DataStax Developer Day

DataStax Enterprise Search

What are we doing today?

- Explore the product catalog use case
- Discuss how your use case might be limited using just Cassandra
- Use DSE Search to perform queries on different columns
- Make changes to our DSE Search schema
- Dive into full text searching

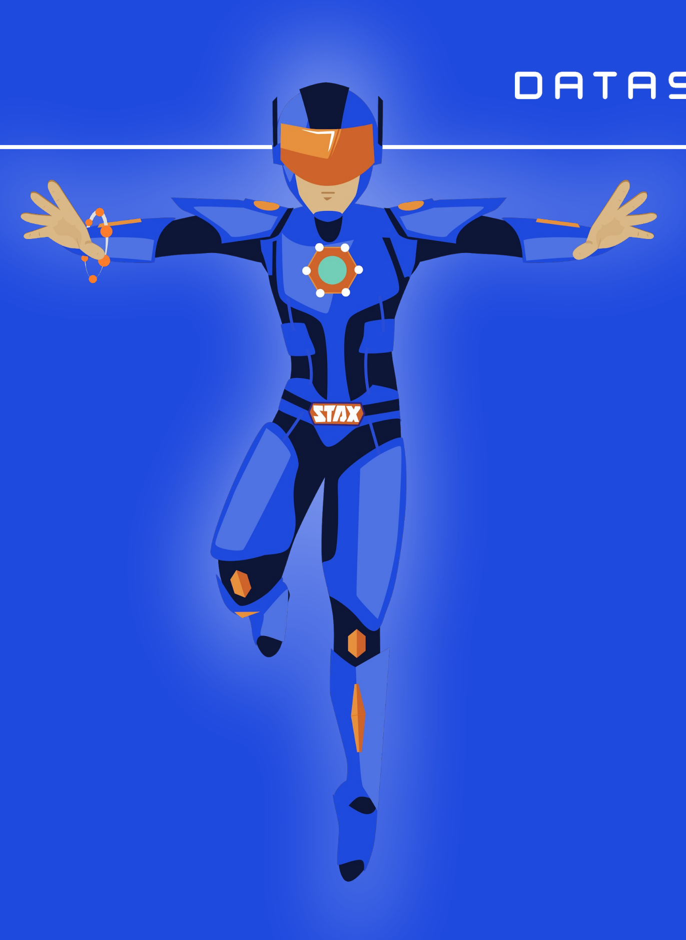
How's your Cassandra?

- We assume that you are somewhat familiar with Cassandra
- If you don't, the reasons to use Search may not make sense

DSE Search

DATASTAX®

Product Catalog Use Case



What Functionality Do We Need?

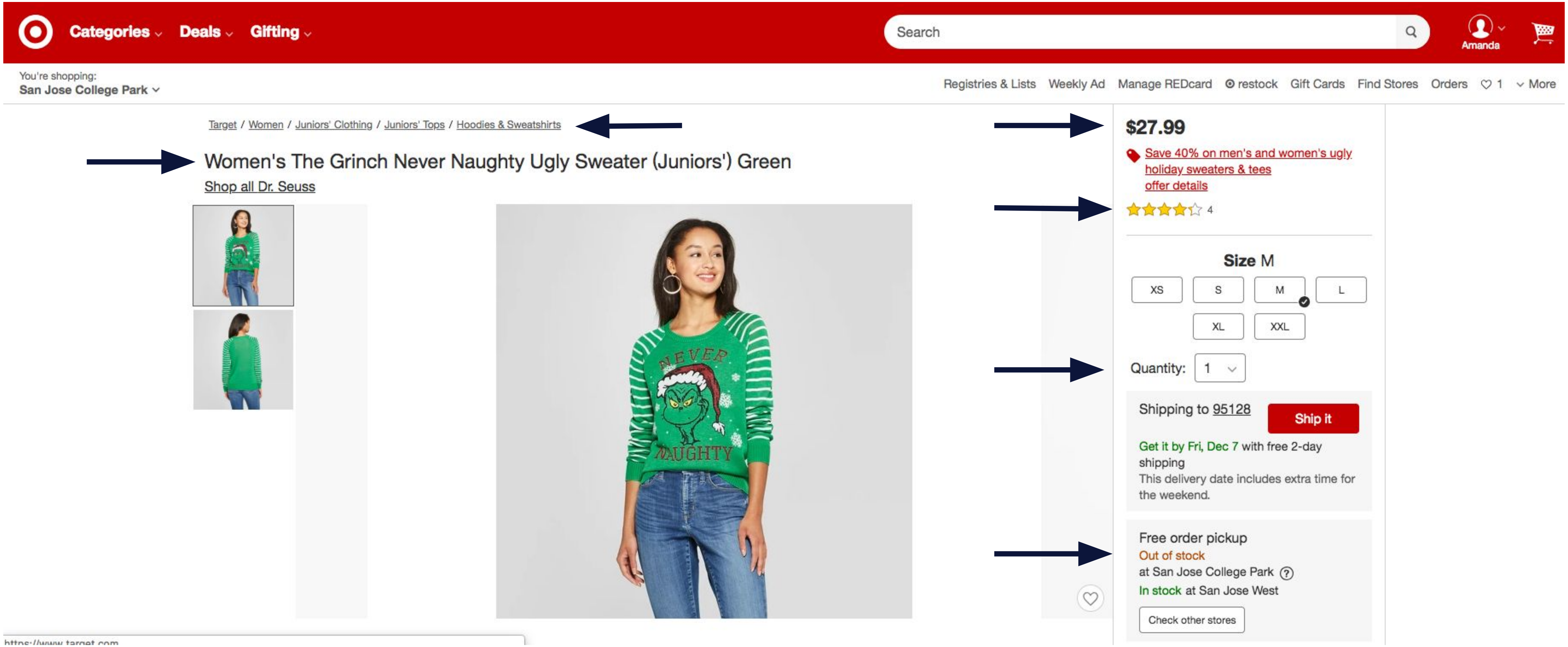
- Querying columns
- Search in text
- Sorting through results
- Counting
- Pagination

Searching

- Cassandra designed to allow on specific columns – partition key columns

- Some additional features to make querying more flexible
  - Secondary Indexes
  - Materialized Views
  - SASI – SSTable attached secondary indexes

Searching



You're shopping:
San Jose College Park

Target / Women / Juniors' Clothing / Juniors' Tops / Hoodies & Sweatshirts

Women's The Grinch Never Naughty Ugly Sweater (Juniors') Green

Shop all Dr. Seuss

$27.99

Save 40% on men's and women's ugly holiday sweaters & tees

offer details

★★★★☆ 4

Size M

XS S M L XL XXL

Quantity: 1

Shipping to 95128

Get it by Fri, Dec 7 with free 2-day shipping

This delivery date includes extra time for the weekend.

