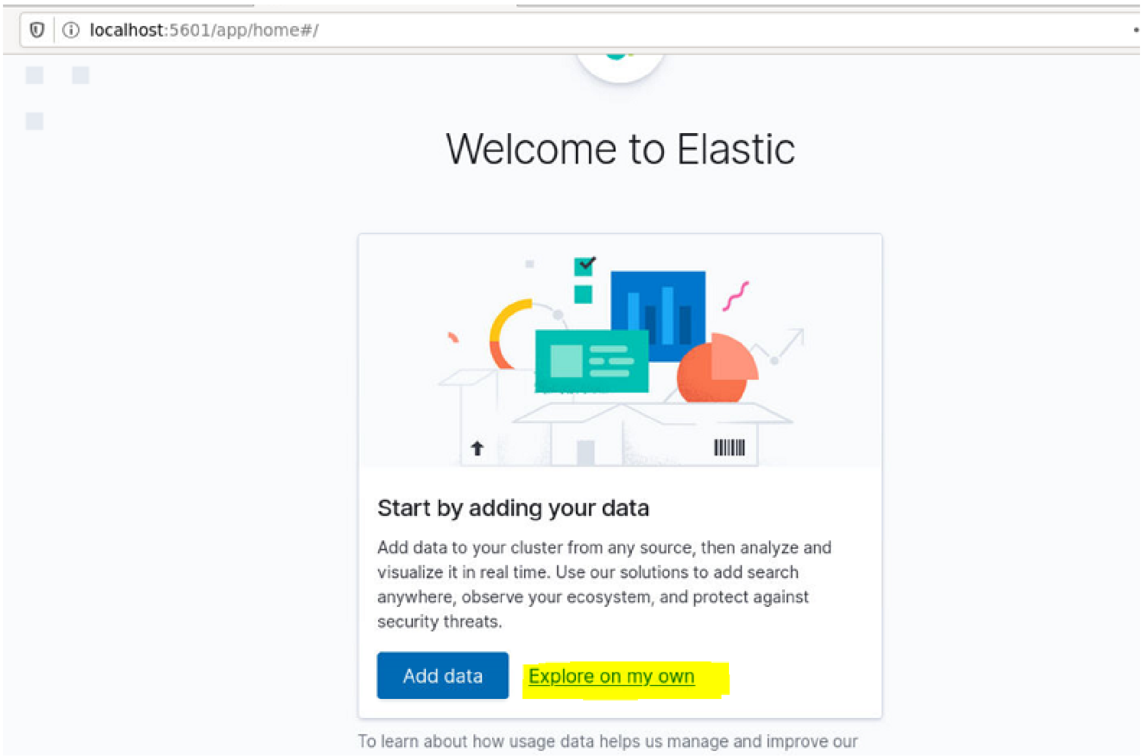
Lab 2. Getting Started with Elasticsearch

We will cover the following topics in this lab:

- Using the Kibana Console UI
- Core concepts of Elasticsearch
- CRUD operations
- Creating indexes and taking control of mapping
- REST API overview

Using the Kibana Console UI

In Lab 1, we successfully installed Kibana and launched the UI at `http://localhost:5601`. As we mentioned previously, Kibana is the window into the Elastic Stack. It not only provides insight into the data through visualizations, but it also has developer tools such as the `Console`. The following diagram shows the `Console` UI:

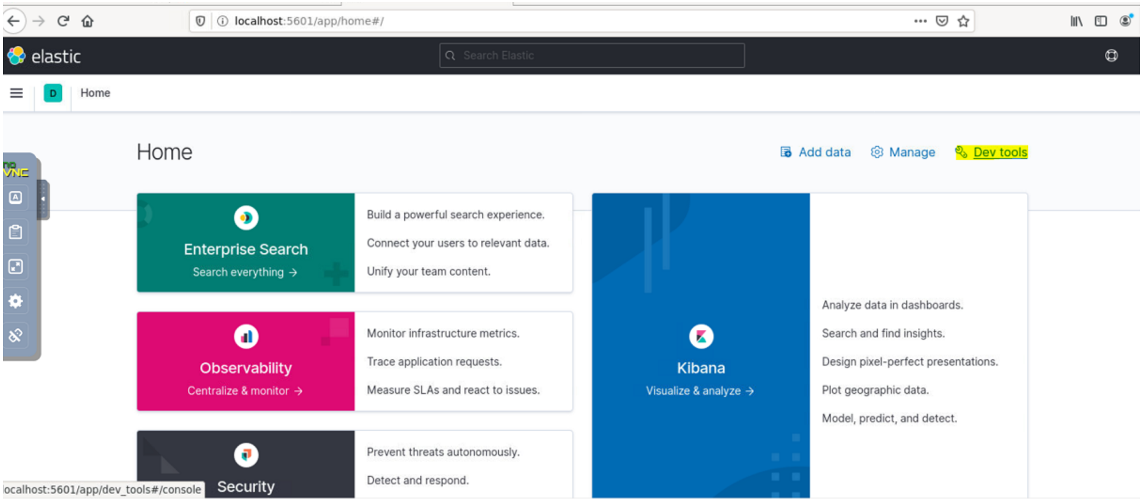


Welcome to Elastic

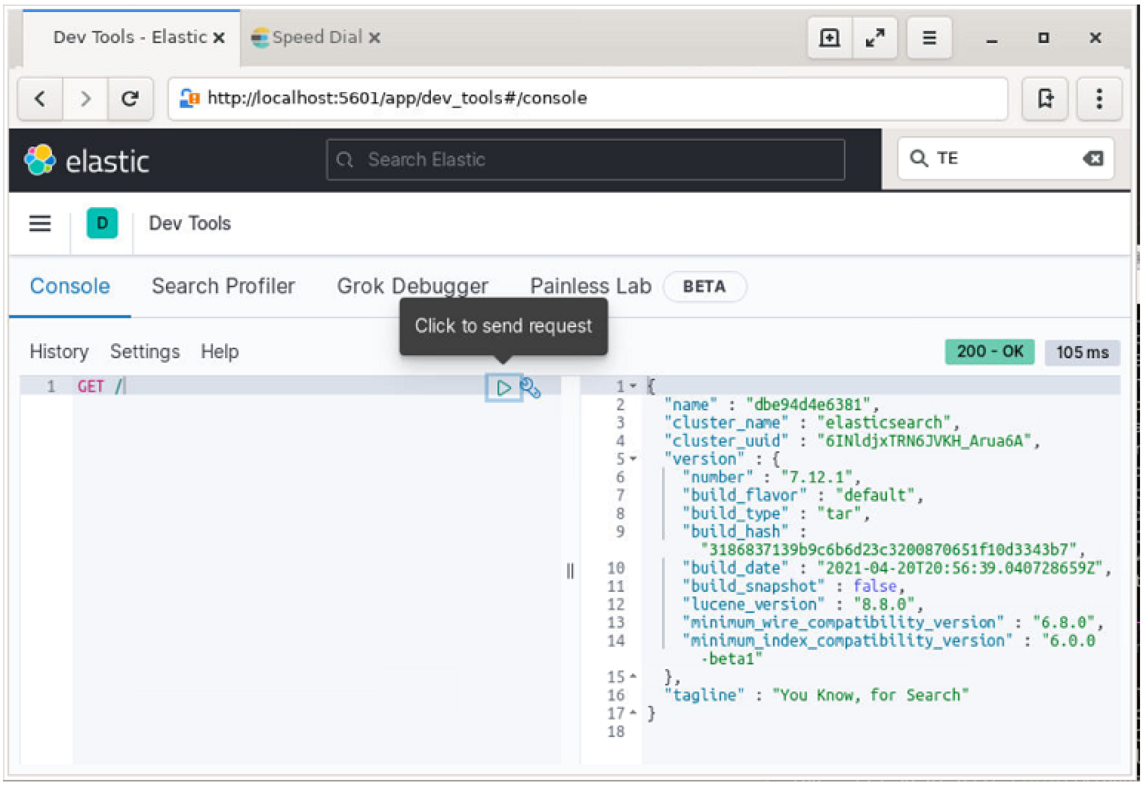
Start by adding your data

Add data to your cluster from any source, then analyze and visualize it in real time. Use our solutions to add search anywhere, observe your ecosystem, and protect against security threats.

