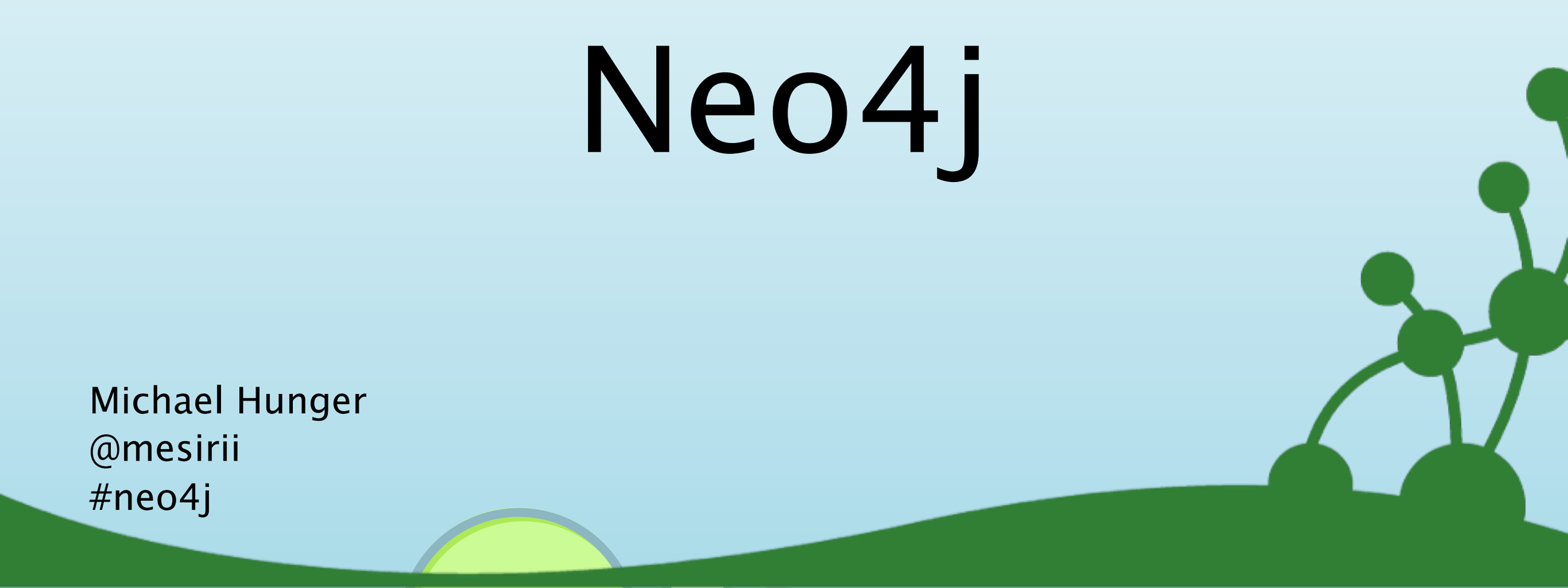
REALITY IS A GRAPH

EMBRACE IT

Introduction to Neo4j

Michael Hunger
@mesirii
#neo4j



Introduction to Neo4j

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@mesirii
#neo4j

Neo4j

Introduction to Neo4j

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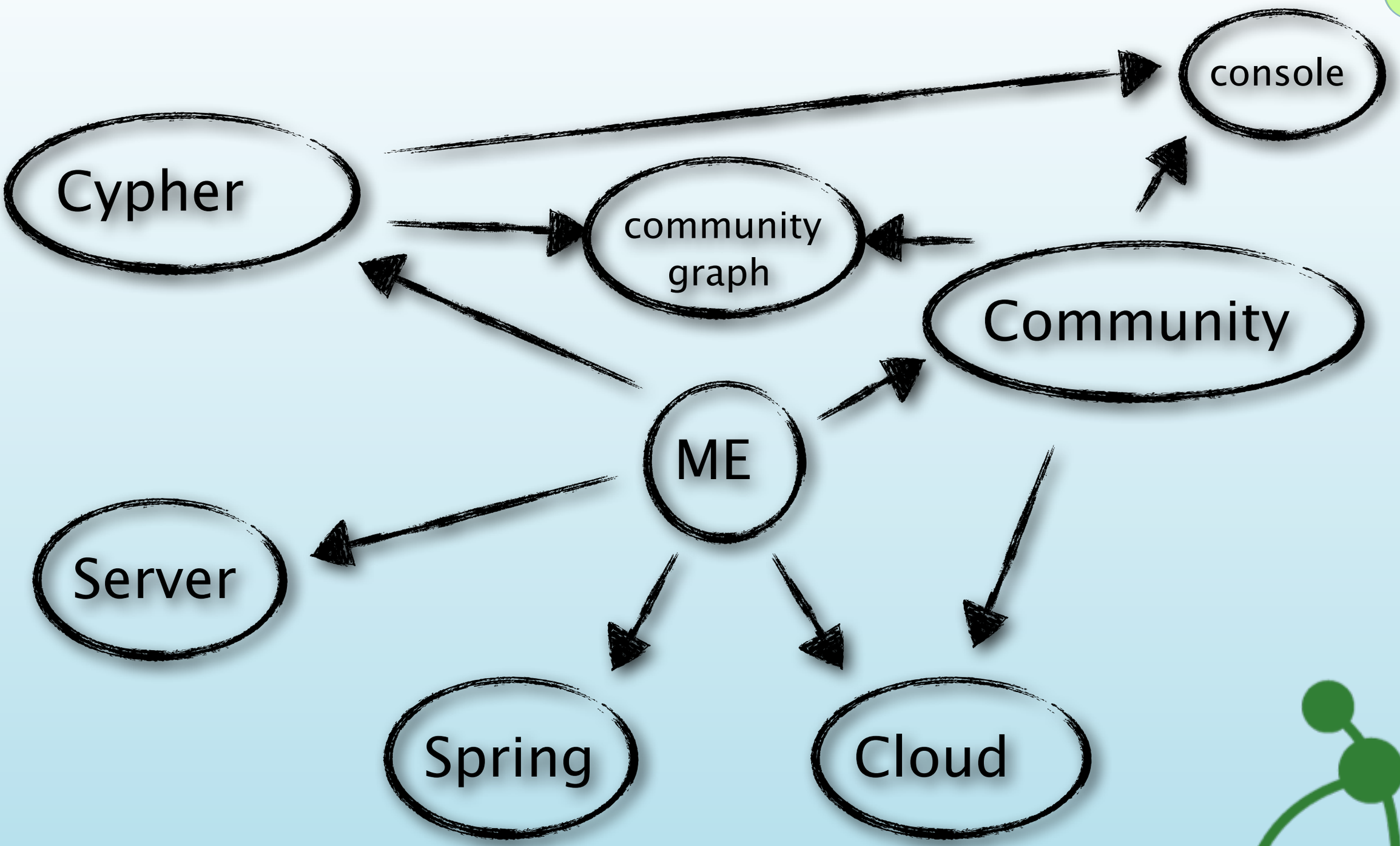
(Michael) -[:WORKS_ON]-> (Neo4j)



The Path Forward

The Path Forward

1.No .. NO .. NOSQL

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1. No .. NO .. NOSQL
2. Why graphs?

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3. What's a graph database?

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4. Some things about Neo4j.

The Path Forward

1. No .. NO .. NOSQL
2. Why graphs?
3. What's a graph database?
4. Some things about Neo4j.
5. How do people use Neo4j?

NOSQL

NOSQL

Neo4j

Neo4j

What is NOSQL?

What is NOSQL?

What is NOSQL?

It's not "No to SQL"

What is NOSQL?

It's not "No to SQL"

It's not "Never SQL"

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It's "**Not Only SQL**"

What is NOSQL?

It's not "No to SQL"

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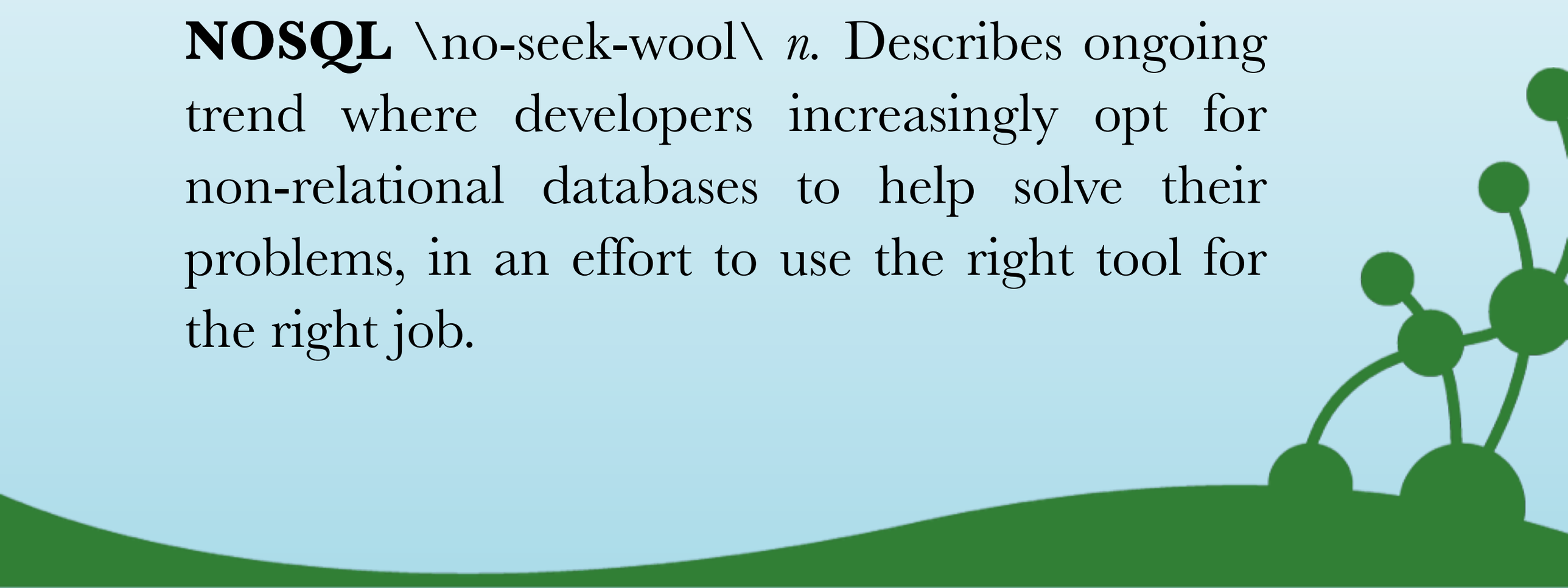
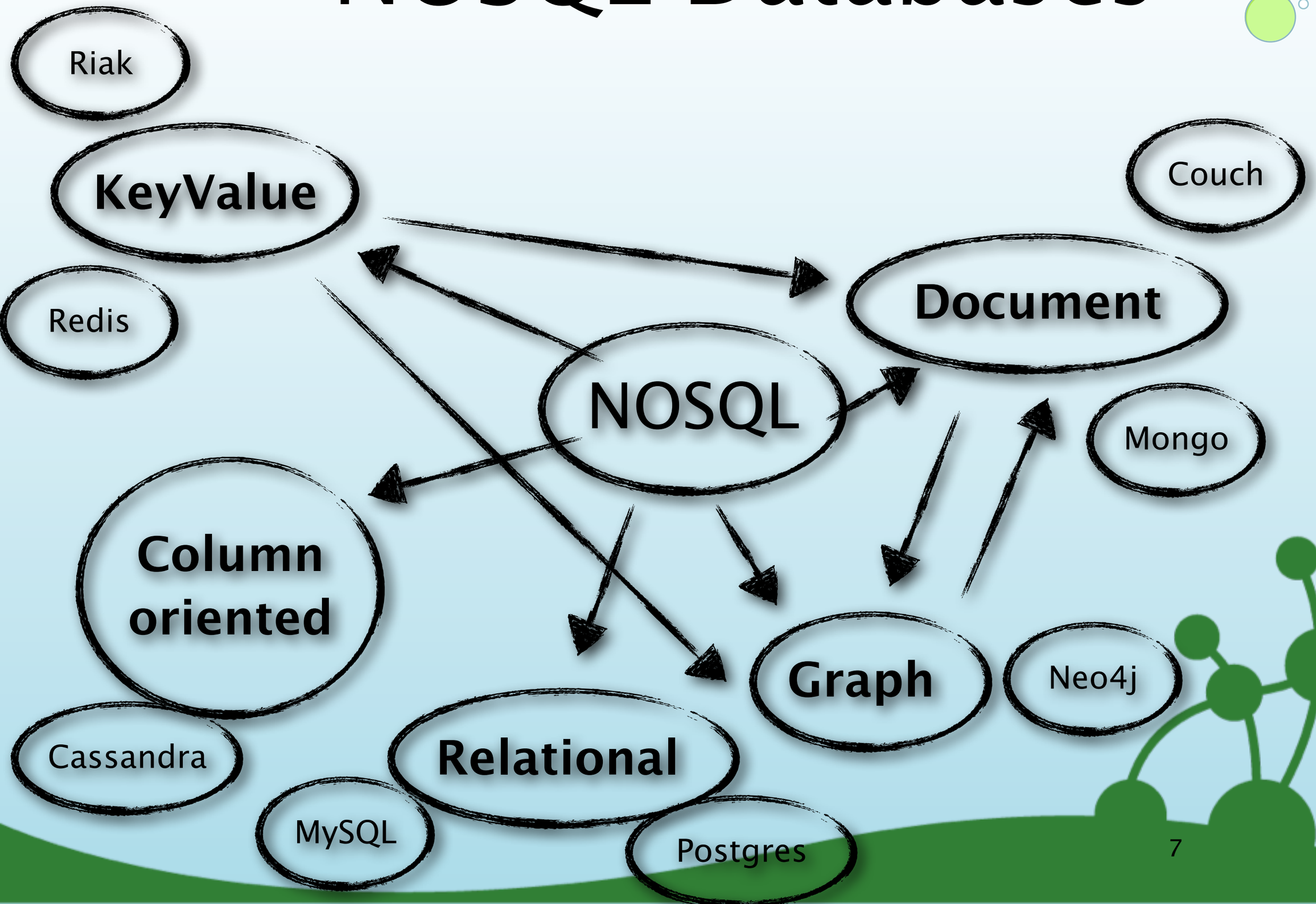
It's "**Not Only SQL**"

NOSQL \no-seek-wool\ *n.* Describes ongoing trend where developers increasingly opt for non-relational databases to help solve their problems, in an effort to use the right tool for the right job.



NOSQL Databases



Living in a NOSQL World

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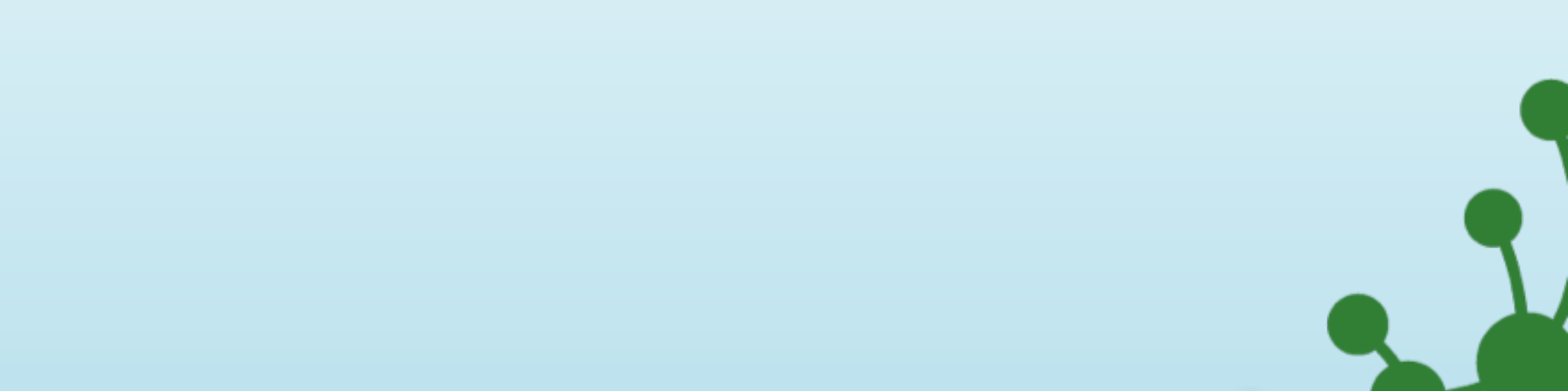
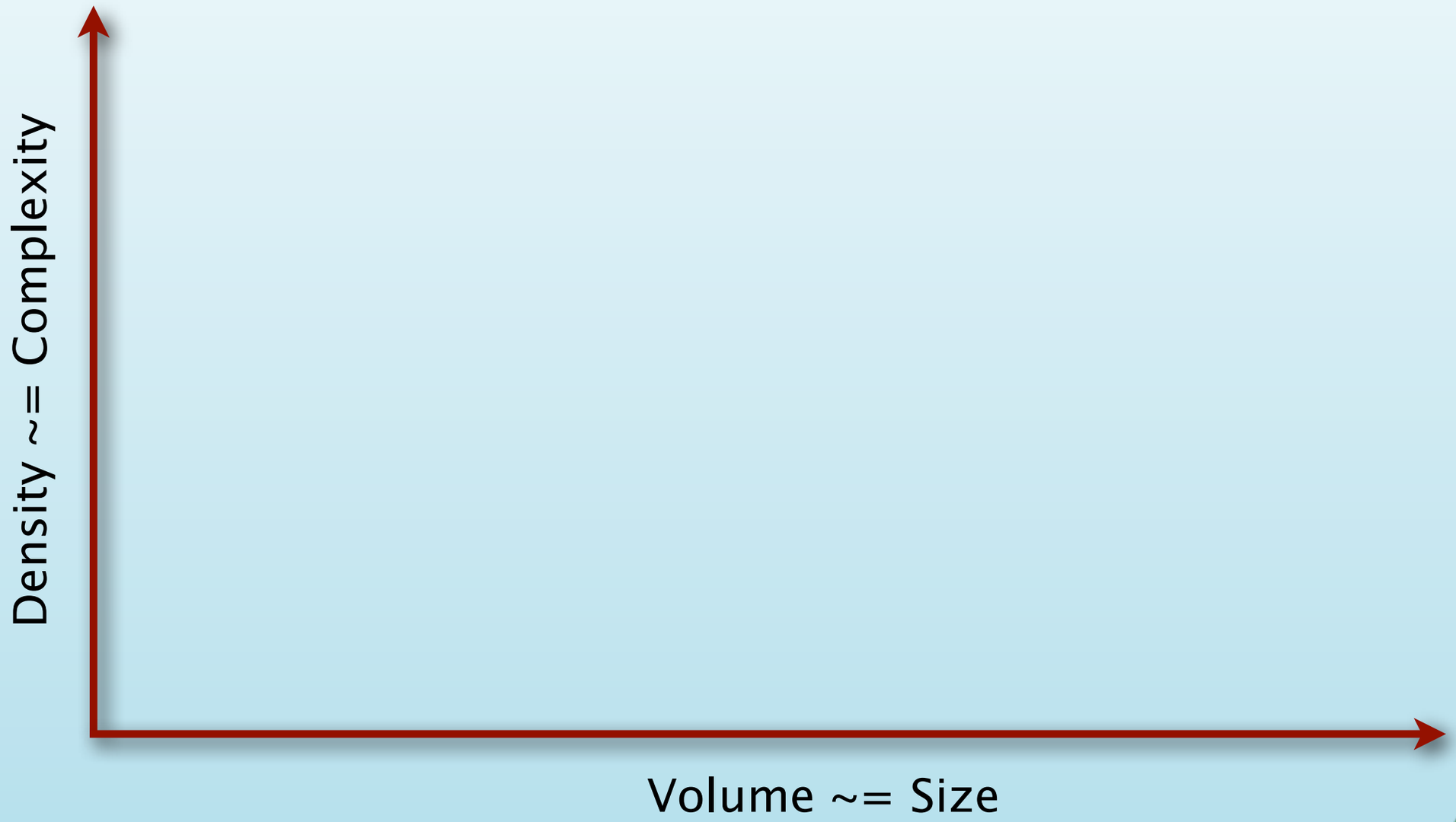


Living in a NOSQL World



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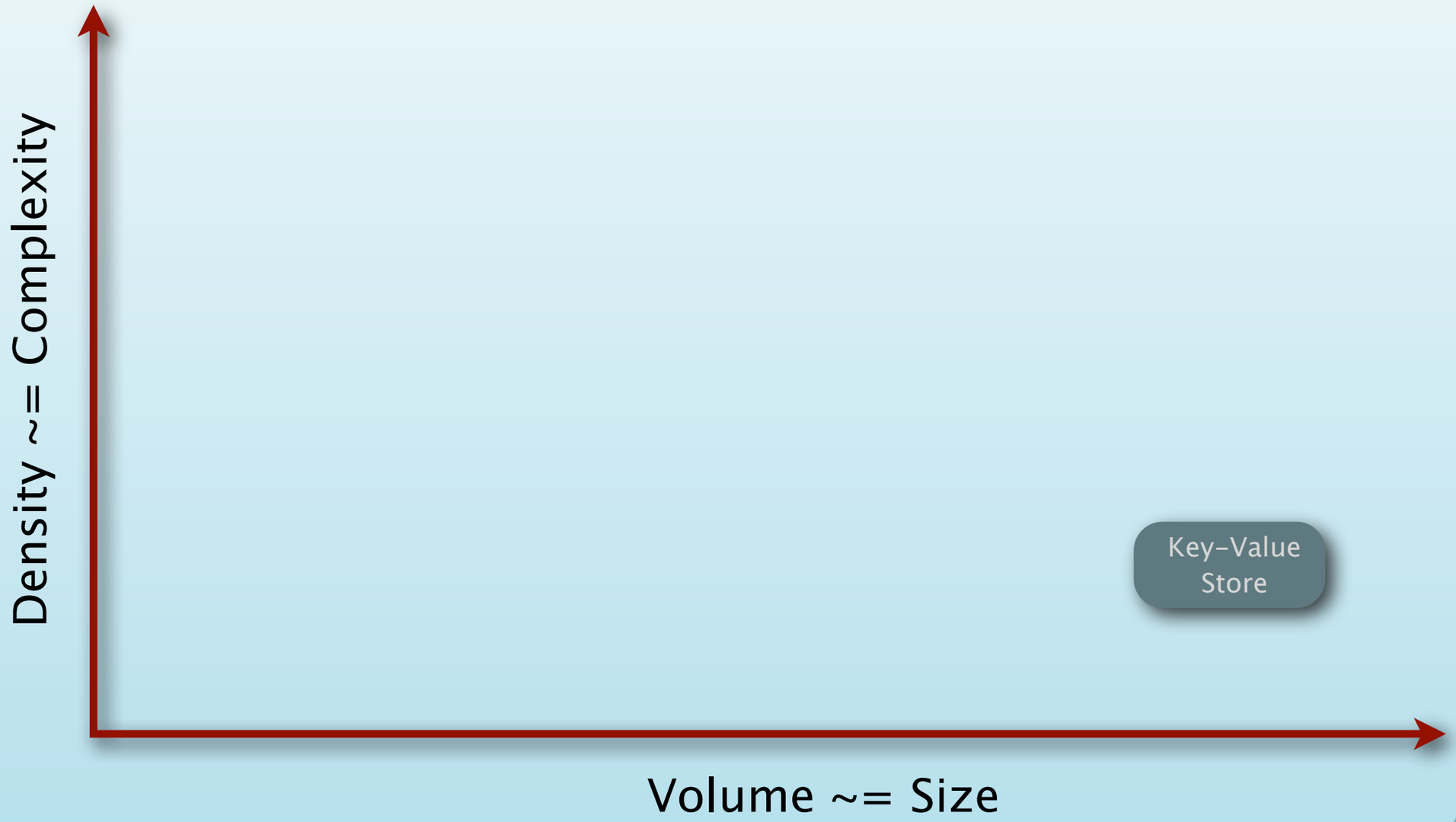

