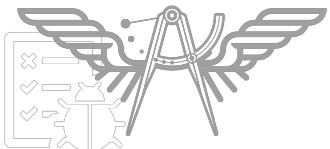


ELK Stack





Somkiat Puisungnoen

Somkiat Puisungnoen

Update Info 1 View Activity Log 10+ ...

Timeline About Friends 3,138 Photos More

When did you work at Opendream? X

... 22 Pending Items

Intro

Software Craftsmanship

Software Practitioner at สยามชัมนาณกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Post Photo/Video Live Video Life Event

What's on your mind?

Public Post

Somkiat Puisungnoen 15 mins · Bangkok · ⚙️

Java and Bigdata





Page

Messages

Notifications 3

Insights

Publishing Tools

Settings

Help ▾



somkiat.cc

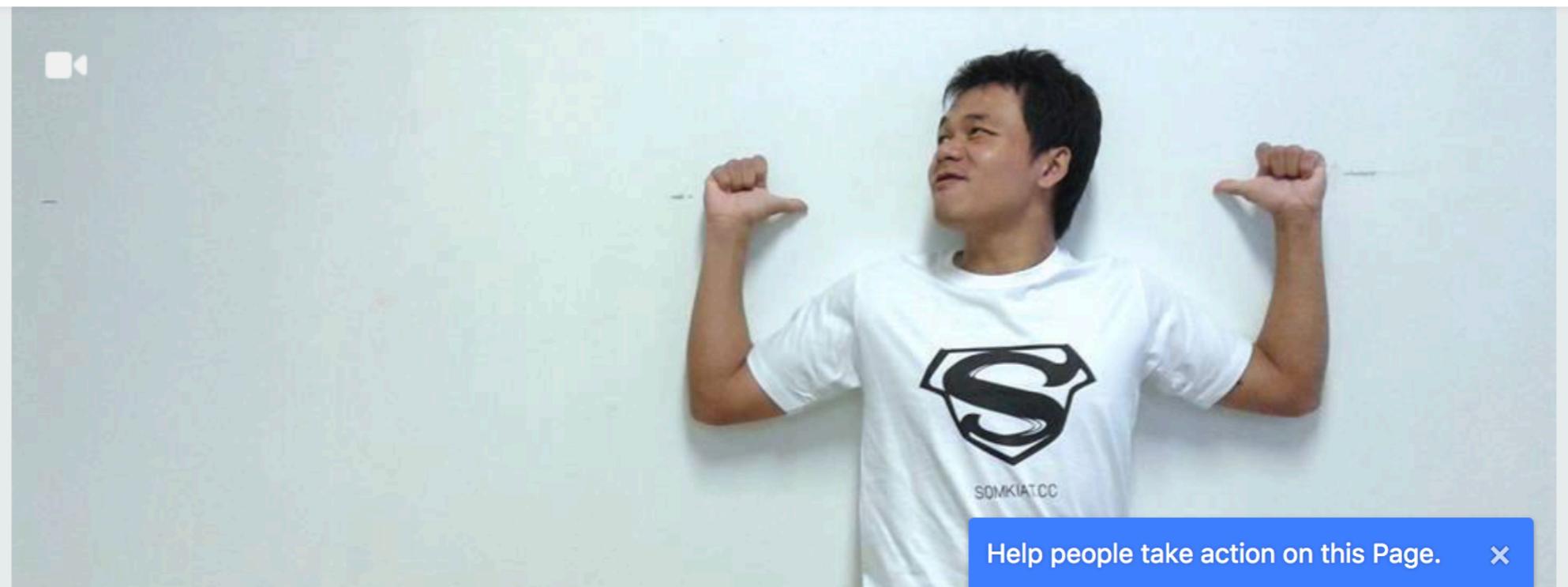
@somkiat.cc

Home

Posts

Videos

Photos



ELK Stack

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https://github.com/up1/course_elk



Agenda

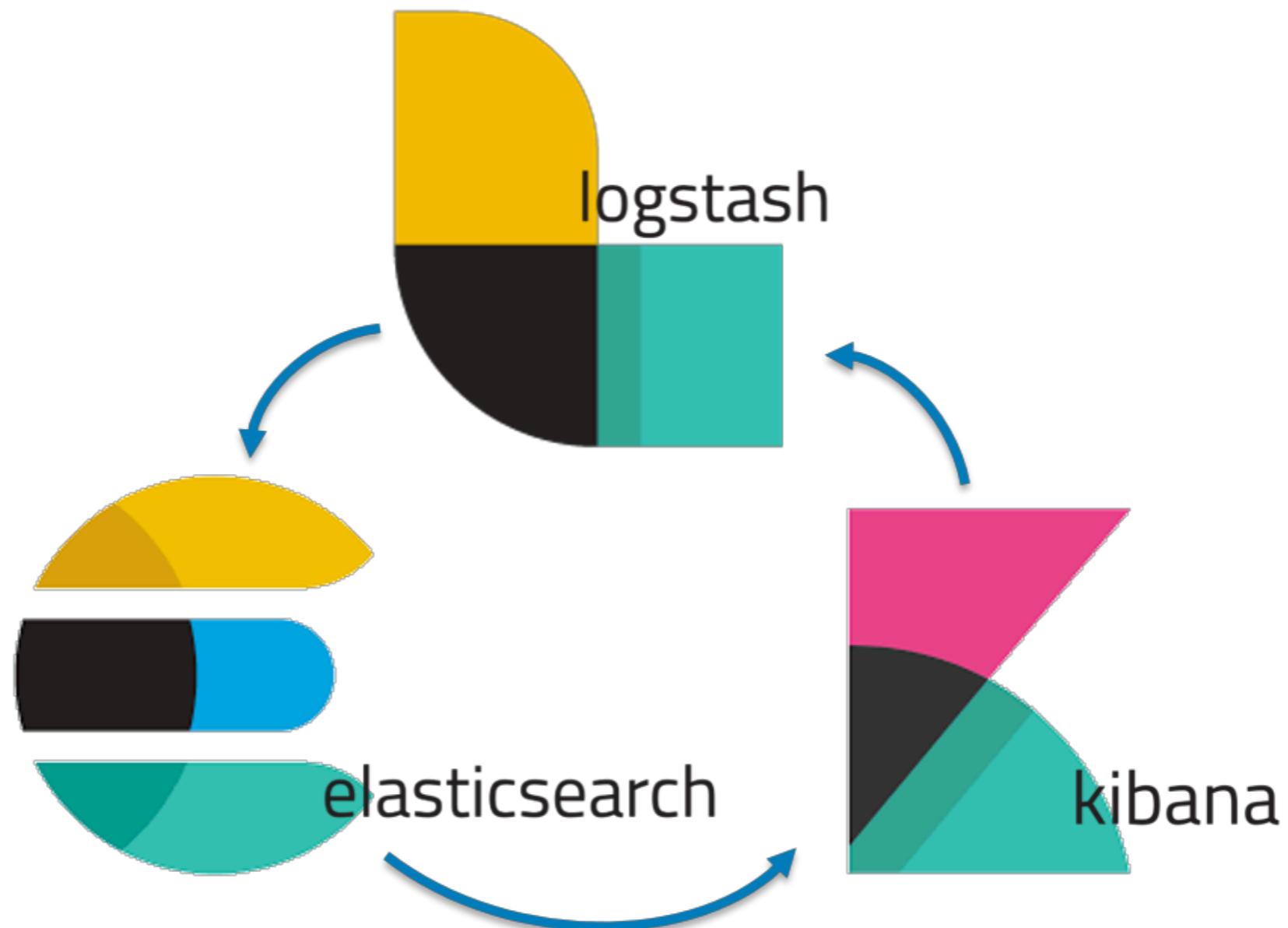
- ELK stack
- Introduction to Elasticsearch
- CRUD (Create, Read, Update, Delete)
- Search DSL (Domain Specific Language)
- Analyzer
- Mapping
- Aggregation



Agenda

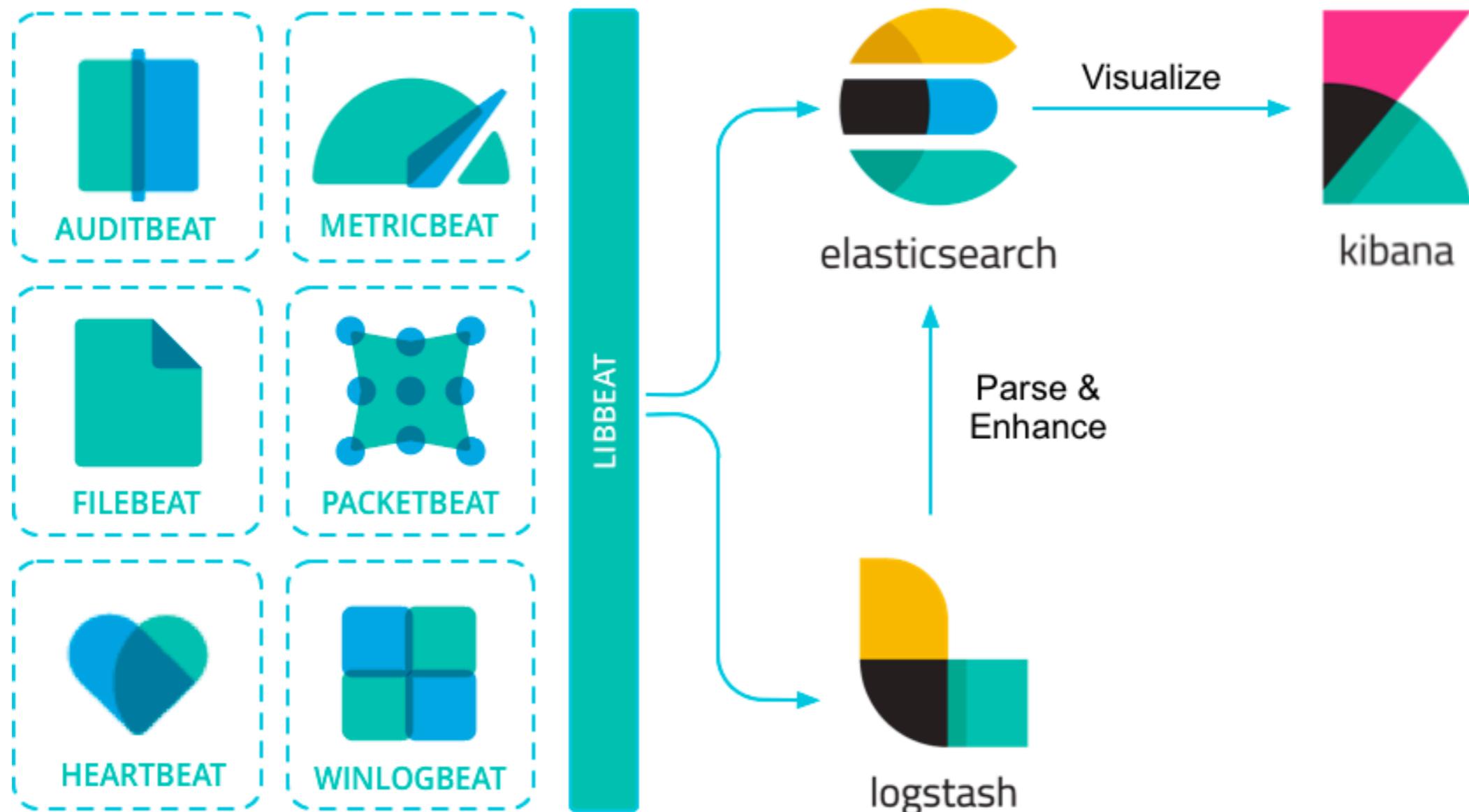
- Working with Kibana
- Useful features
 - Auto-suggestion
 - ngram algorithm
- Clustering management
- Design for scaling
- Working with Logstash







Beat



<https://www.elastic.co/guide/en/beats/libbeat/current/index.html>



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Beat

Purpose	Library
Audit data	Auditbeat
Log files	Filebeat
Cloud data	Functionbeat
Availability	Heartbeat
Metrics	Metricbeat
Network traffic	Packetbeat
Windows event logs	Winlogbeat

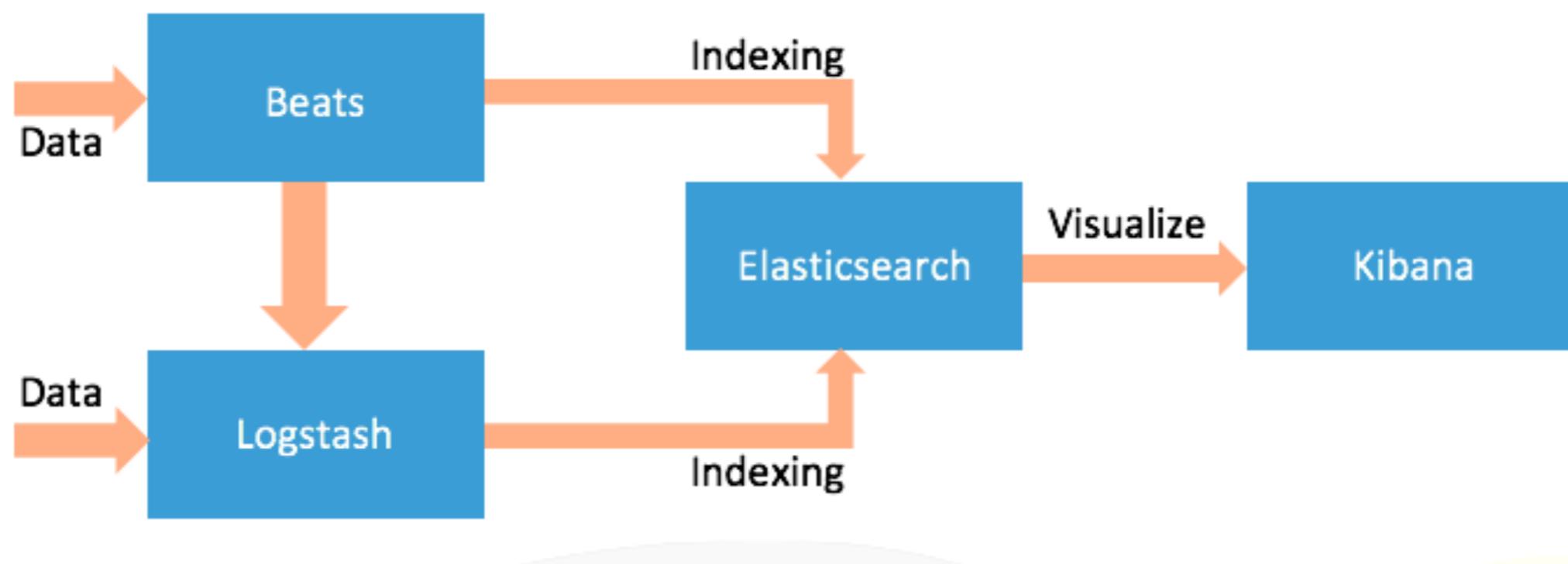
<https://www.elastic.co/guide/en/beats/libbeat/current/beats-reference.html>



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ELK stack



Elasticsearch ?



Elasticsearch

Search
Analytic
Real-time
Distributed
Scalability



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Distributed Search Engine

Open Source
Document-based
Based on **Apache Lucene**
JSON over HTTP



Distributed Search Engine



Compass



elasticsearch



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Apache Lucene

The screenshot shows the official Apache Lucene website. At the top, there's a navigation bar with a search bar containing "Search with Apache So" and a dropdown menu "select provider". Below the search bar are three tabs: "CORE (JAVA)", "SOLR", and "PYLUCENE". A large green banner features the text "Ultra-fast Search Library and Server" and the Apache Lucene logo. To the right of the banner is the Solr logo. Below the banner, a dark grey box contains the text "Apache Lucene and Solr set the standard for search and indexing performance". The main content area has a white background. It starts with a heading "Welcome to Apache Lucene" and a subtext "The Apache Lucene™ project develops open-source search software, including:". Below this is a bulleted list of projects: "Lucene Core", "Solr™", and "PyLucene". To the right of the list are two download buttons: one for "Apache Lucene 7.5.0" (green) and one for "Apache Solr 7.5.0" (orange). At the bottom right of this section is a link "Projects".

Ultra-fast Search Library and Server

Apache Lucene and Solr set the standard for search and indexing performance

Welcome to Apache Lucene

The Apache Lucene™ project develops open-source search software, including:

- [Lucene Core](#), our flagship sub-project, provides Java-based indexing and search technology, as well as spellchecking, hit highlighting and advanced analysis/tokenization capabilities.
- [Solr™](#) is a high performance search server built using Lucene Core, with XML/HTTP and JSON/Python/Ruby APIs, hit highlighting, faceted search, caching, replication, and a web admin interface.
- [PyLucene](#) is a Python port of the Core project.

[DOWNLOAD](#)

Apache Lucene 7.5.0

[DOWNLOAD](#)

Apache Solr 7.5.0

[Projects](#)

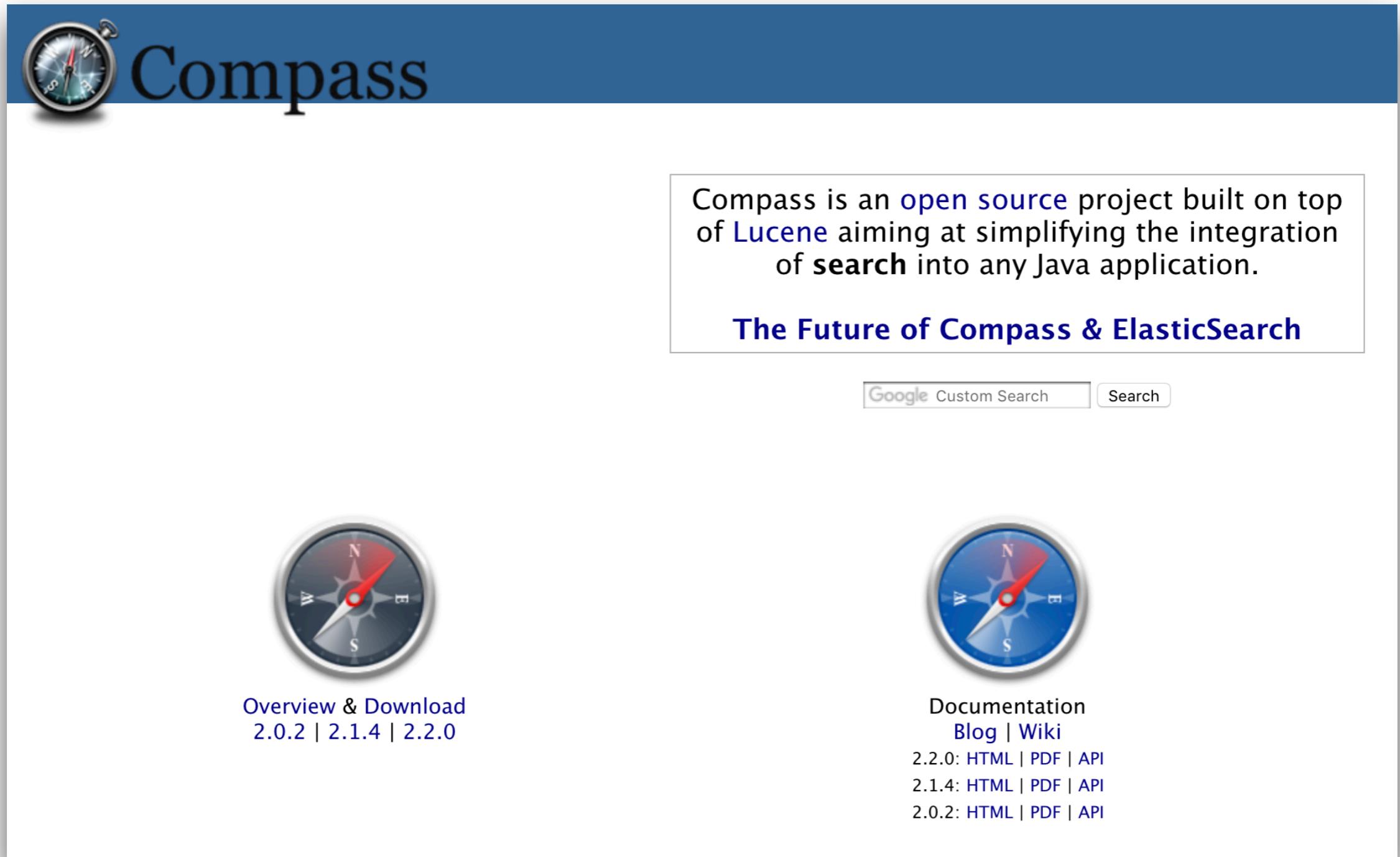
<http://lucene.apache.org/>



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Compass



The screenshot shows the official website for the Compass project. At the top left is a compass icon. To its right, the word "Compass" is written in a large, serif font. Below this, a central text box contains the following text:
Compass is an [open source](#) project built on top
of [Lucene](#) aiming at simplifying the integration
of [search](#) into any Java application.

Below this text box is a section titled "The Future of Compass & ElasticSearch". At the bottom of the page are two large compass icons, one blue and one grey, each accompanied by download links for version 2.0.2, 2.1.4, and 2.2.0. A search bar at the very bottom includes a "Google Custom Search" input field and a "Search" button.

[Overview & Download](#)
2.0.2 | 2.1.4 | 2.2.0

[Documentation](#)
[Blog](#) | [Wiki](#)
2.2.0: [HTML](#) | [PDF](#) | [API](#)
2.1.4: [HTML](#) | [PDF](#) | [API](#)
2.0.2: [HTML](#) | [PDF](#) | [API](#)

<http://www.compass-project.org/>



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Document based

JSON (JavaScript Object Notation)

Dynamic Schema (Schema-less)

Some relationship (nested, parent/child)



StackOverflow Question

```
{  
  "items": [  
    {  
      "owner": {  
        "reputation": 13,  
        "user_id": 9796344,  
        "user_type": "registered",  
        "profile_image": "",  
        "display_name": "Cherry",  
        "link": "https://stackoverflow.com/users/9796344/cherry"  
      },  
      "score": 0,  
      "last_activity_date": 1528986761,  
      "creation_date": 1528986761,  
      "post_type": "question",  
      "post_id": 50859951,  
      "link": "https://stackoverflow.com/q/50859951"  
    }  
  ],  
  "has_more": false,  
  "quota_max": 10000,  
  "quota_remaining": 9986  
}
```

<https://api.stackexchange.com/docs/posts-by-ids>



Ranking from DB Engine (2018)

343 systems in ranking, June 2018

Rank			DBMS	Database Model	Score		
Jun 2018	May 2018	Jun 2017			Jun 2018	May 2018	Jun 2017
1.	1.	1.	Oracle 	Relational DBMS	1311.25	+20.84	-40.51
2.	2.	2.	MySQL 	Relational DBMS	1233.69	+10.35	-111.62
3.	3.	3.	Microsoft SQL Server 	Relational DBMS	1087.73	+1.89	-111.23
4.	4.	4.	PostgreSQL 	Relational DBMS	410.67	+9.77	+42.13
5.	5.	5.	MongoDB 	Document store	343.79	+1.67	+8.79
6.	6.	6.	DB2 	Relational DBMS	185.64	+0.03	-1.86
7.	7.	↑ 9.	Redis 	Key-value store	136.30	+0.95	+17.42
8.	↑ 9.	↑ 11.	Elasticsearch 	Search engine	131.04	+0.60	+19.48
9.	↓ 8.	↓ 7.	Microsoft Access	Relational DBMS	130.99	-2.12	+4.44
10.	10.	↓ 8.	Cassandra 	Wide column store	119.21	+1.38	-4.91
11.	11.	↓ 10.	SQLite 	Relational DBMS	114.26	-1.19	-2.44

<https://db-engines.com/en/ranking>



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Use cases

Security/log analytics
Marketing
Operations
Searching data



Let's start



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Installation

Elasticsearch
Kibana



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Elasticsearch

Required Java 8

JDK 1.8.0_131+

Need \$JAVA_HOME



Start Elasticsearch

./bin/elasticsearch

```
[0g8-71W] loaded module [reindex]
[0g8-71W] loaded module [repository-url]
[0g8-71W] loaded module [transport-netty4]
[0g8-71W] loaded module [tribe]
[0g8-71W] no plugins loaded
[0g8-71W] using discovery type [zen]
initialized
[0g8-71W] starting ...
[0g8-71W] publish_address {127.0.0.1:9300},
[0g8-71W] recovered [0] indices into cluster_state
transport] [0g8-71W] publish_address {127.0.0.1:9200},
```



Default of Memory

1 GB !!! (Java need more memory)

```
 ] [DW5j42N] JVM arguments [-Xms1g, -Xmx1g, -  
ction=75, -XX:+UseCMSInitiatingOccupancyOnly, -XX:  
Dfile.encoding=UTF-8, -Djna.nosys=true, -XX:-Omit  
.netty.noKeySetOptimization=true, -Dio.netty.recy  
led=false, -Dlog4j2.disable.jmx=true, -Djava.io.t  
T/elasticsearch.G4kbTLZn, -XX:+HeapDumpOnOutOfMem  
s_err_pid%p.log, -Xlog:gc*,gc+age=trace,safepoint  
ize=64m, -Djava.locale.providers=COMPAT, -XX:UseA
```



Config of JVM

`$ES_HOME/config/jvm.options`

```
# Xms represents the initial size of total heap space  
# Xmx represents the maximum size of total heap space  
  
-Xms1g  
-Xmx1g
```



Default plugins

```
[o.e.p.PluginsService      ] [DW5j42N] loaded module [aggs-matrix-stats]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [analysis-common]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [ingest-common]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [lang-expression]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [lang-mustache]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [lang-painless]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [mapper-extras]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [parent-join]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [percolator]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [rank-eval]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [reindex]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [repository-url]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [transport-netty4]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [tribe]
```



Install X-Pack by default

```
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-core]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-deprecation]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-graph]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-logstash]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-ml]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-monitoring]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-rollup]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-security]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-sql]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-upgrade]
[o.e.p.PluginsService      ] [DW5j42N] loaded module [x-pack-watcher]
[o.e.p.PluginsService      ] [DW5j42N] no plugins loaded
```

<https://www.elastic.co/guide/en/elasticsearch/reference/current/installing-xpack-es.html>



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X-Pack ?

