elastic

logistics

- Class Hours:
- Start time is 9:30am
- End time is 4:30pm
- Class times may vary slightly for specific classes
- Breaks mid-morning and afternoon (10 minutes)

- Lunch:
- Lunch is 11:45am to 1pm
- Yes, 1 hour and 15 minutes
- Extra time for email, phone calls, or simply a walk.

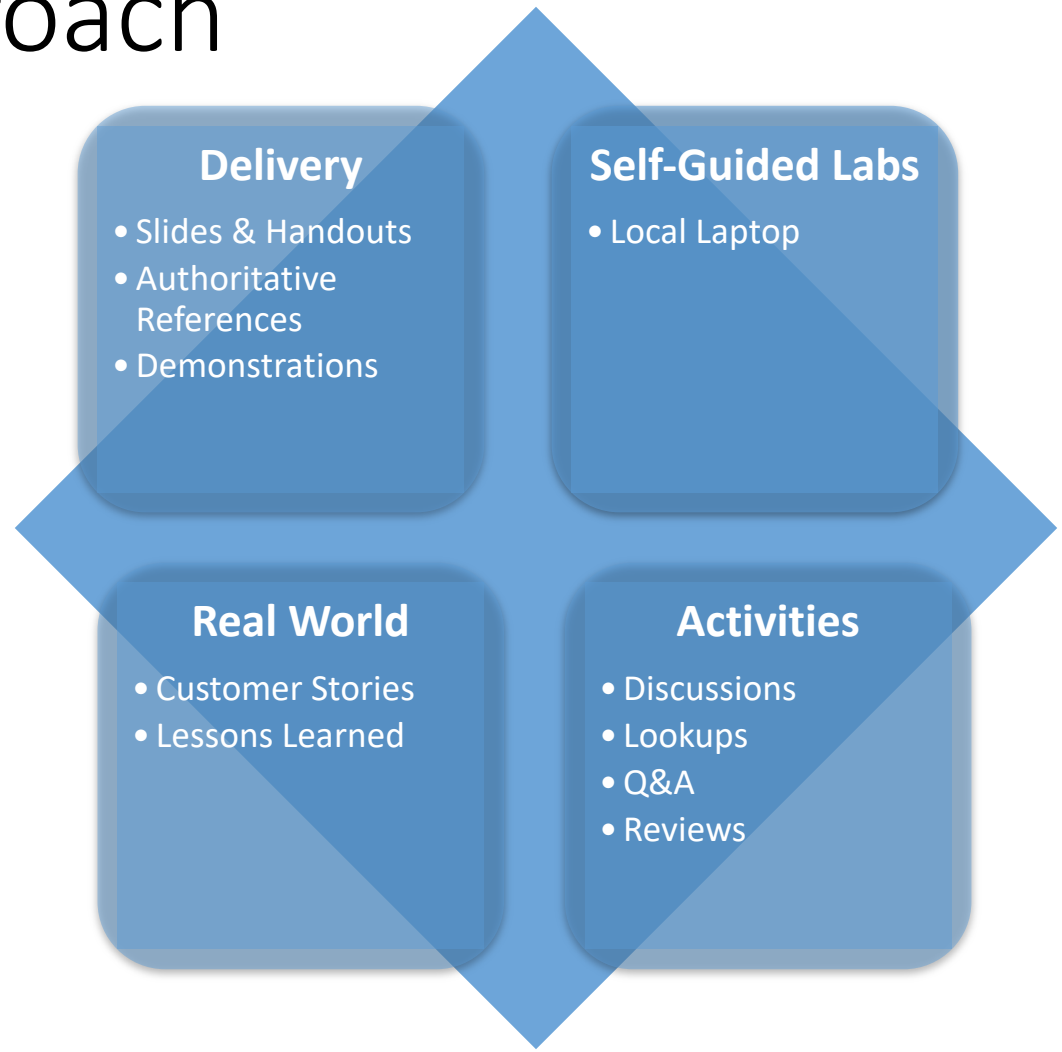
- Telecommunication:
- Turn off or set electronic devices to vibrate
- Reading or attending to devices can be distracting to other students

- Miscellaneous
- Courseware
- Bathroom

course objectives

- Get familiar with Elasticsearch as a distributed database and search engine
- Install and configure Elasticsearch
- Understand Easticsearch Domain-specific Language
- Understand difference between search and filter
- Learn how to cluster Elasticsearch for high availability
- Setup Logstash to transform log lines into JSON
- Setup Kibana as a graphical front-end

course approach



End of Day Office Hours - 1:1 Assistance

the training dilemma

meet the instructor

Jason Smith

Cloud Consultant with a Linux sysadmin background.
Focused on cloud-native technologies: automation, containers & orchestration

Twitter
@jruels

github
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Expertise

- Cloud
- Automation
- CICD
- Docker
- Kubernetes

introductions

- Name
- Job Role
- Which statement best describes your Elasticsearch experience?
  a. I am ***currently working*** with Elasticsearch on a project/initiative
  b. I ***expect to work*** with Elasticsearch on a project/initiative in the future
  c. I am ***here to learn*** about Elasticsearch outside of any specific work related project/initiative
- Expectations for course (please be specific)

elastic stack overview

Elastic Stack

- 2010 - Released as Open Source project
- 2012 - Elasticsearch company founded
- 2015 - Rebranded as Elastic

- Highly scalable
- Open Source
  - Enterprise support available
- Built for searching and analyzing large datasets

Elastic Stack

elasticsearch

logstash

- 2009 - Released as Open Source project
- 2015 - Added to Elastic family
- 2015 - Log forwarder released

- Open Source data collection engine
- Real-time pipelining capabilities
- Collect logs from multiple input sources and send to Elasticsearch

Elastic Stack

elasticsearch

- 2011 - Released as Open Source project
- 2013 - Added to Elastic family

logstash

- Browser based analytics & search dashboard for Elasticsearch
- Visualize Elasticsearch data
- Highly customizable

kibana

Elastic Stack

elasticsearch

logstash

kibana

Elastic Stack

elasticsearch

logstash

kibana

beats

- 2015 - Beats tools released
- Open platform for single-purpose data shippers

Elastic Stack

- 2016 - X-Pack released
- Subscription tools to enable monitoring, alerting, reporting and much more

Elastic Stack

elasticsearch

"ELK Stack"

logstash

x-pack

kibana

beats

elasticsearch basics

logical concepts of elasticsearch

documents

Documents are the things you're searching for. They can be more than text – any structured JSON data works. Every document has a unique ID, and a type.

types

A type defines the schema and mapping shared by documents that represent the same sort of thing. (A log entry, an encyclopedia article, etc.)

indices

An index powers search into all documents within a collection of types. They contain inverted indices that let you search across everything within them at once.

Elasticsearch is moving away from 'types'. In Elasticsearch 6 only one type is allowed per index.

what is an inverted index

Document 1:
Space: The final frontier. These are the voyages…

Document 2:
He's bad, he's number one. He's the space cowboy with the laser gun!

Inverted index

space:	1, 2
the:	1, 2
final:	1
frontier:	1
he:	2
bad:	2
…	

It’s not quite that simple.

TF-IDF means Term Frequency * Inverse Document Frequency

Term Frequency is how often a term appears in a given document

Document Frequency is how often a term appears in all documents

Term Frequency / Document Frequency measures the relevance of a term in a document

using indices

RESTful API

Elasticsearch fundamenatally works via HTTP requests and JSON data. Any language or tool that can handle HTTP can use Elasticsearch.

client API's

Most languages have specialized Elasticsearch libraries to make it even easier.

analytic tools

Web-based graphical UI's such as Kibana let you interact with your indices and explore them without writing code.