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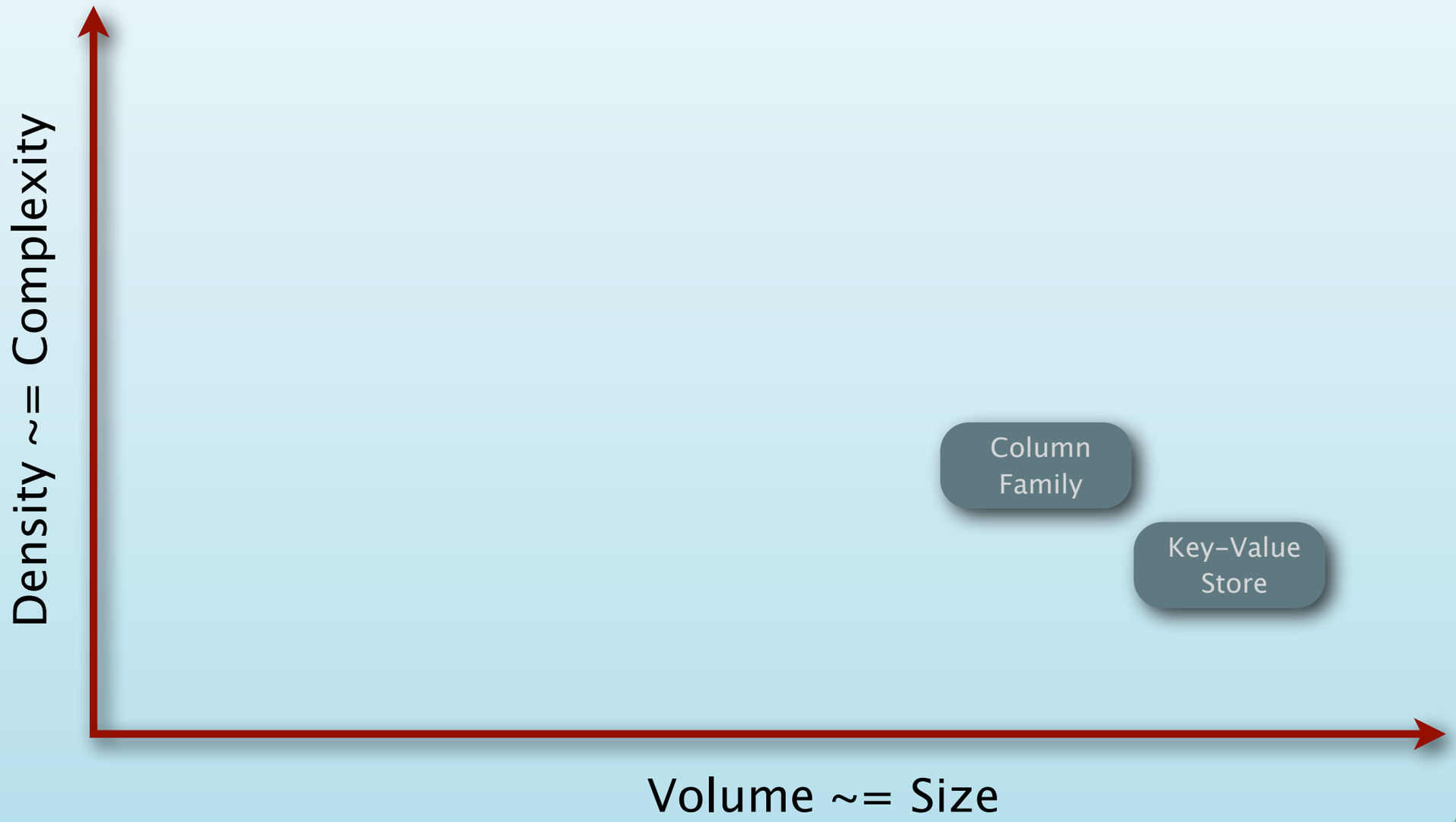

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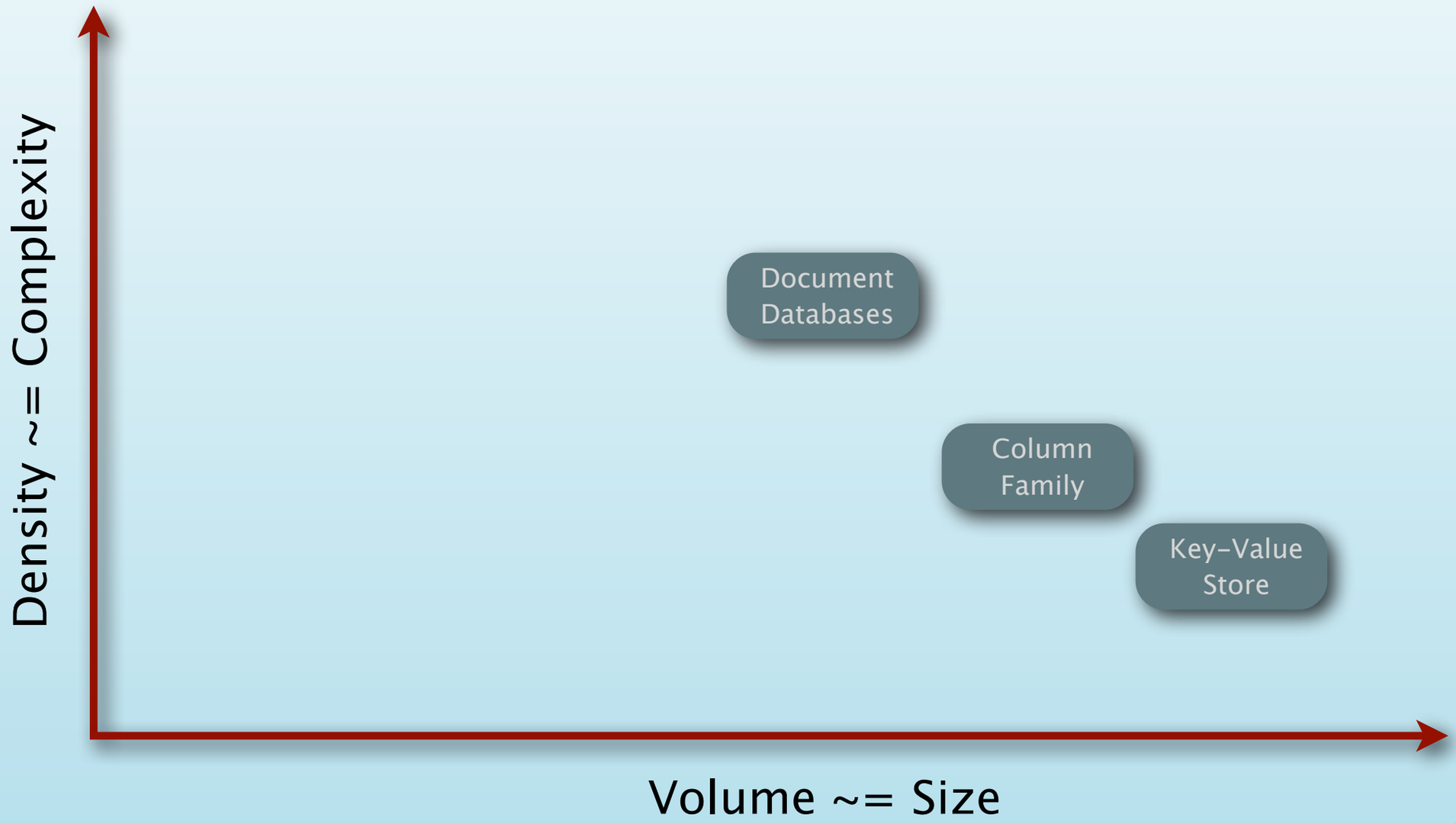

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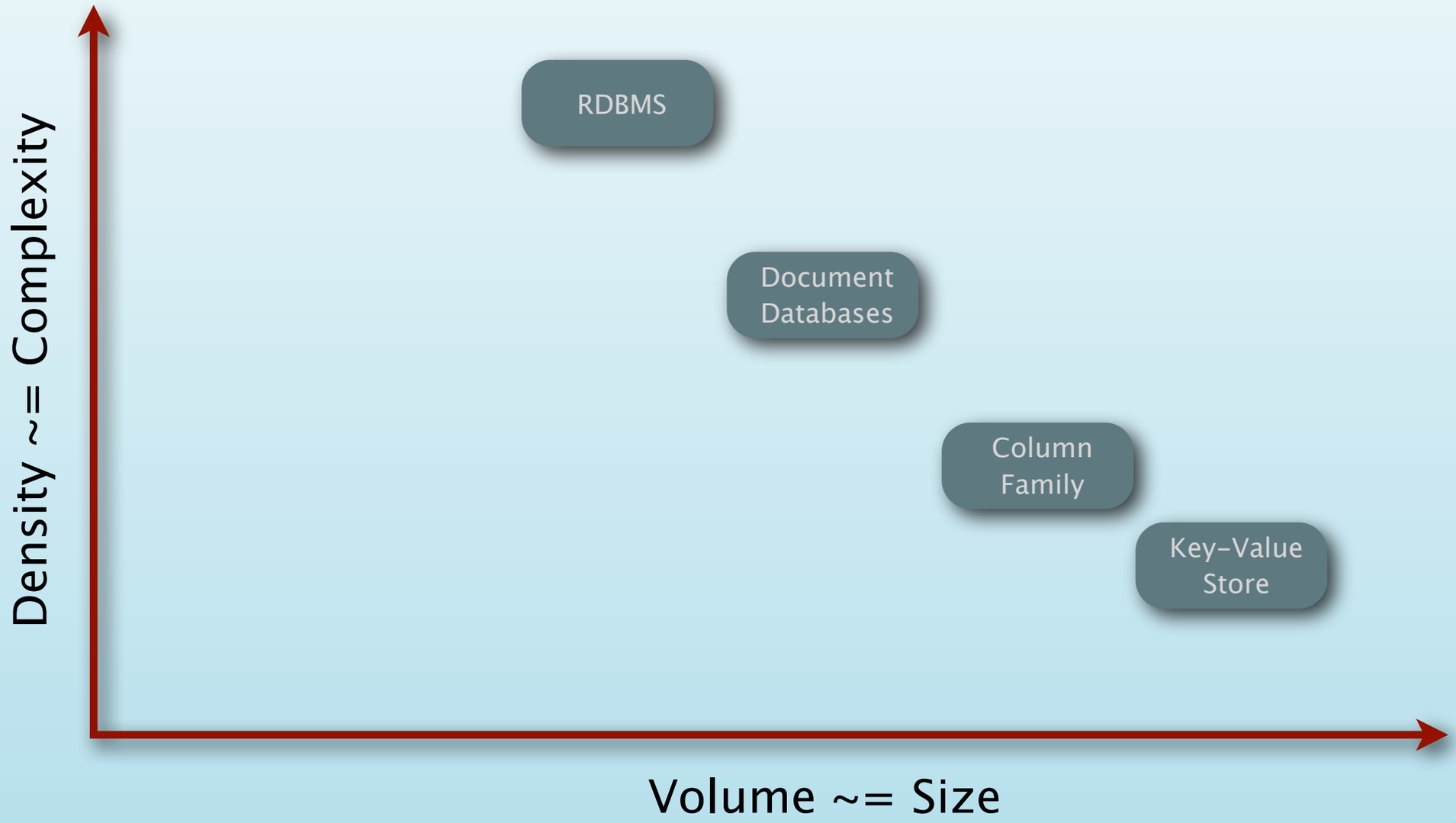

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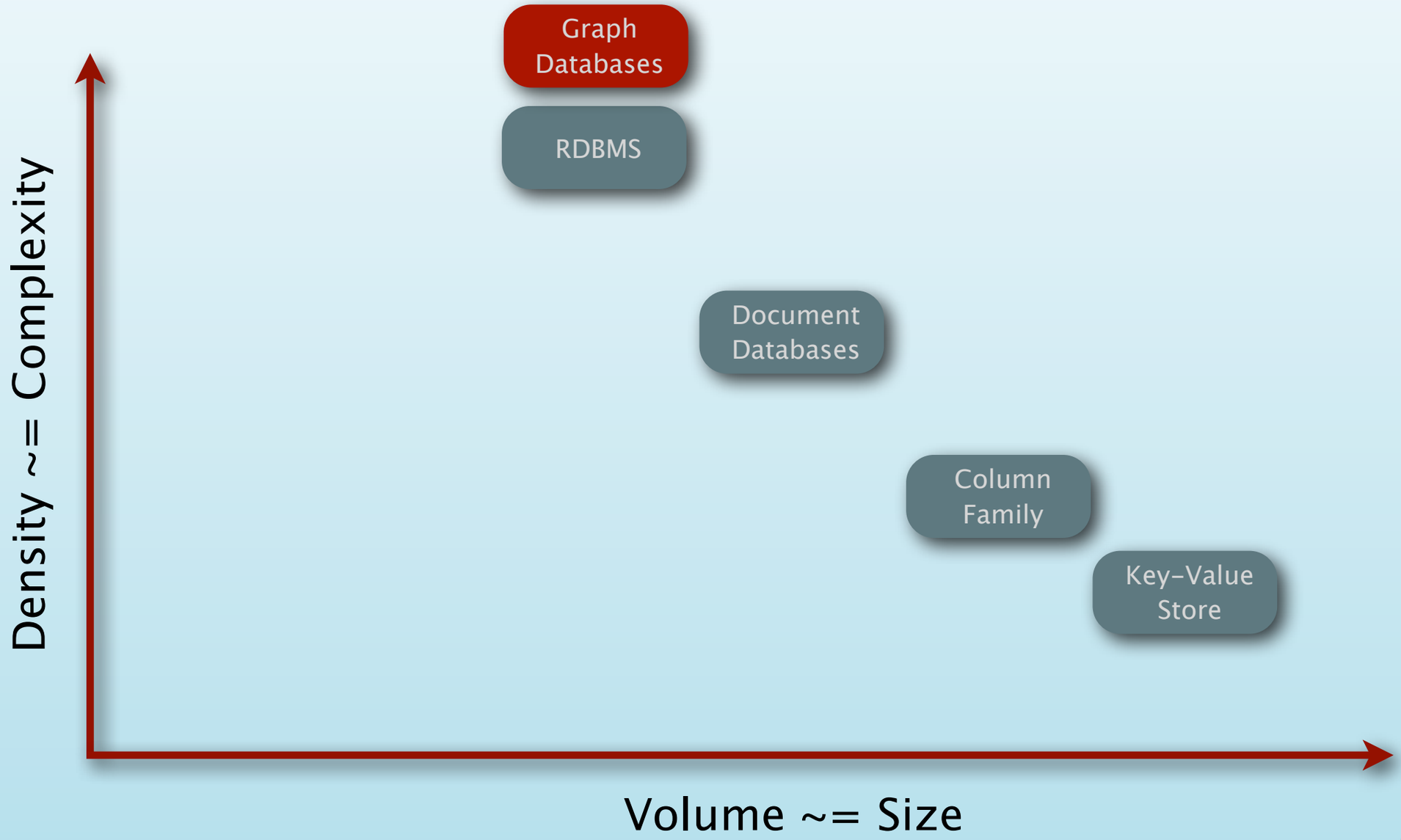

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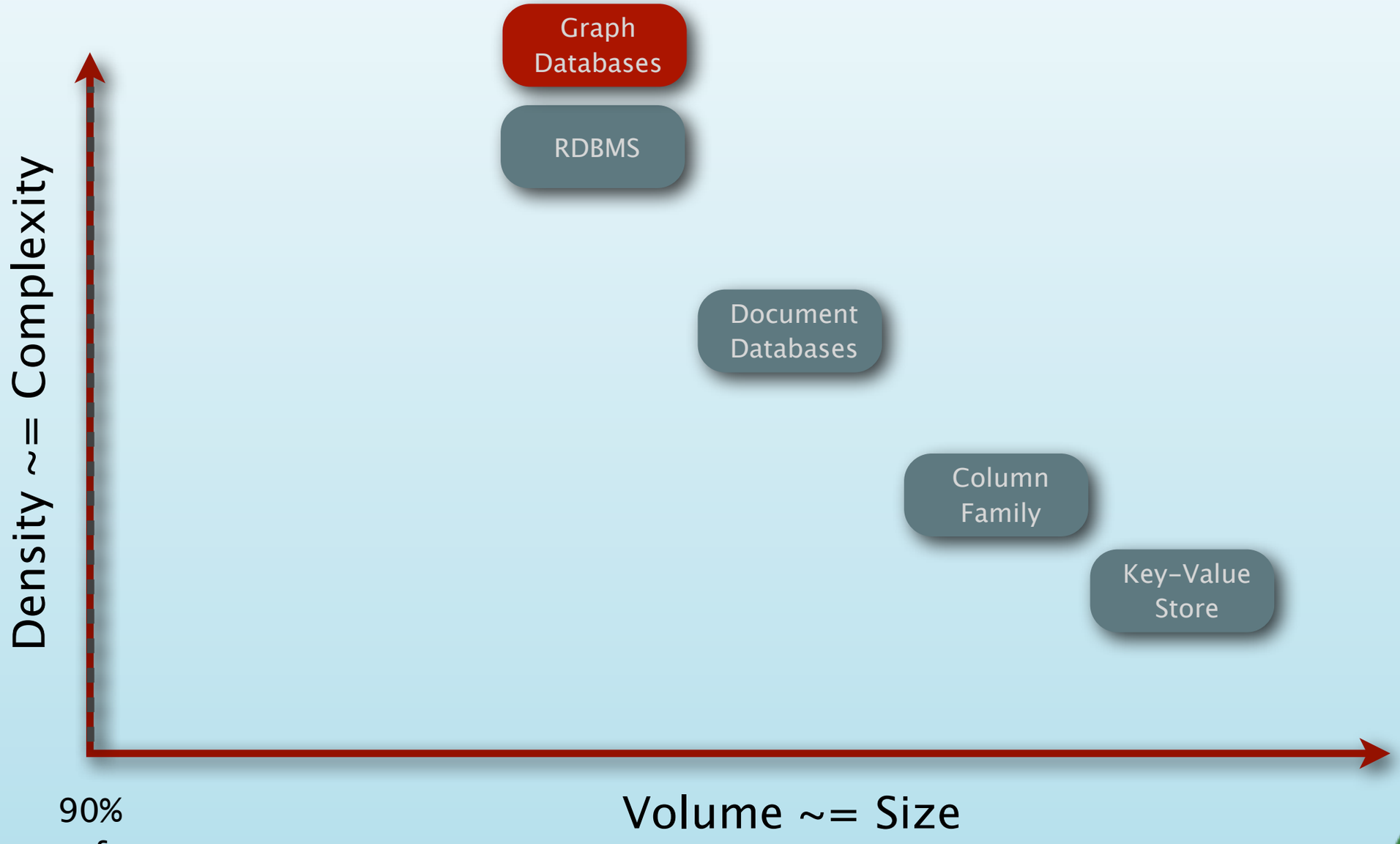

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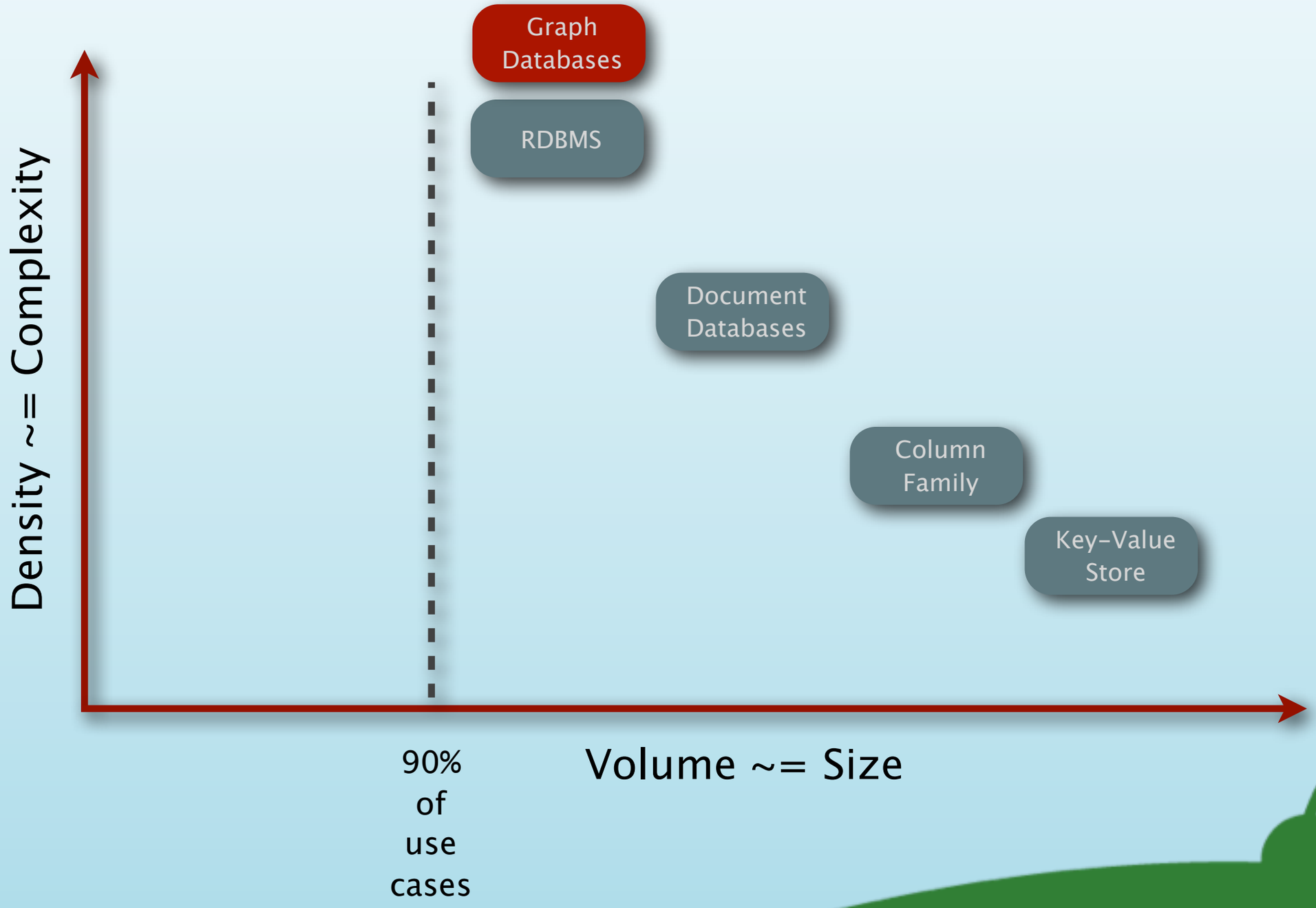


Trends in BigData & NOSQL

1. increasing data size (big data)

- "Every 2 days we create as much information as we did up to 2003" - Eric Schmidt

2. increasingly connected data (graph data)

- for example, text documents to html

3. semi-structured data

- individualization of data, with common sub-set

4. architecture - a facade over multiple services

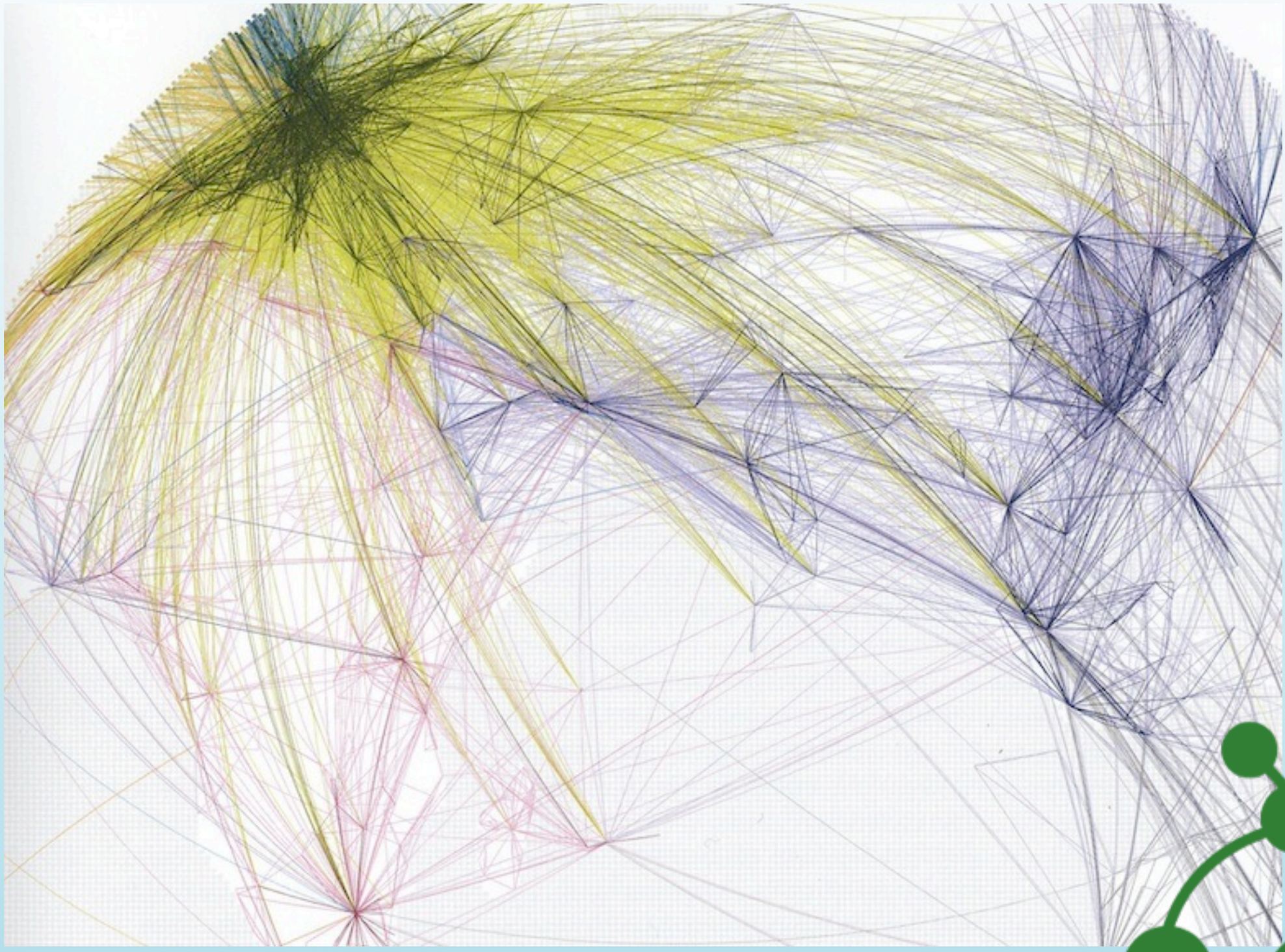
- from monolithic to modular, distributed applications

A Graph?