Free order pickup

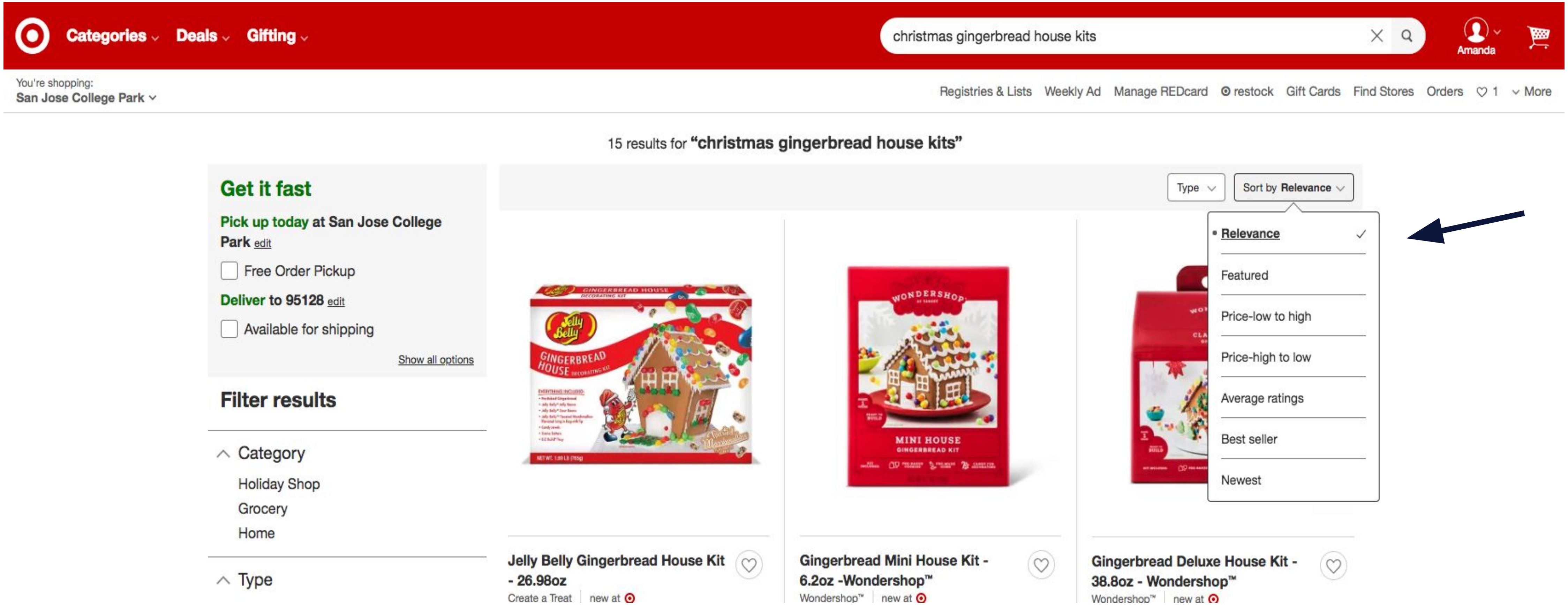
Out of stock at San Jose College Park

In stock at San Jose West

Sorting

- Limited in Cassandra by how data is stored to disk
- Can only sort within a partition
    - Need to search on partition key
- Only clustering columns are ordered
    - Need to know what columns that can order ahead of time
    - Need to re-create table if new ordering requirements
- Clustering columns sorted in groups following the primary key ordering
- Cannot arbitrarily change clustering column order
    - Depends on the order of the proceeding clustering columns

Sorting



15 results for **"christmas gingerbread house kits"**

Get it fast

Pick up today at San Jose College Park edit

□ Free Order Pickup

Deliver to 95128 edit

□ Available for shipping

Show all options

Filter results

Category

- Holiday Shop
- Grocery
- Home

Type

Type | Sort by **Relevance**

- **Relevance** ✓
- Featured
- Price-low to high
- Price-high to low
- Average ratings
- Best seller
- Newest

Jelly Belly Gingerbread House Kit - 26.98oz
Create a Treat | new at

Gingerbread Mini House Kit - 6.2oz -Wondershop™
Wondershop™ | new at

Gingerbread Deluxe House Kit - 38.8oz - Wondershop™
Wondershop™ | new at

Sorting

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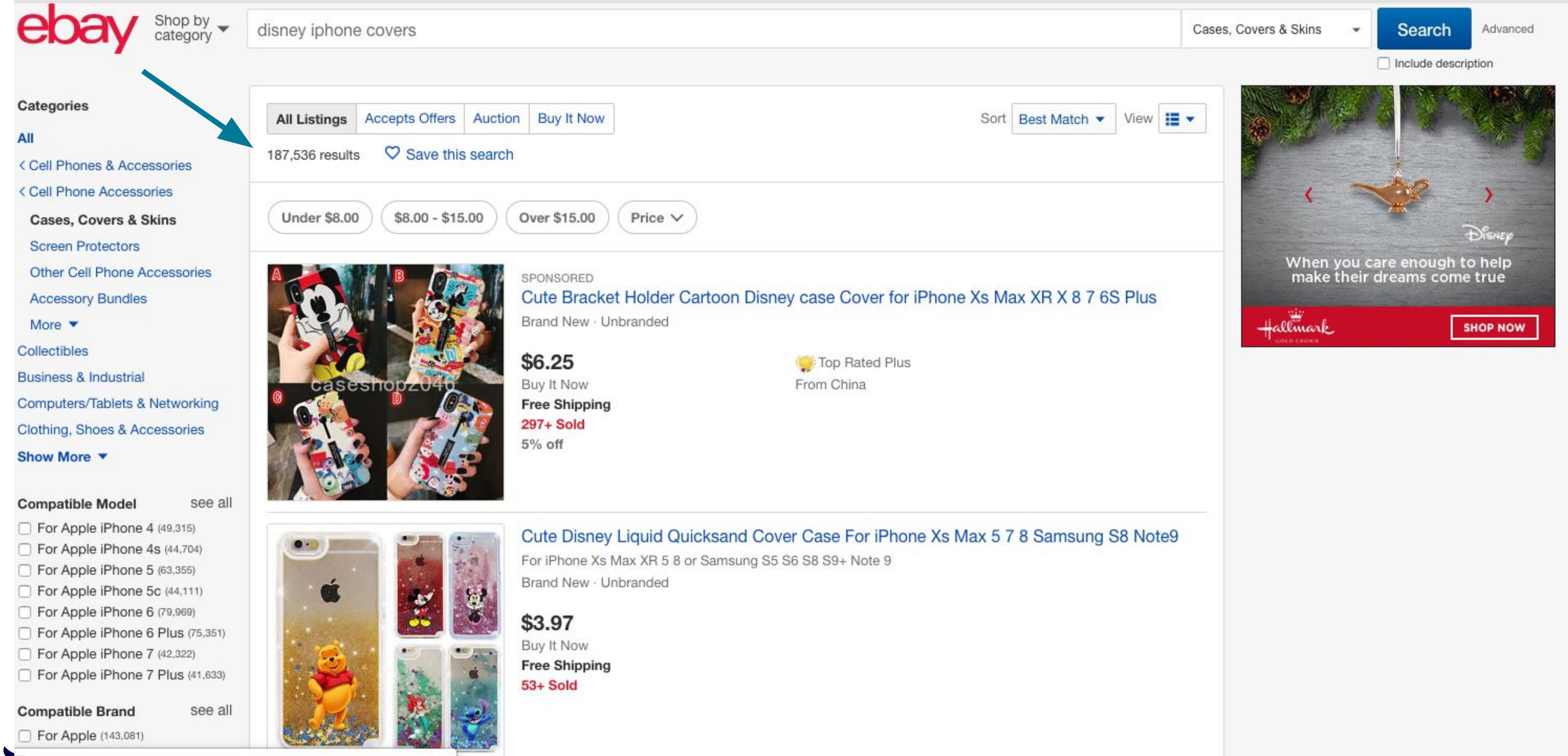
Counting

