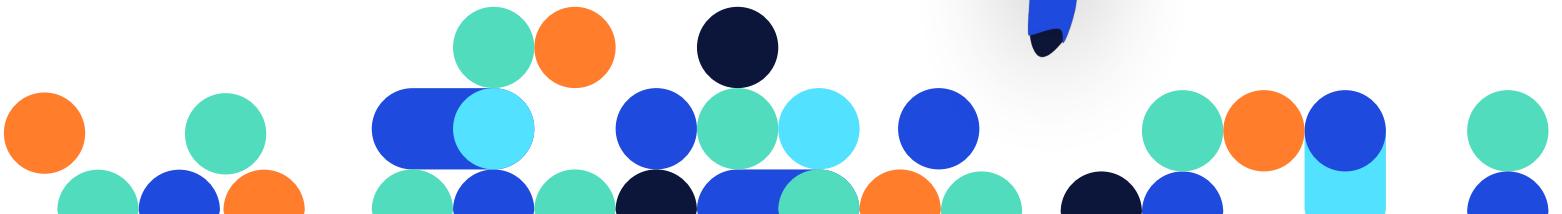


DataStax Developer Day



DSE Graph



DSE Graph - Agenda

- DSE Graph and its applications
- Retrieving graph elements
- Walking paths in a graph
- Graph training on DataStax Academy



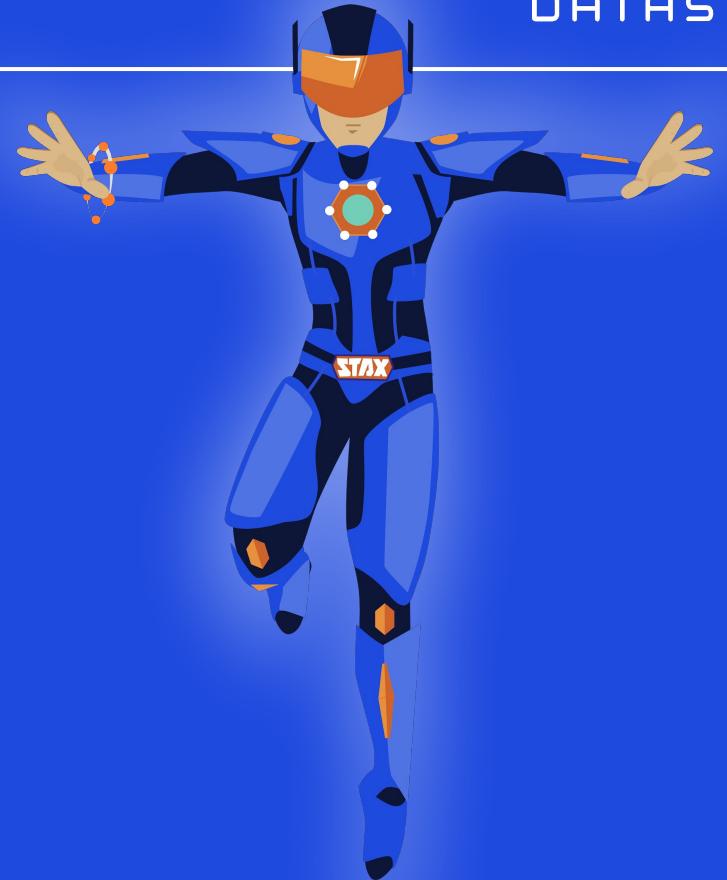
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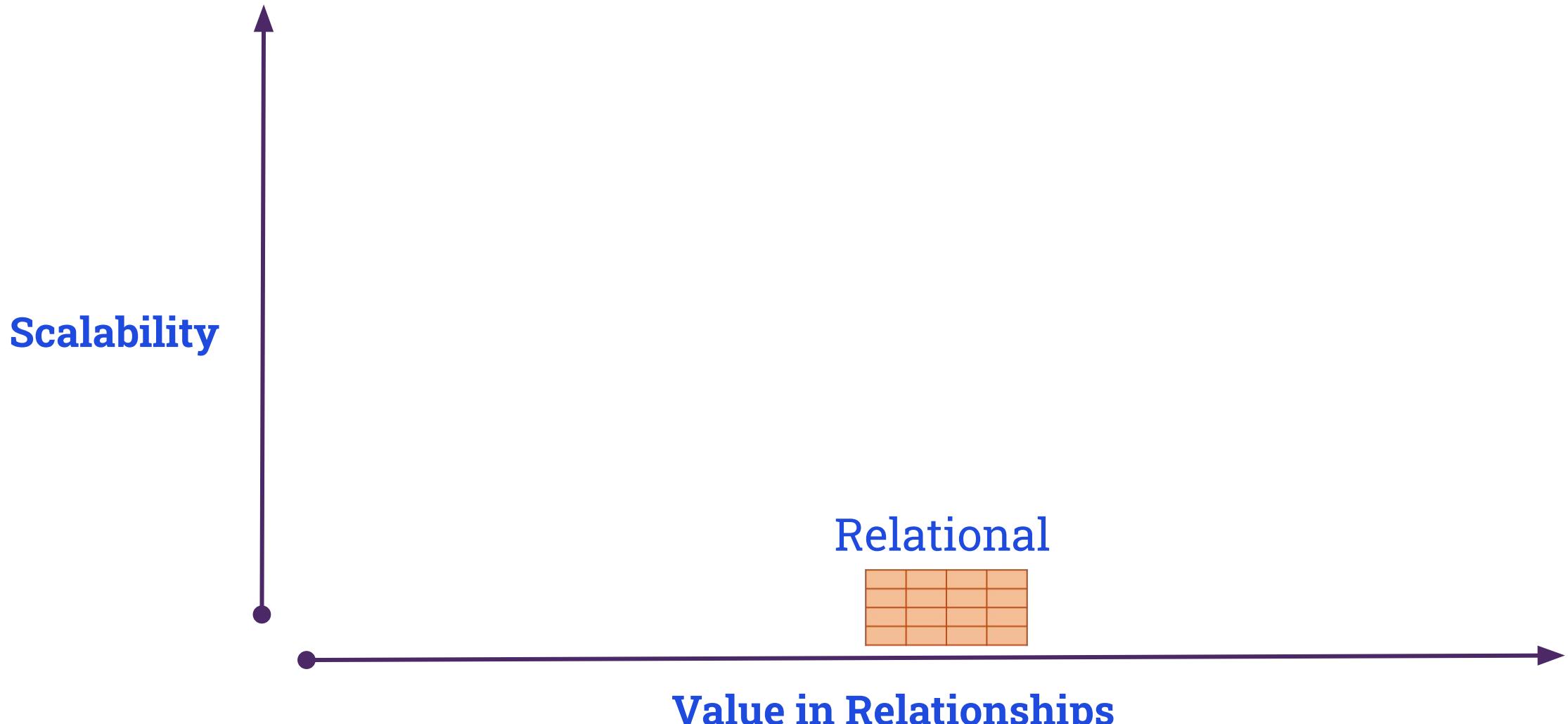


DSE Graph

Why Graph?



Distributed Database Landscape

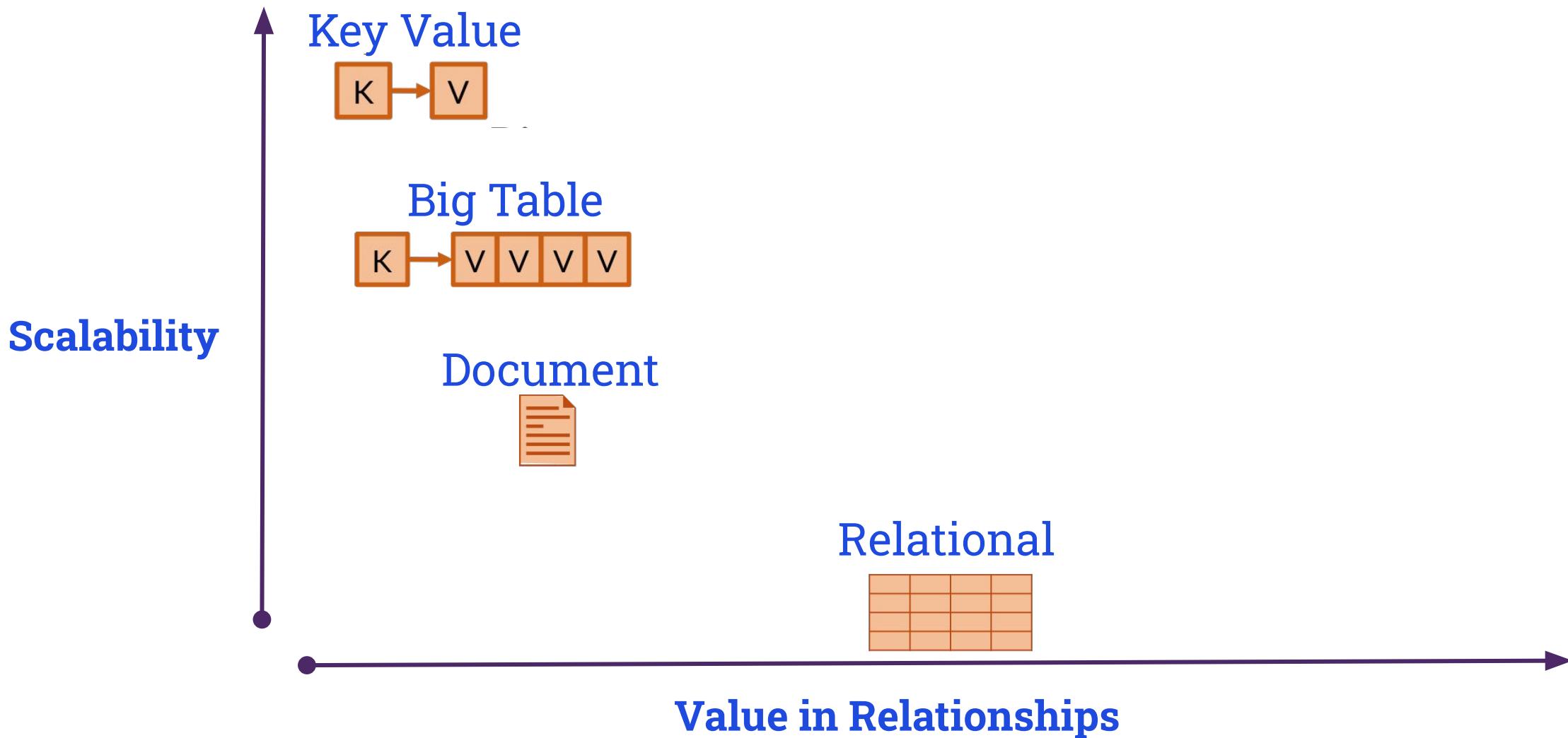


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Distributed Database Landscape