To learn about how usage data helps us manage and improve our


localhost:5601/app/home#/
elastic
Search Elastic
Home
Home
Add data
Manage
Dev tools
Enterprise Search
Search everything →
Build a powerful search experience.
Connect your users to relevant data.
Unify your team content.
Observability
Centralize & monitor →
Monitor infrastructure metrics.
Trace application requests.
Measure SLAs and react to issues.
Security
Prevent threats autonomously.
Detect and respond.
Kibana
Visualize & analyze →
Analyze data in dashboards.
Search and find insights.
Design pixel-perfect presentations.
Plot geographic data.
Model, predict, and detect.
ocalhost:5601/app/dev_tools#/console

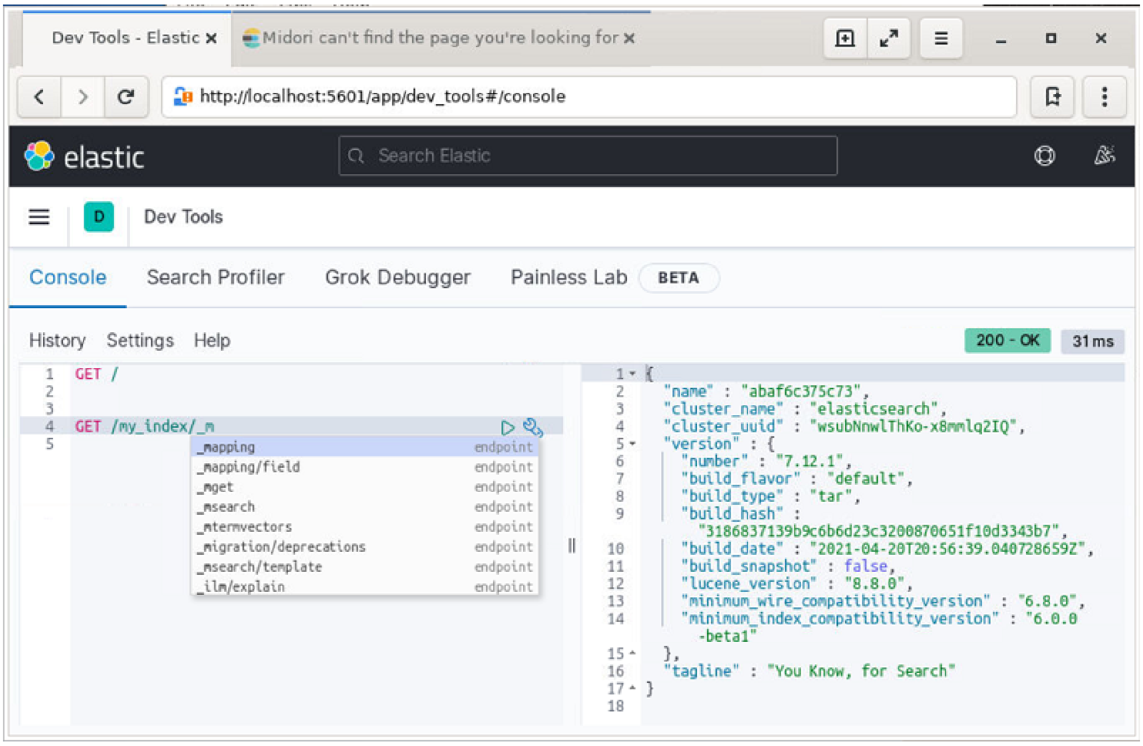
The Console is divided into two parts: the editor pane and the results pane. You can type the REST API command and press the green triangle-like icon, which sends the query to the Elasticsearch instance (or cluster).



```
GET /
```

```
{
  "name" : "dbe94d4e6381",
  "cluster_name" : "elasticsearch",
  "cluster_uuid" : "6INldjxTRN6JVKH_Arua6A",
  "version" : {
    "number" : "7.12.1",
    "build_flavor" : "default",
    "build_type" : "tar",
    "build_hash" :
      "3186837139b9c6b6d23c3200870651f10d3343b7",
    "build_date" : "2021-04-20T20:56:39.040728659Z",
    "build_snapshot" : false,
    "lucene_version" : "8.8.0",
    "minimum_wire_compatibility_version" : "6.8.0",
    "minimum_index_compatibility_version" : "6.0.0
      -beta1"
  },
  "tagline" : "You Know, for Search"
}
```