REST: a quick intro.

Anatomy of a HTTP request

METHOD: the “verb” of the request. GET, POST, PUT, or DELETE

PROTOCOL: what flavor of HTTP (HTTP/1.1)

HOST: what web server you want to talk to

URL: what resource is being requested

BODY: extra data needed by the server

HEADERS: user-agent, content-type, etc.

example: GET request for google.com

GET /index.html
Protocol: HTTP/1.1
Host: www.google.com
No body
Headers:

```
User-Agent: Mozilla/5.0 (Windows; U; Windows NT 6.1; en-US; rv:1.9.1.5) Gecko/20091102 Firefox/3.5.5 (.NET CLR 3.5.30729)
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Language: en-us,en;q=0.5
Accept-Encoding: gzip,deflate
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.7
Keep-Alive: 300
Connection: keep-alive
Cookie: PHPSESSID=r2t5uvjq435r4q7ib3vtdjq120
Pragma: no-cache
Cache-Control: no-cache
```

RESTful API's

pragmatic definition: using HTTP requests to communicate with web services

examples:

GET requests retrieve information (like search results)
PUT requests insert or replace new information
DELETE requests delete information

REST fancy-speak

Representational State Transfer

Six guiding constraints:

- client-server architecture
- statelessness
- cacheability
- layered system
- code on demand (ie, sending Javascript)
- uniform interface

why REST?

- language and system independent
- highly scalable

the curl command

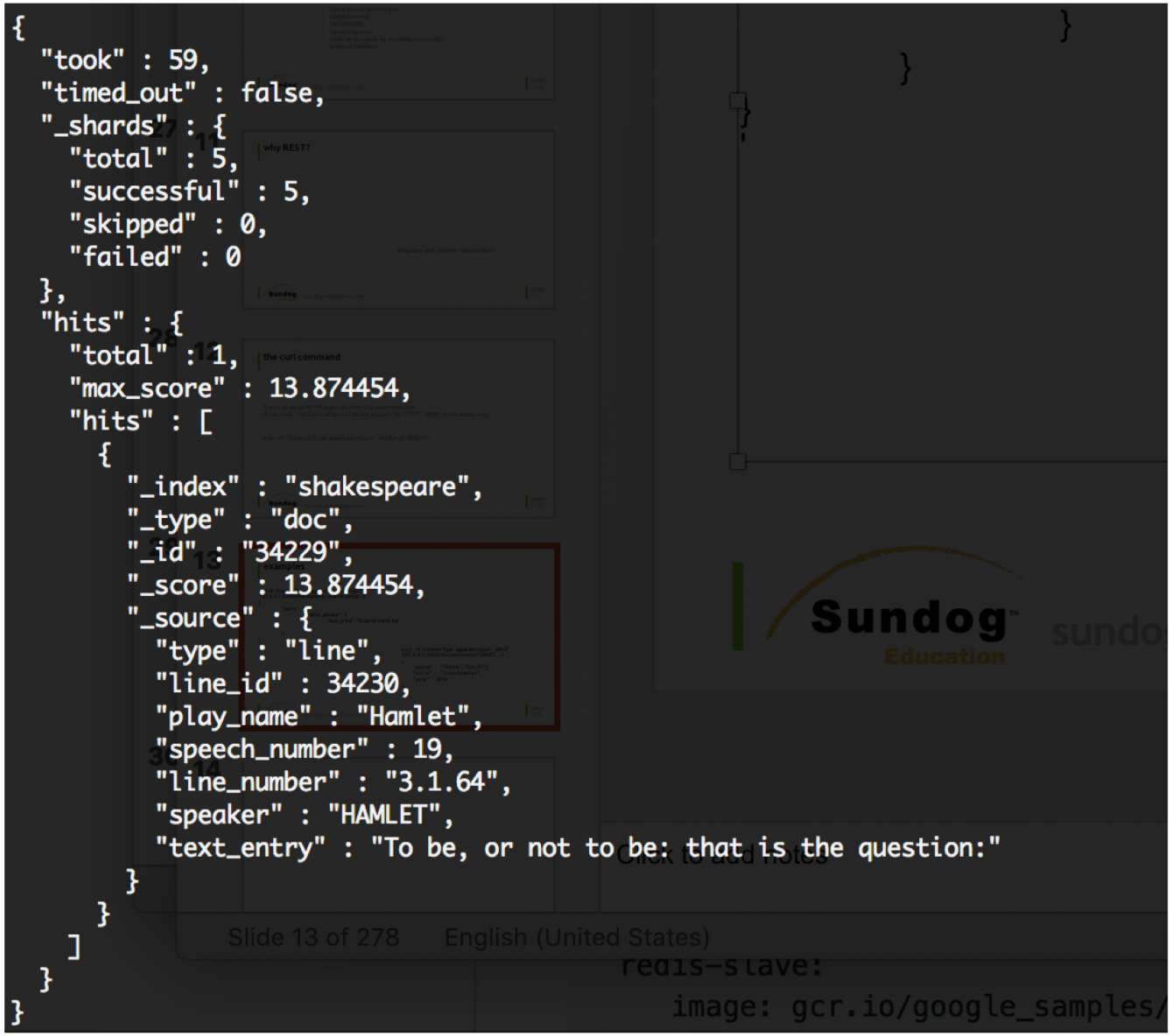
A way to issue HTTP requests from the command line
From code, you'll use whatever library you use for HTTP / REST in the same way.

curl –H "Content-Type: application/json" <URL> -d '<BODY>'

examples

```
$ curl -H 'Content-Type: application/json' -XGET '127.0.0.1:9200/shakespeare/_search?pretty' -d '
> {
> "query" : {
> "match_phrase" : {
> "text_entry" : "to be or not to be"
> }
> }
> }
> '
```

examples


{
"took" : 59,
"timed_out" : false,
"_shards" : {
"total" : 5,
"successful" : 5,
"skipped" : 0,
"failed" : 0
},
"hits" : {
"total" : 1,
"max_score" : 13.874454,
"hits" : [
{
"_index" : "shakespeare",
"_type" : "doc",
"_id" : "34229",
"_score" : 13.874454,
"_source" : {
"type" : "line",
"line_id" : 34230,
"play_name" : "Hamlet",
"speech_number" : 19,
"line_number" : "3.1.64",
"speaker" : "HAMLET",
"text_entry" : "To be, or not to be: that is the question:"
}
}
]
}
}
Sundog
Education
Slide 13 of 278
English (United States)
image: gcr.io/google_samples/

the httpie command

A way to issue HTTP requests from the command line
Simpler syntax than curl, defaults to ‘pretty’ output.

http <VERB> <URL> -d ‘<BODY>’

examples

```
$ http GET localhost:9200/shakespeare/_search <<<'{
> "query" : {
> "match_phrase" : {
> "text_entry" : "to be or not to be"
> }
> }
> }
> '
```

examples

```
HTTP/1.1 200 OK
content-encoding: gzip
content-length: 280
content-type: application/json; charset=UTF-8

{
    "_shards": {
        "failed": 0,
        "skipped": 0,
        "successful": 5,
        "total": 5
    },
    "hits": {
        "hits": [
            {
                "_id": "34229",
                "_index": "shakespeare",
                "_score": 13.874454,
                "_source": {
                    "line_id": 34230,
                    "line_number": "3.1.64",
                    "play_name": "Hamlet",
                    "speaker": "HAMLET",
                    "speech_number": 19,
                    "text_entry": "To be, or not to be: that is the question:",
                    "type": "line"
                },
                "_type": "doc"
            }
        ],
        "max_score": 13.874454,
        "total": 1
    },
    "timed_out": false,
    "took": 16
}
```

