name=line["actorName"]
   MERGE (m:Movie{id:line["movieId"]}) SET m.title=line["movieTitle"]
   MERGE (a)-[:ACTED_IN{role:line["role"]}]->(m)',
   {batchSize:500}
)
```

movie-db.csv

actorId,actorName,role,movieId,movieTitle,movieYear,**labels**

keanu,Keanu Reeves,Neo,tt0133093,The Matrix,1999,**Movie**

keanu,Keanu Reeves,Neo,tt0234215,The Matrix Reloaded,2003,**Movie;Sequel**

keanu,Keanu Reeves,Neo,tt0242653,The Matrix Revolutions,2003,**Movie;Sequel**

laurence,Laurence Fishburne,Morpheus,tt0133093,The Matrix,1999,**Movie**

laurence,Laurence Fishburne,Morpheus,tt0234215,The Matrix Reloaded,2003,**Movie;Sequel**

laurence,Laurence Fishburne,Morpheus,tt0242653,The Matrix Revolutions,2003,**Movie;Sequel**

carrieanne,Carrie-Anne Moss,Trinity,tt0133093,The Matrix,1999,**Movie**

carrieanne,Carrie-Anne Moss,Trinity,tt0234215,The Matrix Reloaded,2003,**Movie;Sequel**

carrieanne,Carrie-Anne Moss,Trinity,tt0242653,The Matrix Revolutions,2003,**Movie;Sequel**

apoc.create.addLabels

```
LOAD CSV WITH HEADERS
FROM "file:///movie-db.csv"
AS line
MATCH (m:Movie{id:line["movieId"]})
CALL apoc.create.addLabels(m, split(line["labels"], ";"))
YIELD node RETURN node
```

Import GraphML

in neo4j.conf:

```
apoc.import.file.enabled=true
```

```
CALL apoc.import.graphml(
  "graphml.xml",
  { batchSize: 5000, readLabels: true }
)
```

```
<?xml version="1.0" encoding="UTF-8"?>
<graphml xmlns="http://graphml.graphdrawing.org/xmlns" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://graphml.graphdrawing.org/xmlns
http://graphml.graphdrawing.org/xmlns/1.0/graphml.xsd">
<graph id="G" edgedefault="directed">
  <node id="n6" labels=":Actor">