Here, we have simply sent the `GET /` query. This is equivalent to the `curl` command that we sent to Elasticsearch for testing the setup, that is, `curl http://localhost:9200`. As you can see, the length of the command that's sent via the Console is already more concise than the `curl` command. You don't need to type `http` followed by the host and port of the Elasticsearch node, that is, `http://localhost:9200`. However, as we mentioned earlier, there is much more to it than just skipping the host and port with every request. As you start typing in the `Console` editor, you will get an autosuggestion dropdown, as displayed in the following screenshot:



```
GET /


GET /my_index/_m
```

```
_mapping                  endpoint
_mapping/field            endpoint
_mget                     endpoint
_msearch                  endpoint
_mtermvectors             endpoint
_migration/deprecations   endpoint
_msearch/template         endpoint
_ilm/explain              endpoint
```

```
{
  "name" : "abaf6c375c73",
  "cluster_name" : "elasticsearch",
  "cluster_uuid" : "wsubNnwlThKo-x8mmlq2IQ",
  "version" : {
    "number" : "7.12.1",
    "build_flavor" : "default",
    "build_type" : "tar",
    "build_hash" :
      "3186837139b9c6b6d23c3200870651f10d3343b7",
    "build_date" : "2021-04-20T20:56:39.040728659Z",
    "build_snapshot" : false,
    "lucene_version" : "8.8.0",
    "minimum_wire_compatibility_version" : "6.8.0",
    "minimum_index_compatibility_version" : "6.0.0
      -beta1"
  },
  "tagline" : "You Know, for Search"
}
```

Now that we have the right tool to generate and send queries to Elasticsearch, let's continue learning about the core concepts.

Core concepts of Elasticsearch

Let's look at the following core abstractions of Elasticsearch:

- Indexes
- Types
- Documents
- Clusters
- Nodes
- Shards and replicas
- Mappings and types
- Inverted indexes

Let's start learning about these with an example:

```
PUT /catalog/_doc/1
{
   "sku": "SP000001",
   "title": "Elasticsearch for Hadoop",
   "description": "Elasticsearch for Hadoop",
   "author": "Vishal Shukla",
   "ISBN": "1785288997",
   "price": 26.99
}
```

Copy and paste this example into the editor of your Kibana Console UI and execute it. This will index a document that represents a product in the product catalog of a system. All of the examples that are written for the Kibana Console UI can be very easily converted into `curl` commands that can be executed from the command line. The following is the curl version of the previous Kibana Console UI command:

```
curl -XPUT http://localhost:9200/catalog/_doc/1 -H 'content-type: application/json' -d
'{ "sku": "SP000001", "title": "Elasticsearch for Hadoop", "description":
"Elasticsearch for Hadoop", "author": "Vishal Shukla", "ISBN": "1785288997", "price":
26.99}'
```

We will use this example to understand the following concepts: indexes, types, and documents.

In the previous code block, the first line is `PUT /catalog/_doc/1`, which is followed by a JSON document.

