Couchbase

# 2교시.
# NoSQL 모델링, SDK 개요, 실습

1. SQL, NoSQL 모델링
2. SDK 개요
3. SDK 실습 : Python, Java

A. SQL Samples

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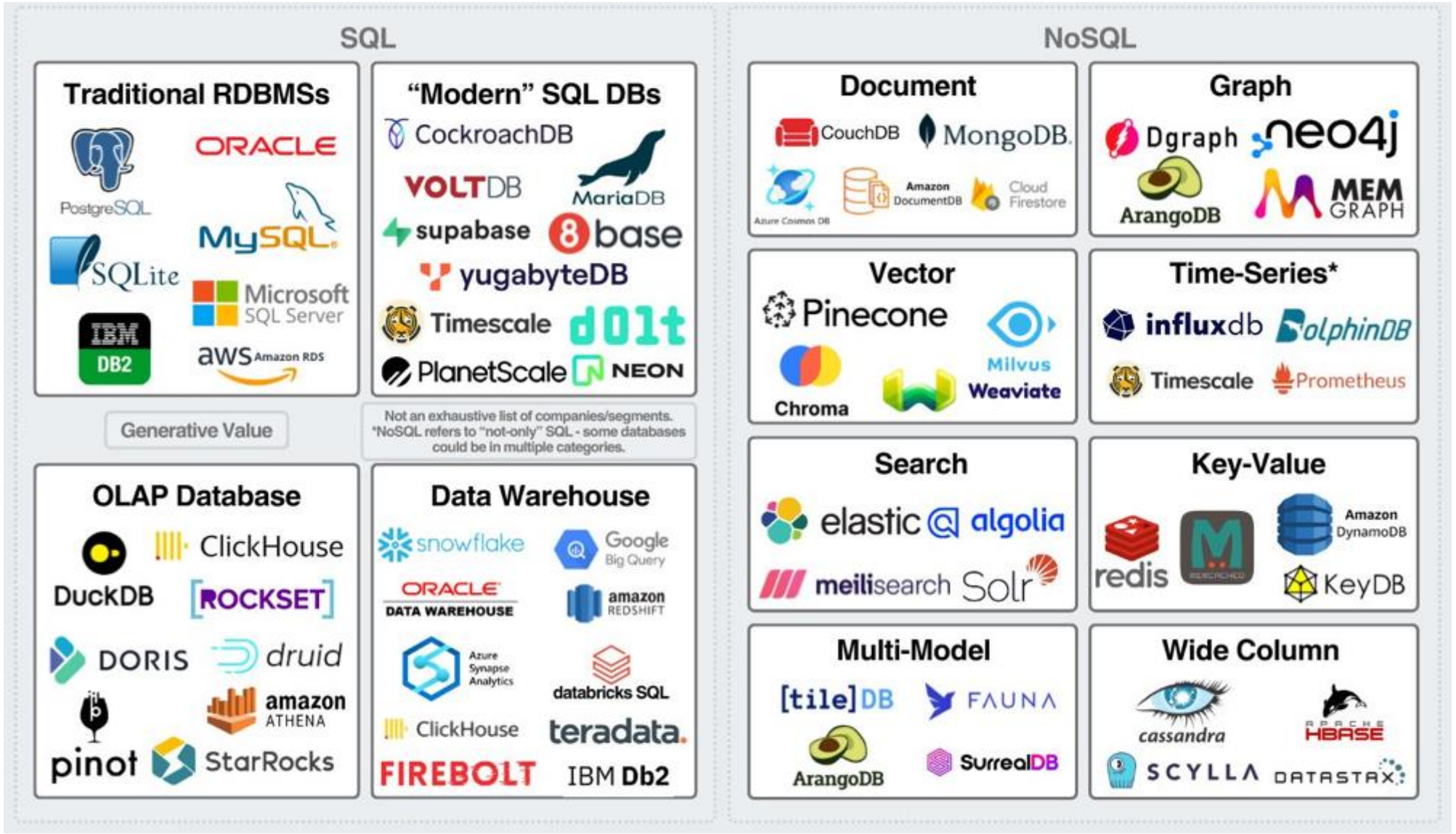
# 2-1.
# SQL, NoSQL 모델링

# 데이터 모델 : SQL(Table)과 NoSQL(Real World)



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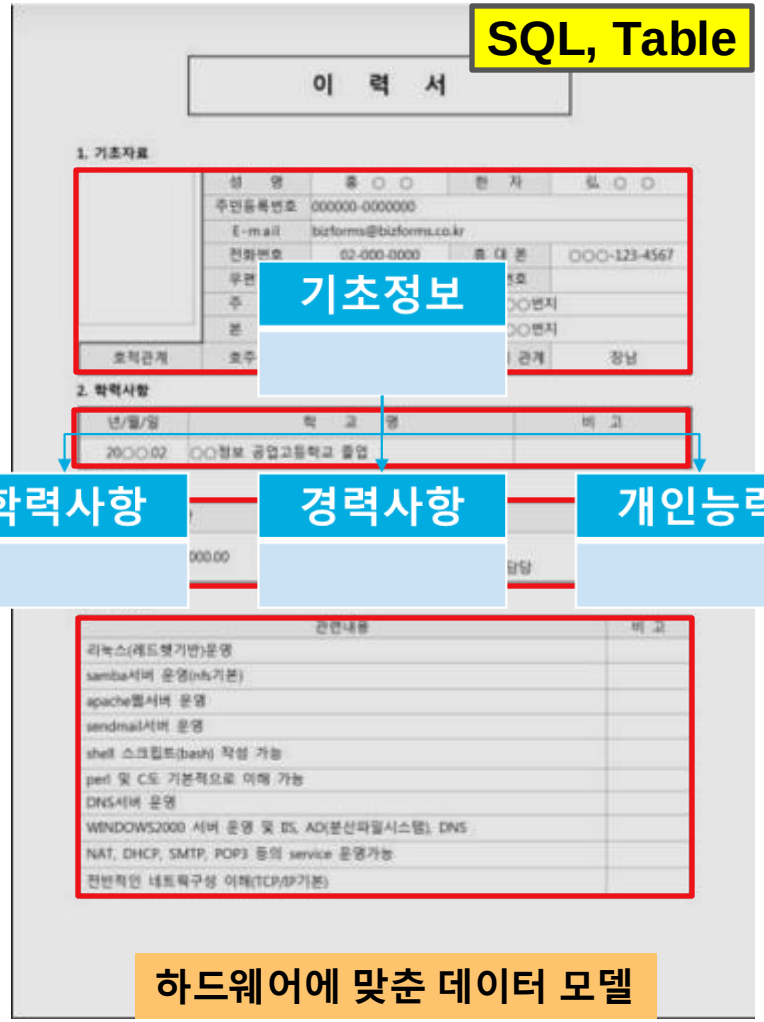
# 데이터 모델 : JSON 도큐먼트

**JSON은 텍스트로 이루어져 있으므로, 사람과 기계 모두 읽고 쓰기 쉽다. 프로그래밍 언어와 플랫폼에 독립적이므로, 서로 다른 시스템 간에 객체를 교환하기에 좋다.**

- JSON 도큐먼트의 장점
  - 단일 도큐먼트 내에 다양한 정보를 계층 구조를 활용하여 저장
  - 정보 추가/삭제가 유연한 구조 제공
  - 데이터 전달을 위한 표준 인터페이스 역할
- RDB와 차별점
  - 여러 테이블로 분리, 저장되는 데이터를 단일 도큐먼트에 저장
  - 테이블 간 조인을 최소화하여 데이터 처리 속도 향상




NoSQL, JSON 도큐먼트

```
KEY : 1001
{
    "성명": "홍길동",
    "주소": "서울시 OO구 OO동 OOO-OOO",
    "E-mail": "HongKildong@couchbase.com",
    …
    "학력사항": [
        {
            "졸업년도": "2019년",
            "학교명": "OO정보 공업고등학교"
        }
    ],
    "경력사항": [
        {
            "기간": "2019 ~ 현재",
            "관련내용": "XX글로벌 IT팀 Unix 서버 담당"
        }
    ]
    "개인능력": [
        {
            "관련내용": "리눅스 운영"
            "비고": NULL
        },
        …
    ]
}
```

실제 세계에 맞춘 데이터 모델



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# 논리 / 물리 모델

- RDBMS와 유사한 구조의 논리 계층 구조로 구성하여 편리한 데이터 관리
- Data 서비스를 완전 메모리DB로 사용도 가능하며 용도에 따라 물리 저장 방식을 선택할 수 있음

| RDBMS | Couchbase |
|---|---|
| Server | Cluster |
| **Database** | **Bucket** |
| **Schema** | **Scope** |
| **Table** | **Collection** |
| **Row** | **Document (JSON)** |
| Value | Sub-Document, Array |

| Feature | Ephemeral Bucket | Couchbase Bucket | Magma Bucket |
|---|---|---|---|
| Bucket memory quota (per node) | Min 256MB | Min 256MB | Min 1024MB |
| Max Object Size | 20MB | 20MB | 20MB |
| Persistence | no | yes | yes |
| Replication and XDCR | yes | yes | yes |
| Encrypted data access | yes | yes | yes |
| Rebalance | yes | yes | yes |
| N1QL, Seach, Analytics, Eventing | yes | yes | yes |
| Indexing | yes | yes | yes |
| Backup | yes | yes | yes |



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# 관계형 vs. 다큐멘터 데이터 모델

| 관계형 데이터 모델 | 다큐멘트 데이터 모델 |
| --- | --- |
| ***Required* 정규화** | ***Relaxed* 정규화** |
| • Schema enforced by the database (스키마가 데이터베이스에 의해 강제짐)<br>• Same fields required in all records (모든 레코드는 같은 필드를 가져야 함) | • Schema inferred from structure (시키마는 구조로 부터 추론됨)<br>• Fields may vary, be duplicate or missing (필드에 어떤 제약도 없음) |
| • Optimized for data entry(데이터 구성에 최적화)<br>• Reduced duplicated data (중복 감소,제거)<br>• Minimize data inconsistencies (데이터 불일치 최소화) | • Optimized based on access patterns (사용 패턴에 최적화)<br>• Flexible and agile development(유연하고 빠른 개발)<br>• Supports clustered, scalable architecture(확장성 보장) |



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# Real World Data 를 JSON으로 표현

**Customer**

| CustomerID | Name | DoB |
|---|---|---|
| CBL2017 | Jane Smith | 1990-01-30 |

Customer Document Key: CBL2017

```
{
    "Name" : "Jane Smith",
    "DOB"  : "1990-01-30”
}
```

OR

Customer Document Key: CBL2017

```
{
    "Name" : {
         "fname": "Jane",
         "lname": "Smith"
     }
    "DOB"  : "1990-01-30"
}
```

- **The Primary Key becomes the Document Key**
- **Column name-Column value become KEY-VALUE pair**



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# 고객의 카드 정보를 JSON으로 표현

## Customer

| CustomerID | Name | DoB |
|---|---|---|
| CBL2017 | Jane Smith | 1990-01-30 |

## Billing

| CustomerID | Type | CardNum | Expiry |
|---|---|---|---|
| CBL2017 | Visa | 5827-2842-2847-3222 | 2025-03 |
| CBL2017 | Master | 6274-2542-5847-3949 | 2024-12 |

