Связи решают все!

Евгений Газдовский

Animotron.org

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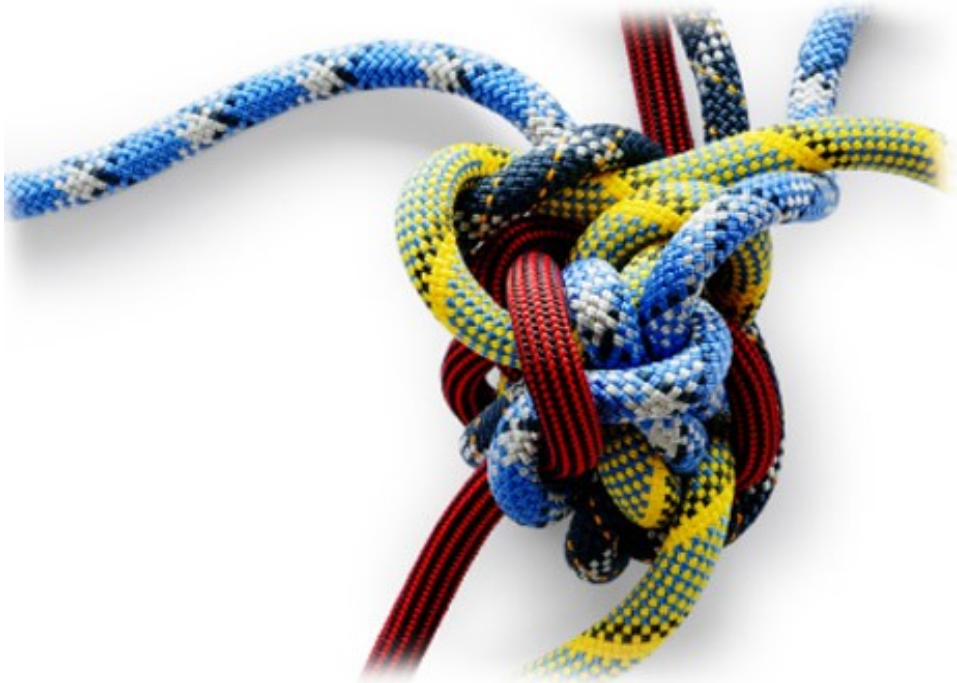
Если имеем сложные запутанные модели



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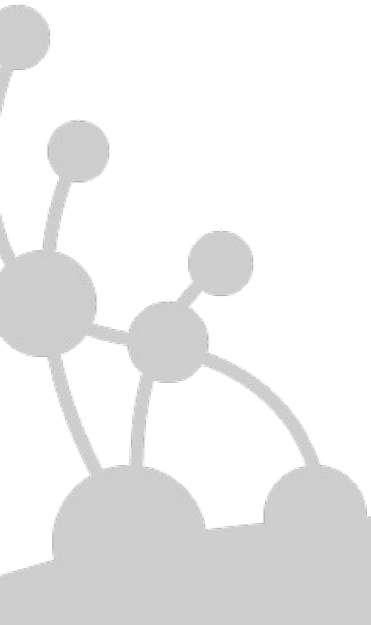
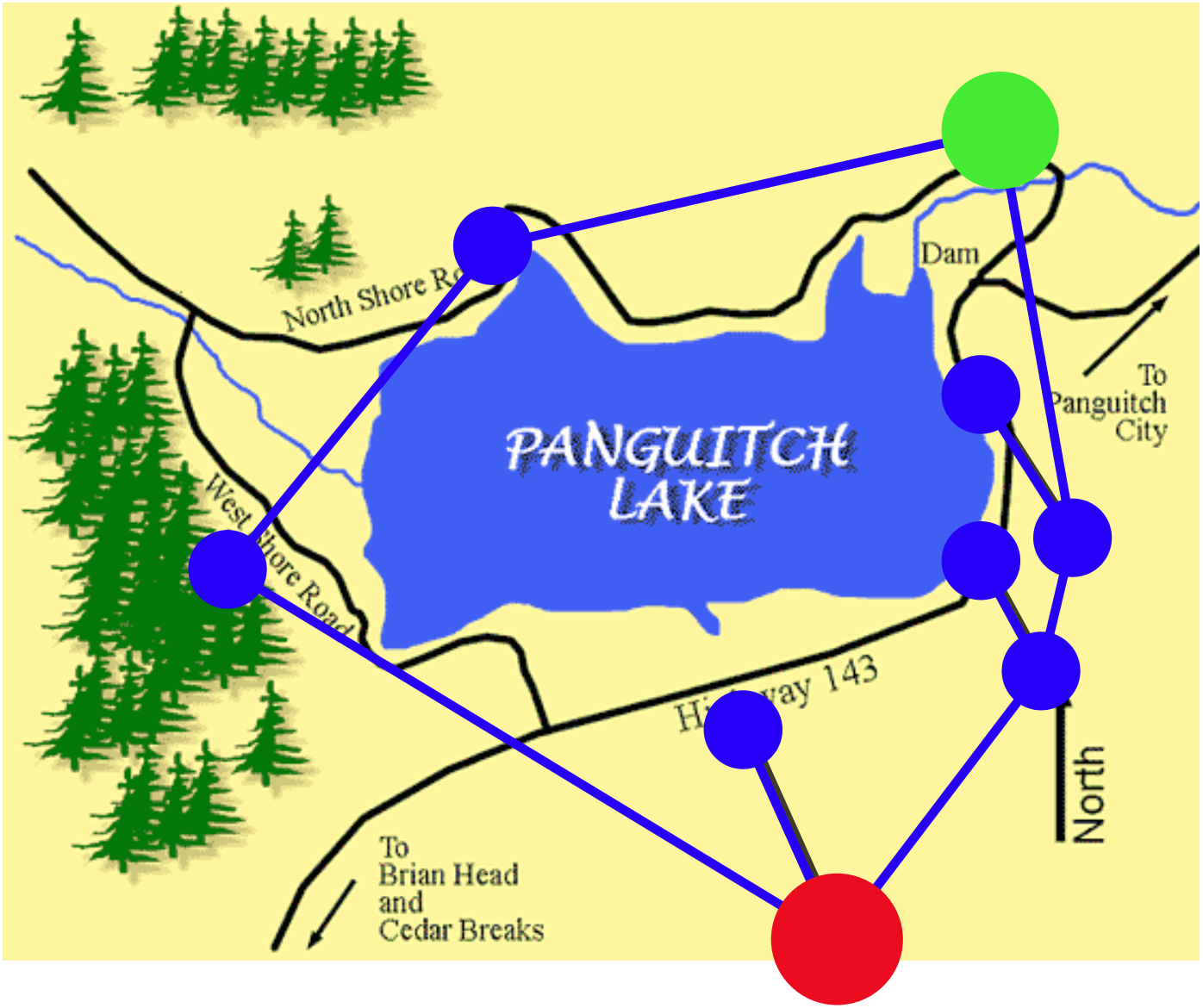
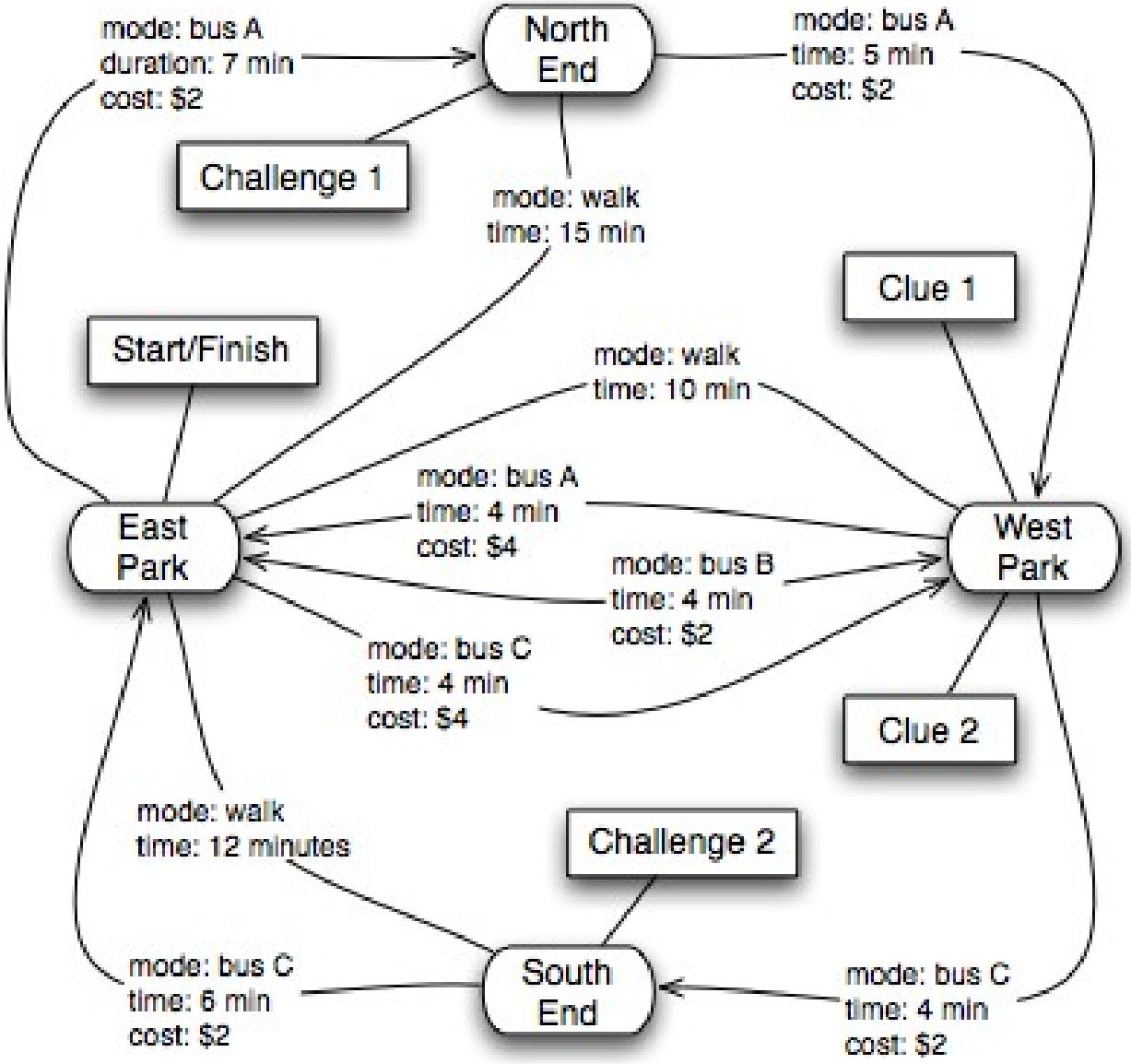
Гео информационные системы




Dam
To
Panguitch
City
PANGUITCH
LAKE
West Shore Road
Highway 143
North
To
Brian Head
and
Cedar Breaks


mode: bus A
duration: 7 min
cost: $2
North End
mode: bus A
time: 5 min
cost: $2
Challenge 1
mode: walk
time: 15 min
Clue 1
Start/Finish
mode: walk
time: 10 min
mode: bus A
time: 4 min
cost: $4
East Park
West Park
mode: bus B
time: 4 min
cost: $2
mode: bus C
time: 4 min
cost: $4
Clue 2
mode: walk
time: 12 minutes
Challenge 2
mode: bus C
time: 6 min
cost: $2
South End
mode: bus C
time: 4 min
cost: $2