A Graph?

Yes, a graph

They are everywhere



Flight Patterns in Europe

Graphs Everywhere

- Relationships in
  - Politics, Economics, History, Science, Transportation
- Biology, Chemistry, Physics, Sociology
  - Body, Ecosphere, Reaction, Interactions
- Internet
  - Hardware, Software, Interaction
- Social Networks
  - Family, Friends
  - Work, Communities
  - Neighbours, Cities, Society

Good Relationships

- the world is rich, messy and related data
- relationships are as least as important as the things they connect
- Graphs = Whole > Σ parts
- complex interactions
- always changing, change of structures as well
- Graph: Relationships are part of the data
- RDBMS: Relationships part of the fixed schema

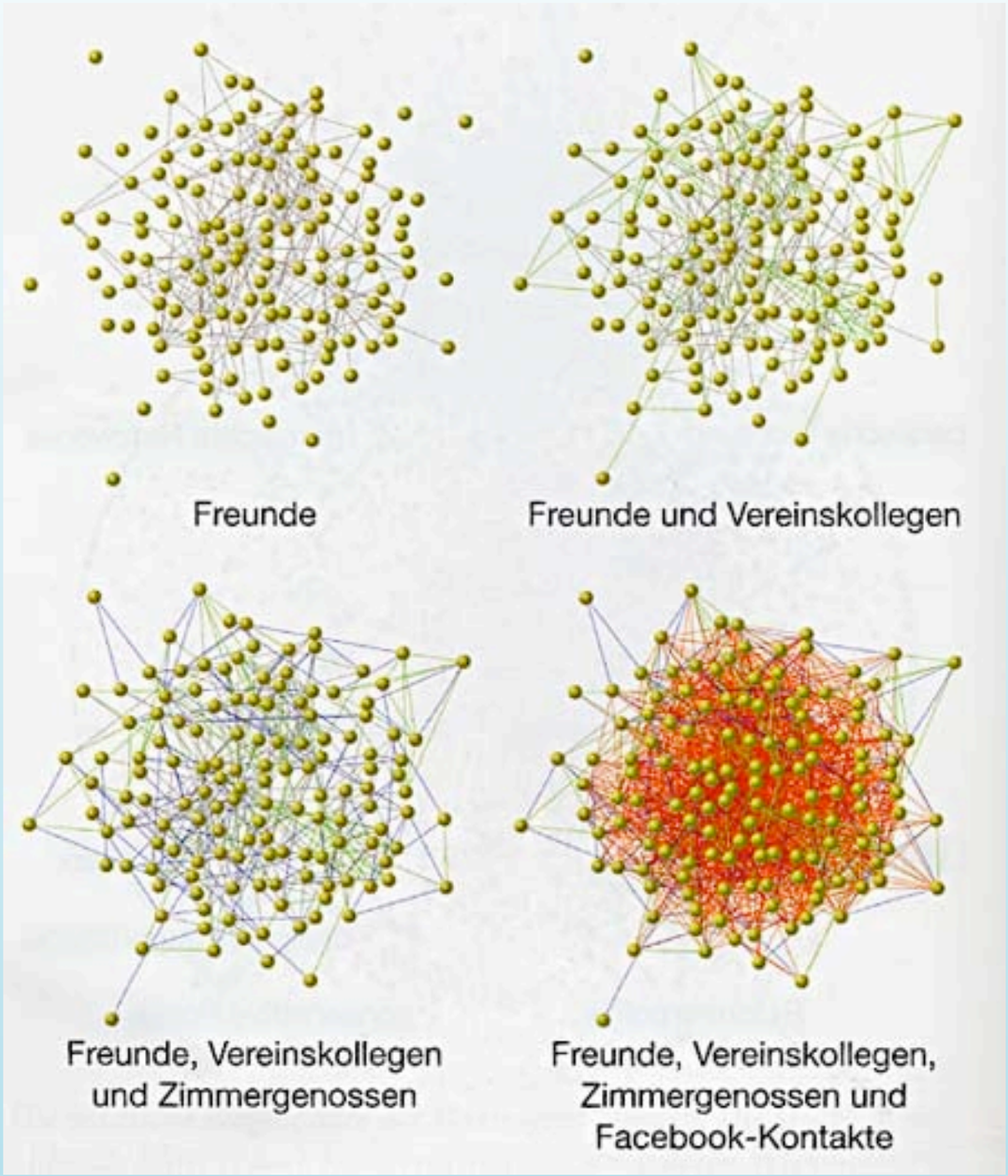
Questions and Answers

- Complex Questions
- Answers lie between the lines (things)
- Locality of the information
- Global searches / operations very expensive
- constant query time, regardless of data volume

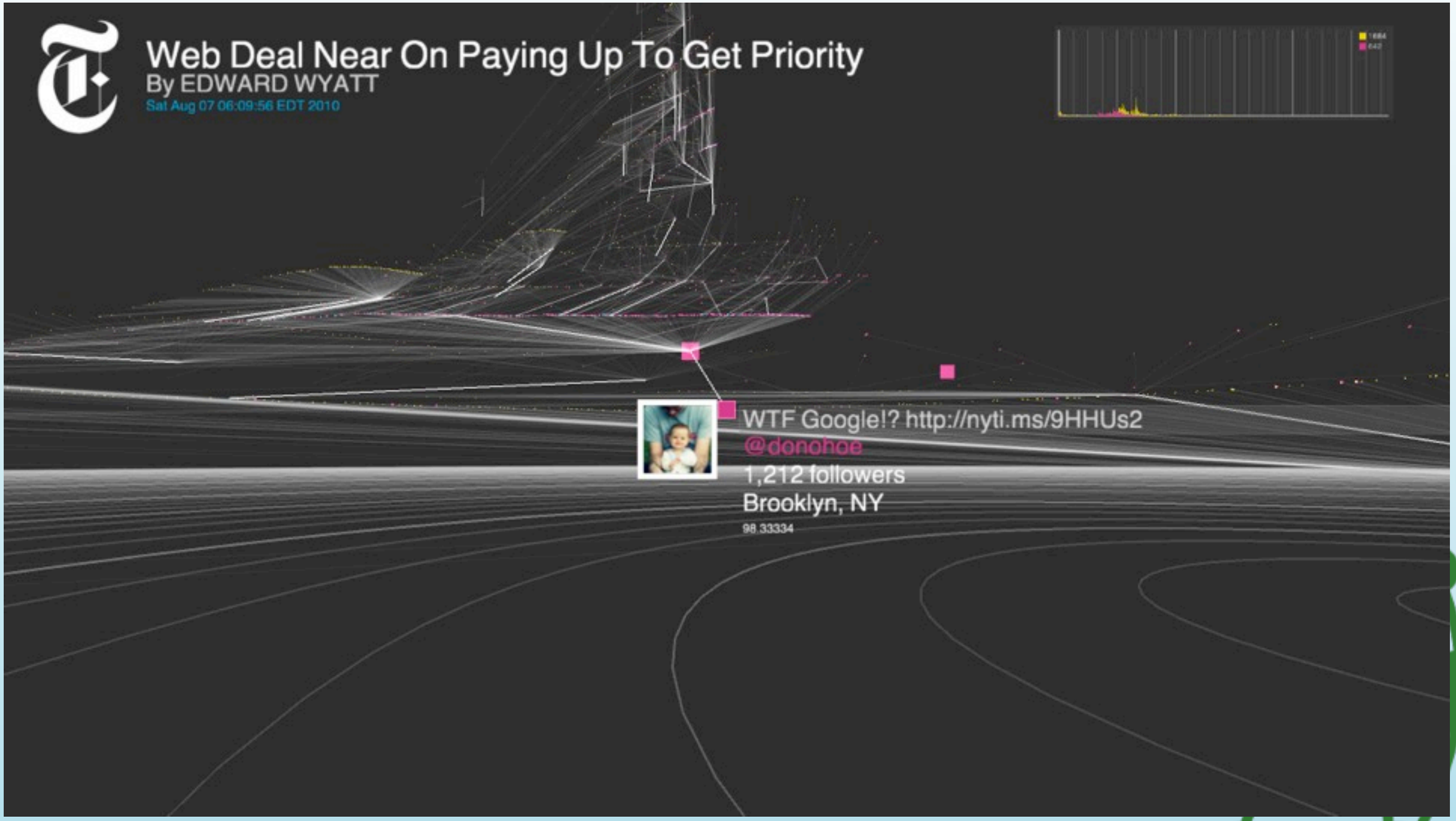
Categories ?

- Categories == Classes, Trees ?
- What if more than one category fits?
- Tags
- Categories vi relationships like „IS_A“
- any number, easy change
- „virtual“ Relationships - Traversals
- Category dynamically derived from queries

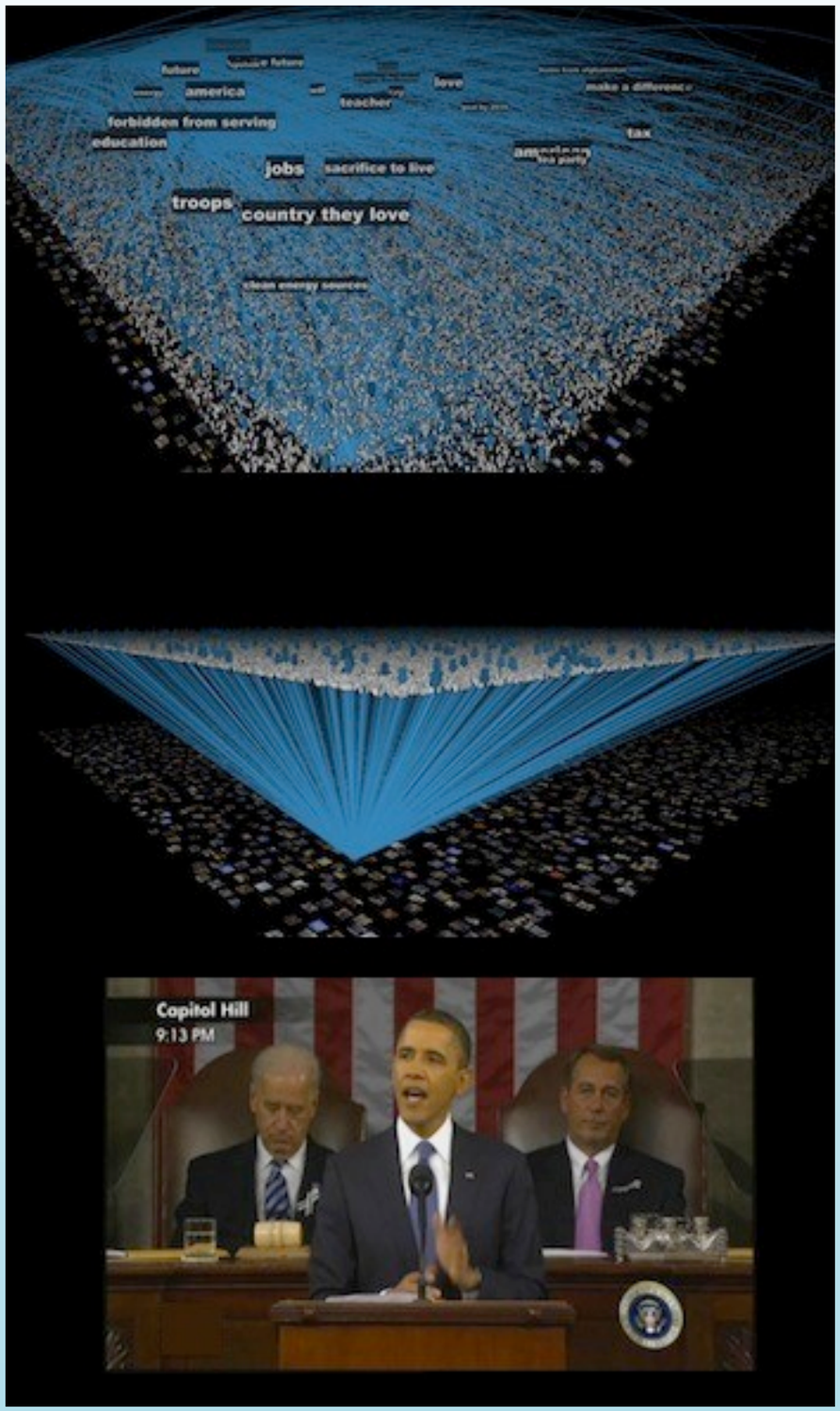
Fowler & Christakis „Connected“



New York Times R&D „Cascade“



Deb Roy - MIT & Bluefin Labs

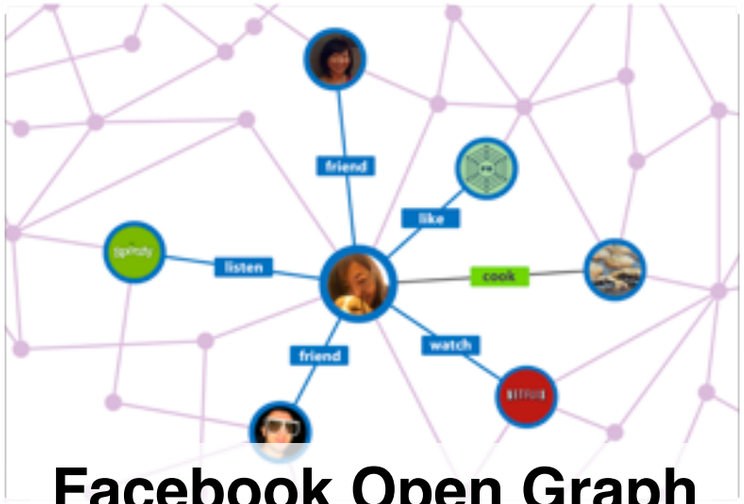


„Birth of a Word“ TED Talk

Researches Social Reactions
to (Media) Events

Everyone is talking about graphs...

Everyone is talking about graphs...



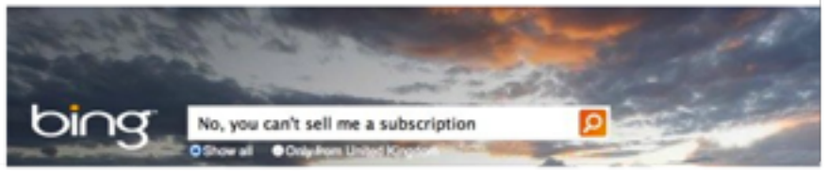
Facebook Open Graph

Google Just Got A Whole Lot Smarter, Launches Its Knowledge Graph

FREDERIC LARDINOIS

Bing one-ups knowledge graph, hires Encyclopaedia Britannica to supply results

By Daniel Cooper posted Jun 8th 2012 3:02PM



Why the Interest Graph Is a Marketer's Best Friend

1 day ago by **Nadim Hossain**

5

Everyone is talking about graphs...

Facebook Open Graph

Google Just Got A Whole Lot Smarter, Launches Its Knowledge Graph

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Bing one-ups knowledge graph, hires Encyclopaedia Britannica to supply results

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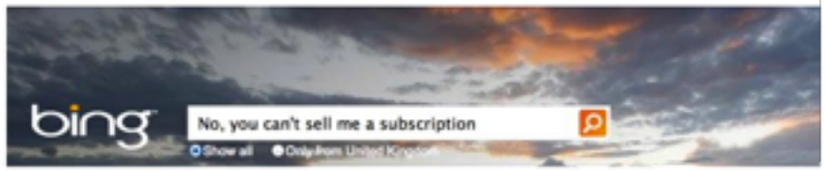

Why the Interest Graph Is a Marketer's Best Friend

1 day ago by **Nadim Hossain**

5

Neo4j
The World's Leading Graph Database

Each of us has not only one graph, but many!

Graph DB 101

A graph database...

A graph database...

NO: not for charts & diagrams, or vector artwork

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NO: not for charts & diagrams, or vector artwork

YES: for storing data that is structured as a graph

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remember linked lists, trees?

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remember linked lists, trees?

graphs are the general-purpose data structure

A graph database...

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remember linked lists, trees?

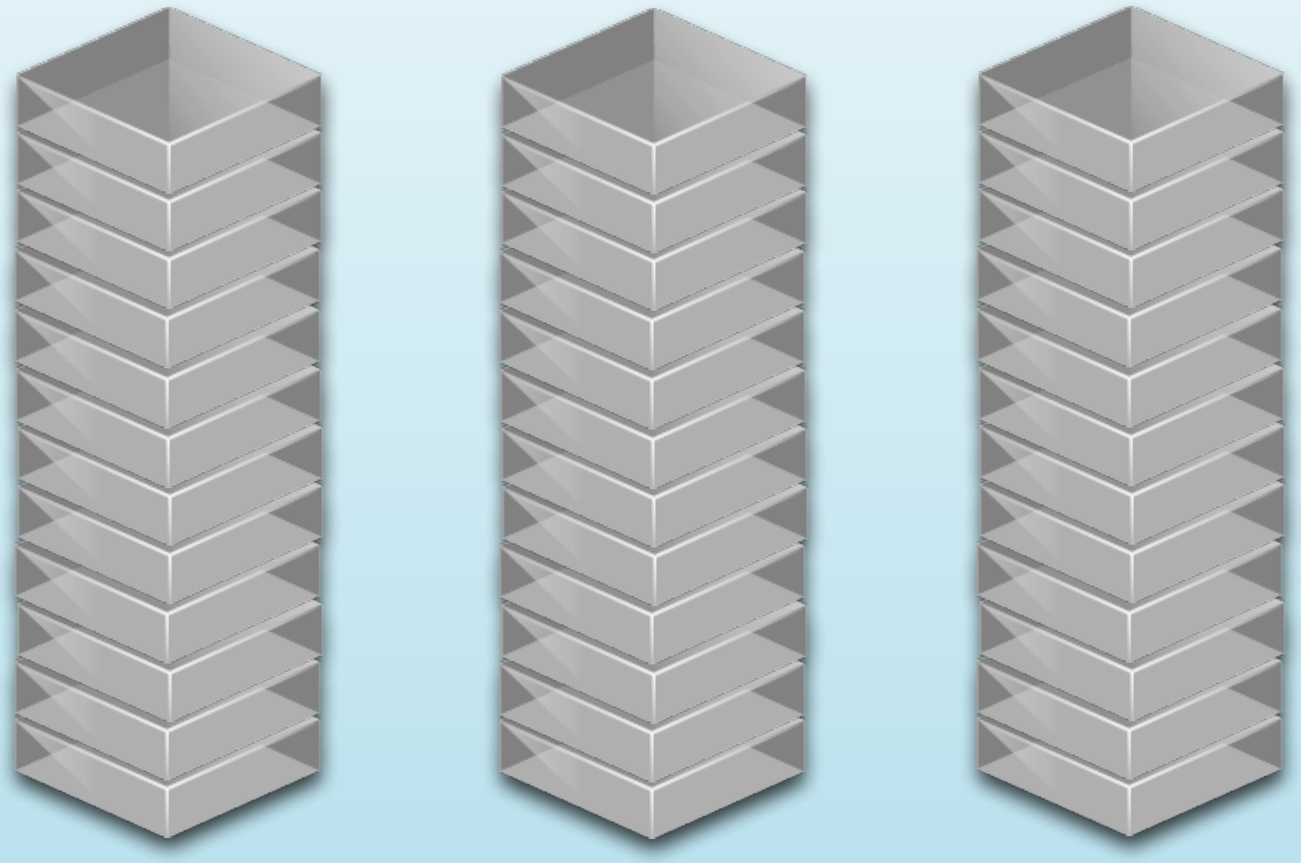
graphs are the general-purpose data structure

"A relational database may tell you the average age of everyone in this session,

but a graph database will tell you who is most likely to buy you a beer."

You know relational

You know relational



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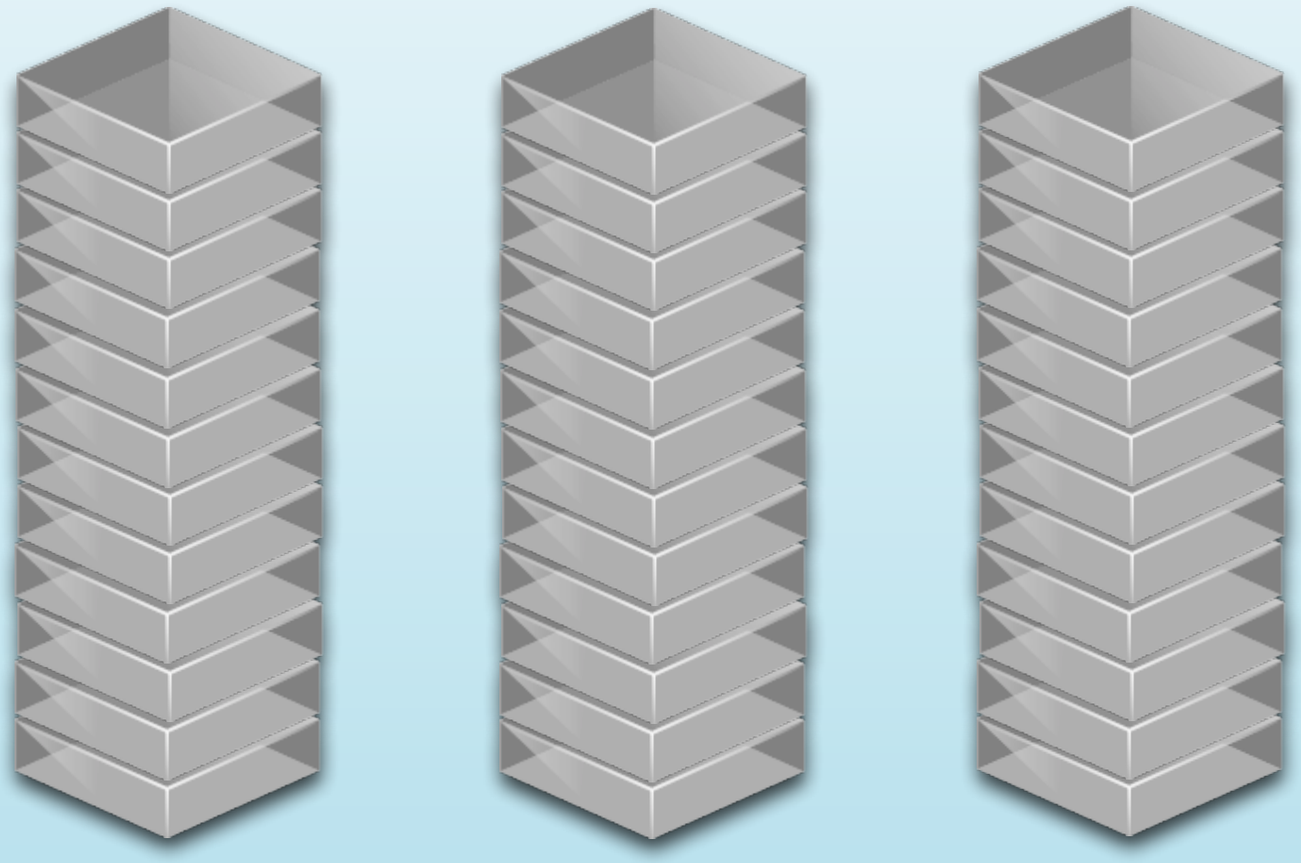
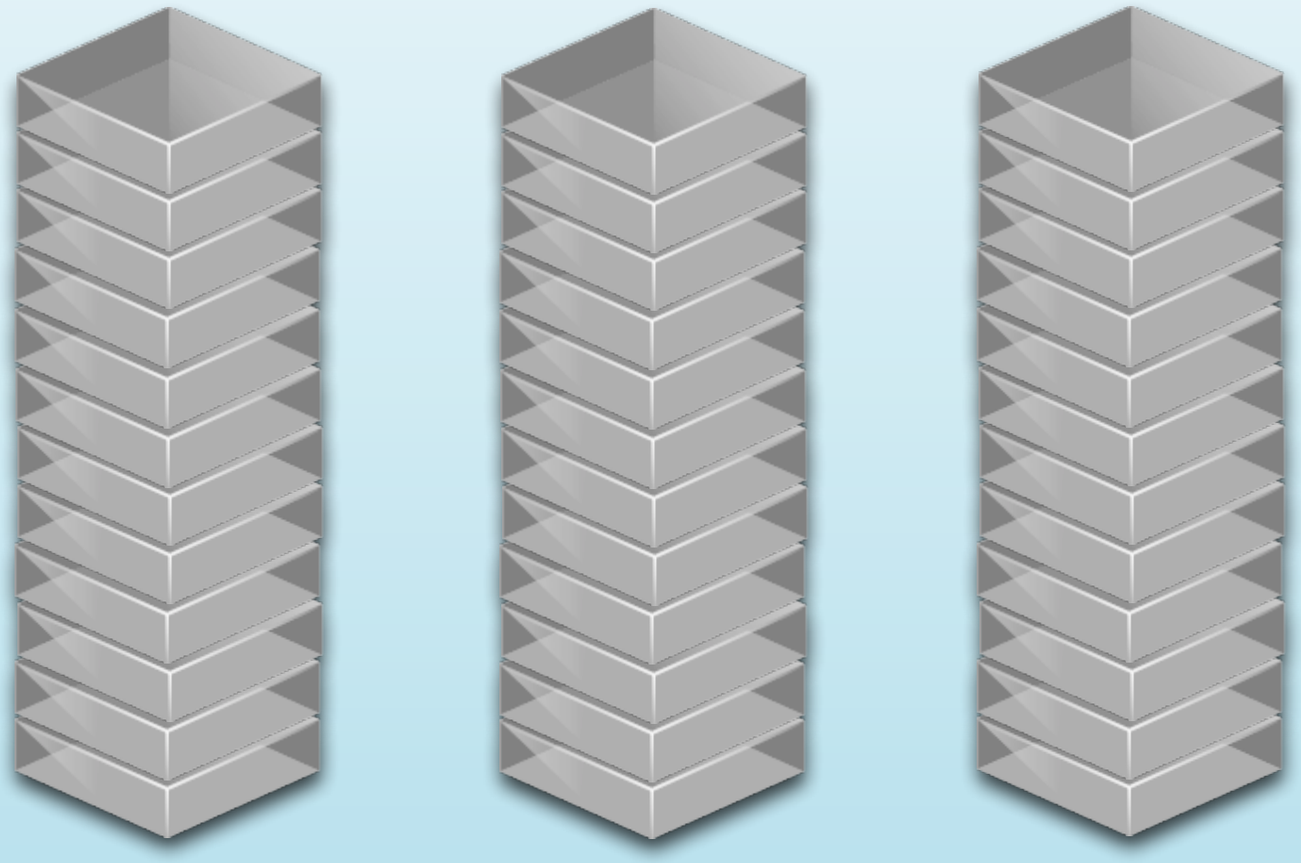