Customer Document Key: CBL2017

```
{
    "Name" : "Jane Smith",
    "DOB"  : "1990-01-30",
    "Billing" : [
        {
            "type"    : "visa",
            "cardnum" : "5827-2842-2847-3222",
            "expiry"  : "2025-03"
        },
        {
            "type"    : "master",
            "cardnum" : "6274-2542-5847-3949",
            "expiry"  : "2024-12"
        }
    ]
}
```

- **Denormalization simplifies data access and offers the best performance**
  **비정규화는 데이터 사용을 단순화 해주고, 최고의 성능을 제공함**
- **Value evolution: Simply add additional array element or update a value**



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# 테이블(RDBMS)을 컬렉션(NoSQL)에 매핑 | eCommerce 예제

| Orders | |
|---|---|
| id | 200 |
| customer | 40 |
| status | Paid |

| Customers | |
|---|---|
| id | 40 |
| name | Jane Smith |
| email | jane@couchbase.com |
| address | 11-21 Paul Street |
| city | London |
| postcode | EC2Q 4JU |
| telephone | 44-20-3837-9130 |

| Orders Details | |
|---|---|
| id | 3000 |
| order | 200 |
| item | 1 |
| quantity | 3 |

| Products | |
|---|---|
| id | 1 |
| name | T-shirt |
| description | Red Couchbase T-shirt |
| image | tshirt_red.jpg |

**Bucket: ecommerce | Scope:_default**

*Collection*: **'Products'**

DocID:1

```
{
 "name": "T-shirt",
 "description": "Red Couchbase T-shirt",
 "image": "tshirt_red.jpg"
}
```

*Collection*: **'Customers'**

DocID:40

```
{
 "name": "Jane Smith",
 "email": "jane@couchbase.com",
 "address": "11-21 Paul Street",
 "city": "London",
 "postCode": "EC2A 4JU",
 "telephone": "44-20-3837-9130"
}
```

*Collection*: **'Orders'**

DocID:200

```
{
 "customer": {
  "id": 40,
   "name": "Jane smith",
   "email": "jane@couchbase.com"
 },
 "status":"Paid",
 "orderDetails": [
  { "productId" : 1, "name": "T-shirt","quantity": 3},
 ]
}
```



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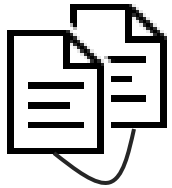
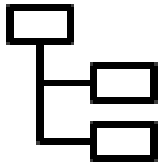
# JSON 데이터 모델시 고려사항



## EMBED WHEN

- There is an Ownership Relationship
  **오너쉽 관계가 명확할 때**
- Both docs are frequently accessed together
  **두 문서가 동시에 사용되는 경우가 많을 때**
- Reads greatly outnumber writes
  **읽기가 쓰기에 비해 많을 때**
- Data is small
  **데이터 사이즈가 작을 때**



## REFER WHEN

- There is not an Ownership Relationship
  **오너쉽 관계가 명확하지 않을 때**
- Both docs are not frequently accessed together
  **두 문서가 동시에 사용되는 경우이 작을 때**
- Document is updated frequently
  **문서가 자주 변경될 때**
- Need to reduce the document size
  **문서의 크기를 줄일 필요가 있을 때**

Try to embed first, refer when it makes sense

**먼저 Embed를 시도해 보고, 그 다음 Refer 고려**



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# Relationships에 따른 Embed 와 Refer

- **1-1**

  **Embed** Example: Satellite and Manufacturer

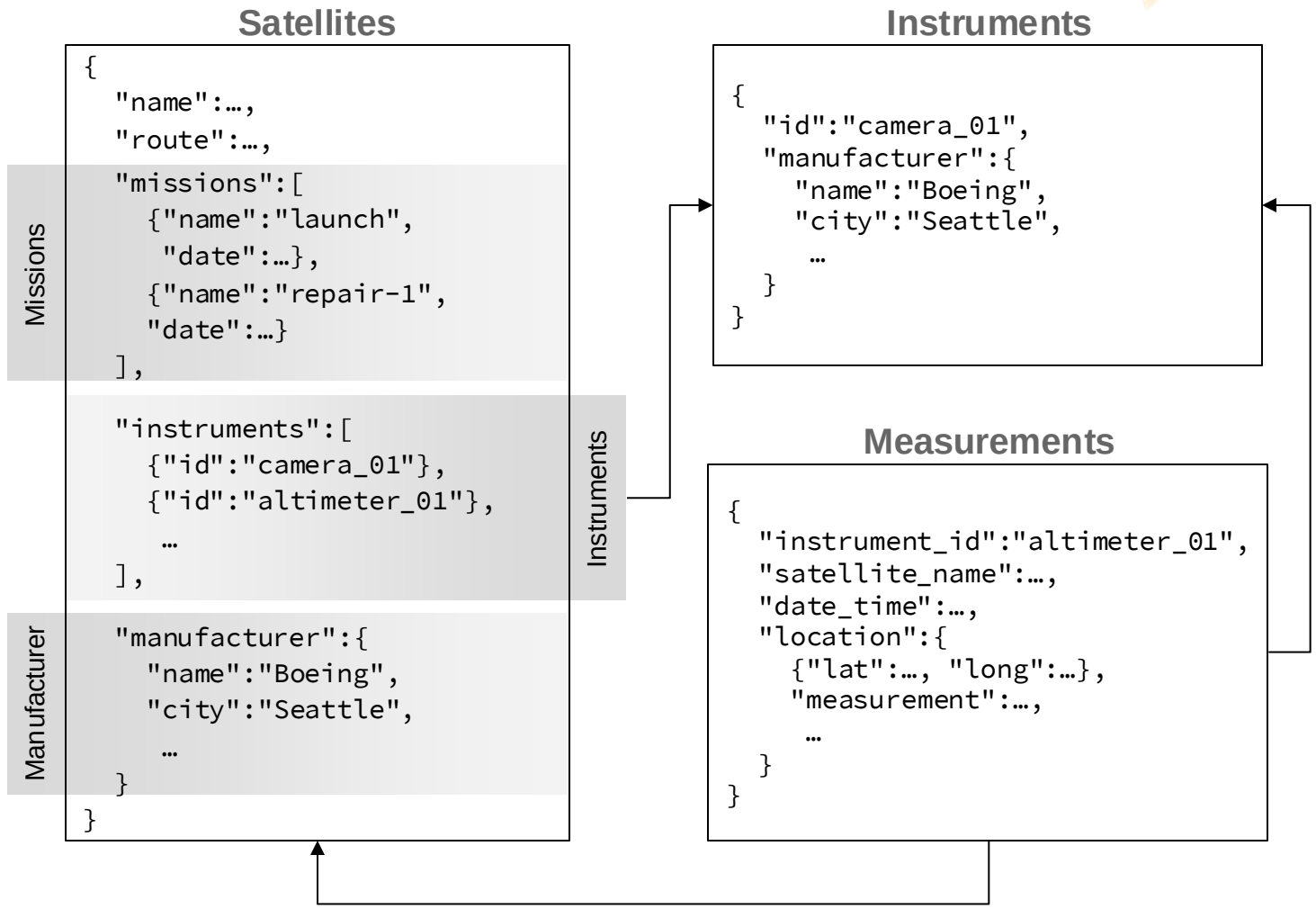
- **1-Many**

  **Embed** Example: Satellite and Missions

  **Reference** Example: Measurements, Satellites and Instruments

- **Many-Many**

  **Reference** Example: Satellite and Instruments



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# 2-2.
# SDK 개요

# SDK 개요

## 10 개 개발 언어에 대한 Couchbase 클러스터 접근을 위한 SDK(Software Development Kit) 제공

### Enterprise Support

v4.2

V4.3

v3.5

v2.8

v3.6

v4.2

v3.3

v1.6

v3.5

### Mobile Support

Java for Android

### Community Support

v1.0-pre

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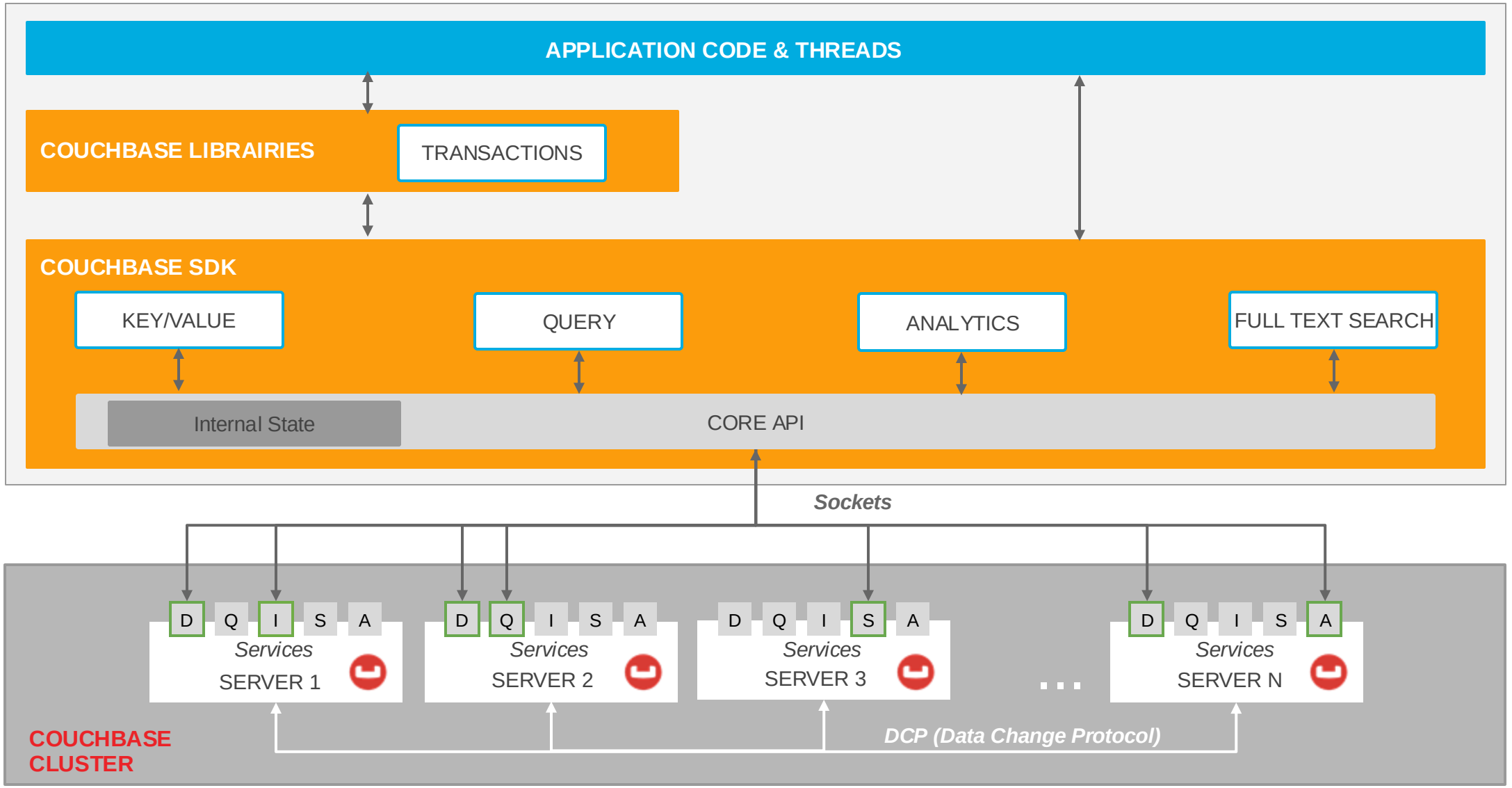
# SDK 아키텍처 : 통합 API 제공