    <data key="id">keanu</data><data key="name">Keanu Reeves</data>
  </node>
  <node id="n7" labels=":Movie">
    <data key="id">tt0133093</data><data key="title">The Matrix</data>
  </node>
  <edge id="e3" source="n6" target="n7" label="ACTED_IN"><data key="role">Neo</data></edge>
</graph>
</graphml>
```

Import via JDBC

Table or SQL statement

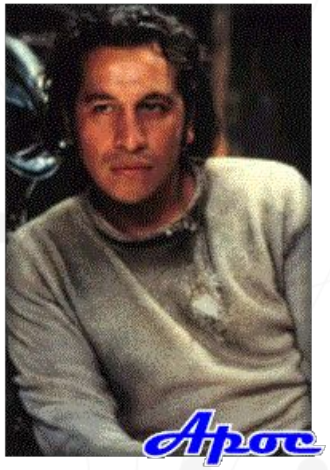
```
1  CALL apoc.load.jdbc('jdbc:mysql://host:3306/mdb?user=test','movies')
2  YIELD row
3  CREATE (:Movie {title:row.title, year:row.year})
```

title	year
The Matrix	1999
The Matrix Reloaded	2003
The Matrix Revolutions	2003

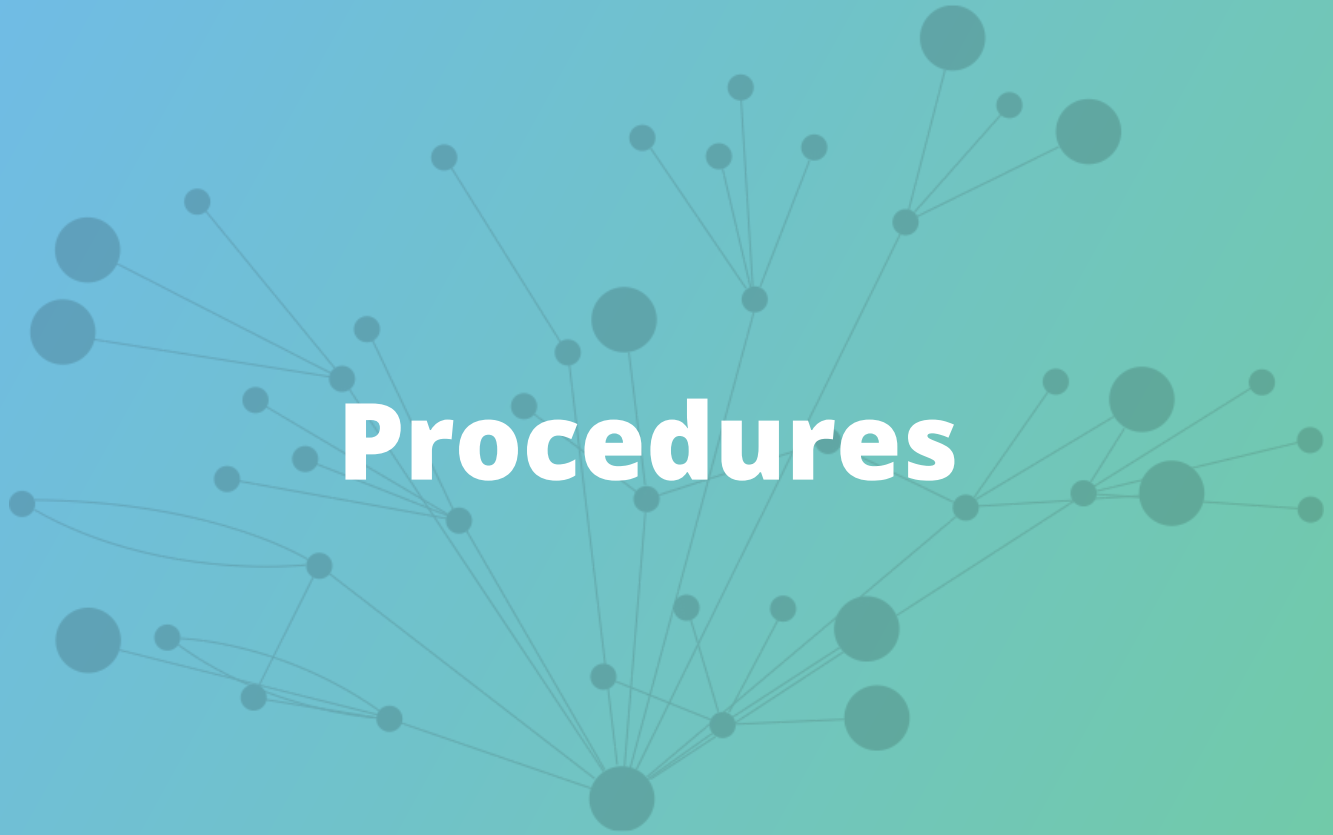
URL can be defined in neo4j.conf

So that user/password is not part of the Cypher query

APOC User Guide



https://neo4j-contrib.github.io/neo4j-apoc-procedures/



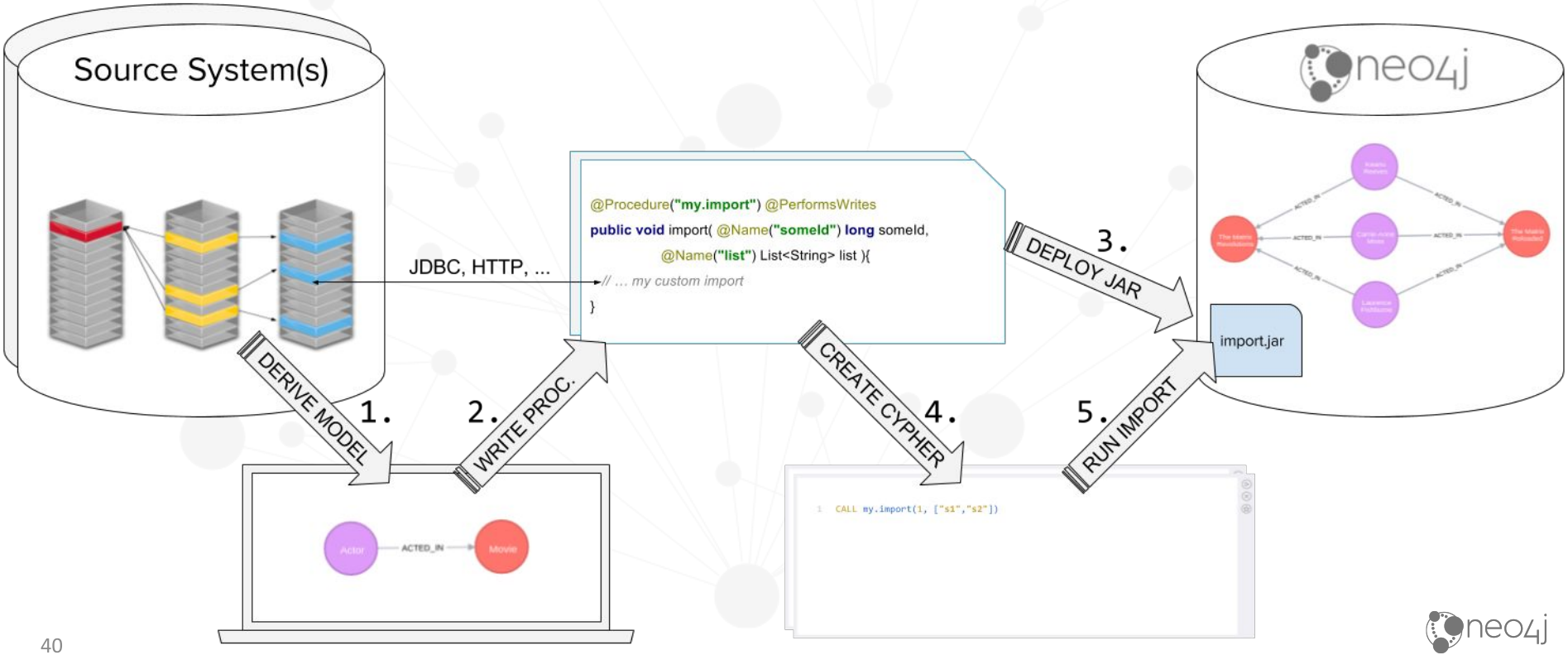
Procedures