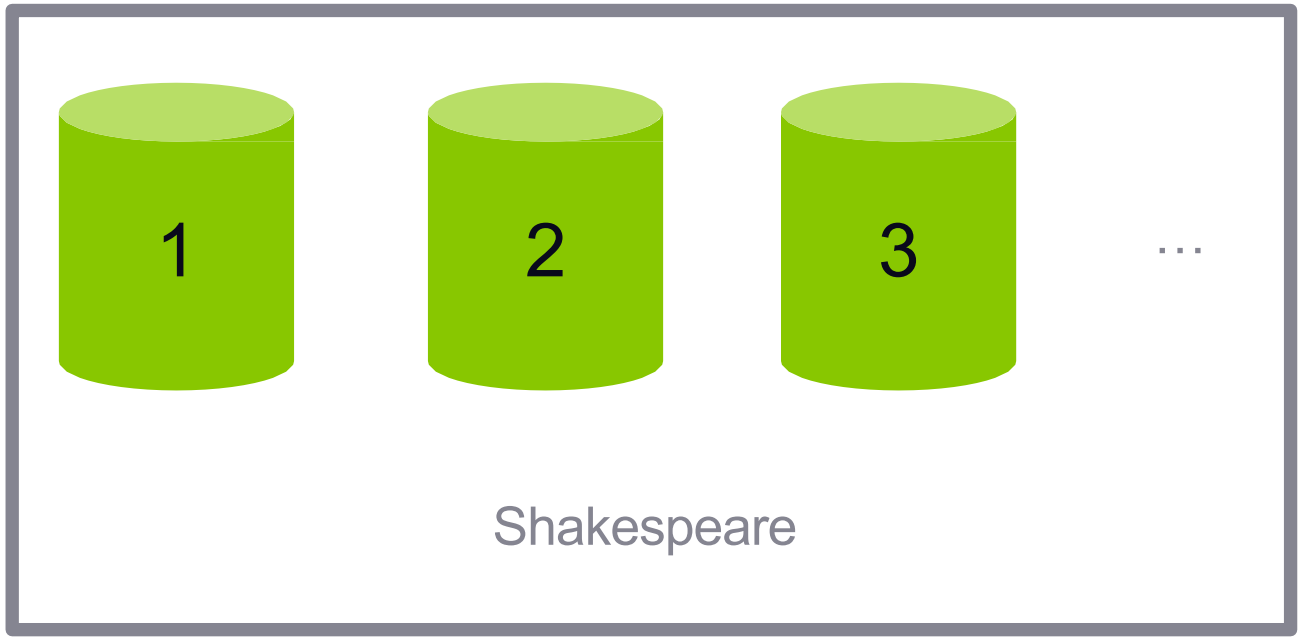
lab01: lab setup

- Install VirtualBox (if needed)
- Install Ubuntu VM
- Install Elasticsearch
- Upload some data

how elasticsearch scales

an index is split into shards

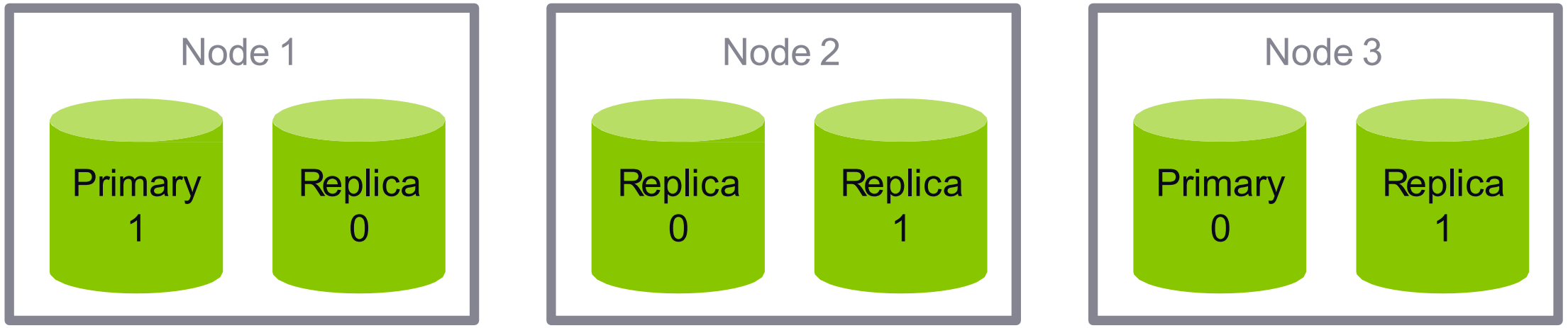
Documents are hashed to a particular shard.



Each shard may be on a different node in a cluster.
Every shard is a self-contained Lucene index of its own.

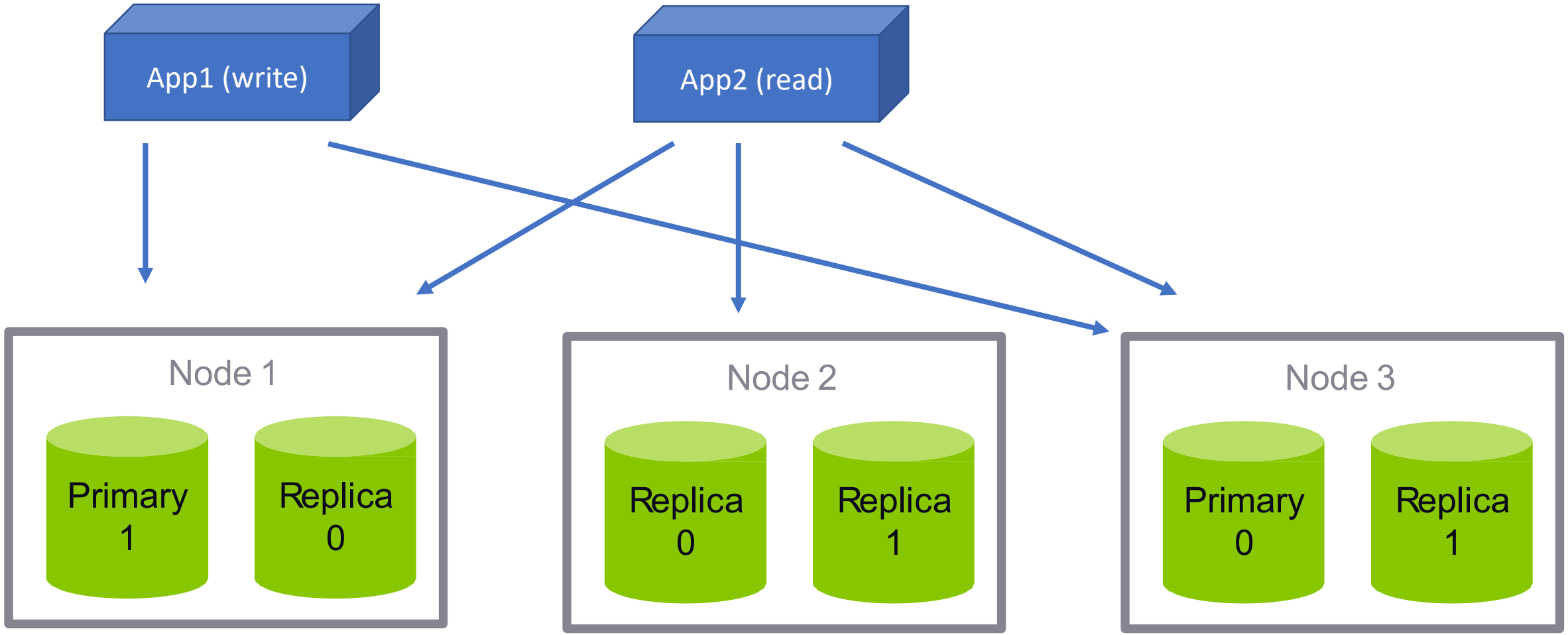
primary and replica shards

This index has two primary shards and two replicas.
Your application should round-robin requests among nodes.