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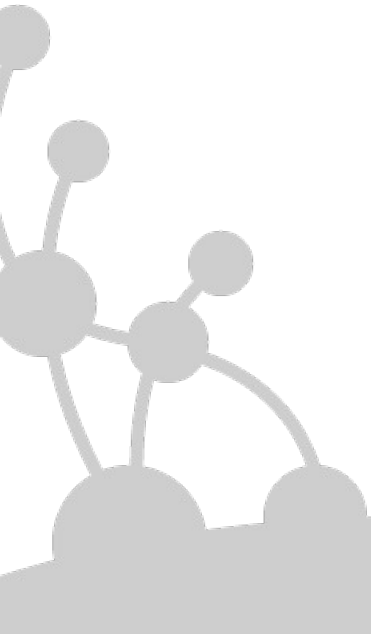
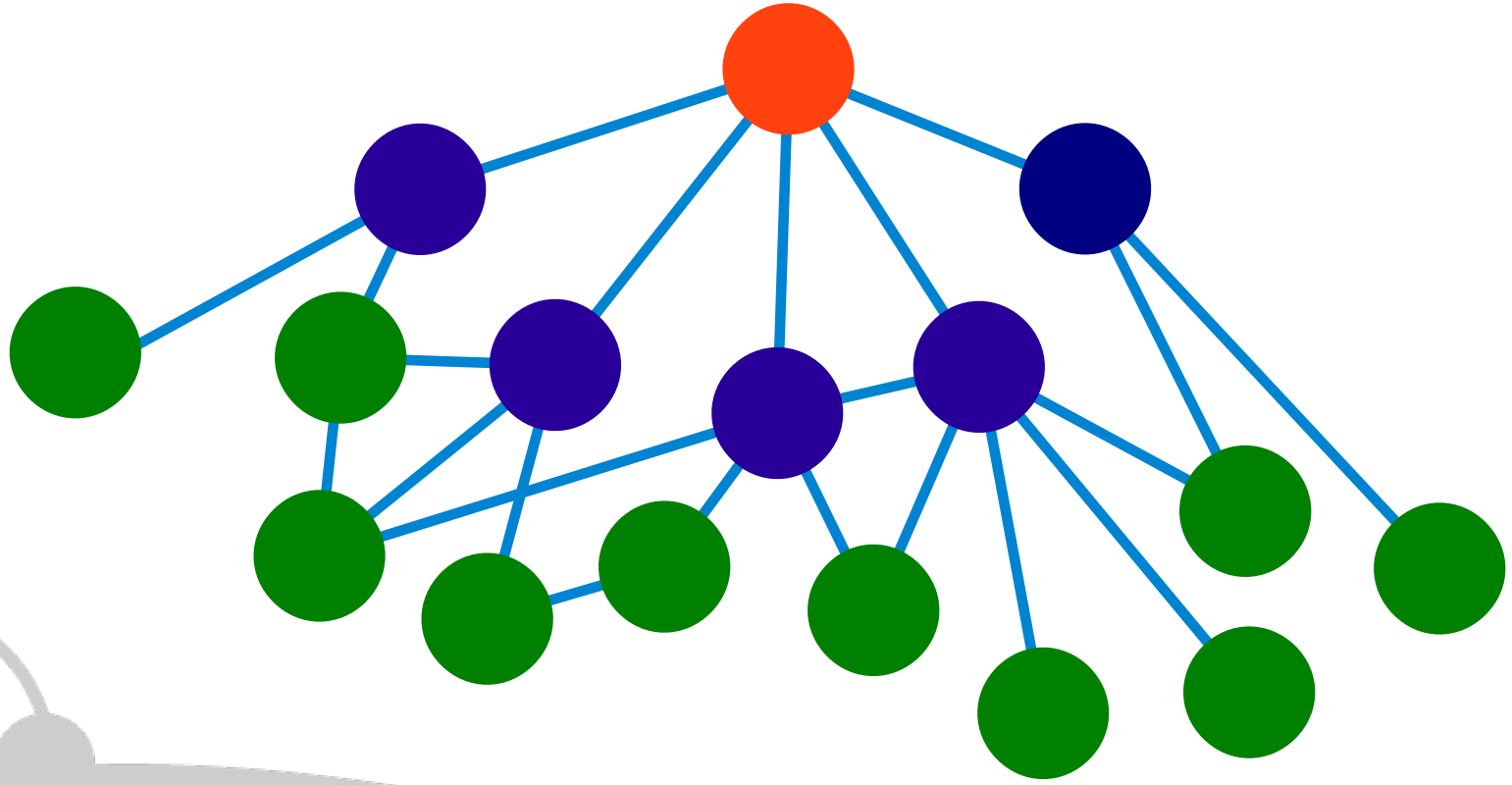
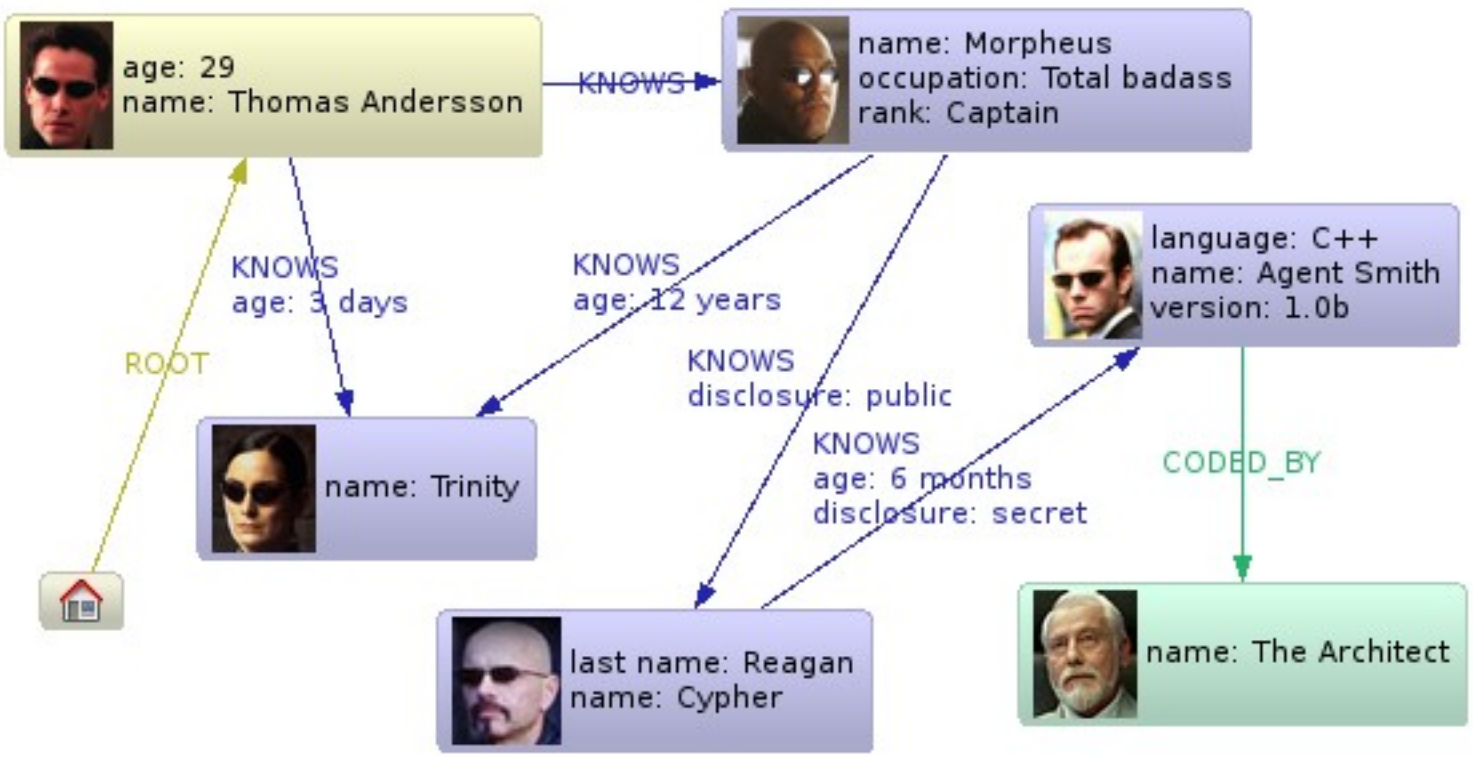
Социальные сети



FOAF

Я, друзья, друзья друзей




age: 29
name: Thomas Andersson
KNOWS
name: Morpheus
occupation: Total badass
rank: Captain
KNOWS
age: 3 days
KNOWS
age: 12 years
language: C++
name: Agent Smith
version: 1.0b
ROOT
KNOWS
disclosure: public
KNOWS
age: 6 months
disclosure: secret
CODED_BY
name: Trinity
last name: Reagan
name: Cypher
name: The Architect

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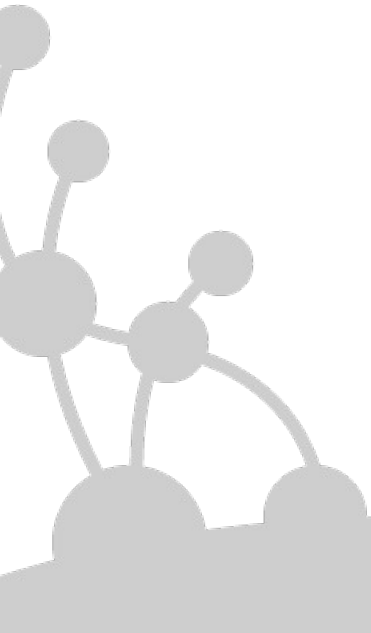
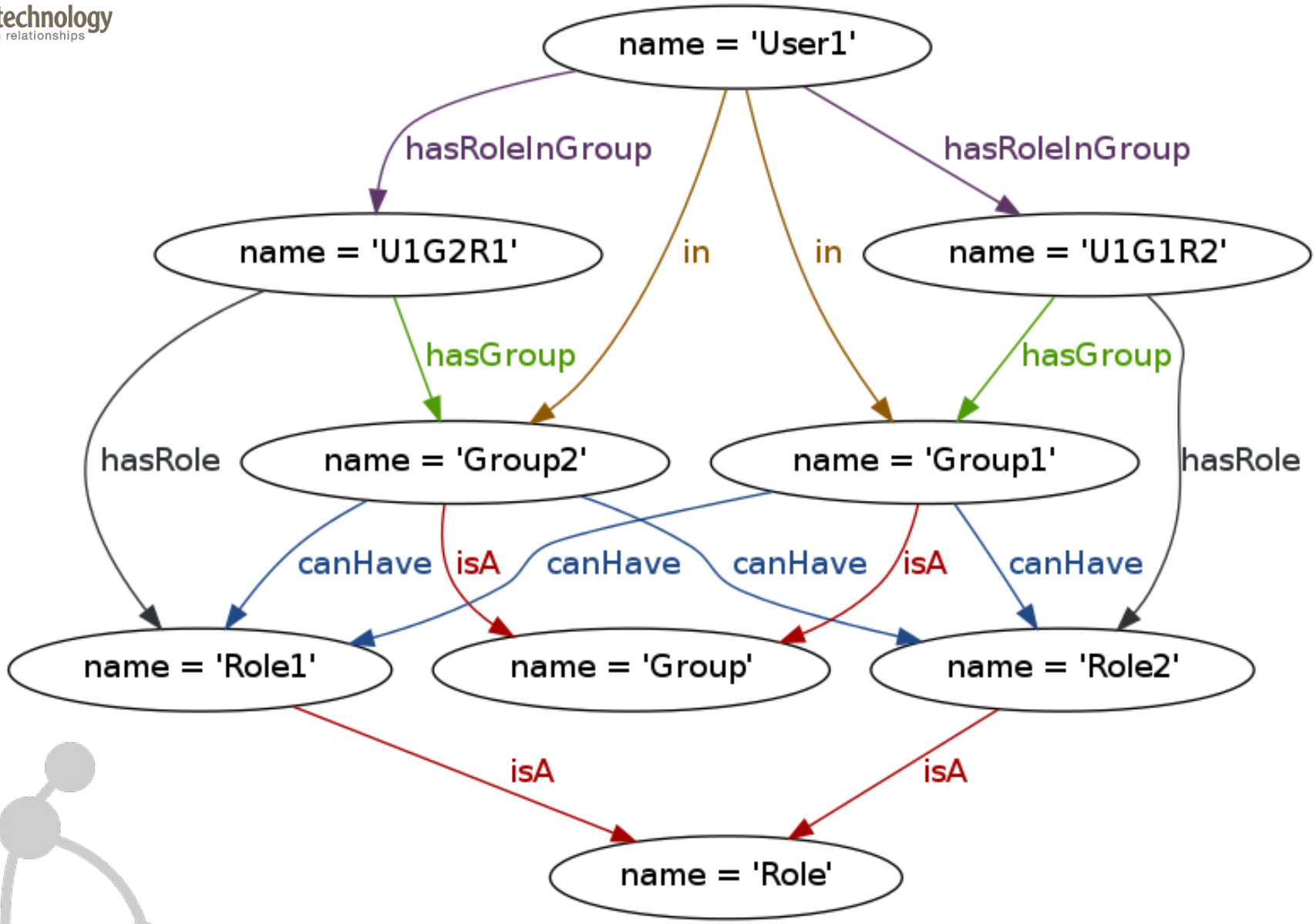
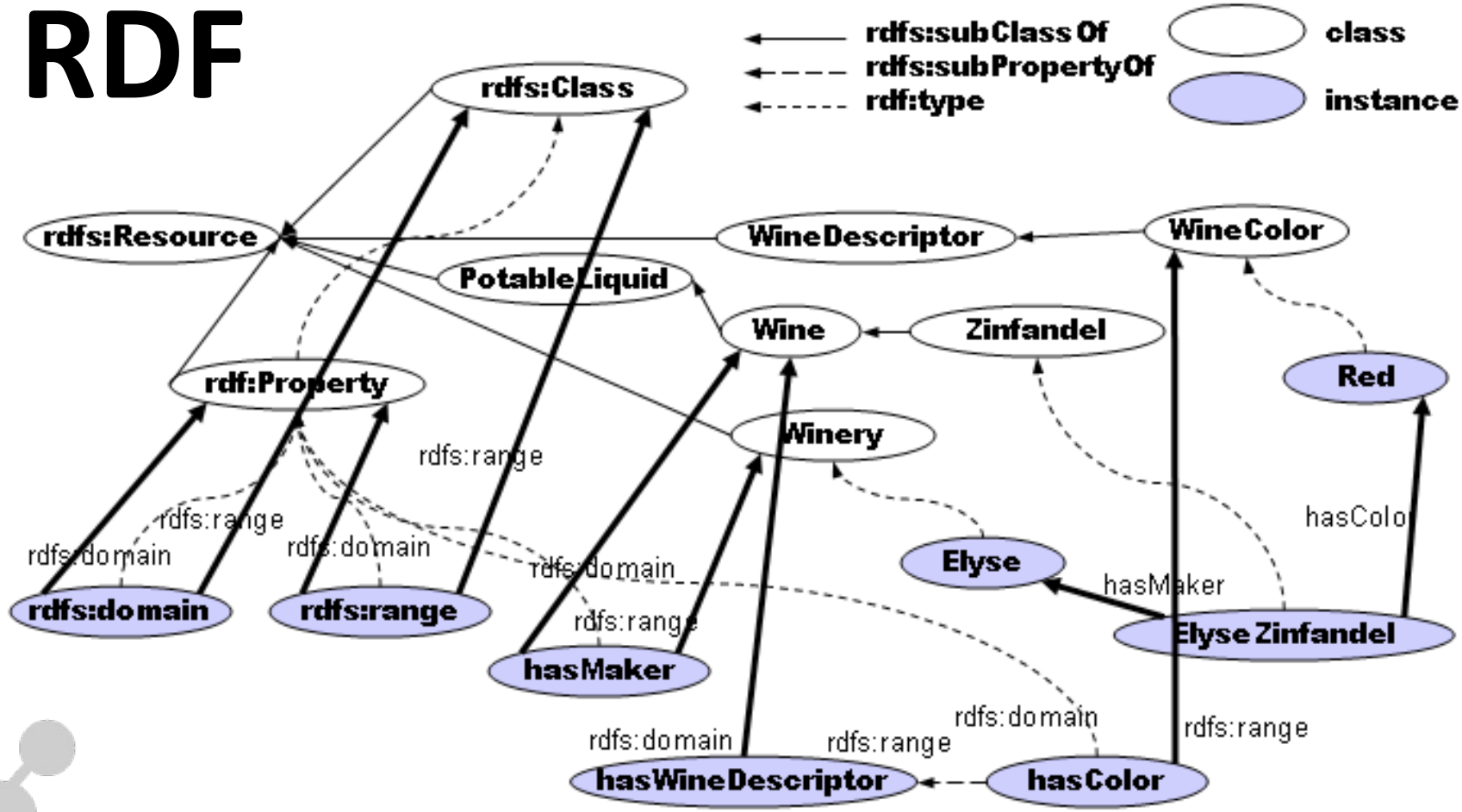
Онтологии




name = 'User1'
hasRoleInGroup
hasRoleInGroup
name = 'U1G2R1'
in
in
name = 'U1G1R2'
hasGroup
hasGroup
hasRole
name = 'Group2'
name = 'Group1'
hasRole
canHave
isA
canHave
canHave
isA
canHave
name = 'Role1'
name = 'Group'
name = 'Role2'
isA
isA
name = 'Role'