Procedures

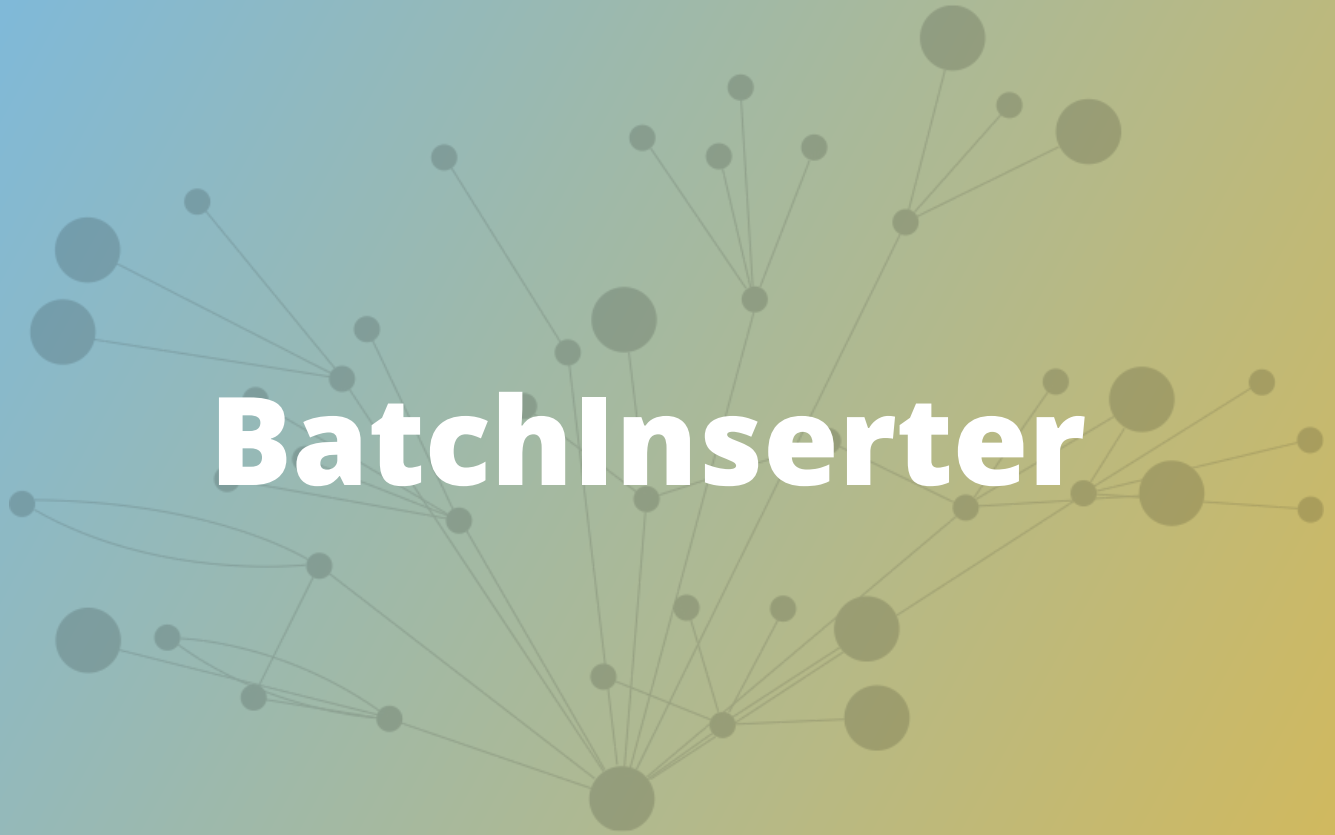
- Extension of the Neo4j server
  - Will be deployed as `.jar` file to the `plugins` folder
- Database is online during import, transactional!
- Make use of one of our APIs for graph processing

  => Performance
- Fine grained user/role concept
- The cluster is being synchronized automatically

Procedures


Source System(s)
JDBC, HTTP, ...
@Procedure("my.import") @PerformsWrites
public void import(@Name("someId") long someId,
@Name("list") List<String> list){
// … my custom import
}
neo4j
import.jar
1. DERIVE MODEL
2. WRITE PROC.
3. DEPLOY JAR
4. CREATE CYPHER
5. RUN IMPORT
Actor
ACTED_IN
Movie
CALL my.import(1, ["s1","s2"])

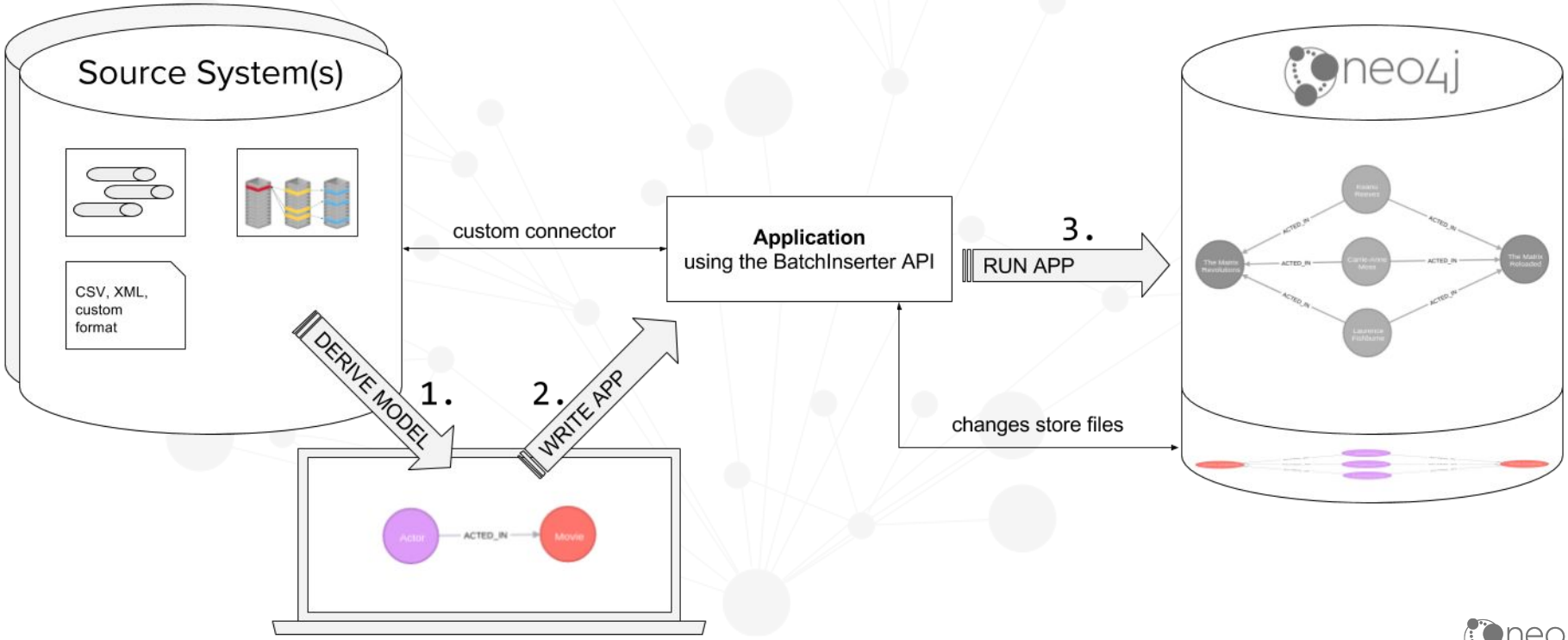
BatchInserter



BatchInserter

- Initial import or update
- Not transactional! Not thread-safe! Private API!