Elastic Stack Extension
Security
Monitoring
Alerting
Reporting
Machine Learning



Licence

	FREE OPEN SOURCE	BASIC	GOLD	PLATINUM
Elasticsearch	Download		Request Info	Request Info
✓ Scalability & Resiliency	✓	✓	✓	✓
✓ Query & Analytics	✓	✓	✓	✓
✓ Data Enrichment	✓	✓	✓	✓
✓ Management & Tooling	✓	✓	✓	✓
✓ Security			✓	✓
✓ Alerting			✓	✓
✓ Machine Learning				✓
Kibana				
✓ Explore & Visualize	✓	✓	✓	✓
✓ Stack Management & Tooling	✓	✓	✓	✓
✓ Stack Monitoring		✓	✓	✓

<https://www.elastic.co/subscriptions>



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Hello Elasticsearch

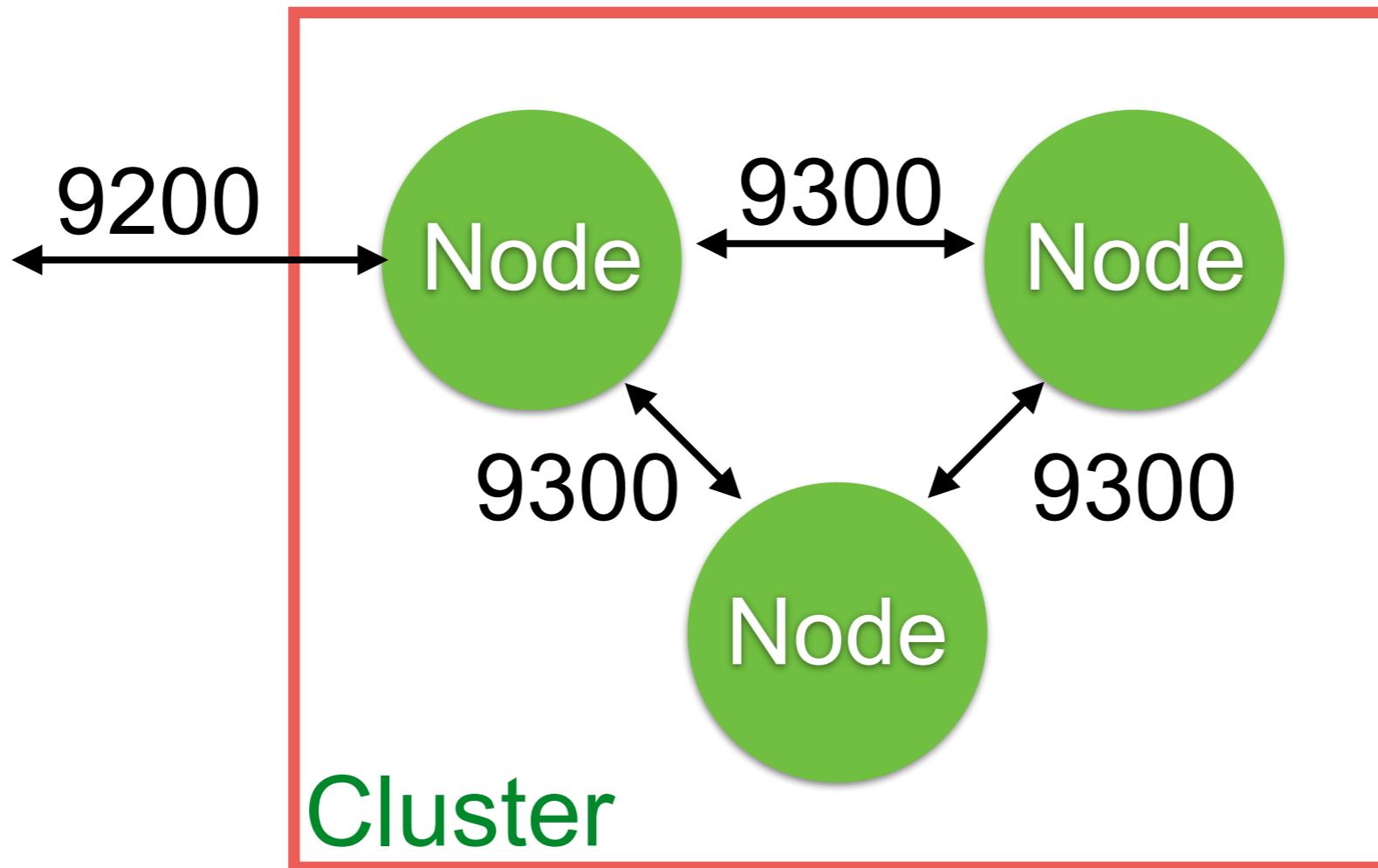
<http://localhost:9200/>

```
{  
  "name": "DW5j42N",  
  "cluster_name": "elasticsearch",  
  "cluster_uuid": "boIZeF6MSHyxZ2owIG66rg",  
  "version": {  
    "number": "6.4.2",  
    "build_flavor": "default",  
    "build_type": "tar",  
    "build_hash": "04711c2",  
    "build_date": "2018-09-26T13:34:09.098244Z",  
    "build_snapshot": false,  
    "lucene_version": "7.4.0",  
    "minimum_wire_compatibility_version": "5.6.0",  
    "minimum_index_compatibility_version": "5.0.0"  
  },  
  "tagline": "You Know, for Search"  
}
```



Ports of Elasticsearch

RESTful API with JSON Over HTTP (9200)
Java API (9300)



```
{  
  name: "19f9aJW",  
  cluster_name: "elasticsearch",  
  cluster_uuid: "jGPzn4phQOWck81uuGDUNQ",  
  - version: {  
      number: "6.5.4",  
      build_flavor: "default",  
      build_type: "tar",  
      build_hash: "d2ef93d",  
      build_date: "2018-12-17T21:17:40.758843Z",  
      build_snapshot: false,  
      lucene_version: "7.5.0",  
      minimum_wire_compatibility_version: "5.6.0",  
      minimum_index_compatibility_version: "5.0.0"  
    },  
  tagline: "You Know, for Search"  
}
```



Name of node and cluster

```
{  
  name: "19f9aJW",  
  cluster_name: "elasticsearch",  
  cluster_uuid: "jGPzn4phQOWck81uuGDUNQ",  
  - version: {  
      number: "6.5.4",  
      build_flavor: "default",  
      build_type: "tar",  
      build_hash: "d2ef93d",  
      build_date: "2018-12-17T21:17:40.758843Z",  
      build_snapshot: false,  
      lucene_version: "7.5.0",  
      minimum_wire_compatibility_version: "5.6.0",  
      minimum_index_compatibility_version: "5.0.0"  
    },  
  tagline: "You Know, for Search"  
}
```



Name of node and cluster

\$ES_HOME/config/elasticsearch.yml

```
# ----- Cluster -----  
#  
# Use a descriptive name for your cluster:  
#  
cluster.name: my-application  
#  
# ----- Node -----  
#  
# Use a descriptive name for the node:  
#  
node.name: node-1  
#  
# Add custom attributes to the node:  
#  
#node.attr.rack: r1  
#
```



Change in Elasticsearch 7.x

Default name = Hostname

<https://www.elastic.co/guide/en/elasticsearch/reference/master/breaking-changes-7.0.html>



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Try to change and restart !!!



```
{  
  name: "19f9aJW",  
  cluster_name: "elasticsearch",  
  cluster_uuid: "jGPzn4phQOWck81uuGDUNQ",  
  - version: {  
      number: "6.5.4",  
      build_flavor: "default",  
      build_type: "tar",  
      build_hash: "d2ef93d",  
      build_date: "2018-12-17T21:17:40.758843Z",  
      build_snapshot: false,  
      lucene_version: "7.5.0",  
      minimum_wire_compatibility_version: "5.6.0",  
      minimum_index_compatibility_version: "5.0.0"  
    },  
  tagline: "You Know, for Search"  
}
```



Compatibility of DSL and Index



```
{  
  name: "19f9aJW",  
  cluster_name: "elasticsearch",  
  cluster_uuid: "jGPzn4phQOWck81uuGDUNQ",  
  - version: {  
      number: "6.5.4",  
      build_flavor: "default",  
      build_type: "tar",  
      build_hash: "d2ef93d",  
      build_date: "2018-12-17T21:17:40.758843Z",  
      build_snapshot: false,  
      lucene_version: "7.5.0", DSL version  
      minimum_wire_compatibility_version: "5.6.0",  
      minimum_index_compatibility_version: "5.0.0"  
    },  
  tagline: "You Know, for Search" Index version  
}
```



```
{  
  name: "19f9aJW",  
  cluster_name: "elasticsearch",  
  cluster_uuid: "jGPzn4phQOWck81uuGDUNQ",  
  - version: {  
      number: "6.5.4",  
      build_flavor: "default",  
      build_type: "tar",  
      build_hash: "d2ef93d",  
      build_date: "2018-12-17T21:17:40.758843Z",  
      build_snapshot: false,  
      lucene_version: "7.5.0",  
      minimum_wire_compatibility_version: "5.6.0",  
      minimum_index_compatibility_version: "5.0.0"  
    },  
  tagline: "You Know, for Search" Index version  
}
```



Health of cluster

http://localhost:9200/_cluster/health

```
{  
  "cluster_name": "elasticsearch",  
  "status": "green",  
  "timed_out": false,  
  "number_of_nodes": 1,  
  "number_of_data_nodes": 1,  
  "active_primary_shards": 0,  
  "active_shards": 0,  
  "relocating_shards": 0,  
  "initializing_shards": 0,  
  "unassigned_shards": 0,  
  "delayed_unassigned_shards": 0,  
  "number_of_pending_tasks": 0,  
  "number_of_in_flight_fetch": 0,  
  "task_max_waiting_in_queue_millis": 0,  
  "active_shards_percent_as_number": 100.0  
}
```



Health of cluster

Status	Meaning
Green	All shards are allocated
Yellow	Primary shard is allocated, but replicas are not
Red	Shard not allocated in the cluster



cat APIs

`http://localhost:9200/_cat`

```
=^.^=
/_cat/allocation
/_cat/shards
/_cat/shards/{index}
/_cat/master
/_cat/nodes
/_cat/tasks
/_cat/indices
/_cat/indices/{index}
/_cat/segments
/_cat/segments/{index}
/_cat/count
/_cat/count/{index}
/_cat/recovery
/_cat/recovery/{index}
/_cat/health
/_cat/pending_tasks
/_cat/aliases
/_cat/aliases/{alias}
```

<https://www.elastic.co/guide/en/elasticsearch/reference/current/cat.html>



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cat APIs

`http://localhost:9200/_cat/nodes?v`

ip	heap.percent	ram.percent	cpu	load_1m	load_5m	load_15m	node.role	master	name
127.0.0.1	20	100	7	1.98			mdi	*	DW5j42N



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Start Kibana

```
[status][plugin:xpack_main@6.4.2] Status changed from yellow to green - Ready
[status][plugin:searchprofiler@6.4.2] Status changed from yellow to green - Ready
[status][plugin:ml@6.4.2] Status changed from yellow to green - Ready
[status][plugin:tilemap@6.4.2] Status changed from yellow to green - Ready
[status][plugin:watcher@6.4.2] Status changed from yellow to green - Ready
[status][plugin:index_management@6.4.2] Status changed from yellow to green - Ready

[status][plugin:graph@6.4.2] Status changed from yellow to green - Ready
[status][plugin:grokdebugger@6.4.2] Status changed from yellow to green - Ready
[status][plugin:logstash@6.4.2] Status changed from yellow to green - Ready
[status][plugin:reporting@6.4.2] Status changed from yellow to green - Ready
[kibana-monitoring][monitoring-ui] Starting monitoring stats collection
[status][plugin:security@6.4.2] Status changed from yellow to green - Ready
[license][xpack] Imported license information from Elasticsearch for the [monitor]
tatus: active
[listening][server][http] Server running at http://localhost:5601
```



Hello Kibana

<http://localhost:5601/>

The image shows the Kibana landing page. On the left is a vertical sidebar with icons for APM, Logging, Metrics, Security analytics, Dashboard, Discover, Visualize, Timelion, and Saved Objects. The main content area is divided into several sections:

- Add Data to Kibana**:
 - APM**: APM automatically collects in-depth performance metrics and errors from inside your applications. [Add APM](#)
 - Logging**: Ingest logs from popular data sources and easily visualize in preconfigured dashboards. [Add log data](#)
 - Metrics**: Collect metrics from the operating system and services running on your servers. [Add metric data](#)
 - Security analytics**: Centralize security events for interactive investigation in ready-to-go visualizations. [Add security events](#)
- Data already in Elasticsearch?**: [Set up index patterns](#)
- Visualize and Explore Data**:
 - Dashboard**: Display and share a collection of visualizations and saved searches.
 - Timelion**: Use an expression language to analyze time series data
 - Discover**: Interactively explore your data by querying and filtering raw documents.
 - Visualize**: Create visualizations and aggregate data stores in your
- Manage and Administer the Elastic Stack**:
 - Console**: Skip cURL and use this JSON interface to work with your data directly.
 - Index Patterns**: Manage the index patterns that help retrieve your data from Elasticsearch.
 - Saved Objects**: Import, export, and manage your saved searches,



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Using Dev Tools

The screenshot shows the Kibana interface with a sidebar on the left and a main content area on the right.

Left Sidebar:

- Kibana logo
- Discover
- Visualize
- Dashboard
- Timelion
- APM
- Dev Tools** (highlighted with a red box)
- Monitoring
- Management

Main Content Area:

Dev Tools

Welcome to Console

Quick intro to the UI

The Console UI is split into two panes: an editor pane (left) and a response pane (right). Use the editor to type requests and submit them in the response pane on the right side.

Console understands requests in a compact format, similar to cURL:

```
1 # index a doc
2 PUT index/type/1
3 {
4   "body": "here"
5 }
6
7 # and get it ...
8 GET index/type/1
```

While typing a request, Console will make suggestions which you can then accept by hitting Enter/Tab. These suggestions are made based on types.

A few quick tips, while I have your attention

- Submit requests to ES using the green triangle button.
- Use the wrench menu for other useful things.
- You can paste requests in cURL format and they will be translated to the Console syntax.
- You can resize the editor and output panes by dragging the separator between them.
- Study the keyboard shortcuts under the Help button. Good stuff in there!

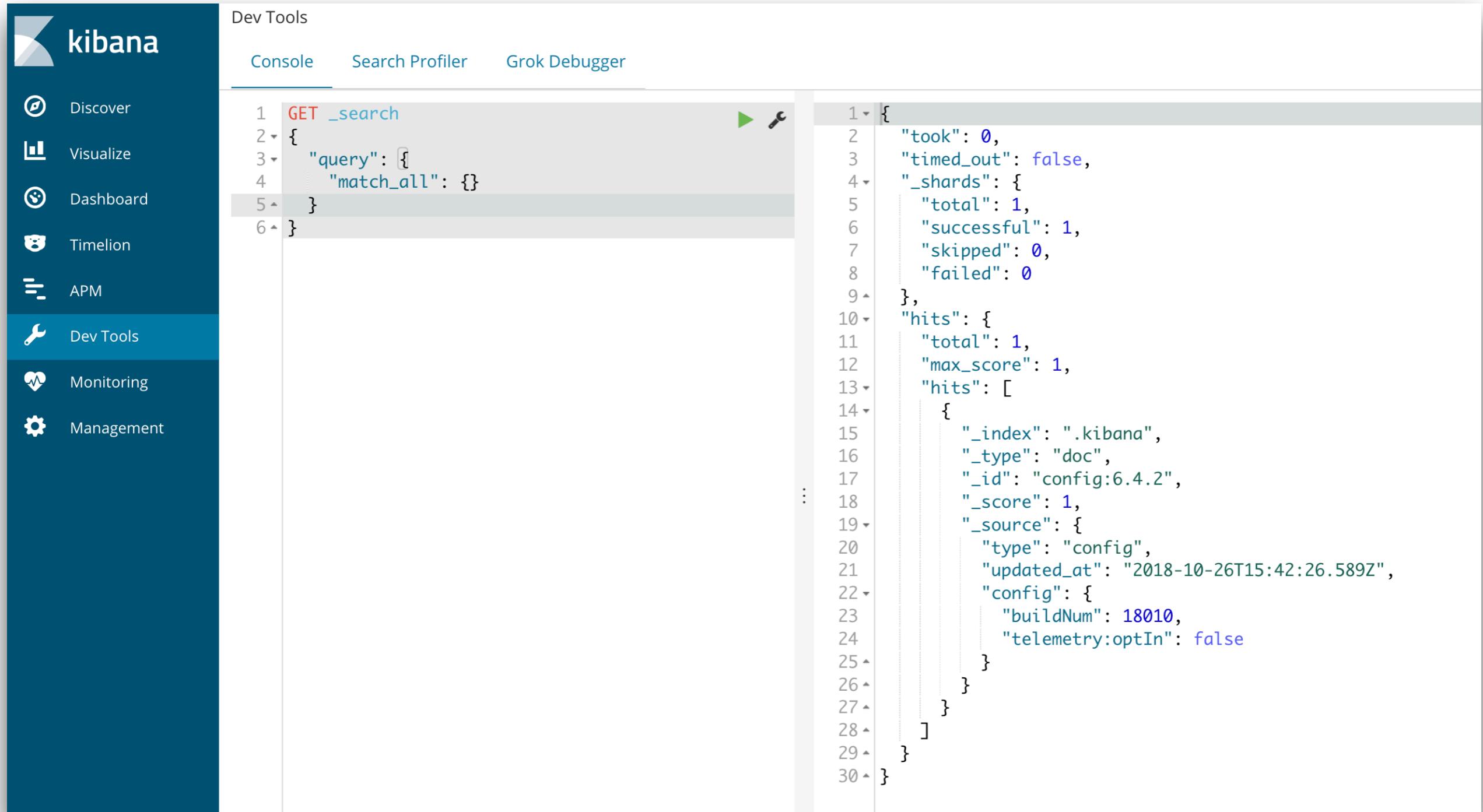
[Get to work](#)



ELK Stack

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Ready to start



The screenshot shows the Kibana Dev Tools interface. On the left is a sidebar with icons for Discover, Visualize, Dashboard, Timelion, APM, Dev Tools (which is selected), Monitoring, and Management. The main area is titled "Dev Tools" and contains three tabs: Console, Search Profiler, and Grok Debugger. The "Console" tab is active, displaying a code editor with a GET _search request and its JSON response. The request is:

```
1 GET _search
2 {
3   "query": {
4     "match_all": {}
5   }
6 }
```

The response is:

```
1 {
2   "took": 0,
3   "timed_out": false,
4   "_shards": {
5     "total": 1,
6     "successful": 1,
7     "skipped": 0,
8     "failed": 0
9   },
10  "hits": {
11    "total": 1,
12    "max_score": 1,
13    "hits": [
14      {
15        "_index": ".kibana",
16        "_type": "doc",
17        "_id": "config:6.4.2",
18        "_score": 1,
19        "_source": {
20          "type": "config",
21          "updated_at": "2018-10-26T15:42:26.589Z",
22          "config": {
23            "buildNum": 18010,
24            "telemetry:optIn": false
25          }
26        }
27      }
28    ]
29  }
30 }
```