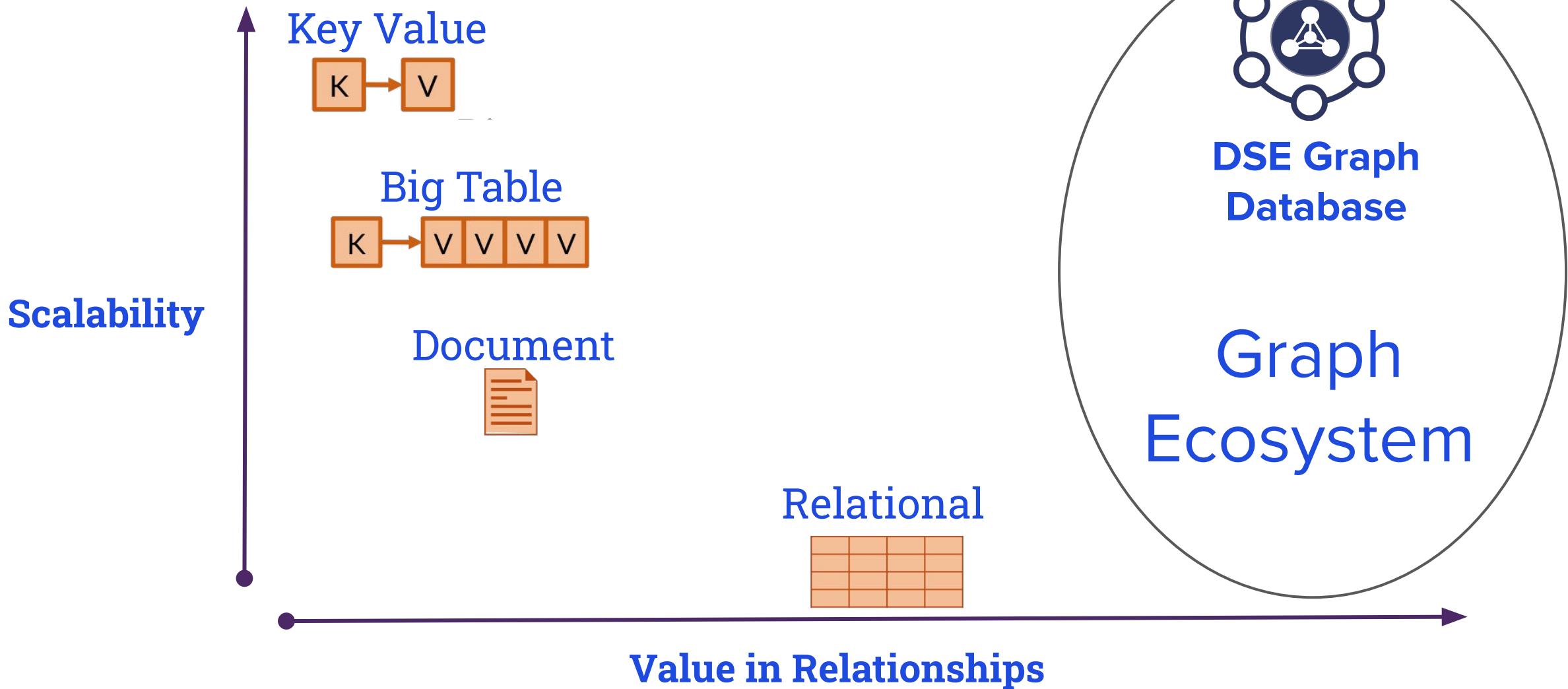


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Distributed Database Landscape

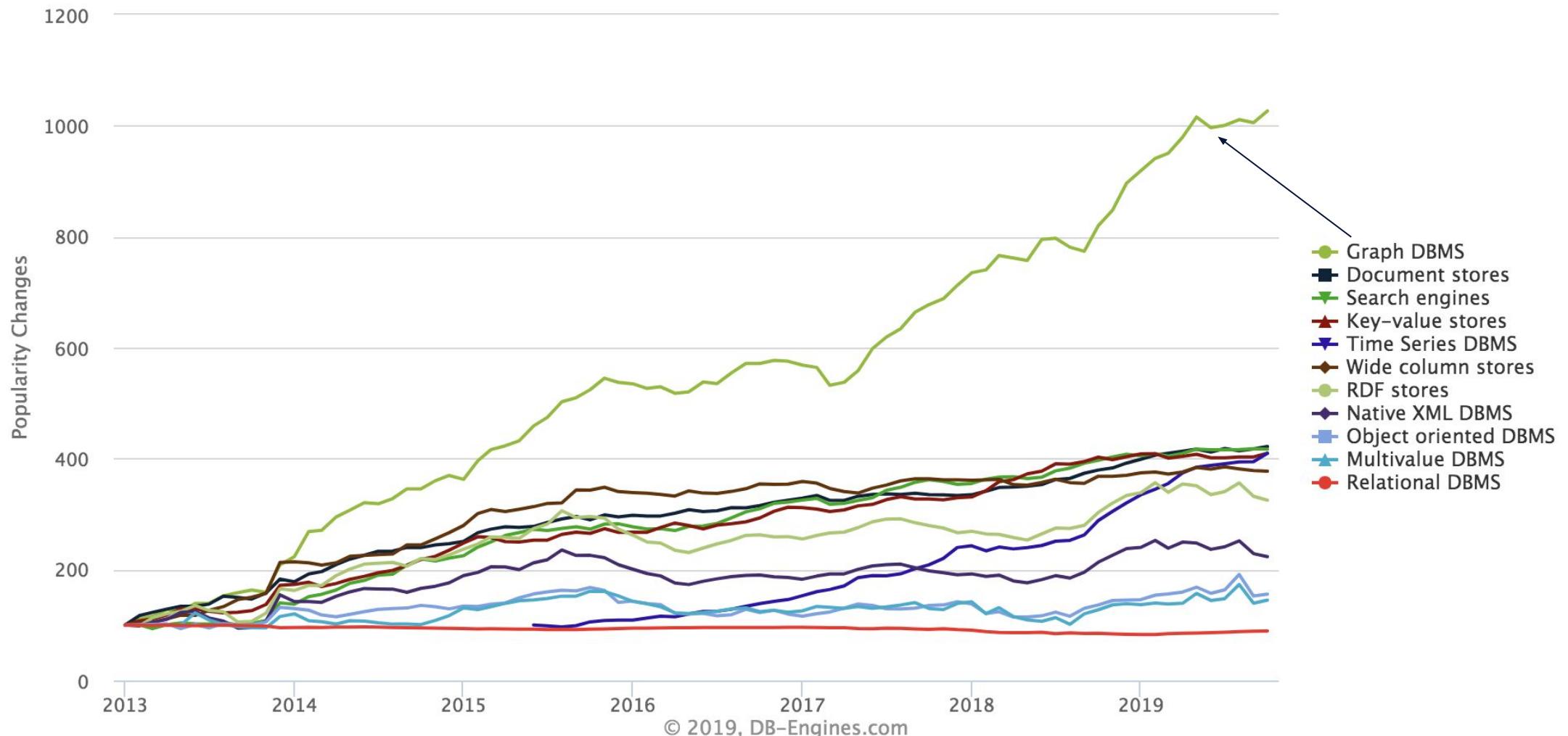


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The Graph Trend



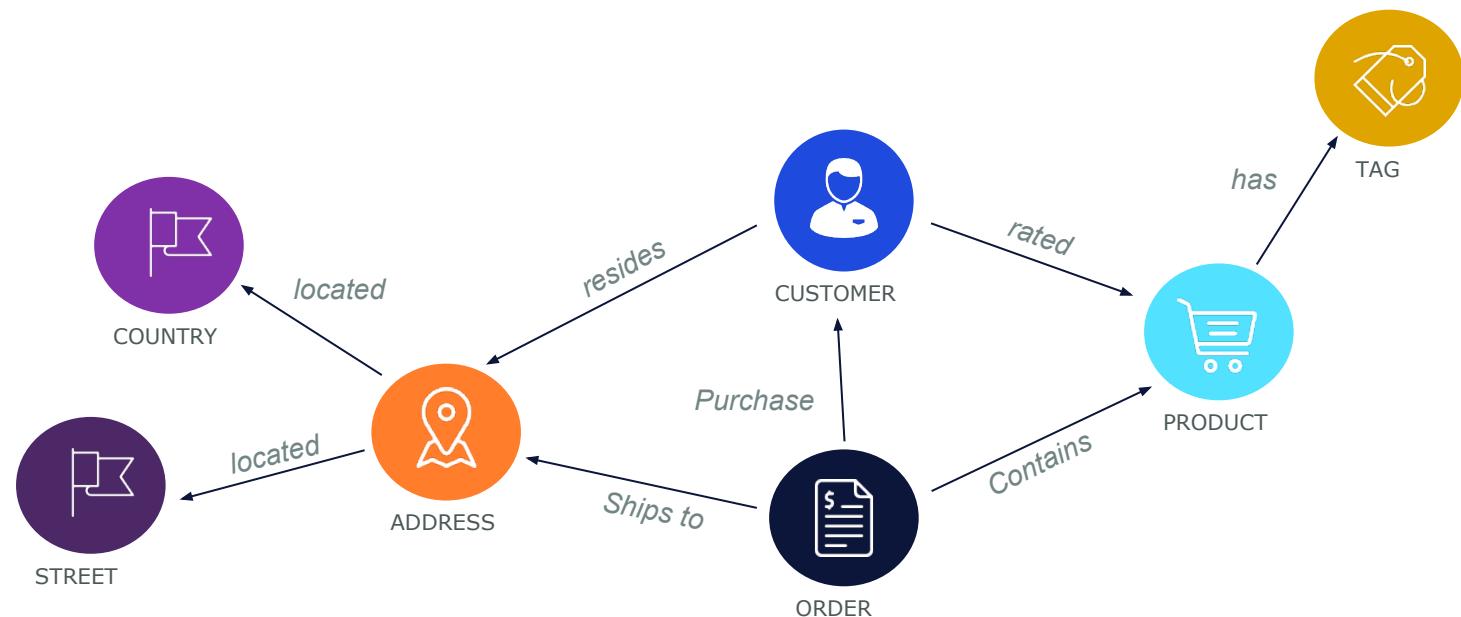
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Getting Started

- Data is represented as a **Graph** (Vertices & Edges)
- Dedicated to **highly connected** dataset (lot of “Joins”)
- Discover simple and complex **relationships** between objects.



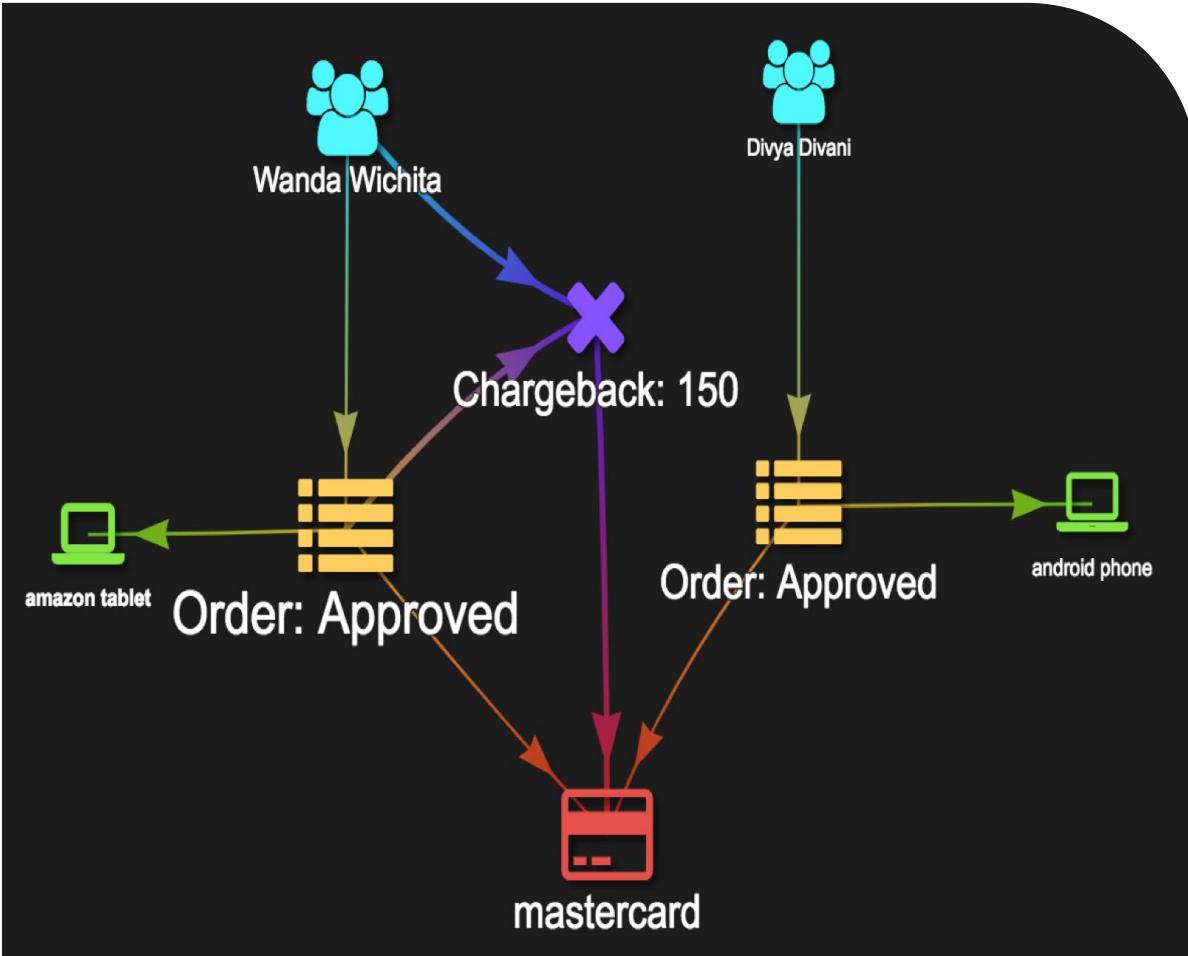
Customer 360



Gain a singular, contextual view of the customer in real time for a seamless, personalized customer experience across all touchpoints.