- Cassandra does have COUNT, but...
- Need to read through partitions to get the count
- If not restricting to a partition, that means doing a full table scan
- Also no way to count how much each value shows up in a column

https://academy.datastax.com/support-blog/counting-keys-might-well-be-counting-stars

Counting



disney iphone covers

Cases, Covers & Skins

□ Include description

Categories

All

< Cell Phones & Accessories

< Cell Phone Accessories

Cases, Covers & Skins

Screen Protectors

Other Cell Phone Accessories

Accessory Bundles

More

Collectibles

Business & Industrial

Computers/Tablets & Networking

Clothing, Shoes & Accessories

Show More

Compatible Model see all

- □ For Apple iPhone 4 (49,315)
- □ For Apple iPhone 4s (44,704)
- □ For Apple iPhone 5 (63,355)
- □ For Apple iPhone 5c (44,111)
- □ For Apple iPhone 6 (79,969)
- □ For Apple iPhone 6 Plus (75,351)
- □ For Apple iPhone 7 (42,322)
- □ For Apple iPhone 7 Plus (41,633)

Compatible Brand see all

- □ For Apple (143,081)

All Listings | Accepts Offers | Auction | Buy It Now

Sort Best Match View

187,536 results ♡ Save this search

Under $8.00 | $8.00 - $15.00 | Over $15.00 | Price

SPONSORED

Cute Bracket Holder Cartoon Disney case Cover for iPhone Xs Max XR X 8 7 6S Plus

Brand New · Unbranded

$6.25

Buy It Now

Free Shipping

297+ Sold

5% off

Top Rated Plus

From China

Cute Disney Liquid Quicksand Cover Case For iPhone Xs Max 5 7 8 Samsung S8 Note9

For iPhone Xs Max XR 5 8 or Samsung S5 S6 S8 S9+ Note 9

Brand New · Unbranded

$3.97

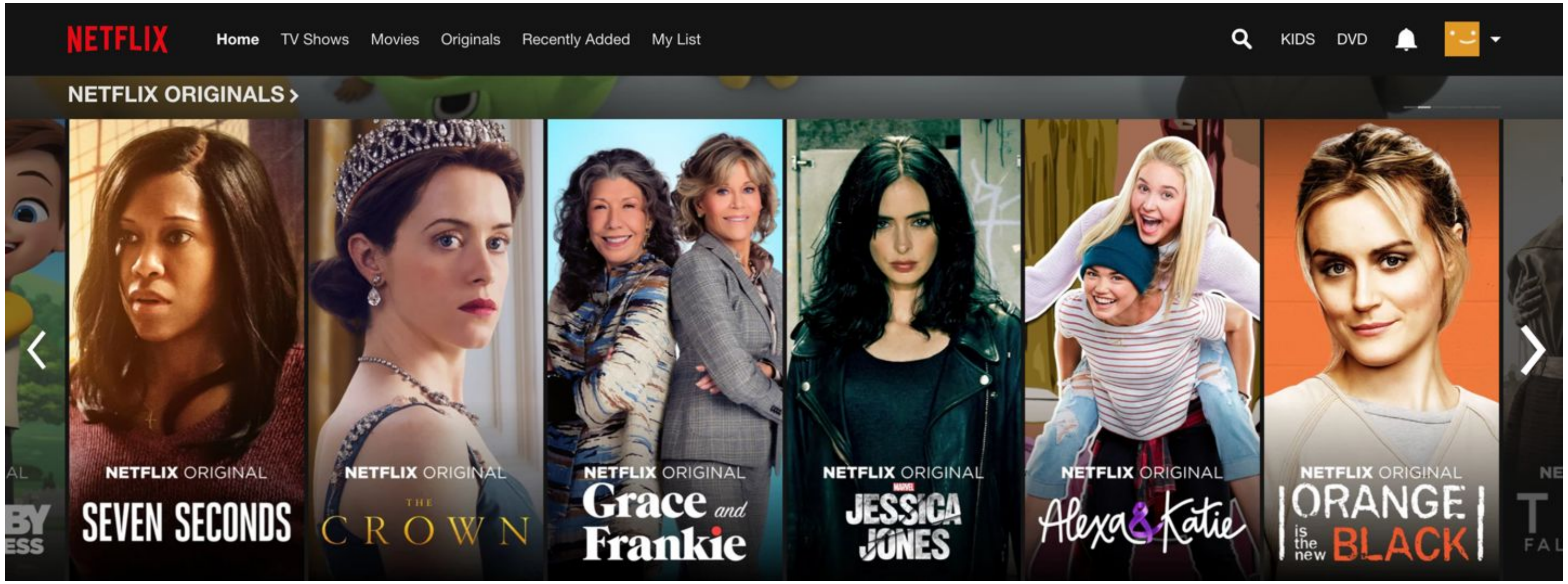
Buy It Now

Free Shipping

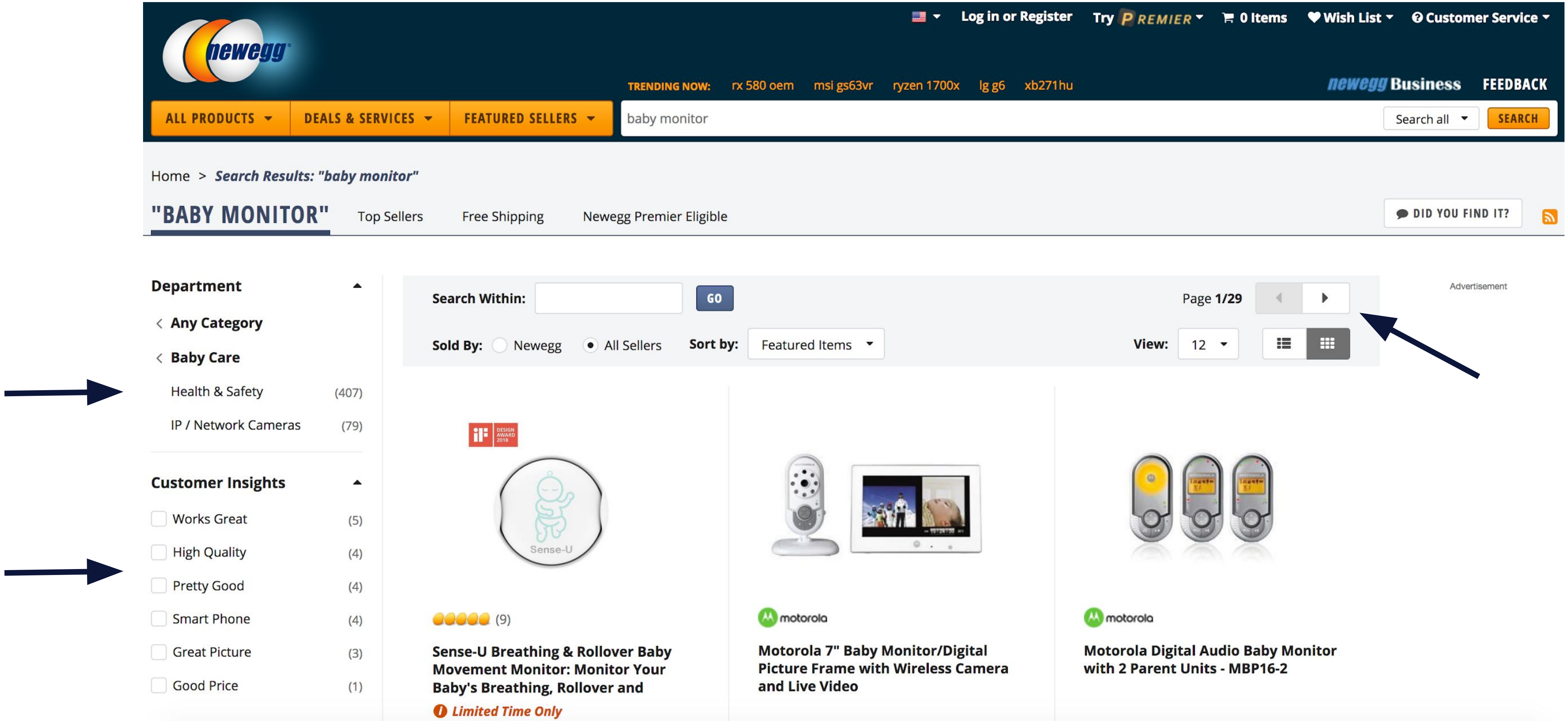
53+ Sold

Pagination

- Affected by limitations of counting, cannot efficiently do offset paging
- Cassandra driver can do cursor-based paging through results
- Essentially can only go forward or back from the current page



Pagination



Log in or Register | Try PREMIER | 0 Items | Wish List | Customer Service

TRENDING NOW: rx 580 oem | msi gs63vr | ryzen 1700x | lg g6 | xb271hu