ELK Stack

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Basic concepts



Basic concepts

Cluster

Node

Index

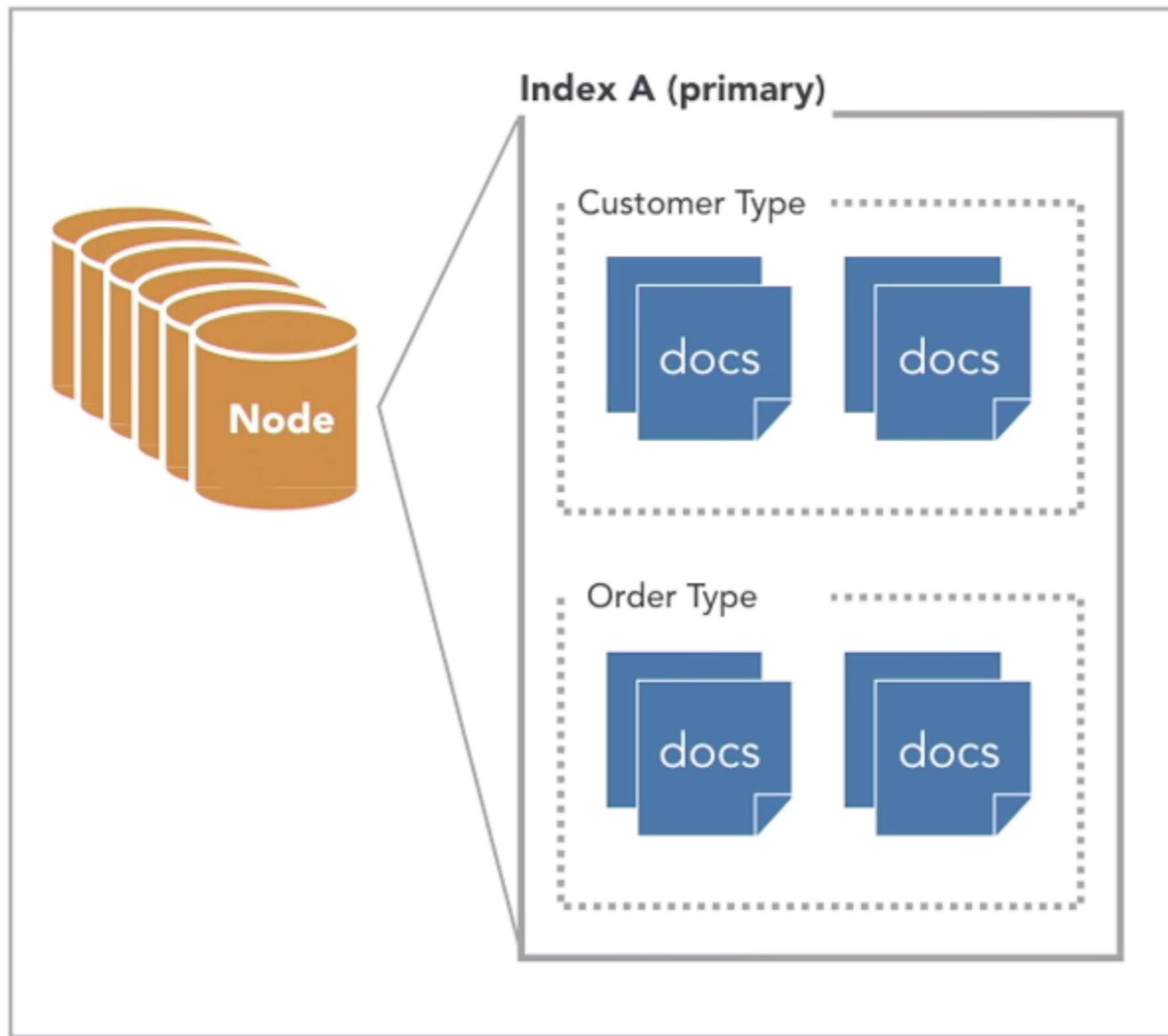
Type

Document

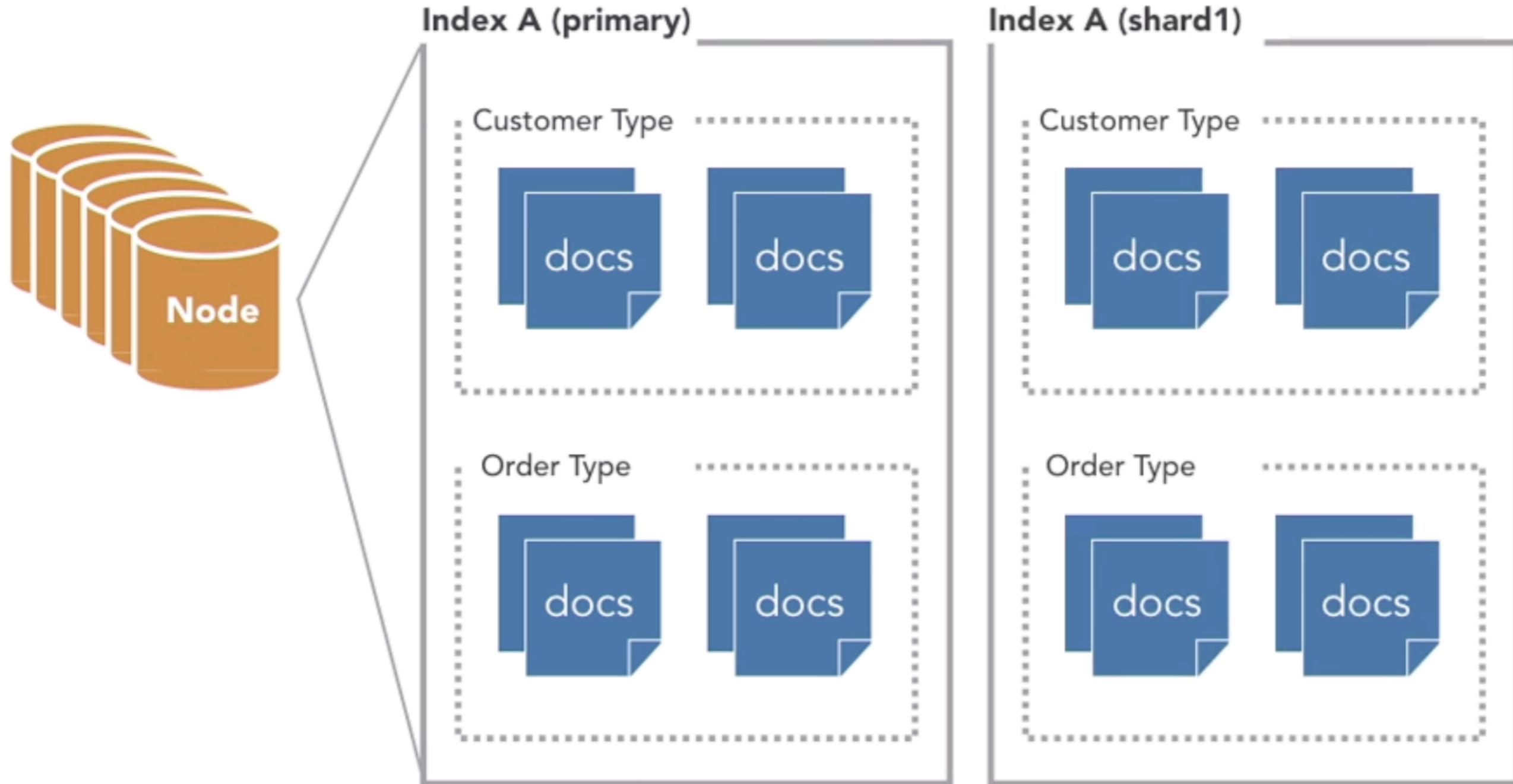
Shard/Replica



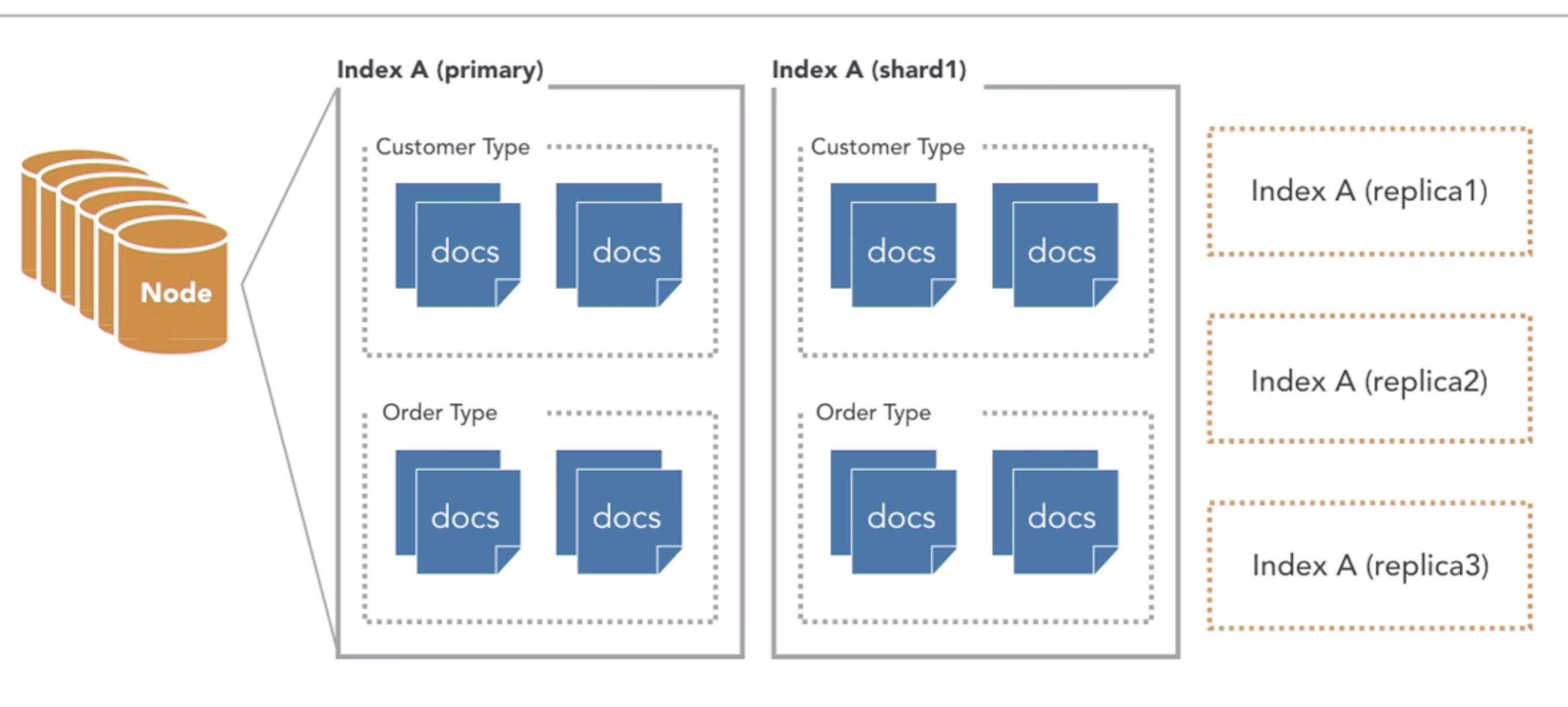
Cluster



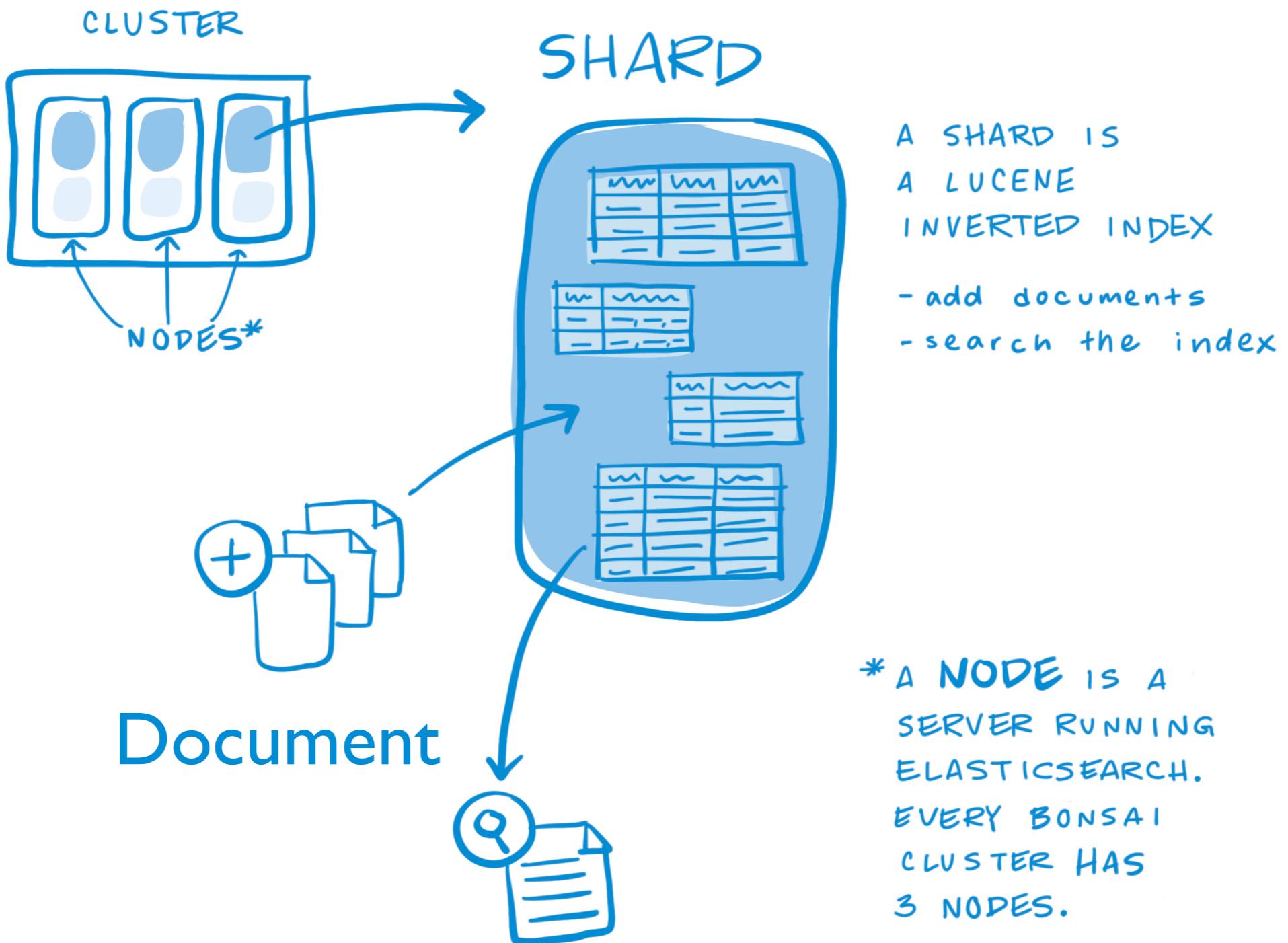
Cluster with shard



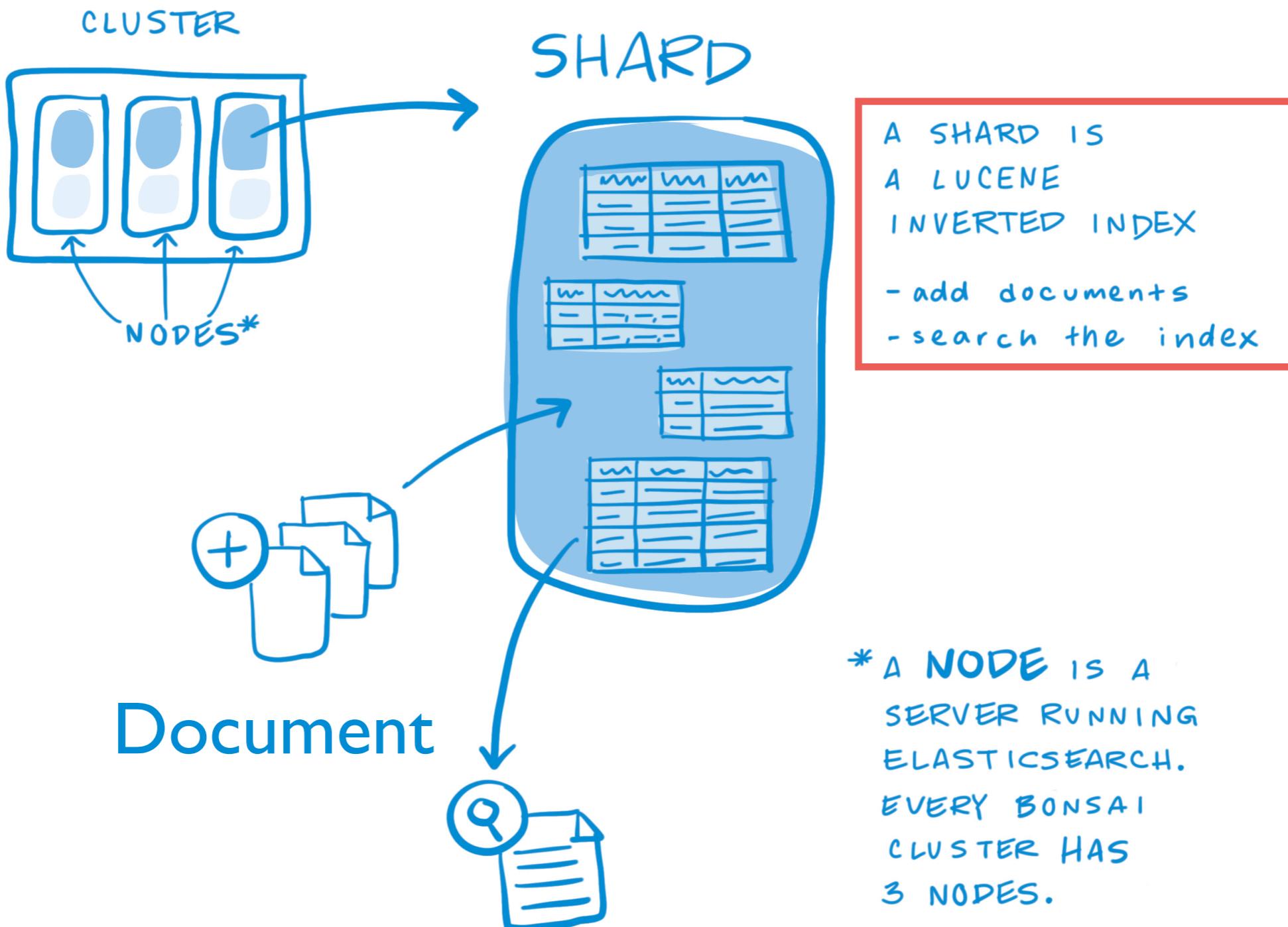
Cluster with replica



Basic concepts

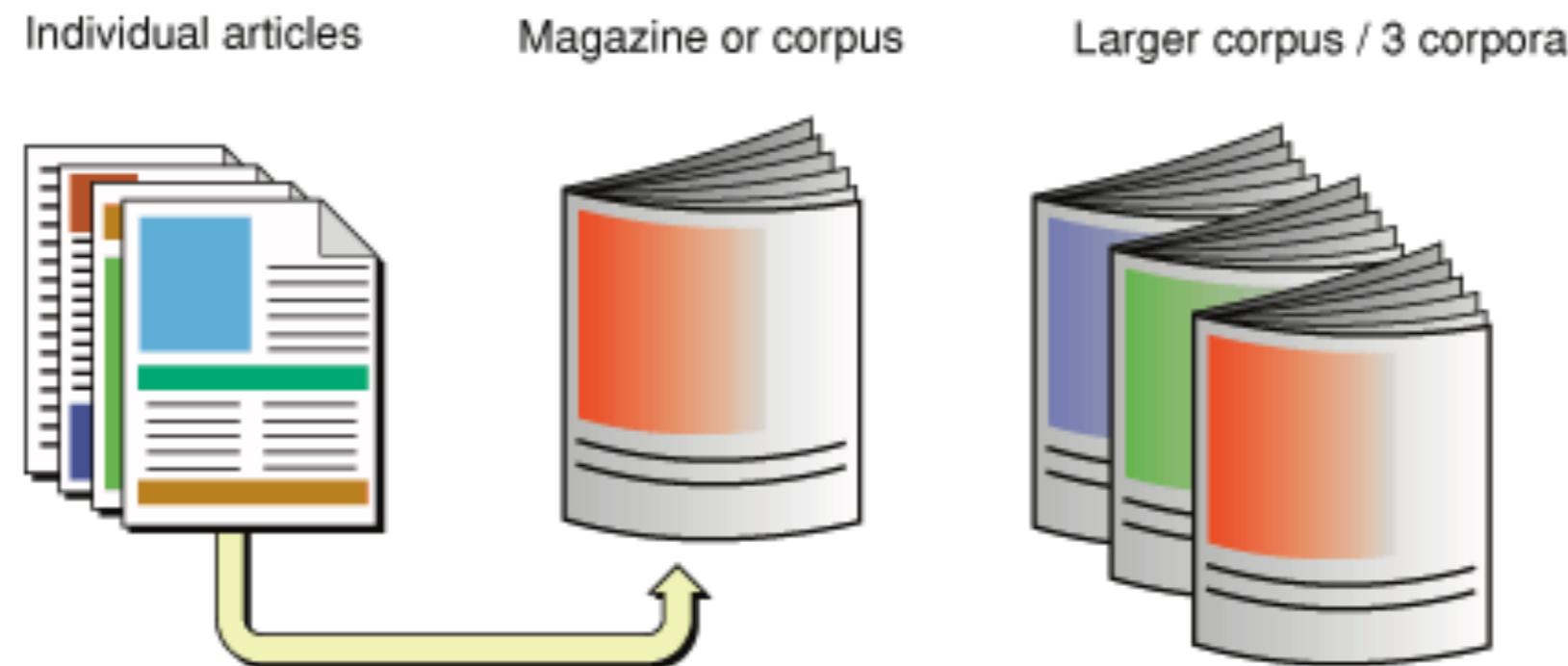


Basic concepts



Inverted Index

Corpus is a collection of documents



https://developer.apple.com/library/archive/documentation/UserExperience/Conceptual/SearchKitConcepts/searchKit_basics/searchKit_basics.html#/apple_ref/doc/uid/TP40002843-TPXREF101

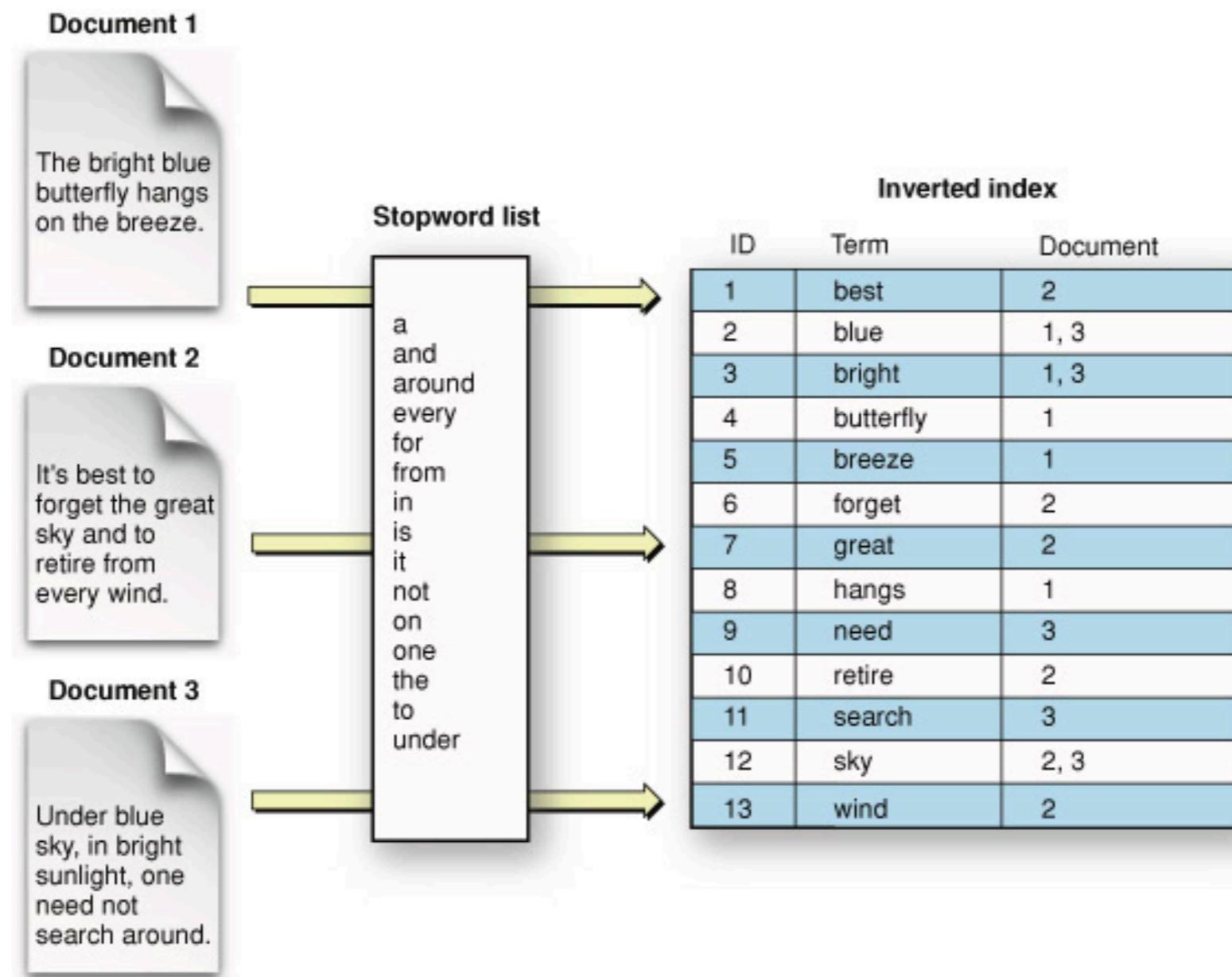


ELK Stack

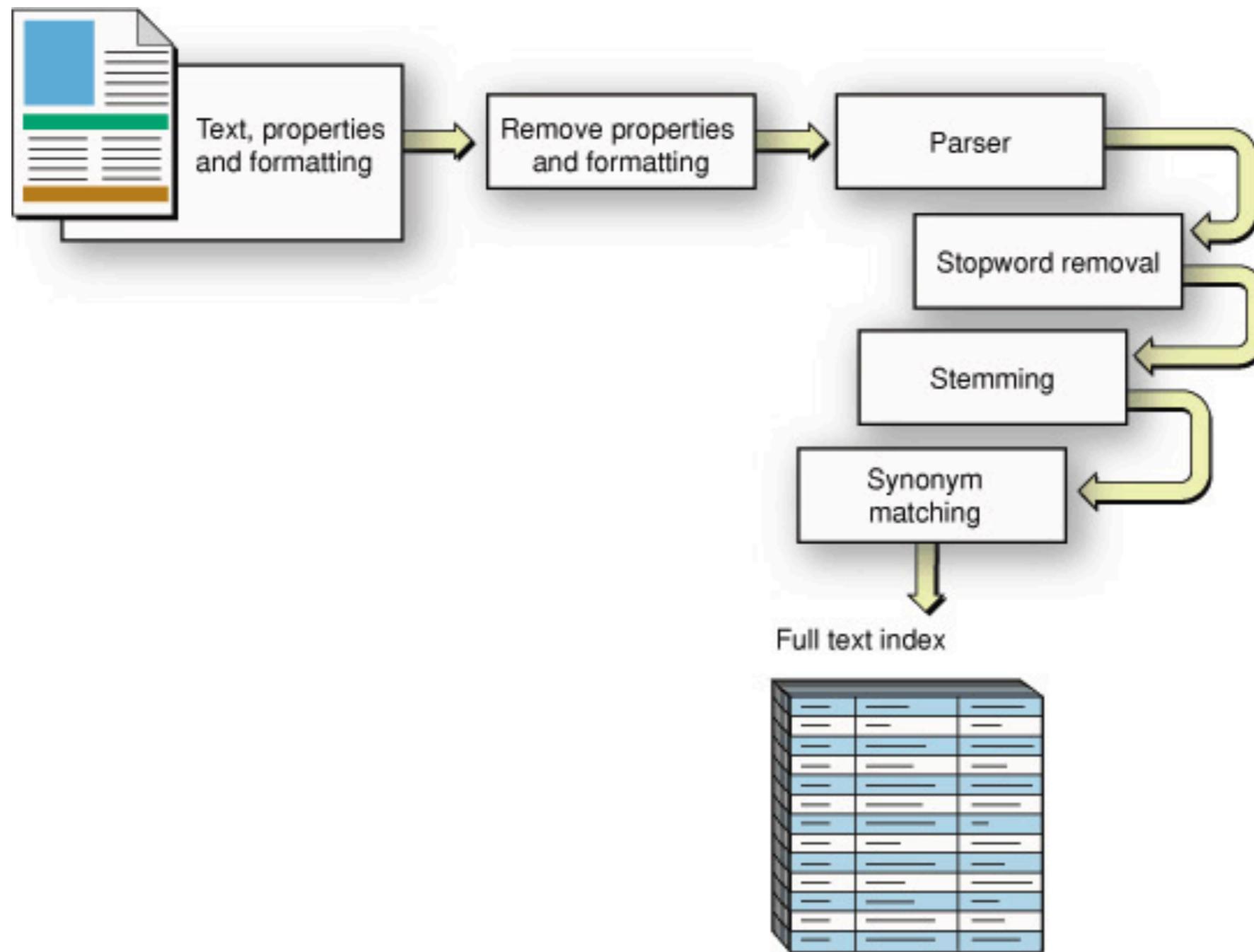
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Inverted Index