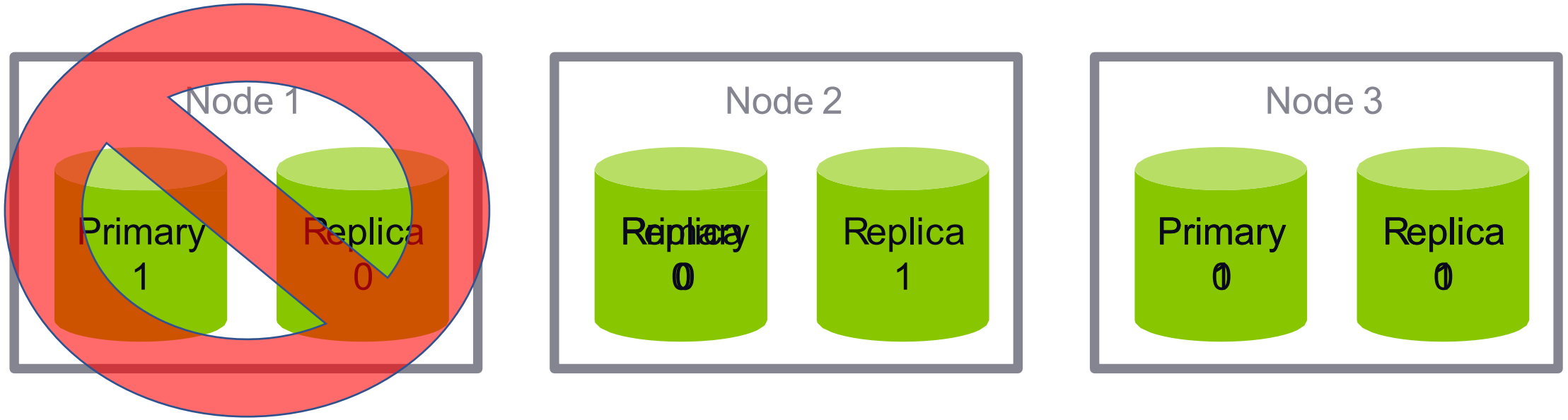
Write requests are routed to the primary shard, then replicated
Read requests are routed to the primary or any replica

primary and replica shards



primary and replica shards

This index has two primary shards and two replicas.
Your application should round-robin requests among nodes.



Write requests are routed to the primary shard, then replicated
Read requests are routed to the primary or any replica

The number of primary shards cannot be changed later.

Not as bad as it sounds – you can add more replica shards for more read throughput.

Worst case you can re-index your data.

The number of shards can be set up front via a PUT command via REST / HTTP

```
PUT /testindex
{
"settings": {  "number_of_shards": 3
, "number_of_replicas": 1
}
}
```

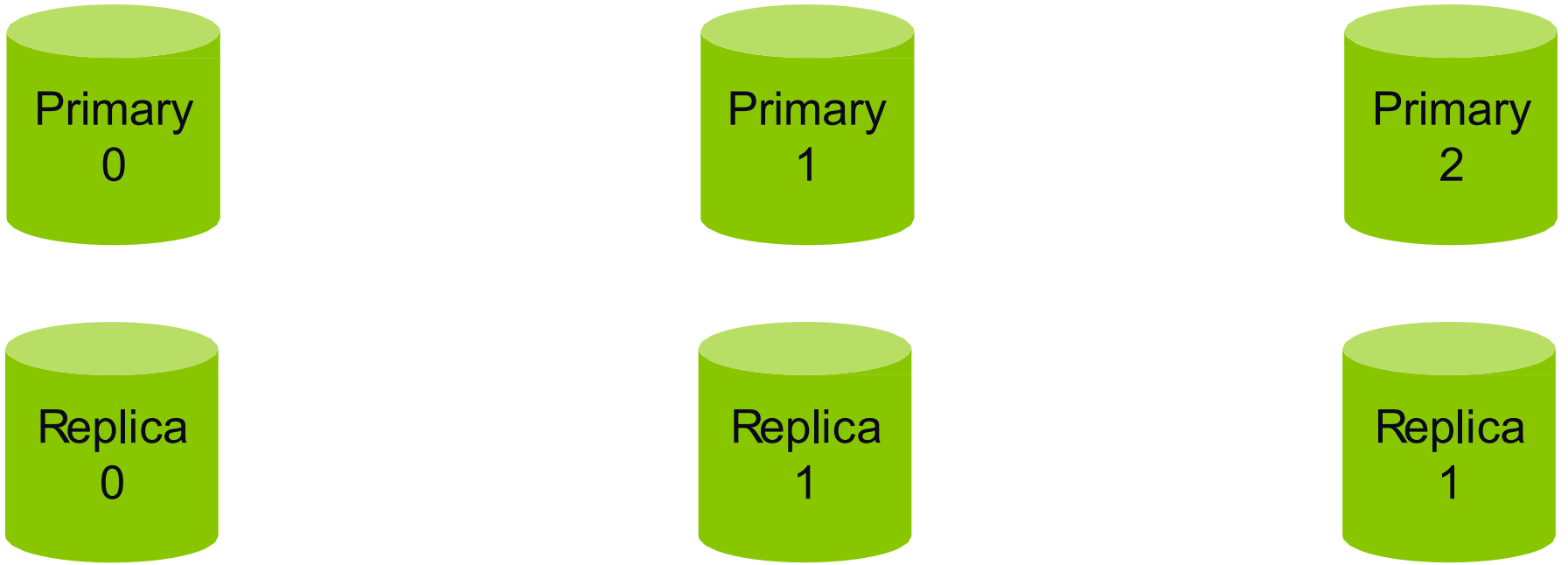
number of shards quiz

How many total shards does the code on the right create?

```
PUT /testindex
{
"settings": {  "number_of_shards": 3
, "number_of_replicas": 1
}
}
```

primary and replica shards

This index has 3 primary shards and 3 replicas.



quiz time

The schema for your documents are defined by...

- The index
- The type
- The document itself

01

The schema for your documents are defined by...

- The index
- The type
- The document itself

01

02

What purpose do inverted indices serve?

- They allow you search phrases in reverse
- order
- They quickly map search terms to documents
- They load balance search requests across
- your cluster

02

What purpose do inverted indices serve?

- They allow you search phrases in reverse
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- They quickly map search terms to documents
- They load balance search requests across
- your cluster

03

- 8
- 15
- 20

An index configured for 5 primary shards and 3 replicas would have how many shards intotal?

03

- 8
- 15
- 20

An index configured for 5 primary shards and 3 replicas would have how many shards intotal?

04

- true
- false

Elasticsearch is built only for full-text search of documents.

04

- true
- false

Elasticsearch is built only for full-text search of documents.