Fraud Detection



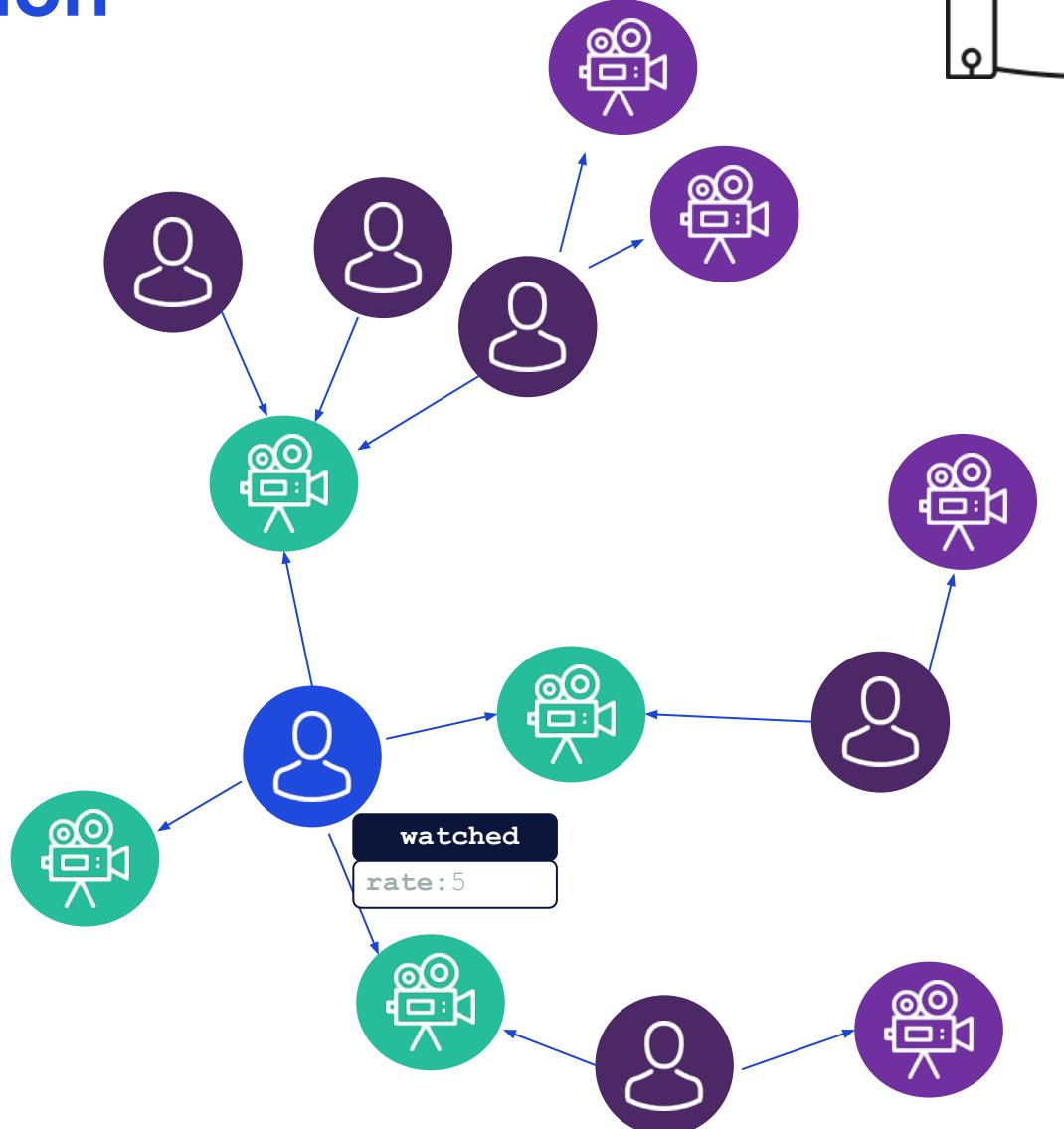
A graph database helps connect the dots to identify trends while at the same time spot outliers as potential threats.



Personalization & Recommendation



The screenshot shows a video platform interface. At the top, there's a navigation bar with a search bar, a tour status indicator ('Tour: Off'), and a user profile ('cedrick lunven'). Below the navigation bar, the 'RECENT VIDEOS' section displays five video thumbnails. From left to right: 1. Two men at a desk with laptops, titled 'DISTRIBUTED DATA SHOW EPISODE 40: FEATURE FLAGS WITH CEDRICK' by cedrick lunven. 2. A chart titled 'any Databases Being Deployed in Clouds' by Chadd Boehm. 3. A trailer thumbnail for 'THE FIRST PURGE TRAILER #1 (2018)' by Crystal Schaden. 4. A thumbnail for 'LEARN DINOSAURS NAMES AND SOUNDS WITH FUNNY CAT - BEST TOY' by Otha Hane. 5. A thumbnail for 'MOTHER CAT AND CUTE KITTEN BEST FAMILY CATS COMILATION' by Bill Turner. Below the recent videos, the 'RECOMMENDED FOR YOU' section displays five more video thumbnails. From left to right: 1. A presentation slide about Spark by Nukia Kuhman. 2. A presentation by Duyhai Doan about Apache Cassandra 3. 3. A thumbnail for 'CUTE CATS!' featuring a close-up of an orange cat. 4. A trailer thumbnail for 'FUNNIEST CATS AND KITTENS COMPILATION 2017 | BEST CUTE CAT' by Anahi Hessel. 5. A thumbnail for 'ARE YOU HERE OFFICIAL TRAILER #1 (2014) - ZACH GALIFIANAKIS, AMY' by Isaias Pouros.

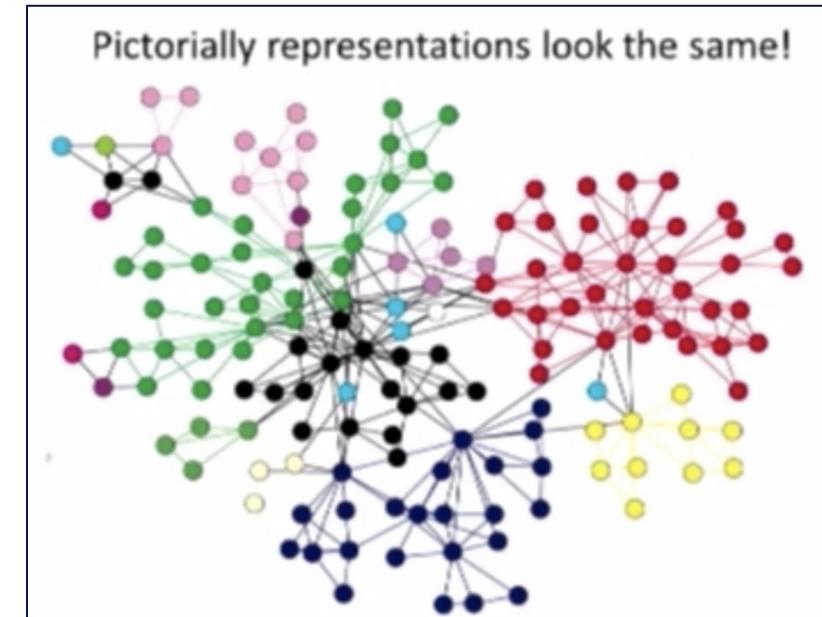
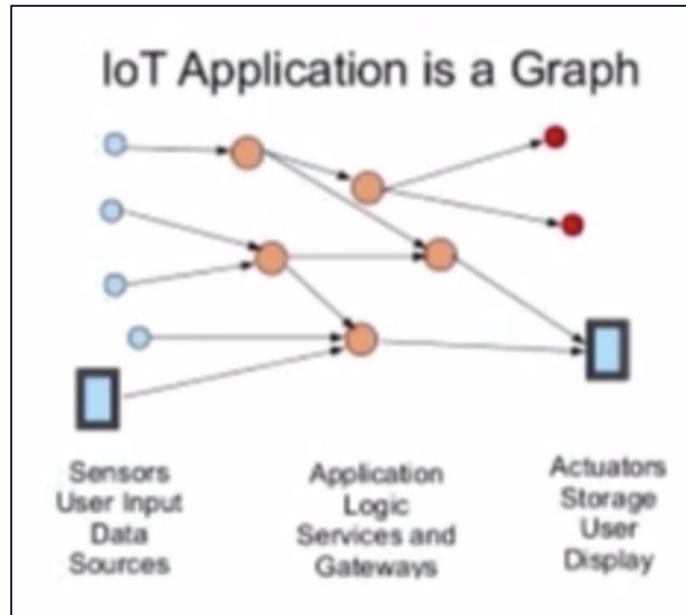


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IoT, Asset management & Networking



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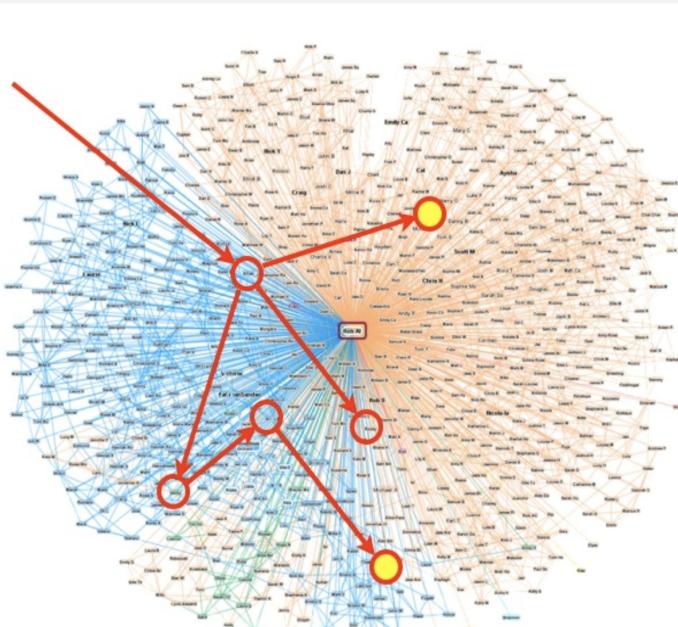
<https://community.datastax.com>



More use cases...

