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Elasticsearch as a search alternative to a relational database

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What is Elasticsearch?

What is Elasticsearch (ES)?

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- Document-oriented schema-free "database"
- Built on top of Apache Lucene
- Real-time search and data analytics
- Full-text search
- Distributed (horizontal scalability)
- High-avalability
- REST API

"Open Source (Apache 2)

distributed

RESTful

search engine

built on top of Lucene"

ES for relational database users...

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Oracle	Elasticsearch
Database	Index
Partition	Shard
Table	Type
Row	Document
Column	Field
Schema	Mapping
Index	- (everything is indexed)
SQL	Query DSL

Clustering – single node cluster

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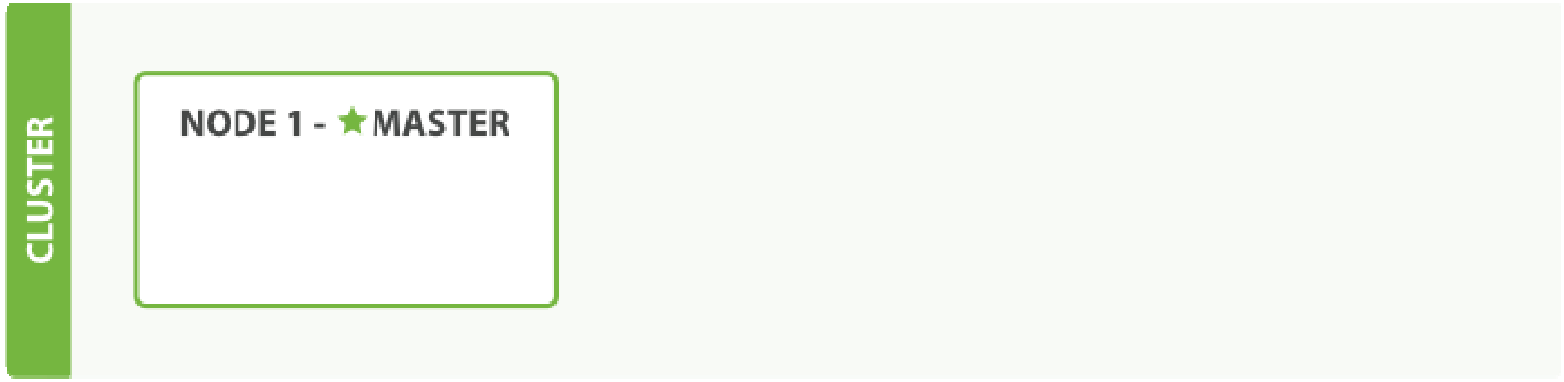

- **Node** = running instance of ES
- **Cluster** = 1+ nodes with the same cluster.name
- Every cluster has **1 master node**
- **Clients talk to any node in the cluster**
- 1 Cluster can have any number of indexes

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About indexes & shards

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Index

- All data is stored inside one or more indexes
- Index has one or more shards (change requires reindexing)
- One index is one folder somewhere on disk
- Backup an index? Just tar/zip the folder....

Shard

- Each shard is one full instance of Lucene
- Each shard can have zero or more replicas (can be changed at any time)