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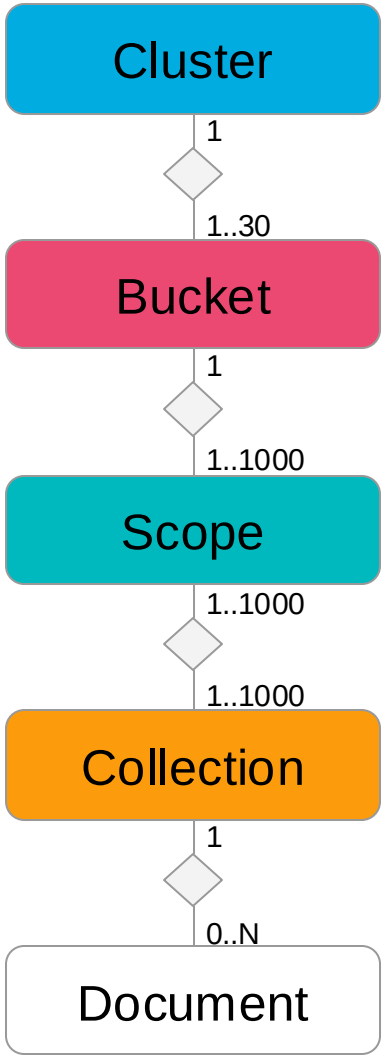
# SDK 아키텍처 : 엔티티 계층구조




- Provides access to **cluster-level** operations(인스턴스)
- Manages bootstrapping, fault tolerance, rebalancing

- Provides access to **bucket level** operations(데이터베이스)
- Manages persistence, replicas, TTL, compression mode, XDCR conflict resolution, ejection policy, compaction frequency

- Unique **keyspace of Collections**(스키마)
- Applications can be assigned per-scope access-rights

- Unique **keyspace of Documents**(테이블)
- Collections might be assigned to different scopes.

- JSON: numbers, strings, embedded documents and arrays(로우)
- Non JSON: UTF8, buffer, bytearray, serialized objects

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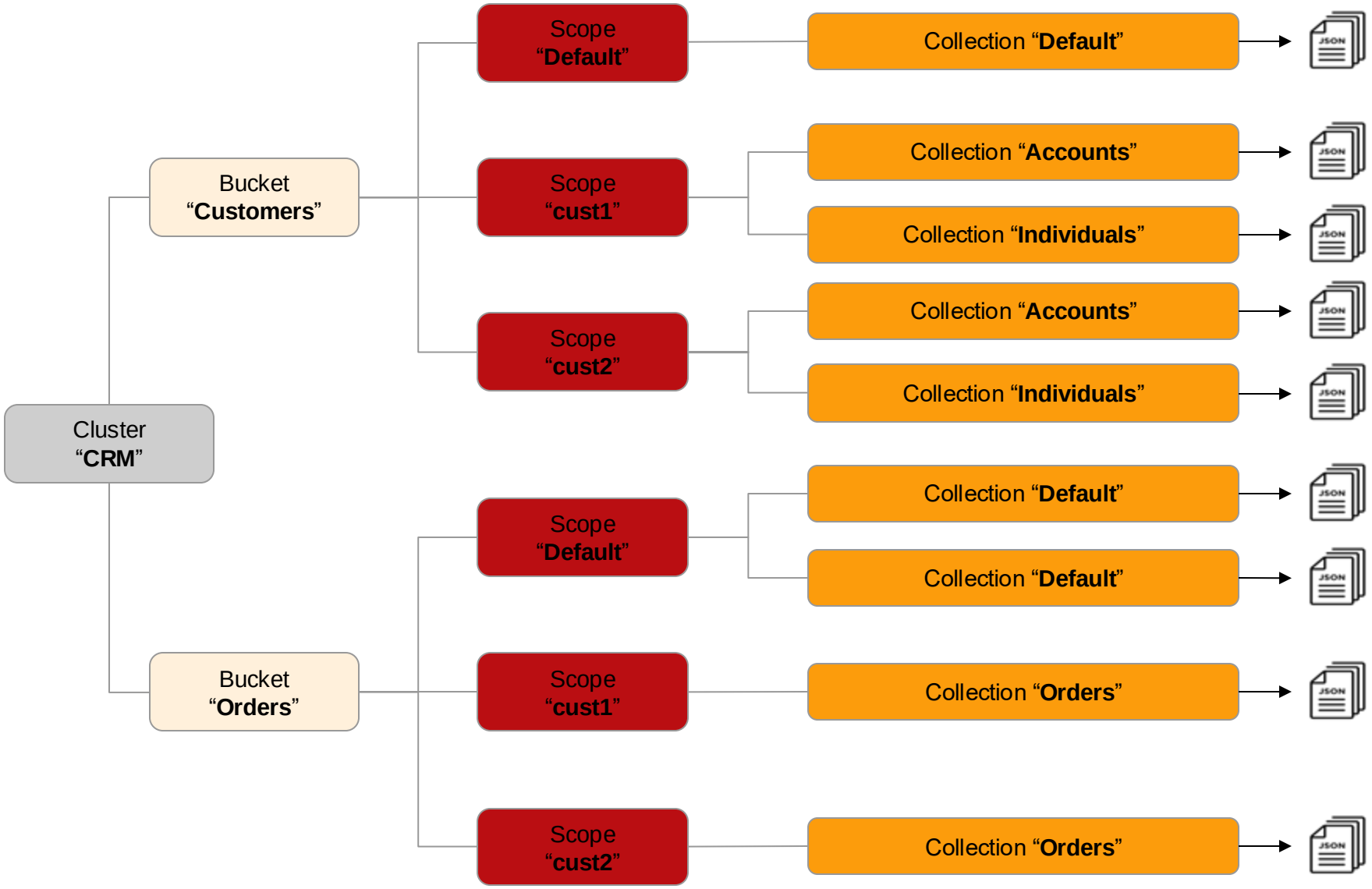
# SDK 아키텍처 : 엔티티 계층구조

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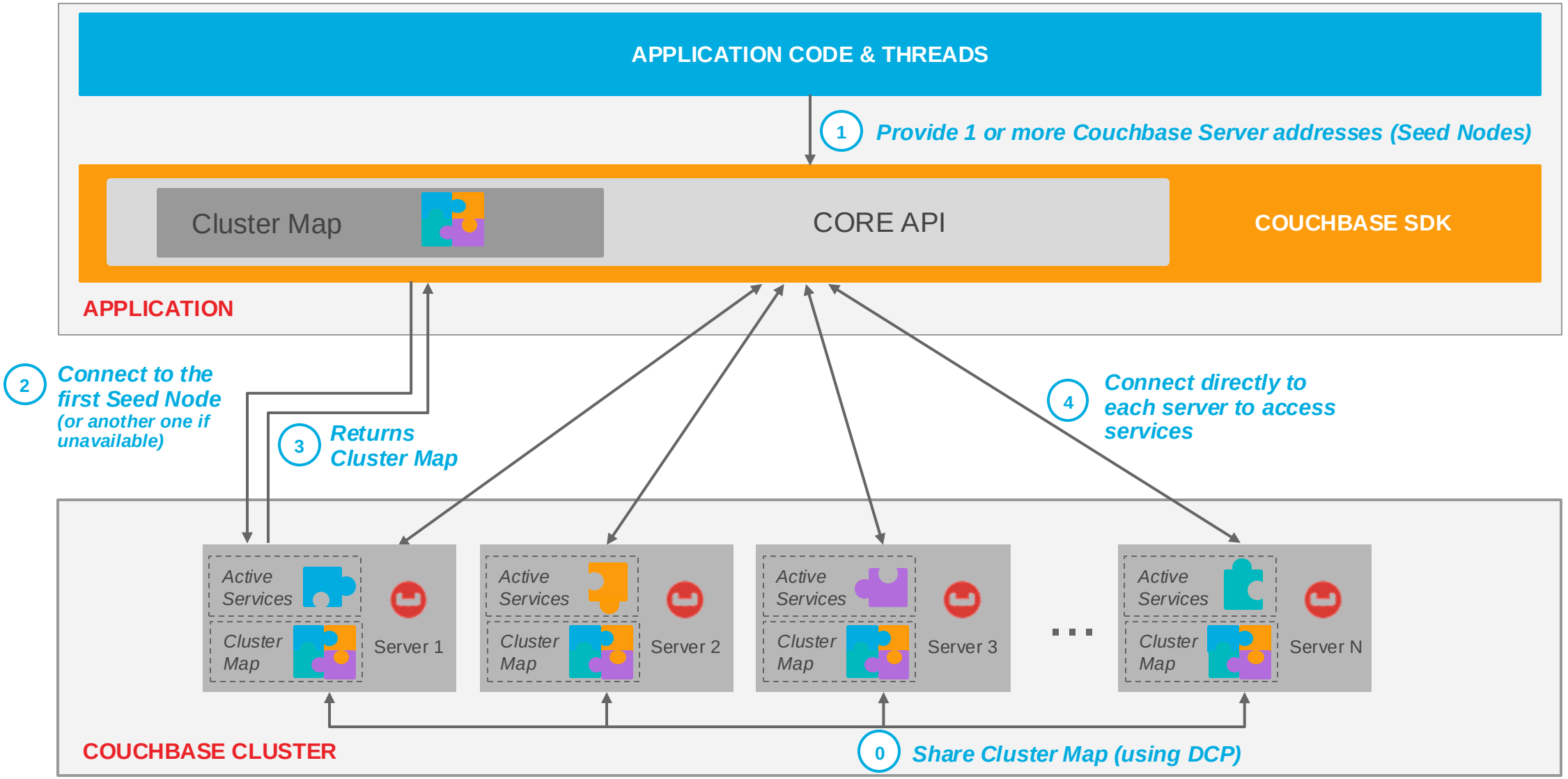
# SDK 아키텍처 : Connection 세부 단계(Bootstrapping)