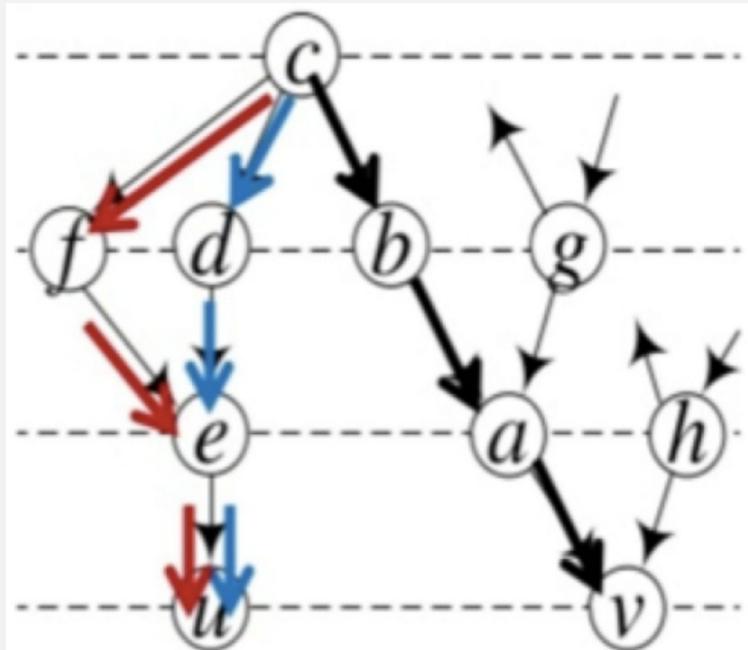
Healthcare

What drugs will bind to protein X and interact with drug Y



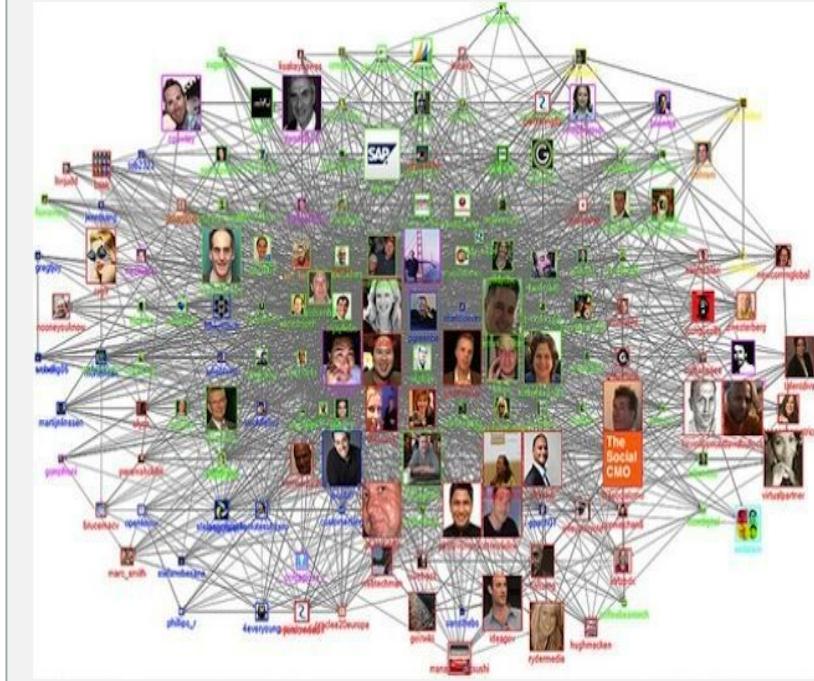
Path Finding

What manufacturing lines lead to the most defects.



Social

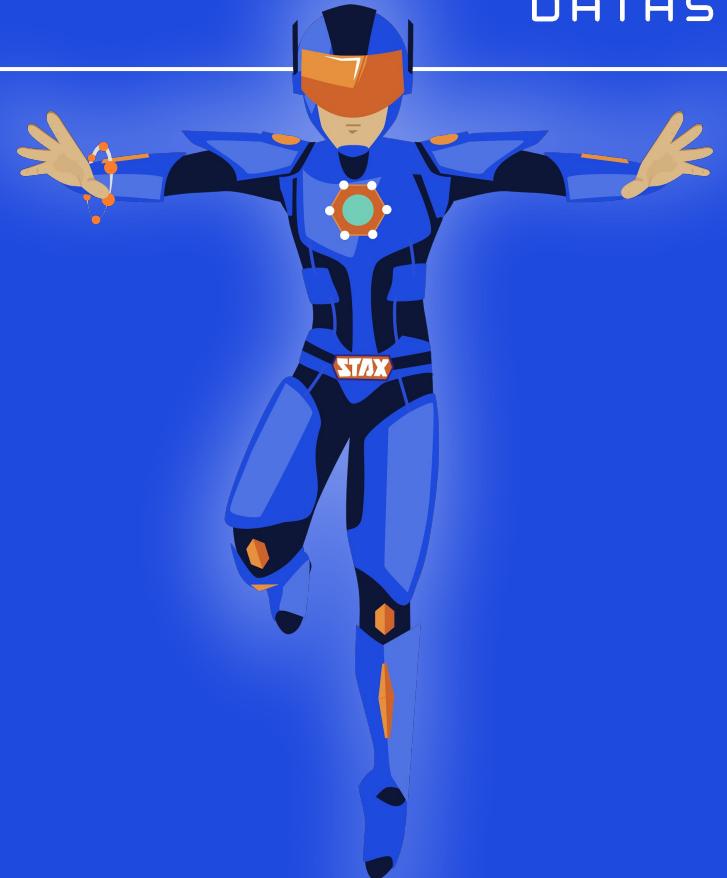
How people are connected.
Who is more influential.



DSE Graph

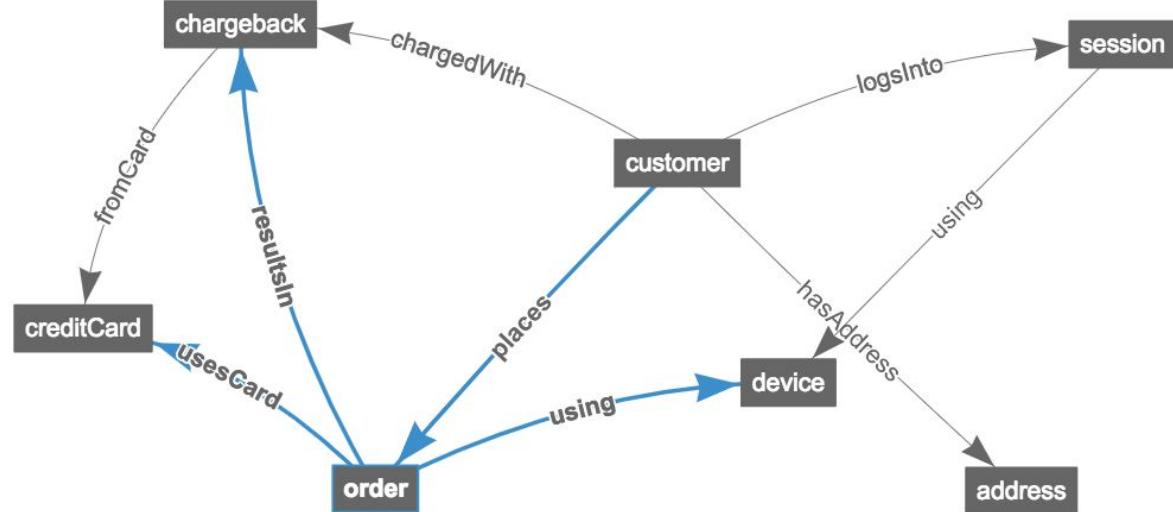


Property Graph Fundamentals



Vertex

A **vertex** is an **noun**, such as a person, location, customer, order or anything else you can think of as nouns.



Label

Properties

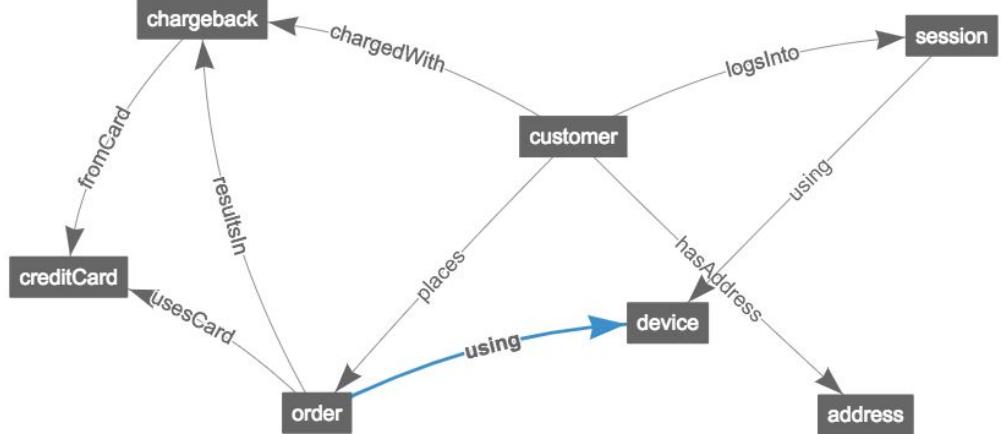
Single | Multiple

order			
ID Properties			
Name	Type		
orderid	Uuid		
Properties			
Name	Type	Cardinality	TTL
amount	Decimal	Single	
createdtime	Timestamp	Single	
creditcardhashed	Text	Single	
deviceid	Uuid	Single	
ipaddress	Text	Single	
outcome	Text	Single	



Edge

An **edge** defines the relationship between two vertices, it is a **verb**. A person can create software, or an author can write a book. Think verbs when you are defining edges.

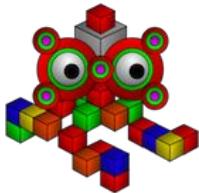


using

Cardinality: Multiple

Properties
(none)





Apache TinkerPop™

Open source graph **computing** framework.



DSE Graph



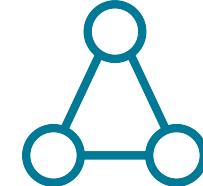
Microsoft Cosmos DB



IBM Graph



Amazon Graph DB
(internal)



Others: Google,
OrientDB, Neo4j, etc.





Gremlin Query Language

<http://kelvinlawrence.net/book/Gremlin-Graph-Guide.html>

```
// Get a ranking of the most relevant products for Gremlin given his purchase history.  
g.V().has("name", "gremlin").out("bought").aggregate("stash").  
  in("bought").out("bought").  
  where(not(within("stash"))).  
  groupCount().  
  order(local).by(values,desc)
```

```
// What are the names of projects that were created by two friends?  
g.V().match(  
  as("a").out("knows").as("b"),  
  as("a").out("created").as("c"),  
  as("b").out("created").as("c"),  
  as("c").in("created").count().is(2)).  
  select("c").by("name")
```

Gremlin is the standard language for Graph. What SQL is to an RDBMS, Gremlin is to a graph database.