foo

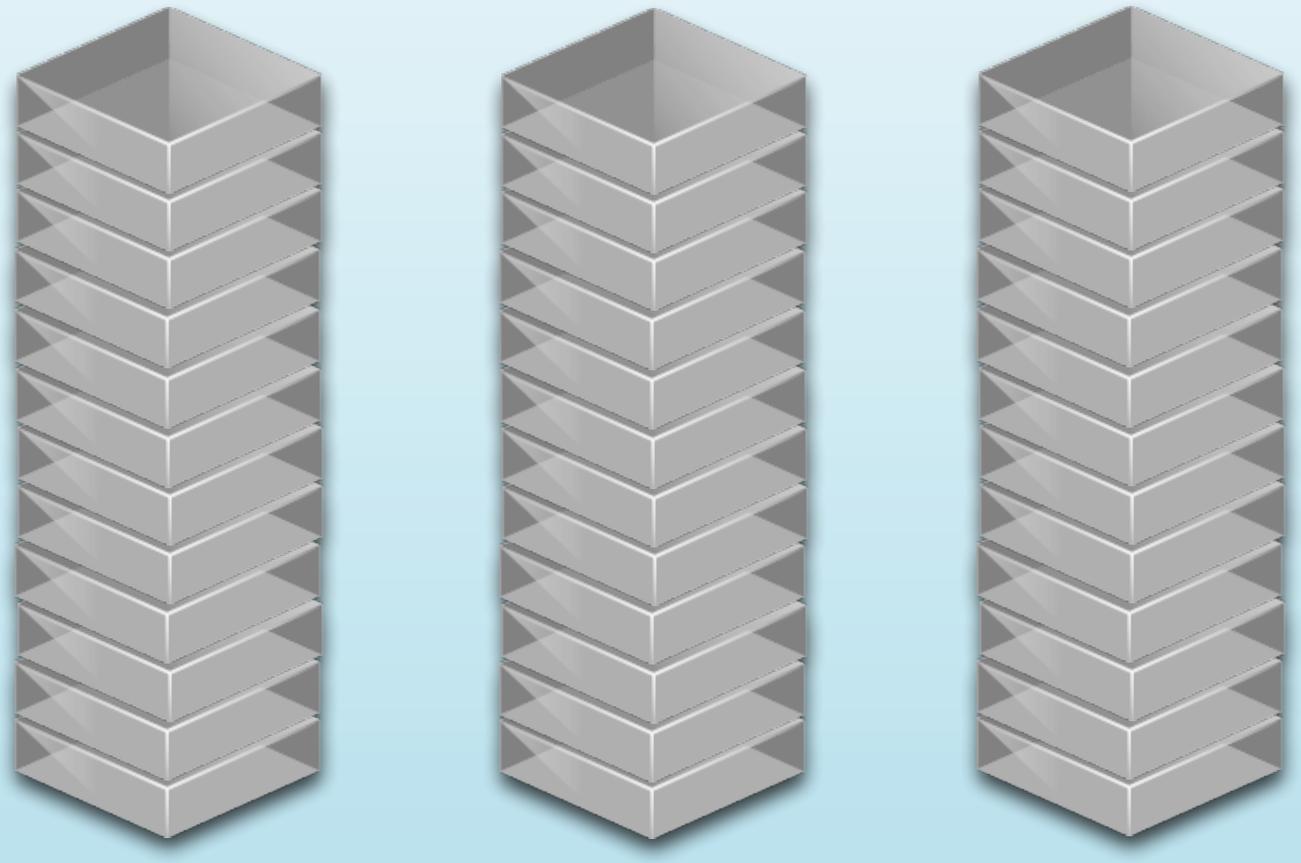
You know relational



foo

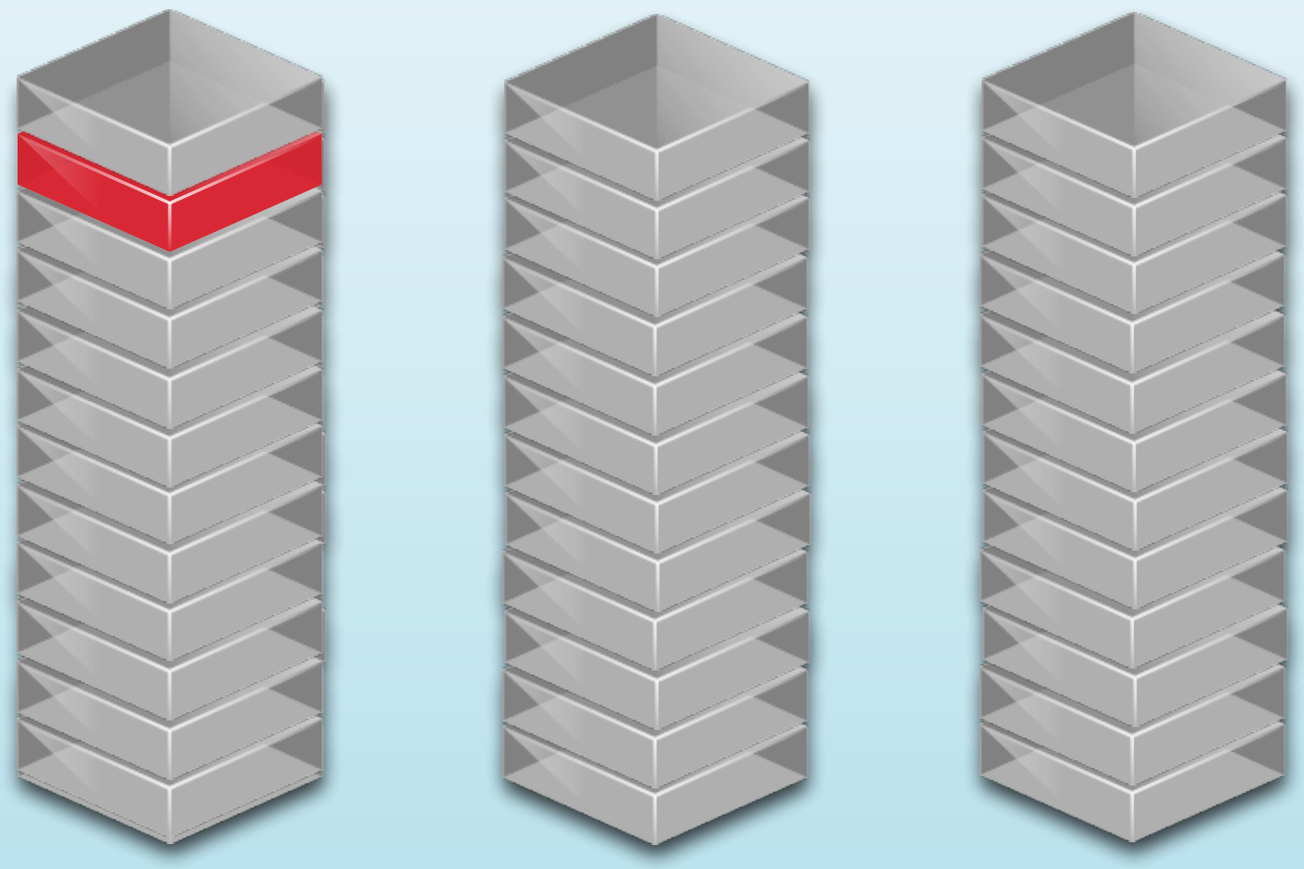
bar

You know relational



`foo` `foo_bar` `bar`

You know relational



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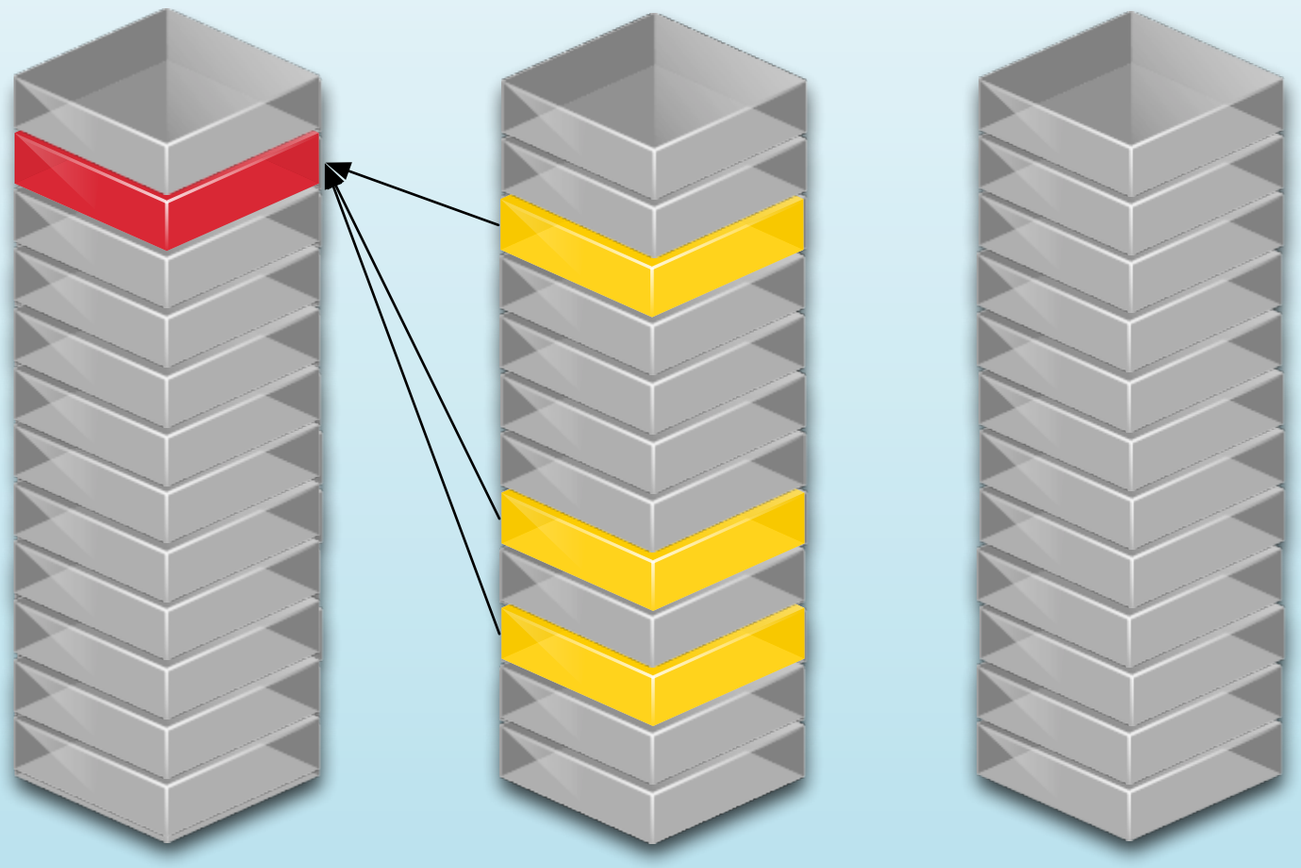

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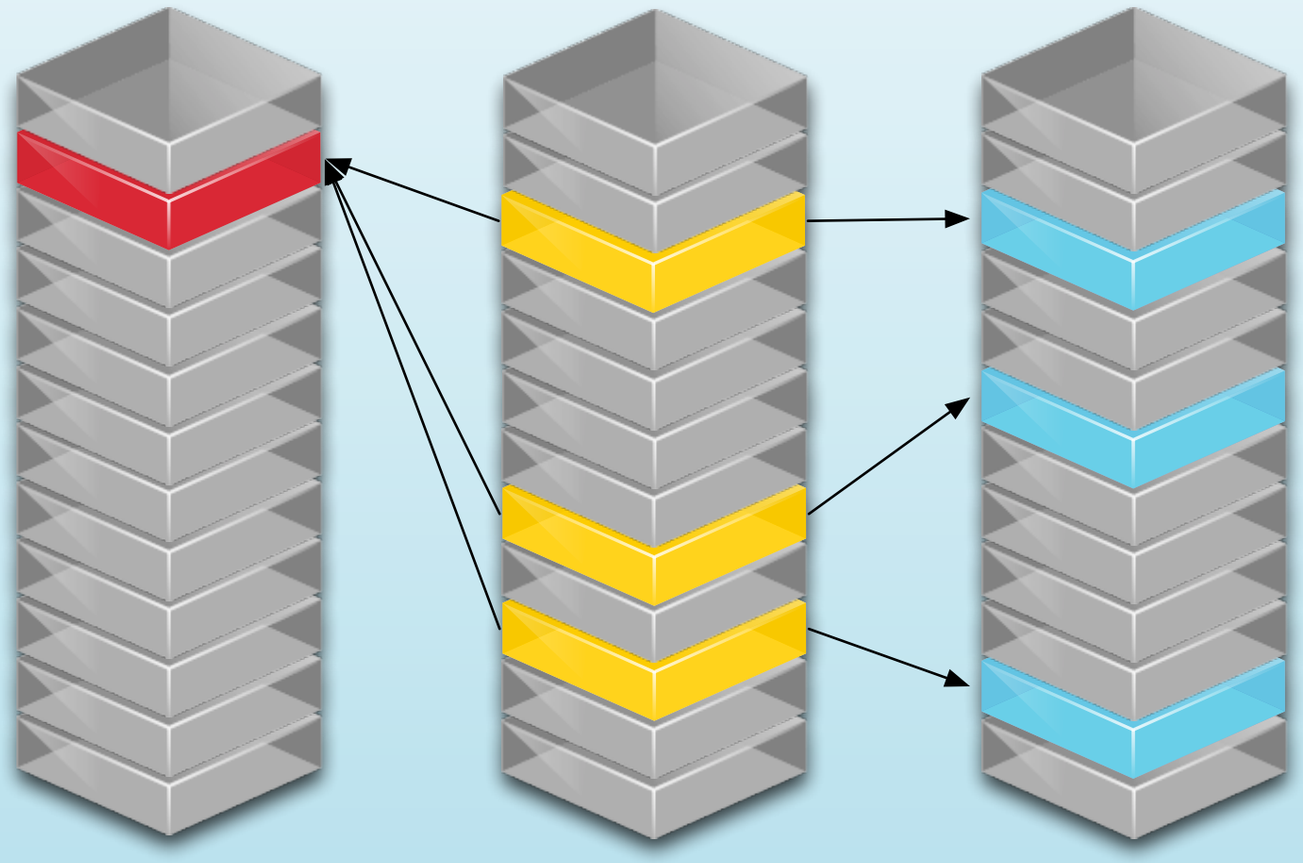
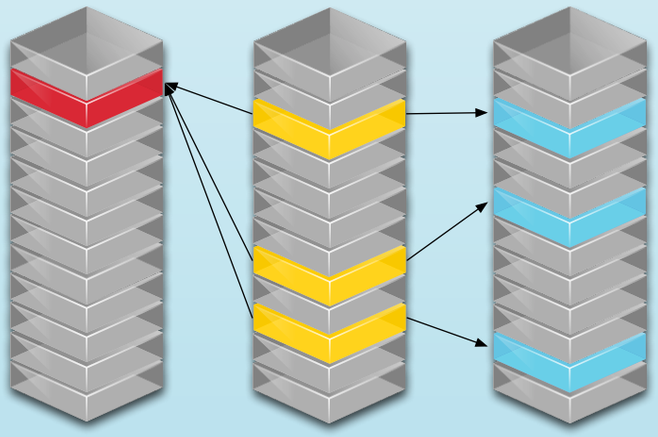


foo foo_bar bar

You know relational

now consider relationships...



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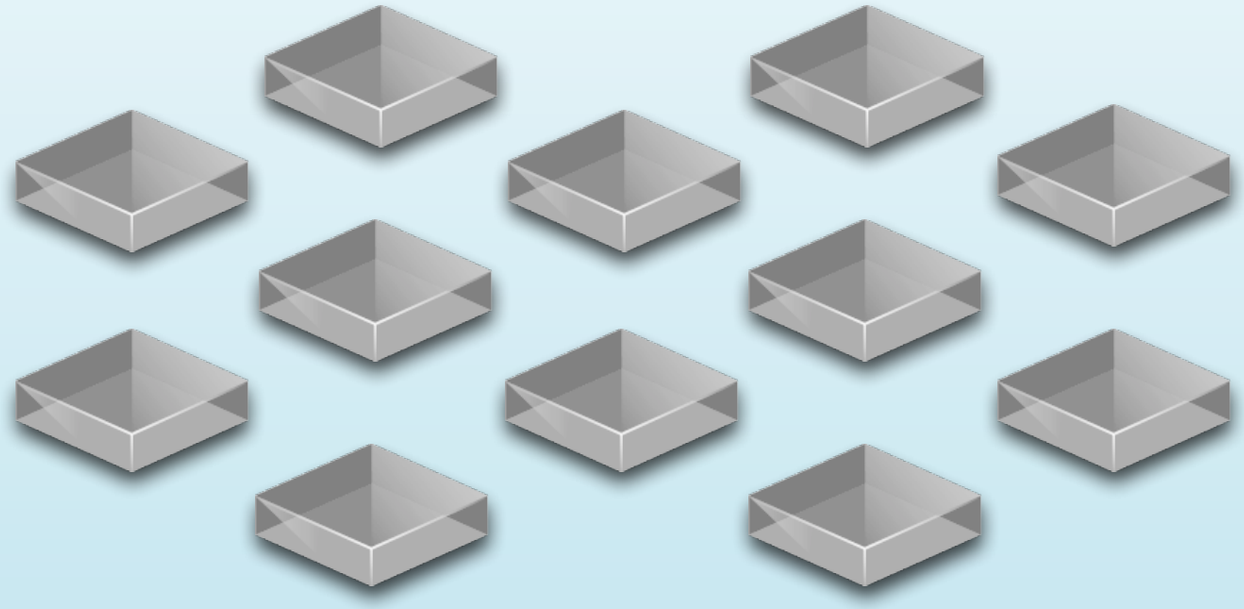

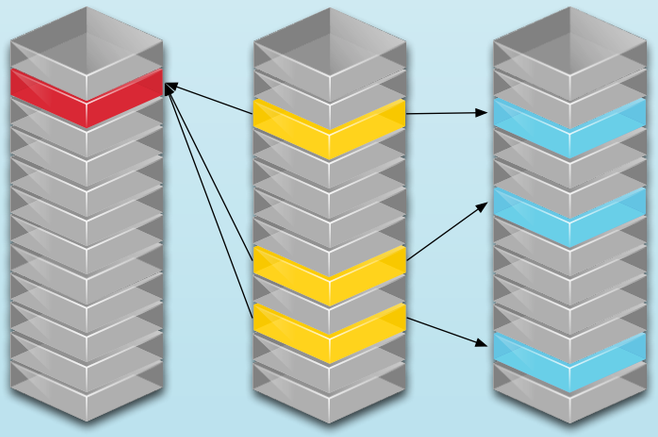

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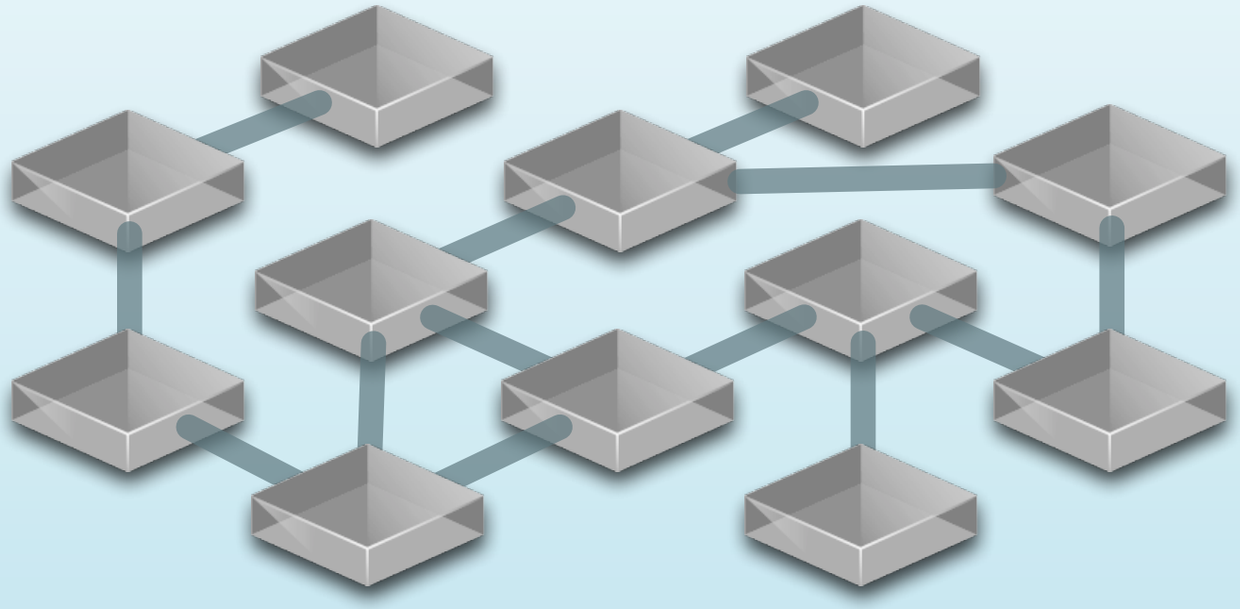