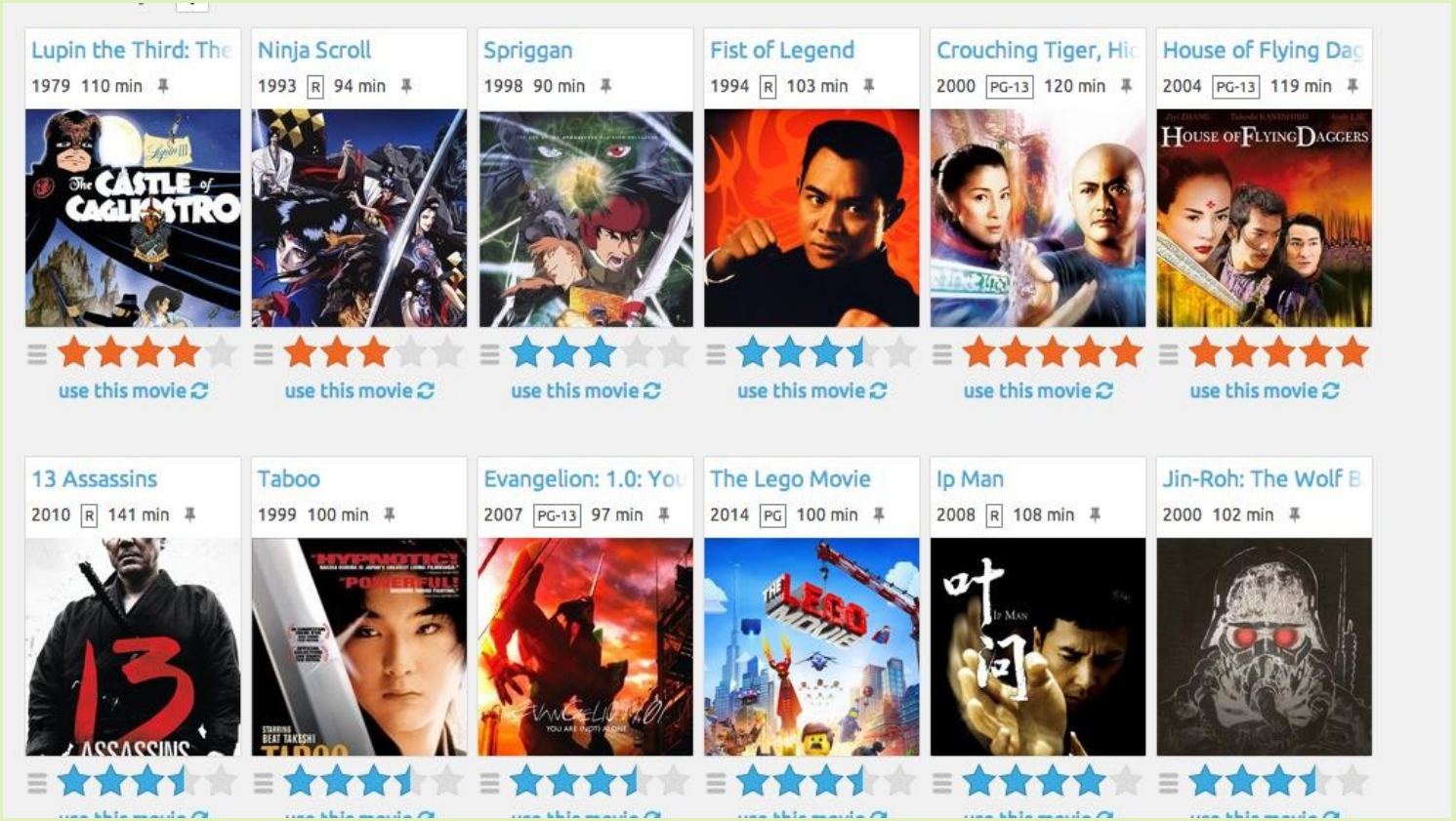
examining movielens

movielens

movielens is a free dataset of movie ratings gathered from movielens.org.

It contains user ratings, movie metadata, and user metadata.

Let's download and examine the data files from movielens.org



lab02: download MovieLens data

- Visit GroupLens website
- Download small data set
- Look through sample data files

Instructor led lab

creating mappings

what is a mapping?

a mapping is a schema definition.
elasticsearch has reasonable defaults, but sometimes you need to customize them.

```
curl -H "Content-Type: application/json" -XPUT 127.0.0.1:9200/movies -d '
{
    "mappings": {
        "movie": {
            "properties" : {
                "year" : {"type": "date"}
            }
        }
    }
}'
```

NOTE: Content-Type is now required in Elasticsearch 6.x+

elasticsearch 5 syntax

In Elasticsearch 5 it was possible to send a REST request without the Content-Type. Elasticsearch would then “sniff” the content and set the type based on that.

```
curl 'http://localhost:9200/_search' -d'
{
    "query" : {
        "match_all" : {}
    }
}'
```

elasticsearch syntax

There are two reasons this changed.

Clarity

Sending plain text content to API
that doesn't support it returns.

```
Content-Type header [text/plain] is not supported
```

In Elasticserach 5 it returned this.

```
Unexpected character ('a' (code 97)): was expecting
double-quote to start field name
```

elasticsearch syntax

There are two reasons this changed.

Security

```
<html>
  <body>
    <script src="https://code.jquery.com/jquery-3.2.1.min.js"
            type="text/javascript"></script>
    <script type="text/javascript">
      $(function() {
        $.ajax({
          url: "http://localhost:9200/visitors/doc/",
          type:'POST',
          data: JSON.stringify({ browser: navigator.userAgent,
                                 date: new Date() }),
          contentType: 'text/plain'
        });
      });
    </script>
  </body>
</html>
```

- JSON sent as text/plain
- Cross Origin Resource Sharing

common mappings

field types

text, keyword, byte, short, integer, long, float, double, boolean, date

```
"properties": {
   "user_id" : {
       "type": "long"
    }
}
```

field index

do you want this field to be queryable? true / false

```
"properties": {
   "genre" : {
      "index": "false"
    }
}
```

field analyzer

define your tokenizer and token filter. standard / whitespace / simple / english etc.

```
"properties": {
   "description" : {
      "analyzer": "english"
    }
}
```

more about analyzers

character filters

remove HTML encoding, convert & to and

tokenizer

split strings on whitespace / punctuation / non-letters

token filter

lowercasing, stemming, synonyms, stopwords

choices for analyzers

standard
: splits on word boundaries, removes punctuation, lowercases. good choice if language is unknown

simple
: splits on anything that isn't a letter, and lowercases

whitespace
: splits on whitespace but doesn't lowercase

language (i.e. english)
: accounts for language-specific stopwords and stemming

lab03: create year mapping

- Log into VM
- Use curl to create mapping for year field.
- Confirm it was created successfully

* Instructor led lab

hacking
curl

make life easier

From your home directory:

```
mkdir bin
cd bin
vi curl
```
(Hit I for insert mode)

```
#!/bin/bash
/usr/bin/curl -H "Content-Type: application/json" "$@"
```

Esc – wq! – enter

```
chmod a+x curl
```

*Instructor led lab

remember

Without this hack, you need to add

```
-H "Content-Type: application/json"
```

to every curl command!