newegg Business | FEEDBACK

ALL PRODUCTS | DEALS & SERVICES | FEATURED SELLERS

baby monitor | Search all | SEARCH

Home > *Search Results: "baby monitor"*

"BABY MONITOR" | Top Sellers | Free Shipping | Newegg Premier Eligible | DID YOU FIND IT?

Department

- Any Category
- Baby Care

Health & Safety	(407)
IP / Network Cameras	(79)

Customer Insights

□ Works Great	(5)
□ High Quality	(4)
□ Pretty Good	(4)
□ Smart Phone	(4)
□ Great Picture	(3)
□ Good Price	(1)

Search Within: GO | Page 1/29

Sold By: ○ Newegg ● All Sellers | Sort by: Featured Items | View: 12

Advertisement

(9)

Sense-U Breathing & Rollover Baby Movement Monitor: Monitor Your Baby's Breathing, Rollover and

Limited Time Only

motorola

Motorola 7" Baby Monitor/Digital Picture Frame with Wireless Camera and Live Video

motorola

Motorola Digital Audio Baby Monitor with 2 Parent Units - MBP16-2

Introducing DSE Search

- Apache Solr™
  - Open-source enterprise search platform
  - Provides tools and an interface for running search queries
- Apache Lucene™
  - Text indexing and search engine library
  - The core of the indexing and search capabilities available with DSE Search

DSE Search

- Rich functionality not available in Cassandra
- More convenient way to access data
  - Doesn't require complex data models or data duplication
  - Less work needed on the application side to format results
- Accessible from CQL
  - Core functionality using pure CQL syntax
  - More features available using the solr_query column
  - Changes to the search index schema or configuration

DATA MODEL CAVEAT

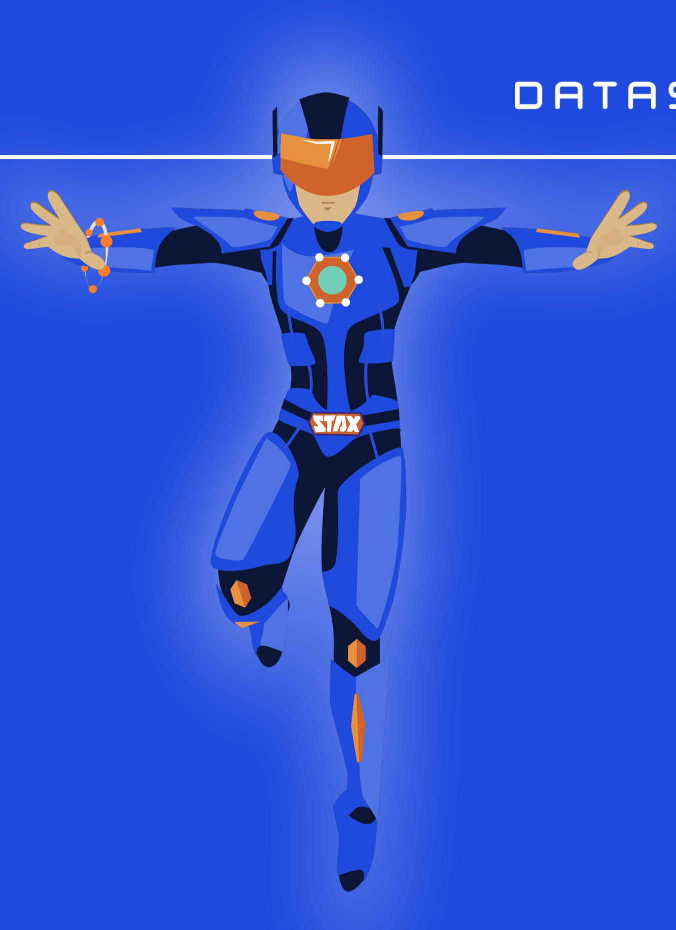
TOTALLY BELABOR THIS

Search features

- CQL enabled search
- SQL “like” syntax
- Filtering / Matching
- Allows indexing on non-primary key columns
- Indexing and Lucene under the hood
- Tight integration with Apache Cassandra in DSE
  - “-s” switch to “dse cassandra”
- CQL auto filters and uses search indexes when combined with DSE Analytics (Spark)
- Geospatial queries