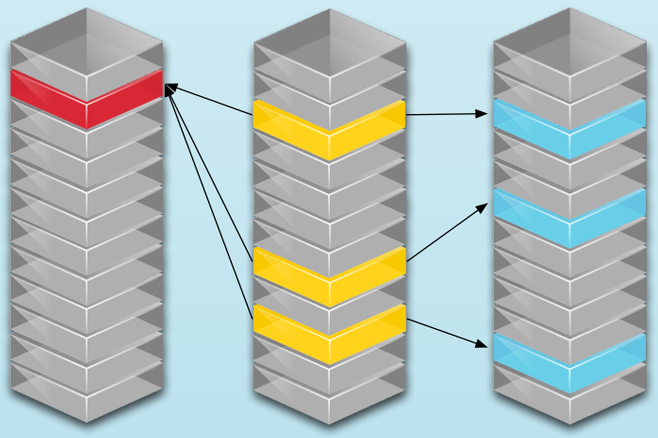

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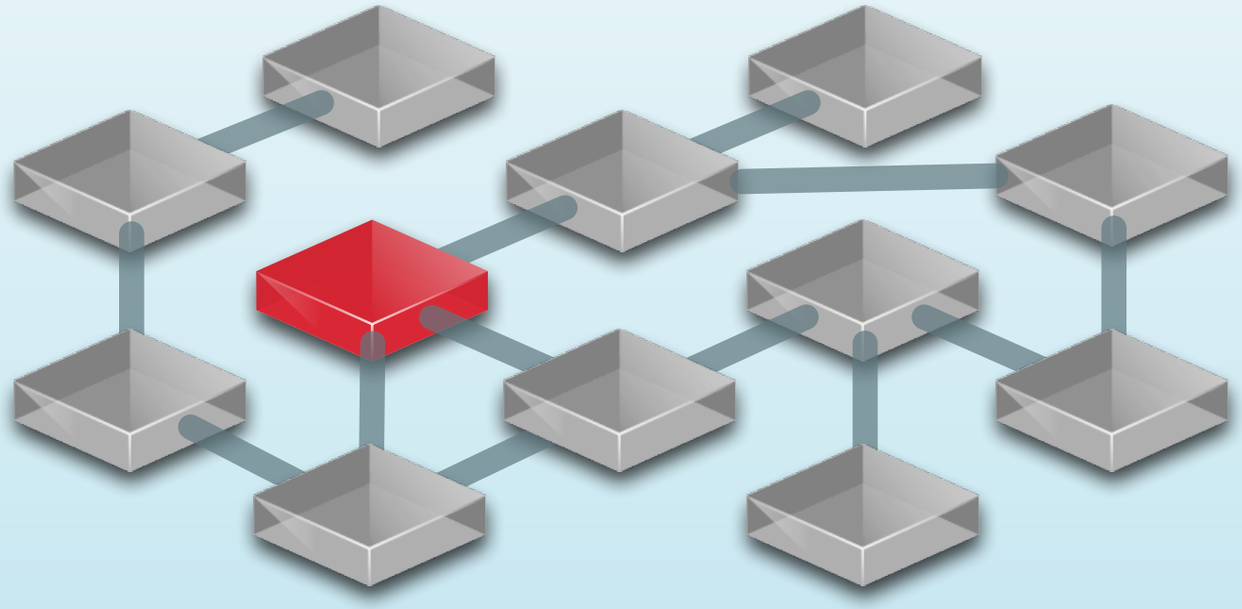

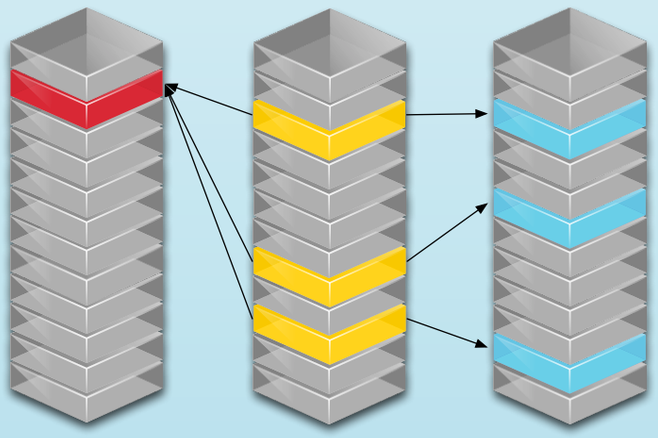

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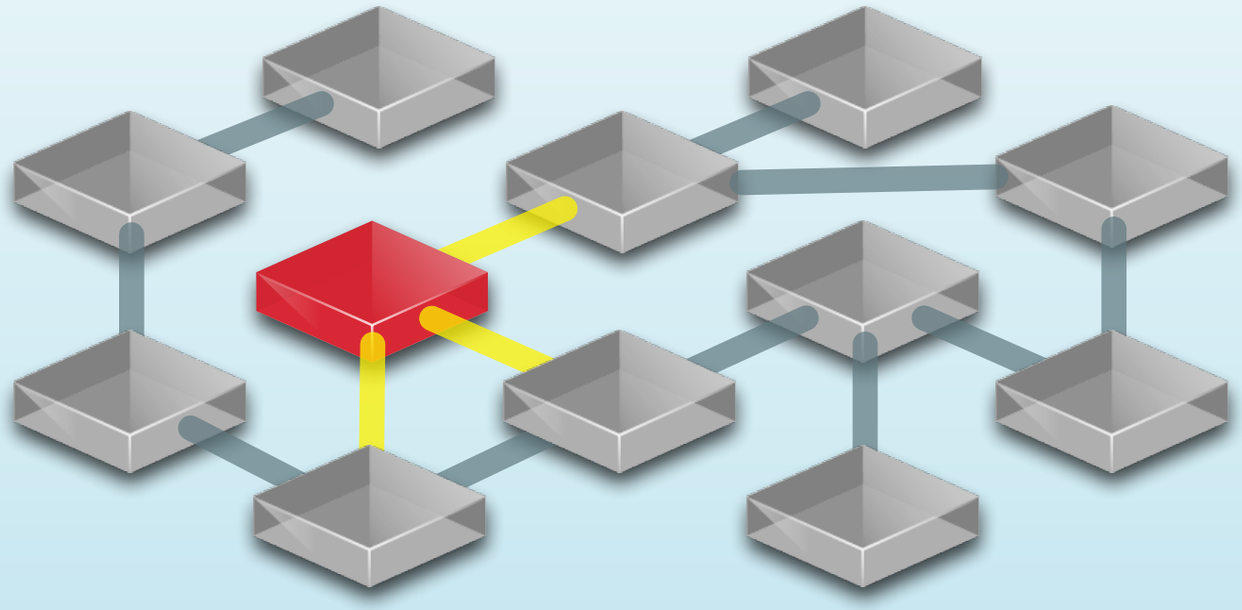

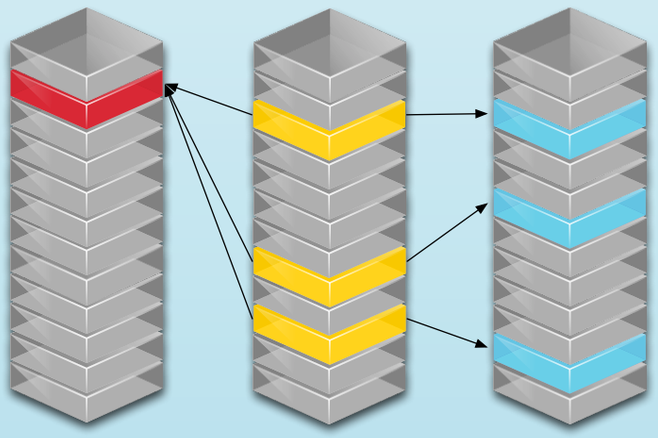

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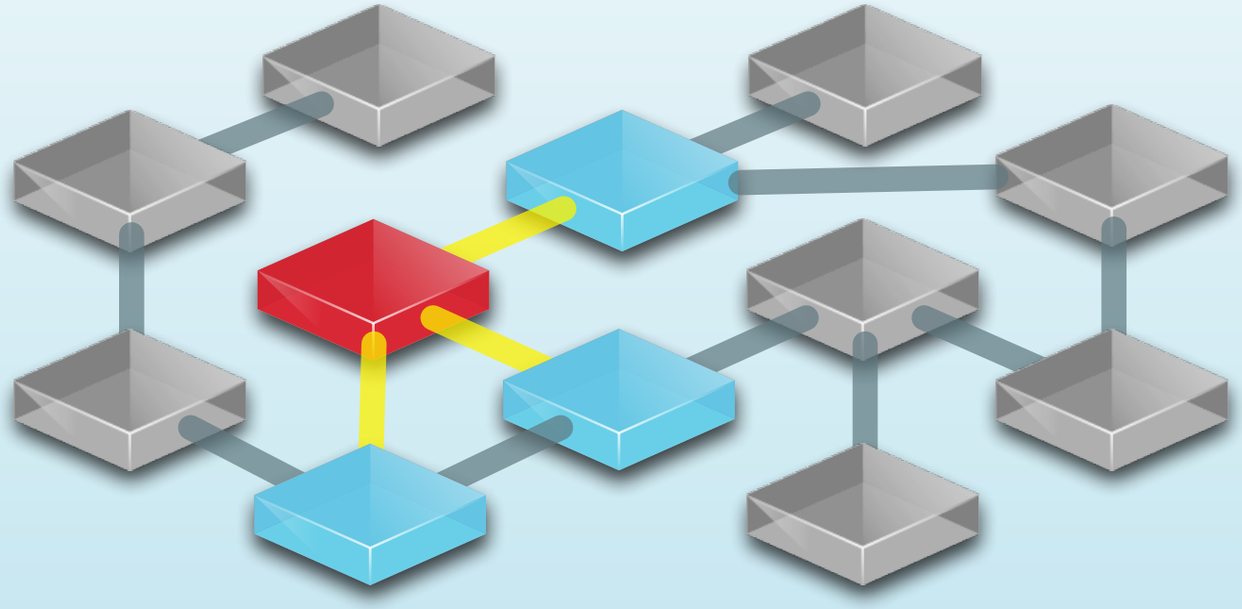
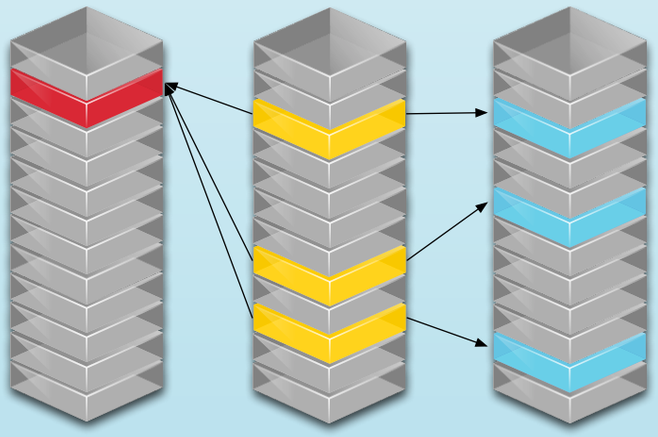
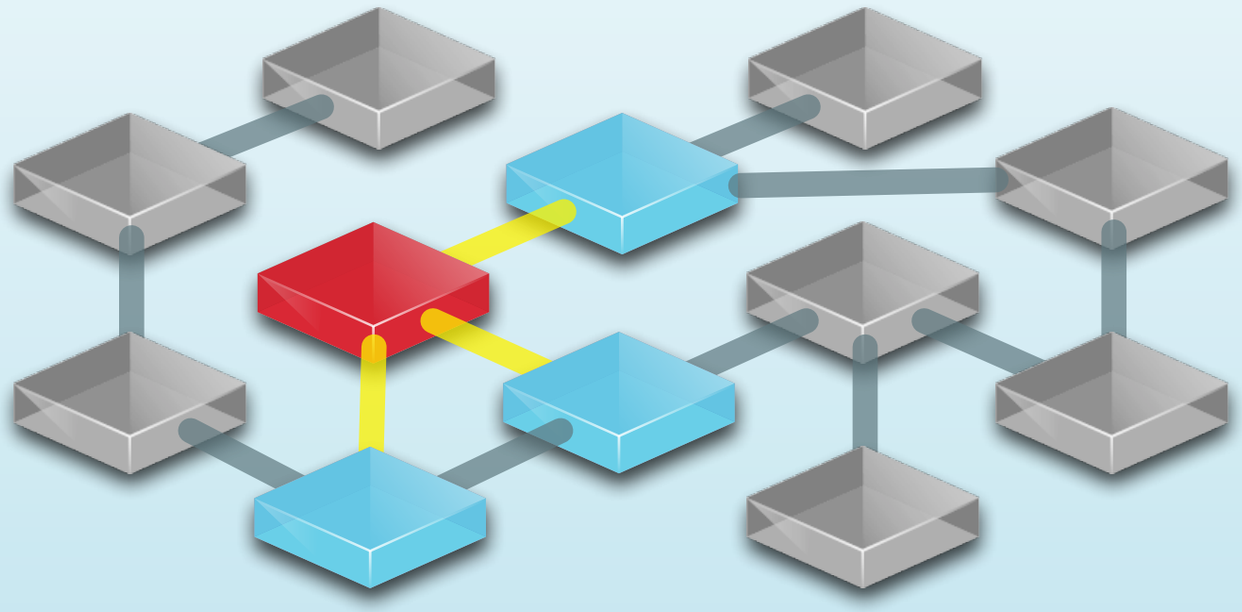
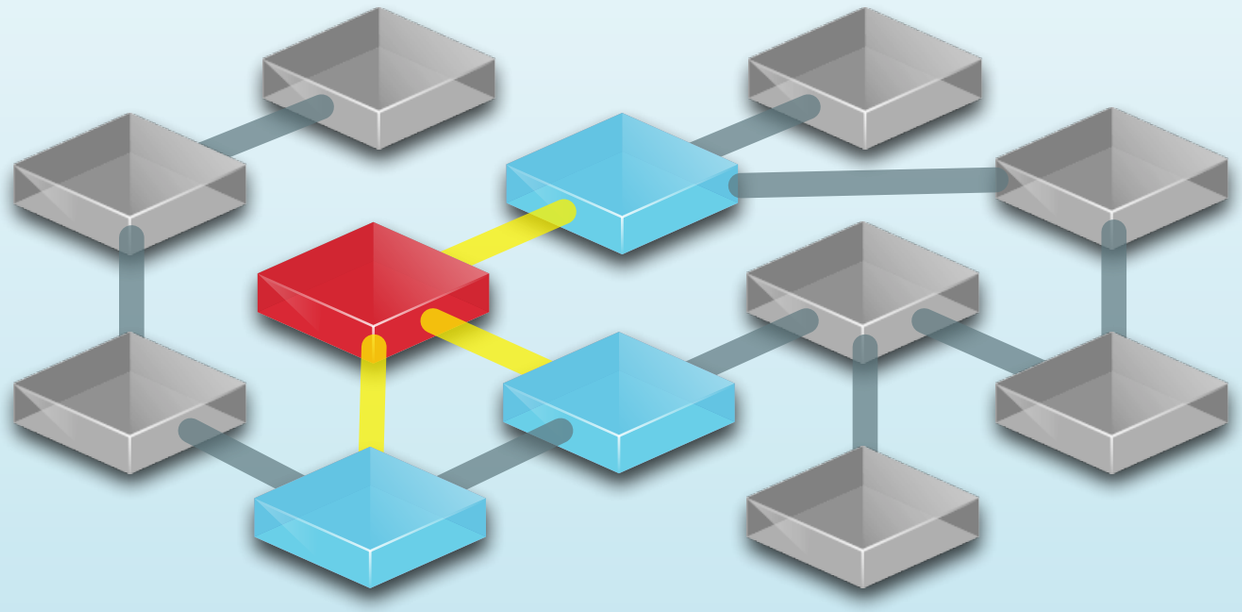
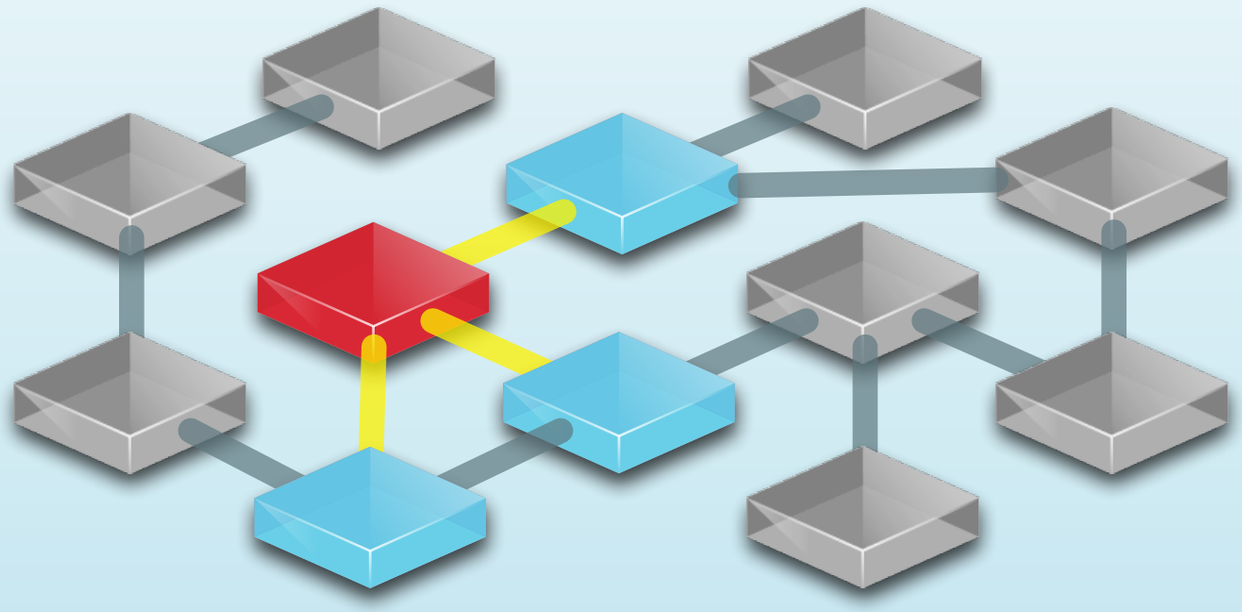








We're talking about a Property Graph



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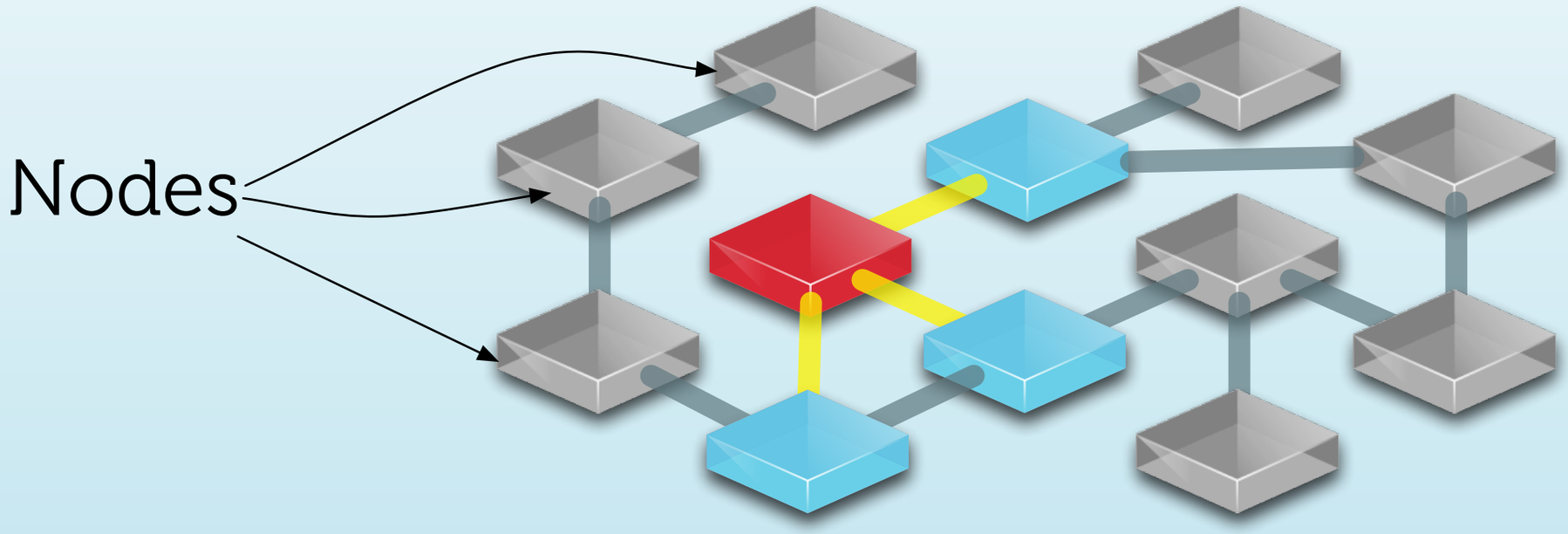
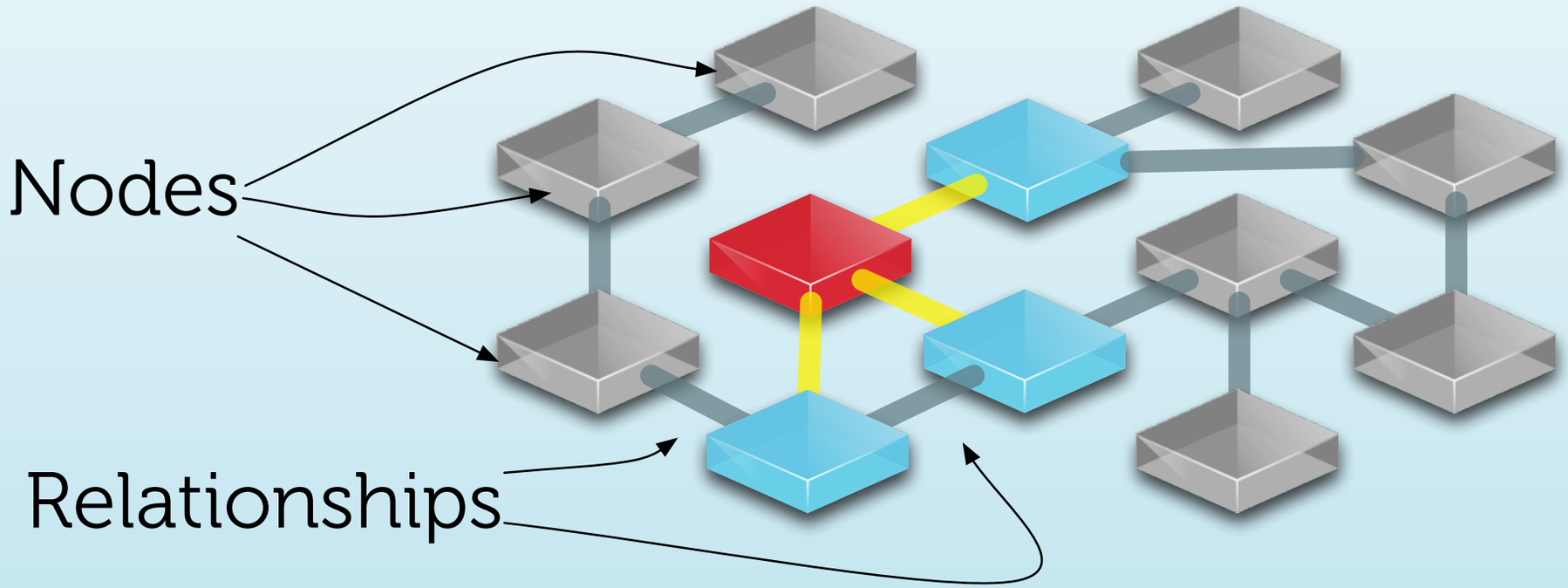