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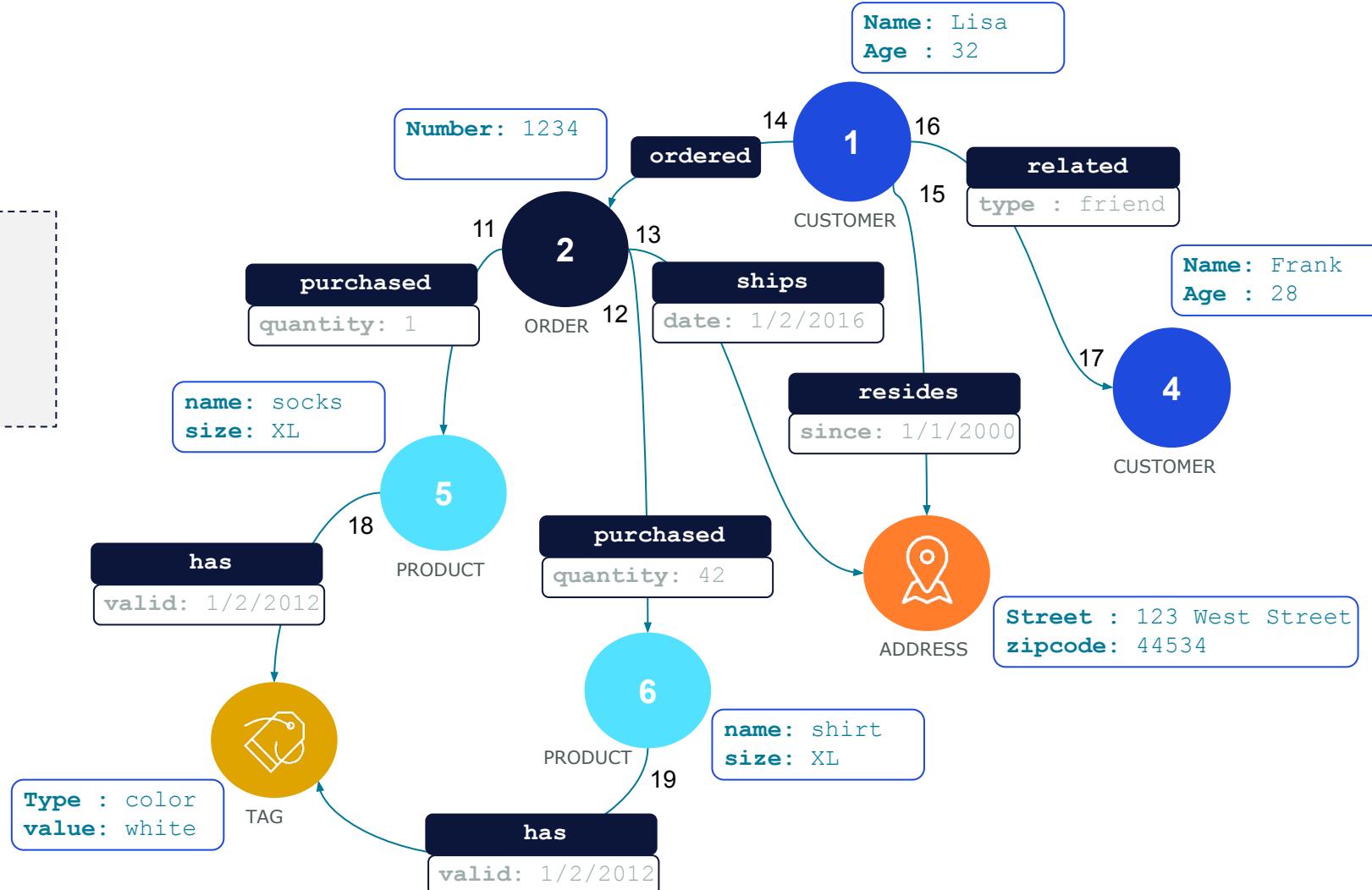




Gremlin Playground

Find Lisa's order numbers.

```
g.V().has('customer', 'name',  
          .out('ordered') 'Lisa')  
  
.values('number')
```

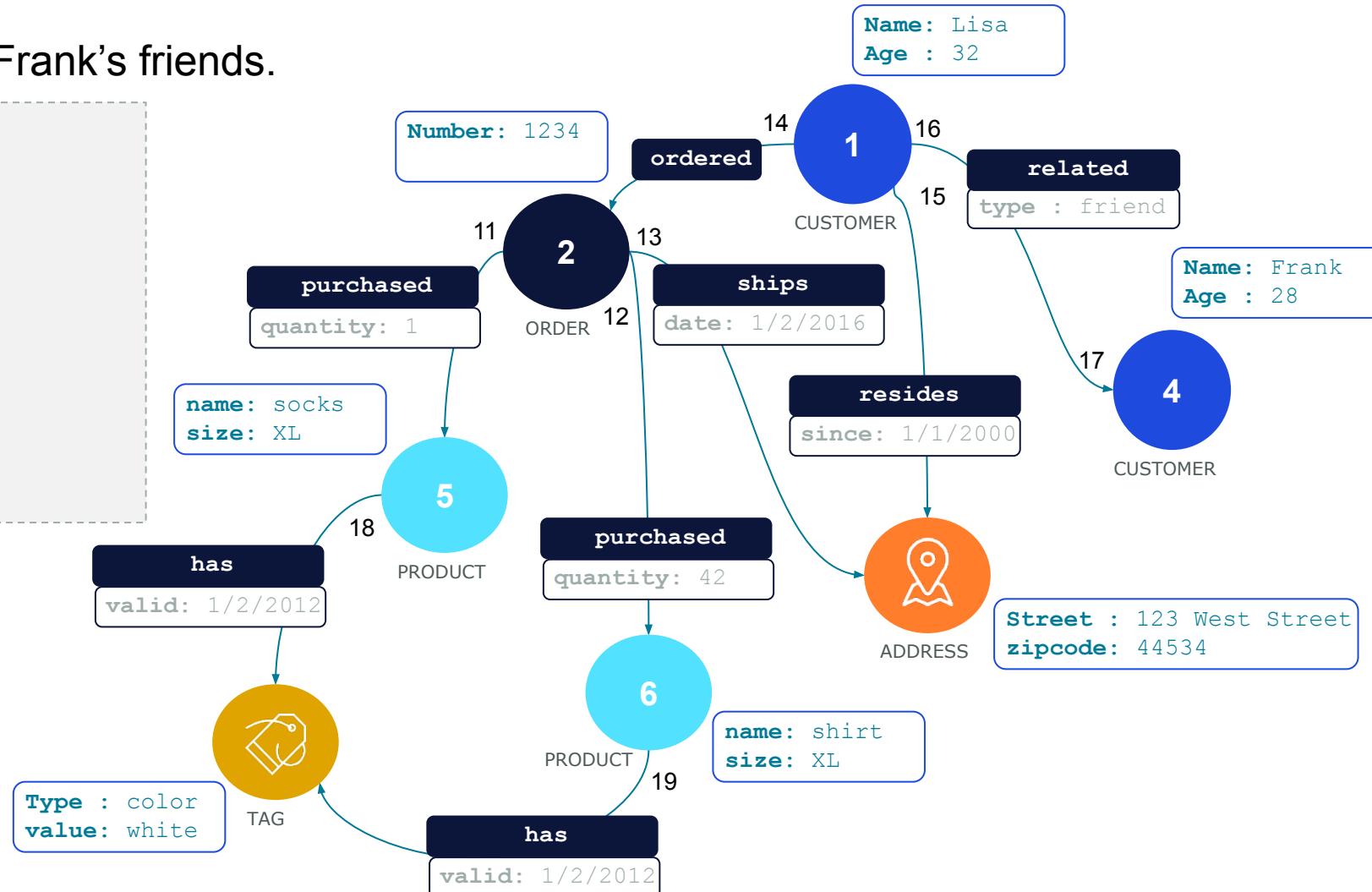




Gremlin Playground (Your Turn)

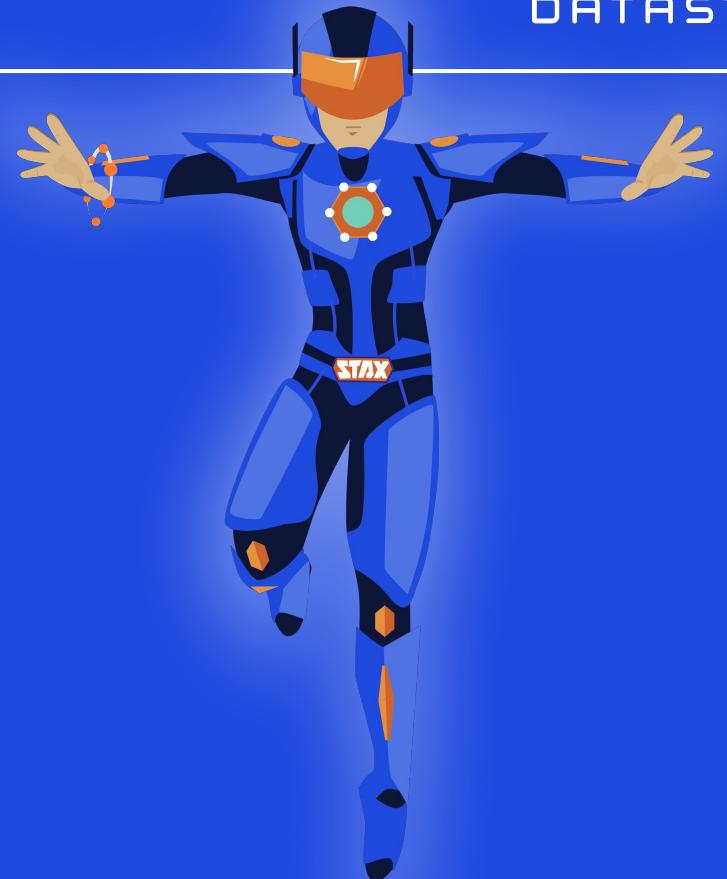
Find all product names purchased by Frank's friends.

```
g.V().has('customer', 'name',  
         'Frank').  
    .outE('related').has('type',  
         'friend')  
    .inv()  
    .out('ordered')  
    .out('purchased')  
).values('name')
```



DSE Graph

Introduction to DSE Graph

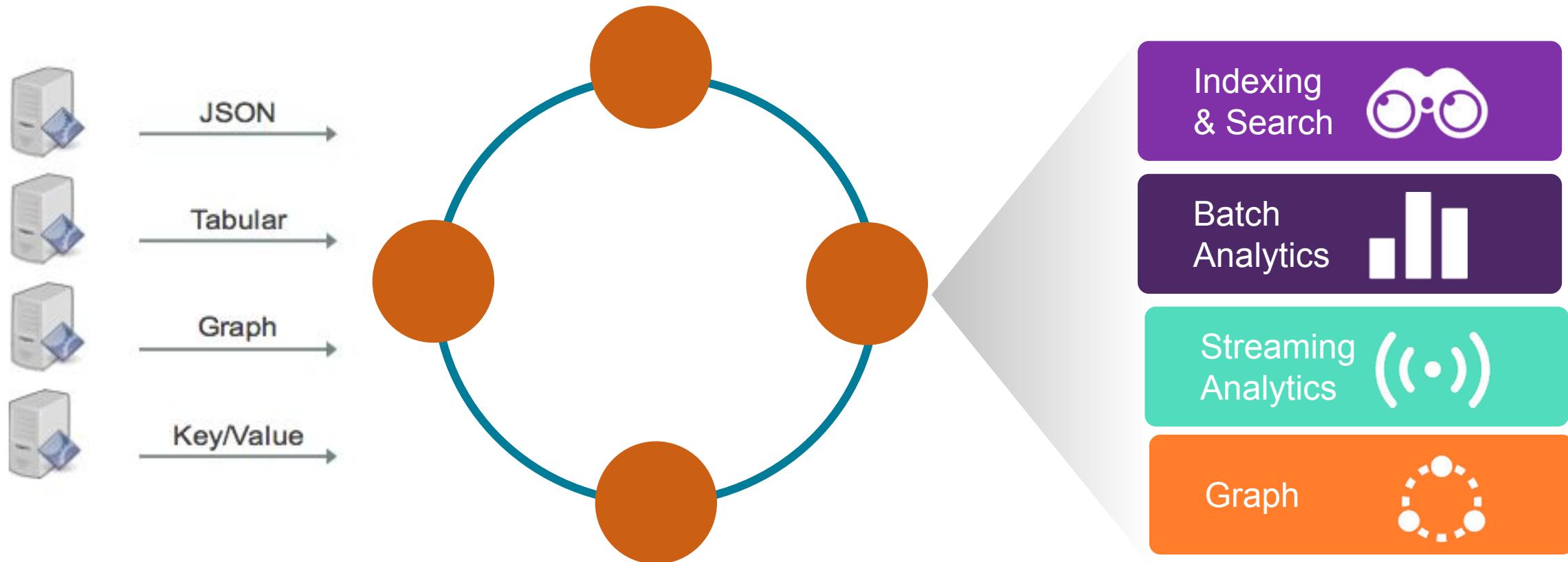


Our solution DataStax Enterprise (DSE)

- A **unified data layer** of database, search, and analytics, all independent of the public cloud provider and portable
- Consistent data management built for on-prem, hybrid-, and/or multi-cloud
- Consistent security **model** across entire data layer
 - Row and columnar level control of your data helps you achieve data governance and compliance