`PUT` is the `HTTP` method that's used to index a new document. `PUT` is among the other `HTTP` methods we covered earlier. Here, `catalog` is the name of the index, `_doc` is the name of the type where the document will be indexed (more on this later; each index in Elasticsearch 7.0 should create just one type), and `1` is the ID to be assigned to the document after it is indexed.

Types

Typically, documents with mostly common sets of fields are grouped under one type. Elasticsearch is schemaless, allowing you to store any JSON document with any set of fields into a type. In practice, we should avoid mixing completely different entities, such as customers and products, into a single type. It makes sense to store them in separate types within separate indexes.

The following code is for the index for customers:

```
PUT /customers/_doc/1
{
 "firstName": "John",
 "lastName": "Smith",
 "contact": {
 "mobile": "212-xxx-yyyy"
 }

}
```

The following code is for the index for products:

```
PUT /products/_doc/1
{
 "title": "Apple iPhone Xs (Gold, 4GB RAM, 64GB Storage, 12 MP Dual Camera, 458 PPI
Display)",
 "price": 999.99
}
```

As you can see, different types of documents are better handled in different indexes since they may have different sets of fields/attributes.

Mappings

To understand mappings, let's add another product to the product catalog:

```
PUT /catalog/_doc/2
{
    "sku": "SP000002",
    "title": "Google Pixel Phone 32GB - 5 inch display",
    "description": "Google Pixel Phone 32GB - 5 inch display (Factory Unlocked US
Version)",
    "price": 400.00,
    "resolution": "1440 x 2560 pixels",
    "os": "Android 7.1"
}
```

Copy and paste this example into the editor of your Kibana Console UI and execute it.

As you can see, the product has many different fields, as it is of a completely different category. Yet, there are some fields that are common in all products. The common fields are the reason why all of these documents are called **products**.

Defining the mappings for the type of product

To see the mappings of the product type in the catalog index, execute the following command in the Kibana Console UI:

```
GET /catalog/_mapping
```

This is an example of a `GET` mapping API (https://www.elastic.co/guide/en/elasticsearch/reference/current/indices-get-mapping.html). You can request mappings of a specific type, all the types within an index, or within multiple indexes.

The response should look like the following:

```
{
  "catalog" : {
    "mappings" : {
      "properties" : {
        "ISBN" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "author" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "description" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "os" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "price" : {
          "type" : "float"
        },
        "resolution" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "sku" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "title" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        }
      }
    }
  }
}
```

At the top level of the JSON response, `catalog` is the index for which we requested mappings. The `mappings` child product signifies the fact that these are mappings for the product type. The actual datatype mappings for each field are under the `properties` element.

The actual type mappings that are returned will be slightly different from the ones shown in the preceding code. It has been simplified slightly. As you can see, only `price` is of the `float` datatype; the other fields were mapped to the `text` type. In reality, each `text` datatype field is mapped as follows:

```
"field_name": {
"type": "text",
"fields": {
"keyword": {
"type": "keyword",
"ignore_above": 256
}
  }
}
```

CRUD operations

To understand how to perform CRUD operations, we will cover the following APIs. These APIs fall under the category of document APIs, which deal with documents:

- Index API
- Get API
- Update API
- Delete API

Indexing a document by providing an ID

We have already seen this version of the indexing operation. The user can provide the ID of the document using the `PUT` method.

The format of this request is `PUT /<index>/<type>/<id>`, with the JSON document as the body of the request:

```
PUT /catalog/_doc/1
{
    "sku": "SP000001",
    "title": "Elasticsearch for Hadoop",
    "description": "Elasticsearch for Hadoop",
    "author": "Vishal Shukla",
    "ISBN": "1785288997",
    "price": 26.99
}
```

Indexing a document without providing an ID

If you don't want to control the ID generation for the documents, you can use the `POST` method.