RDF



rdfs:domain: class that is reachable from a start node of a property edge via rdf:type→rdfs:subClassOf
rdfs:range: class that is reachable from a target node of a property edge via rdf:type→rdfs:subClassOf

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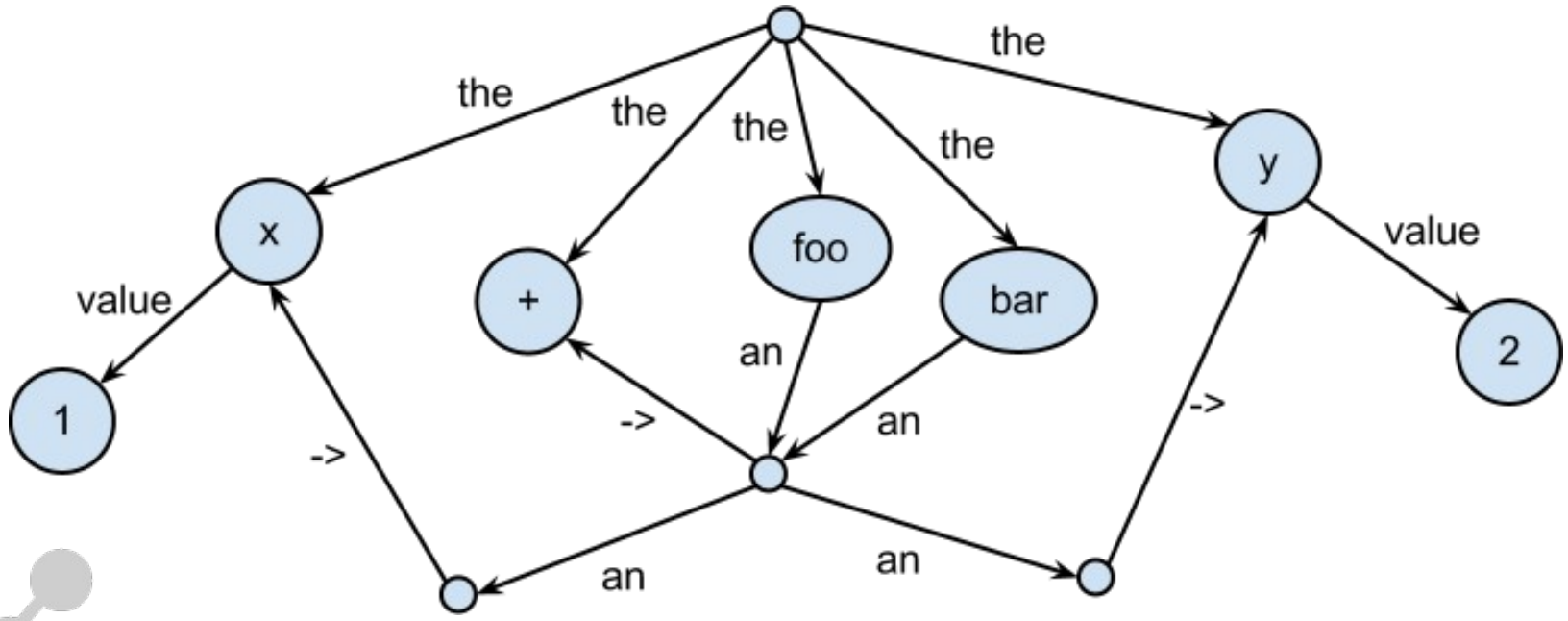
Animo



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Не хотим головной боли от RDBMS

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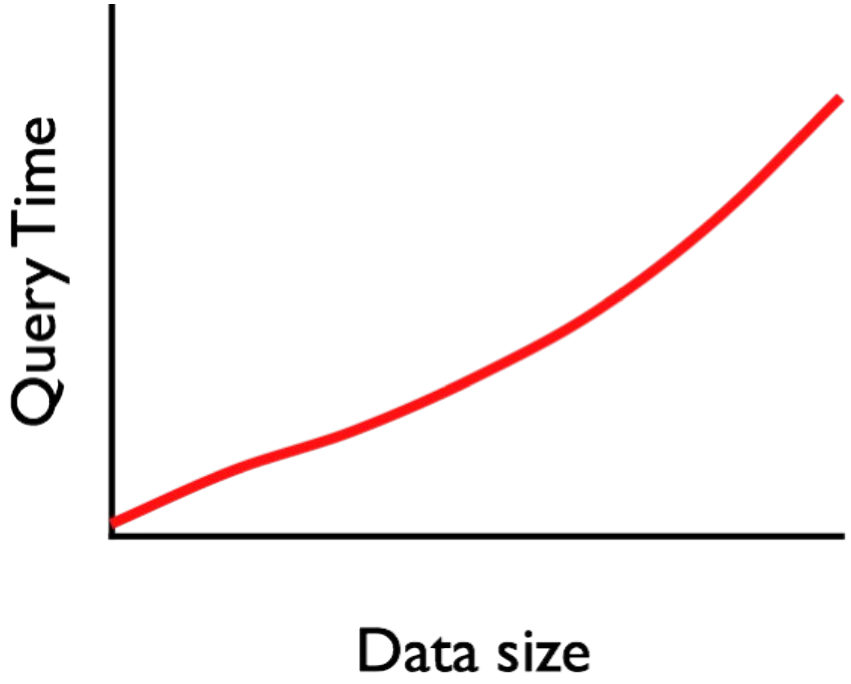
Моделирование отношений в реляционных СуБД

Уменьшение производительности

во многих случаях



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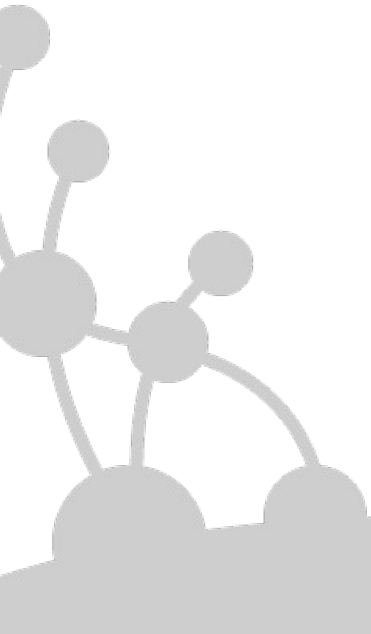
Альтернативы реляционным СуБД

Key/value

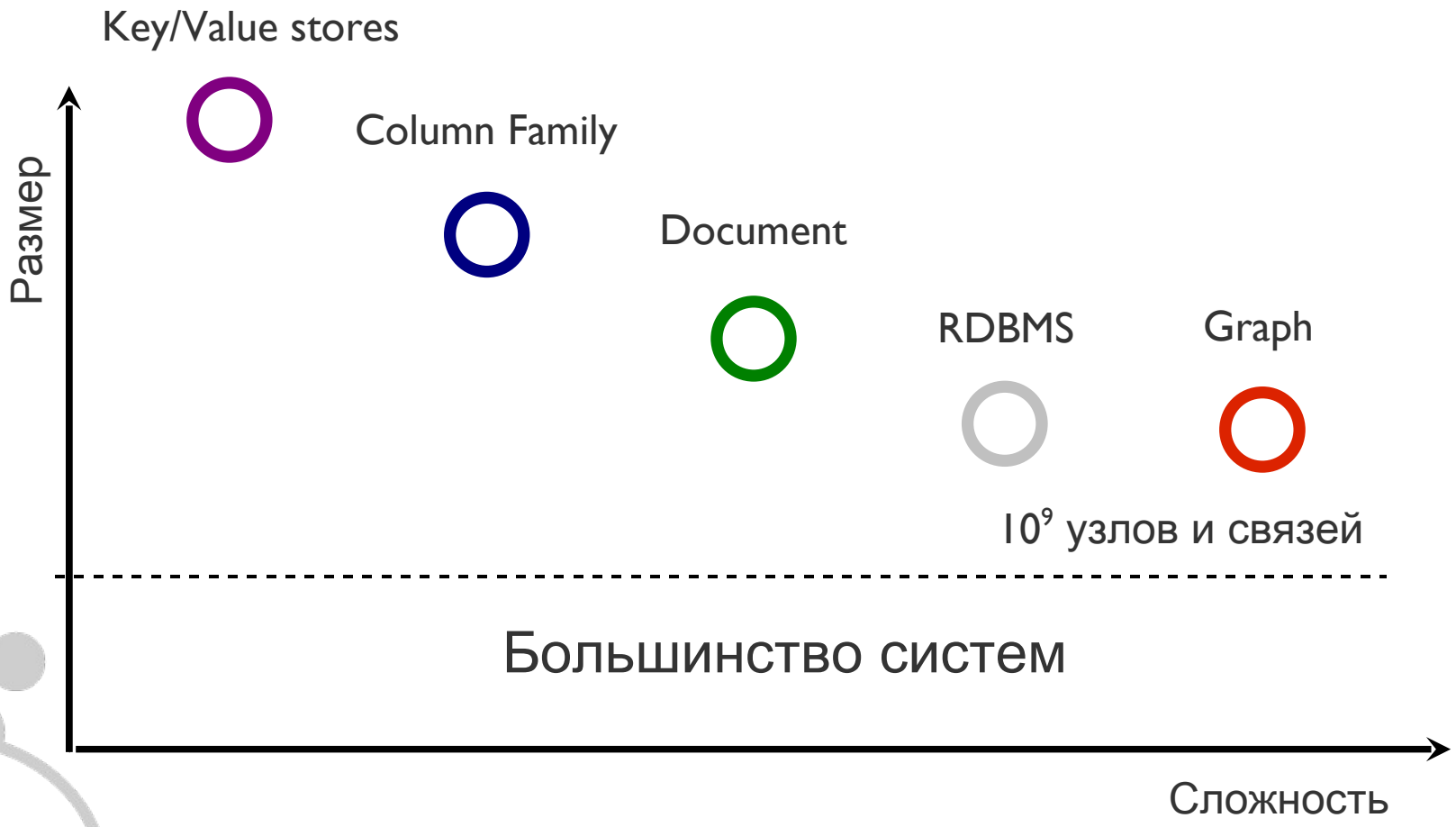
Document

Column Family

Graph



Сложность / размер



Для каждого варианта своё!

Эпоха использования реляционных СУБД для всех задач закончилась.

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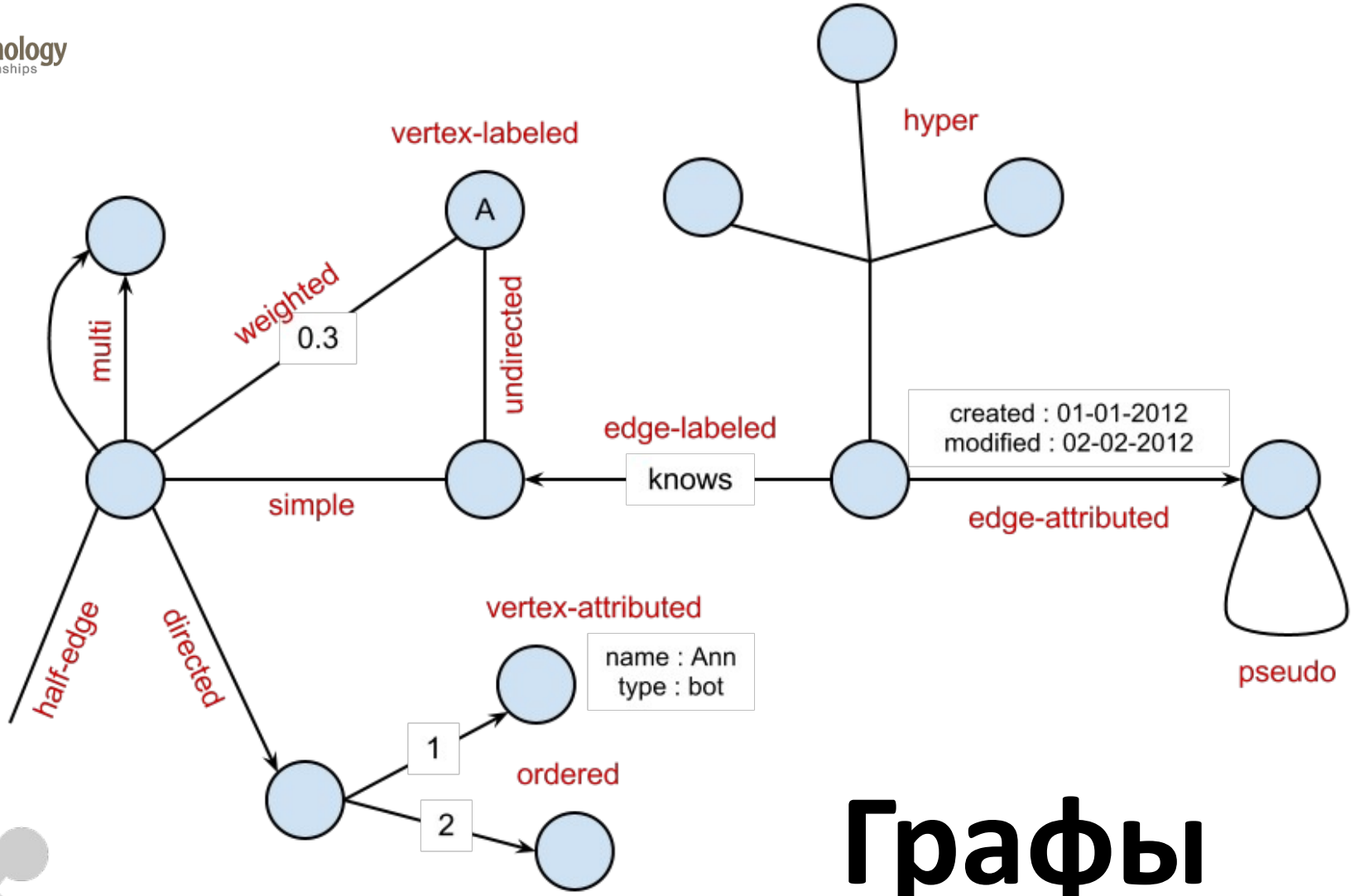