The rest of the course assumes you have this in place.

import

one document

insert

```
curl -XPUT 127.0.0.1:9200/movies/movie/109487 -d '
{
"genre" : ["IMAX","Sci-Fi"],  "title" : "Interstellar",  "year" : 2014
}'
```


A FILM BY CHRISTOPHER NOLAN
INTERSTELLAR
LEGENDARY
SYNCOPY
WARNER BROS. PICTURES

import
many
documents

json bulk import

```
curl -XPUT 127.0.0.1:9200/_bulk –d‘
{ "create" : { "_index" : "movies", "_type" : "movie", "_id" : "135569" } }
{ "id": "135569", "title" : "Star Trek Beyond", "year":2016 , "genre":["Action", "Adventure", "Sci-Fi"] }
{ "create" : { "_index" : "movies", "_type" : "movie", "_id" : "122886" } }
{ "id": "122886", "title" : "Star Wars: Episode VII - The Force Awakens", "year":2015 , "genre":["Action", "Adventure", "Fantasy", "Sci-Fi", "IMAX"] }
{ "create" : { "_index" : "movies", "_type" : "movie", "_id" : "109487" } }
{ "id": "109487", "title" : "Interstellar", "year":2014 , "genre":["Sci-Fi", "IMAX"] }
{ "create" : { "_index" : "movies", "_type" : "movie", "_id" : "58559" } }
{ "id": "58559", "title" : "Dark Knight, The", "year":2008 , "genre":["Action", "Crime", "Drama", "IMAX"] }
{ "create" : { "_index" : "movies", "_type" : "movie", "_id" : "1924" } }
{ "id": "1924", "title" : "Plan 9 from Outer Space", "year":1959 , "genre":["Horror", "Sci-Fi"] } ‘
```

updating documents

versions

Every document has a _version field
Elasticsearch documents are immutable.
When you update an existing document:
- a new document is created with an incremented _version
- the old document is marked for deletion

partial update api

Lab:

- Look at document for Interstellar
- Run curl command to output Interstellar document data

```
curl -XGET 127.0.0.1:9200/movies/movie/109487?pretty
```


```
{
  "_index" : "movies",
  "_type" : "movie",
  "_id" : "109487",
  "_version" : 1,
  "found" : true,
  "_source" : {
    "id" : "109487",
    "title" : "Interstellar",
    "year" : 2014,
    "genre" : [
      "Sci-Fi",
      "IMAX"
    ]
  }
}
```

partial update api

```
curl -XPOST 127.0.0.1:9200/movies/movie/109487/_update -d '
{
    "doc": {
        "title": "Outerstellar"
    }
}'
```

Send data to REST API using `POST` verb
Update title for movie with id 109487
New version of document created
Old version deleted (eventually)

deleting documents

it couldn’t be easier.

Just use the DELETE method:

```
curl -XDELETE 127.0.0.1:9200/movies/movie/12345
```

lab: delete document

Now let's delete the Dark Knight

First: Find out movie ID

```
curl -s -XGET 127.0.0.1:9200/movies/_search?q=Dark
```

Second: Delete it!

```
curl -XDELETE 127.0.0.1:9200/movies/movie/58559?pretty
```

Third: Confirm it was deleted

```
curl -s -XGET 127.0.0.1:9200/movies/_search?q=Dark
```

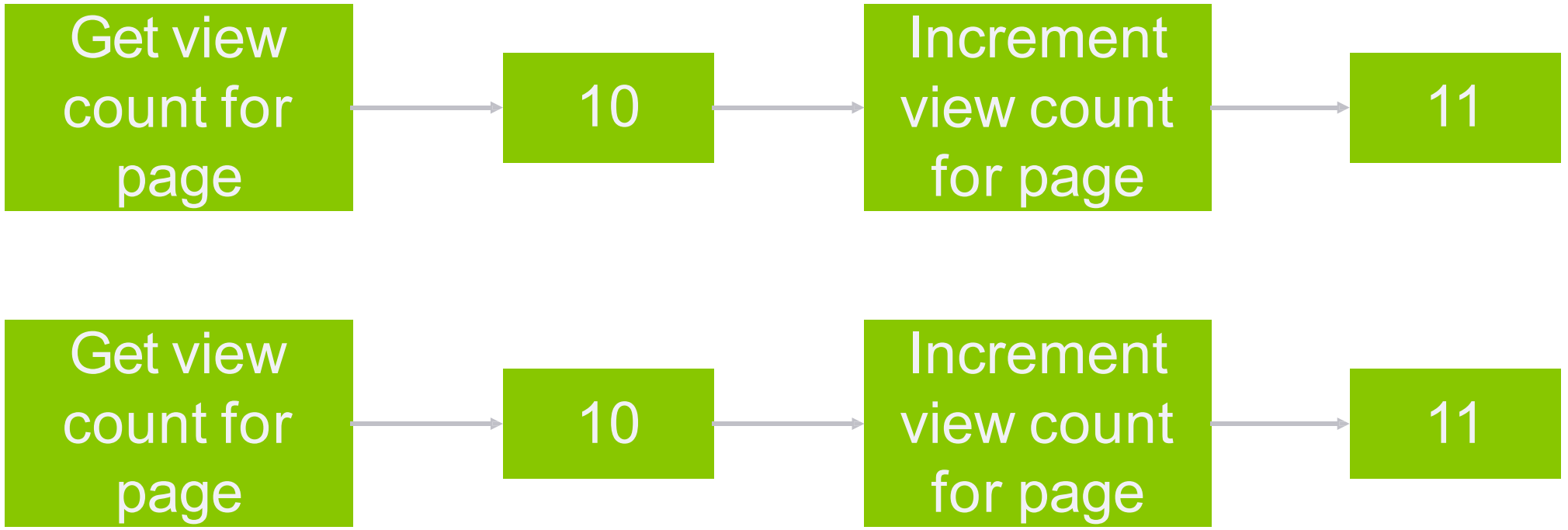
elasticsearch

exercise

insert, update, and then **delete** a movie of your choice into the movies index!

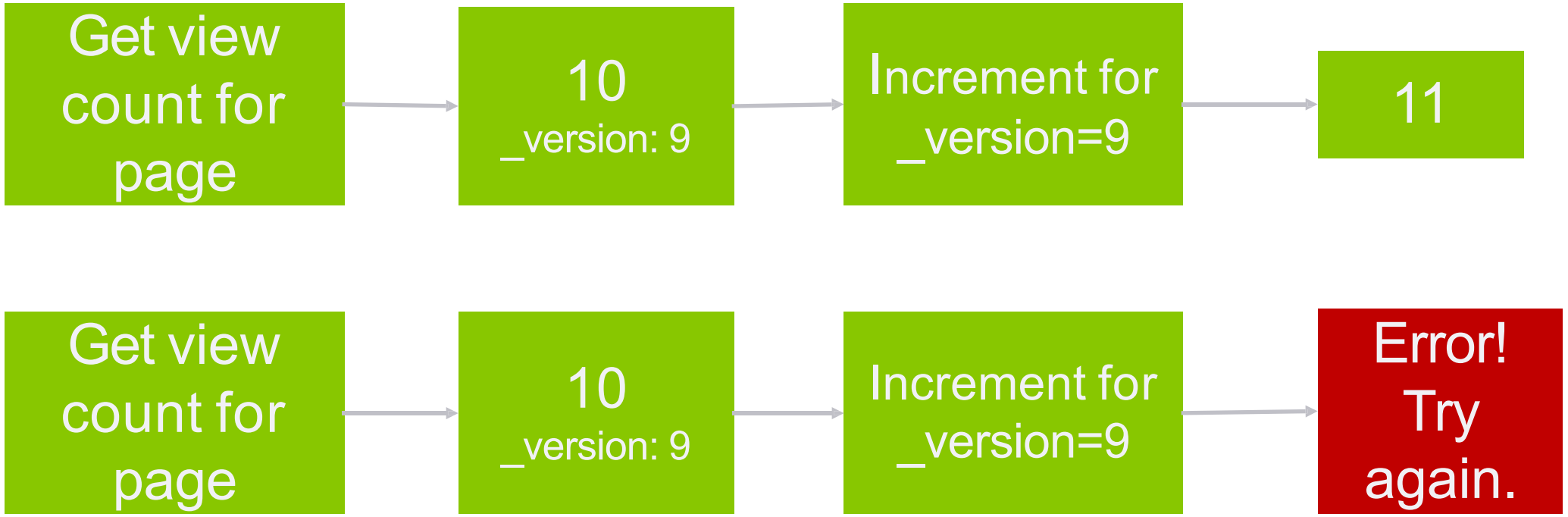
dealing with concurrency

the problem



But it should be 12!