Try to construct index



Text extraction



CRUD with Elasticsearch

02-crud/book_document.json



CRUD with Elasticsearch

Create document

Read document

Update document

Delete document



Create a document

PUT /store/book/1

```
{  
  "title": "Elasticsearch: The Definitive Guide",  
  "author_name": [  
    "Clinton Gormley",  
    "Zachary Tong"  
,  
  "tag": [  
    "search",  
    "computer"  
,  
  "isbn-13": "978-1449358549",  
  "isbn-10": "1449358543",  
  "price": 44.3,  
  "page": 724,  
}
```



Create document

PUT **/store/book/1**

Index name

Type name

Document ID



Compare with RDBMS

Database

Table

Row

Column

Index

Type*

Document

Field

* Only 1 type per index



Change in Elasticsearch 7.x

of shard of index change from 5 to 1

```
#! Deprecation: the default number of shards will change  
from [5] to [1] in 7.0.0; if you wish to continue using  
the default of [5] shards, you must manage this on the  
create index request or with an index template
```

```
{  
  "_index": "store1",  
  "_type": "book",  
  "_id": "2",  
  "_version": 1,  
  "result": "created",  
  "_shards": {  
    "total": 5,  
    "successful": 5,  
    "failed": 0  
  }  
}
```



Read document

GET /store/book/1

```
{  
  "_index": "store",  
  "_type": "book",  
  "_id": "1",  
  "_version": 1,  
  "found": true,  
  "_source": {  
    "title": "Elasticsearch: The Definitive Guide",  
    "author_name": [  
      "Clinton Gormley",  
      "Zachary Tong"  
    ],  
    "tag": [  
      "search",  
      "computer"  
    ]  
  }  
}
```

Information of document



Update document

Whole document
Partial document



Update whole document

PUT /store/book/123

```
{  
  "title": "Update",  
  "author_name": [  
    "user1",  
    "user2"  
  ],  
  "tag": [  
    "update",  
    "book"  
  ]  
}
```



Update partial document

POST /store/book/123/_update

```
{  
  "doc": {  
    "title": "partial update",  
    "tag": [  
      "test",  
      "computer"  
    ],  
    "views": 0  
  }  
}
```



Delete document

DELETE /store/book/1

```
{  
  "_index": "store",  
  "_type": "book",  
  "_id": "1",  
  "_version": 2,  
  "result": "deleted",  
  "_shards": {  
    "total": 2,  
    "successful": 1,  
    "failed": 0  
  },  
  "_seq_no": 1,  
  "_primary_term": 1  
}
```



More features

Update by query

Delete by query

Partial update document



Workshop

02-crud/book_document.json



Bulk API

03-bulk/book_bulk.json

<https://www.elastic.co/guide/en/elasticsearch/reference/current/docs-bulk.html>



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Bulk API

Perform many index/delete operation in single API call

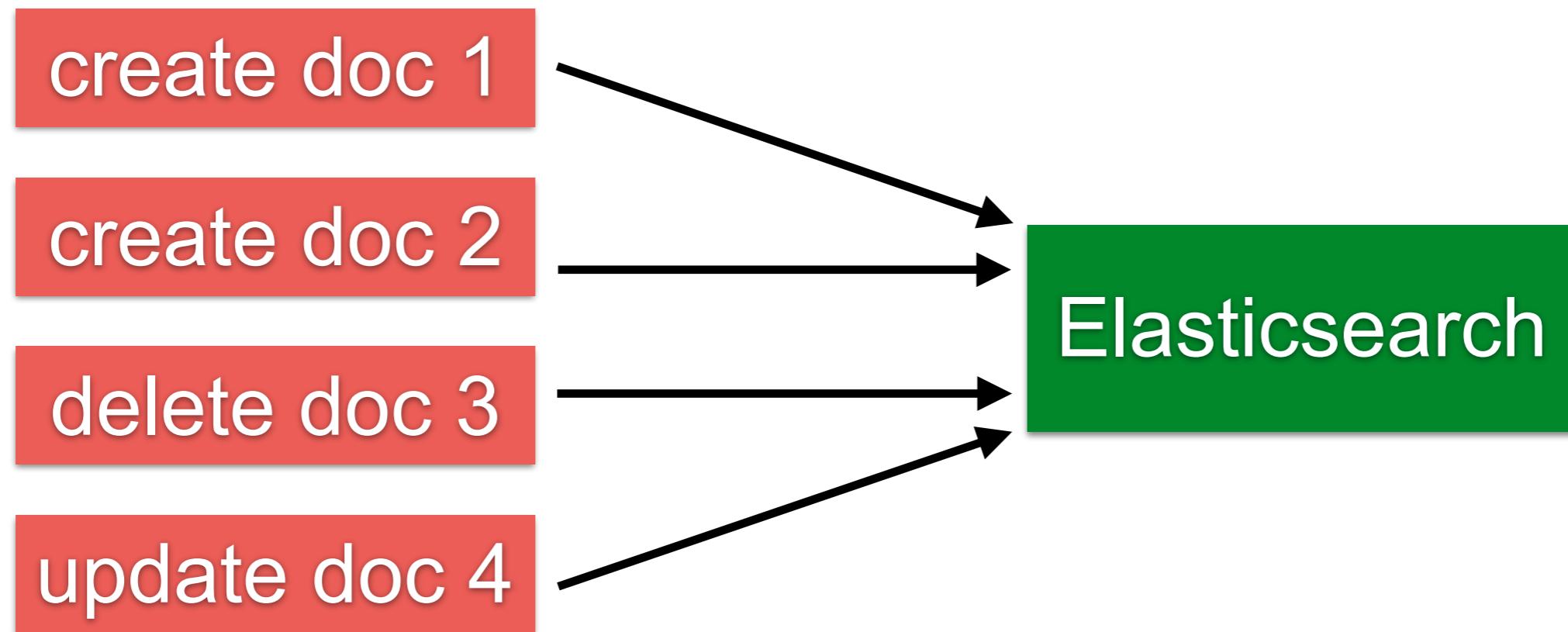
Increase indexing speed



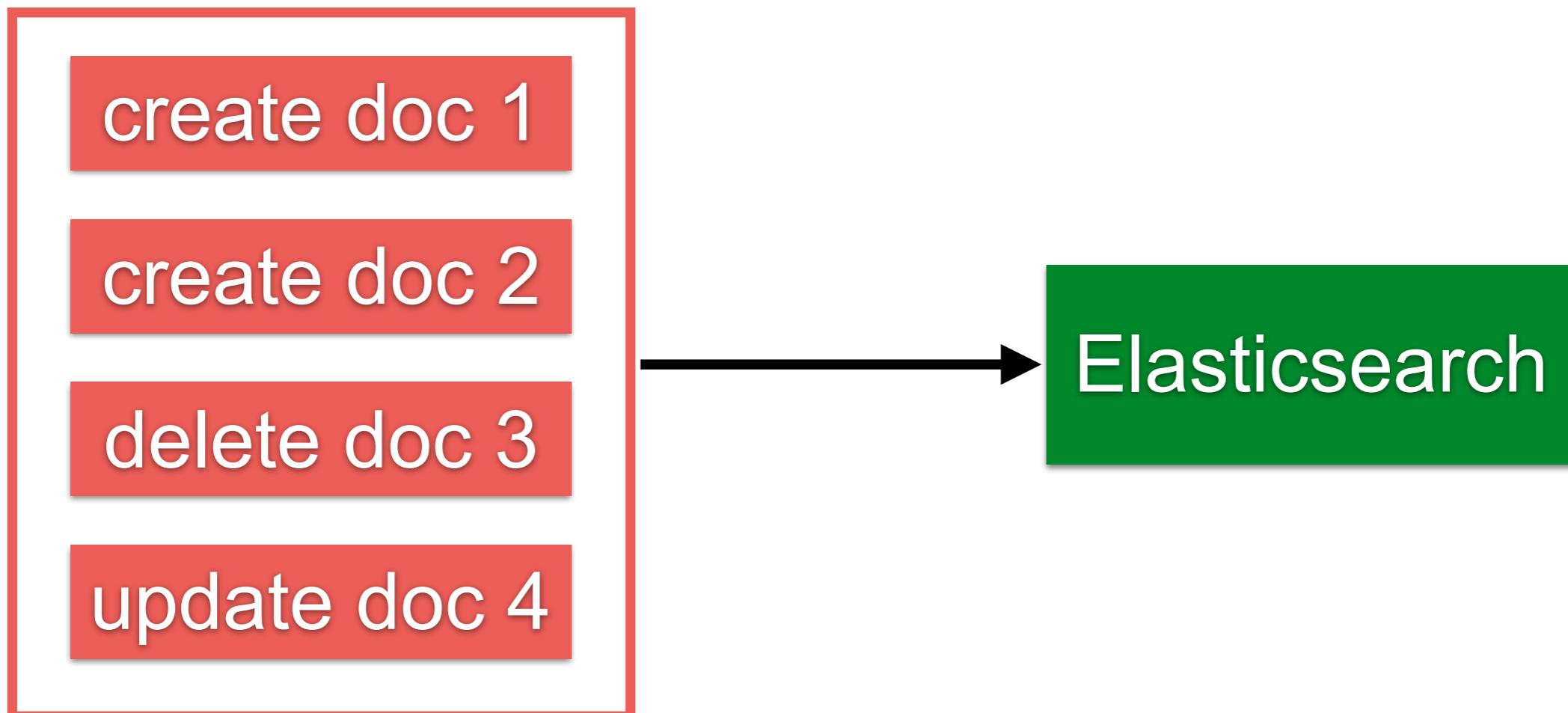
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Without Bulk API



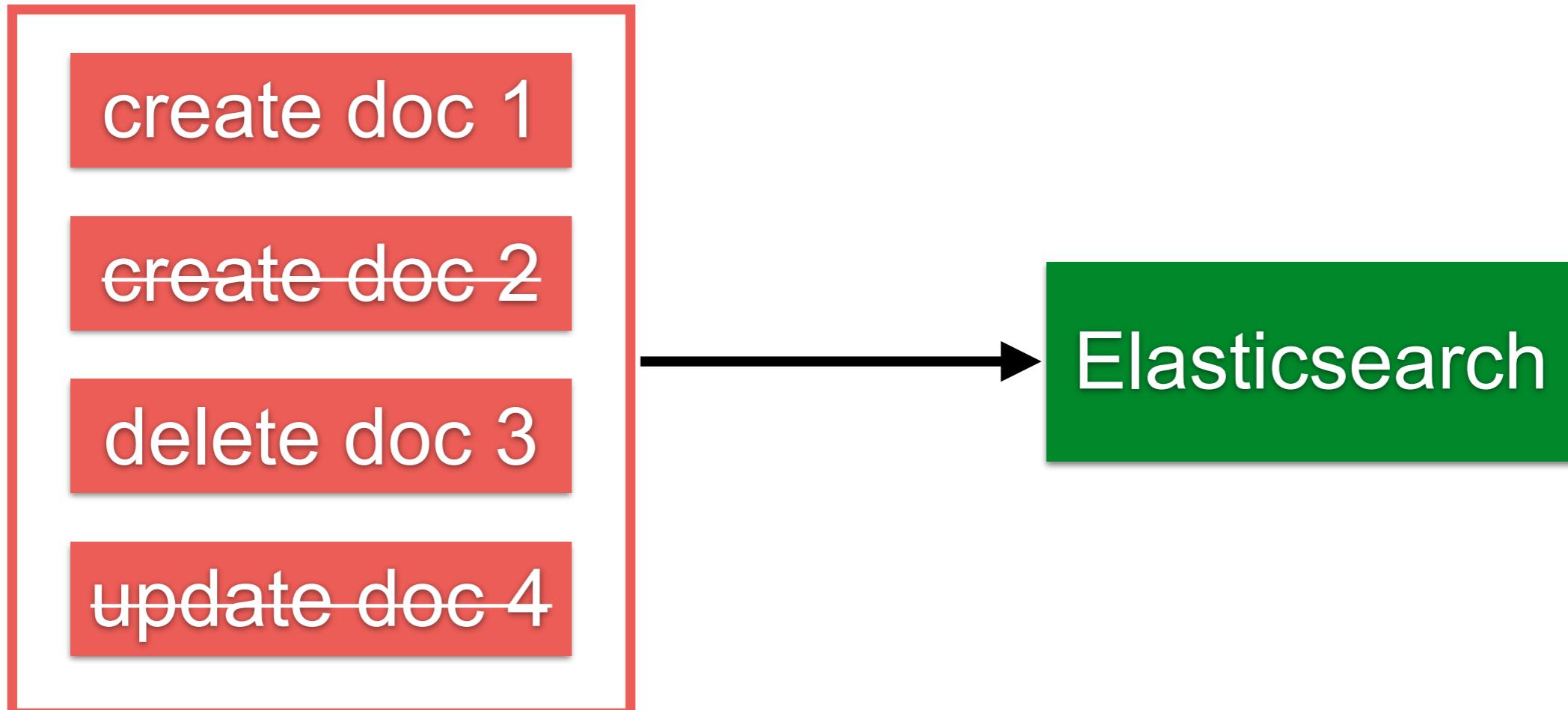
With Bulk API



Store in memory 5-15 MB



No transaction in bulk api



Create a document

POST /store/book/_bulk

```
{"create": {"_id": "1001"}  
{"title": "new book 1000", "description": "my new book"}}
```



Response from Bulk API

```
{  
  "took": 89,  
  "errors": false,  
  "items": [  
    {  
      "create": {  
        "_index": "store",  
        "_type": "book",  
        "_id": "1001",  
        "_version": 1,  
        "result": "created",  
        "_shards": {  
          "total": 2,  
          "successful": 1,  
          "failed": 0  
        },  
        "_seq_no": 0,  
        "_primary_term": 1,  
        "status": 201  
      }  
    }  
  ]  
}
```

Time in milliseconds

HTTP Status 201 = Created



Search API

04-search/search_api.json



Query DSL

04-search/book_search.json



Query DSL

Domain Specific Language for query data
Flexible query language
Based on JSON format

<https://www.elastic.co/guide/en/elasticsearch/reference/current/query-dsl.html>

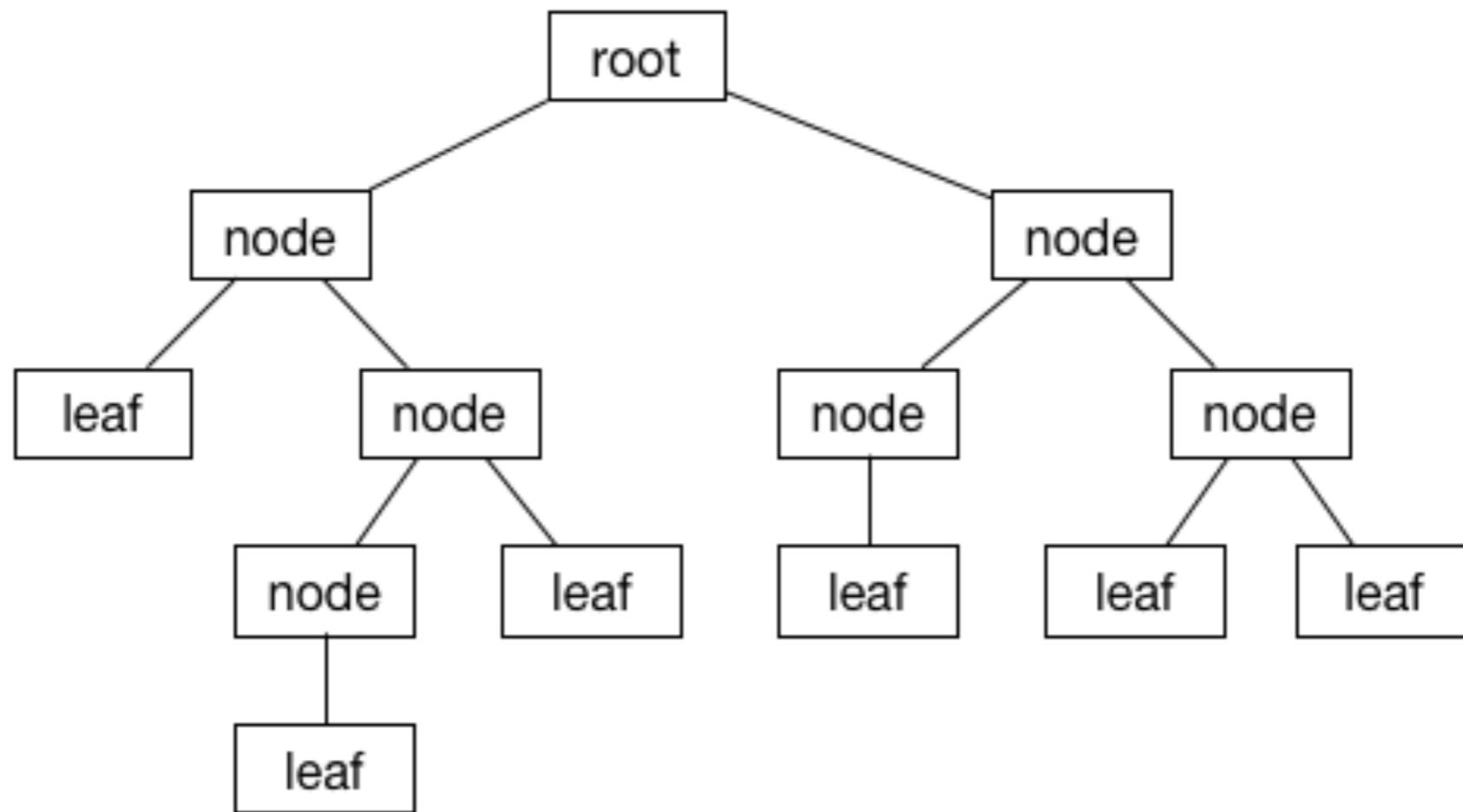


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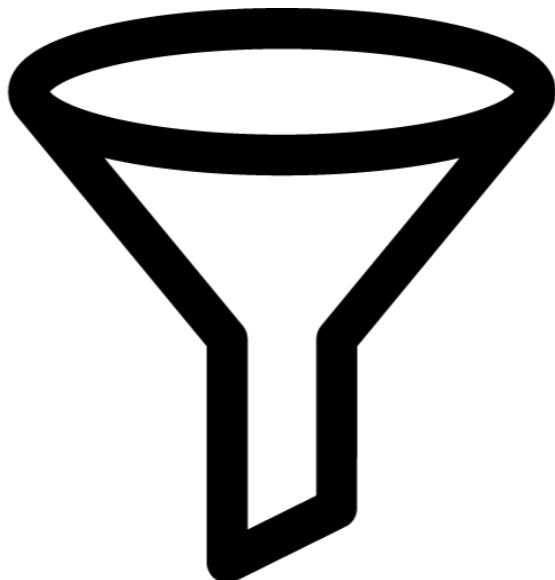
Query DSL

1. Leaf query clause
2. Compound query clause



Query DSL

Query (unstructured data)
Filter (structured data)



Query



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Query DSL

Query	Filter
Relevance	Boolean, yes/no
Full text search	Exact values
Not cached	Cached
Slower	Faster

Filter first, then query remaining documents



Query DSL

Full text query
Term level query
Compound query
Joining query
Geo query
Specialized query
Span query



Leaf query clause

GET /store/book/_search

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



Compound query clause

GET /store/book/_search

```
{  
  "query": {  
    "bool": {  
      "must": [{}],  
      "should": [{}],  
      "must_not": [{}]  
    }  
  }  
}
```



_all field is disabled (ES 6.0+)

_all field



WARNING

Deprecated in 6.0.0.