Графы

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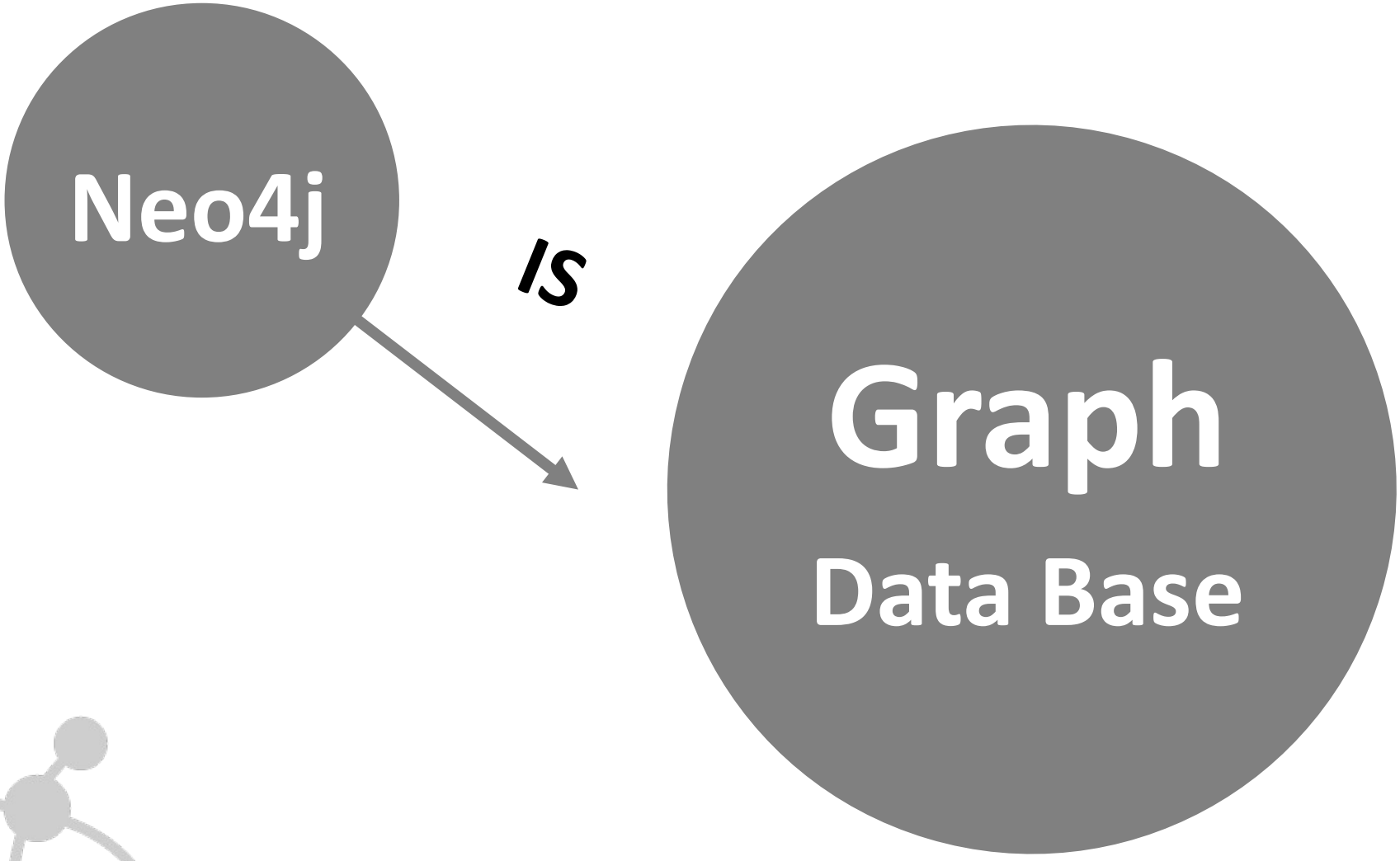
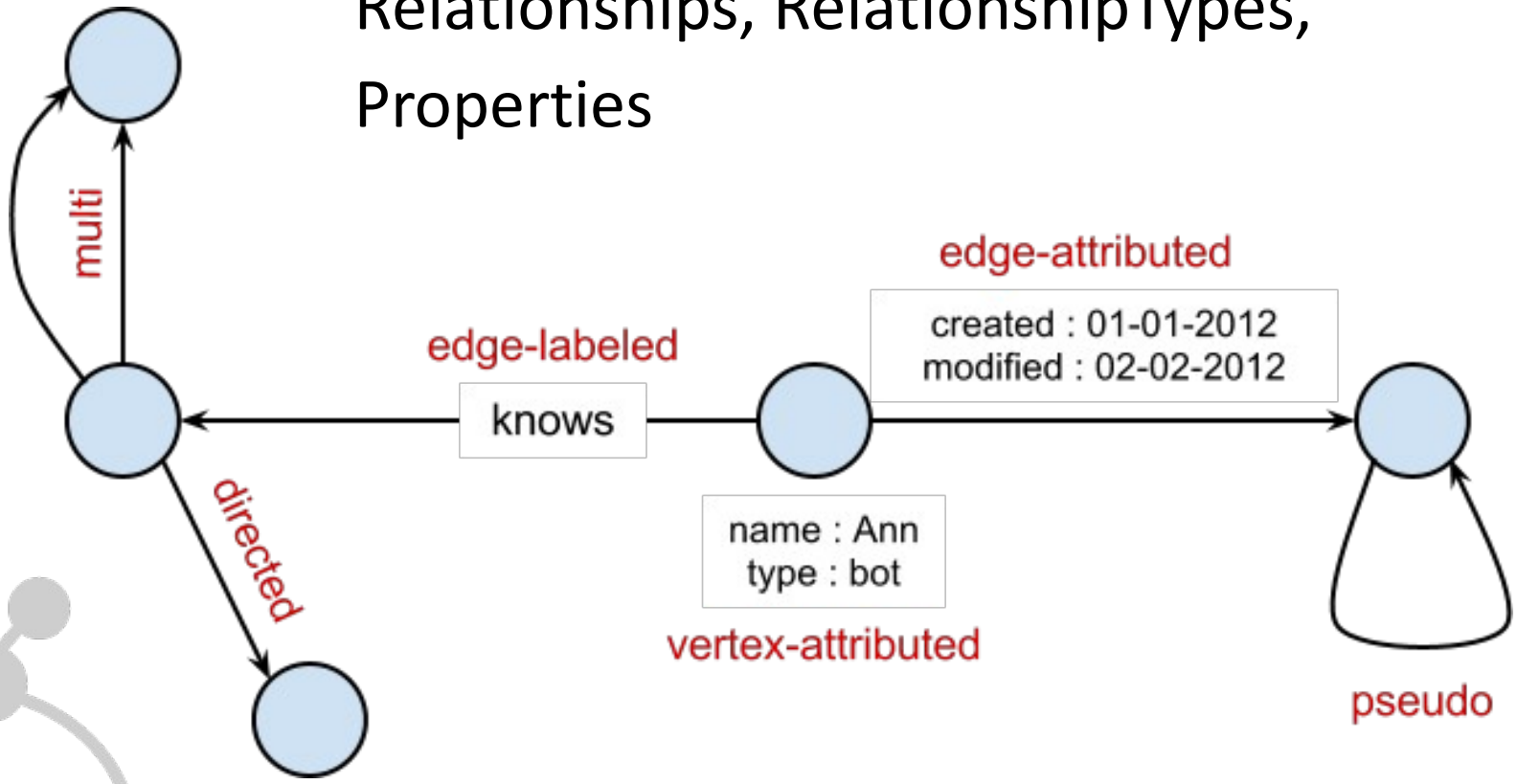


Neo4j — это

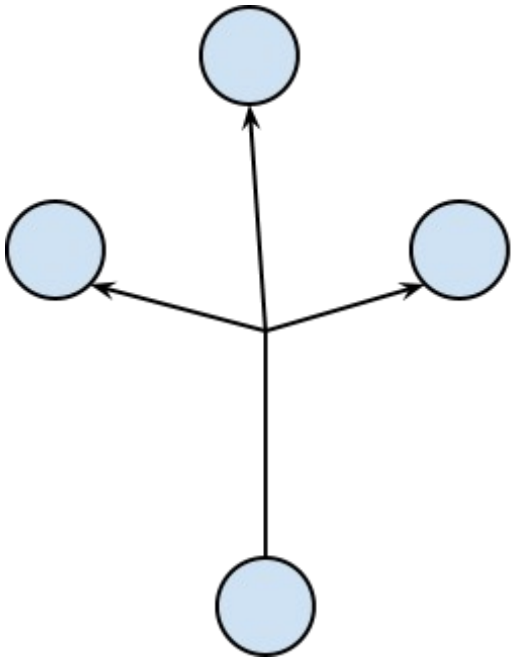
Nodes,

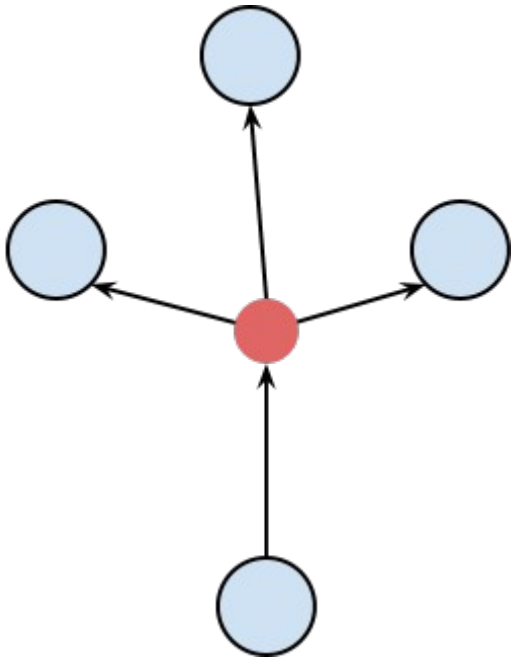
Relationships, RelationshipTypes,

Properties



Моделирование гиперграфа





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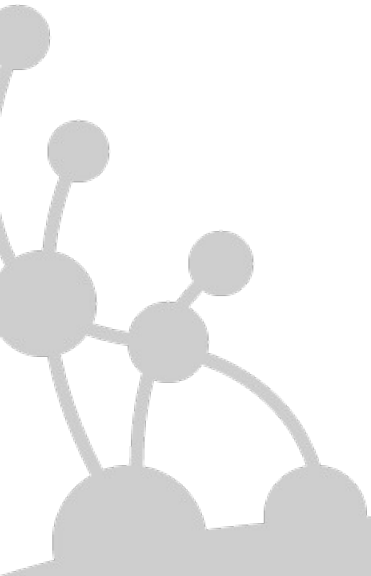
Enhanced Neo4j API

Vertexes, Edges



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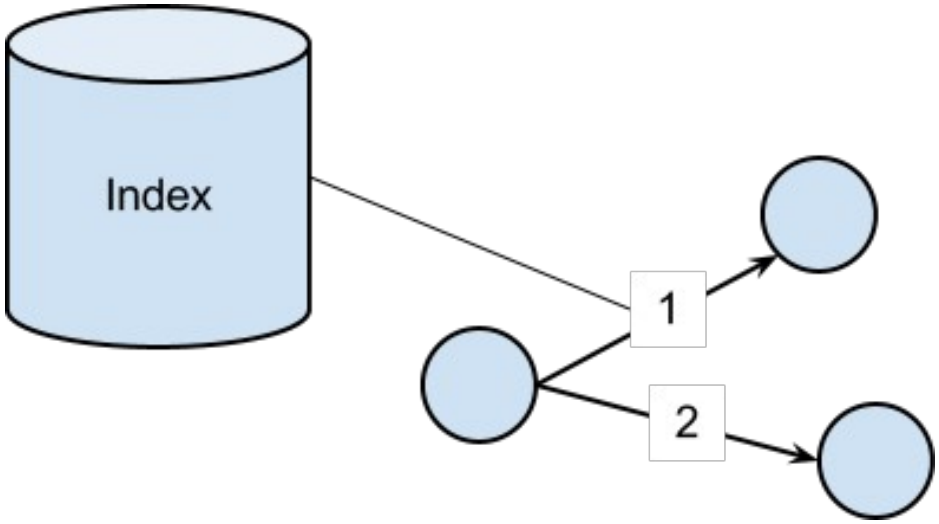
Моделирование упорядоченого графа



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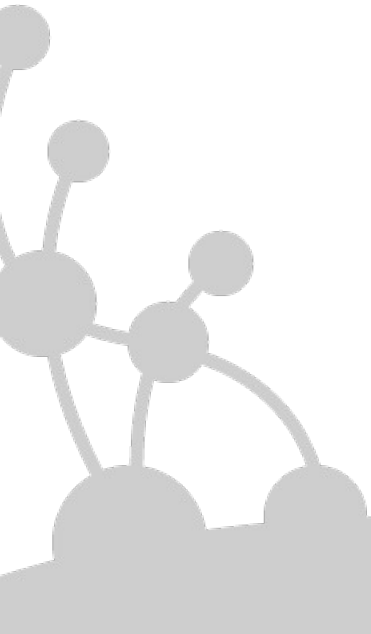
Взаимодействие с Neo4j

Embedded

REST API



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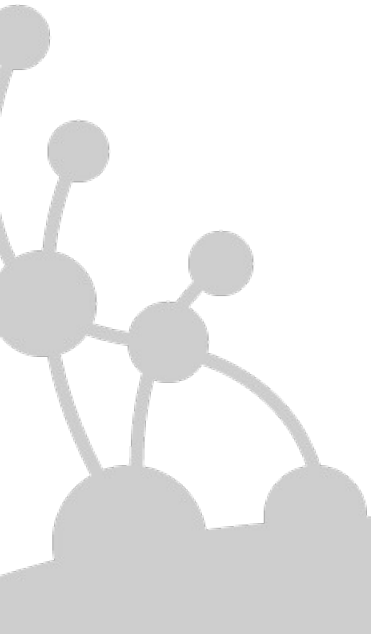
Взаимодействие с Neo4j