DSE Search

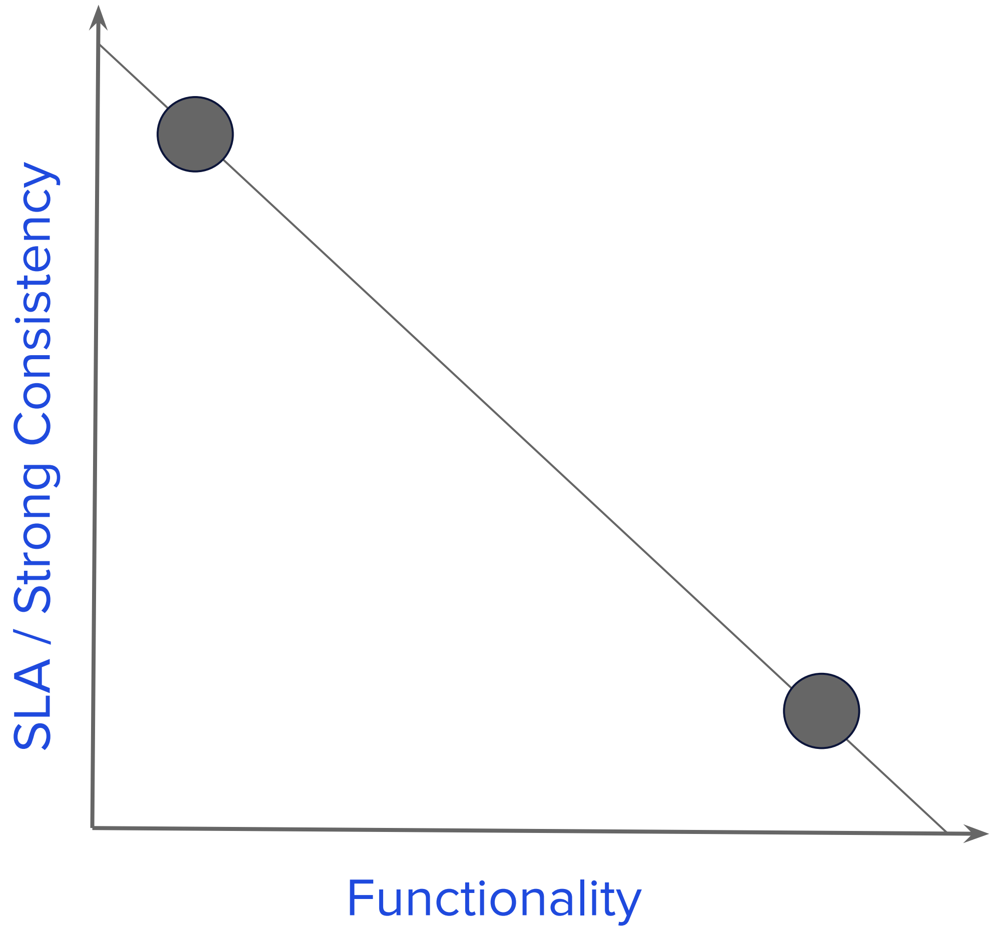
Data model and trade-offs



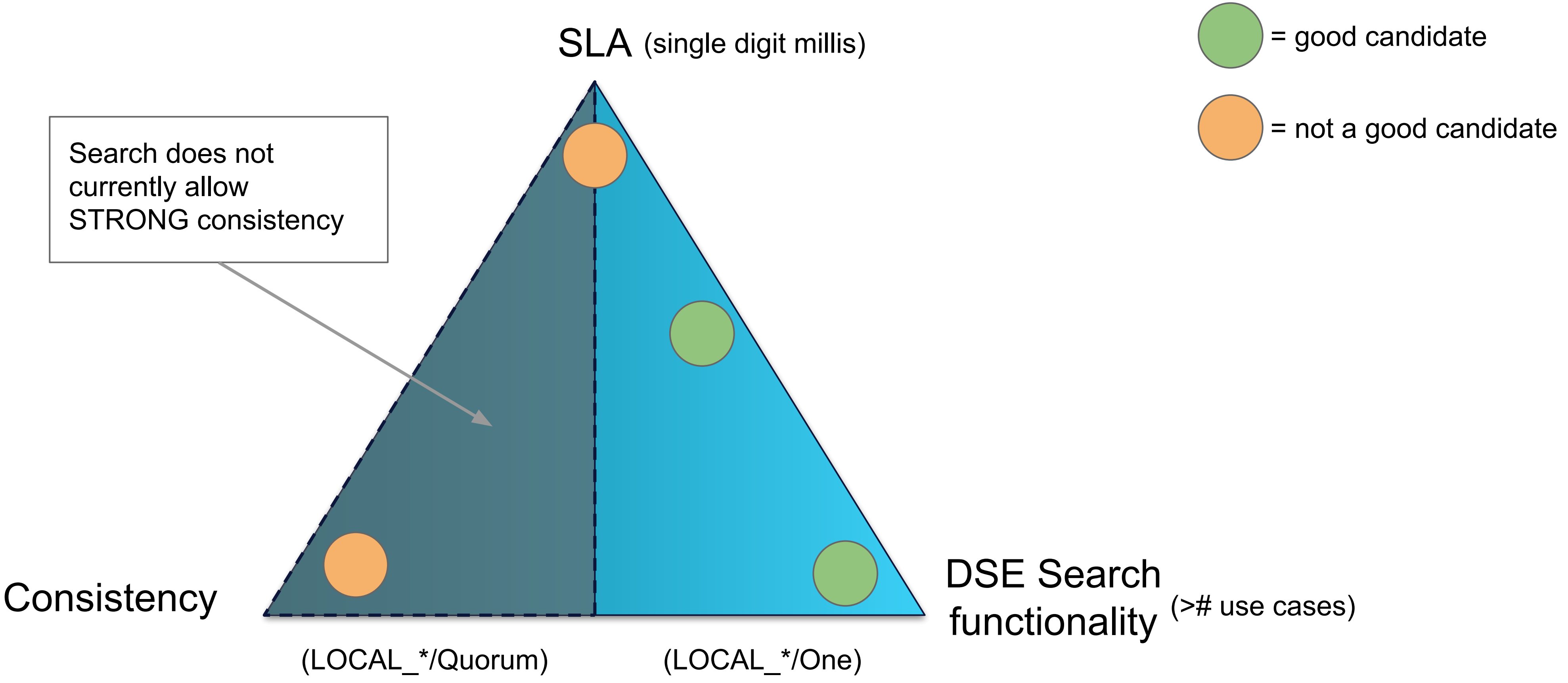
Data model

- DSE Search is not here to bail you out of a bad data model
- Still need to denormalize tables
- There are trade-offs and balance, depends on your needs

Balancing act



Balancing act



SLA (single digit millis)

Search does not currently allow STRONG consistency

Consistency

DSE Search functionality (>## use cases)

(LOCAL_*/Quorum)

(LOCAL_*/One)

🟢 = good candidate

🟠 = not a good candidate

DSE Search

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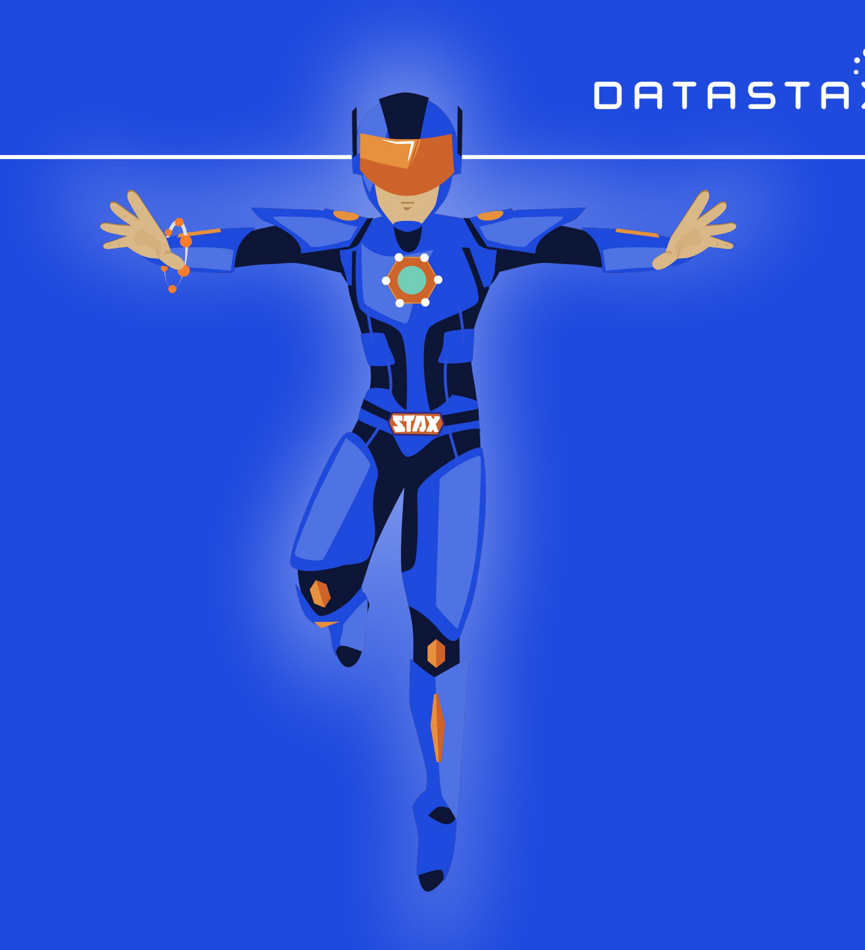
Getting Started with Search