Clustering – adding a second node

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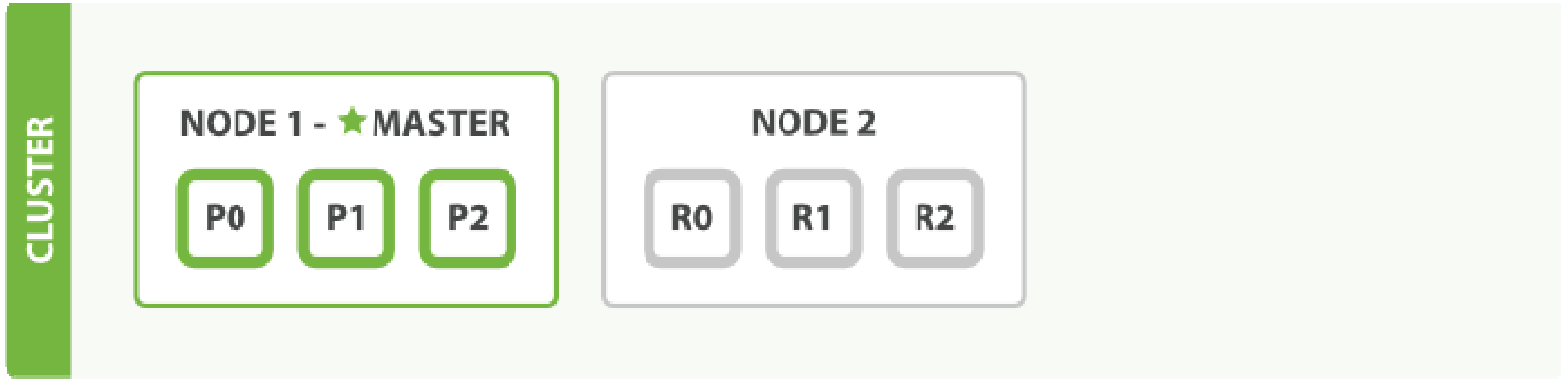

- Example above:
  - 3 indexes
  - Each index has one primary (P) and one replica (R) shard

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Clustering – adding a third node

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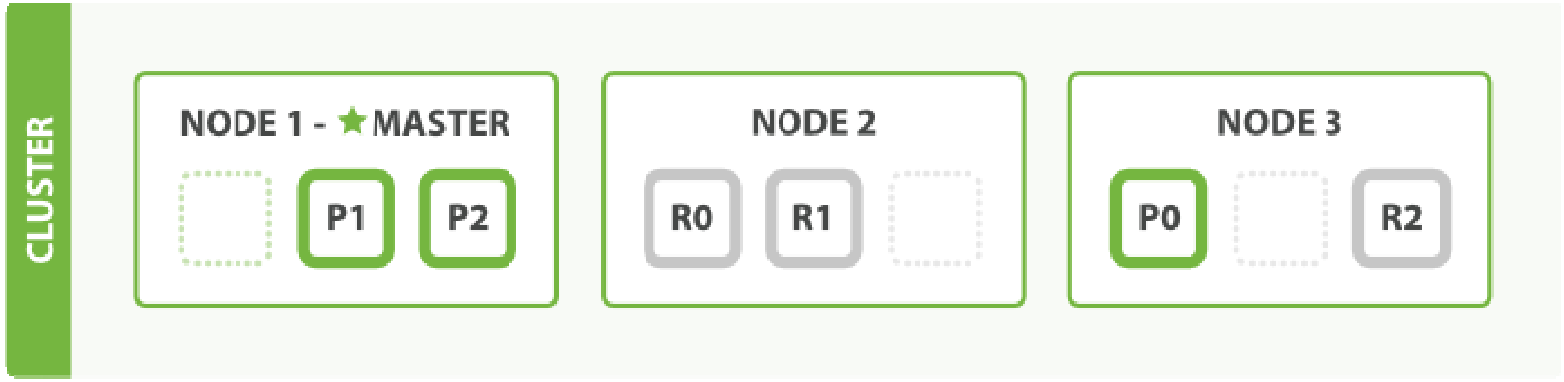

- More primary shards:
  - faster indexing
  - more scale
- More replicas:
  - faster searching
  - more failover

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About documents...

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- Documents are JSON-based
- Schema-free, but not necessarily!
- If no schema:
  - ES guesses field type
  - and indexes it
- With schema (or explicit mapping):
  - Mapping applies to specific document type (type is just a label)
  - Mapping defines the following for each field:
    - kind (string, number, date...)
    - to index or not
    - to store data or not

About documents...

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- Each document has an ID (auto-generated or manually assigned)
- You can force placement of a document into a specific shard – routing!
- Versioning is available – optimistic version control !