Java, Ruby, Python API

Blueprints, Gremlin

Cypher Query

Spring



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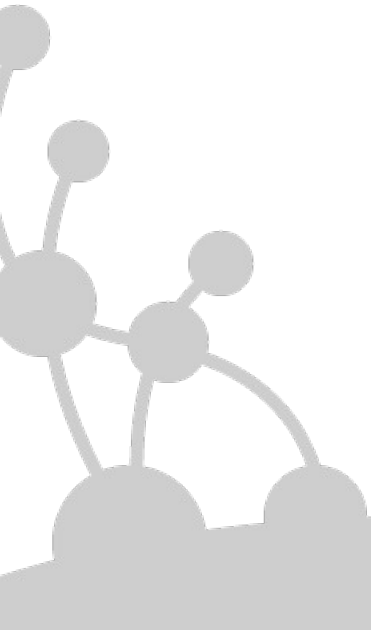
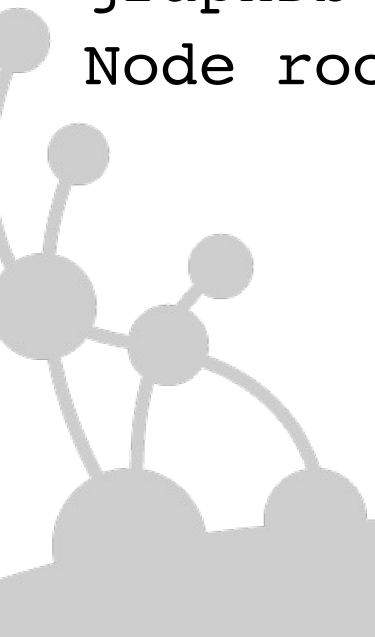
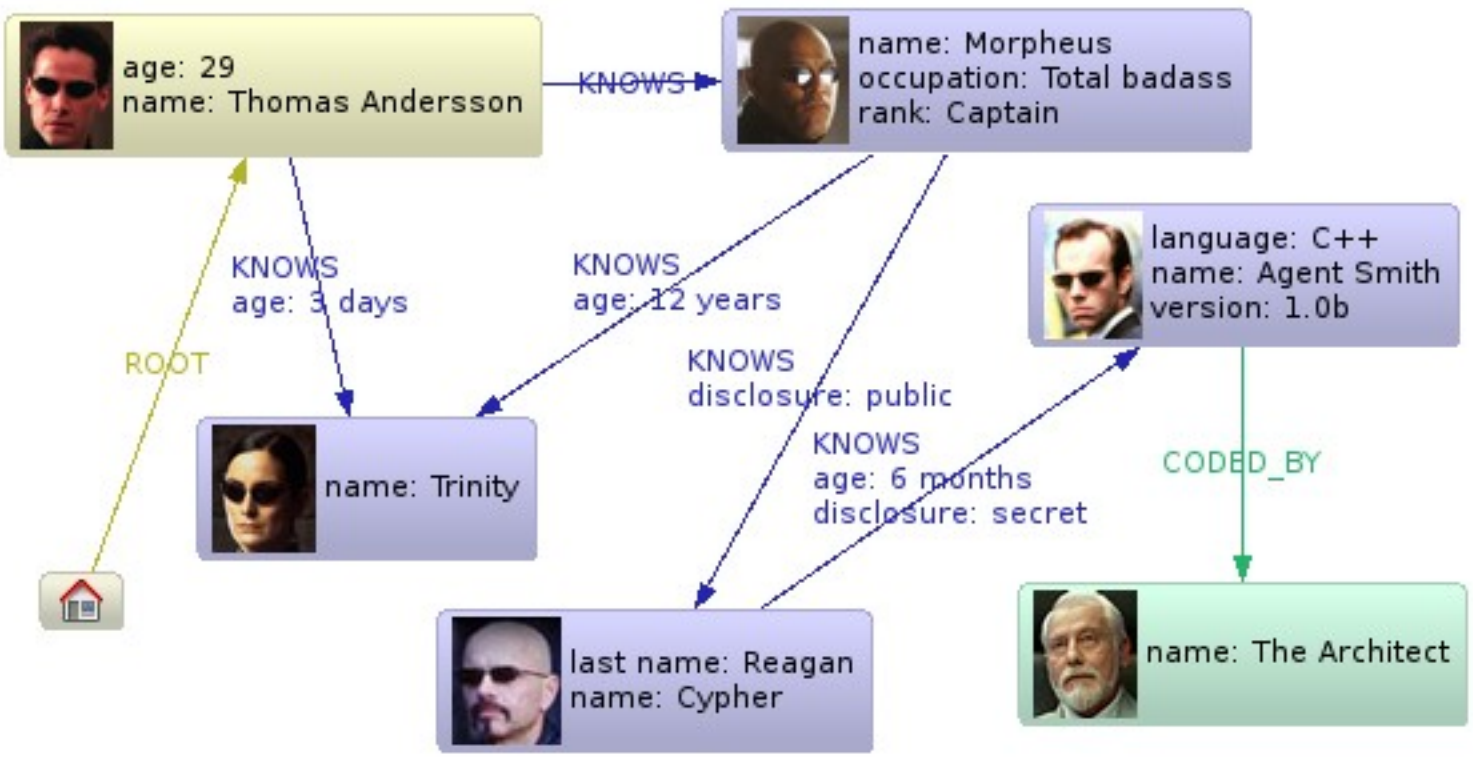
Embedded Java API



Создание БД

```
String STORAGE = "/home/foo/data";
EmbeddedGraphDatabase graphDb;
graphDb = new EmbeddedGraphDatabase(STORAGE);
Node root = graphDb.getReferenceNode();
```




age: 29
name: Thomas Andersson
KNOWS
name: Morpheus
occupation: Total badass
rank: Captain
KNOWS
age: 3 days
KNOWS
age: 12 years
language: C++
name: Agent Smith
version: 1.0b
ROOT
KNOWS
disclosure: public
KNOWS
age: 6 months
disclosure: secret
CODED_BY
name: Trinity
last name: Reagan
name: Cypher
name: The Architect

Добавление узлов

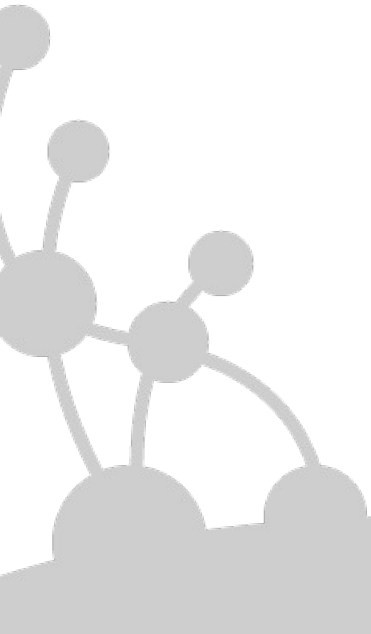
```
Node neo = graphDb.createNode();
neo.setProperty("name", "Thomas Anderson");
neo.setProperty("age", 29);
Node trinity = graphDb.createNode();
trinity.setProperty("name", "Trinity");
```

Типы связей

```
enum NeoRelType implements RelationshipType
{
    ROOT, KNOWS, CODED_BY
}
```

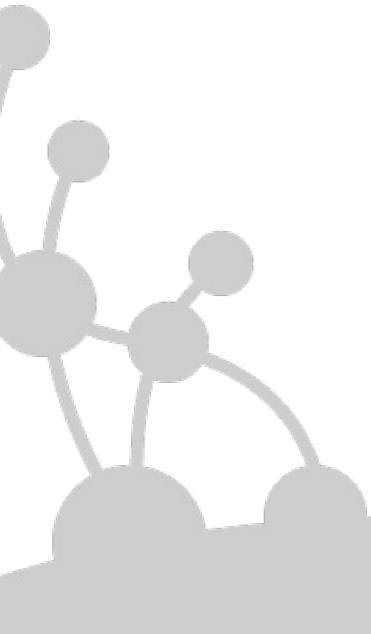
Добавление связей

```
root.createRelationshipTo(neo, ROOT);
Relationship r;
r = neo.createRelationshipTo(trinity, KNOWS);
r.setProperty("age", "3 days")
```



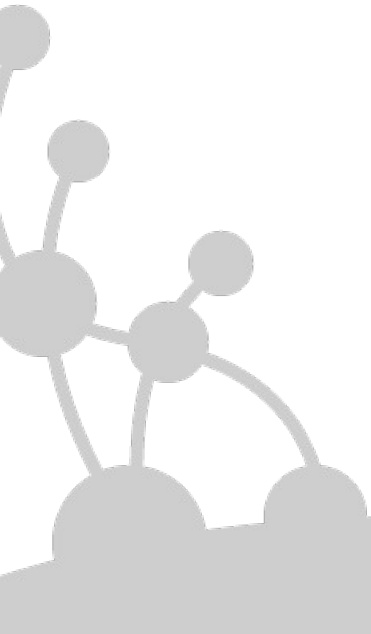
Начало и конец

```
Node start = r.getStartNode();
Node end = r.getEndNode();
Node n = r.getOtherNode(start);
```



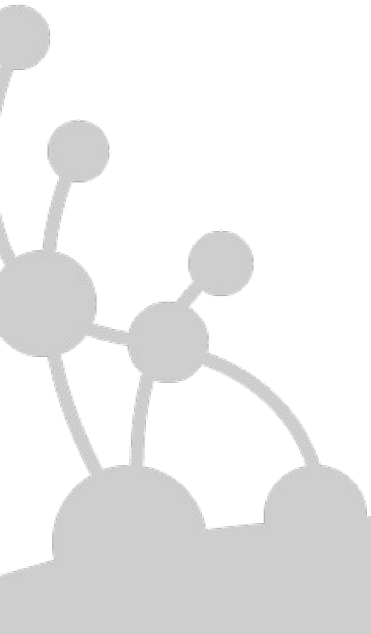
Связи

```
Relationship x = neo.getSingleRelationship(Direction.OUTGOING);
Relationship y = trinyty.getSingleRelationship(Direction.INCOMING);
Itreator<Relationship> it = neo.getRelationships(ROOT);
```



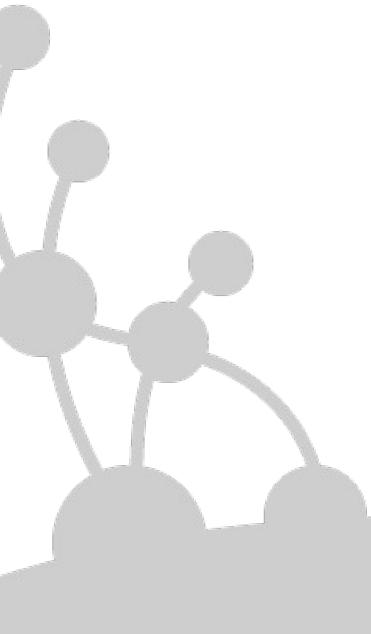
Свойства

```
boolean hasName = neo.hasPropperty("name")
String name = (String)neo.getProperty("name");
String age = (String)r.getProperty("age");
```



Удаление узлов, связей

```
r.delete(); trinity.delete();
```



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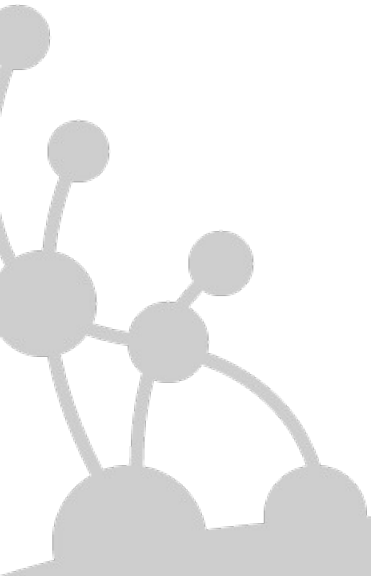
Фреймворк построения индексов

Relationship

Node



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Фреймворк построения индексов

Property

Произвольный ключ

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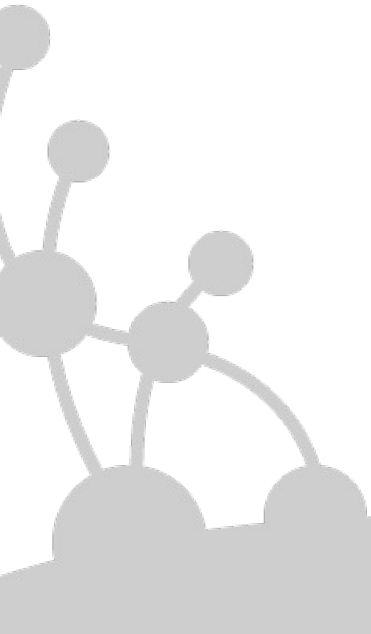
Фреймворк построения индексов

Lucene

Berkeley Database



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Полнотекстовый поиск

создание индекса Lucene

```
IndexManager index = graphDb.index();
Index<Node> fulltextMovies =
index.forNodes( "movies-fulltext",
    MapUtil.stringMap( IndexManager.PROVIDER,
    "lucene", "type", "fulltext" ) );
```

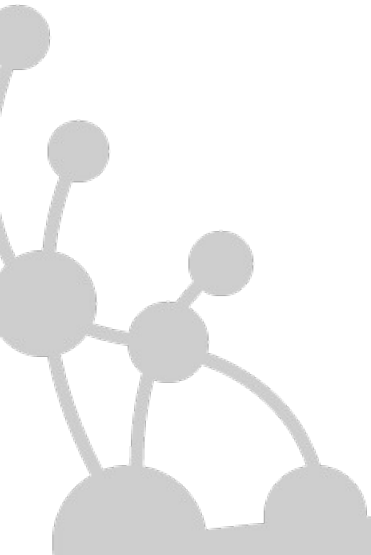
Полнотекстовый поиск

добавление

```
fulltextMovies.add( theMatrix, "title",
                                "The Matrix" );
fulltextMovies.add( theMatrixReloaded,
"title", "The Matrix Reloaded" );
```

Собственно поиск

```
Node found = fulltextMovies.query( "title",
        "reloaded" ).getSingle();
```



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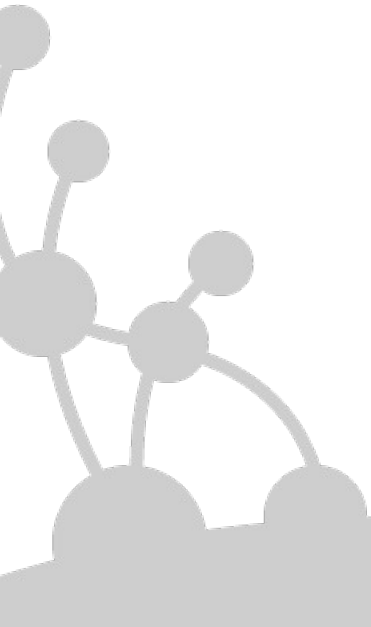
Все возможности Lucene