We're talking about a Property Graph



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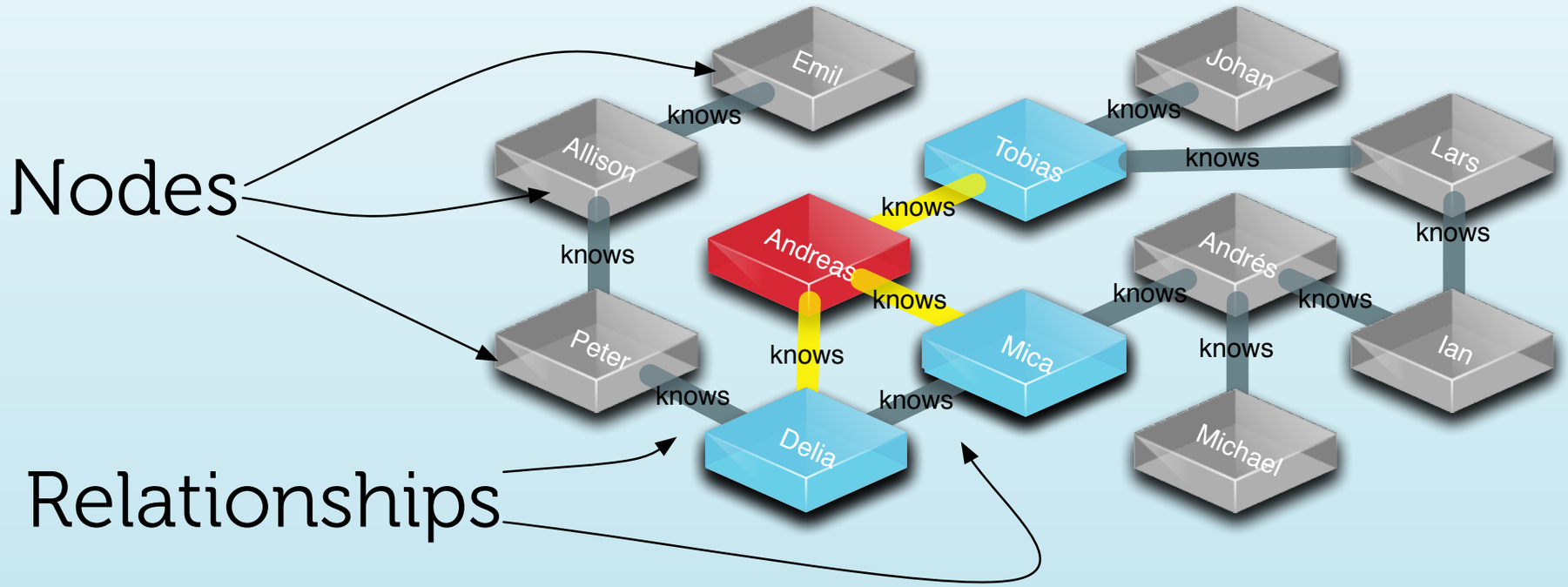
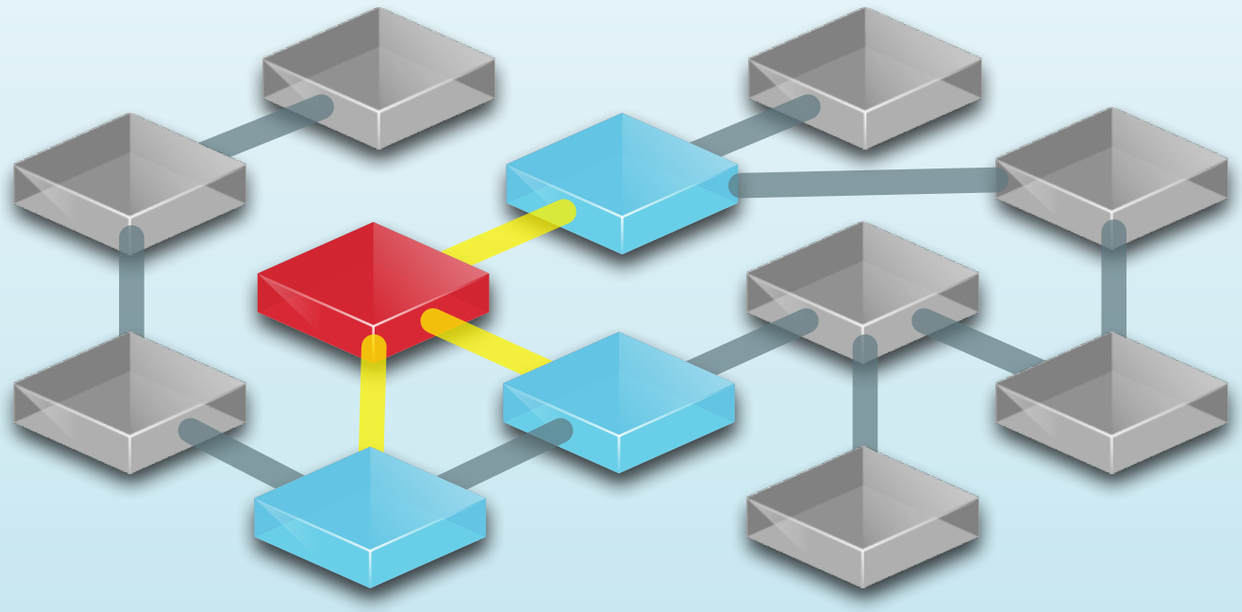
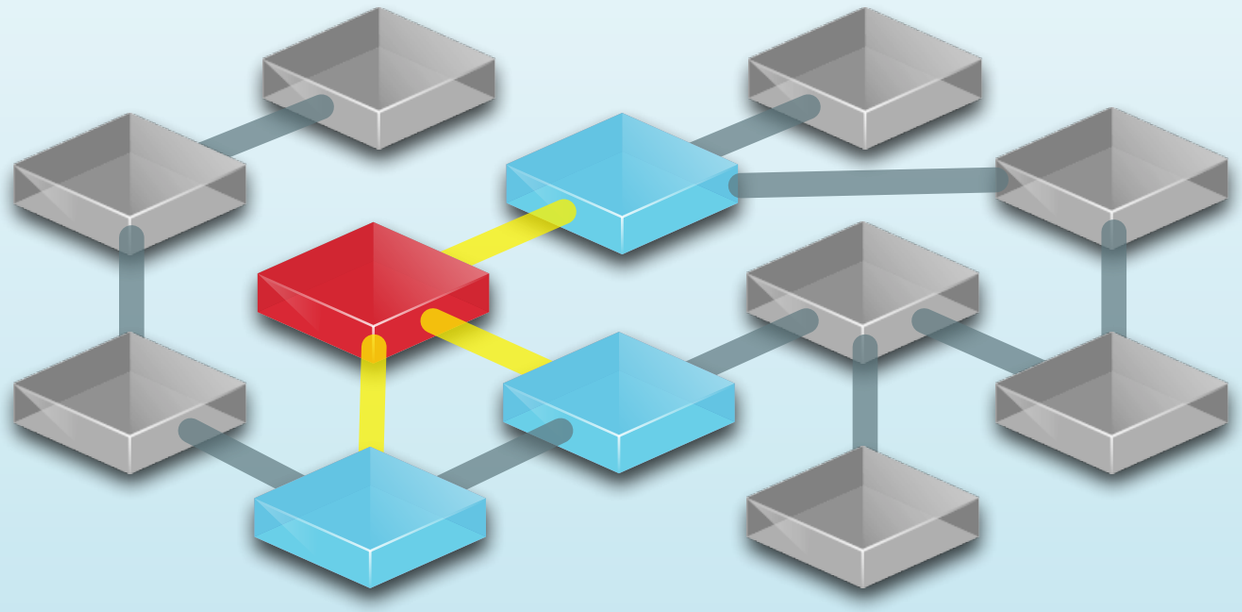


Properties (each a key+value)

\+ Indexes (for easy look-ups)





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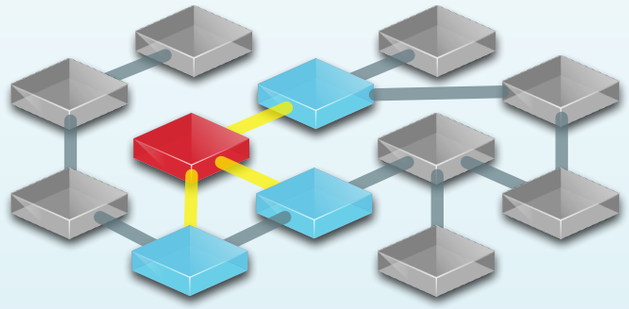

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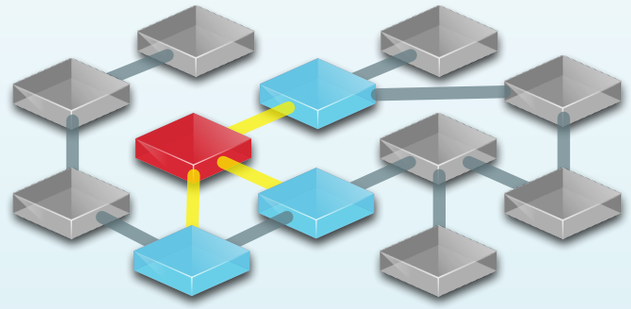
- a sample social graph



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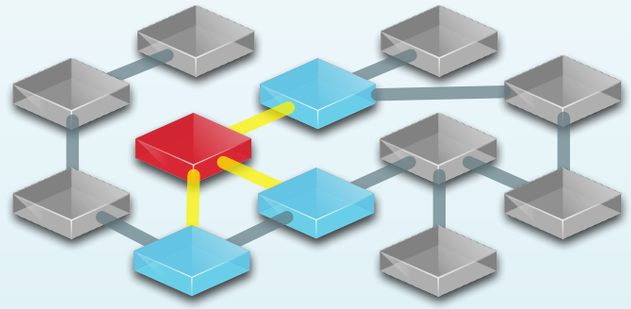
- a sample social graph
  - with ~1,000 persons



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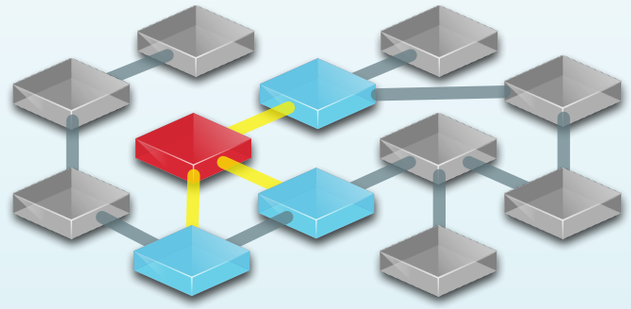
- average 50 friends per person



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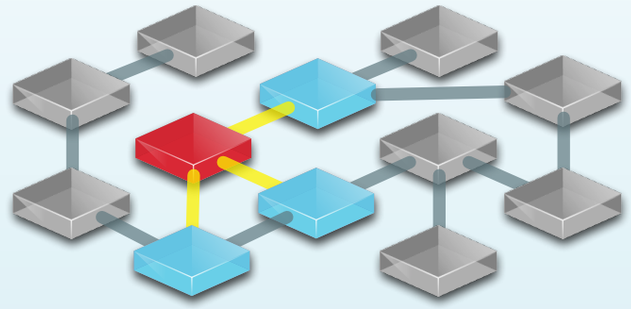
- pathExists(a,b) limited to depth 4



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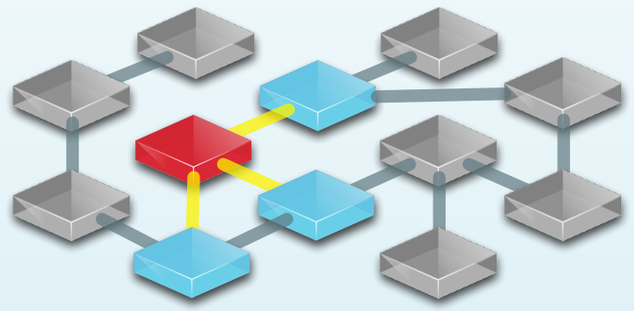

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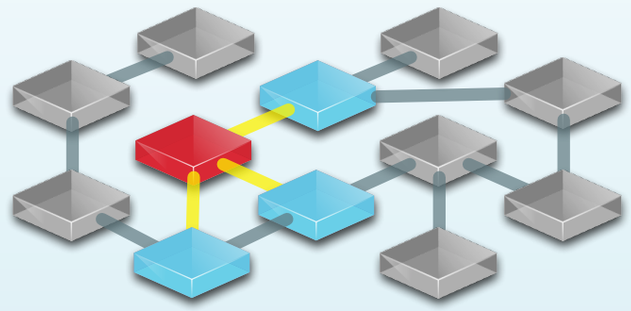

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	# persons	query time
Relational database	1,000	2000ms

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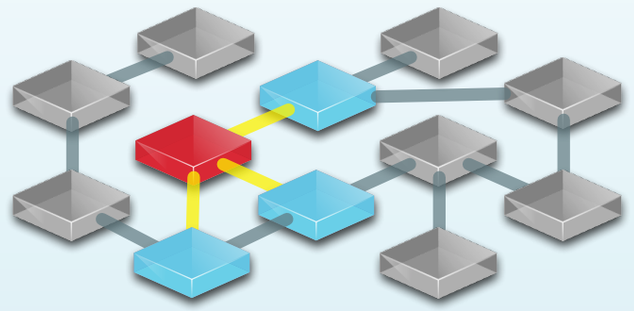

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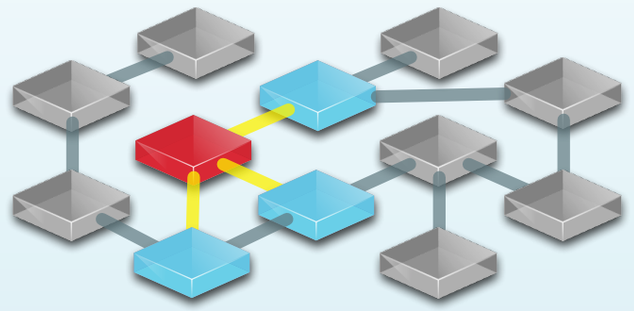

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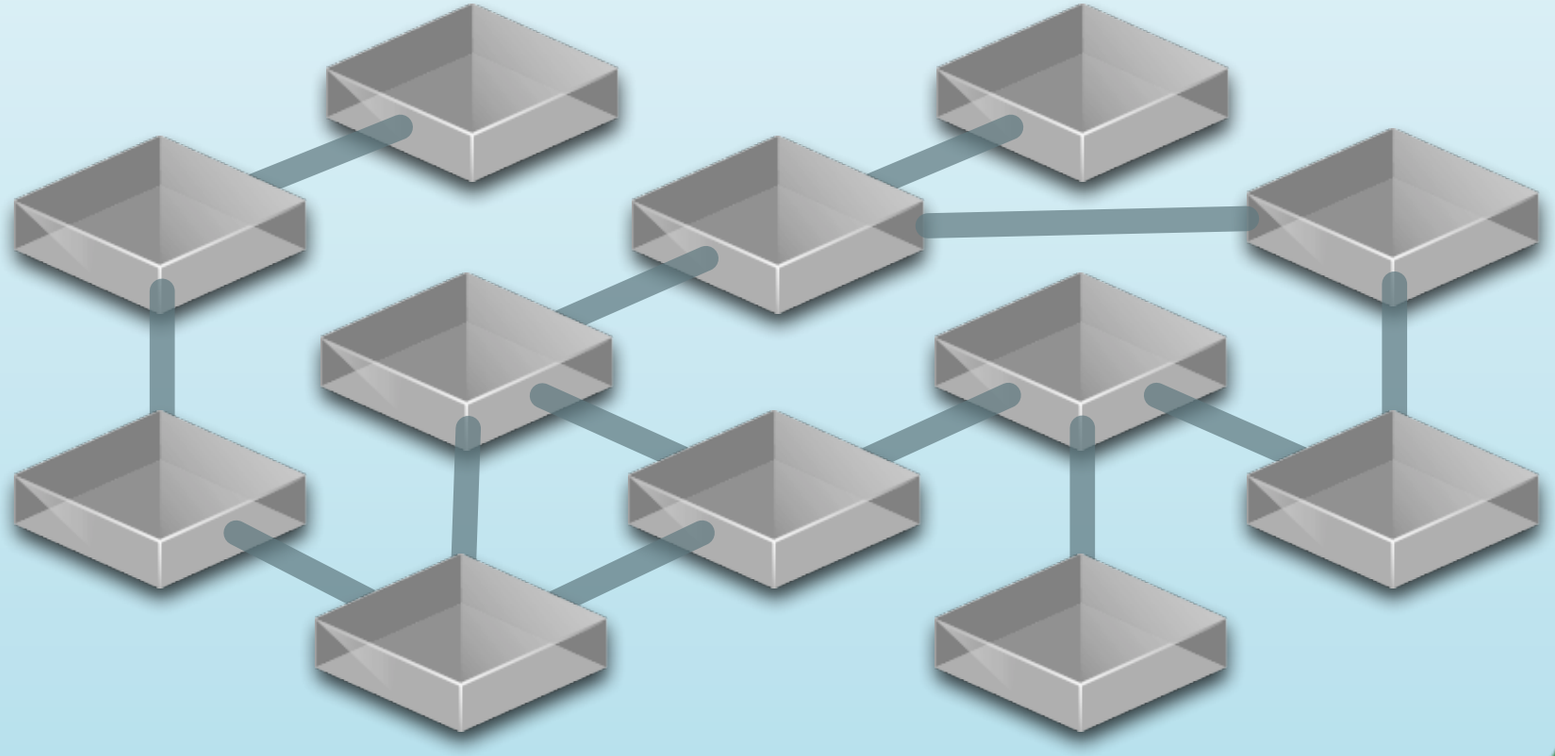
Graph Database: Pros & Cons

- Strengths
  - Powerful data model, as general as RDBMS
  - Fast, for connected data
  - Easy to query
- Weaknesses:
  - Sharding (though they can scale reasonably well)
    - also, stay tuned for developments here
  - Requires conceptual shift
    - though graph-like thinking becomes addictive

And, but, so how do you query this "graph" database?

Query a graph with a traversal



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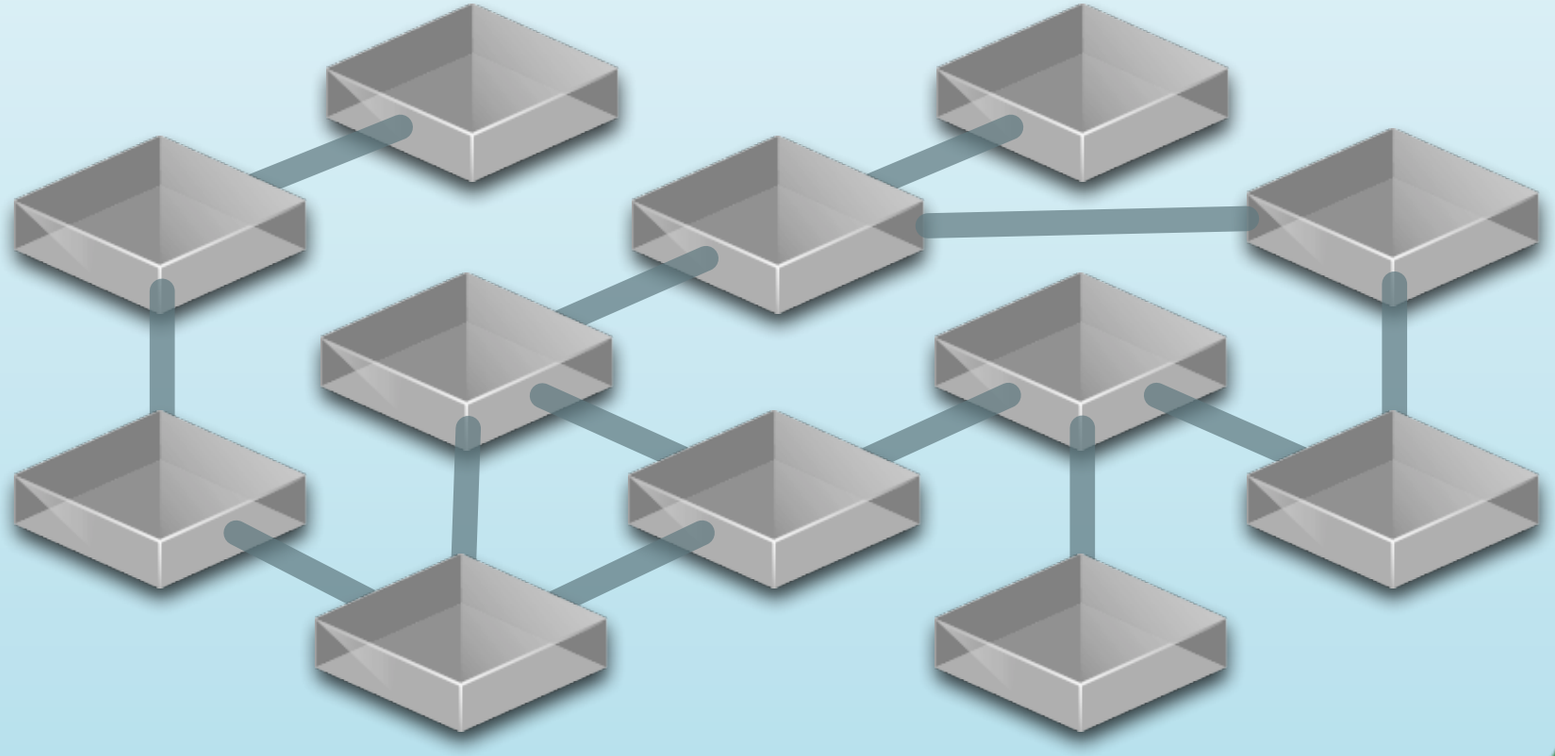
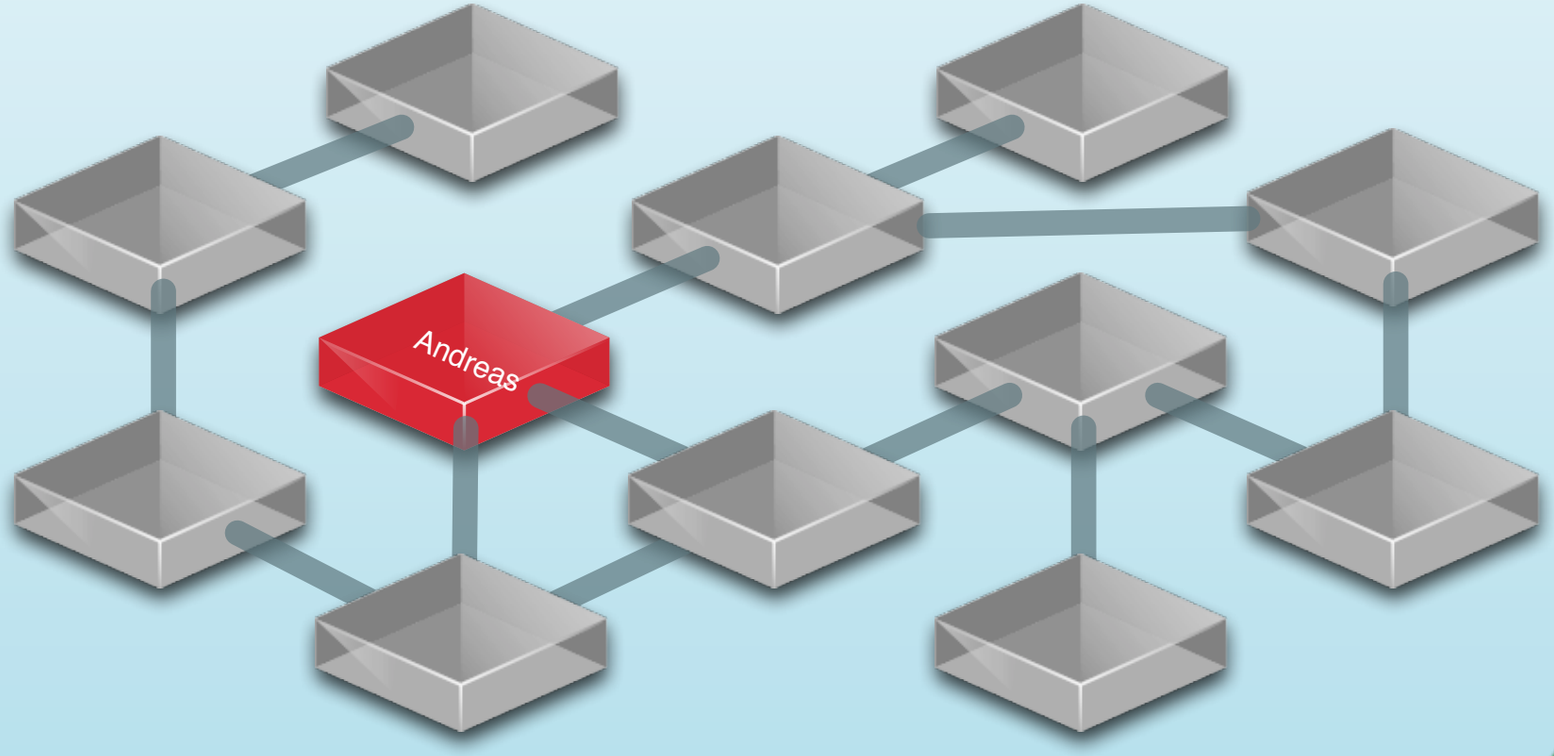


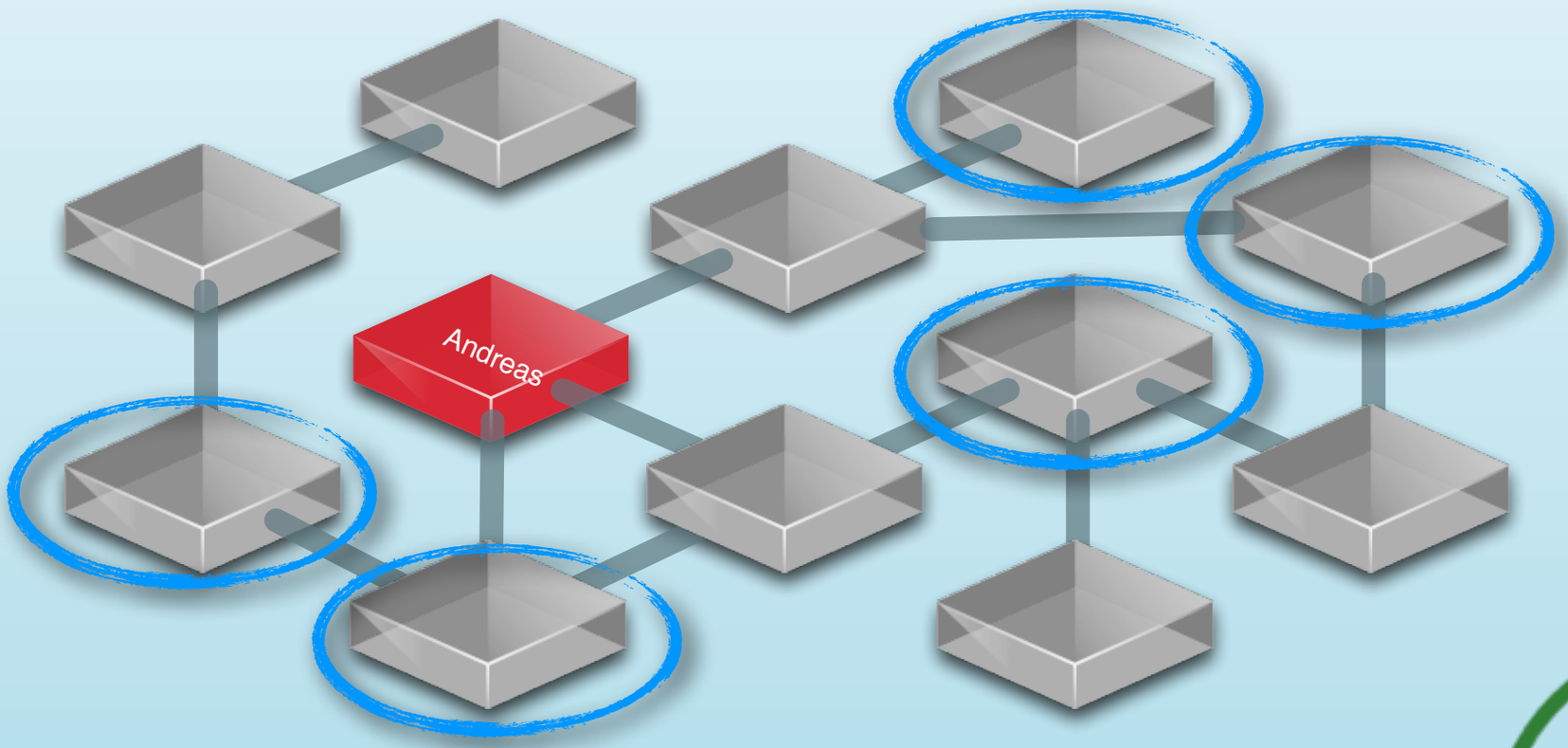
Query a graph with a traversal

```
// lookup starting point in an index
start n=node:People(name = 'Andreas')
```