Creating a search index

- Use CQL to create the search index
  - Command runs on all Search nodes in the datacenter
  - Uses a default search schema and config, which can be altered later
  - Also indexes existing table data
  - New data that you add to the table is automatically indexed

```
// Index all columns in the table
CREATE SEARCH INDEX ON keyspace.table;

// Only index certain columns in the table
CREATE SEARCH INDEX ON keyspace.table WITH COLUMNS column1, column2, ...;
```

CQL Search Query

- Accessing a query using search index can be done through CQL
- Will execute query just using Cassandra, if possible
- Otherwise will use the search index

```
SELECT * FROM keyspace.table WHERE predicate1 AND predicate2 AND ...;

SELECT col1, col2, ... FROM keyspace.table WHERE predicate1 AND predicate2 AND ...;

SELECT COUNT(*) FROM keyspace.table WHERE predicate1 AND predicate2 AND ...;

SELECT * FROM keyspace.table WHERE predicate1 AND predicate2 AND ... LIMIT #rows;
```

CQL Query Predicates

```
CREATE TABLE killrvideo.users (
   userid UUID,
   created_date TIMESTAMP,
   email TEXT,
   firstname TEXT,
   lastname TEXT,
   phone_number SET<TEXT>
   PRIMARY KEY ((userid))
);
```

- Equality and Inequality

```
SELECT * FROM killrvideo.users
  WHERE email = 'eboyeri5@aol.com';
SELECT * FROM killrvideo.users
  WHERE email != 'eboyeri5@aol.com';
```

- Range

```
SELECT * FROM killrvideo.users
  WHERE created_date >= '2018-04-01’
  AND created_date < '2018-05-01';
```

- Contains

```
SELECT * FROM killrvideo.users WHERE
  phone_number CONTAINS '650-389-6000';
```

- In

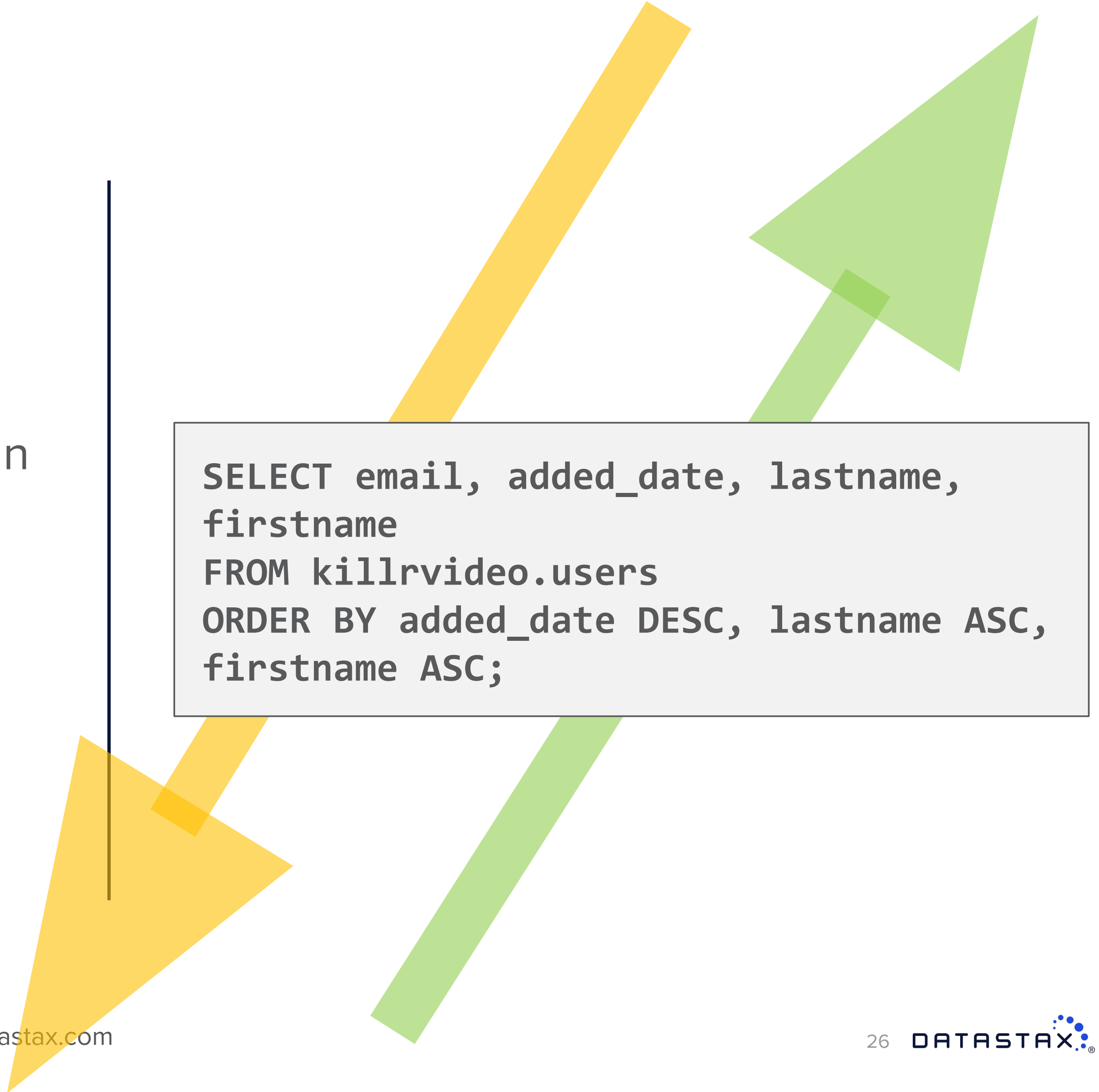
```
SELECT * FROM killrvideo.users
WHERE firstname IN ('Beauregard','Muffin');
```

- Like

```
SELECT * FROM killrvideo.users
WHERE lastname LIKE 'McD%';
```

CQL Query

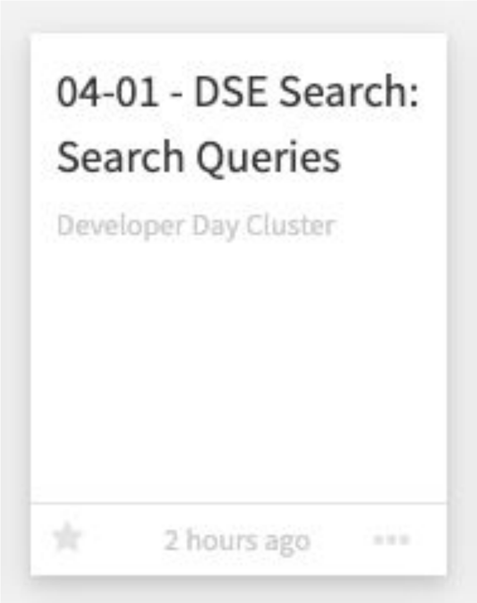
- Sort by any column
- Text can't be sorted by default, but can be changed in the search index schema
- Ascending (default) or descending order



```
SELECT email, added_date, lastname,
firstname
FROM killrvideo.users
ORDER BY added_date DESC, lastname ASC,
firstname ASC;
```

Time for an exercise!