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# Sample Code : Synchronous

```
Cluster c = Cluster.connect("localhost", "username","password");
Bucket b = c.bucket("travel-sample");
Collection col = b.defaultCollection();

// KV
MutationResult mr = col.upsert("doc1", JsonObject.create().put("name","mike"));
GetResult d1 = col.get("doc1");
String name = d1.contentAsObject().getString("name");
System.out.println(name); // name == "mike"

// SQL++ query
final QueryResult qr = cluster.query("select * from `travel-sample` limit 10",
                        queryOptions().metrics(true));
for (JsonObject row : qr.rowsAsObject()) {System.out.println("Row: " + row);}
System.out.println("Exec time:“+qr.metaData().metrics().get().executionTime());

// Search query
final SearchResult sr = cluster.searchQuery("airportIdx",
                      SearchQuery.prefix("LAX"),
                      searchOptions().fields("name"));
for (SearchRow row : sr.rows()){
      System.out.println("Score/ID: "+row.score(+”/”)+row.id());
}

// Analytics query
AnalyticsResult ar = cluster.analyticsQuery(
  "select count(*) from airports where country = \”France\”");
for (JsonObject row : ar.rowsAsObject()) { System.out.println("Row: "+row);}
```

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# Sample Code : Connections

```
static String endpoint = "couchbase://10.0.0.183,10.0.10.92";
static String username = "Administrator";
static String password = "P@ssw0rd";
static String bucketName = ”travel-sample";
static String scopeName = ”inventory";
static String collectionName = ”airport";

ClusterEnvironment env = ClusterEnvironment.builder()
                    .timeoutConfig(TimeoutConfig.kvTimeout(Duration.ofSeconds(15))
                                   .kvDurableTimeout(Duration.ofSeconds(15)))
                    .thresholdLoggingTracerConfig(config)
                    .build();

Cluster cluster = Cluster.connect(endpoint, ClusterOptions.clusterOptions(username, password)
        // Use the pre-configured profile below to avoid latency issues with your connection.
      .environment(env)
    );

// get a bucket reference
Bucket bucket = cluster.bucket(bucketName);
bucket.waitUntilReady(Duration.ofSeconds(30));
Scope scope = bucket.scope(scopeName);
Collection collection = scope.collection(collectionName);
```

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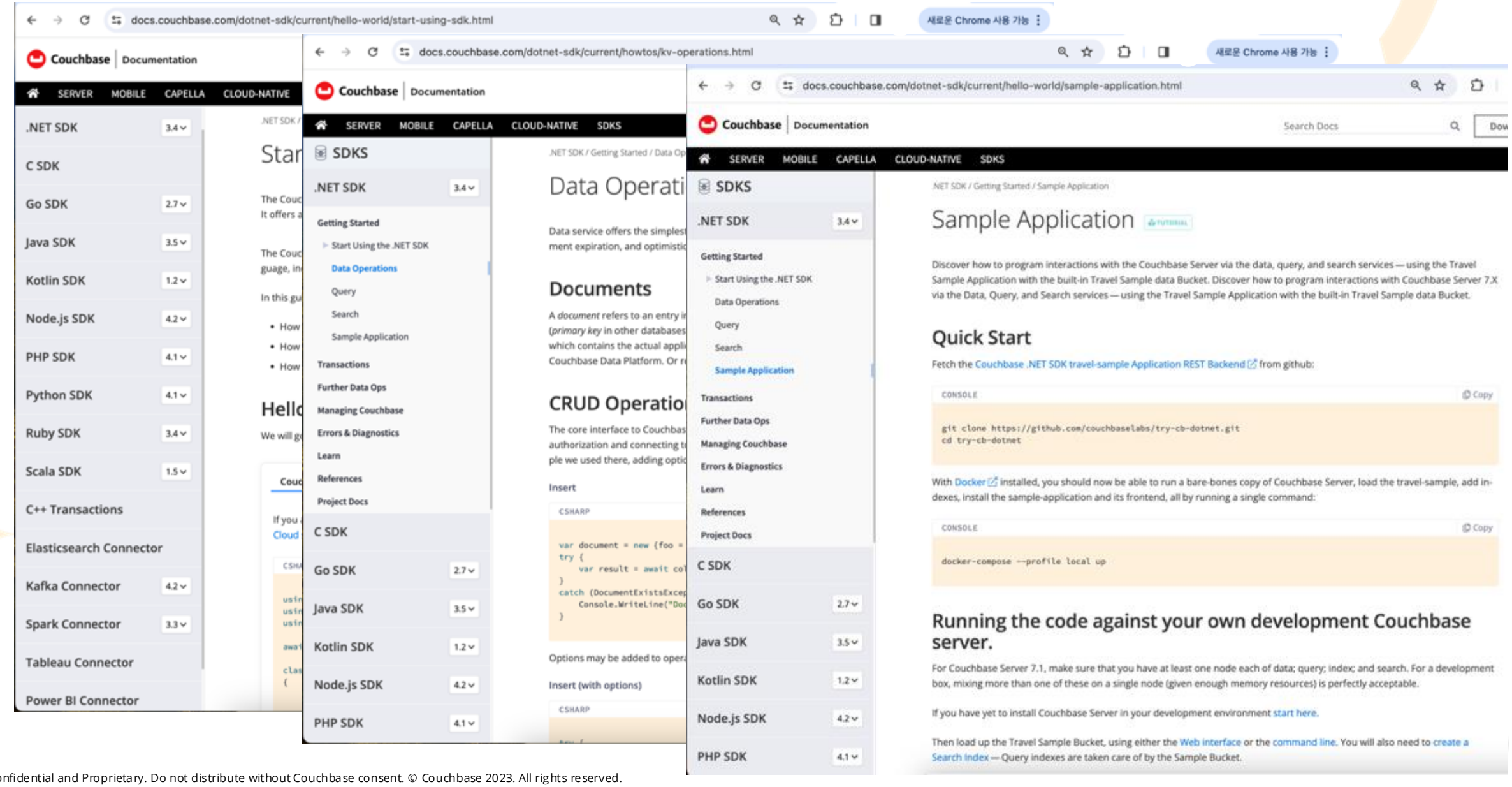
# 개발 지원 문서



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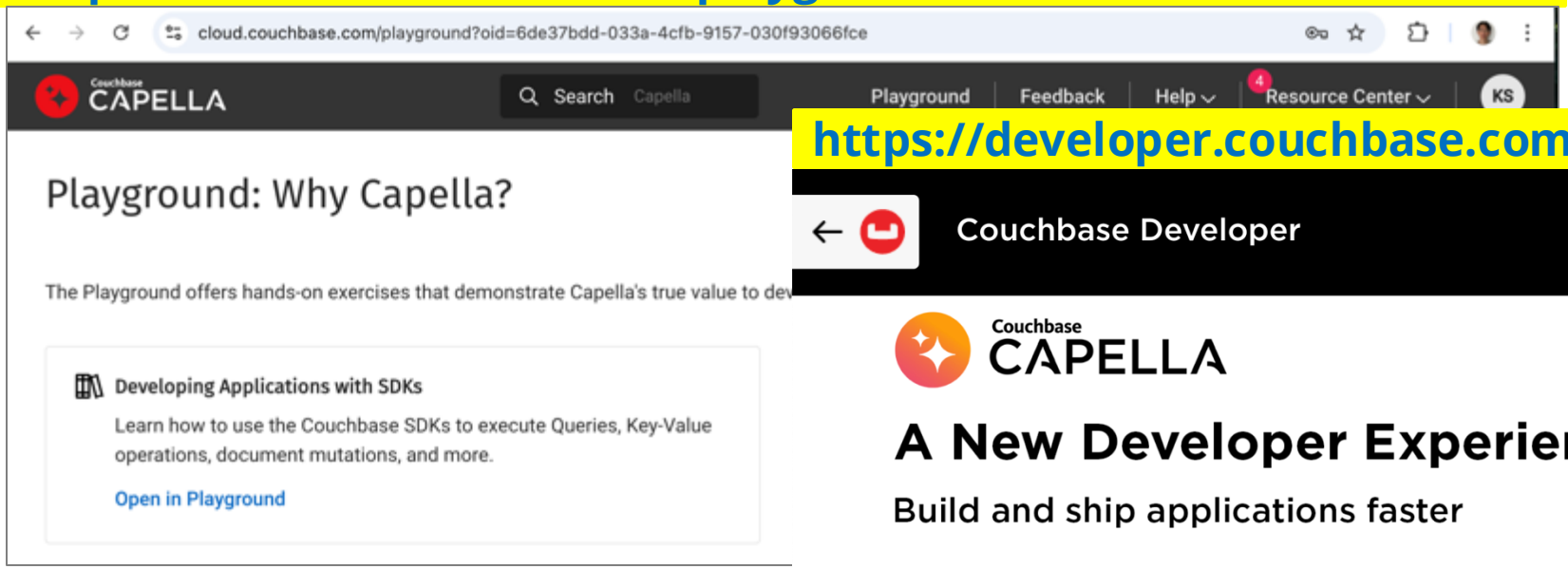
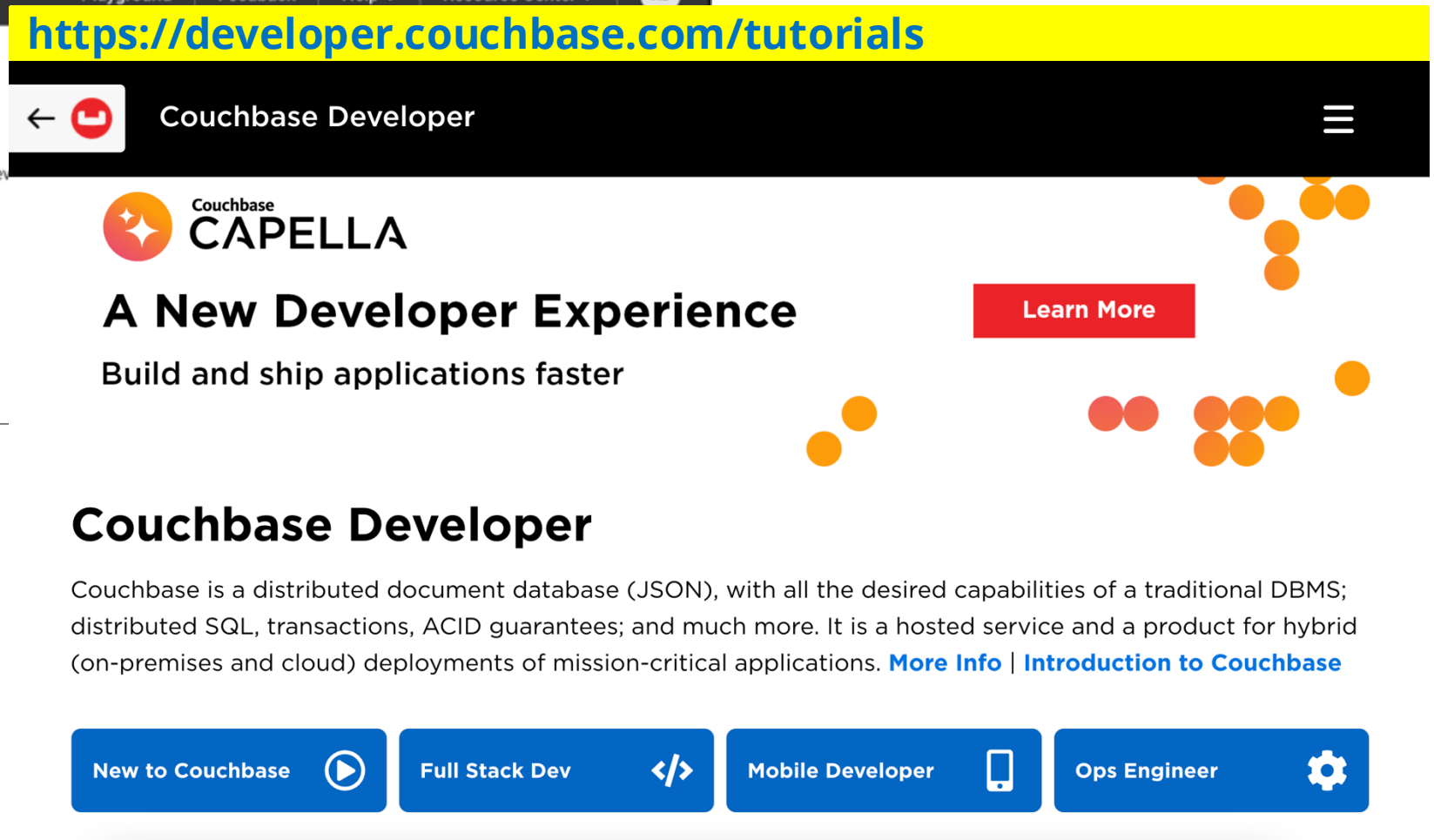
# 개발자 포털/플레이그라운드