`_all` may no longer be enabled for indices created in 6.0+, use a custom field and the mapping `copy_to` parameter

Space issue
Analyzer issue
Highlighting issue

<https://www.elastic.co/guide/en/elasticsearch/reference/6.5/mapping-all-field.html>



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Workshop

amazon

All ▾ elasticsearch

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EN ▾ Hello. Sign in Account & Lists ▾ Orders Cart 0

1-16 of 119 results for "elasticsearch"

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- Data Processing
- Web Development & Design
- Online Internet Searching
- Databases & Big Data
- ▼ See more

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- Business Software
- Search Engines
- Application Development
- Computer Databases
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- English

Book Format

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Query

amazon

All ▾ elasticsearch 

Departments ▾ Your Amazon.com Today's Deals Gift Cards Sell

New to Amazon? EN Hello, Sign In Account Lists Orders Cart

Sort by Featured

1-16 of 119 results for "elasticsearch"

Filter

Books

- Computers & Technology
- Data Processing
- Web Development & Design
- Online Internet Searching
- Databases & Big Data
- ▼ See more

Kindle Store

- Computers & Technology
- Business Software
- Search Engines
- Application Development
- Computer Databases
- ▼ See more
- ▼ See All 8 Departments

Refine by

Book Language

- English

Book Format

- Paperback

Packt

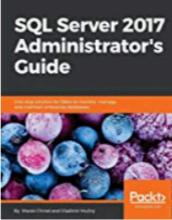
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By Waheed Ahmad, Gregory Smith



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Paging

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Aggregation API

05-aggregation/book_aggregation.json

<https://www.elastic.co/guide/en/elasticsearch/reference/current/search-aggregations.html>



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```
SELECT count(1), sum(price)  
FROM some_table  
GROUP BY some_column
```



Aggregation Types

Bucketing
Metric
Matrix
Pipeline



Structure

```
"aggregations" : {  
    "<aggregation_name>" : {  
        "<aggregation_type>" : {  
            <aggregation_body>  
        }  
        [ , "meta" : { [ <meta_data_body> ] } ] ?  
        [ , "aggregations" : { [ <sub_aggregation> ]+ } ] ?  
    }  
    [ , "<aggregation_name_2>" : { ... } ] *  
}
```



Count by category

GET /store/book/_search

```
{  
  "aggs": {  
    "all_book_title": {  
      "terms": {  
        "field": "category.keyword"  
      }  
    }  
  }  
}
```



Count by category

GET /store/book/_search

```
{  
  "aggs": {  
    "all_book_title": {  
      "terms": {  
        "field": "category.keyword"  
      }  
    }  
  }  
}
```

Aggregation name



Count by category

GET /store/book/_search

```
{  
  "aggs": {  
    "all_book_title": {  
      "terms": { Aggregation type  
        "field": "category.keyword"  
      }  
    }  
  }  
}
```



Result of aggregation

```
{  
  "hits": {  
    "total": 5,  
    "max_score": 1,  
    "hits": [  
      {  
        "_source": {  
          "title": "The Logstash Book"  
        }  
      },  
      {  
        "_source": {  
          "title": "Elasticsearch Server: Second Edition"  
        }  
      }  
    ]  
  }  
}
```

Search result



Result of aggregation

```
"aggregations": {  
    "all_book_title": {  
        "doc_count_error_upper_bound": 0,  
        "sum_other_doc_count": 0,  
        "buckets": [          Aggregation result  
            {  
                "key": "Computer & Technology",  
                "doc_count": 5  
            },  
            {  
                "key": "Online Searching",  
                "doc_count": 3  
            },  
            {  
                "key": "Java Programming",  
                "doc_count": 2  
            }  
        ]  
    }  
}
```



Show only aggregation result

GET /store/book/_search

```
{  
  "size": 0, Set search result size = 0  
  "aggs": {  
    "all_book_title": {  
      "terms": {  
        "field": "category.keyword"  
      }  
    }  
  }  
}
```



Range of price

GET /store/book/_search

```
{  
  "size": 0,  
  "aggs": {  
    "price_range": {  
      "range": {  
        "field": "price",  
        "ranges": [  
          { "from": 0, "to": 10 },  
          { "from": 11, "to": 20 },  
          { "from": 21, "to": 50 }  
        ]  
      }  
    }  
  }  
}
```



Result of aggregation

```
"buckets": [
  {
    "key": "0.0-10.0",
    "from": 0,
    "to": 10,
    "doc_count": 1
  },
  {
    "key": "11.0-20.0",
    "from": 11,
    "to": 20,
    "doc_count": 0
  },
  {
    "key": "21.0-50.0",
    "from": 21,
    "to": 50,
    "doc_count": 3
  }
]
```



Range of price and ordering

GET /store/book/_search

```
{  
  "size": 0,  
  "aggs": {  
    "price_range": {  
      "range": {  
        "field": "price",  
        "ranges": [  
          { "from": 0, "to": 10 },  
          { "from": 11, "to": 20 },  
          { "from": 21, "to": 50 }  
        ]  
      }  
    }  
  }  
}
```



Workshop aggregation with car

05-aggregation/car.json



Try by yourself

Best seller by color

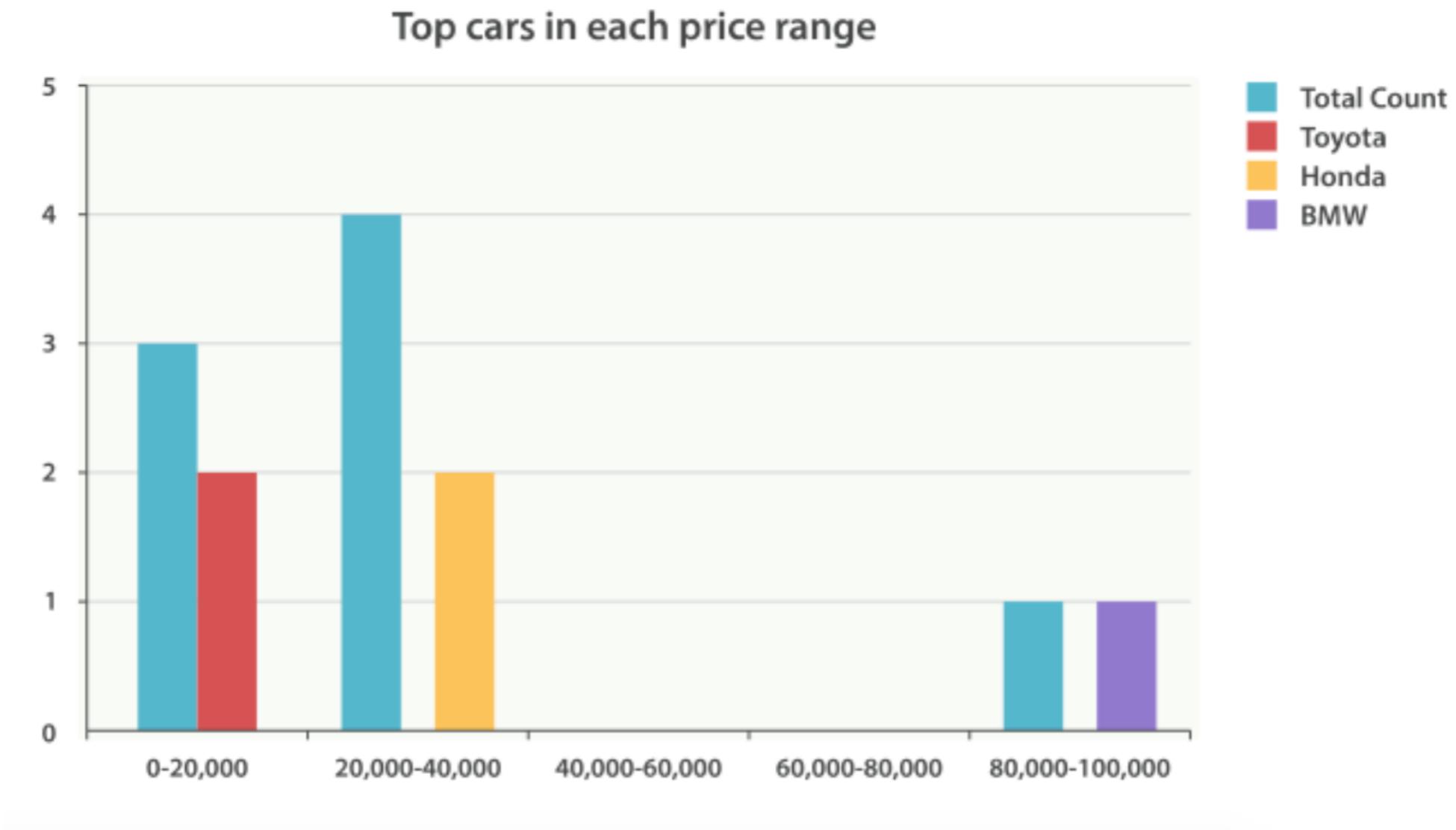
Statistic of best seller by color

Detail of car in each color

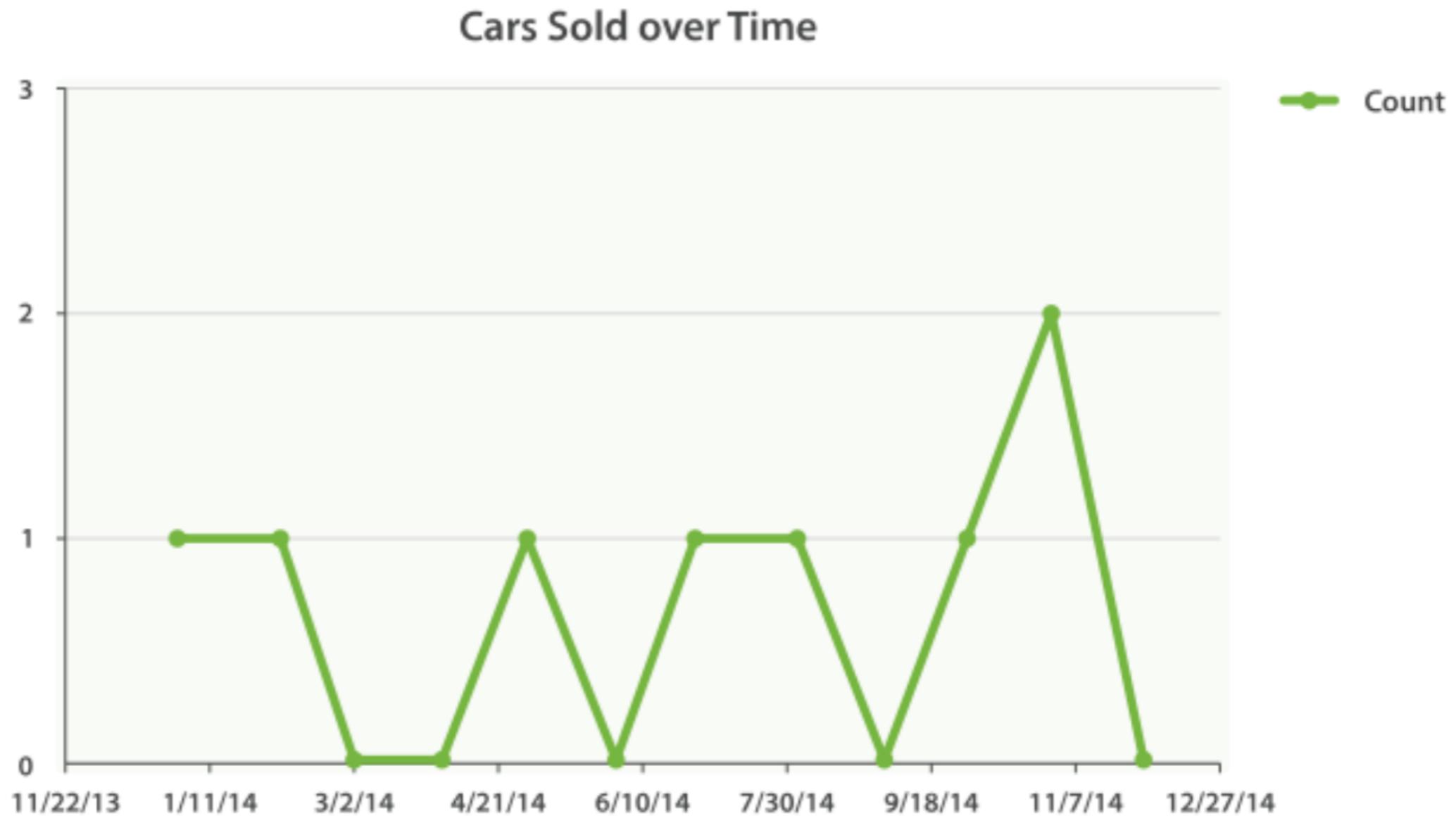
Min/max of price by make



Top cars in each price range ?



Cars sold over Time ?



Mapping

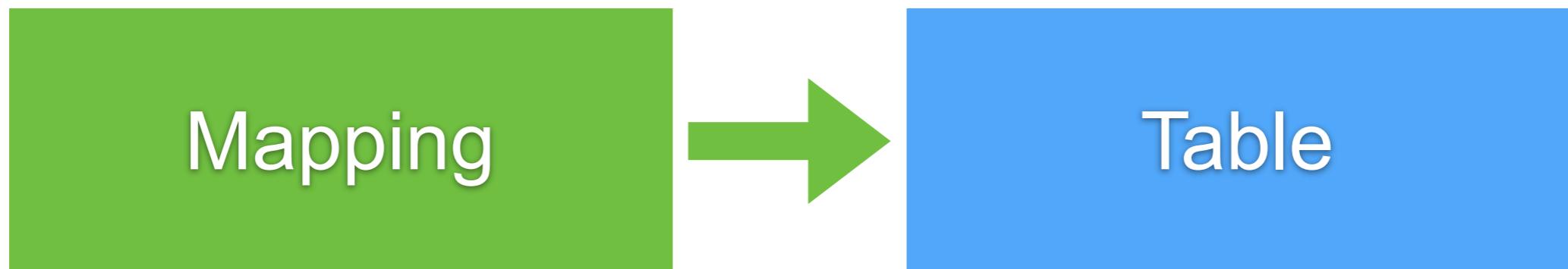
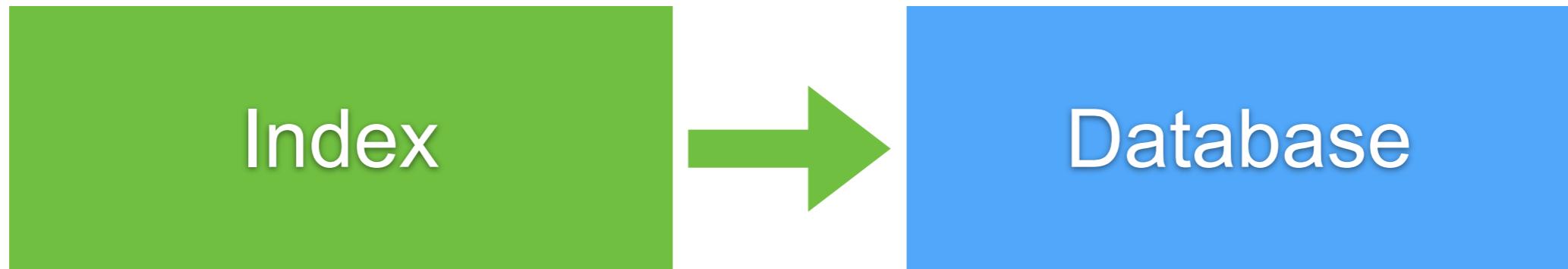
<https://www.elastic.co/guide/en/elasticsearch/reference/current/mapping.html>



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Explicit Mapping



Mapping type

Meta-fields

Field or properties



Meta-field

Metadata of document
`_index, _type, _id, _source`



Field or properties

List of fields or properties of document



Mapping/Schema of document

GET /store/_mapping/book

```
"mappings": {  
    "book": {  
        "properties": {  
            "author name": {  
                "type": "text",  
                "fields": {  
                    "keyword": {  
                        "type": "keyword",  
                        "ignore_above": 256  
                    }  
                }  
            }  
        }  
    }  
}
```



Mapping/Schema of document

GET /store/_mapping/book

```
"mappings": {  
    "book": {  
        "page": {  
            "type": "long"  
        },  
        "price": {  
            "type": "float"  
        },  
        "published_date": {  
            "type": "date"  
        }  
    }  
}
```



Field Datatypes

Core

Complex

Geo

Specialized



Field Datatypes

text	date
keyword	ip
long	boolean
double	completion
geo_point	geo_shape
array	object
nested	binary

<https://www.elastic.co/guide/en/elasticsearch/reference/current/mapping-types.html>



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Field Datatypes

text	date
keyword	ip
long	boolean
double	completion
geo_point	geo_shape
array	object
nested	binary

<https://www.elastic.co/guide/en/elasticsearch/reference/current/mapping-types.html>



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Array

No data type **array** in Elasticsearch

["name", "title"]	array of string
[1, 2, 3]	array of integer
[{"name": "up1", "age": 30}]	array of object



Mapping configuration

Maximum number of fields = 1,000

Maximum depth of fields = 20

Maximum depth of nested fields = 50



Dynamic/Explicit mapping

Fields and mapping types not need to defined before being used



Mapping

Explicit mapping

Quick data insertion

Manual mapping

Better search Results

Increased performance

Concerned of the field types



Analyzer

07-analyzer

<https://www.elastic.co/guide/en/elasticsearch/reference/current/analysis.html>

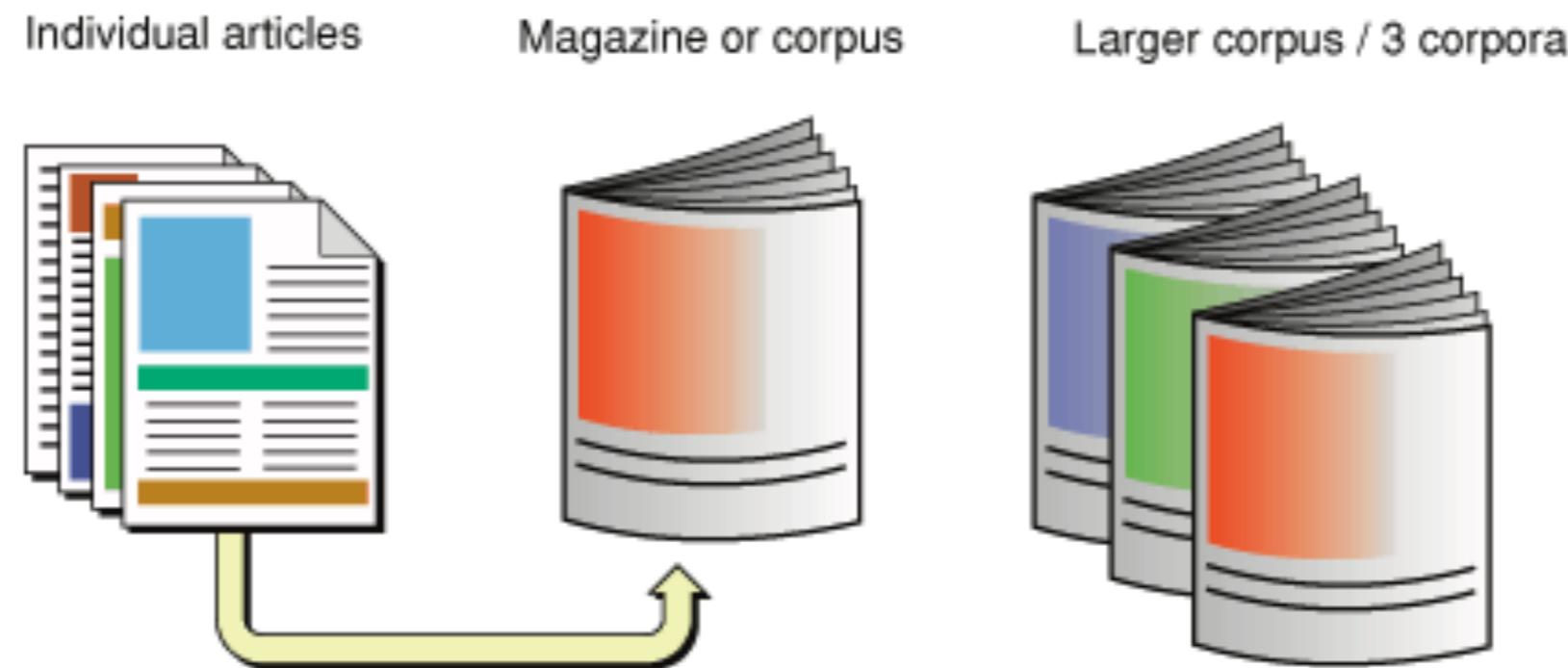


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Inverted Index

Corpus is a collection of documents



https://developer.apple.com/library/archive/documentation/UserExperience/Conceptual/SearchKitConcepts/searchKit_basics/searchKit_basics.html#/apple_ref/doc/uid/TP40002843-TPXREF101

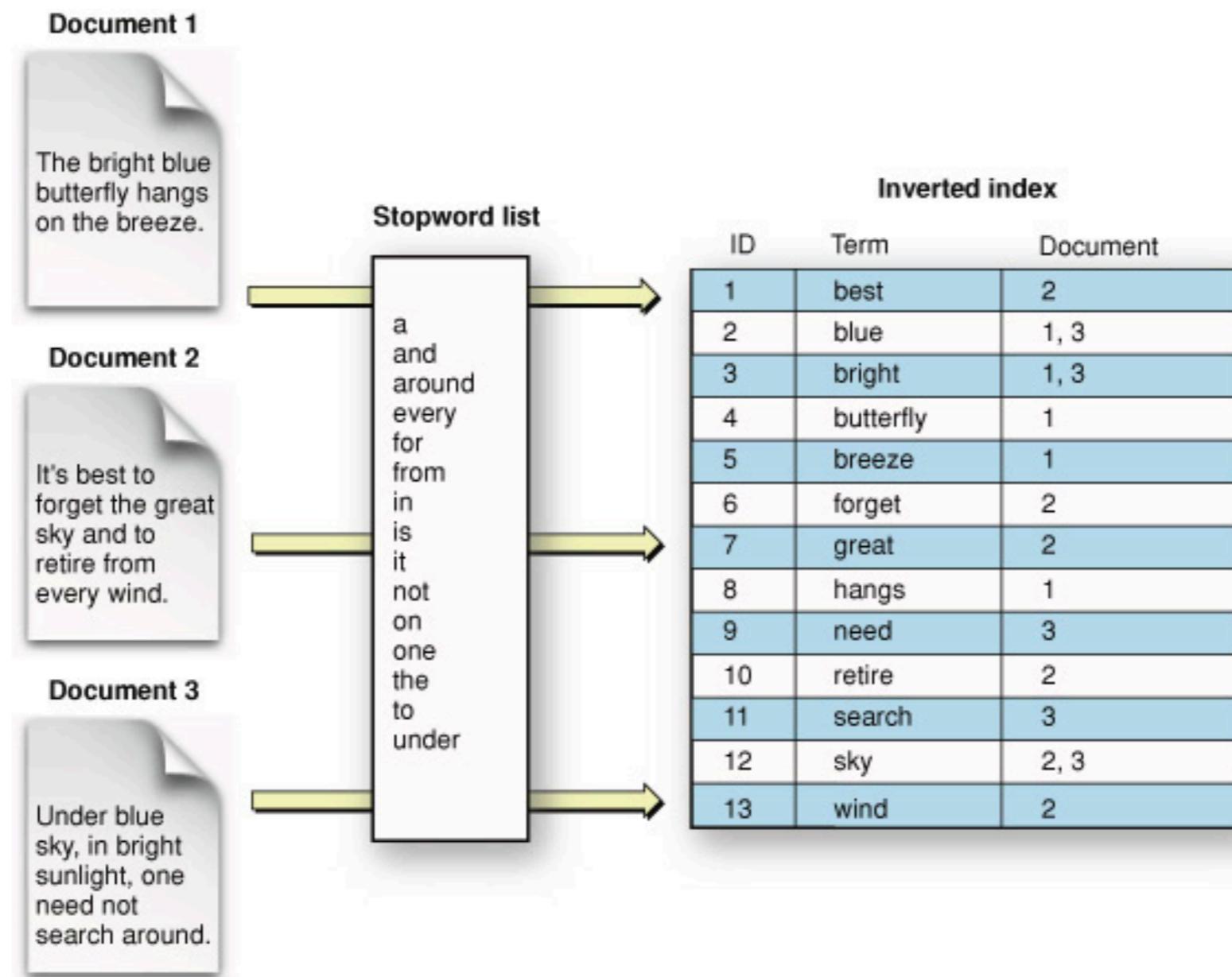


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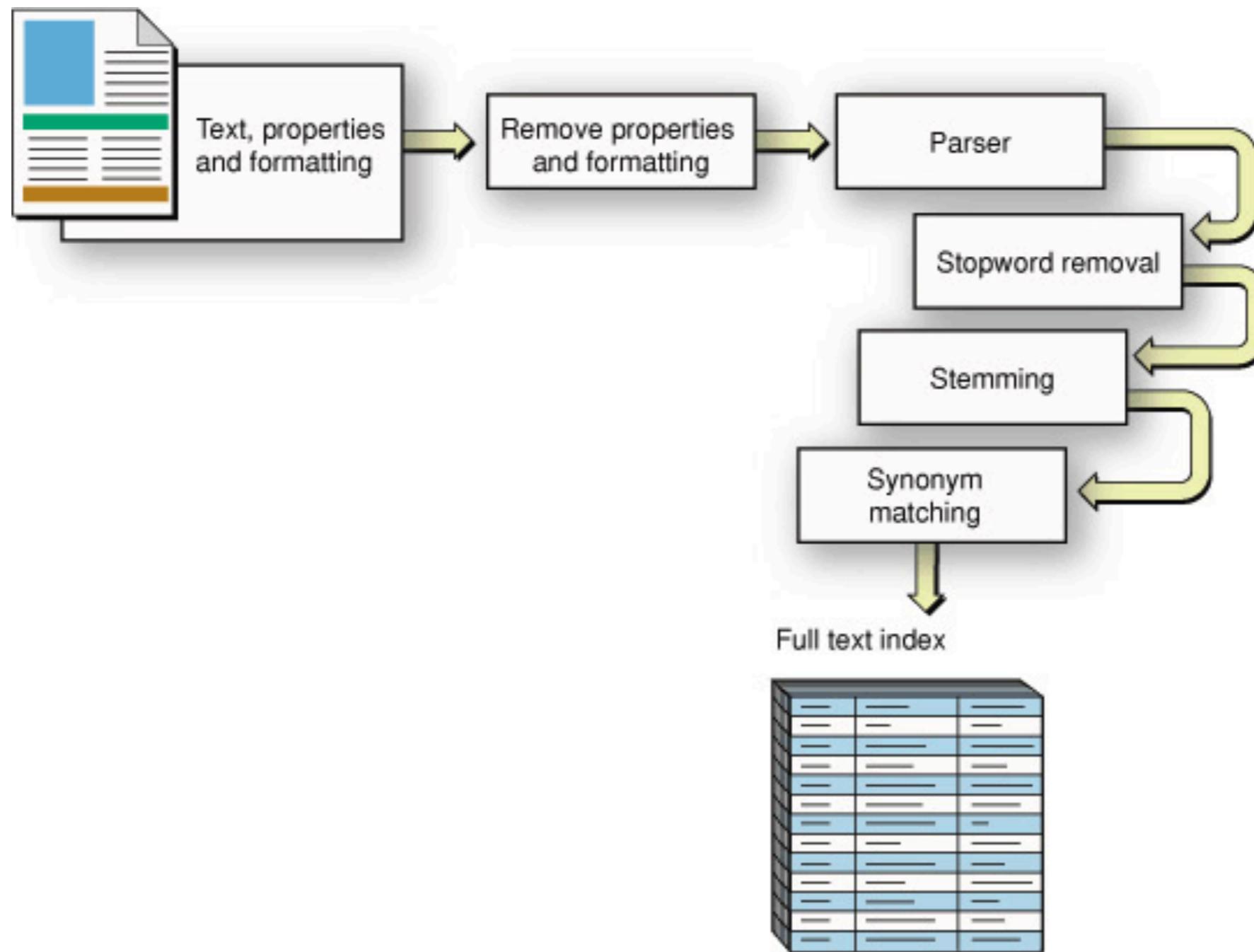
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Inverted Index

Try to construct index



Text extraction



More tools



Elasticsearch Head

 **ElasticSearch Head**
offered by travistx

★★★★★ (75) · [Developer Tools](#) · 45,312 users

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ElasticSearch http://192.168.7.8:9200/ · [Connect](#) · Rick · cluster health: yellow (6, 18)

Overview · Browser · Structured Query · Any Request · Info · Status · Nodes Stats · Cluster Nodes · Cluster State · Cluster Health

Cluster Overview · New Index

	cu_docs	bnvil	cu_msg	anvil
Leon	size: 180Gb (540Gb) docs: 995131 (995131)	size: 80kb (480kb) docs: 90 (90)	size: 313Gb (1.56Tb) docs: 10047450 (10140915)	index: close
Pris	Info · Actions	Info · Actions	Info · Actions	Info · Actions
Rick	3Wqr1xaCRu-b0uEzDkmrDg inet[/192.168.7.8:9202]	0 1	0 1	0 1 2 3 4
Rachel	180Gb (540Gb) docs: 995131 (995131)	0 1	0 1 2 3 4	0 1 2 3 4
Zhora	87Kstv0FTV5kkqwENaja6A inet[/192.168.7.8:9203]	1 2	0 1	0 1 2 3 4
Roy	b6NxRTxsR_WUQj5cXPKHbw inet[/192.168.7.8:9205]	0 2	0 1	0 1 2 3 4
Unassigned	Info · Actions	0 2	0 1	0 1 2 3 4

Compatible with your device

ElasticSearch Head
Chrome Extension containing the excellent Elasticsearch Head application.

[Website](#) · [Report Abuse](#)

Additional Information
Version: 0.1.3 · Updated: December 4, 2017 · Size: 434KiB · Language: English (United States)



<https://github.com/mobz/elasticsearch-head>



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Elasticsearch Dump



<https://github.com/taskrabbit/elasticsearch-dump>



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Kibana



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Geo Location

08-geo-location/sample_geo.json



Geo Location Type

Geo-point
Geo-shape



Geo-point

Must pre-define in mapping of index