Index details

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- inverted index

  Elasticsearch Server 1.0 (doc 1)
  Mastering Elasticsearch (doc 2)
  Apache Solr 4 Cookbook (doc 3)

Term	Count	Document
1.0	1	<1>
4	1	<3>
apache	1	<3>
cookbook	1	<3>
elasticsearch	2	<1>,<2>
mastering	1	<2>
server	1	<1>
solr	1	<3>

Indexing example

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```
POST /blog/blog_comment?routing=1
{
  "user_id" : 1,
  "date" : "2015-04-01T13:12:12",
  "comment" : "What's so cool about Elasticsearch?"
}
```

```
GET /blog/_mapping
{
   "blog": {
      "mappings": {
         "blog_comment": {
            "properties": {
               "comment": {
                  "type": "string"
               },
               "date": {
                  "type": "date",
                  "format": "dateOptionalTime"
               },
               "user_id": {
                  "type": "long"
               }
            }
         }
      }
   }
}
```

```
GET /blog/_search
{
   "took": 6,
   "timed_out": false,
   "_shards": {
      "total": 2,
      "successful": 2,
      "failed": 0
   },
   "hits": {
      "total": 1,
      "max_score": 1,
      "hits": [
         {
            "_index": "blog",
            "_type": "blog_comment",
            "_id": "AUzhH9M9HW_GzrF8oLAj",
            "_score": 1,
            "_source": {
               "user_id": 1,
               "date": "2015-04-01T13:12:12",