Search Queries



04-01 - DSE Search: Search Queries

Developer Day Cluster

DSE Search

Text Search

Text Search

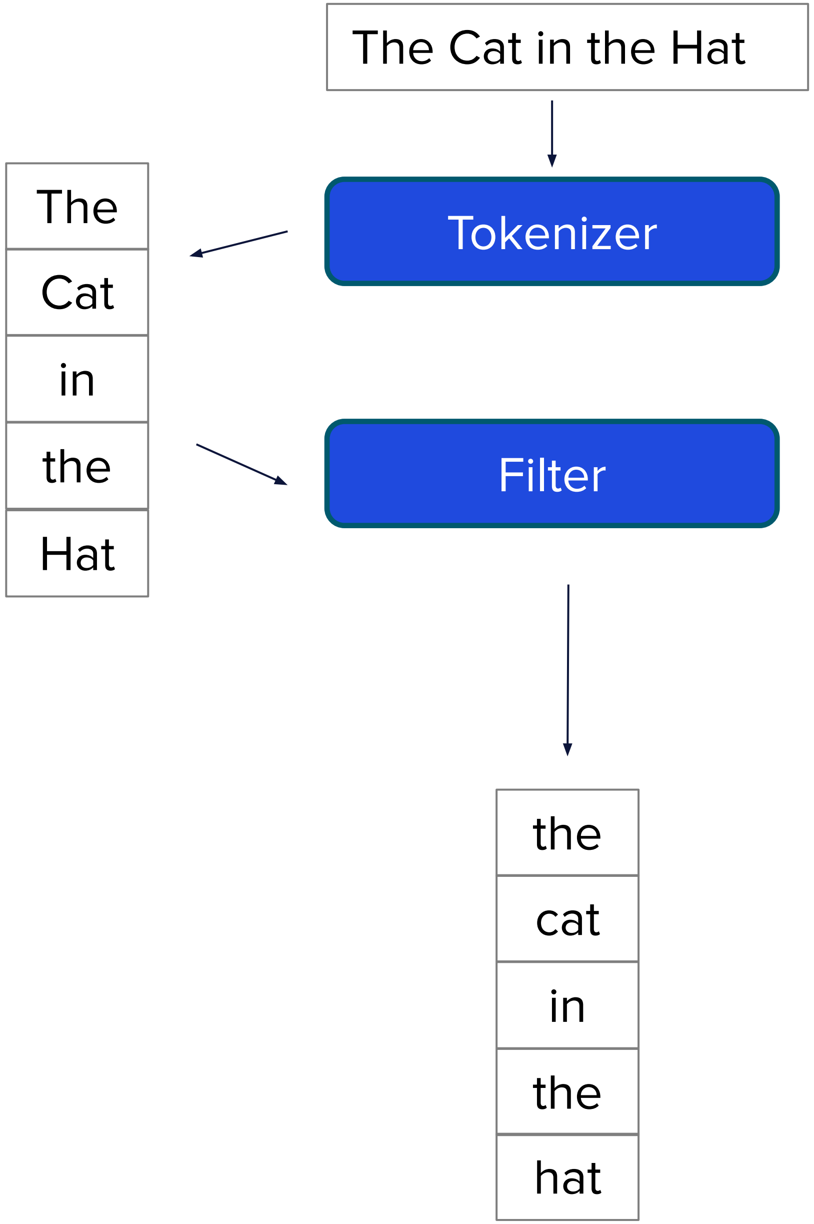
- One of DSE Search's strengths is in full-text search
- Retrieves results based on how well the text matches the search parameters
  - Calculates a relevancy score
  - Only includes the rows with the highest score are included in the search results
- Uses the more expressive Lucene query syntax instead of just CQL

Field Types

- The Search equivalent to data types found in the search index schema
- Cassandra data types map to a corresponding field type
- Some data types may have several compatible field types
  - For the Cassandra TEXT data type, you can use:
    - StrField (default)
    - TextField (text search capabilities)
- Power users can even create fully customizable field types

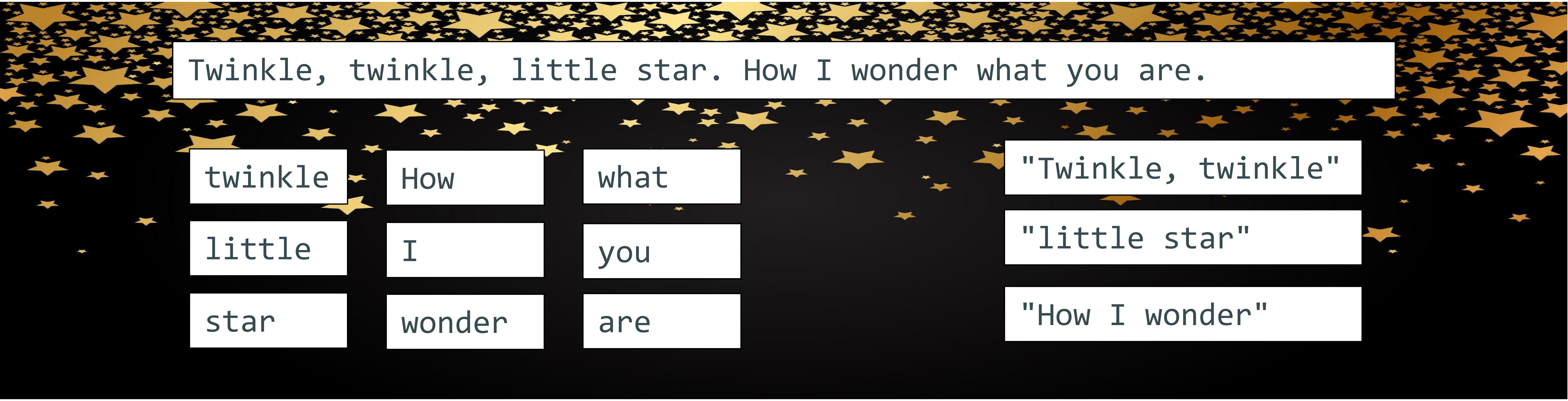
TextField

- TextField is processed as it is indexed
  - Analysis Chain
  - Tokenizer – breaks up text into tokens
  - Filter – performs some sort of processing
  - Resulting terms is what is indexed
- Search parameters also go through analysis chain
  - Compared against the indexed terms
  - Matching rows included in the results



Terms and Phrases

- Term – Tokenized data, or words, from text analysis or search input
- Phrase – Terms that are positioned in a certain order



```
Twinkle, twinkle, little star. How I wonder what you are.
```

twinkle	How	what
little	I	you
star	wonder	are

"Twinkle, twinkle"

"little star"

"How I wonder"