сортировка

числовые диапазоны

маски

составные запросы



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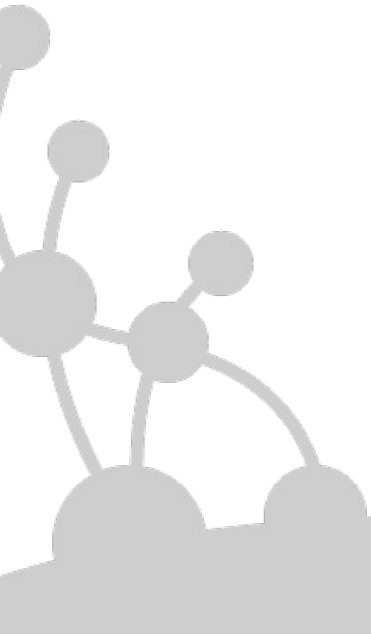
Автоматическое индексирование

через имена и значения свойств



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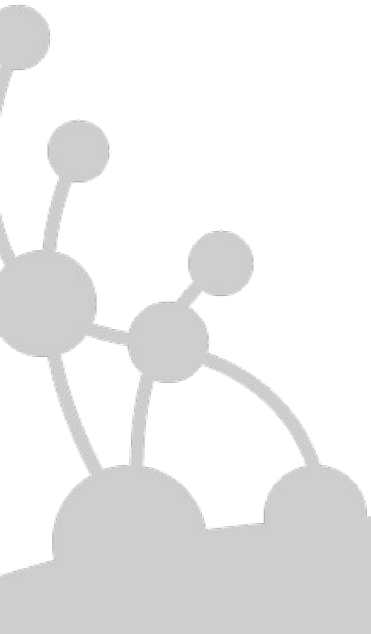
Запросы в Neo4j — это

Поиск узлов и связей по индексу

Траверс графа



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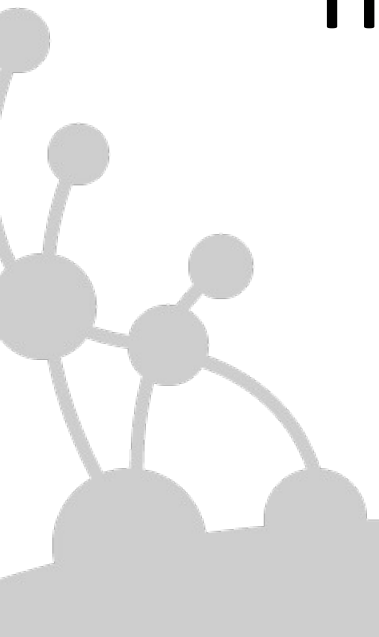
Траверс графа — это

поиск множества путей

по заданным условиям



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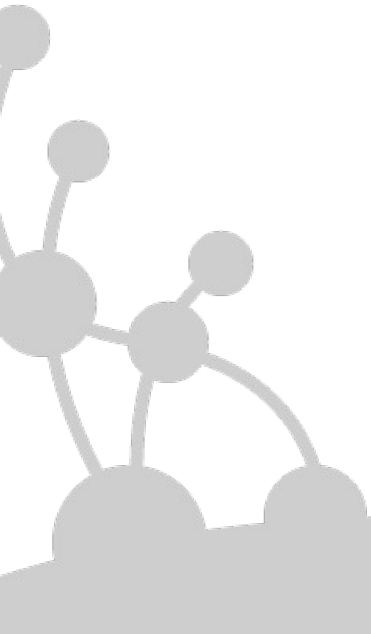
Траверс графа

```
TraversalDescription td_KNOWS =
        Traversal.description().
           breadthFirst().
           relationships(KNOWS, OUTGOING);
```



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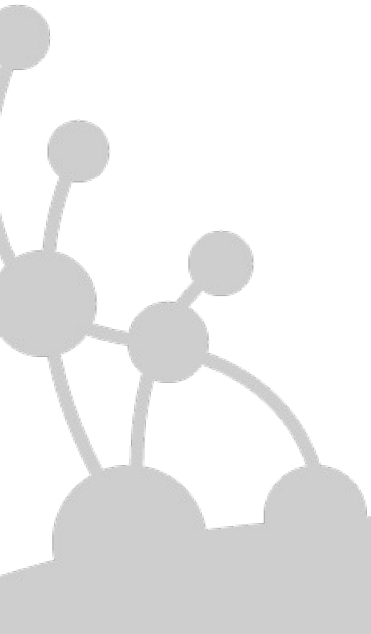
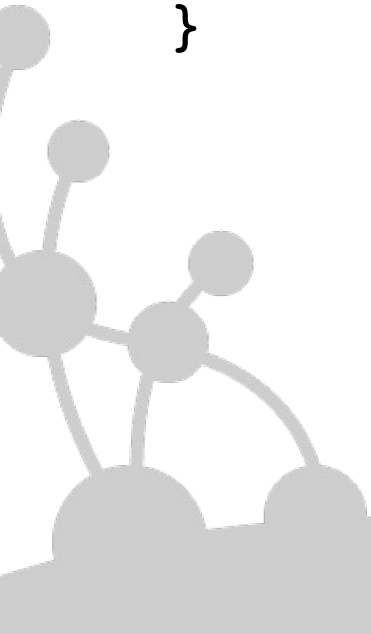
Траверс графа

```
Traverce t = td_KNOWS.traverce(neo);
```



Траверс графа

```
Iterateriable<Nodes> nodes = t.nodes();
for (Node n : nodes) {
   …
}
```



Траверс графа

```
Iteratrable<Relationship> relationships;
relationships = t.relationships();
for (Relationship n : relationships) {
   …
}
```

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Траверс графа

```
Path p;
Iterator<Path> paths = t.iterator();
while (paths.hasNext()) {
    //…
    p = paths.next();
    //…
}
```

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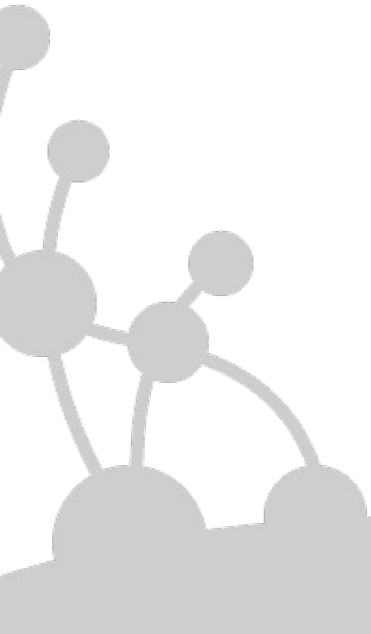
Все алгоритмы ленивые и могут быть распараллелены



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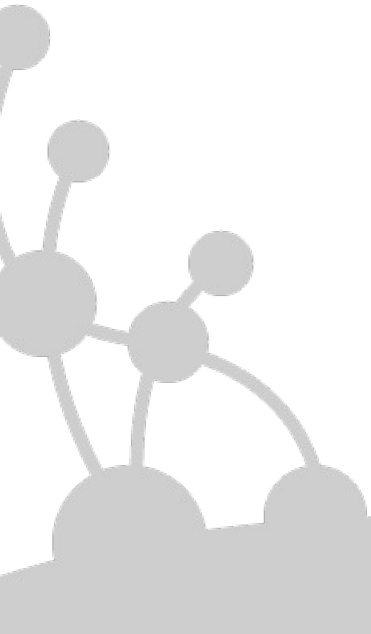
Встроенные алгоритмы обхода графа

в глубину и ширину



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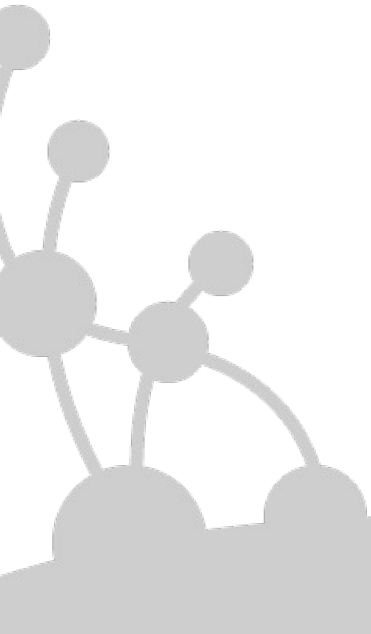
Коллекция алгоритмов поиска путей

Дейкстры, A*,
всех путей



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Транзакции

ACID

Многопоточность

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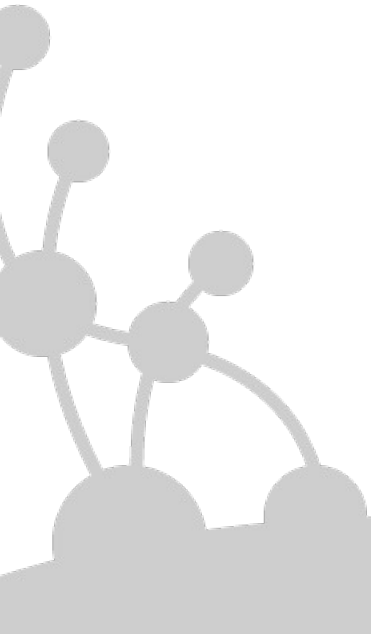
Транзакции

привязаны к thread



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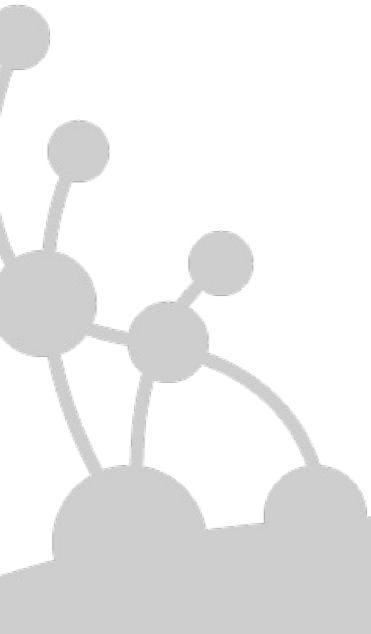
Транзакции

только на запись



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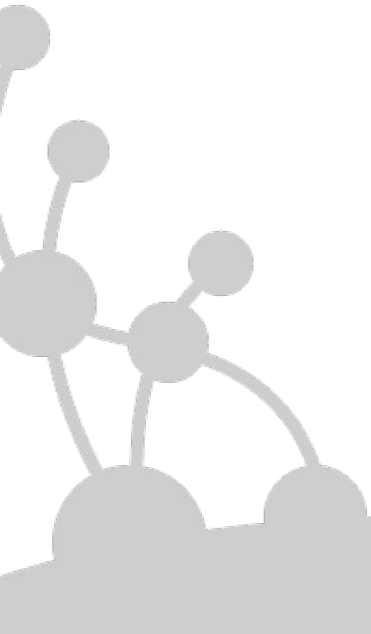
Транзакции

```
Transaction tx = graphDb.beginTx();
try {
   Node n = graphDb.createNode();
   //…
   tx.success();
} finally {
   tx.finish()
}
```

Транзакции

могут быть вложенными



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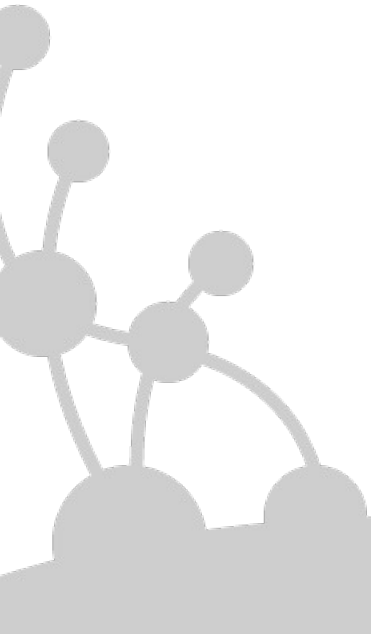
Транзакции