- But extremely fast
- Database is offline during import
- Can handle complex data transformations
- The cluster needs to be synchronized after the import

BatchInserter



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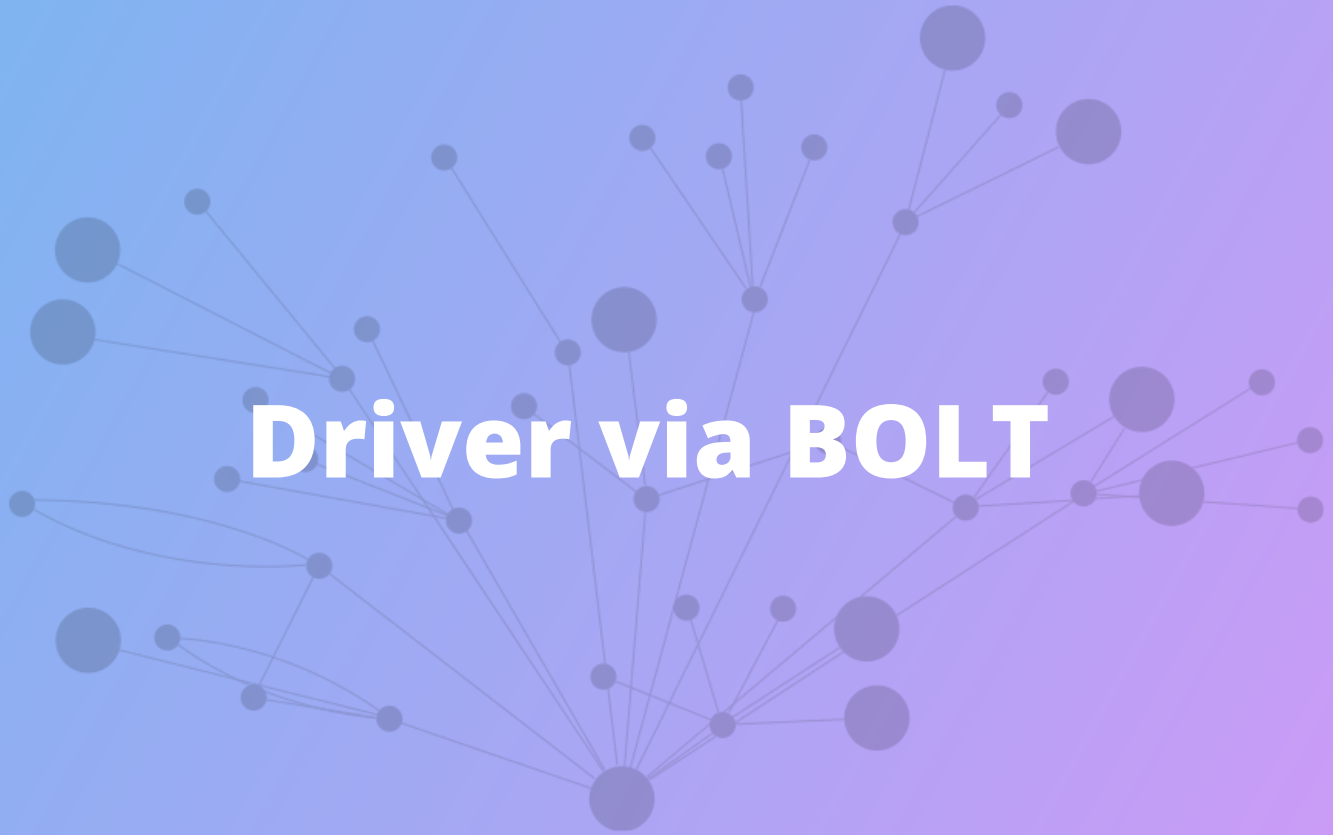
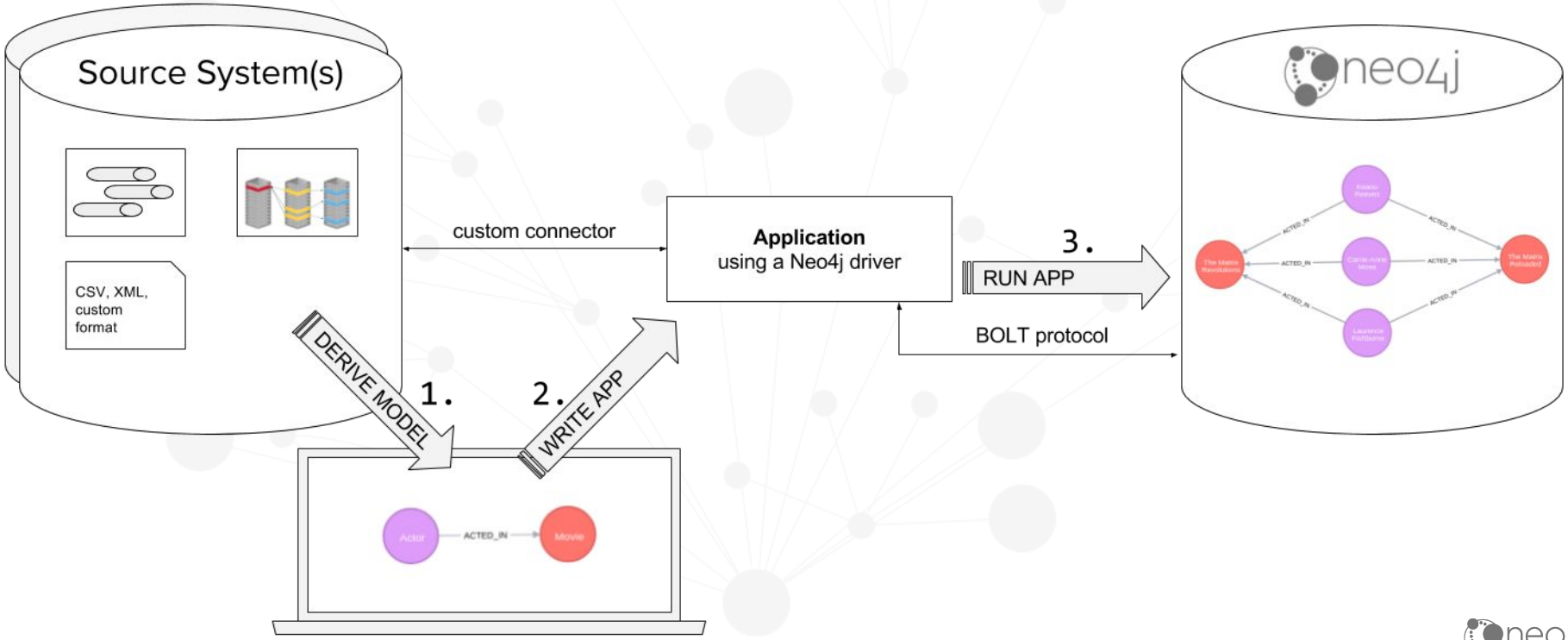
Driver via BOLT



Driver via BOLT

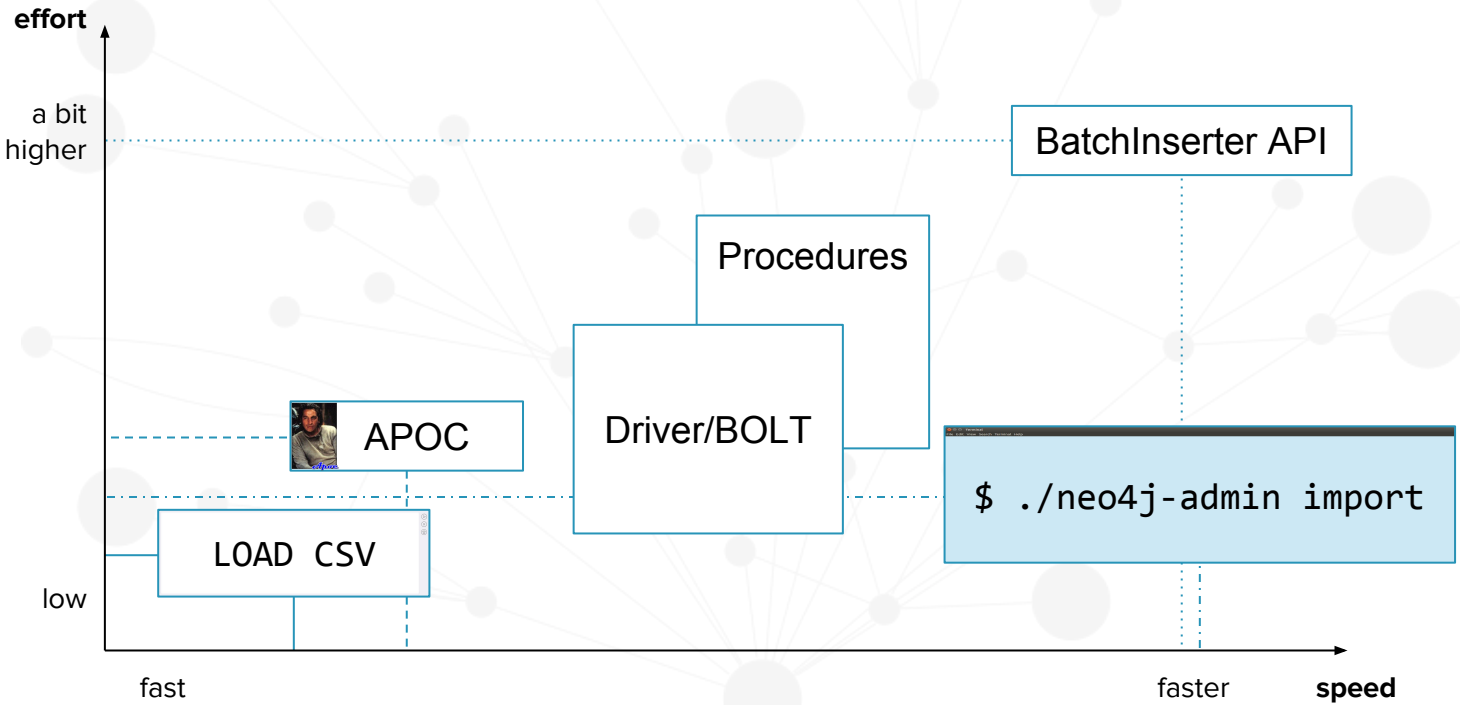
- Drivers for many languages available
- Transactional processing
- Batching
- Parallelization possible

Driver via BOLT



So, which method should I use?

It depends...



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Documentation

$ ./neo4j-admin import - https://neo4j.com/docs/operations-manual/current/tools/import/

LOAD CSV
- http://neo4j.com/docs/developer-manual/current/cypher/clauses/load-csv/
- https://neo4j.com/developer/guide-import-csv/

Eager operator
- https://neo4j.com/docs/developer-manual/current/cypher/execution-plans/row-operators/#query-plan-eager
- http://www.markhneedham.com/blog/2014/10/23/neo4j-cypher-avoiding-the-eager/

APOC - https://neo4j-contrib.github.io/neo4j-apoc-procedures/

Procedures - http://neo4j.com/docs/developer-manual/current/extending-neo4j/procedures/

BatchInserter - http://neo4j.com/docs/java-reference/current/javadocs/org/neo4j/unsafe/batchinsert/BatchInserter.html

Drivers
- https://neo4j.com/docs/developer-manual/current/drivers/
- https://neo4j.com/developer/language-guides/