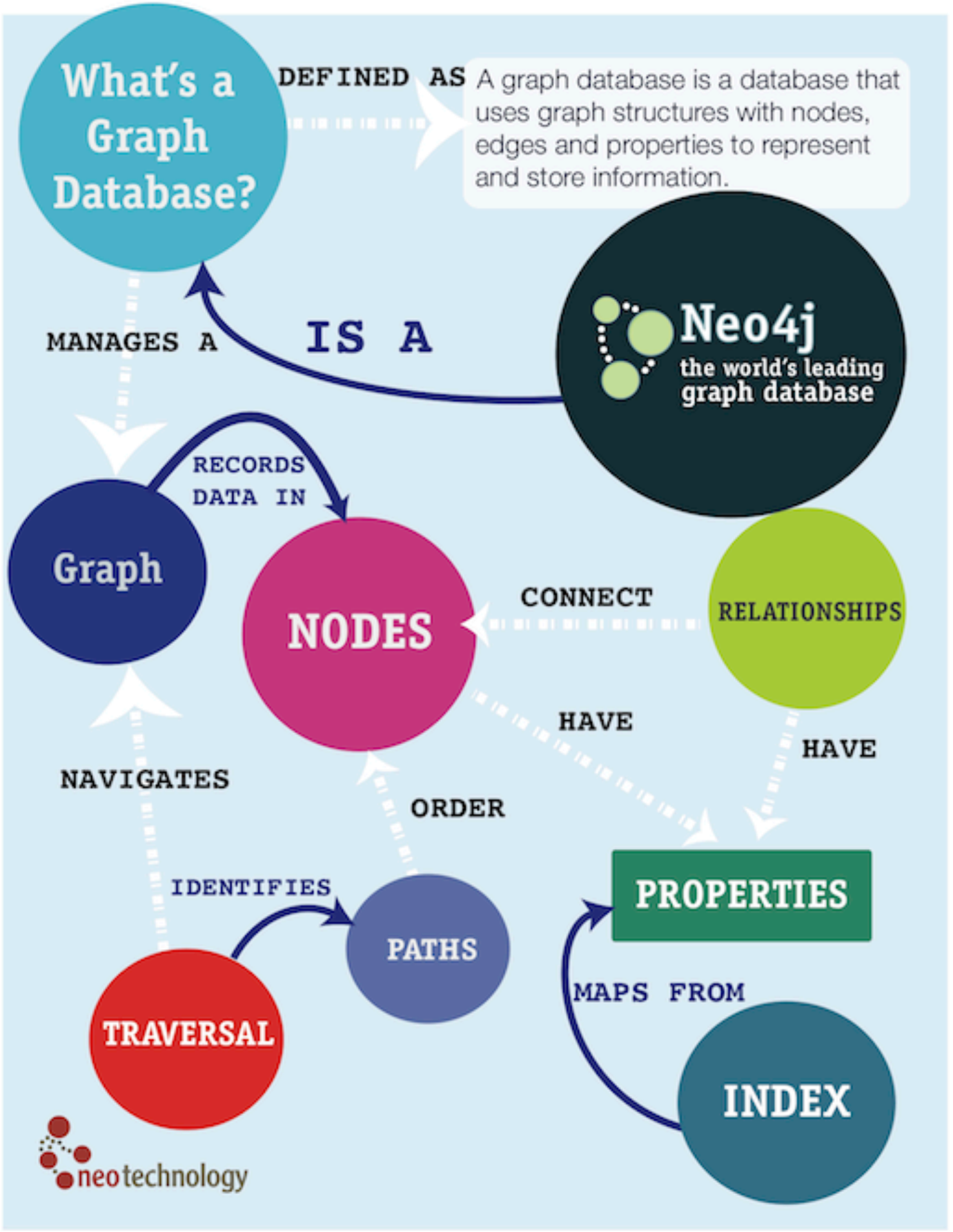


Query a graph with a traversal

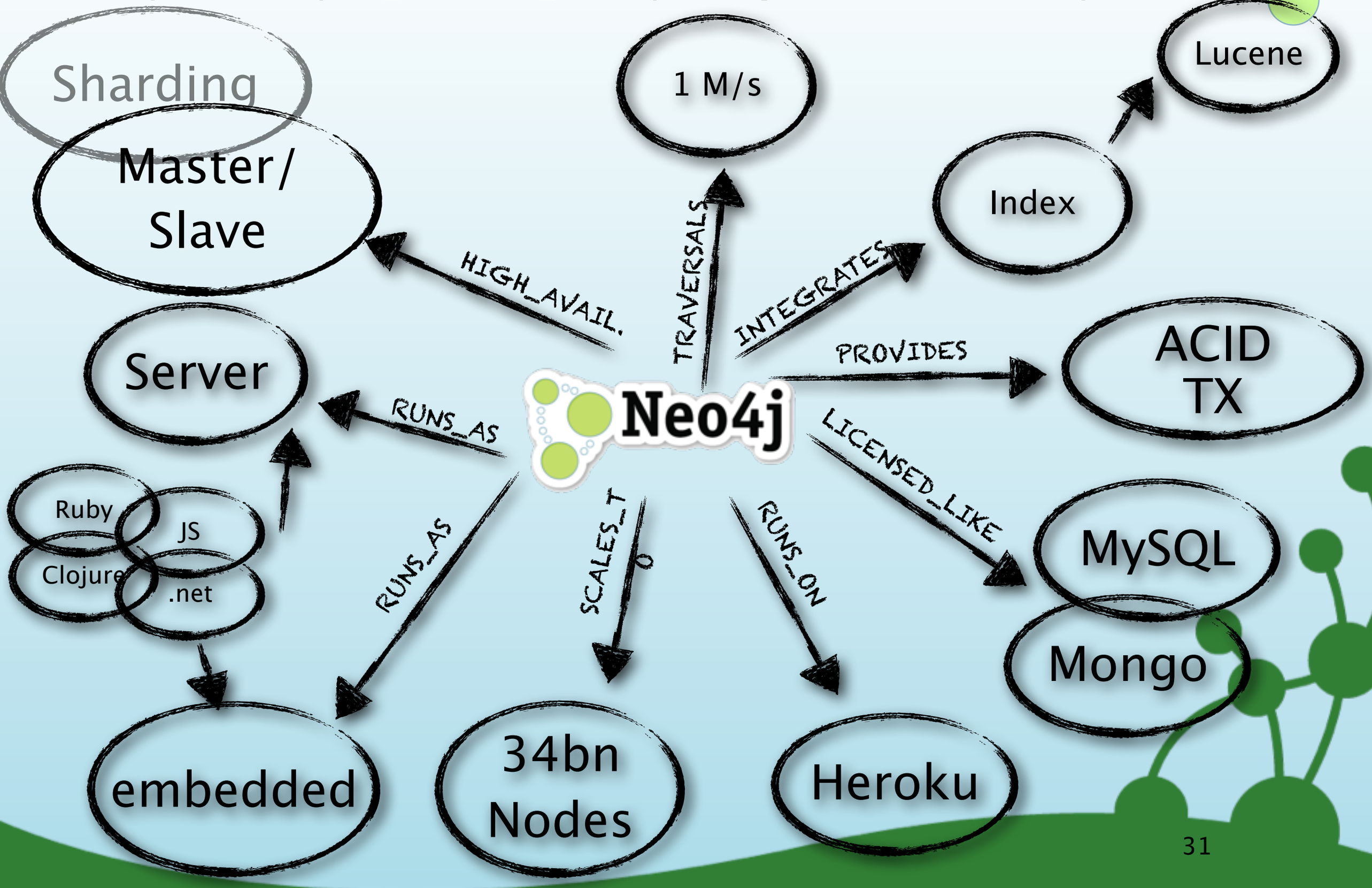
```
// then traverse to find results
start n=node:People(name = 'Andreas')
  match (n)--()--(foaf) return foaf
```



Neo4j – the Graph Database


What's a Graph Database?
DEFINED AS
A graph database is a database that uses graph structures with nodes, edges and properties to represent and store information.
Neo4j
the world's leading graph database
IS A
MANAGES A
RECORDS DATA IN
Graph
NODES
CONNECT
RELATIONSHIPS
HAVE
HAVE
NAVIGATES
ORDER
IDENTIFIES
PATHS
PROPERTIES
MAPS FROM
TRAVERSAL
INDEX
neotechnology

(Neo4j) -[:IS_A]-> (Graph Database)



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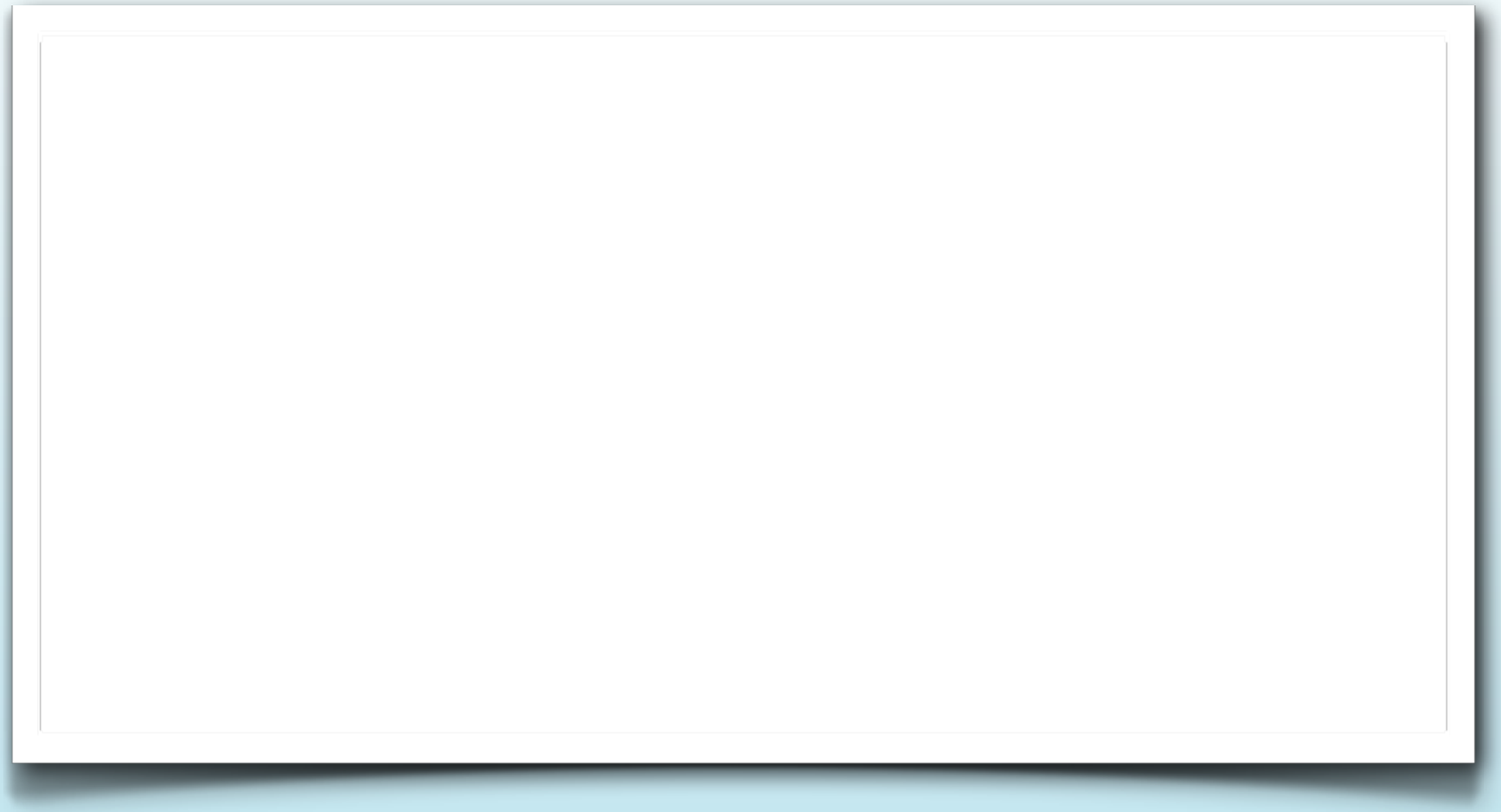
  - higher-performance with High-Availability (read scaling)

Whiteboard --> Data



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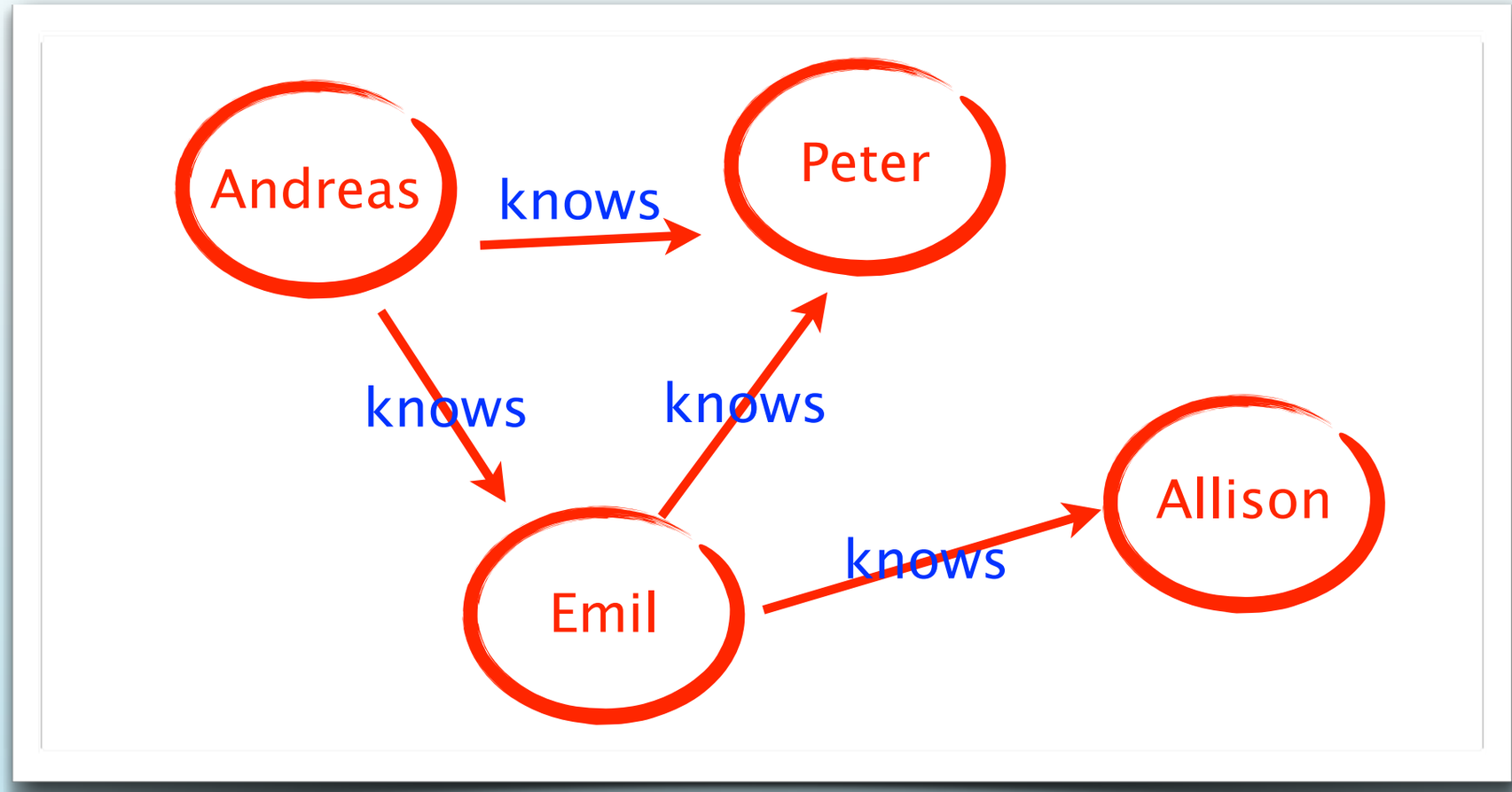

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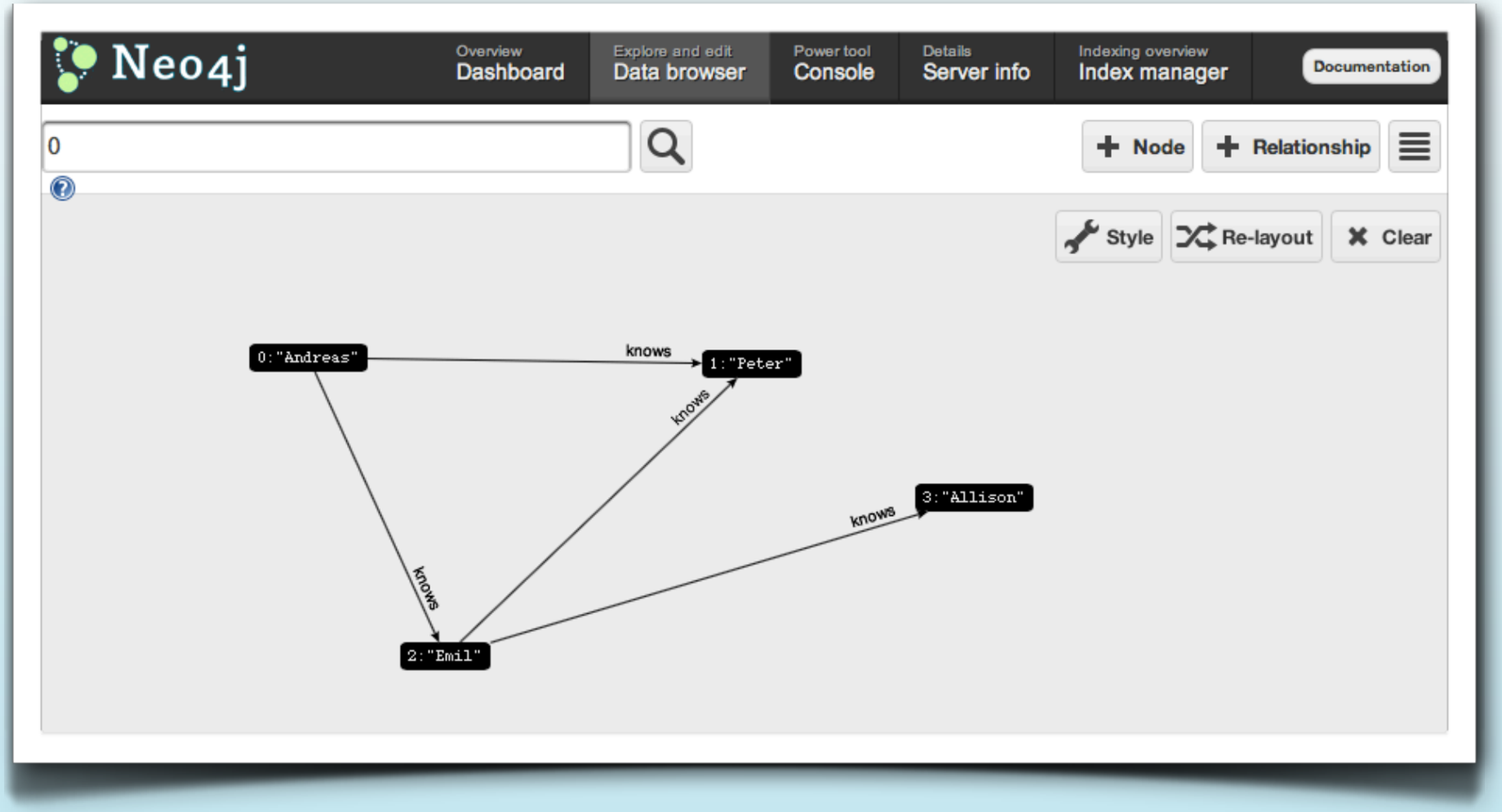

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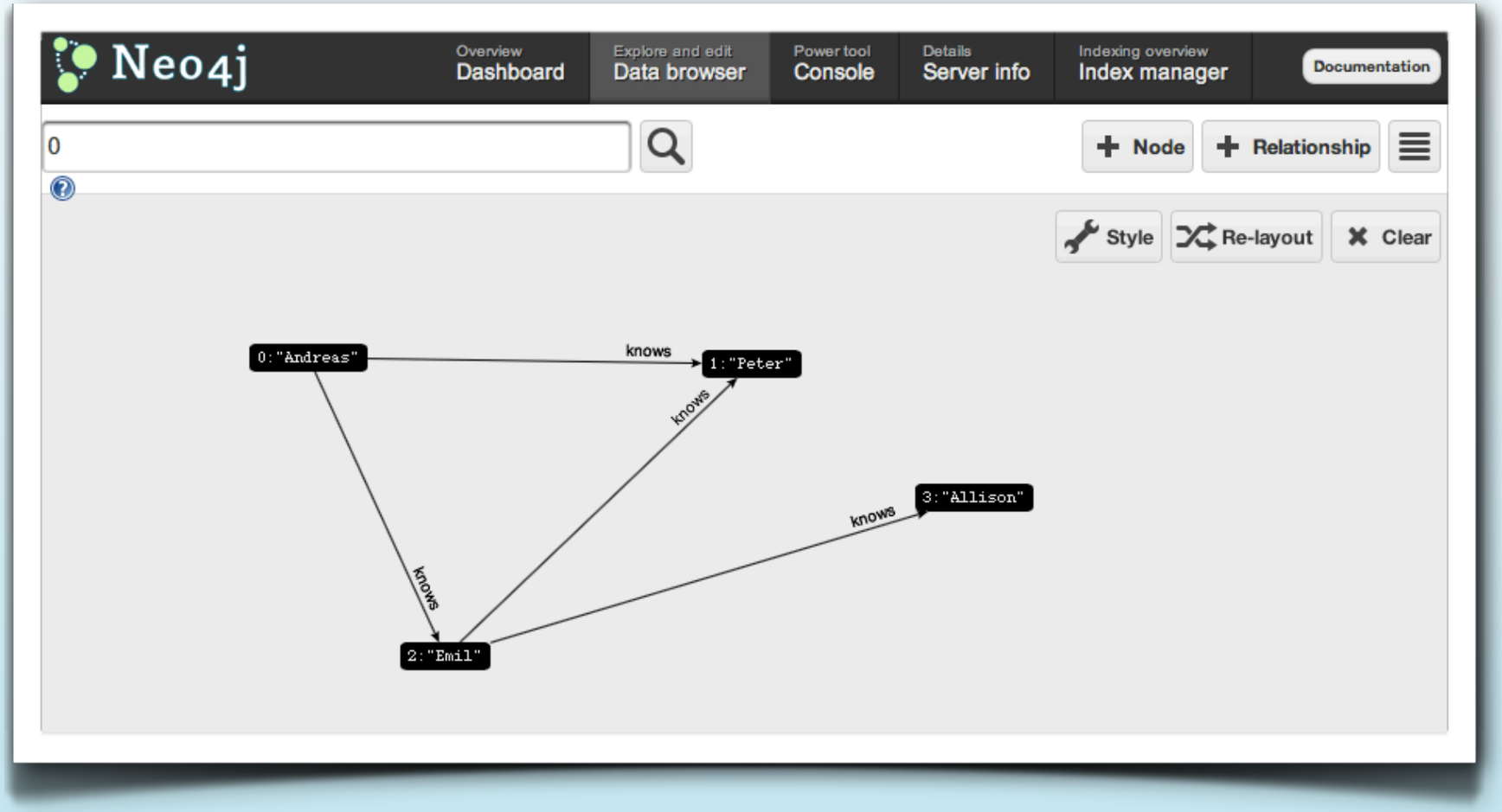


```
// Cypher query - friend of a friend
start n=node(0)
match (n)--()--(foaf)
return foaf
```