https://cloud.couchbase.com/playground




https://developer.couchbase.com/tutorials

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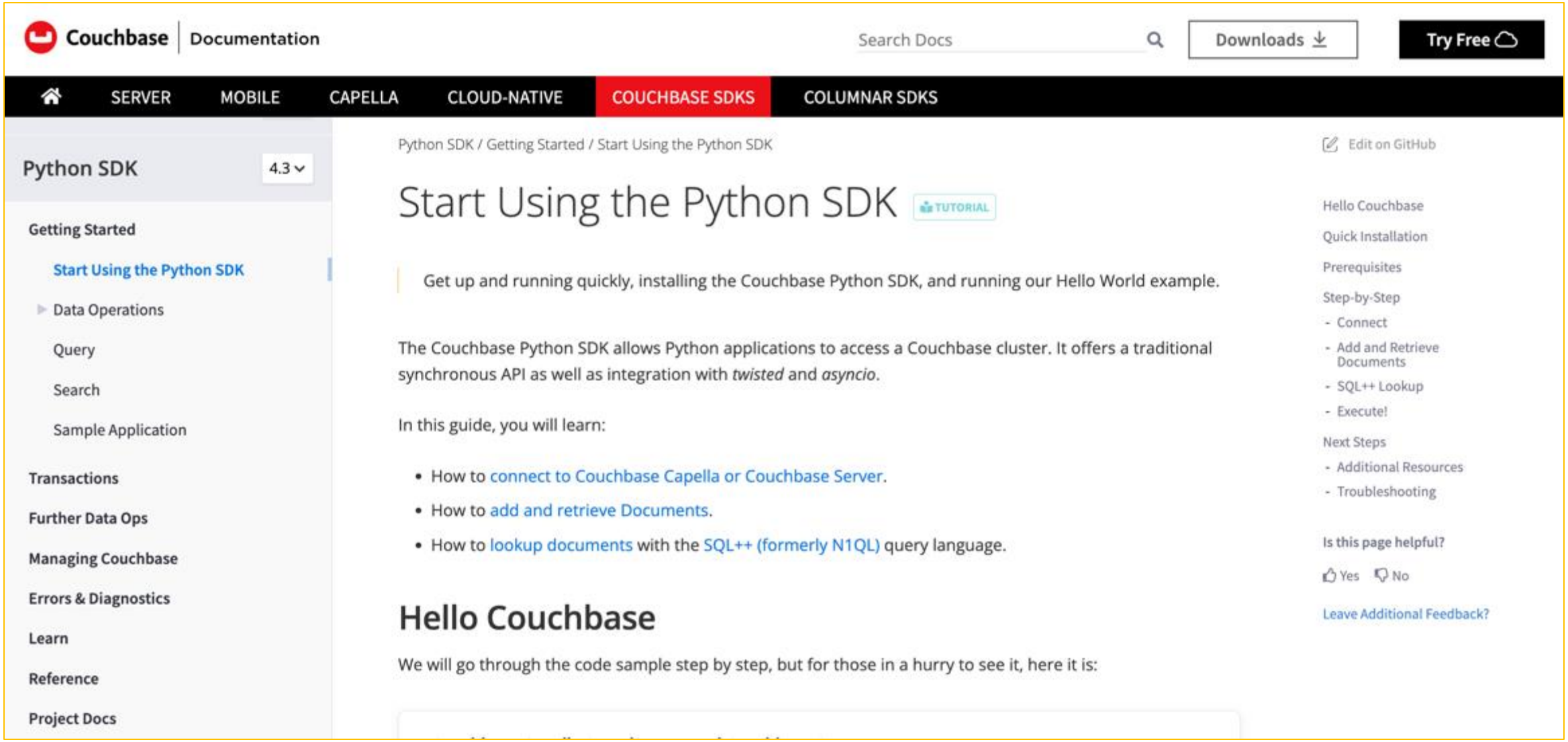
# 2-3.
# SDK 실습 (Python, Java)

# 실습

https://docs.couchbase.com/java-sdk/current/hello-world/start-using-sdk.html
https://docs.couchbase.com/python-sdk/current/hello-world/start-using-sdk.html

KV Rangescan/Prefixscan
동일한 SQL Query

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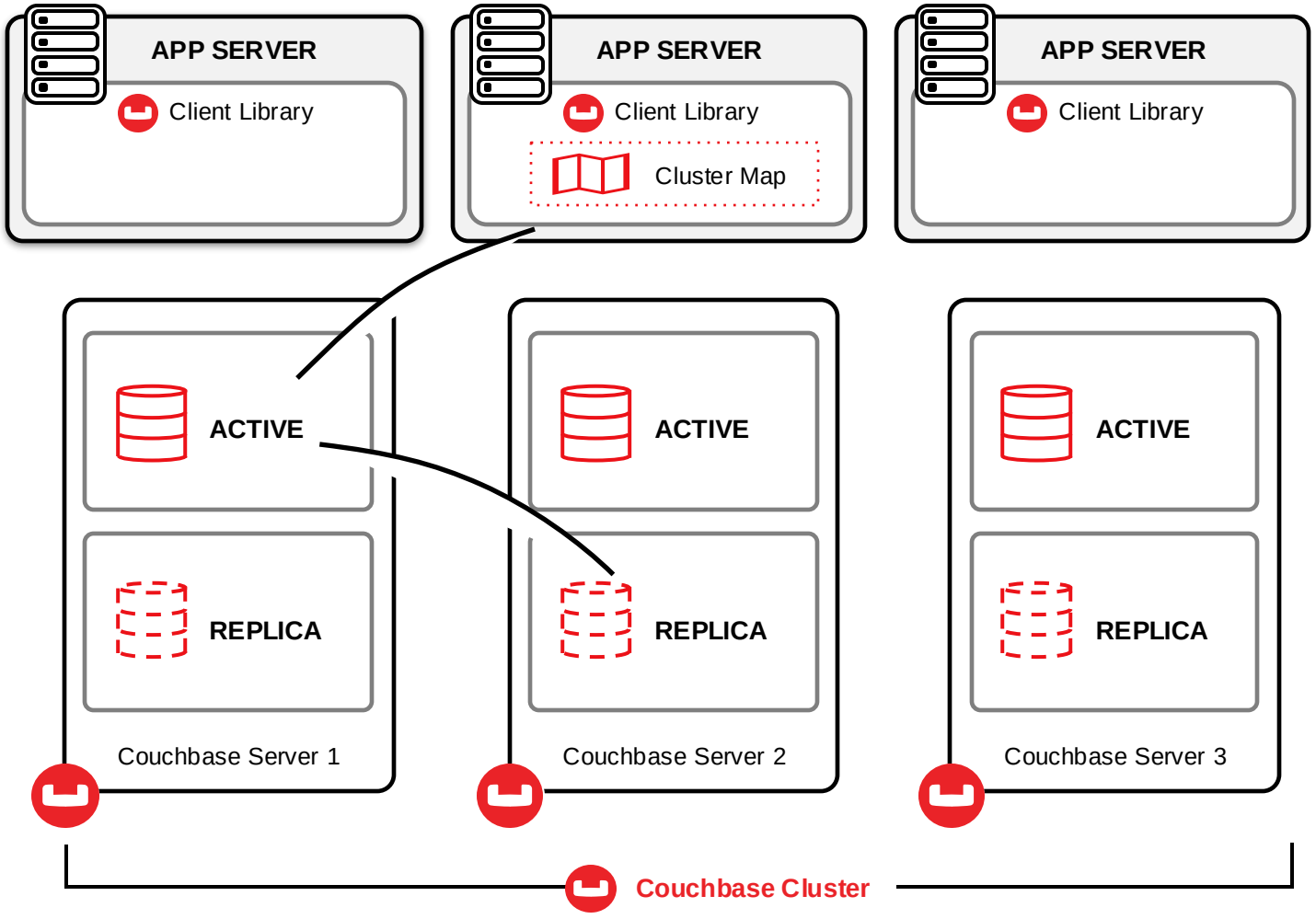
# A Fully Distributed Database