               "comment": "What's so cool about Elasticsearch?"
            }
         }
      ]
   }
}
```

Storing data - indexing

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- data input: REST, Java API, Rivers*
- data analysis: tokenizer and one or more filters
- types of filters:
  - lowercase filter – makes all tokens lowercased
  - synonyms filter – changes one token to another on the basis of synonym rules
  - language stemming filters - reducing tokens into root or base forms, the stem
- different data storing needs
  - string analyze,not_analyze field configuration
  - _all in field
  - memory field data or doc values
- segments, segment merging, throttling
- routing, indexing with routing

So, we can store documents

and then what?!?

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We query them!

- All the usual stuff (think of WHERE in SQL)
- Full text search with support for:
  - highlighting
  - stemming
  - ngrams & edge-ngrams
- Aggregations: term facets, date histograms, ranges
- Geo search: bounding box, distance,distance ranges, polygons
- Percolators (or reverse-search!)

Query details

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- search types (query_then_fetch, query_and_fetch ...)
- same type of analysis as indexing
- explain plan
- sorting,aggregating data with in memory or on disk values
- search filters
  - Boolean
  - And/Or/Not
- filter cache, BitSets
- routing, searching with routing

PBZ use case

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- turnovers by account: 600M documents, 200M/year
- routing by account number

- indexing performance, 30k-40k documents per second
- DB performance in seconds, ES performance in ms (3500 queries/sec):
  - find last 100 turnovers for a given account number: < 50 ms
  - find last 100 turnovers for a given account number where description contains some words: <100ms

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Cluster architecture

PBZ ES cluster architecture

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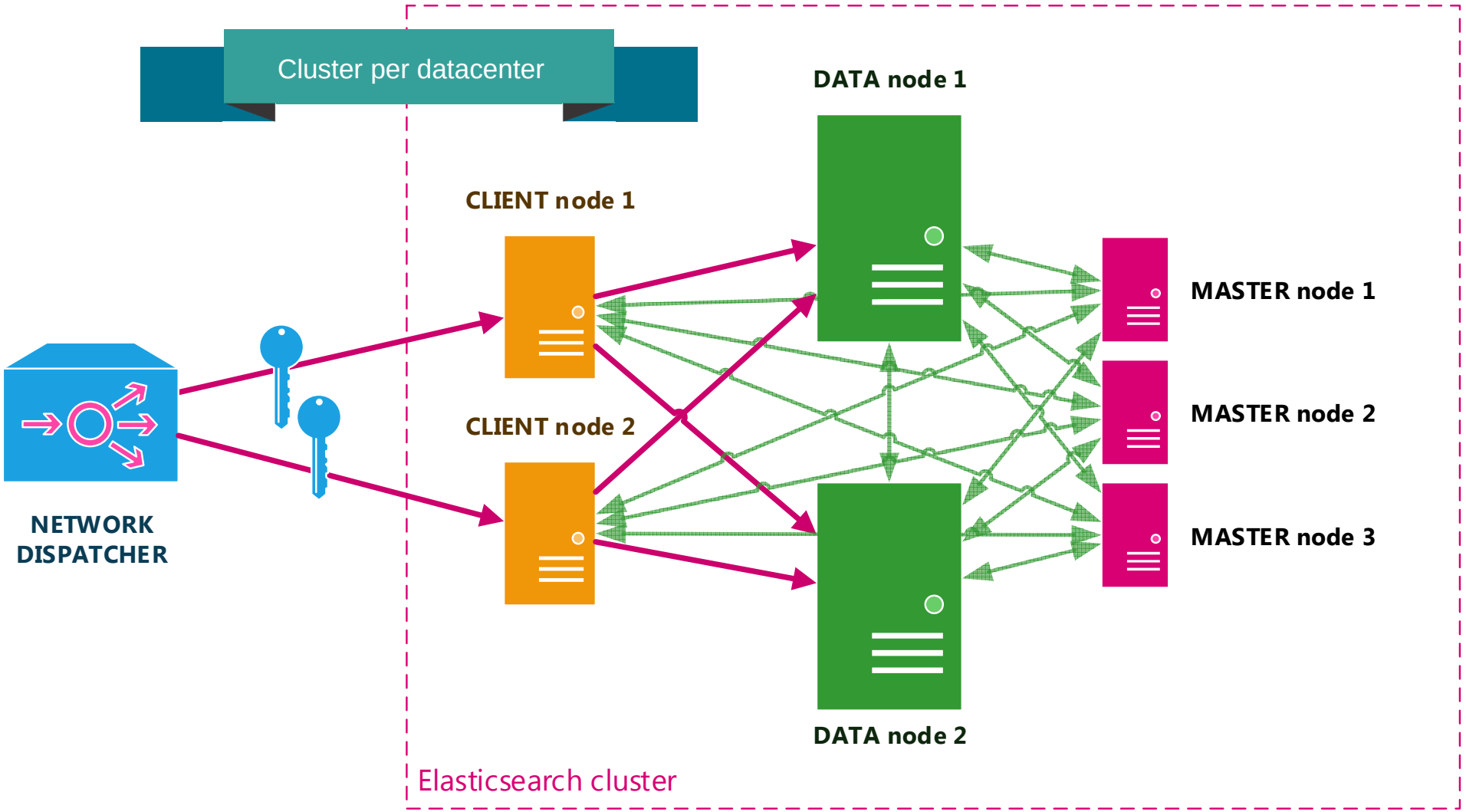

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PBZ ES cluster architecture

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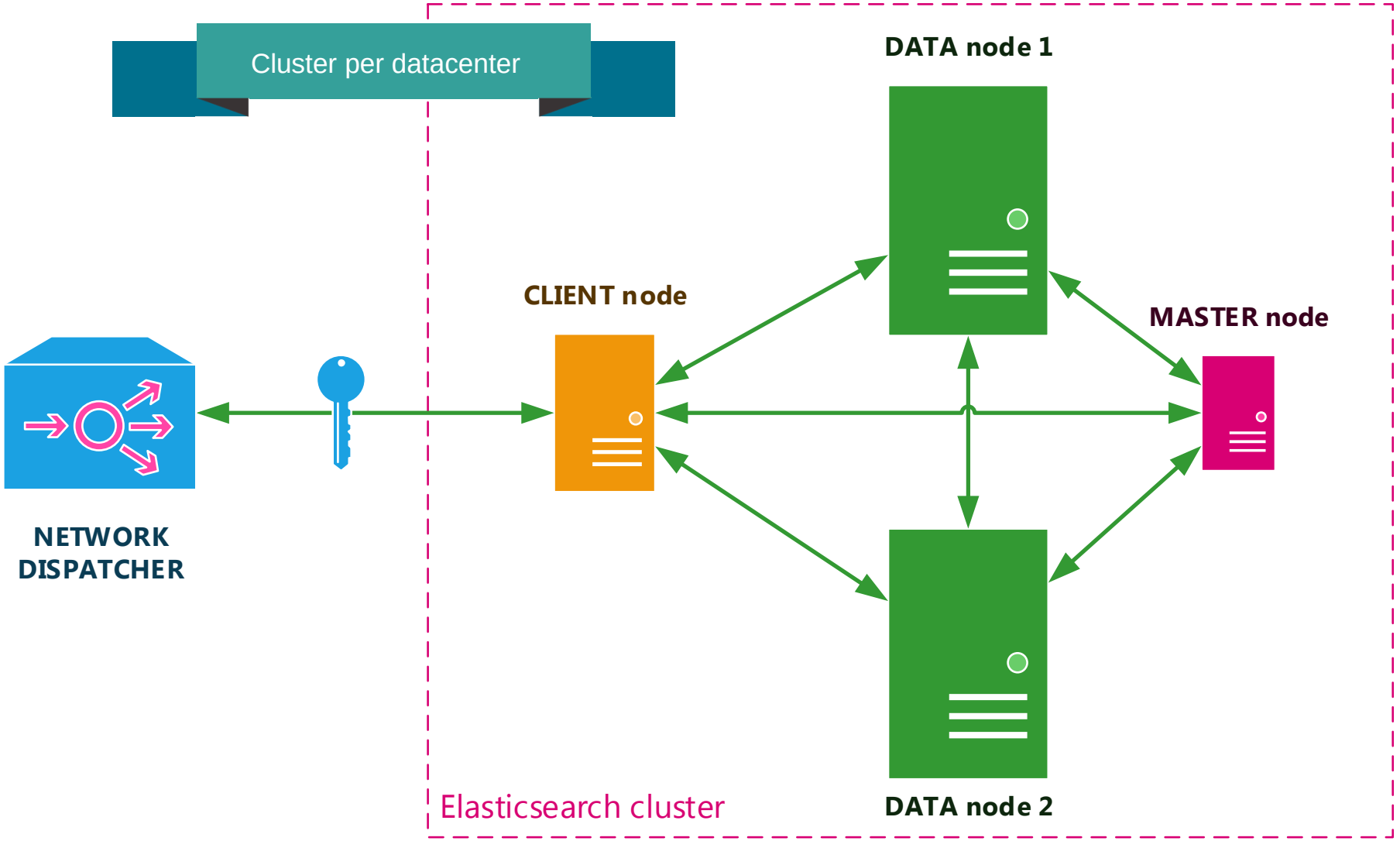

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Elasticsearch Administration

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- plugins
  - Marvel – monitoring console (GC, throttiling, CPU, memory, heap, search/indexing statistics ...)
  - Sense – REST UI to Elasticsearch
  - custom plugins (JDBC rivers ...)
- security
  - Apache Web server
  - Elasticsearch Shield
- speeding up queries using warmers

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Q & A

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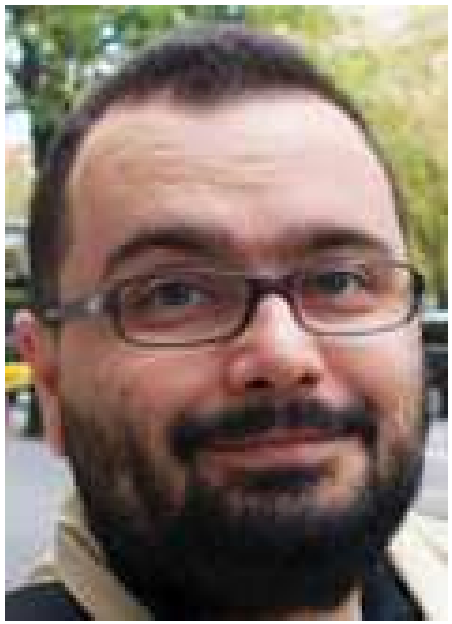

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