The format of this request is `POST /<index>/<type>`, with the JSON document as the body of the request:

```
POST /catalog/_doc
{
    "sku": "SP000003",
    "title": "Mastering Elasticsearch",
    "description": "Mastering Elasticsearch",
    "author": "Bharvi Dixit",
    "price": 54.99
}
```

The ID, in this case, will be generated by Elasticsearch. It is a hash string, as highlighted in the response:

```
{
  "_index" : "catalog",
  "_type" : "_doc",
  "_id" : "UpdateIdHere",
  "_version" : 1,
  "result" : "created",
  "_shards" : {
    "total" : 2,
    "successful" : 1,
    "failed" : 0
  },
  "_seq_no" : 4,
  "_primary_term" : 1
}
```

Copy "_id" field value and save it, we will use its value in the next steps.

Note

As per pure REST conventions, `POST` is used for creating a new resource and `PUT` is used for updating an existing resource. Here, the usage of `PUT` is equivalent to saying [*I know the ID that I want to assign, so use this ID while indexing this document*] .

Get API

The get API is useful for retrieving a document when you already know the ID of the document. It is essentially a get by primary key operation, as follows:

```
GET /catalog/_doc/UpdateIdHere
```

Note: Replace `UpdateIdHere` with your "_id" value.

The format of this request is `GET /<index>/<type>/<id>` . The response would be as expected:

```
{
  "_index" : "catalog",
  "_type" : "_doc",
  "_id" : "UpdateIdHere",
  "_version" : 1,
  "_seq_no" : 4,
  "_primary_term" : 1,
  "found" : true,
  "_source" : {
    "sku" : "SP000003",
    "title" : "Mastering Elasticsearch",
    "description" : "Mastering Elasticsearch",
"author": "Bharvi Dixit",
    "price": 54.99
}
}
```

Update API

The update API is useful for updating the existing document by ID.

The format of an update request is `POST <index>/<type>/<id>/_update`, with a JSON request as the body:

```
POST /catalog/_update/1
{
"doc": {
"price": "28.99"
}
}
```

The properties specified under the `doc` element are merged into the existing document. The previous version of this document with an ID of `1` had a price of `26.99`. This update operation just updates the price and leaves the other fields of the document unchanged. This type of update means that `doc` is specified and used as a partial document to merge with an existing document; there are other types of updates supported.

The response of the update request is as follows:

```
{
  "_index" : "catalog",
  "_type" : "_doc",
  "_id" : "1",
  "_version" : 4,
  "result" : "updated",
  "_shards" : {
    "total" : 2,
    "successful" : 1,
    "failed" : 0
  },
  "_seq_no" : 6,
  "_primary_term" : 1
}
```

Internally, Elasticsearch maintains the version of each document. Whenever a document is updated, the version number is incremented.

The partial update that we saw in the preceding code will work only if the document existed beforehand. If the document with the given ID did not exist, Elasticsearch will return an error saying that the document is missing. Let's understand how to do an `upsert` operation using the update API. The term **upsert** loosely means update or insert, that is, update the document if it exists, otherwise, insert the new document.

The `doc_as_upsert` parameter checks whether the document with the given ID already exists and merges the provided `doc` with the existing document. If the document with the given ID doesn't exist, it inserts a new document with the given document contents.

The following example uses `doc_as_upsert` to merge into the document with an ID of `3` or insert a new document if it doesn't exist:

```
POST /catalog/_update/3
{
"doc": {
    "author": "Albert Paro",
    "title": "Elasticsearch 7",
    "description": "Elasticsearch 7 Course",
"price": "54.99"
},
"doc_as_upsert": true
}
```

We can update the value of a field based on the existing value of that field or another field in the document. The following update uses an inline script to increase the price by two for a specific product:

```
POST /catalog/_update/UpdateIdHere
{
  "script": {
    "source": "ctx._source.price += params.increment",
    "lang": "painless",
    "params": {
      "increment": 2
    }
  }
}
```

Delete API

The delete API lets you delete a document by ID:

```
DELETE /catalog/_doc/UpdateIdHere
```