optimistic concurrency control



Use retry_on_conflicts=N to automatically retry.

labs 4,5,6

- Lab4: Import data
- Lab5: Update documents
- Lab6: Versions & Conflict resolution

controlling

full-text search

using analyzers

sometimes text fields should be exact-match

- use **keyword** mapping type to suppress analyzing (exact match only)
- Use **text** type to allow analyzing

search on analyzed fields will return anything remotely relevant

- depending on the analyzer, results will be case-insensitive, stemmed, stopwords removed, synonyms applied, etc.
- searches with multiple terms need not match them all

Changing mappings

- Can not change mapping on existing index
- Have to delete index and start over

```
curl -XDELETE 127.0.0.1:9200/movies
```

- New mapping of "keyword" for "genre"
- New analyzer of "english" for "title"

```
curl -XPUT 127.0.0.1:9200/movies -d '
{
    "mappings" : {
        "movie": {
            "properties": {
                "id": {"type": "integer"},
                "year": {"type": "date"},
                "genre": {"type": "keyword"},
                "title": {"type": "text", "analyzer": "english"}
            }
        }
    }
}'
```

data modeling

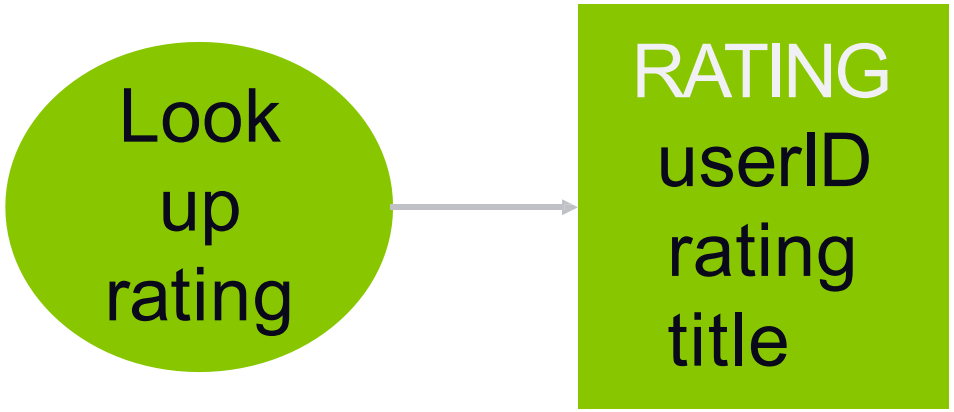
strategies for relational data

normalized data

Minimizes storage space, makes it easy to change titles
But requires two queries, and storage is cheap!

strategies for relational data

denormalized data



titles are duplicated, but only one query

strategies for relational data

Parent / Child Relationship

strategies for relational data

Series index created with mapping for relationships

Star Wars

```
curl -XPUT 127.0.0.1:9200/series -d '
{
    "mappings" : {
        "movie": {
            "properties": {
                "film_to_franchise": {"type": "join", "relations": {"franchise" : "film"}}
            }
        }
    }
}'
```

join type field

Relationship: Parent/Child

strategies for relational data

- ES6: Parents/Children all in same shard
- Forcing everything to be indexed to shard 1.
- Use relationships minimally.

```
{ "create" : { "_index" : "series", "_type" : "movie", "_id" : "1", "routing" : 1} }
{ "id": "1", "film_to_franchise": {"name": "franchise"}, "title" : "Star Wars" }
{ "create" : { "_index" : "series", "_type" : "movie", "_id" : "260", "routing" : 1} }
{ "id": "260", "film_to_franchise": {"name": "film", "parent": "1"}, "title" : "Star Wars: Episode IV - A New Hope", "year":"1977" , "genre":["Action", "Adventure", "Sci-Fi"] }
```

- Parent created: Franchise
- Fields for child created

lab: Analyzers & Relational data

- Lab 7: Create new index mapping
- Lab 8: Create index for relational data

query-line
search

“query lite”

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
  "query": {
    "match": {
      "title": "Star Trek"
    }
  }
}'
```

Proper JSON query

Query lite

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?q=title:star
```

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?q=+year:>2010+title:trek
```

it’s not always simpler.

spaces etc. need to be URLencoded.

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?q=+year:>2010+title:trek
```



```
curl -XGET 127.0.0.1:9200/movies/movie/_search?q=%2Byear%3A%3E2010+%2Btitle%3Atrek
```

and it can be dangerous.

- cryptic and tough to debug
- can be a security issue if exposed to end users
- fragile – one wrong character and you're hosed.

But it's handy for quick experimenting.

learn more.

this is formally called “URI Search”. Search for that on the Elasticsearch documentation.

it’s really quite powerful, but again is only appropriate for quick “curl tests”.

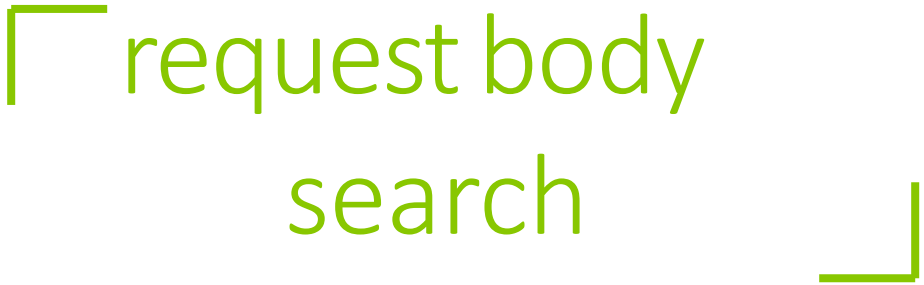
Docs

Parameters

edit

The parameters allowed in the URI are:

Name	Description
`q`	The query string (maps to the `query_string` query, see *Query String Query* for more details).
`df`	The default field to use when no field prefix is defined within the query.
`analyzer`	The analyzer name to be used when analyzing the query string.
`analyze_wildcard`	Should wildcard and prefix queries be analyzed or not. Defaults to `false`.
`batched_reduce_size`	The number of shard results that should be reduced at once on the coordinating node. This value should be used as a protection mechanism to reduce the memory overhead per search request if the potential number of shards in the request can be large.
`default_operator`	The default operator to be used, can be `AND` or `OR`. Defaults to `OR`.
`lenient`	If set to true will cause format based failures (like providing text to a numeric field) to be ignored. Defaults to false.
`explain`	For each hit, contain an explanation of how scoring of the hits was computed.
`_source`	Set to `false` to disable retrieval of the `_source` field. You can also retrieve part of the document by using `_source_include` & `_source_exclude` (see the request body documentation for more details)
`stored_fields`	The selective stored fields of the document to return for each hit, comma delimited. Not specifying any value will cause no fields to return.


request body
search

request body search

how you're supposed to do it

query DSL is in the request body as JSON
(yes, a GET request can have a body!)