оптимальный размер

до 50К изменений



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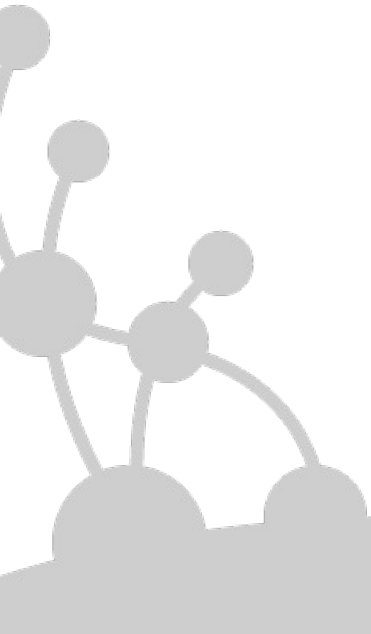
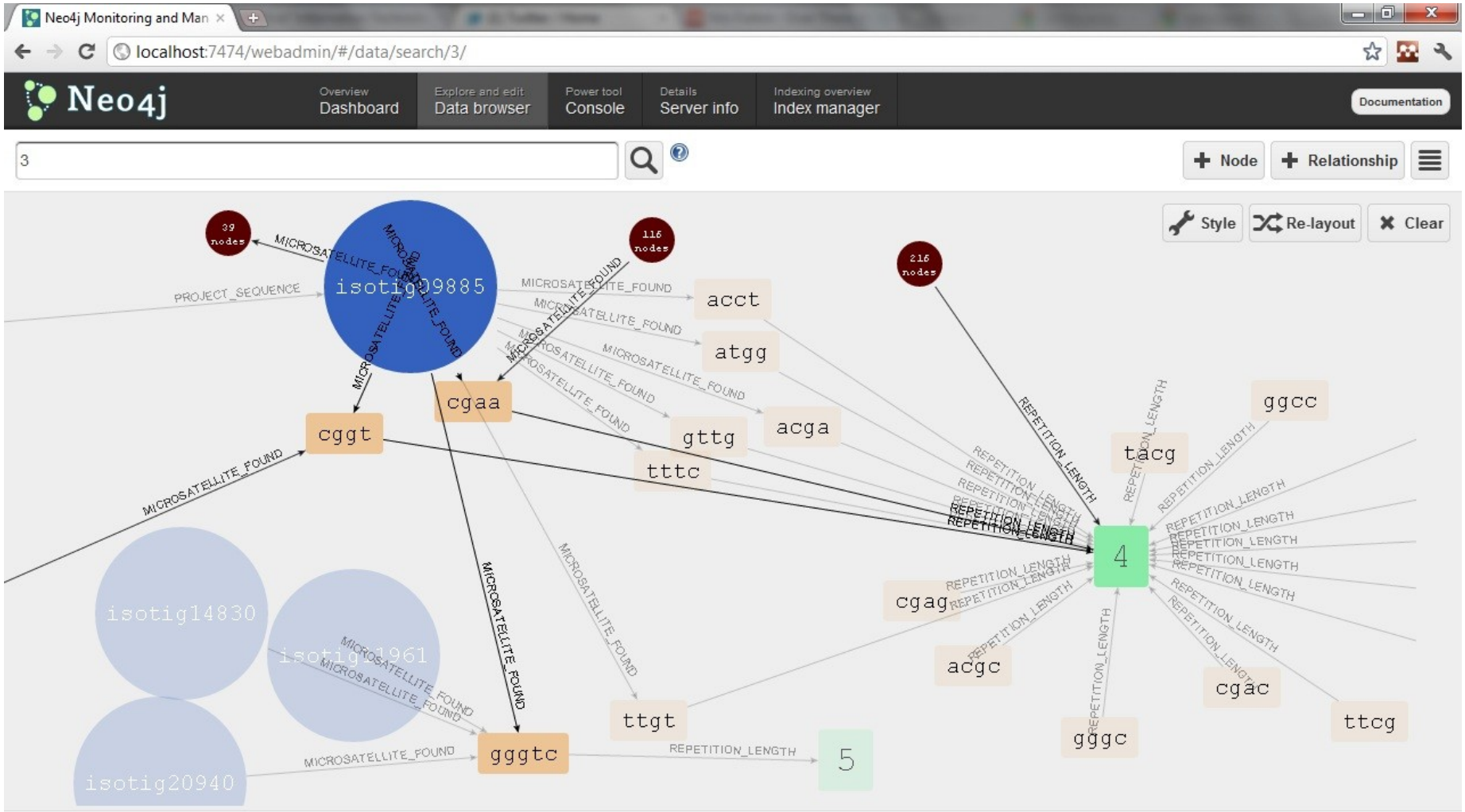
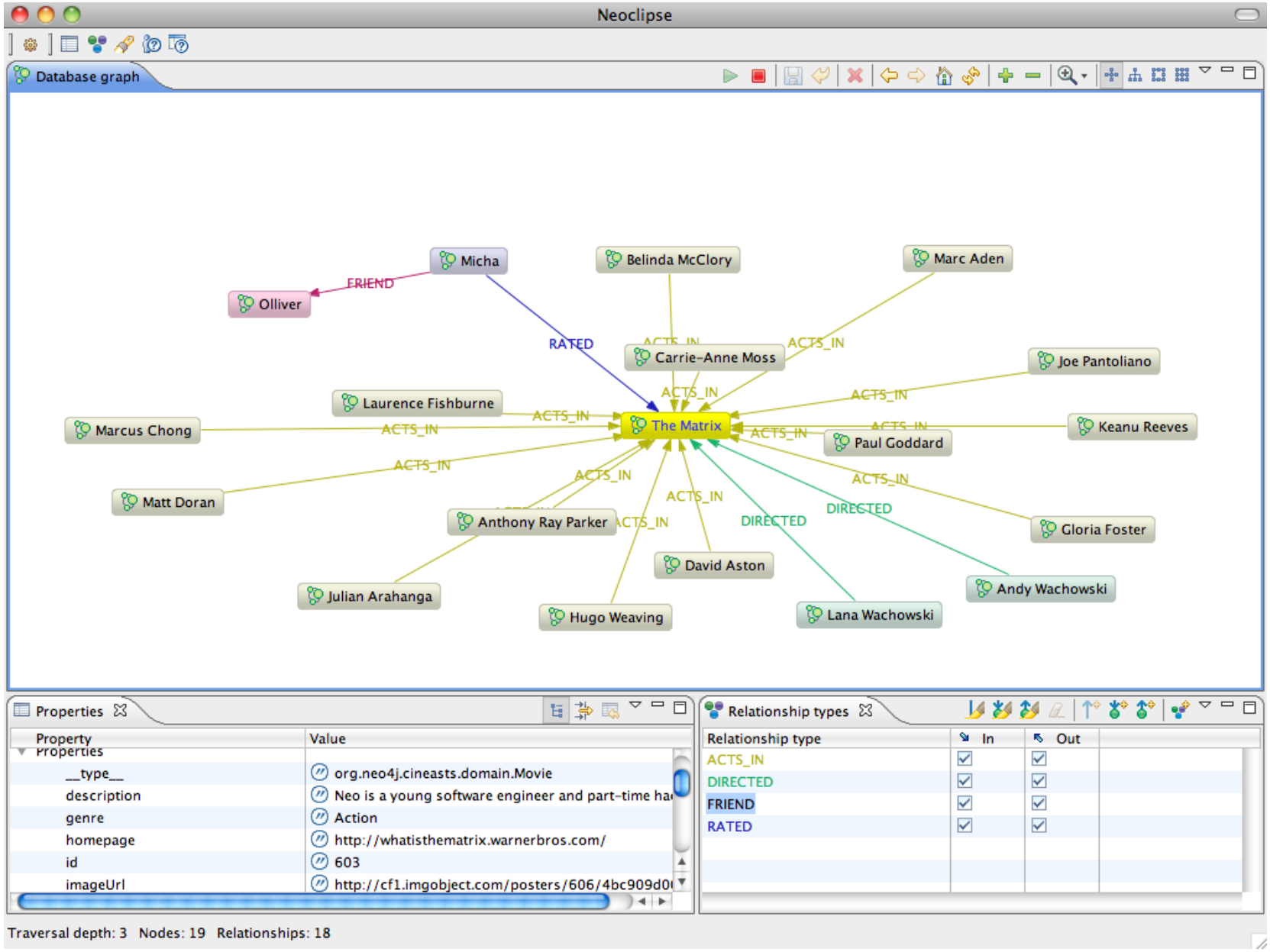
Инструменты



Neo4j Webadmin



Neoclipse


Neoclipse
Database graph
Micha
Belinda McClory
Marc Aden
Olliver
FRIEND
RATED
Carrie-Anne Moss
ACTS_IN
Joe Pantoliano
Laurence Fishburne
Marcus Chong
The Matrix
Keanu Reeves
Paul Goddard
Matt Doran
Anthony Ray Parker
DIRECTED
Gloria Foster
David Aston
Andy Wachowski
Julian Arahanga
Hugo Weaving
Lana Wachowski
Properties
Property
Value
__type__
org.neo4j.cineasts.domain.Movie
description
Neo is a young software engineer and part-time ha
genre
Action
homepage
http://whatisthematrix.warnerbros.com/
id
603
imageUrl
Relationship types
Relationship type
In
Out
ACTS_IN
DIRECTED
FRIEND
RATED
Traversal depth: 3 Nodes: 19 Relationships: 18

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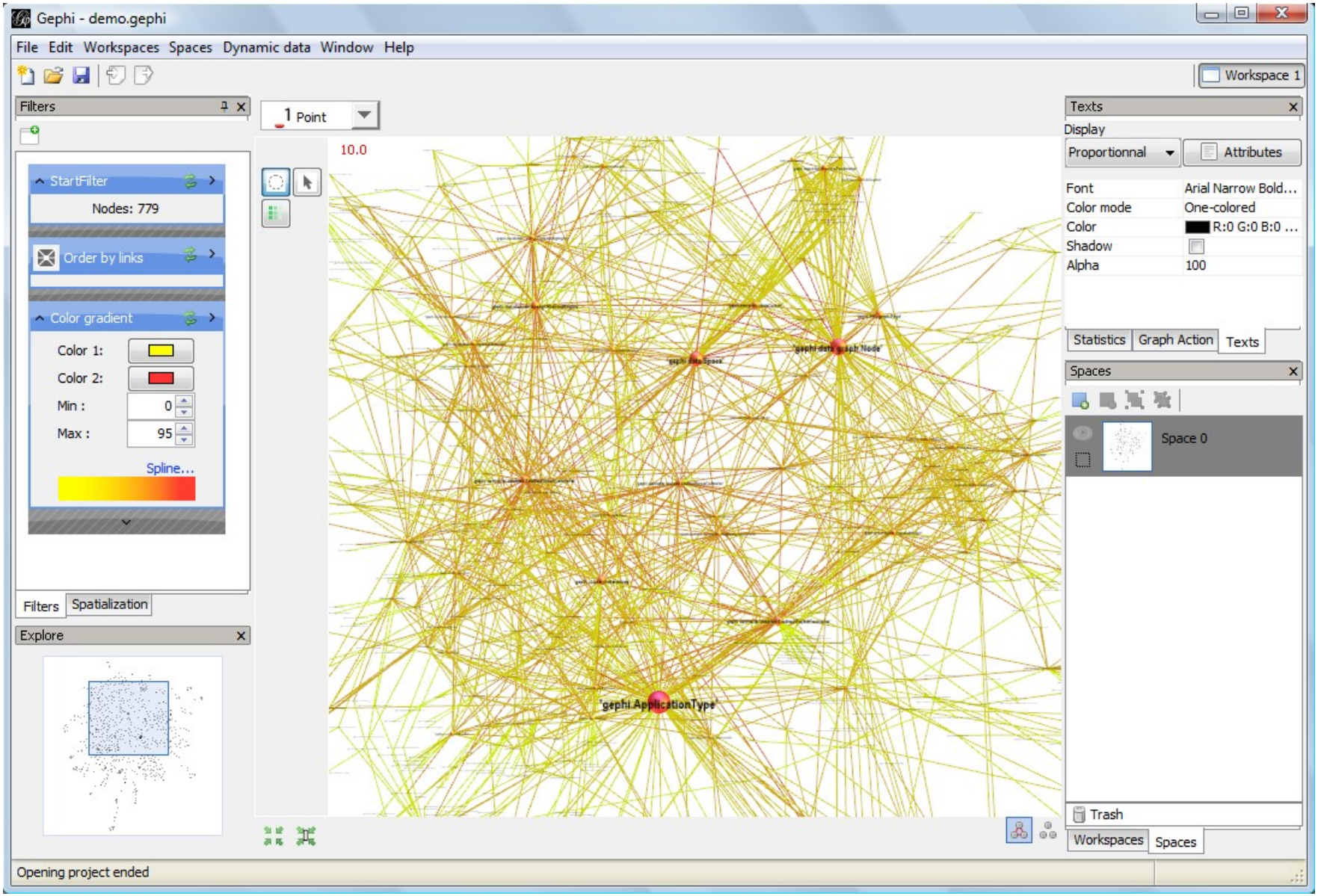
Gephi



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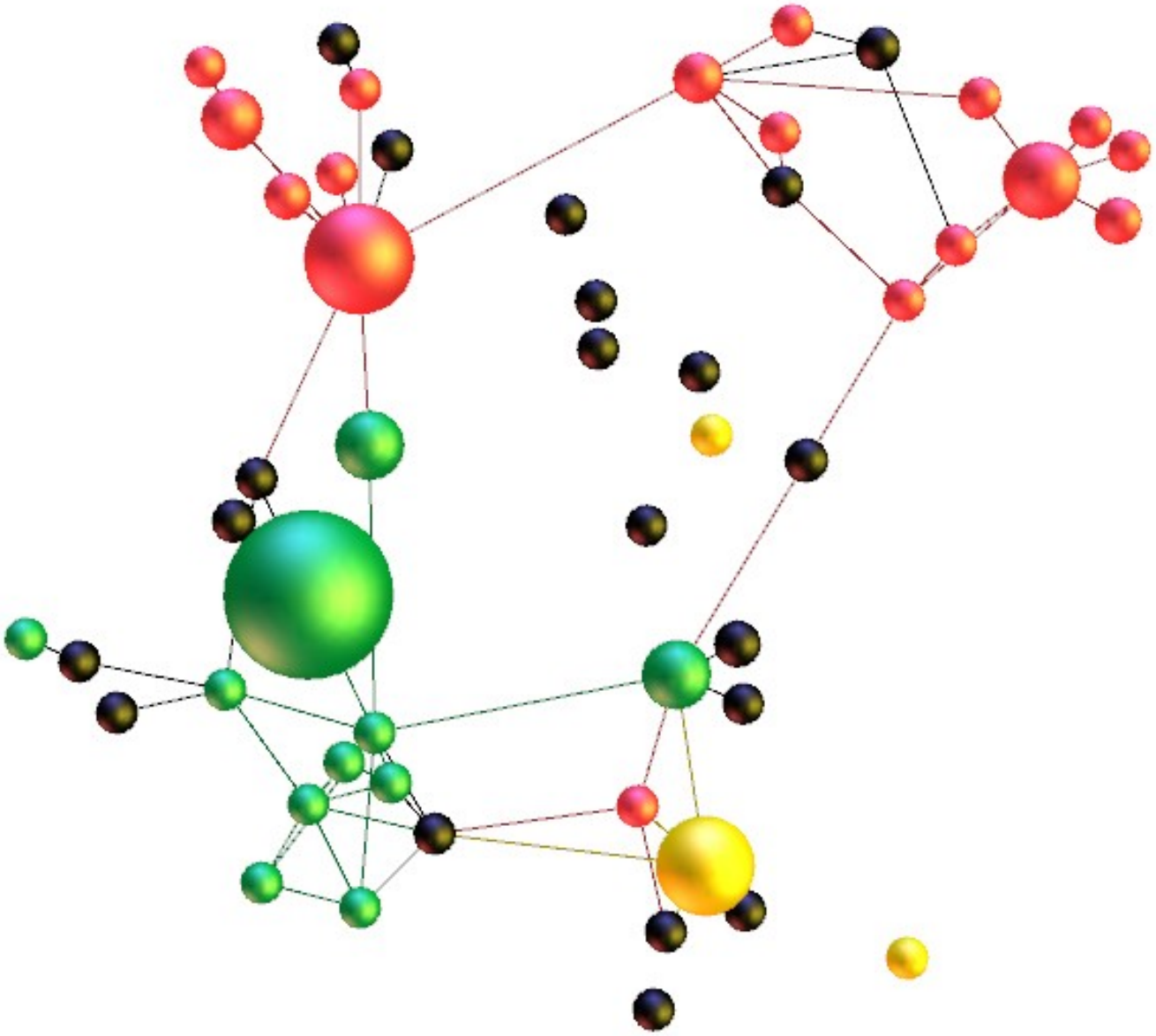
Gephi