```
PUT /my_map
{
  "mappings": {
    "city": {
      "properties": {
        "name": {
          "type": "text"
        },
        "location": {
          "type": "geo_point"
        }
      }
    }
  }
}
```



Geo-point Format

Geo-point as object

Geo-point as string

Geo-point as array

Geo-point as geohash

<https://www.elastic.co/guide/en/elasticsearch/reference/current/geo-point.html>



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Geo-point Format

Type	Format
Object	lat = lon =
String	lat, lon
Array	[lon, lat] ** GeoJSON **

<https://en.wikipedia.org/wiki/GeoJSON>



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Geohash converter

Geohash Converter

Simple and fast conversion from geohash to latitude/longitude and from latitude/longitude to geohash.

GeoHash

Lat, Lng

Precision

<http://geohash.co/>



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Geo-point query

Geo-bounding-box

Geo-distance

Geo-polygon

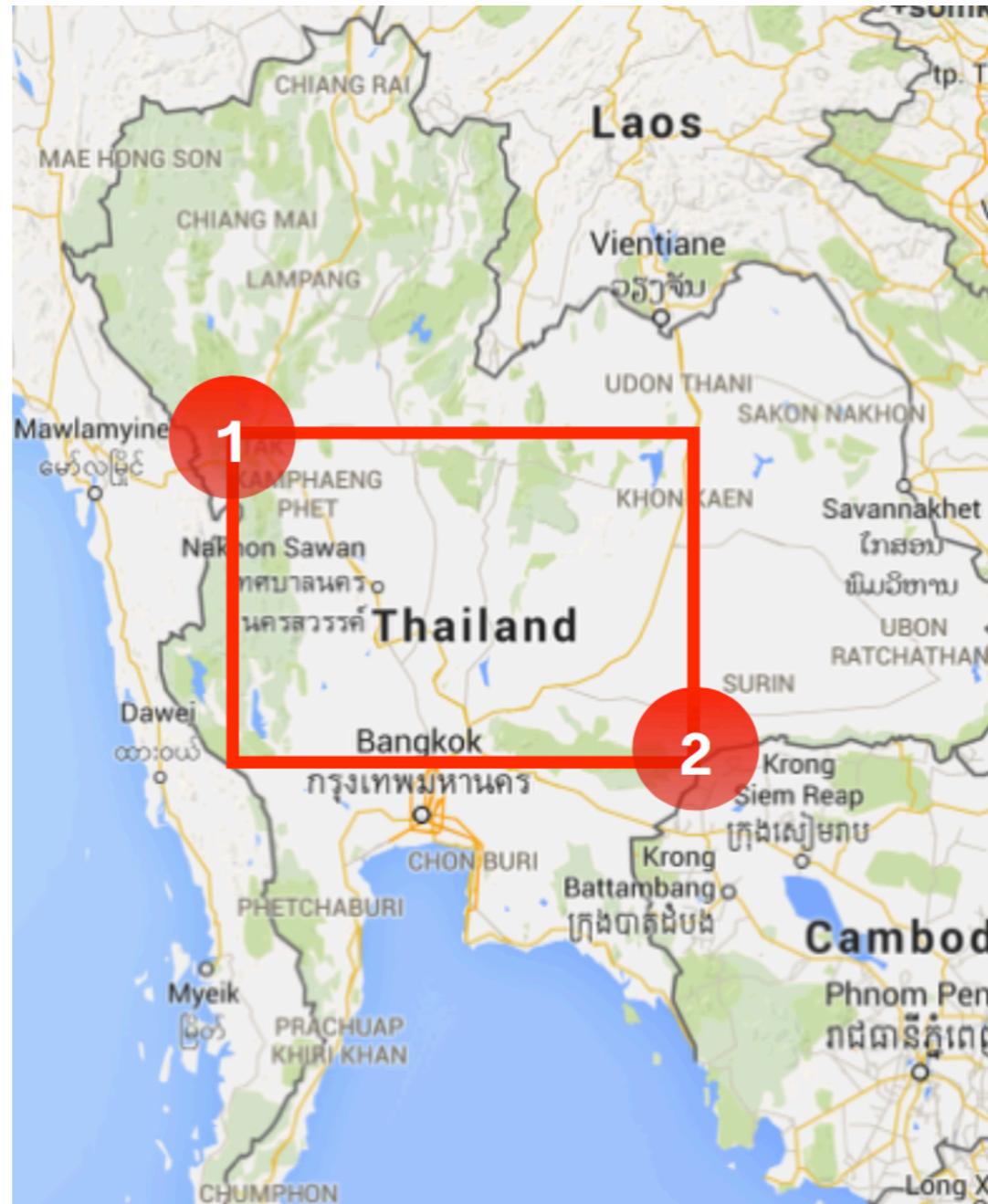
<https://www.elastic.co/guide/en/elasticsearch/reference/current/geo-queries.html>



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Bounding Box



<https://www.elastic.co/guide/en/elasticsearch/reference/current/query-dsl-geo-bounding-box-query.html>



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Geo Distance



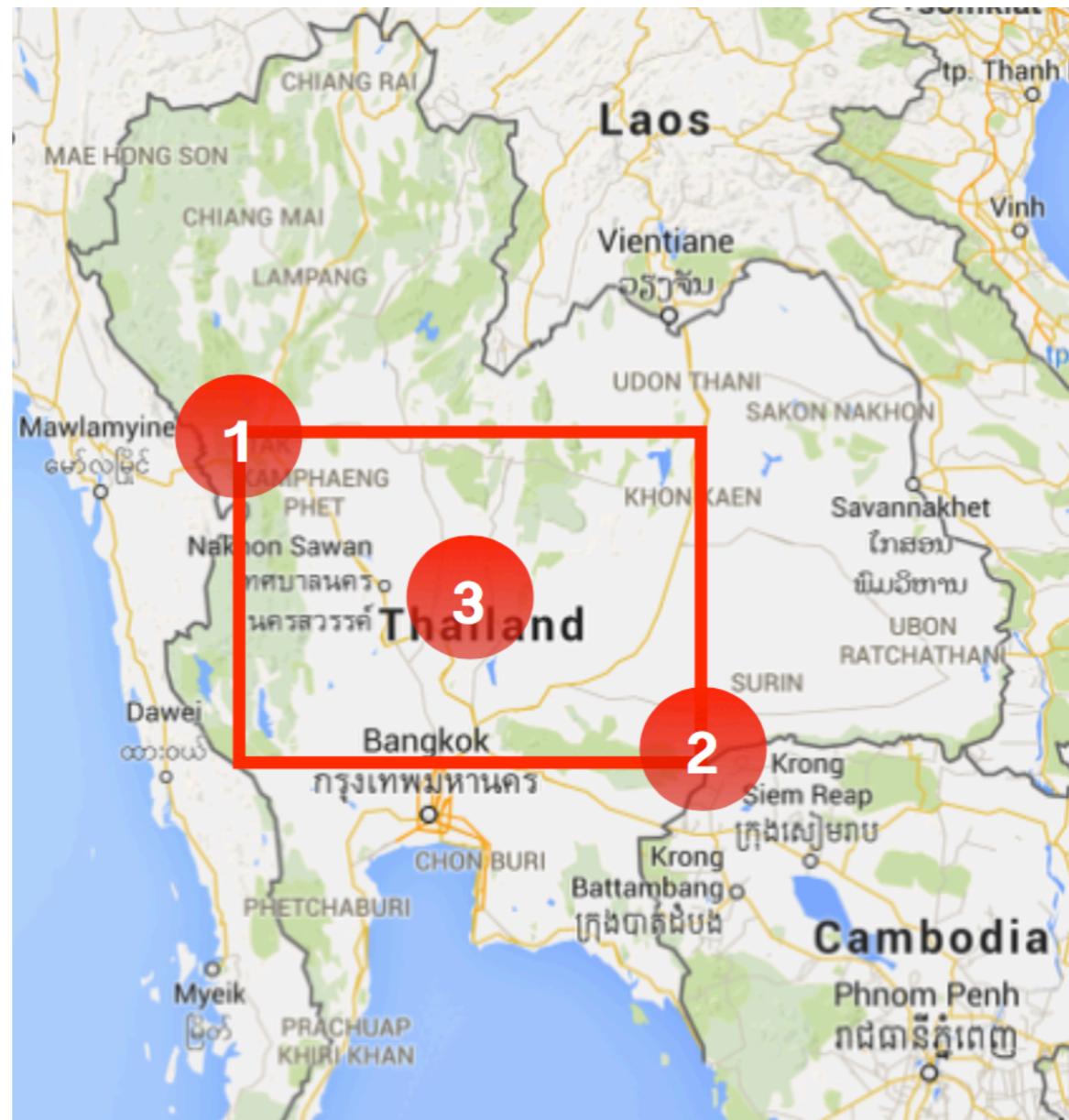
<https://www.elastic.co/guide/en/elasticsearch/reference/current/query-dsl-geo-distance-query.html>



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Try to ordering result



Explain and Profiling your query



2 ways

Explain API
Profile API



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Explain API

GET /my_map/_search

```
{  
  "explain": true,  
  "query": {  
    "bool": {
```

<https://www.elastic.co/guide/en/elasticsearch/reference/6.3/search-explain.html>



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Profile API

Debugging tool

Add overhead to search execution

Output is verbose and depend on internal operation

<https://www.elastic.co/guide/en/elasticsearch/reference/6.3/search-profile.html>



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Profile API

GET /my_map/_search

```
{  
  "profile": true,  
  "query": {  
    "bool": {
```



Working with Data

<https://www.elastic.co/guide/en/kibana/current/tutorial-load-dataset.html>



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Working with Data

\$elasticsearch-plugin install **ingest-geoip**

<https://www.elastic.co/guide/en/elasticsearch/plugins/current/ingest-geoip.html>



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GeolP with Elasticsearch

geoip/instruction.json



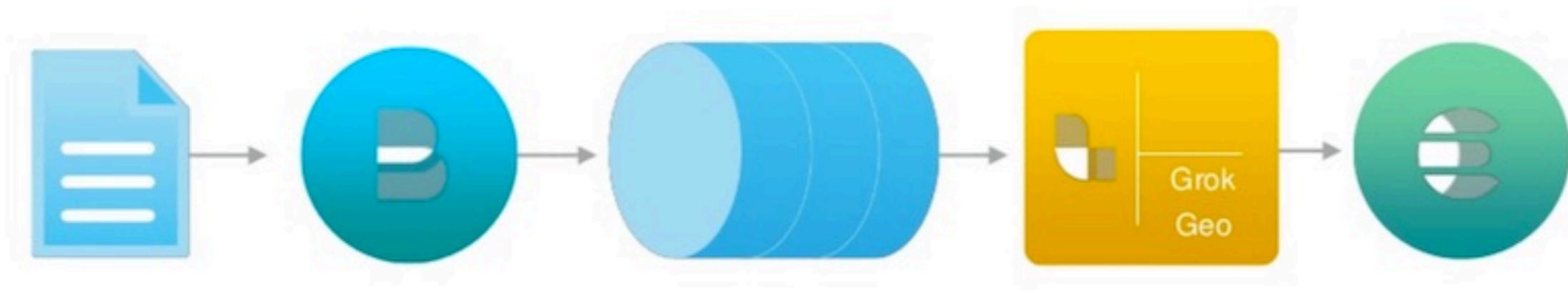
Sample Data

```
{"index":{"_index":"logstash-2015.05.18","_type":"log"}},  
{"@timestamp":"2015-05-18T09:03:25.877Z","ip":"185.124.182.12"},  
{"index":{"_index":"logstash-2015.05.18","_type":"log"}},  
{"@timestamp":"2015-05-18T12:28:25.013Z","ip":"79.1.14.87","e"},  
{"index":{"_index":"logstash-2015.05.18","_type":"log"}},  
{"@timestamp":"2015-05-18T17:44:34.357Z","ip":"178.209.1.7"},  
{"index":{"_index":"logstash-2015.05.18","_type":"log"}},  
{"@timestamp":"2015-05-18T13:04:18.120Z","ip":"118.140.92.127"},  
{"index":{"_index":"logstash-2015.05.18","_type":"log"}},  
{"@timestamp":"2015-05-18T11:37:40.653Z","ip":"235.154.34.221"},  
{"index":{"_index":"logstash-2015.05.18","_type":"log"}},  
{"@timestamp":"2015-05-18T08:46:07.025Z","ip":"228.216.38.41"}
```



Working with Ingest

Pre-process document before actual indexing



<https://www.elastic.co/guide/en/elasticsearch/reference/current/ingest.html>



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Install plugin

```
$elasticsearch-plugin install ingest-geoip
```

<https://www.elastic.co/guide/en/elasticsearch/plugins/current/ingest-geoip.html>



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Working with Logstash

<https://www.elastic.co/guide/en/logstash/current/index.html>



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Logstash



Input
Filter
Output



Design your input first !!

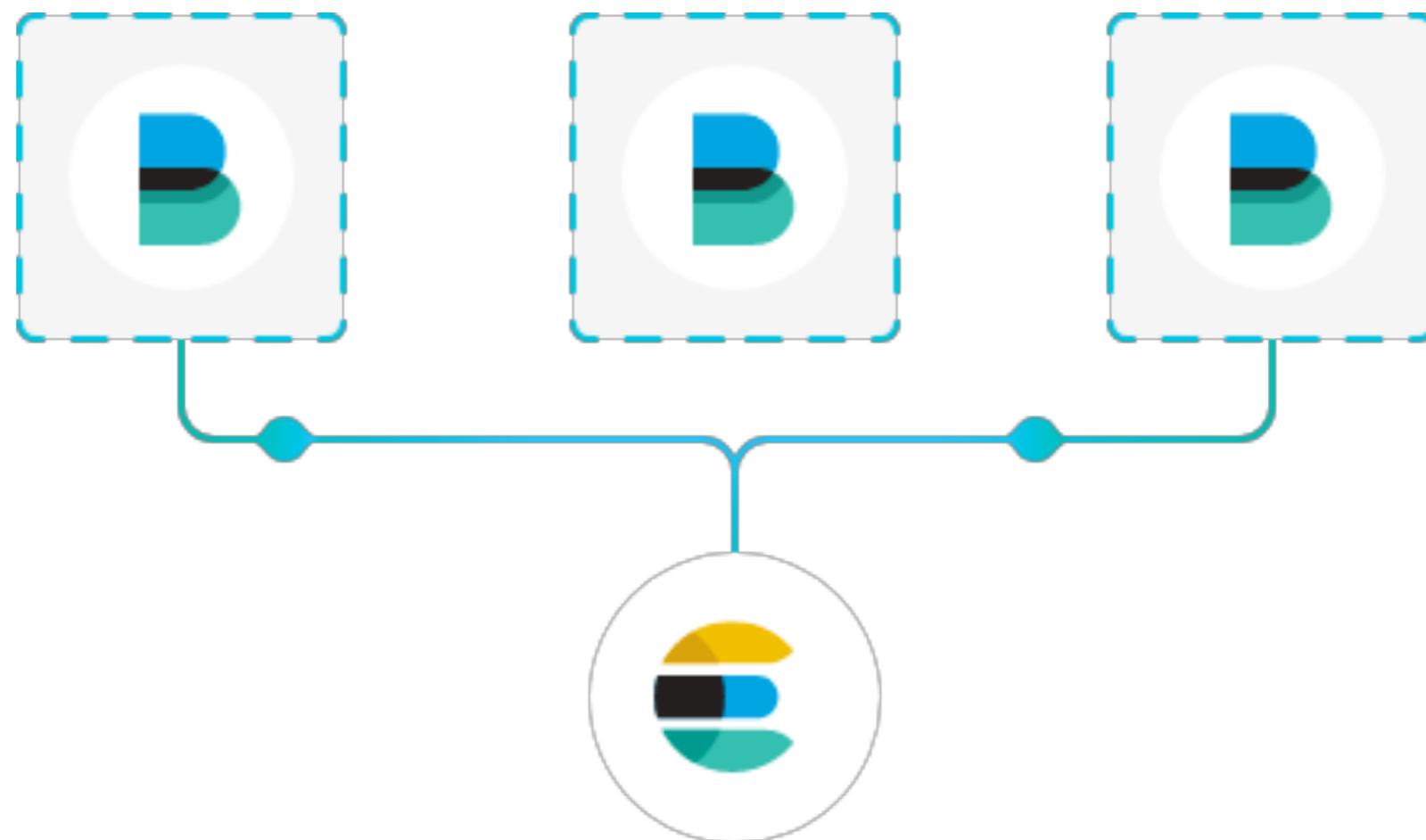


Use beats is better

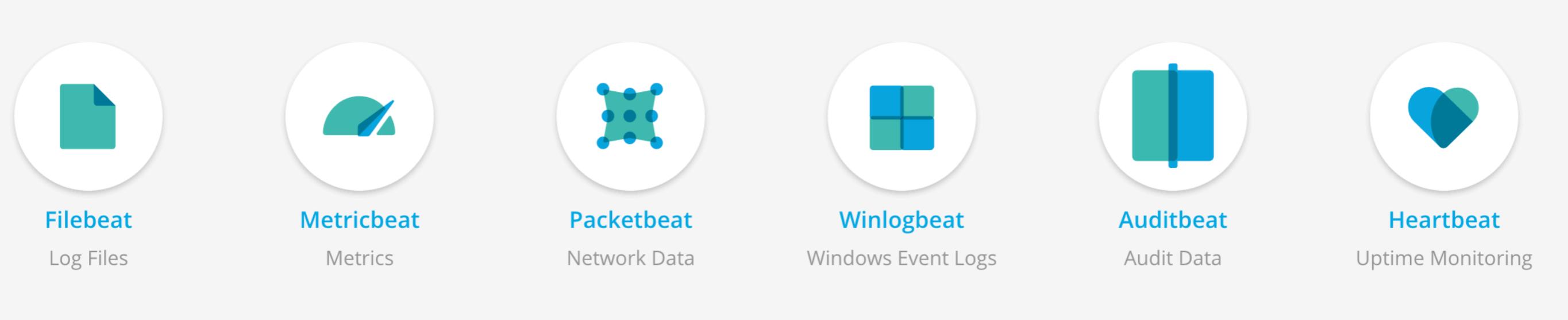
<https://www.elastic.co/products/beats>



Beat



Beat



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Example