Search index schema

- Written and stored as a XML file
- Can edit using CQL, or by uploading the new schema XML file

```
DESCRIBE ACTIVE SEARCH INDEX SCHEMA ON keyspace.table;   // CQLSH only
DESCRIBE PENDING SEARCH INDEX SCHEMA ON keyspace.table;  // CQLSH only
```

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<schema name="autoSolrSchema" version="1.5">
  <types>
    <fieldType class="org.apache.solr.schema.StrField" name="StrField"/>
    :
  </types>
  <fields>
    <field indexed="true" multiValued="false" name="title" type="StrField"/>
    :
  </fields>
  <uniqueKey>video_id</uniqueKey>
</schema>
```

Making changes to the schema

- We need to define our TextField and change the field type for our fields
- Schema with changes that haven't been applied yet is PENDING
- Currently running schema is ACTIVE

```
ALTER SEARCH INDEX SCHEMA ON keyspace.table
ADD fieldType[@name='TextField', @class='solr.TextField']
WITH '{"analyzer": [{
          "tokenizer": {"class": "solr.StandardTokenizerFactory"},
          "filter": {"class":"solr.LowerCaseFilterFactory"}  }]}';

ALTER SEARCH INDEX SCHEMA ON keyspace.table
SET field[@name='name']@type='TextField';
```

Applying changes to the search index

- Reload the search schema to apply the changes to the schema
  - Afterwards, PENDING schema replaces the ACTIVE schema

- Rebuild the search index to reindex the existing data in the table
  - Current indexes would not match the new schema
  - Not needed if changes only made to the search index config

```
RELOAD SEARCH INDEX ON keyspace.table;
REBUILD SEARCH INDEX ON keyspace.table;
```

Using solr_query in CQL

- solr_query is a pseudo-column created with the search index
- Set a Lucene query string to the solr_query column in the WHERE clause

```
SELECT select-clause FROM keyspace.table WHERE solr_query = 'lucene-query';
```

  - Passed to DSE Search / Solr to be executed
  - Search results return to Cassandra, and then retrieves the actual row and column data

Lucene Query syntax in a nutshell

- Search all the things: *:*
- Term search: field-name:term

```
SELECT * FROM killrvideo.videos WHERE solr_query = 'name:cassandra';
```

- Phrase search: field-name:"term term term"

```
SELECT * FROM killrvideo.videos WHERE solr_query = 'name:"Distributed Data Show"';
```

Lucene Query syntax in a nutshell (continued)

- Multiple terms: field-name:(term OR (term AND term))
  - OR / AND must be capitalized!

```
SELECT * FROM killrvideo.users WHERE solr_query = 'name:(Jack OR Jill)';
```

- Multiple fields: field-name:term AND (field-name:term OR field-name:term)

```
SELECT * FROM killrvideo.videos WHERE solr_query = 'name:something AND tags:cats';
```

- Range search: field-name:(1 TO 0]   ( ) - exclusive bounds, [ ] - inclusive bounds

```
SELECT * FROM killrvideo.videos WHERE solr_query = 'year:[2017 TO *]'
```

Levenshtein Distance

- Measure of how similar two strings are
- Based on the number of edits for one string to match the other
- Used by both fuzzy search and proximity search

```
// Distance between the word kitten and sitting is 3

Edit 1:  kitten → sitten (substitution of "s" for "k")

Edit 2:  sitten → sittin (substitution of "i" for "e")

Edit 3:  sittin → sitting (insertion of "g" at the end)
```

Fuzzy Search

- Add ~ at the end of a term
- Degree of similarity to the term is controlled by adding a value after the ~
  - This optional parameter can be 1 or 2
  - Represents the max number of edits to the indexed term

```
SELECT * FROM keyspace.table WHERE solr_query = 'field:term~#';
```

```
seven~1
```

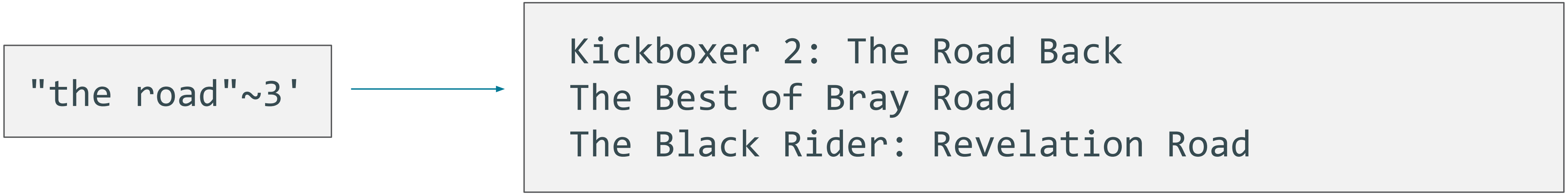
→

```
The Magnificent Seven
Se7en
The Even Stevens Movie
```

Proximity Search

- Add ~ at the end of a phrase
- Degree of similarity controlled by adding a value after the ~
- Represents the maximum distance that terms in the phrase can be apart

```
SELECT * FROM keyspace.table WHERE solr_query = 'field:"phrase"~#';
```

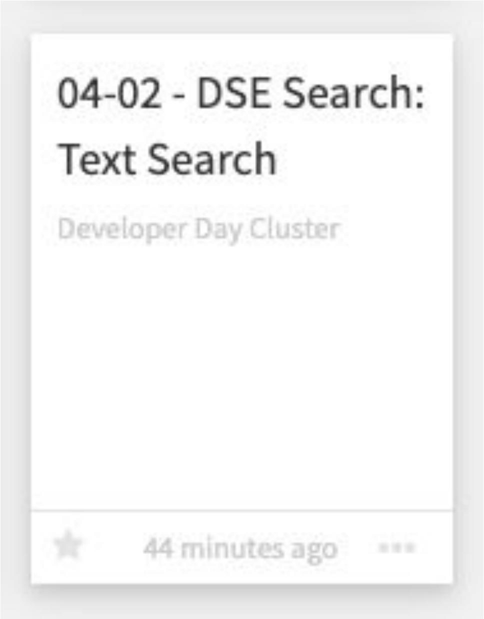


```
"the road"~3'
```

```
Kickboxer 2: The Road Back
The Best of Bray Road
The Black Rider: Revelation Road
```

Time for an exercise!

Text Search



04-02 - DSE Search: Text Search

Developer Day Cluster

44 minutes ago

DSE Search

Wrapping Up

Integrating Search into your application

```
dse cassandra -s
```

- Aaaaand you’re done

In summary...

- Some use cases can be a challenge to implement with just Cassandra
  - DSE Search makes it much easier
- If you can write CQL, you can search
  - Basic search done using only CQL
  - Use the solr_query column for more complex search and text search
  - Also for managing your schema and config
- Search is great at many things, especially:
  - Text search
  - Counting
  - GeoSpatial

Some resources to learn more

- DataStax Academy
  - https://academy.datastax.com
  - DS310 – DataStax Enterprise Search
- DataStax Community
  - https://community.datastax.com
  - Tags: ”search”, “dse search”
- DataStax Documentation
  - DSE Developer Guide

DATASTAX ACADEMY

DATASTAX ACADEMY

Learning Objectives

- Explore KillrVideo domain
- Install/start Cassandra
- Create tables, store, and retrieve data

We're gonna create tables, store, and retrieve data, DATASTAX

Thank You