**No Master-Slave**
Single node type
Direct client communication

**Automatic sharding**
Maximum cluster efficiency

**Automatic failover**
Continuous replication
for no disruption

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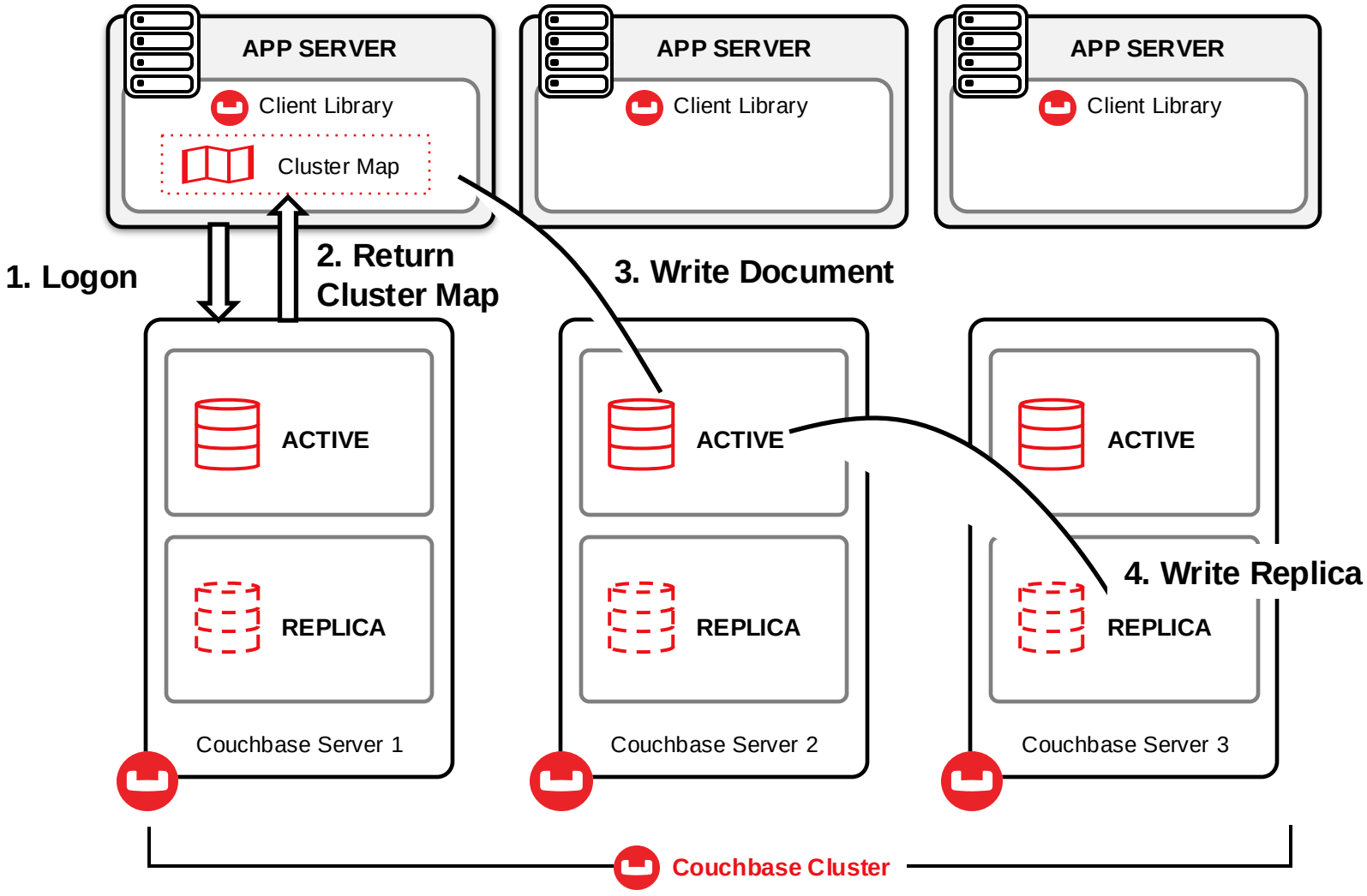
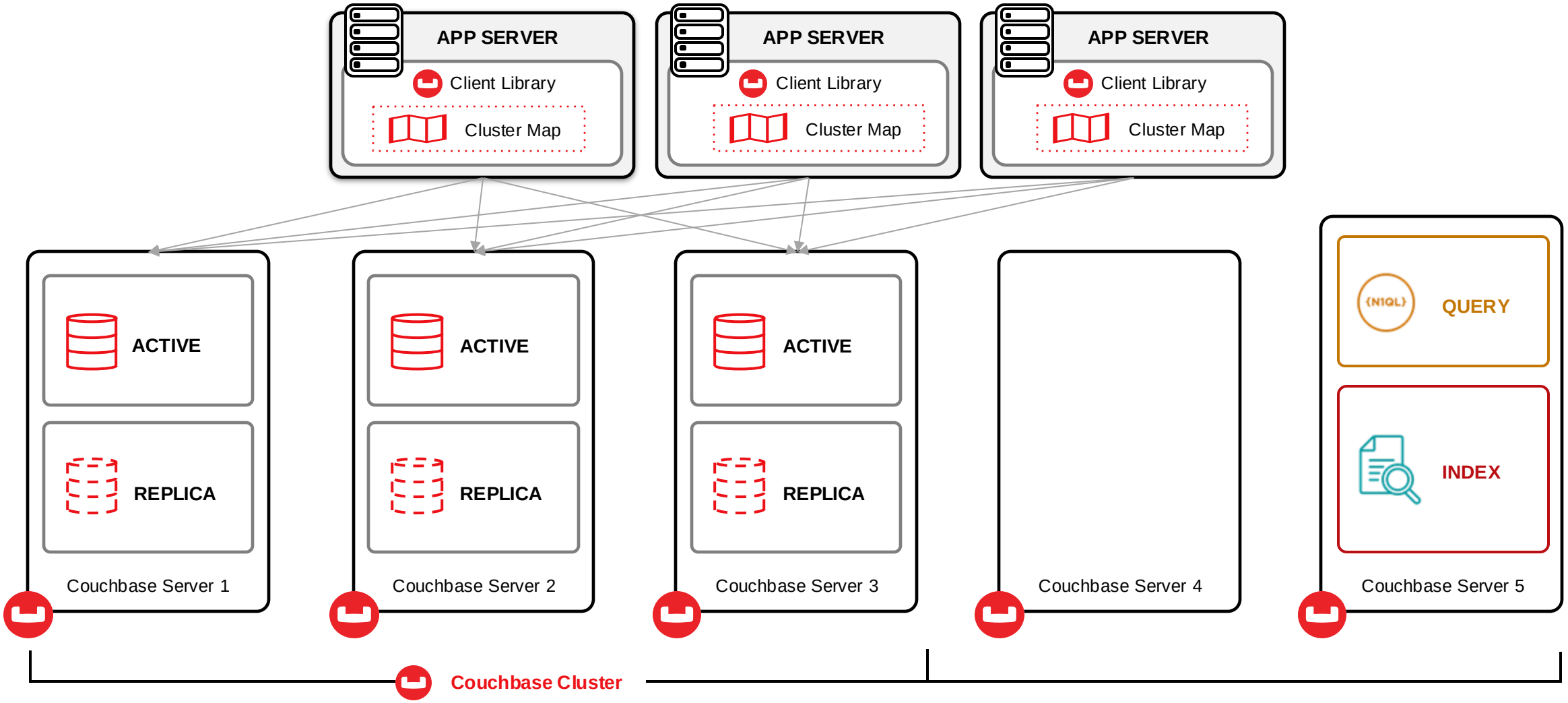
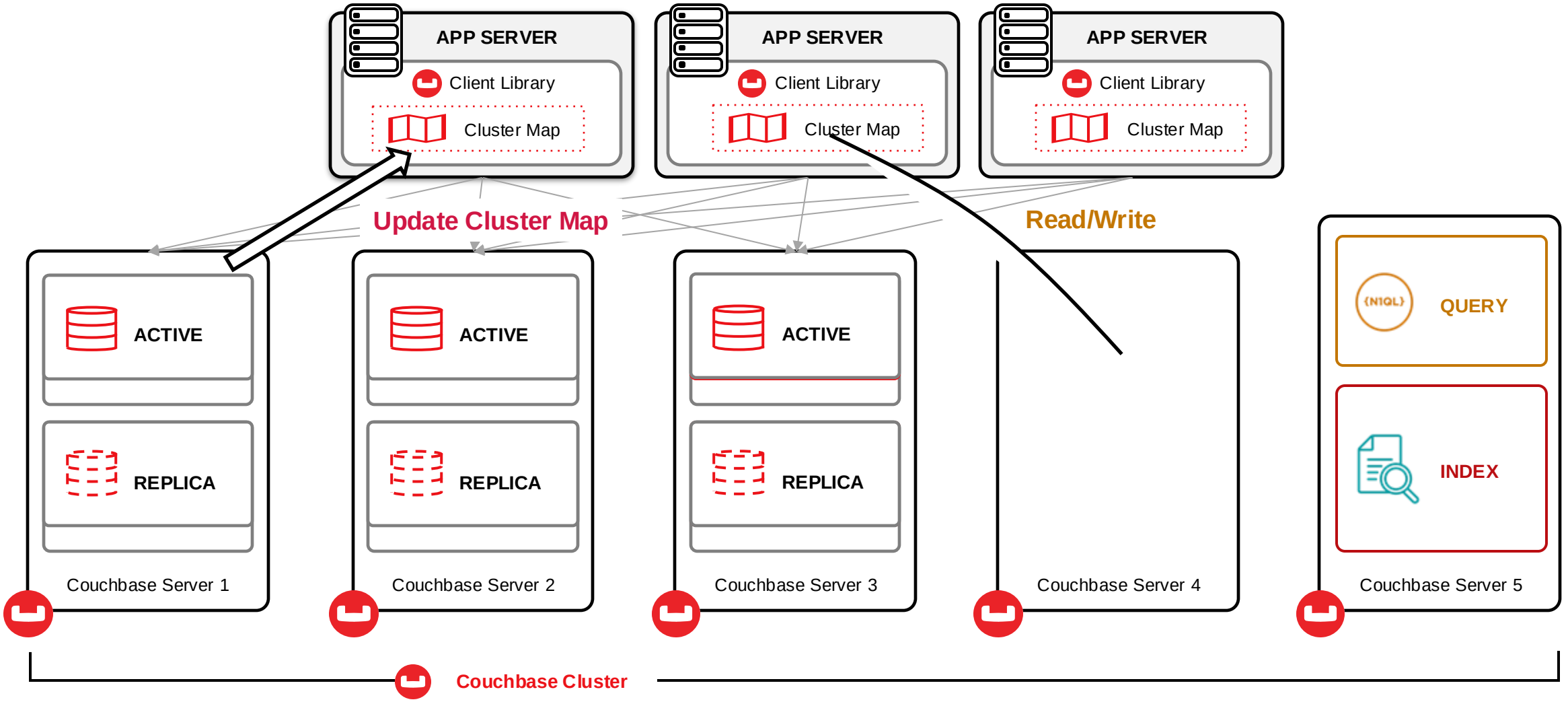
# Basics Operations