```
$filebeat -e -c beat.yml -d "publish"
```

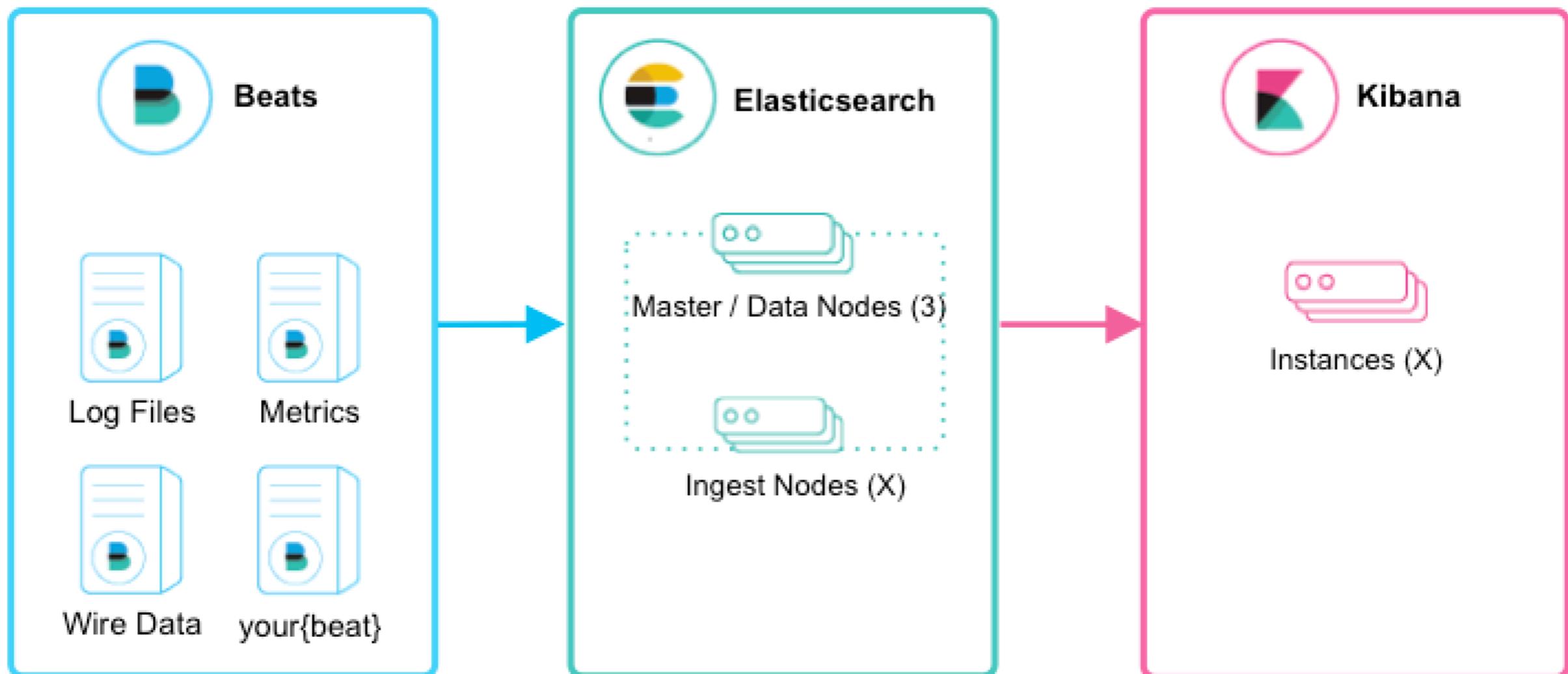
<https://www.elastic.co/guide/en/beats/filebeat/current/index.html>



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Beat and Logstash



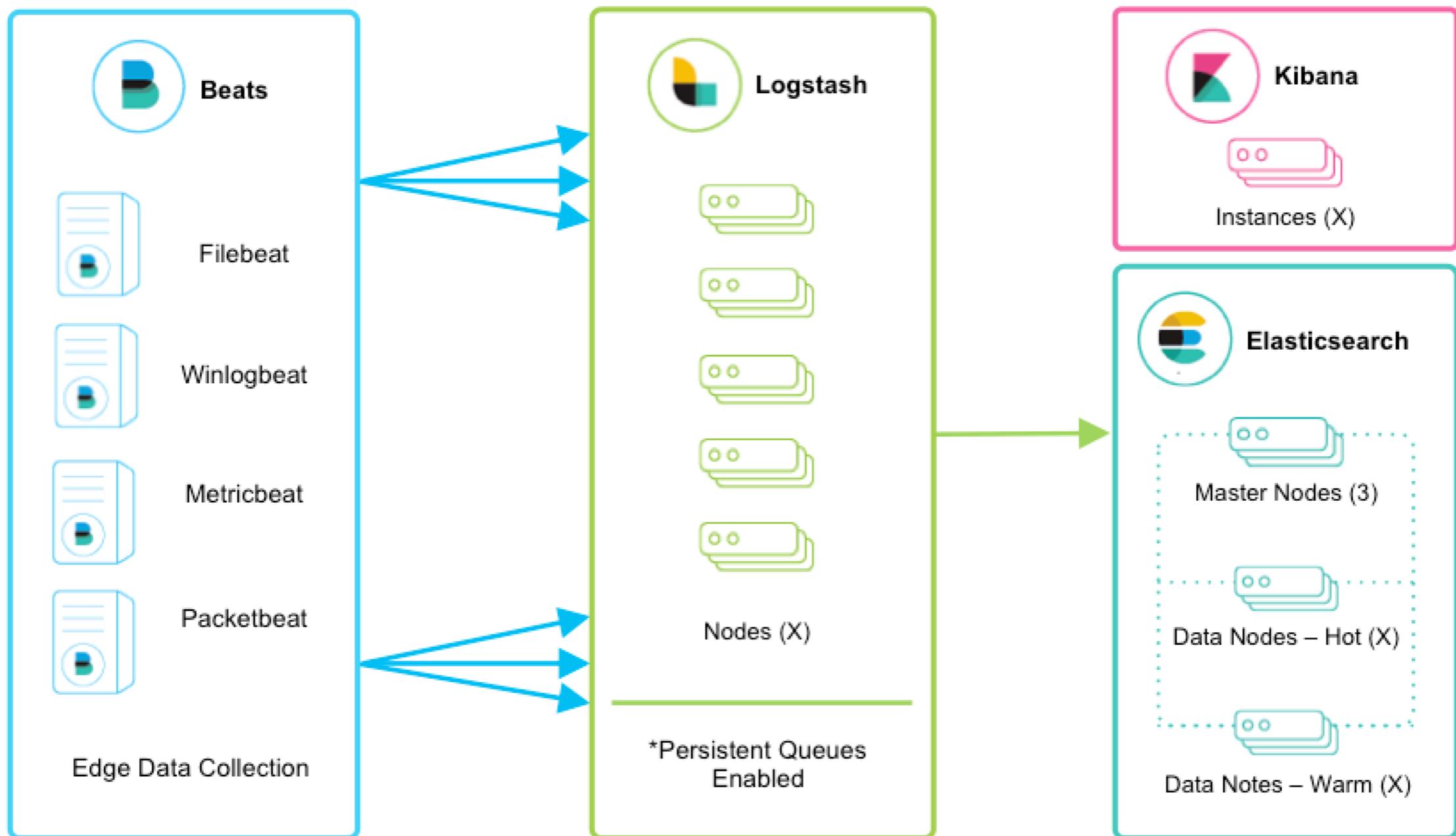
<https://www.elastic.co/guide/en/logstash/current/deploying-and-scaling.html>



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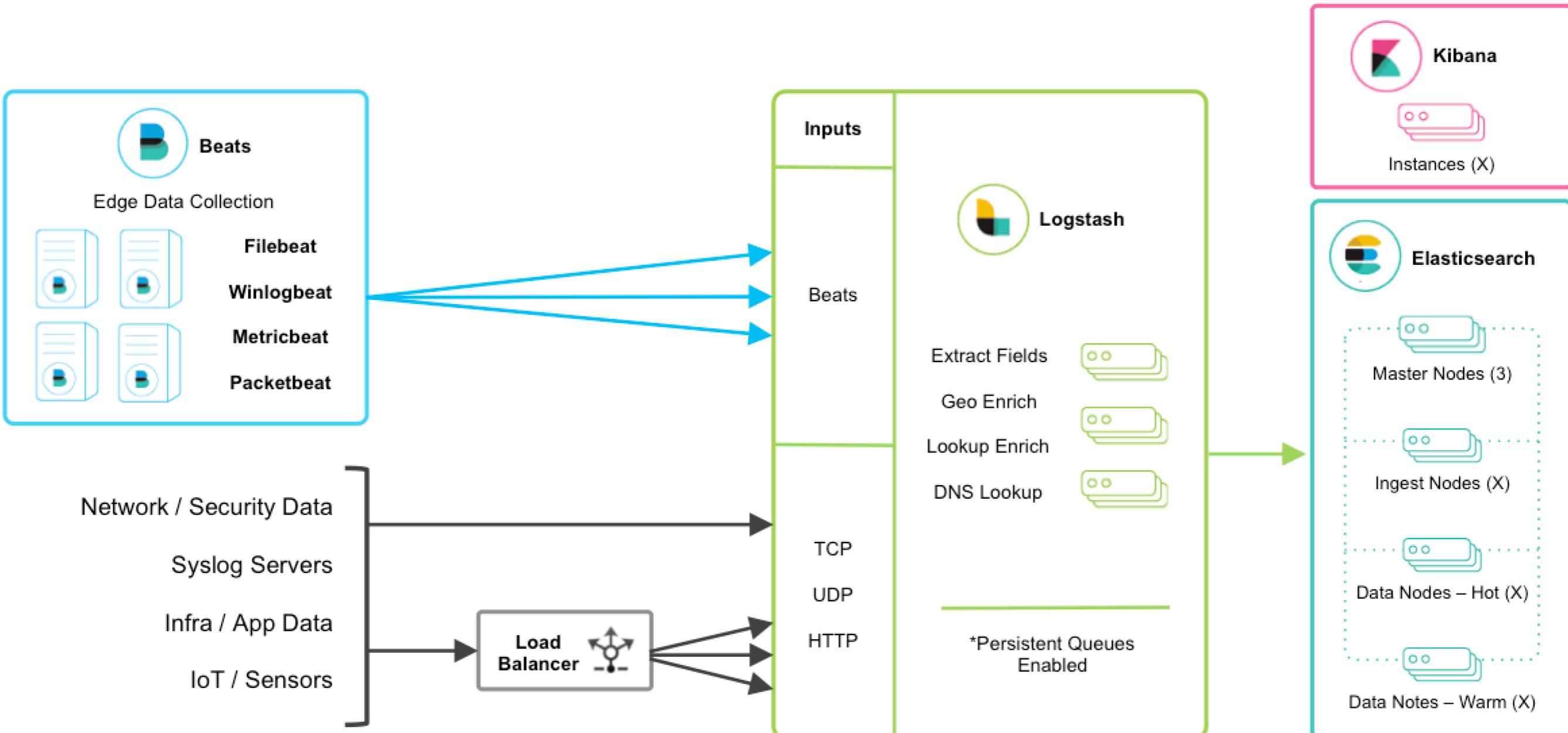
Scaling



<https://www.elastic.co/guide/en/logstash/current/deploying-and-scaling.html>



More data sources



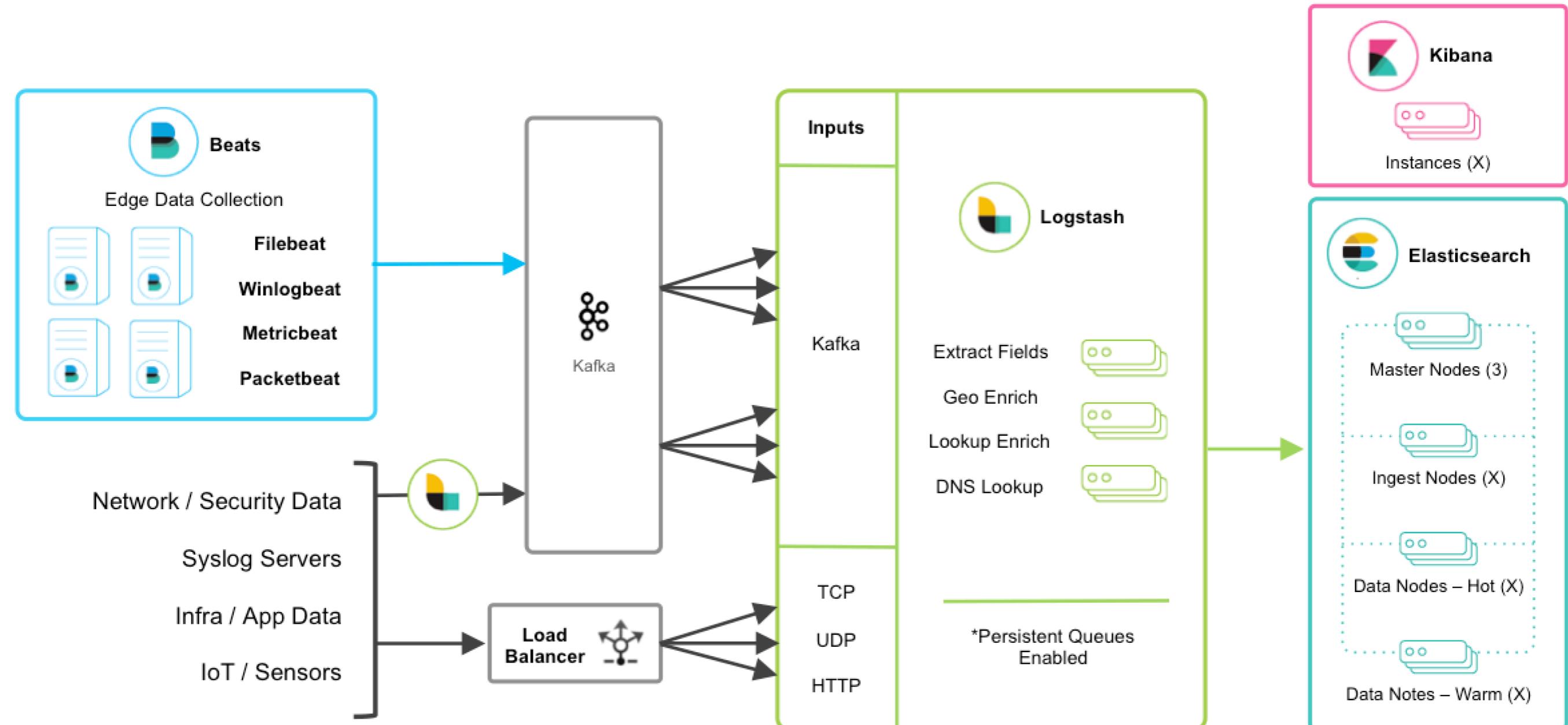
<https://www.elastic.co/guide/en/logstash/current/deploying-and-scaling.html>



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Use messaging Queue



<https://www.elastic.co/blog/logstash-persistent-queue>



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Design for Failure

09-cluster



Elasticsearch Nodes

Node Type	Description
Master	Control the cluster
Data	Keep/store data
HTTP/Query	Run your query
Coordinating	Smart Load Balancer
Ingest	Pre-processing documents before indexing

<https://www.elastic.co/guide/en/elasticsearch/reference/current/modules-node.html>



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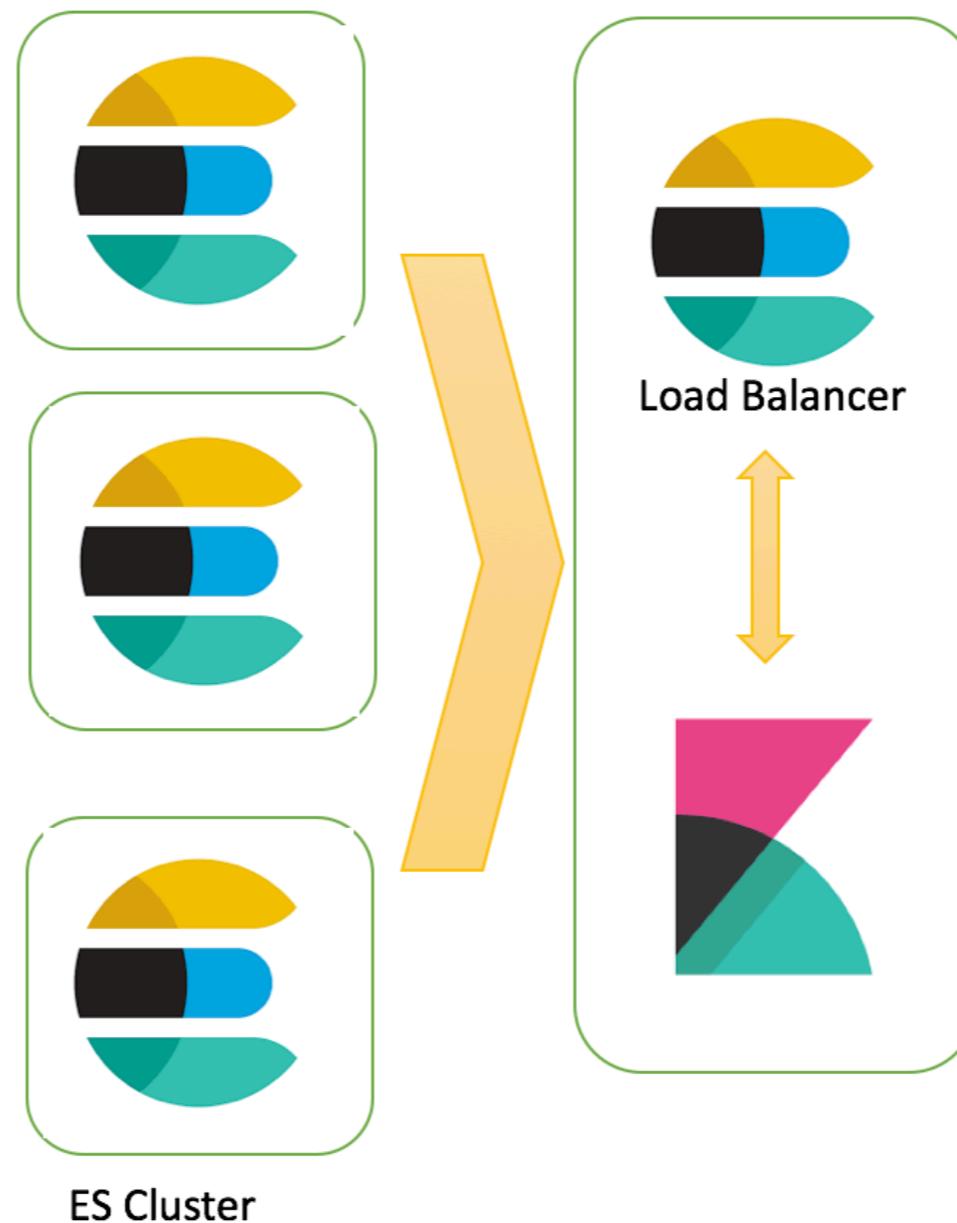
Elasticsearch Nodes

← → ⌂ ⓘ Not Secure | 35.240.161.188:9200/_cat/nodes?v&h=ip,name,node.role,master,heap.percent,ram.percent

ip	name	node.role	master	heap.percent	ram.percent
10.148.0.2	master	m	*	17	33
10.148.0.4	query	-	-	10	63
10.148.0.5	coordinator	-	-	9	78
10.148.0.3	data	d	-	13	63



Elasticsearch Nodes



<https://www.elastic.co/guide/en/kibana/current/production.html#load-balancing>



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Elasticsearch Nodes

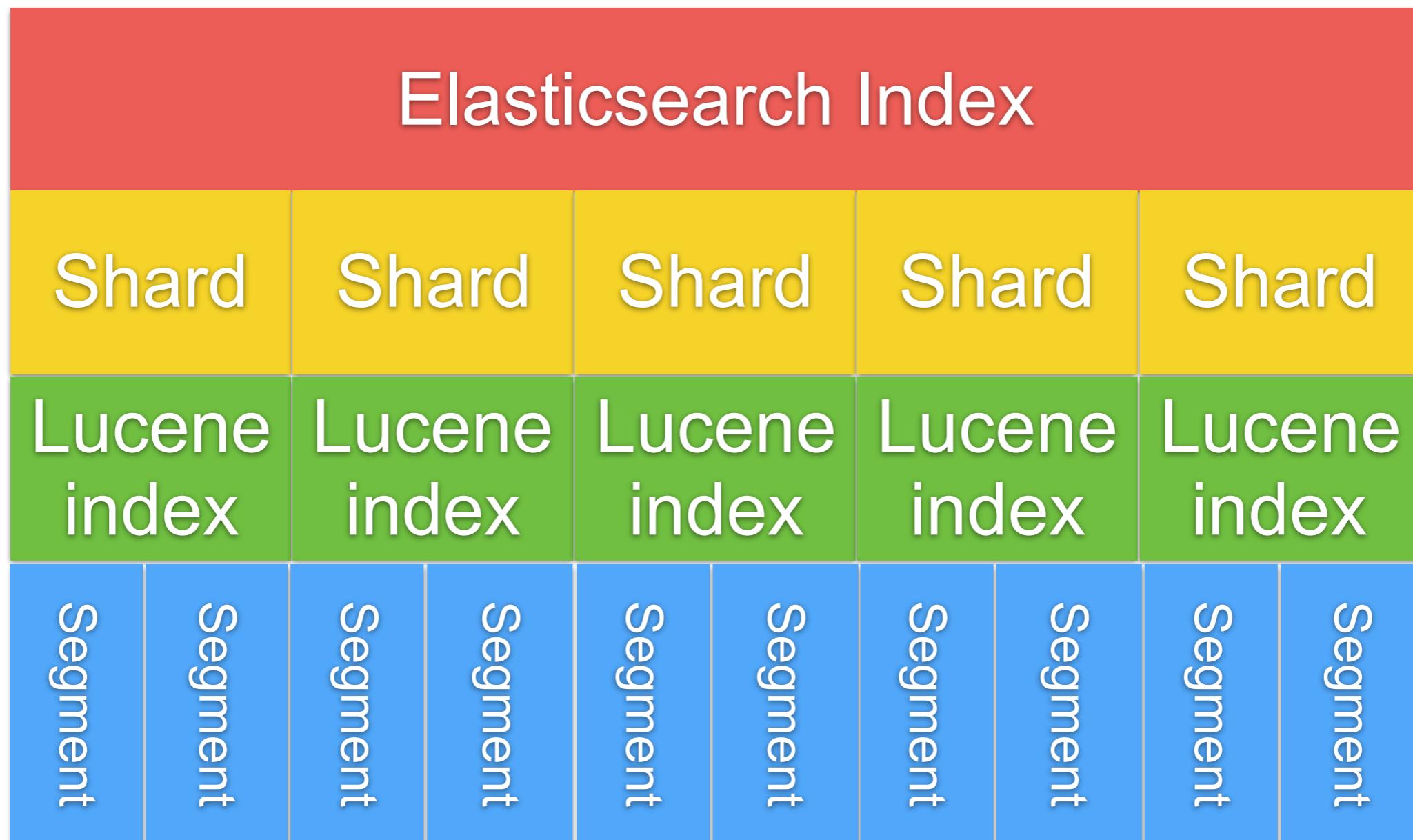


Apache Lucene

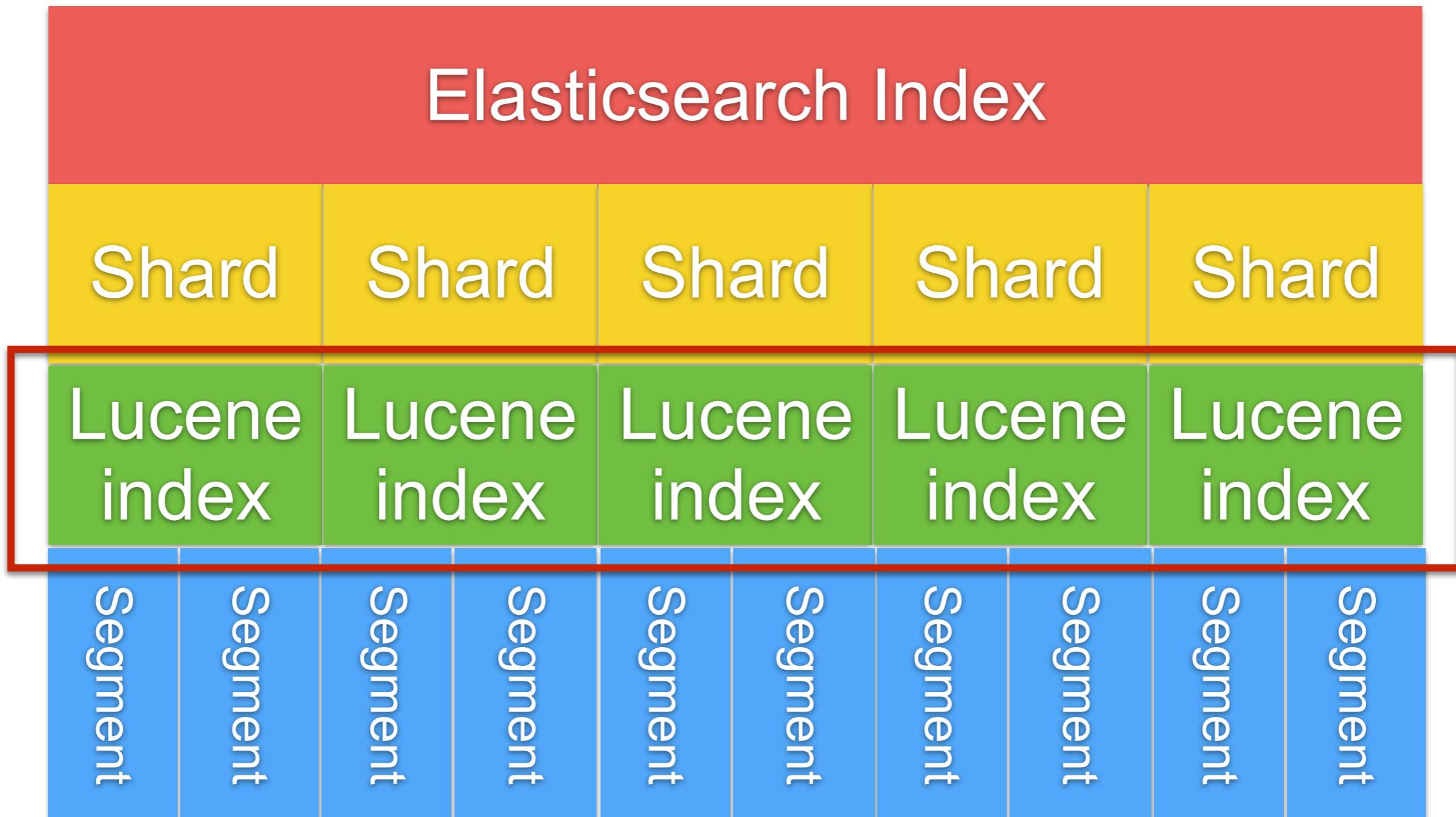
<http://lucene.apache.org/>



Apache Lucene



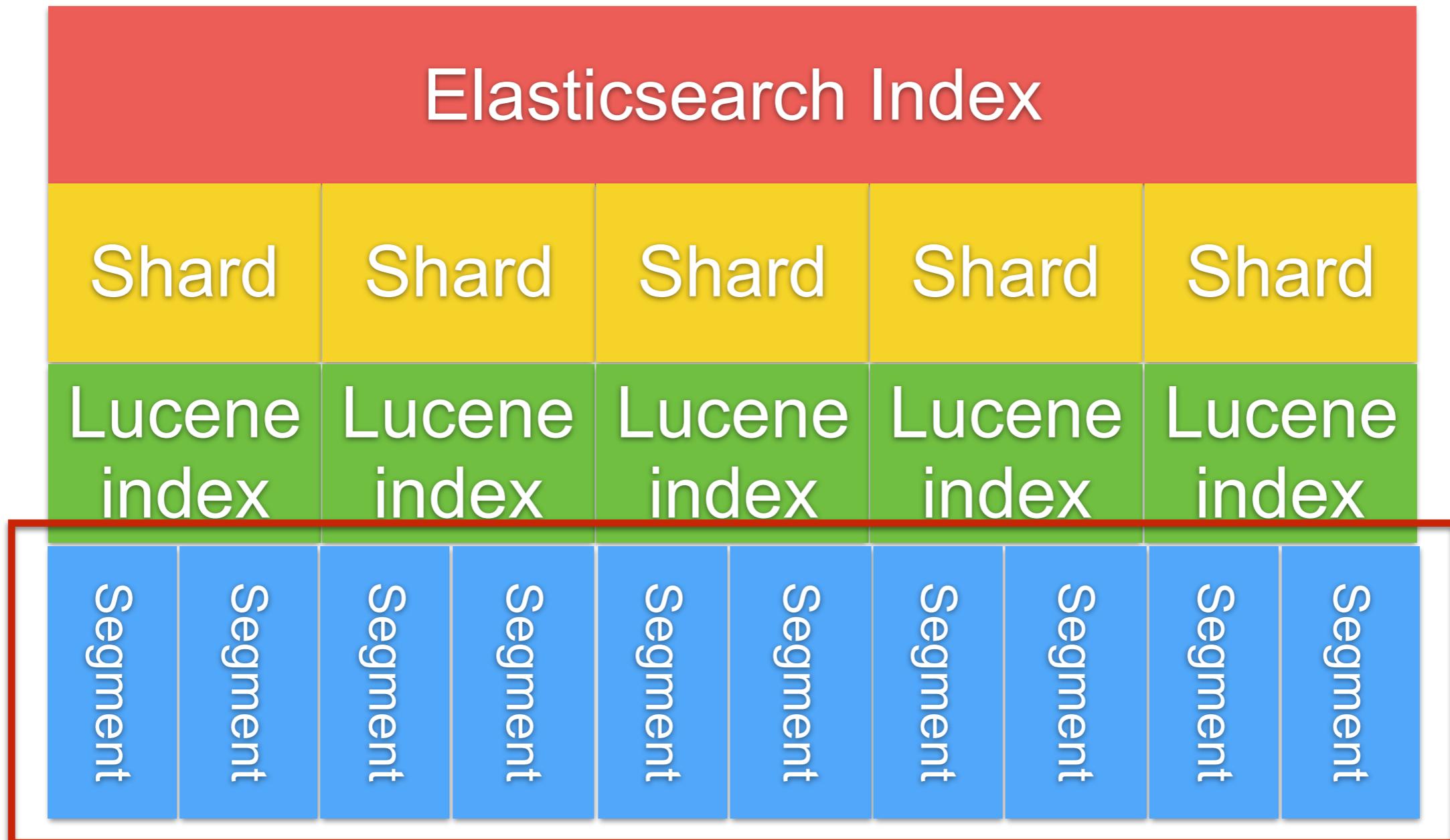
Apache Lucene



Max # of document of Lucene index = 2,147,483,519



Apache Lucene



Segments are immutable

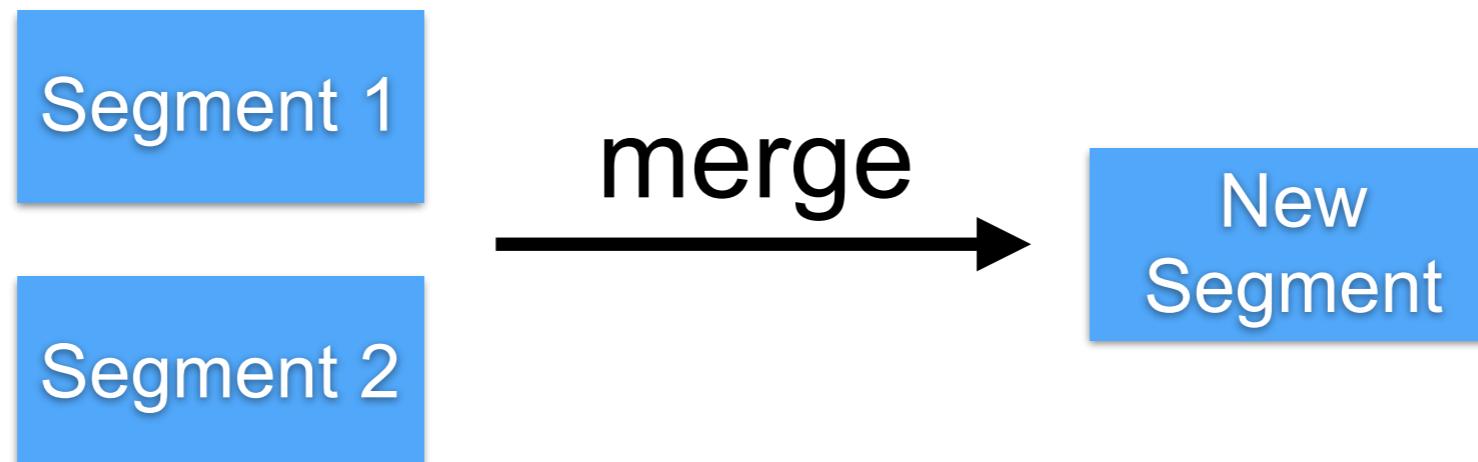


Segment

More shards, more segments

Documents are never delete !!

Lucene segment **merge** use more CPU/IO
Segments are immutable



Hardware



Hardware

CPU
Memory
Network
Storage



Memory

Enable bootstrap.memorylock

Disable all swap files

Change `ES_HEAP_SIZE` (default 1G)

<https://www.elastic.co/guide/en/elasticsearch/reference/current/setup-configuration-memory.html>



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Design your index



Design your index

Sharding
Replication



Sharding

Elasticsearch divides the data in **logical** parts
of sharding is define when index created



How many shard ?



Need to know your size of data

Data Size	# of shard
< 3M	1
>3M <5M	2
>5M	(# of document / 5M) + 1



Sharding

Small shards on multiple nodes make the cluster recovery faster

Small shards on a lot of nodes solve memory mgt problem when query on large data



More shard, more Segment !!

Elasticsearch Index				
Shard	Shard	Shard	Shard	Shard
Lucene index	Lucene index	Lucene index	Lucene index	Lucene index
Segment	Segment	Segment	Segment	Segment

Need to config file descriptor

<https://www.elastic.co/guide/en/elasticsearch/reference/current/system-config.html>



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Don't create more shard than you need !!



Replication

Prevent data loss

Default = 1