Two Ways to Work with Neo4j

Two Ways to Work with Neo4j

- 1. Embeddable on JVM

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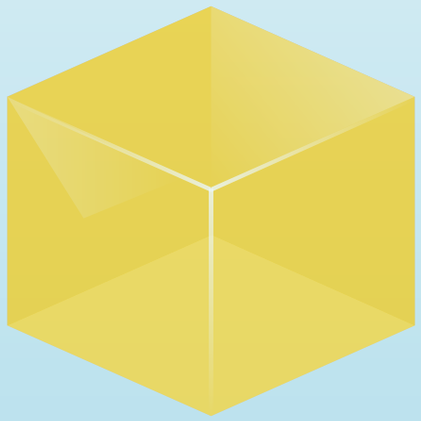

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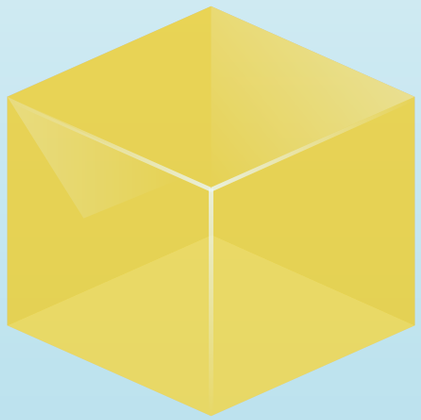

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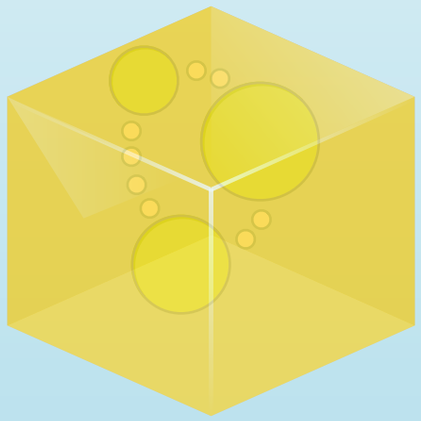

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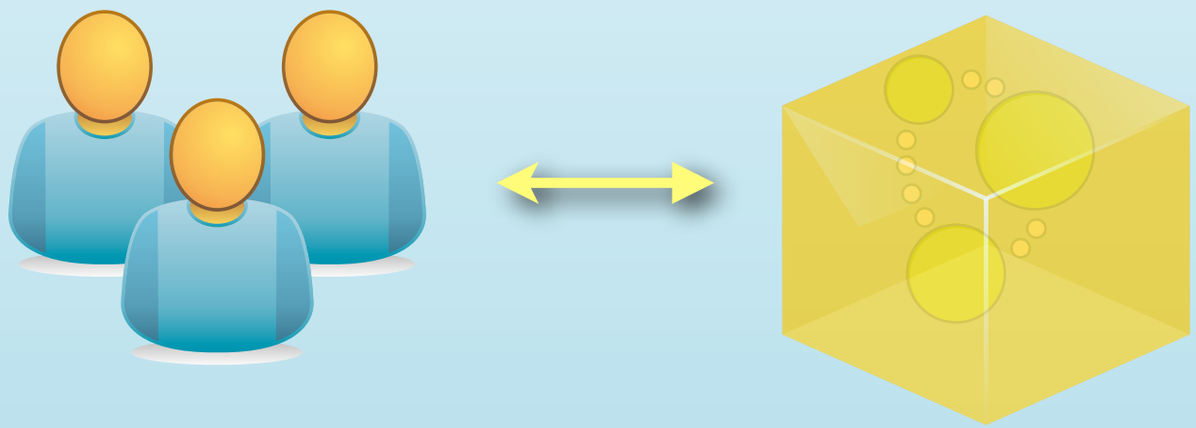

Two Ways to Work with Neo4j

Show me some code, please

```
GraphDatabaseService graphDb =
    new EmbeddedGraphDatabase(“var/neo4j”);
Transaction tx = graphDb.beginTx();
try {
  Node steve = graphDb.createNode();
  Node michael = graphDb.createNode();

  steve.setProperty(“name”, “Steve Vinoski”);
  michael.setProperty(“name”, “Michael Hunger”);

  Relationship presentedWith = steve.createRelationshipTo(
  michael, PresentationTypes.PRESENTED_WITH);
  presentedWith.setProperty(“date”, today);
  tx.success();
} finally {
  tx.finish();
}
```

Spring Data Neo4j

```
@NodeEntity
public class Movie {
  @Indexed private String title;
  @RelatedToVia(type = “ACTS_IN”, direction=INCOMING)
  private Set<Role> cast;
  private Director director;
}

@NodeEntity
public class Actor {
  @RelatedTo(type = “ACTS_IN”)
  private Set<Movies> movies;
}

@RelationshipEntity
public class Role {
  @StartNode private Actor actor;
  @EndNode private Movie movie;
  private String roleName;
}
```

neo4j.rb

```
   gem install neo4j

require 'rubygems'
require 'neo4j'

class Person
  include Neo4j::NodeMixin
  property :name, :age, :rank
  index :name
  has_n :friends
end

Neo4j::Transaction.run do
  neo = Person.new :name=>'Neo', :age=>29
  morpheus =
Person.new :name=>'Morpheus', :rank=>'Captain'
  neo.friends << morpheus
end

neo.friends.each {|p|...}
```

Cypher Query Language

- Declarative query language
  - Describe *what* you want, not *how*
  - Based on pattern matching
- Examples:

```
START david=node:people(name="David")   # index lookup
MATCH david-[:knows]-friends-[:knows]-new_friends
WHERE new_friends.age > 18
RETURN new_friends

START user=node(5, 15, 26, 28)   # node IDs
MATCH user--friend
RETURN user, COUNT(friend), SUM(friend.money)
```

Create Graph with Cypher

```
CREATE
  (steve {name: “Steve Vinoski”})
    -[:PRESENTED_WITH {date:{day}}]->
  (michael {name: “Michael Hunger”})
```

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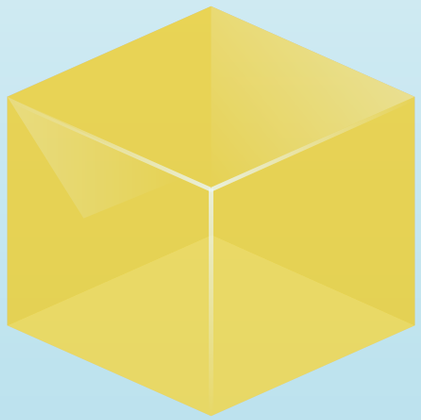

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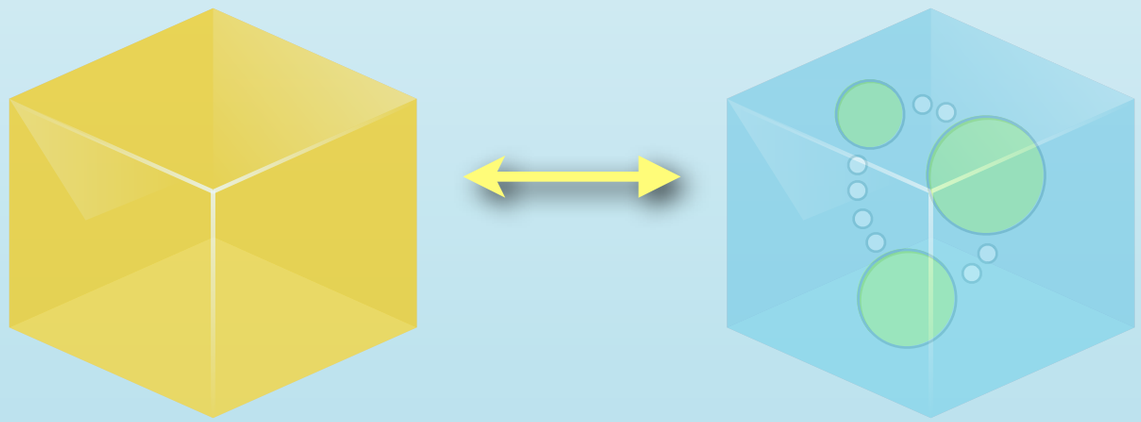

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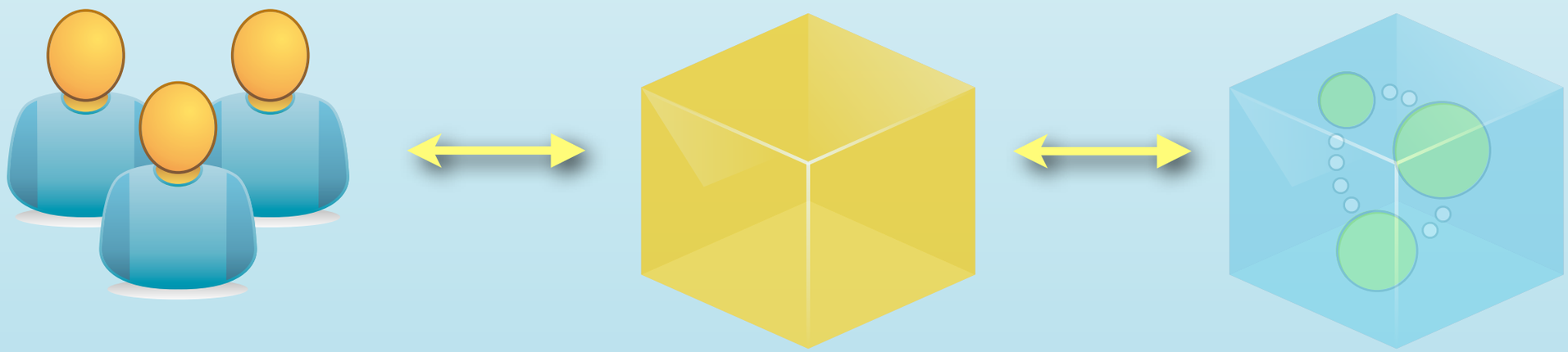

Two Ways to Work with Neo4j

Bindings

REST://

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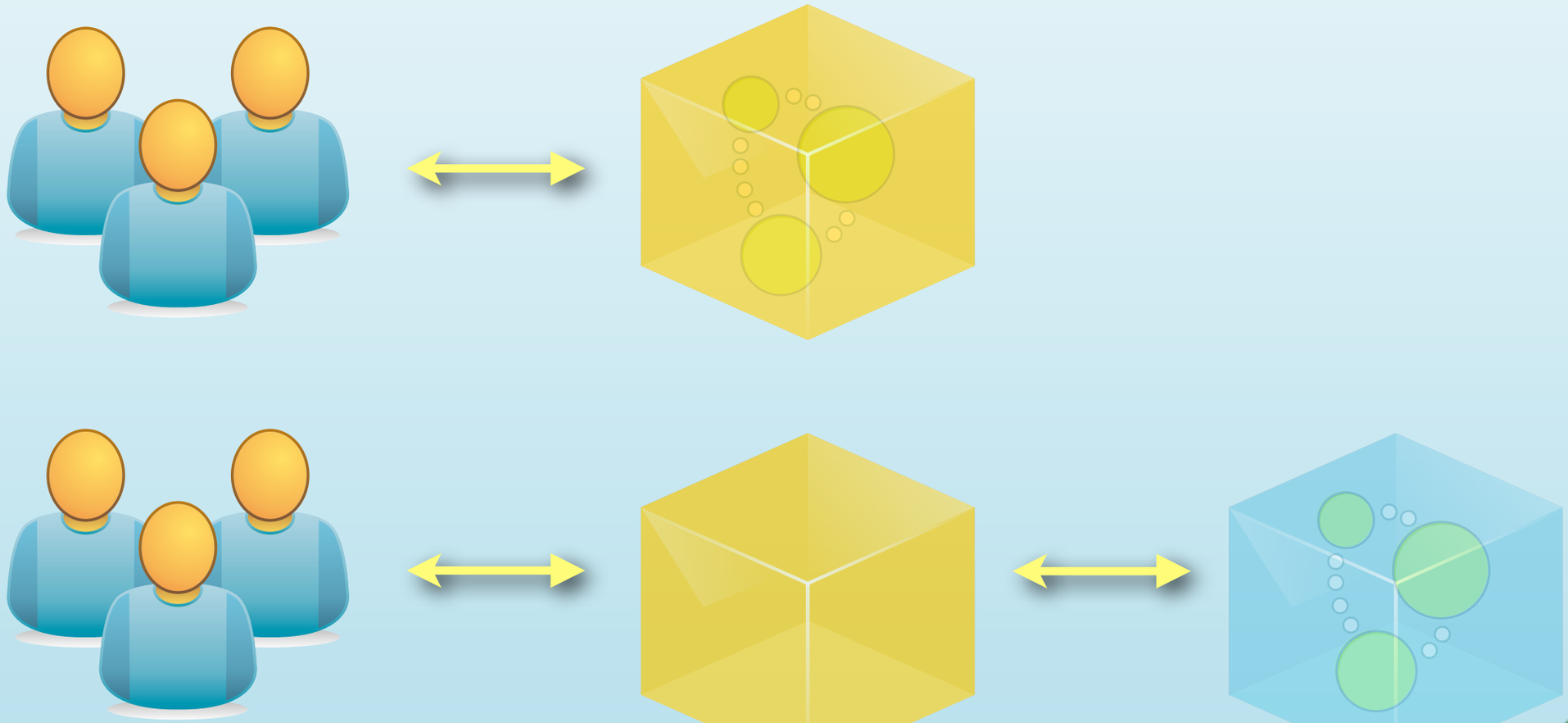

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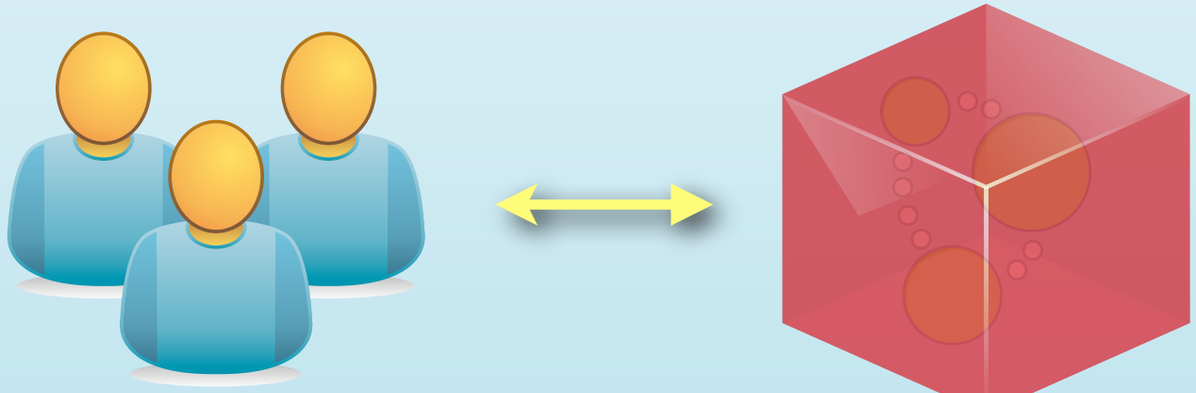

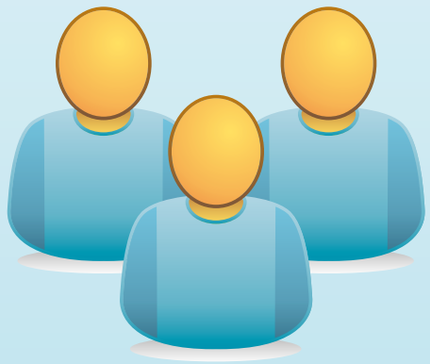

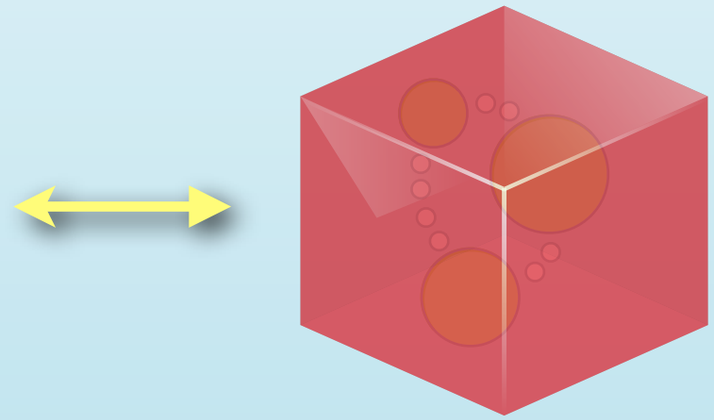

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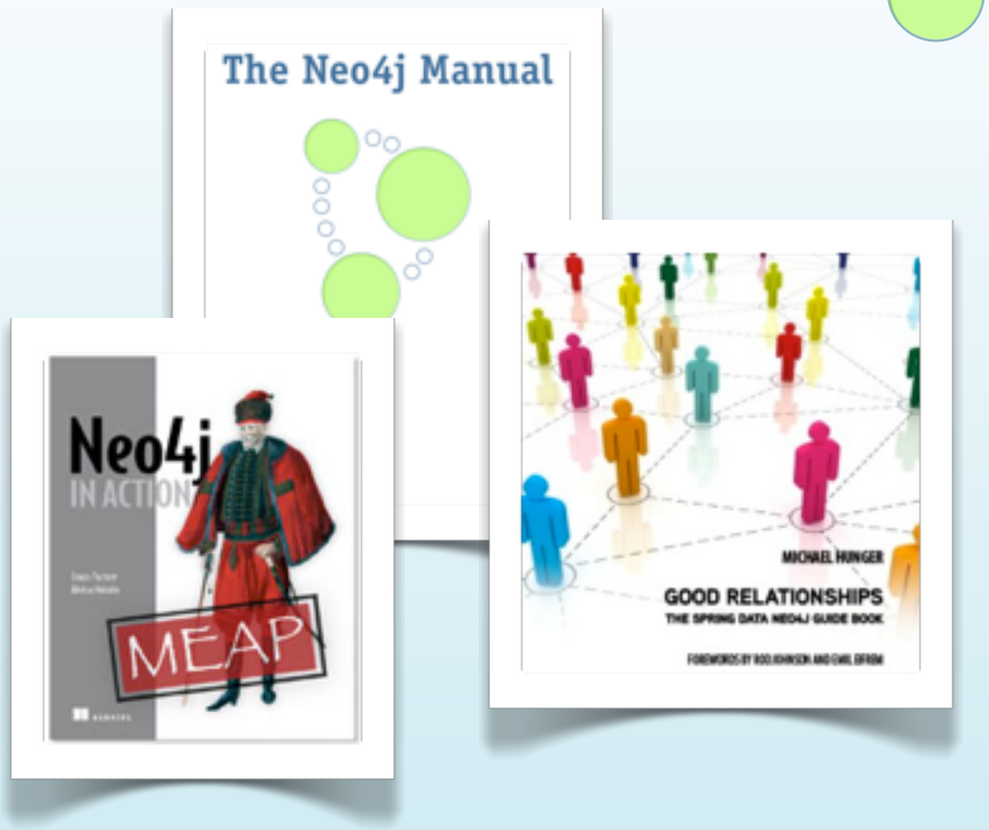

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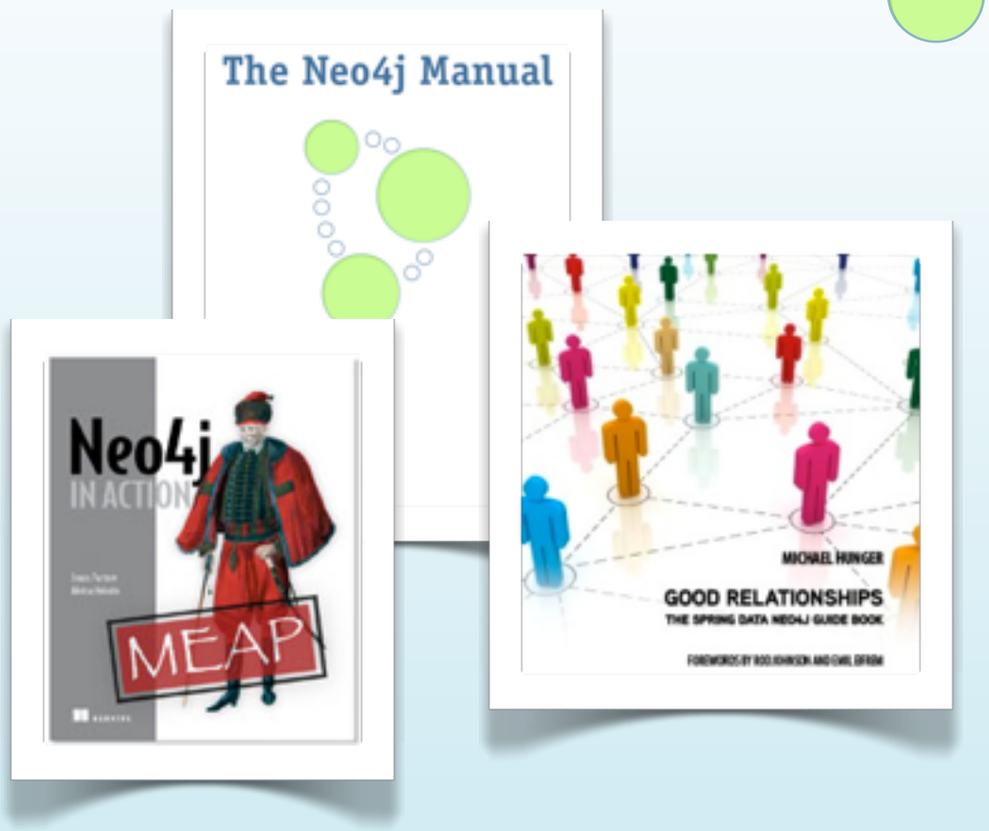

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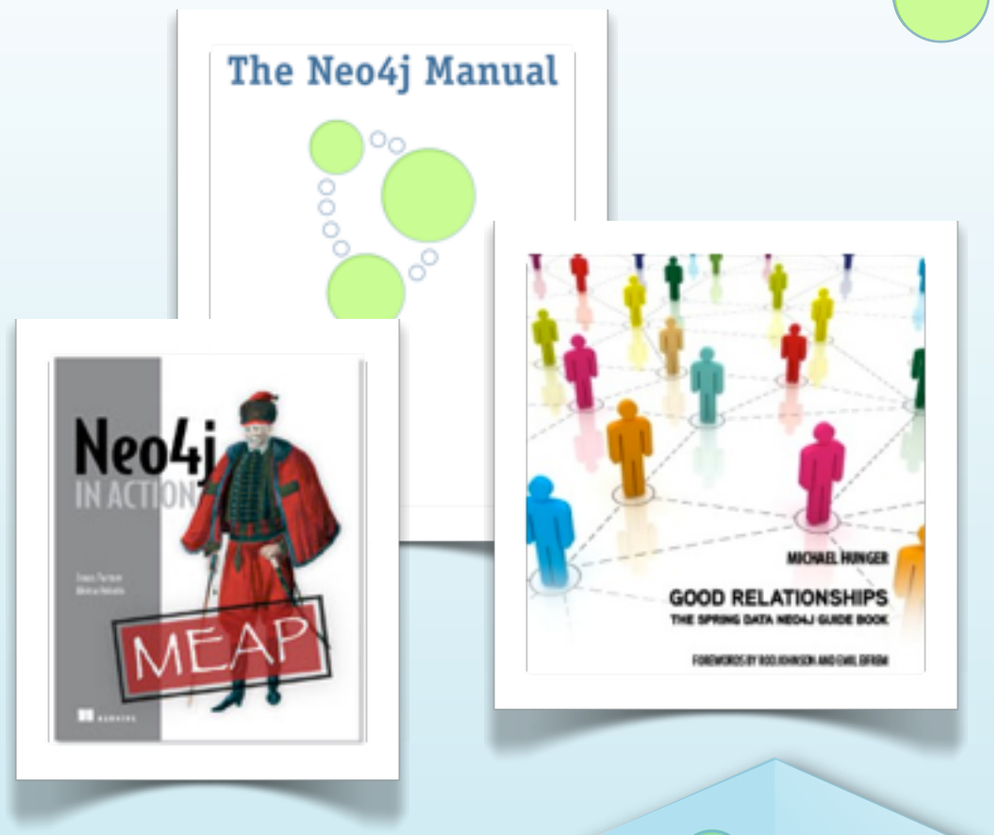

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- Participate
  - http://groups.google.com/group/neo4j
  - http://neo4j.meetup.com
  - a session like this one ;)

Thank you!