Integrated multi-model/mixed workload platform



DataStax Enterprise Graph

Real-time graph database management system

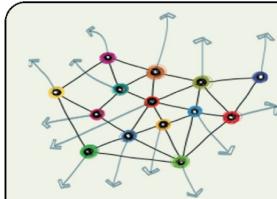
- Adopts *Apache TinkerPop™* standards for data and traversal
- Uses *Apache Cassandra™* for scalable storage and retrieval
- Leverages *Apache Solr™* for full-text search and indexing
- Integrates *Apache Spark™* for fast analytic traversal
- Supports comprehensive data security for the enterprise



DSE Graph Technologies

Applications

 DataStax
DSE Graph



Graph Applications



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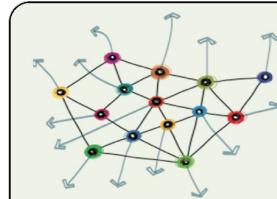


DSE Graph Technologies

Interfaces

 DATASTAX

DSE Graph



Graph Applications



Property graph and Gremlin API
DSE graph schema API



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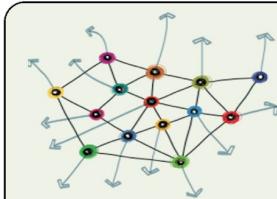


DSE Graph Technologies

Technologies

DATASTAX

DSE Graph



Graph Applications



Property graph and Gremlin API
DSE graph schema API



Fully integrated
backend technologies



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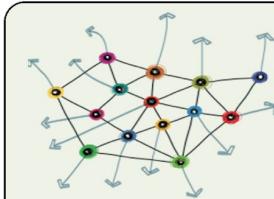
<https://community.datastax.com>

DATASTAX®

DSE Graph Technologies

Middleware

DATASTAX
DSE Graph



Graph Applications



Property graph and Gremlin API
DSE graph schema API



Schema, data, and query mappings
OLTP and OLAP engines



Fully integrated
backend technologies



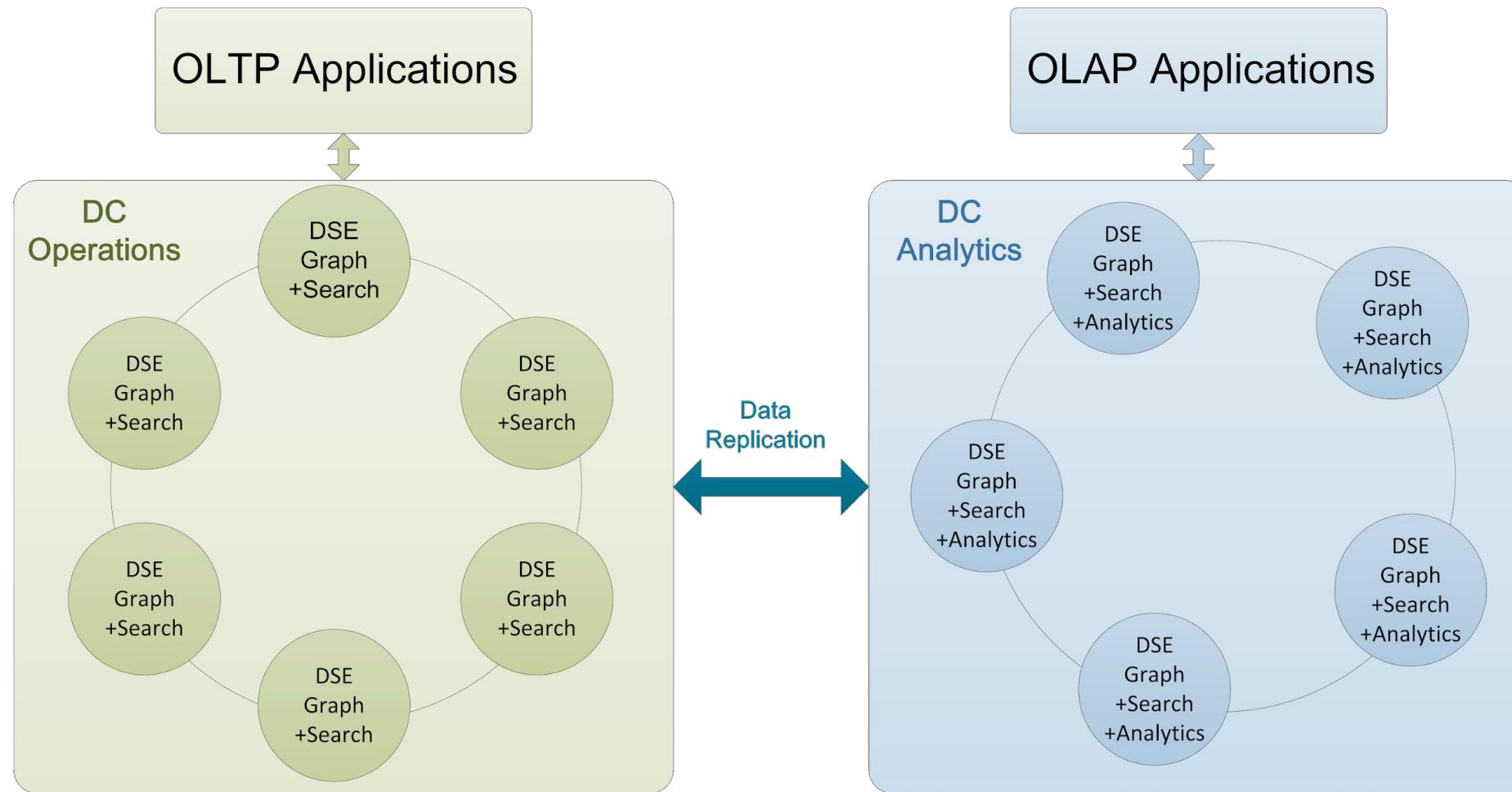
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DSE Graph Multi-DC Deployment

Workload Type Separation



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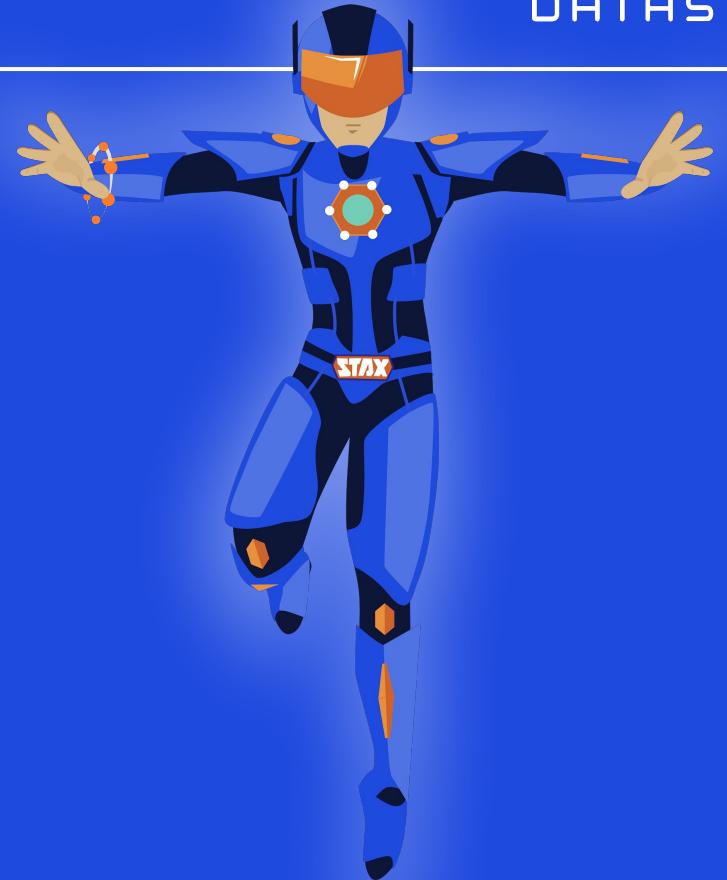
<https://community.datastax.com>



DSE Graph



Tools

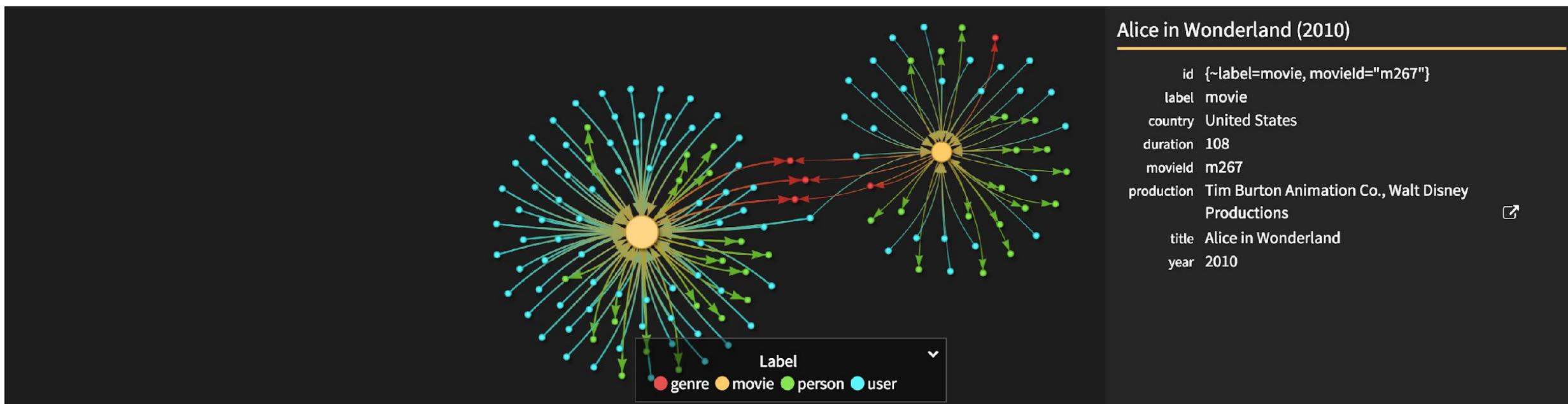


DSE Graph Tools

Gremlin ▾

Real-time ▶ 🔍 ⚙️ ⌛ ⌂

```
g.V().has("movie", "title", "Alice in Wonderland").bothE()
```



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DSE Graph Tools

```
..[$] <O> bin/dse gremlin-console  
      \,,,/ (o o)  
----o00o-(3)-o00o----  
plugin activated: tinkerpop.tinkergraph  
plugin activated: tinkerpop.server  
plugin activated: tinkerpop.utilities  
gremlin> :remote config alias g KillrVideo.g  
==>g=KillrVideo.g  
gremlin> g.V().has("person", "name", "Johnny Depp").in("actor").values("title")  
==>Pirates of the Caribbean: On Stranger Tides  
==>Edward Scissorhands  
==>Ed Wood  
==>Into the Woods  
==>Pirates of the Caribbean: Dead Man's Chest  
==>Pirates of the Caribbean: At World's End (Pirates of the Caribbean 3)  
==>Alice in Wonderland  
==>Chocolat  
==>Finding Neverland  
==>Sweeney Todd: The Demon Barber of Fleet Street  
==>Charlie and the Chocolate Factory  
==>Dead Man  
==>Pirates of the Caribbean: The Curse of the Black Pearl  
==>Cry Baby  
gremlin> █
```