```
# nodes = [(primary + # replication) /2 ] + 1
```



Problems with scaling

CPU consumption
Load average
Request rate
Search latency



Slow log

```
PUT /myindex/_settings
```

```
{  
  "index.search.slowlog.threshold.query.warn: 1s",  
  "index.search.slowlog.threshold.query.info: 500ms",  
  "index.search.slowlog.threshold.query.debug: 1500ms",  
  "index.search.slowlog.threshold.query.trace: 300ms",  
  "index.search.slowlog.threshold.fetch.warn: 500ms",  
  "index.search.slowlog.threshold.fetch.info: 400ms",  
  "index.search.slowlog.threshold.fetch.debug: 300ms",  
  "index.search.slowlog.threshold.fetch.trace: 200ms"  
}
```

If can't optimize then add more resources or rewrite

<https://www.elastic.co/guide/en/elasticsearch/reference/current/index-modules-slowlog.html>



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Indexing Data



Indexing data

Must be define data schema for your need
Default mapping == more cost (Memory/Disk)
Default for data is “text” + “keyword”
Understand analyzer and tokenizer
Use auto generated IDs if possible



Indexing data

Prefer bulk indexing

Change refresh interval

Time based index for log data

<https://www.elastic.co/guide/en/elasticsearch/reference/current/indices-update-settings.html>



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For Large data

Increase refresh interval
Decrease replica number

```
PUT /logstash-2015.05.20/_settings
{
  "index" : {
    "refresh_interval" : "-1",
    "number_of_replicas" : 0
  }
}
```

<https://www.elastic.co/guide/en/elasticsearch/reference/current/indices-update-settings.html>



Query Data



Query data

Use filters as much as possible
Use scan and scroll for dumping large data
 Node query cache
 Shard query cache
Retrieve only necessary fields

<https://www.elastic.co/guide/en/elasticsearch/reference/current/query-cache.html>



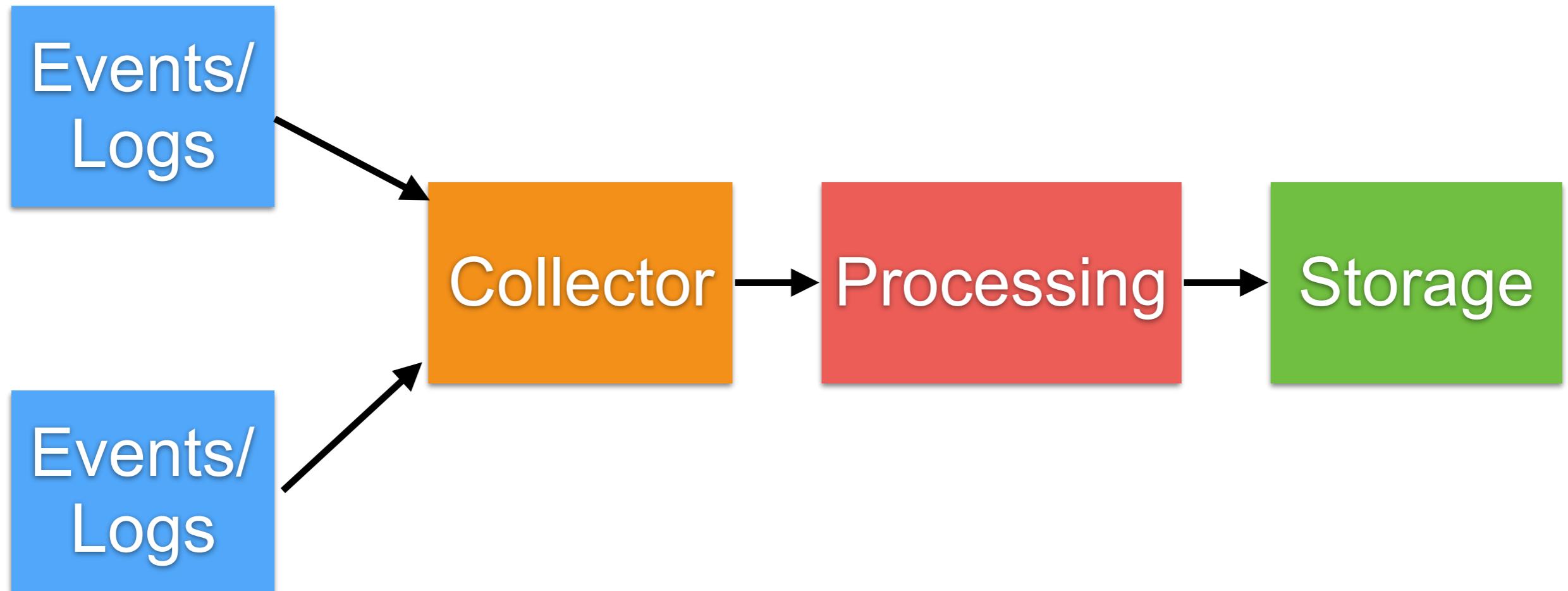
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Use cases



Event or Logging from Servers



Event or Logging from Servers



Data
Collection

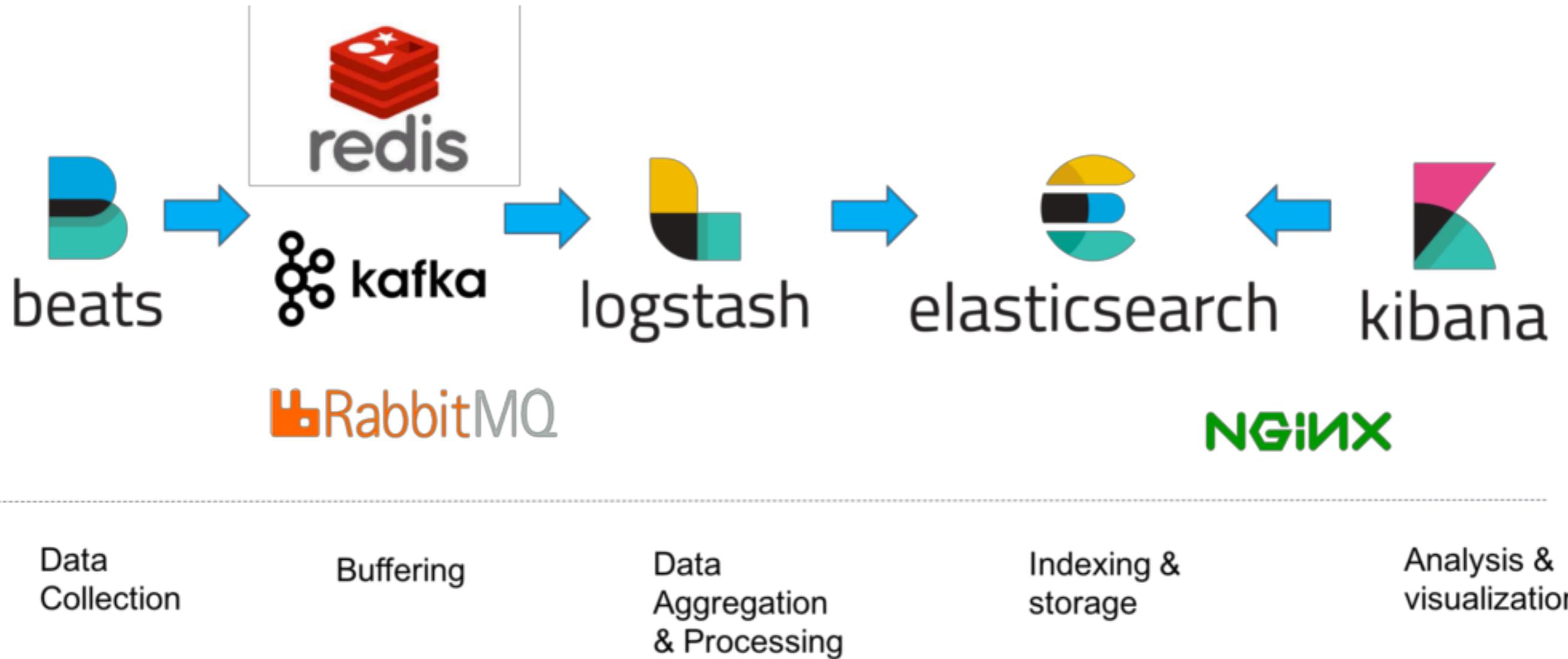
Data
Aggregation
& Processing

Indexing &
storage

Analysis &
visualization



Event or Logging from Servers



Monitoring



Collect data from ?

Elasticsearch nodes

Logstash nodes

Kibana instances

<https://www.elastic.co/guide/en/elasticsearch/guide/current/xpack-monitoring.html>

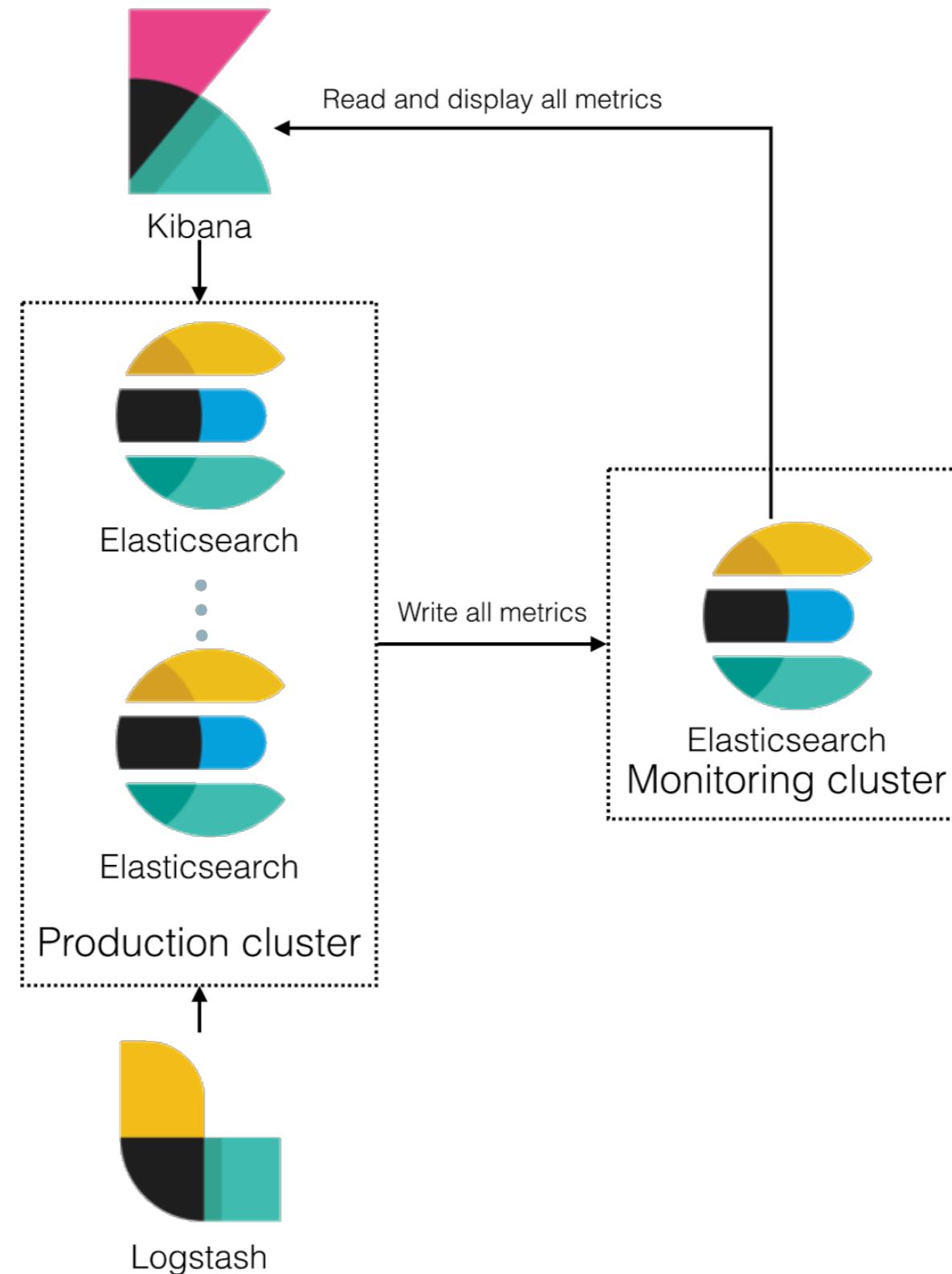


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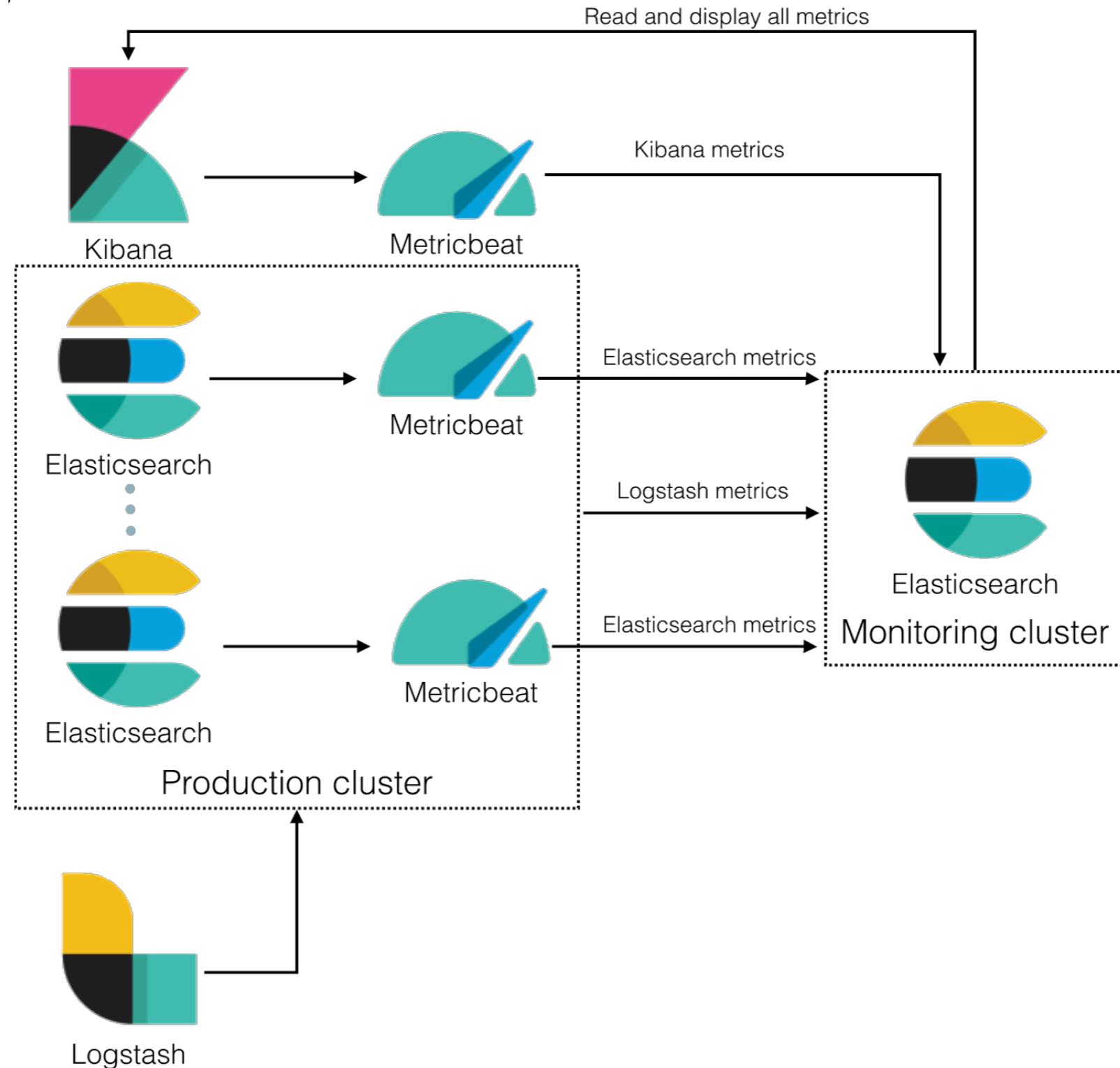
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Recommend architecture



Elasticsearch 6.4 + (beta)



Try to separate kibana