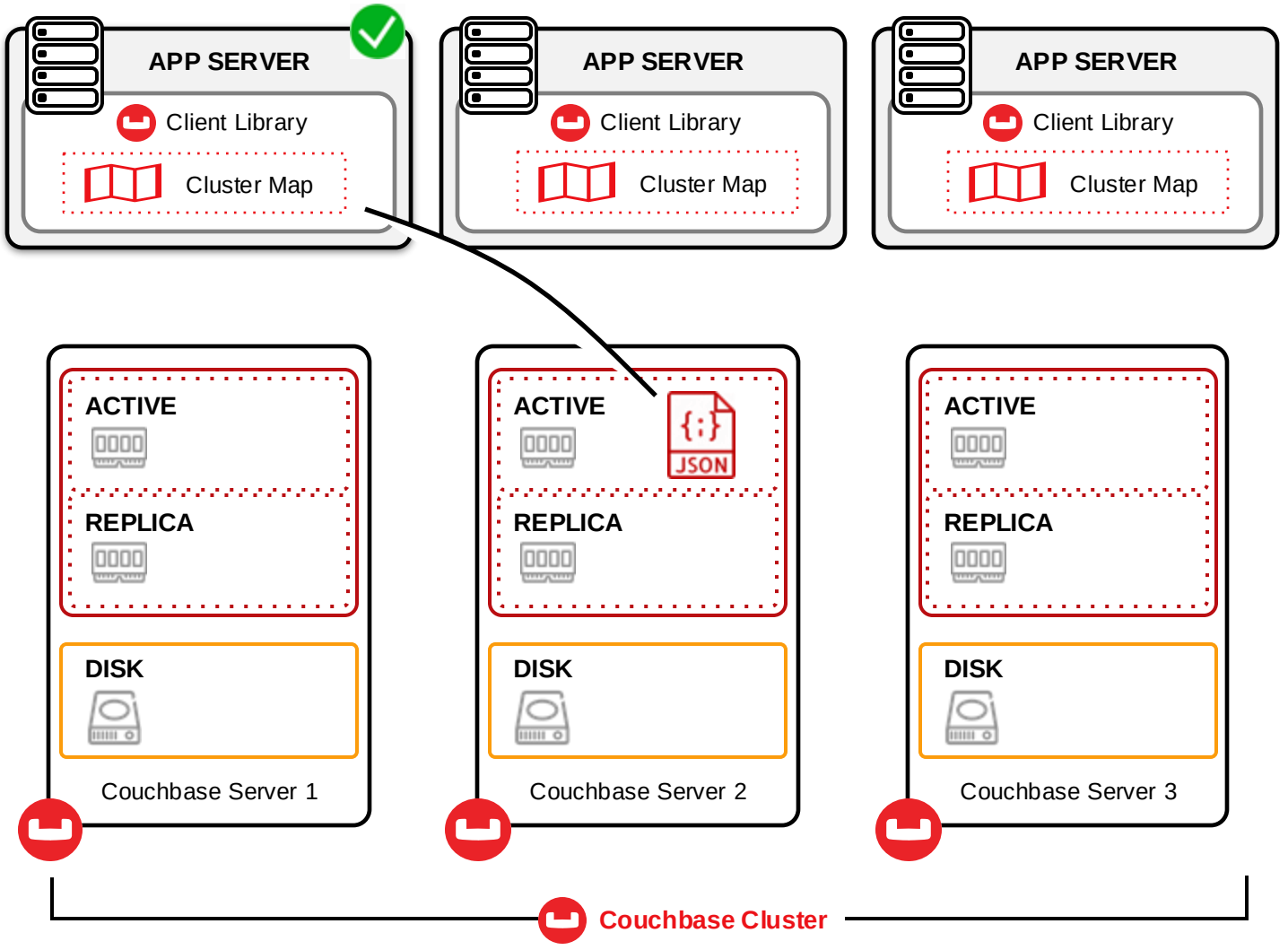
# Scalability – Horizontal & Vertical



# Scalability – Horizontal & Vertical



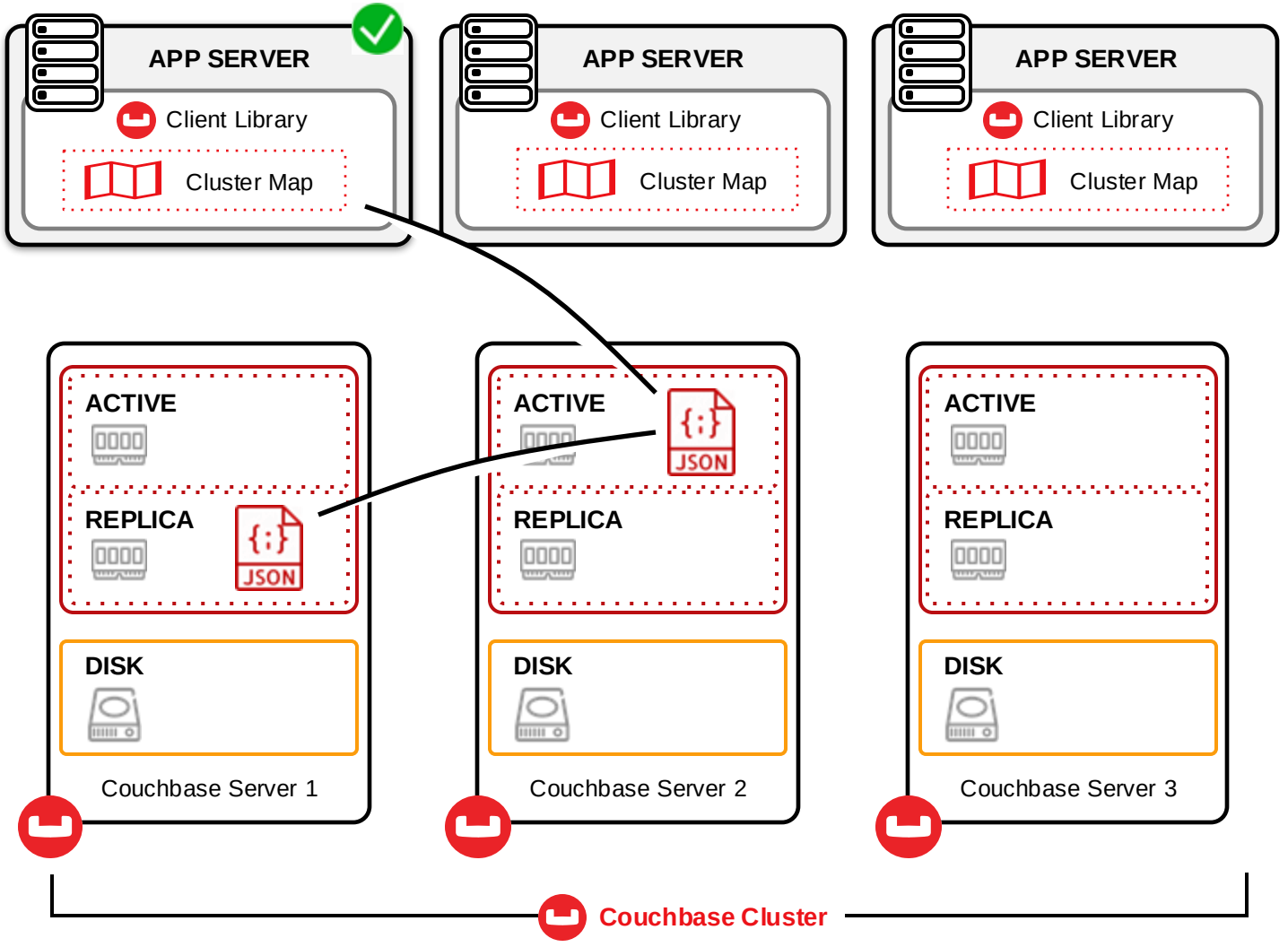
# Durability




**replica = 1**

| Level of Durability |
| --- |
| **None** |
| Majority |
| MajorityAndPersistToActive |
| PersistToMajority |

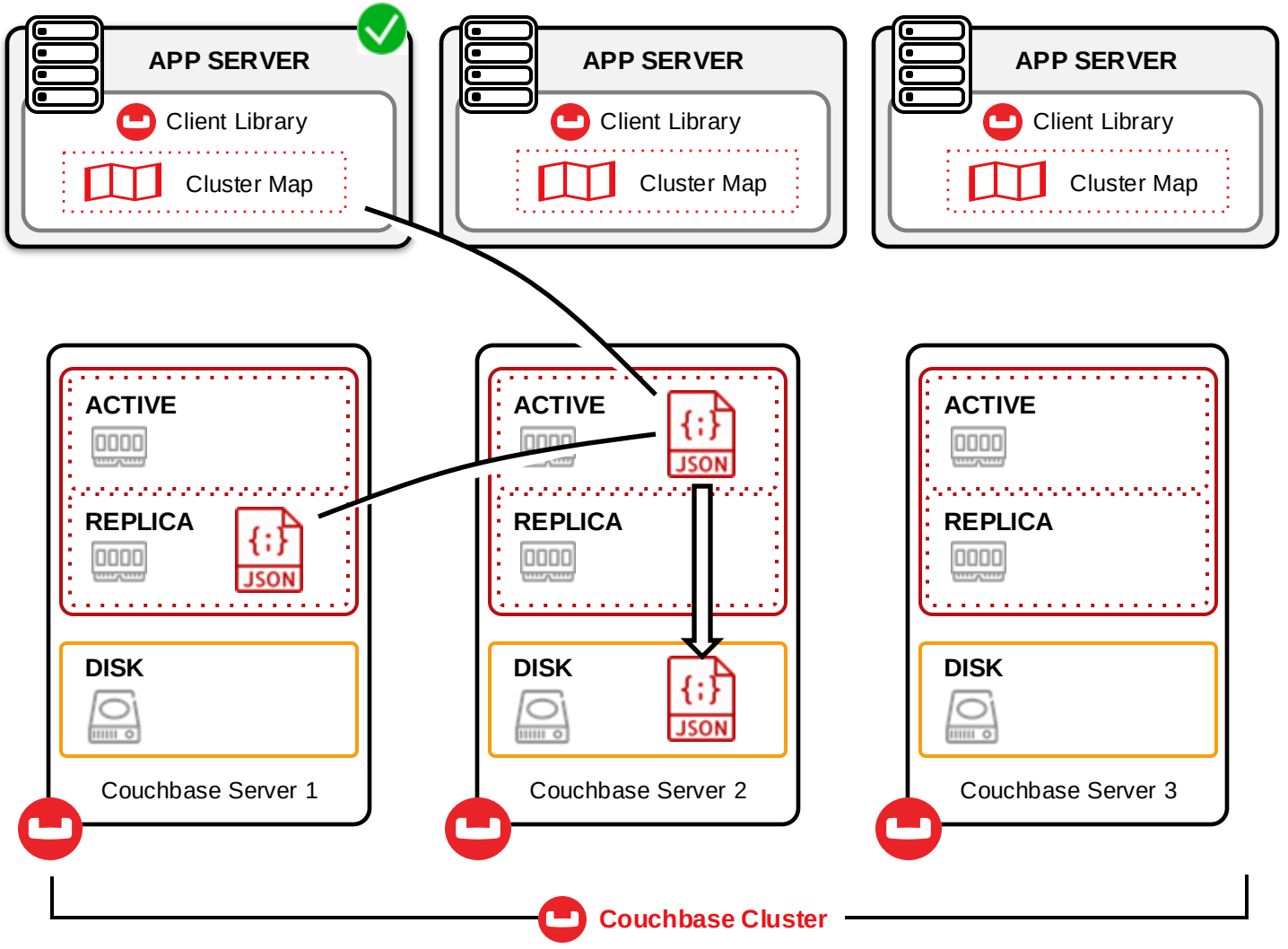
# Durability




**replica = 1**

| Level of Durability |
| --- |
| None |
| **Majority** |
| MajorityAndPersistToActive |
| PersistToMajority |