The response of the delete operation is as follows:

```
{
  "_index" : "catalog",
  "_type" : "_doc",
  "_id" : "UpdateIdHere",
  "_version" : 4,
  "result" : "deleted",
  "_shards" : {
    "total" : 2,
    "successful" : 1,
    "failed" : 0
  },
  "_seq_no" : 9,
  "_primary_term" : 1
}
```

This is how basic CRUD operations are performed with Elasticsearch. Please bear in mind that Elasticsearch maintains data in a completely different data structure, that is, an inverted index, using the capabilities of Apache Lucene. A relational database builds and maintains B-trees, which are more suitable for typical CRUD operations.

Creating indexes and taking control of mapping

In this section, we will look at the following:

- Creating an index
- Creating a mapping
- Updating a mapping

Creating an index

You can create an index and specify the number of shards and replicas to create:

```
PUT /catalog_abc
{
  "settings": {
    "index": {
      "number_of_shards": 5,
      "number_of_replicas": 2
    }
  }
}
```

It is possible to specify a mapping for a type at the time of index creation. The following command will create an index called catalog, with five shards and two replicas. Additionally, it also defines a type called `my_type` with two fields, one of the `text` type and another of the `keyword` type:

```
PUT /catalog1
{
  "settings": {
    "index": {
      "number_of_shards": 5,
      "number_of_replicas": 2
    }
  },
  "mappings": {
    "properties": {
      "f1": {
        "type": "text"
      },
      "f2": {
        "type": "keyword"
      }
    }
  }
}
```

Creating type mapping in an existing index

In the earlier versions of Elasticsearch (6.0 and before), it was possible to define an index and then add multiple types to that index as needed. This is still possible but it is a deprecated feature. A type can be added within an index after the index is created using the following code. The mappings for the type can be specified as follows:

```
PUT /catalog/_mapping
{
  "properties": {
    "name": {
      "type": "text"
    }
  }
}
```

This command creates a type called `_doc`, with one field of the `text` type in the existing index catalog. Let's add a couple of documents after creating the new type:

```
POST /catalog/_doc
{
"name": "books"
}
POST /catalog/_doc
{
"name": "phones"
}
```

After a few documents are indexed, you realize that you need to add fields in order to store the description of the category. Elasticsearch will assign a type automatically based on the value that you insert for the new field. It only takes into consideration the first value that it sees to guess the type of that field:

```
POST /catalog/_doc
{
 "name": "music",
 "description": "On-demand streaming music"
}
```

When the new document is indexed with fields, the field is assigned a datatype based on its value in the initial document. Let's look at the mapping after this document is indexed:

```
{
  "catalog" : {
    "mappings" : {
      "properties" : {
        "description" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "name" : {
          "type" : "text"
        }
      }
    }
  }
}
```

The field description has been assigned the `text` datatype, with a field with the `name` keyword, which is of the `keyword` type. What this means is that, logically, there are two fields, `description` and `description.keyword`. The `description` field is analyzed at the time of indexing, whereas the `description.keyword` field is not analyzed and is stored as is without any analysis. By default, fields that are indexed with double quotes for the first time are stored as both `text` and `keyword` types.

Updating a mapping

Mappings for new fields can be added after a type has been created. A mapping can be updated for a type with the `PUT` mapping API. Let's add a `code` field, which is of the `keyword` type, but with no analysis:

```
PUT /catalog/_mapping
{
  "properties": {
    "code": {
      "type": "keyword"
    }
  }
}
```

This mapping is merged into the existing mappings of the `_doc` type. The mapping looks like the following after it is merged:

```
{
  "catalog" : {
    "mappings" : {
      "properties" : {
        "code" : {
          "type" : "keyword"
        },
        "description" : {
          "type" : "text",
          "fields" : {
            "keyword" : {
              "type" : "keyword",
              "ignore_above" : 256
            }
          }
        },
        "name" : {
          "type" : "text"
        }
      }
    }
  }
}
```

Any subsequent documents that are indexed with the `code` field are assigned the right datatype:

```
POST /catalog/_doc
{
"name": "sports",
"code": "C004",
"description": "Sports equipment"
}
```

This is how we can take control of the index creation and type mapping process, and add fields after the type is created.