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "query": {
        "match": {
            "title": "star"
        }
    }
}'
```

queries and filters

filters ask a yes/no question of your data
queries return data in terms of relevance

use filters when you can – they are faster and cacheable.

example: boolean query with a filter

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d'
{
    "query":{
        "bool": {
            "must": {"term": {"title": "trek"}},
            "filter": {"range": {"year": {"gte": 2010}}}
        }
    }
}'
```

boolean (combines multiple searches)

must (search for title, only return results newer or equal to 2010)

some types of filters

term: filter by exact values

```
{"term": {"year": 2014}}
```

terms: match if any exact values in a list match

```
{"terms": {"genre": ["Sci-Fi", "Adventure"] } }
```

range: Find numbers or dates in a given range (gt, gte, lt, lte)

```
{"range": {"year": {"gte": 2010}}}
```

exists: Find documents where a field exists

```
{"exists": {"field": "tags"}}
```

missing: Find documents where a field is missing

```
{"missing": {"field": "tags"}}
```

bool: Combine filters with Boolean logic (must, must_not, should)

some types of queries

match_all: returns all documents and is the default. Normally used with a filter.

```
{"match_all": {}}
```

match: searches analyzed results, such as full text search.

```
{"match": {"title": "star"}}
```

multi_match: run the same query on multiple fields.

```
{"multi_match": {"query": "star", "fields": ["title", "synopsis" ] } }
```

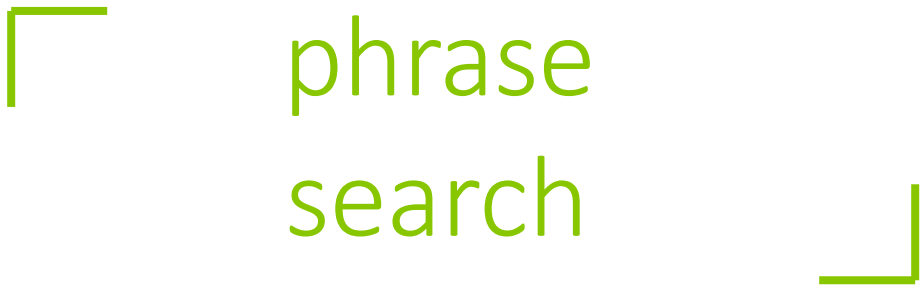
bool: Works like a bool filter, but results are scored by relevance.

syntax reminder

queries are wrapped in a “query”: { } block,
filters are wrapped in a “filter”: { } block.

you can combine filters inside queries, or queries inside filters too.

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d'
{
    "query":{
        "bool": {
            "must": {"term": {"title": "trek"}},
            "filter": {"range": {"year": {"gte": 2010}}}
        }
    }
}'
```


phrase
search

phrase matching

must find all terms, in the right order.

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d'
{
    "query":{
        "match_phrase": {
            "title": "star wars"
        }
    }
}'
```

slop

order matters, but you're OK with some words being in between the terms:

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "query": {
        "match_phrase": {
            "title": {"query": "star beyond", "slop": 1}
        }
    }
}'
```

the slop represents how far you're willing to let a term move to satisfy a phrase (in either direction!)

another example: "quick brown fox" would match "quick fox" with a slop of 1.

proximity queries

remember this is a query – results are sorted by relevance.

just use a really high slop if you want to get any documents that contain the words in your phrase, but want documents that have the words closer together scored higher.

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "query": {
        "match_phrase": {
            "title": {"query": "star beyond", "slop": 100}
        }
    }
}'
```

lab: Phrase & Slop

- Lab 9: URI, JSON, Phrase and Slop searches

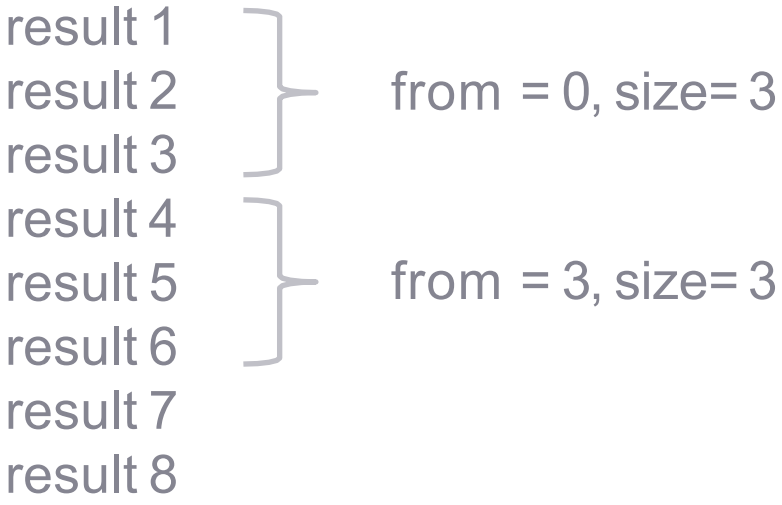
elasticsearch

exercise

search for “Star Wars” movies released after 1980, using both a URI search and a request body search.

pagination

specify “from” and “size”



pagination syntax

URI Search

```
curl -XGET '127.0.0.1:9200/movies/movie/_search?size=2&from=2&pretty'
```

JSON body

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "from": 2,
    "size": 2,
    "query": {"match": {"genre": "Sci-Fi"}}
}'
```

beware

deep pagination can kill performance.

every result must be retrieved, collected, and sorted.

enforce an upper bound on how many results you'll return to users.

sorting

sorting your results is usually quite simple.

```
curl -XGET '127.0.0.1:9200/movies/movie/_search?sort=year&pretty'
```

unless you're dealing with strings.

A text field that is analyzed for full-text search can't be used to sort documents

This is because it exists in the inverted index as individual terms, not as the entire string.

unanalyzed copy using the keyword type.

To sort analyzed field you must make a copy using keyword type and sort by that.

```
curl -XPUT 127.0.0.1:9200/movies/ -d '
{
    "mappings": {
        "movie": {  "properties" : {
            "title": {
                "type" : “text",  "fields": {
                    "raw": {
                        "type": “keyword",
                    }
                }
            }
        }
    }
}'
```

raw keyword field

Now you can sort on the unanalyzed raw field.

```
curl -XGET '127.0.0.1:9200/movies/movie/_search?sort=title.raw&pretty'
```

sadly, you cannot change the mapping on an existing index.

you'd have to delete it, set up a new mapping, and re-index it.

like the number of shards, this is something you should think about before importing data into your index.

more with
filters

complex filtered query

Science fiction movies without term "trek" in the title, released between the years of 2010 and 2015

```
curl -XGET 127.0.0.1:9200/movies/_search?pretty -d'
{
    "query":{
        "bool": {
            "must": {"match": {"genre": "Sci-Fi"}},
            "must_not": {"match": {"title": "trek"}},
            "filter": {"range": {"year": {"gte": 2010, "lt": 2015}}}
        }
    }
}'
```

elasticsearch

exercise

search for science fiction movies before 1960, sorted by title.

fuzziness

fuzzy matches

a way to account for typos and misspellings

the levenshtein edit distance accounts for:

- substitutions of characters (interstellar ->intersteller)
- insertions of characters (interstellar ->insterstellar)
- deletion of characters (interstellar ->interstelar)

all of the above have an edit distance of 1.

the fuzziness parameter

Example of Interstellar being misspelled by 2 characters.

- fuzziness = 2, so we can tolerate 2 errrors.

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "query": {
        "fuzzy": {
            "title": {"value": "intrsteller", "fuzziness": 2}
        }
    }
}'
```

AUTO fuzziness

fuzziness: AUTO

- 0 for 1-2 character strings
- 1 for 3-5 character strings
- 2 for anything else

partial
matching

prefix queries on strings

If we remapped year field to be a string, we could do a simple query as below.

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "query": {
        "prefix": {
            "year": "201"
        }
    }
}'
```

wildcard queries

```
curl -XGET 127.0.0.1:9200/movies/movie/_search?pretty -d '
{
    "query": {
        "wildcard": {
            "year": "1*"
        }
    }
}'
```

“regexp” queries also exist.