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DSE Graph Tools

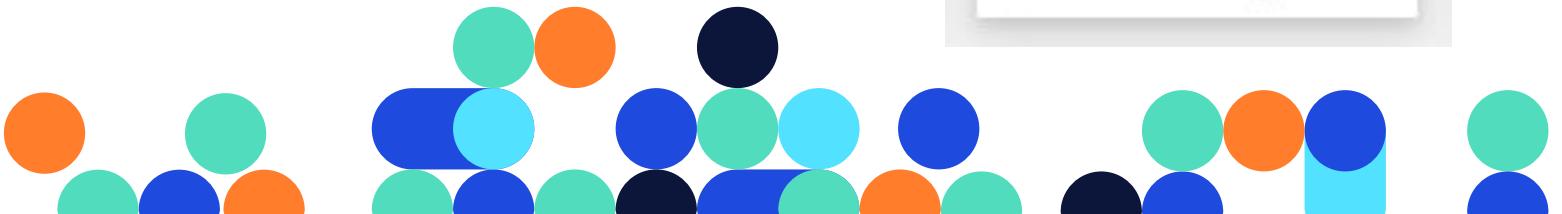
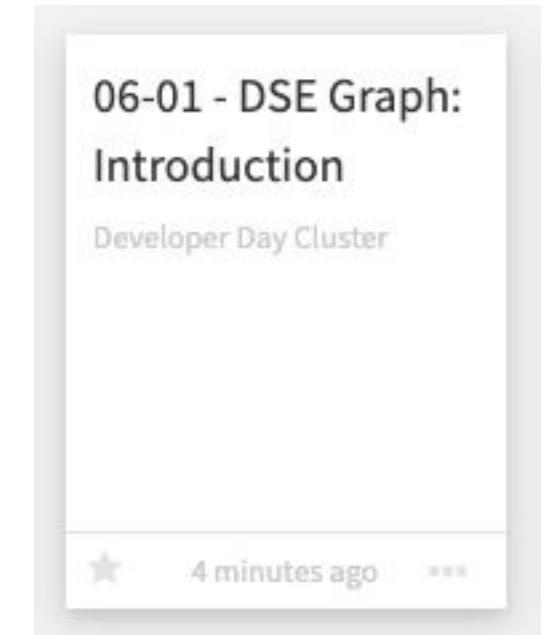
```
..[$] <()> dse-graph-loader-6.0.0/graphloader /var/lib/graph/loading-script.groovy -graph KillrVideo
2018-04-18 17:16:24 INFO DataLoaderImpl:213 - Scheduling [directors] for reading
2018-04-18 17:16:24 INFO DataLoaderImpl:213 - Scheduling [composers] for reading
2018-04-18 17:16:24 INFO DataLoaderImpl:213 - Scheduling [screenwriters] for reading
2018-04-18 17:16:24 INFO DataLoaderImpl:213 - Scheduling [cinematographers] for reading
2018-04-18 17:16:24 INFO DataLoaderImpl:213 - Scheduling [knows] for reading
2018-04-18 17:16:24 INFO Reporter:92 - ADD Request for 0 vertices 12515 edges 0 properties 0 anonymous
2018-04-18 17:16:24 INFO Reporter:97 - Current total additions: 12596 vertices 18560 edges 16456 properties 0 anonymous
2018-04-18 17:16:24 INFO Reporter:99 - 47612 total elements written
2018-04-18 17:16:24 INFO DataLoaderImpl:213 - Scheduling [rated] for reading
2018-04-18 17:16:25 INFO Reporter:92 - ADD Request for 0 vertices 10700 edges 0 properties 0 anonymous
2018-04-18 17:16:25 INFO Reporter:97 - Current total additions: 12596 vertices 29260 edges 16456 properties 0 anonymous
2018-04-18 17:16:25 INFO Reporter:99 - 58312 total elements written
2018-04-18 17:16:26 INFO Reporter:92 - ADD Request for 0 vertices 10600 edges 0 properties 0 anonymous
2018-04-18 17:16:26 INFO Reporter:97 - Current total additions: 12596 vertices 39860 edges 16456 properties 0 anonymous
2018-04-18 17:16:26 INFO Reporter:99 - 68912 total elements written
2018-04-18 17:16:27 INFO Reporter:92 - ADD Request for 0 vertices 10600 edges 0 properties 0 anonymous
2018-04-18 17:16:27 INFO Reporter:97 - Current total additions: 12596 vertices 50460 edges 16456 properties 0 anonymous
2018-04-18 17:16:27 INFO Reporter:99 - 79512 total elements written
```



Time for an exercise!



“DSE Graph: Introduction” Notebook



DSE Graph

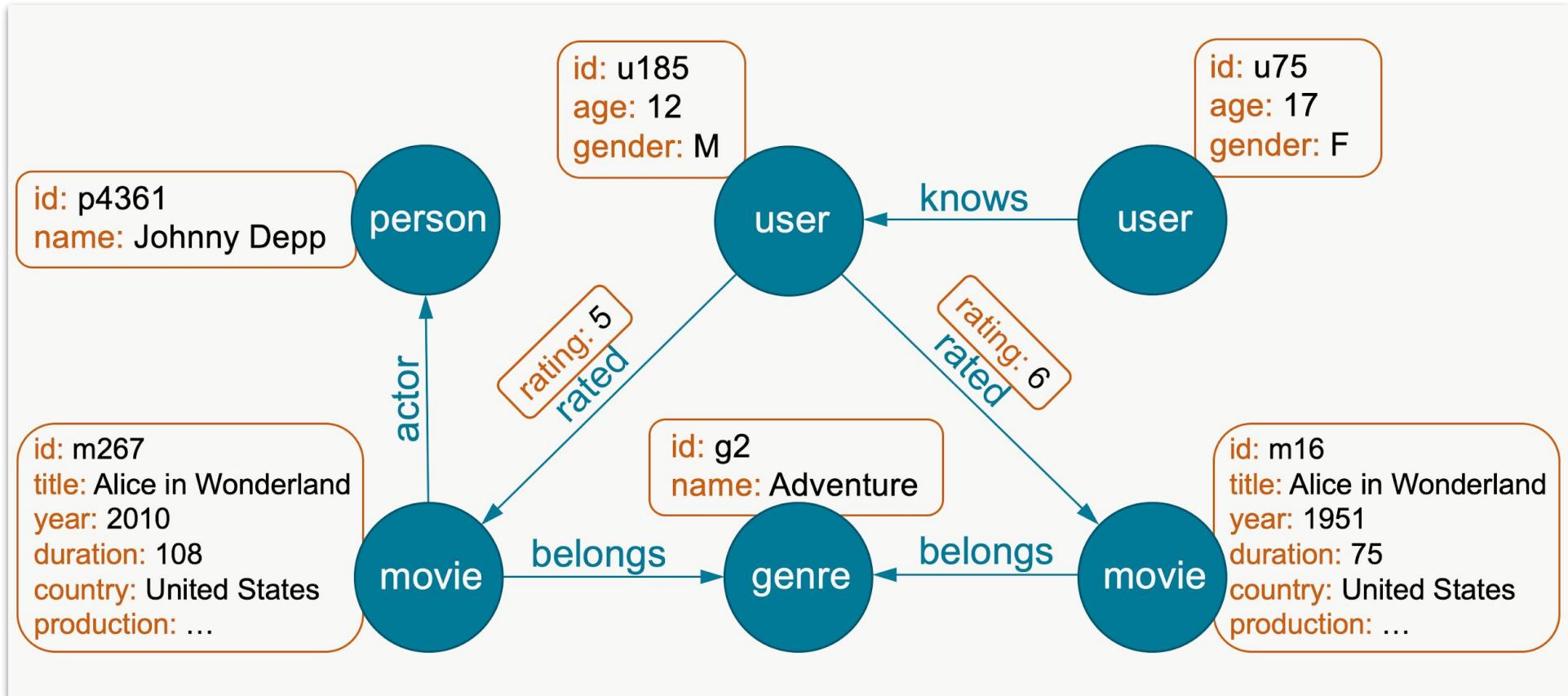
Retrieving Graph Elements



DATASTAX®

The KillrVideo graph

- Property graph – vertex-labeled, edge-labeled, directed, binary, attributed multi-graph:
 - Vertices
 - Edges
 - Properties

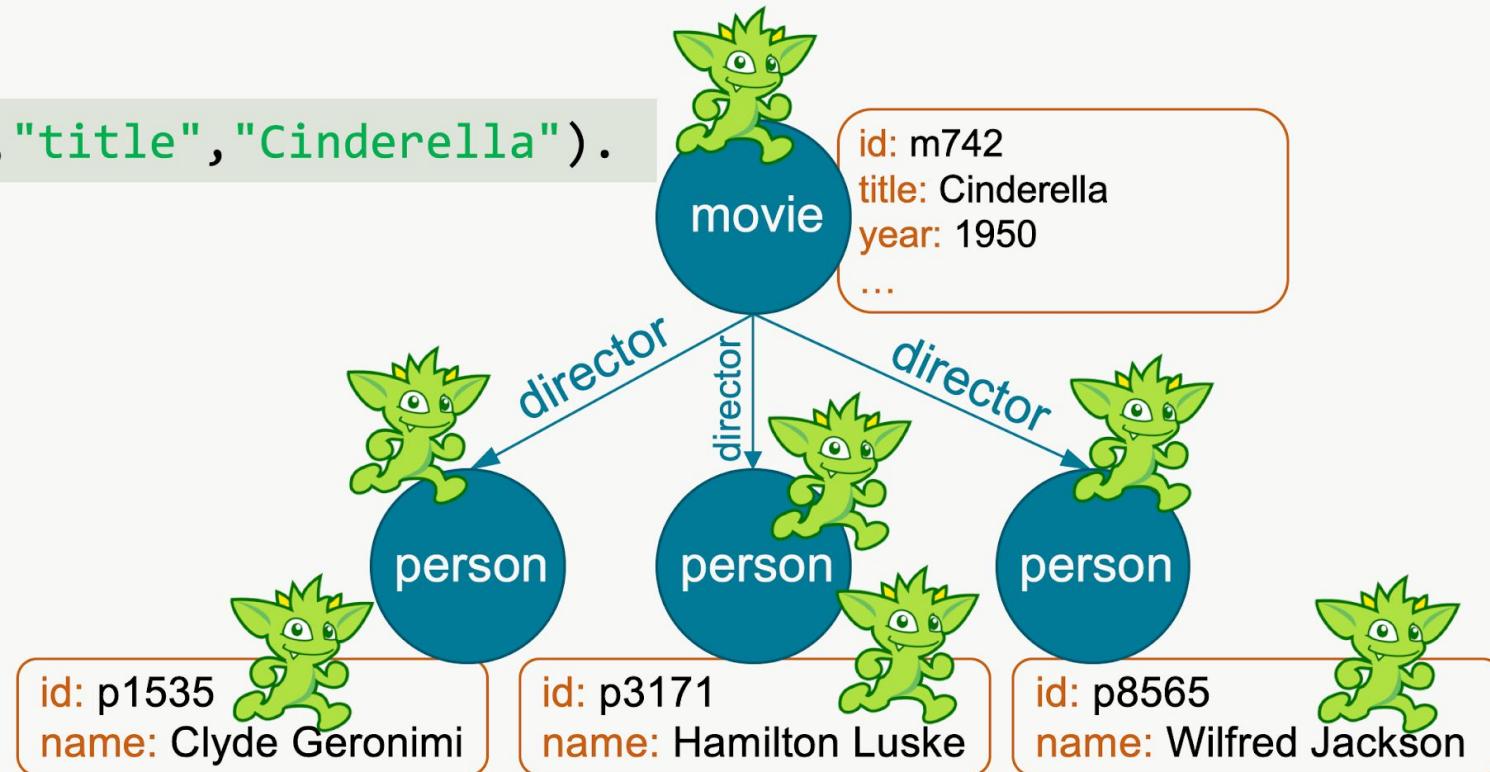


Follow the gremlin

```
g.V().has("movie","title","Cinderella").
```

```
out("director").
```

```
values("name")
```



And another Exercise!