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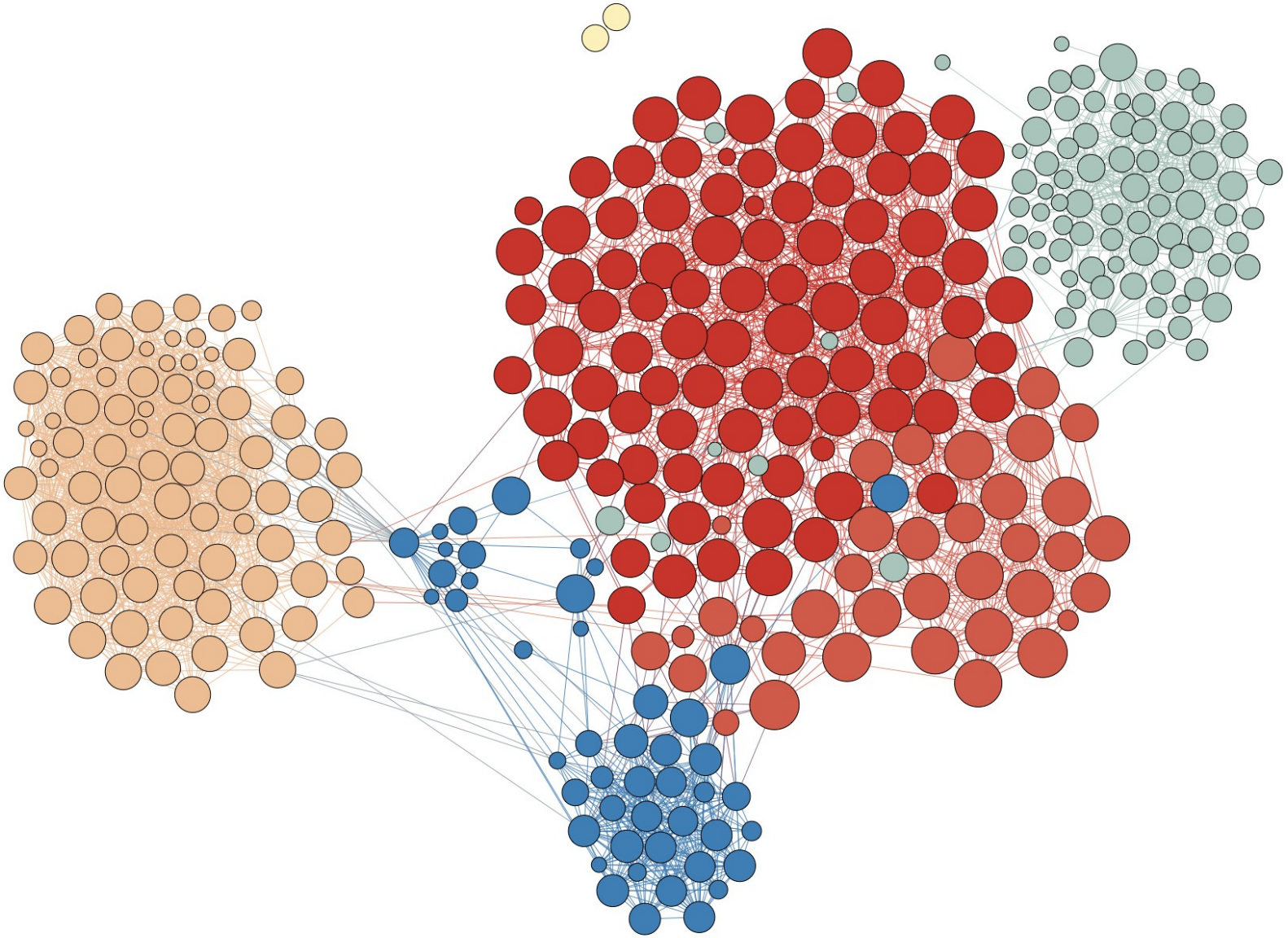
Gephi



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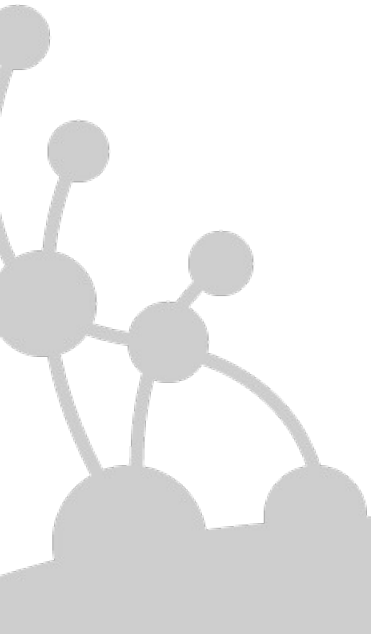
Кластер

CA, AGPL



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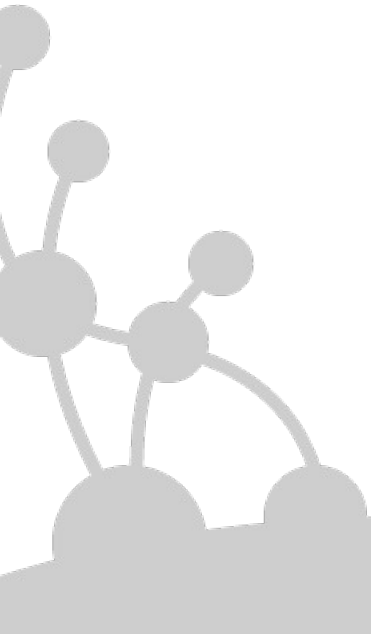
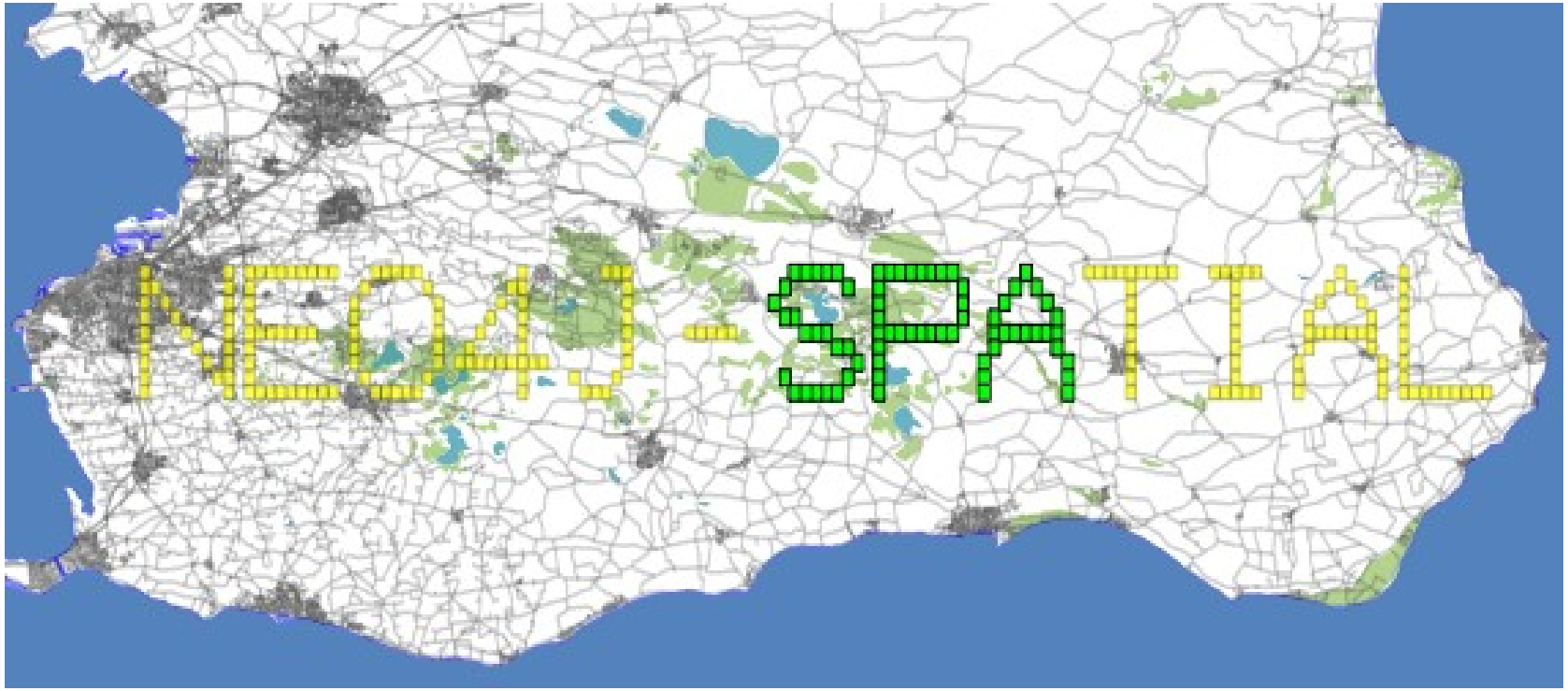
Проекты



Neo4j Spatial



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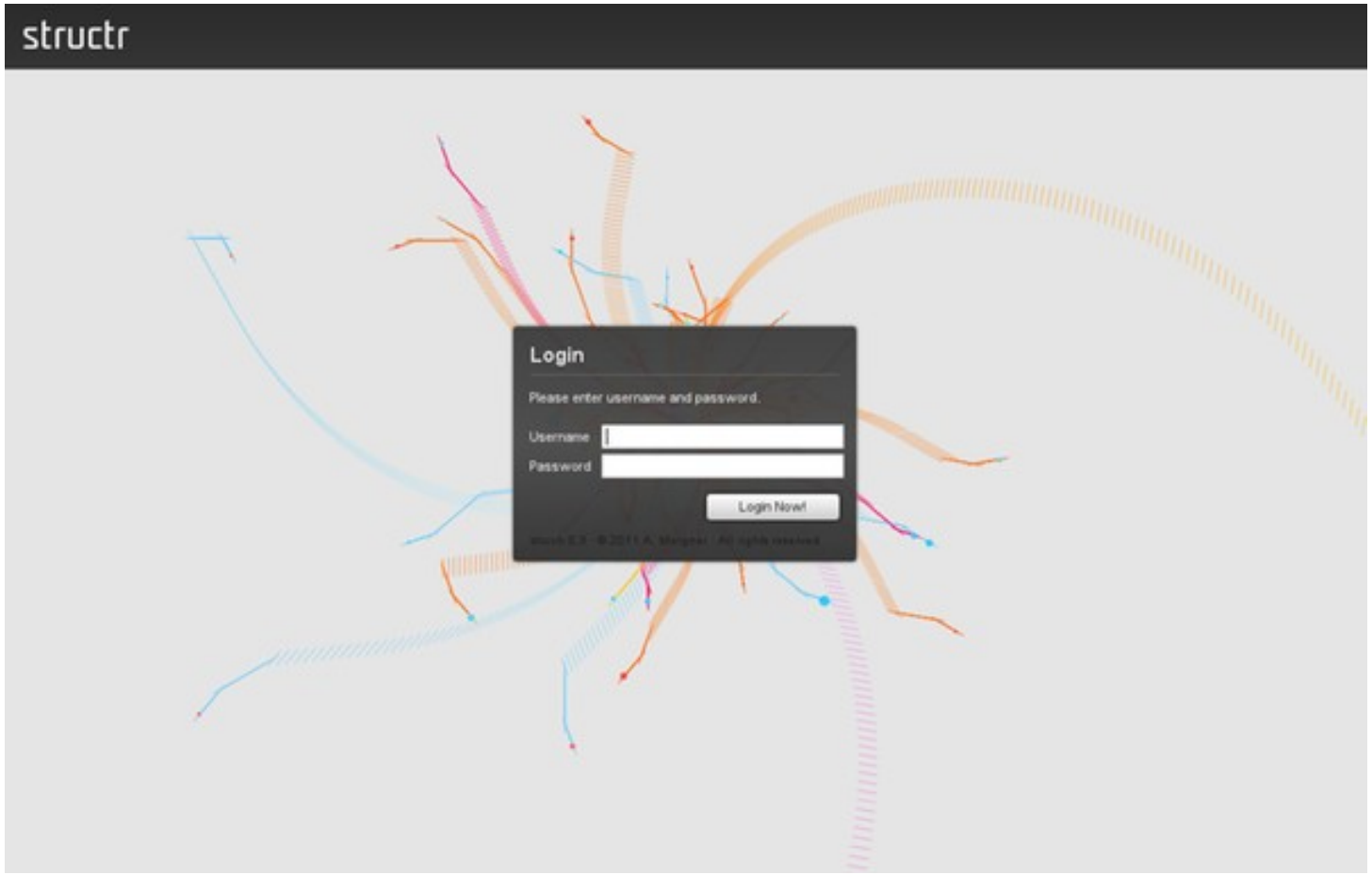
Structur CMS



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Animotron

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Neo4j — это

Встраиваемая Java СуБД

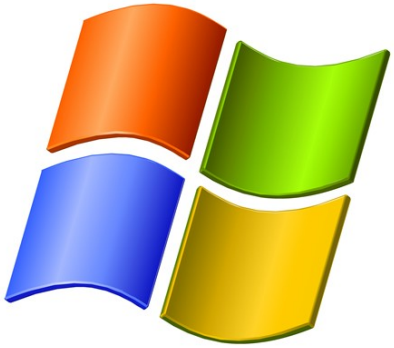
Полностью ACID

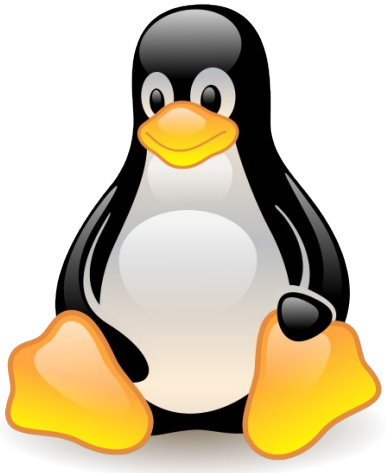
Фреймворк построения индексов

Поддержка 24/7 с 2003 года

Высоко доступная кластеризация (CA)

Большое комьюнити





GPL, AGPL

neo4j.org

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Спасибо за внимание

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twitter.com/gazdovsky

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Пожалуйста, поставьте оценку моему докладу.

Ваше мнение очень важно.

Спасибо!