REST API overview

In the following section, we will cover the common API conventions that are applicable to all REST APIs.

Formatting the JSON response

By default, the response of all the requests is not formatted. It returns an unformatted JSON string in a single line:

```
curl -XGET http://localhost:9200/catalog/_doc/1
```

The following response is not formatted:

```
{"_index":"catalog","_type":"product","_id":"1","_version":3,"found":true,"_source":{
 "sku": "SP000001",
 "title": "Elasticsearch for Hadoop",
 "description": "Elasticsearch for Hadoop",
 "author": "Vishal Shukla",
 "ISBN": "1785288997",
 "price": 26.99
}}
```

Passing `pretty=true` formats the response:

```
curl -XGET http://localhost:9200/catalog/_doc/1?pretty=true
{
 "_index" : "catalog",
 "_type" : "product",
 "_id" : "1",
 "_version" : 3,
 "found" : true,
 "_source" : {
 "sku" : "SP000001",
 "title" : "Elasticsearch for Hadoop",
 "description" : "Elasticsearch for Hadoop",
 "author" : "Vishal Shukla",
 "ISBN" : "1785288997",
 "price" : 26.99
 }
}
```

When you are using the Kibana Console UI, all responses are formatted by default.

Dealing with multiple indexes

The following query matches all documents. The documents that are actually returned by the query will be limited to 10 in this case. The default size of the result is 10, unless specified otherwise in the query:

```
GET /_search
```

This will return all the documents from all the indexes of the cluster. The response looks similar to the following, and it is truncated to remove the unnecessary repetition of documents:

```
{
"took": 3,
"timed_out": false,
"_shards": {
"total": 16,
"successful": 16,
    </span>"failed": 0
},
"hits": {
"total": 4,
"max_score": 1,
"hits": [
      {
        "_index": ".kibana",
        "_type": "doc",
        "_id": "config:7.0.0",
        "_score": 1,
        "_source": {
          "type": "config",
          "config": {
            "buildNum": 16070
          }
        }
      },
      ...
      ...
    ]
  }
}
```

Note

Elasticsearch truncates the hits by `size`, which can be optionally specified as a request parameter using `GET /_search?size=100`. The default value for the `size` is 10, hence the search hits array will contain up to 10 records by default.

Searching all documents in one index

The following code will search for all documents, but only within the catalog index:

```
GET /catalog/_search
```

You can also be more specific and include the type in addition to the index name, like so:

```
GET /catalog/_doc/_search
```

The version with the `_doc` type name produces a deprecation warning because each index is supposed to contain only one type.

Searching all documents in multiple indexes
The following will search for all the documents within the `catalog` index and an index named `my_index`:

```
GET /catalog,my_index/_search
```

Task: create new index named `my_index`. Otherwise, execute following query in Kibana Console UI:

```
GET /catalog,catalog/_search
```

Searching all the documents of a particular type in all indexes
The following will search all the indexes in the cluster, but only documents of the product type will be searched:

```
GET /_all/_doc/_search
```

This feature can be quite handy when you have multiple indexes, with each index containing the exact same type. This type of query can help you query data for that type from all indexes.

Summary

In this lab, we learned about the essential Kibana Console UI and curl commands that we can use to interact with Elasticsearch with the REST API. Then, we looked at the core concepts of Elasticsearch. We performed customary CRUD operations, which are required as support for any data store. We took a closer look at how to create indexes, and how to create and manage mappings. We ended this lab with an overview of the REST API in Elasticsearch, and the common conventions that are used in most APIs.

In the next lab, we will take a deep dive into the search capabilities of Elasticsearch to understand the maximum benefits of Elasticsearch as a search engine.