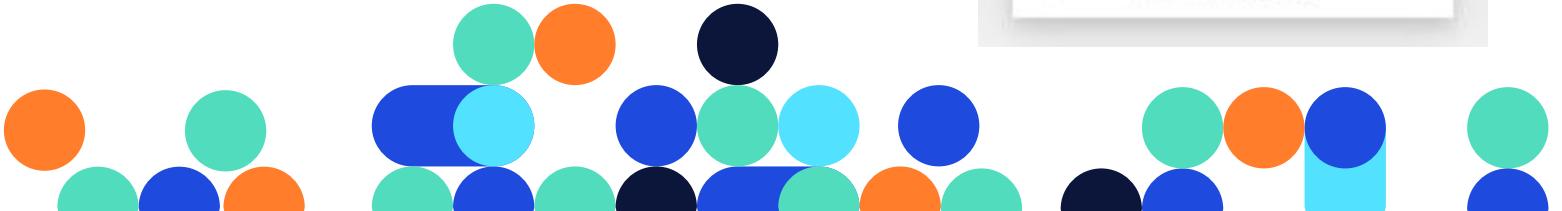


“DSE Graph: Retrieving Graph Elements” Notebook

06-02 - DSE Graph:
Retrieving Graph
Elements

Developer Day Cluster

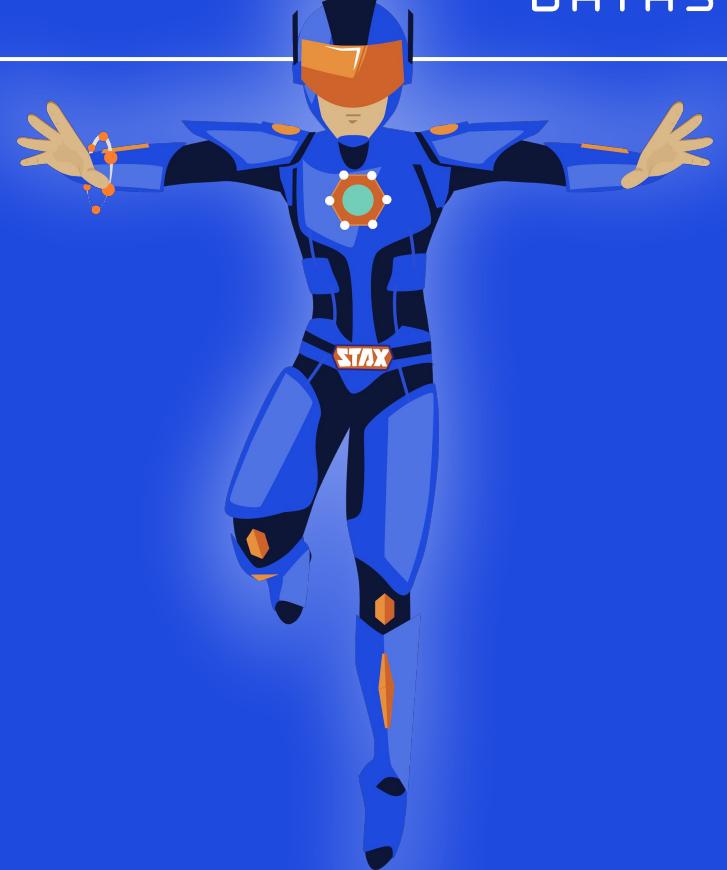
a minute ago ...



DSE Graph

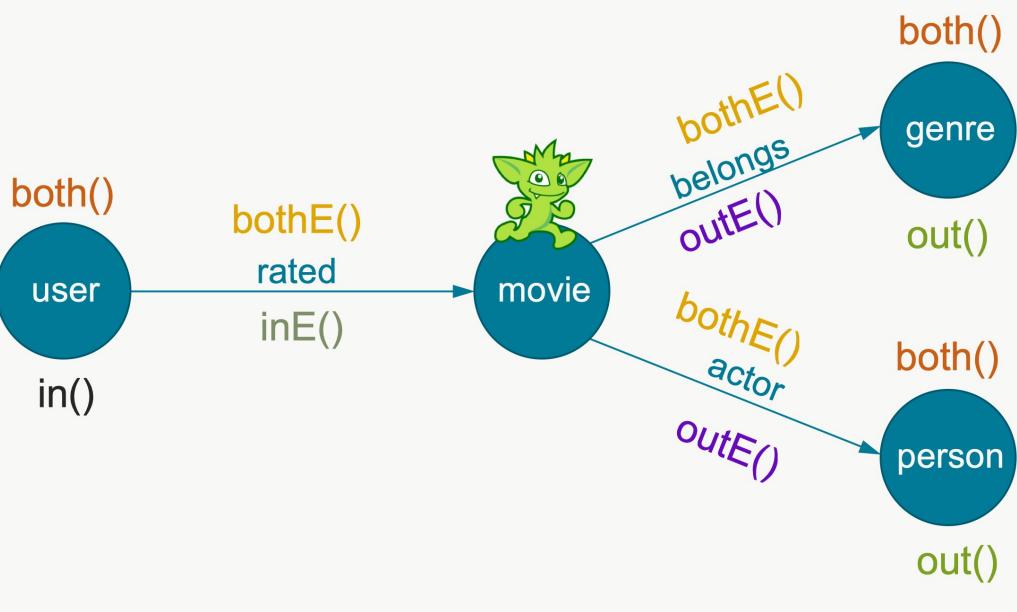


Walking Paths in a Graph



Walking Paths in a Graph

- `in()`, `out()`, `both()`
- `inE()`, `outE()`, `bothE()`



- `inV()`, `outV()`, `bothV()`



Time for an exercise!

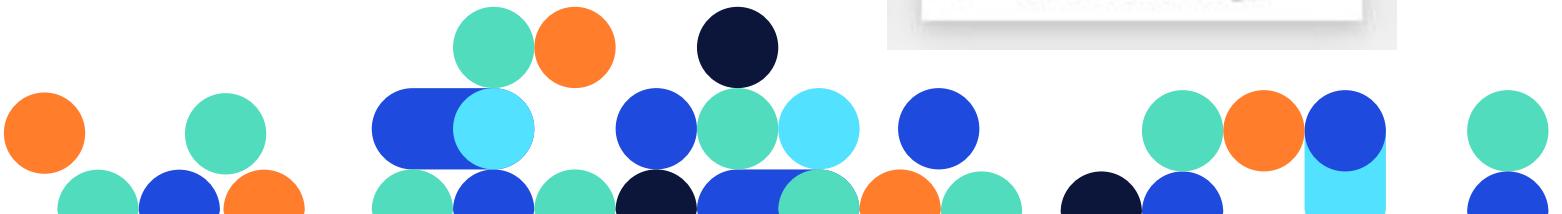


“DSE Graph: Walking Paths in a Graph” Notebook

06-03 - DSE Graph:
Walking Paths

Developer Day Cluster

a few seconds ago ...



DSE Graph

Traversing Neighborhoods and Subgraphs



Time for an exercise!

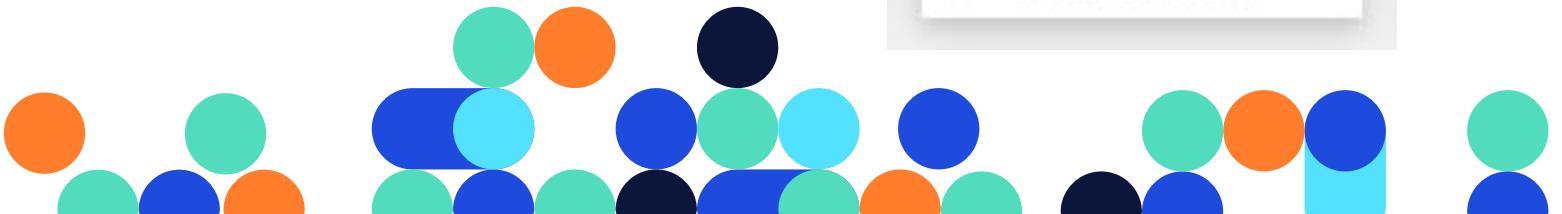


“DSE Graph: Traversing” Notebook

06-04 - DSE Graph:
Traversing

Developer Day Cluster

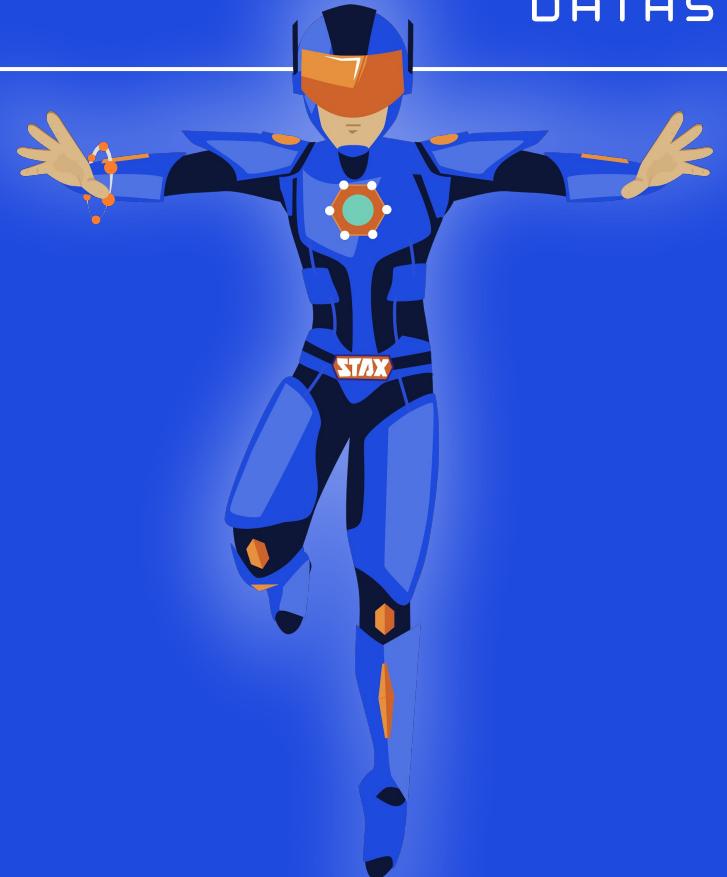
a few seconds ago ...



DSE Graph



Matching Graph Patterns

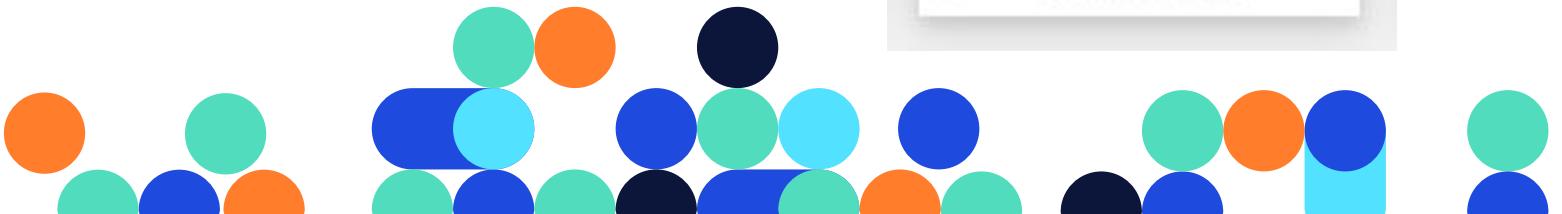
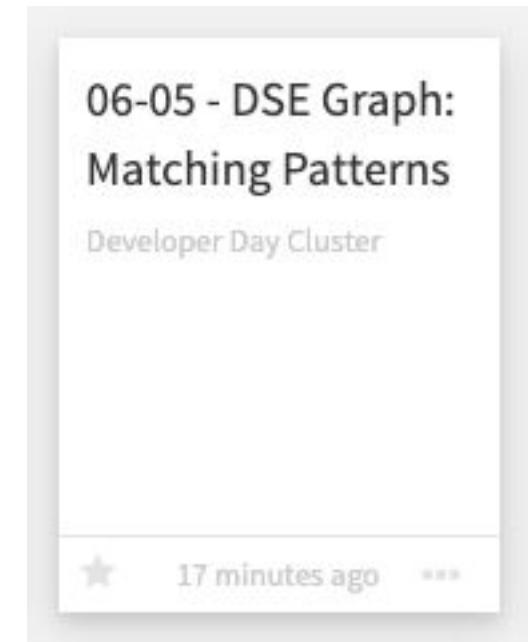


Comparing Imperative and Declarative Traversals

Time for an exercise!



“DSE Graph: Matching Patterns” Notebook



Next Steps

- Continue learning on DataStax Academy:
 - [DS330: DataStax Enterprise 6 Graph](#)
 - [DS332: DataStax Enterprise 6 Graph Analytics](#)

<https://academy.datastax.com>



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Thank You