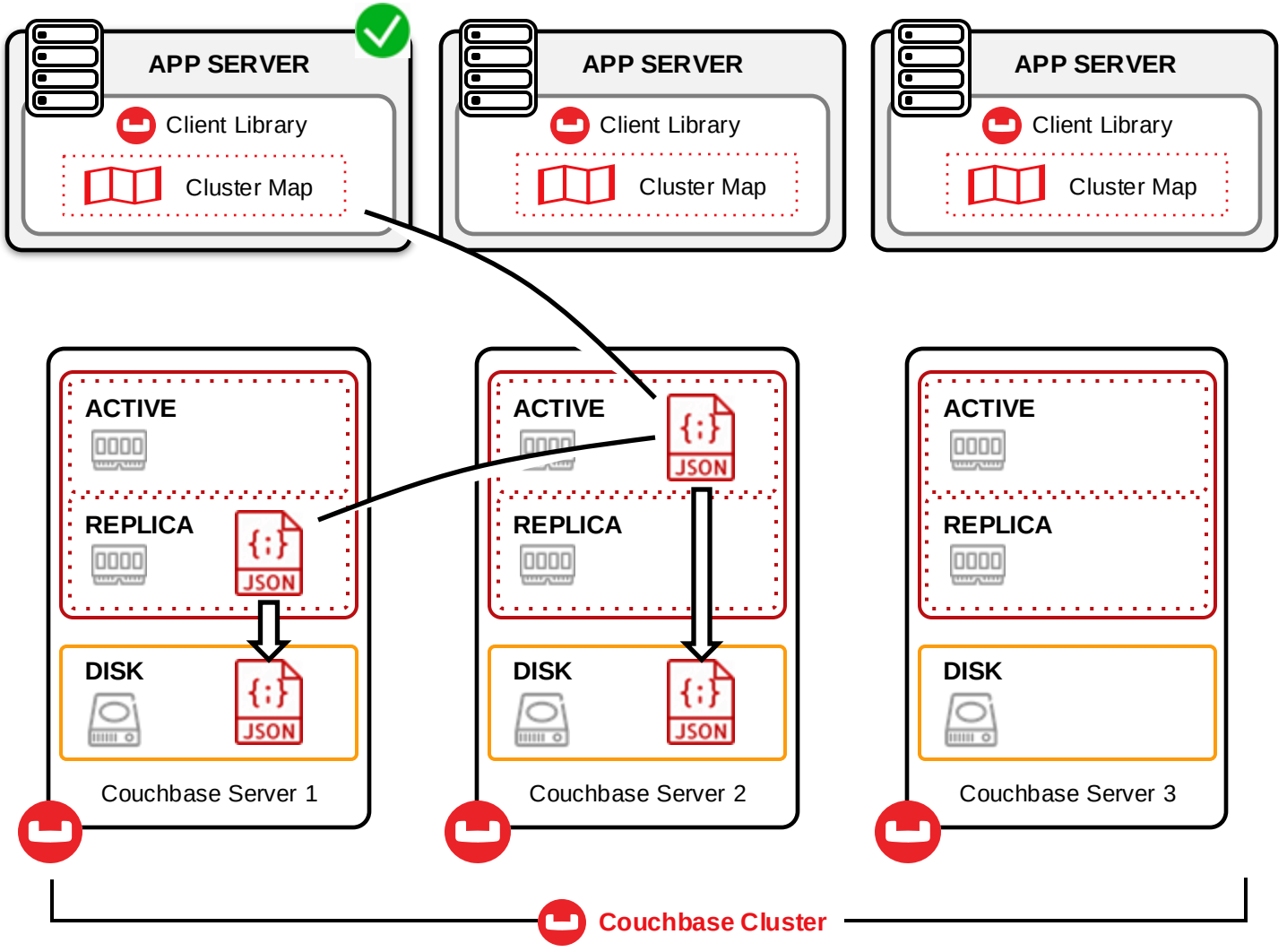
# Durability




**replica = 1**

| Level of Durability |
| --- |
| None |
| Majority |
| **MajorityAndPersistToActive** |
| PersistToMajority |

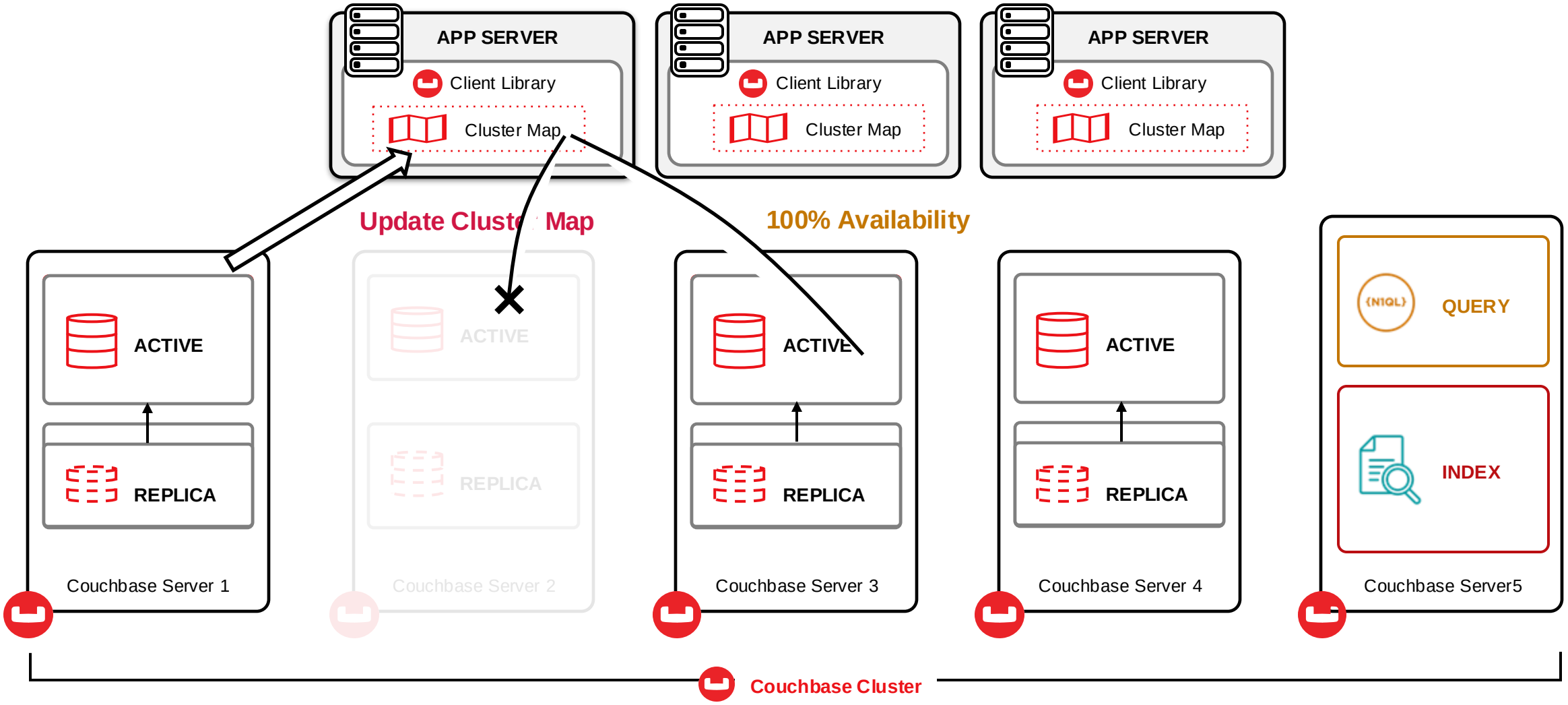
# Durability




**replica = 1**

| Level of Durability |
| --- |
| None |
| Majority |
| MajorityAndPersistToActive |
| **PersistToMajority** |

# Node Failover



# SQL Sample from Capella Playground

```
SELECT route.airline, route.schedule, route.sourceairport
FROM route
WHERE route.sourceairport = "JFK"
ORDER BY route.airline LIMIT 5;
```

```
SELECT h.city, AVG(r.ratings.Overall) AS hotel_rating
FROM hotel AS h
UNNEST h.reviews AS r
WHERE h.country = "United Kingdom"
GROUP BY h.city
HAVING AVG(r.ratings.Overall) > 4.9
```

```
SELECT DISTINCT airline.name, airline.callsign, route.schedule,
route.sourceairport, route.destinationairport
FROM route
INNER JOIN airline
ON route.airlineid = META(airline).id
WHERE route.sourceairport = "JFK"
AND route.destinationairport = "SFO"
AND airline.callsign = "UNITED";
```

```
SELECT h.name, h.address
FROM hotel h
WHERE h.city = 'San Francisco'
AND ANY r IN h.reviews
SATISFIES r.ratings.Overall > 3 END
```

```
SELECT h.city, h.name,
AVG(r.ratings.Overall) AS avg_rating,
RANK() OVER (PARTITION BY h.city ORDER BY AVG(r.ratings.Overall) DESC) as city_rank
FROM hotel as h
UNNEST h.reviews r
WHERE h.country = "France"
GROUP BY h.city, h.name
```

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# SQL Sample from Capella Playground

```
WITH AirlineDestinations AS (
  SELECT r.destinationairport,
  ARRAY_COUNT(r.schedule) AS flights
  FROM `travel-sample`.inventory.route AS r
  WHERE r.airline = "UA"
  GROUP BY r.destinationairport, r.schedule
)
SELECT ad.destinationairport, SUM(ad.flights) AS total_flights
FROM AirlineDestinations AS ad
GROUP BY ad.destinationairport
ORDER BY ad.destinationairport;
```

```
SELECT h.city,
 ARRAY_AGG(h.name)
  FILTER (WHERE ANY AND EVERY r IN h.reviews
  SATISFIES r.ratings.Overall >= 3 END) AS good_hotels,
 ARRAY_AGG(h.name)
  FILTER (WHERE ANY r IN h.reviews
  SATISFIES r.ratings.Overall < 3 END) AS other_hotels
FROM hotel as h
GROUP BY h.city;
```

```
select a.name, count(1) as numRoutes
from route r
join airline a on r.airlineid = meta(a).id
group by a.name
having count(1) > 2000
order by count(1) desc;
```

```
select meta().id as _id, * from route
```

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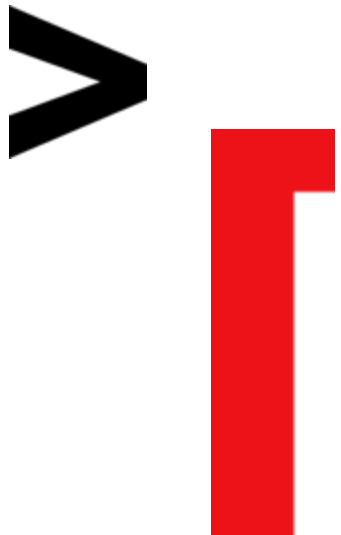
# Appendix.
# SQL Samples



# SQL++ Queries design

**Modelling data using Collections simplifies queries and indexes**

```
CREATE BUCKET CRM;
set query_context = "default:CRM._default"

CREATE COLLECTION Orders;
CREATE COLLECTION  Individuals;
```

Set query context.  Here `_default` scope of bucket `CRM`.

Create collections in that context

```
INSERT INTO Individuals (key,value)
VALUES ("Ind:110", { "Id": "110","Name": "Mary Joe",
                     "Email": "mj@email.com" });

INSERT INTO Orders (key,value)
VALUES ("Ord:123", { "Id": "123", "Indid": "110",
        "Items": [ "Qty": "1","Name": "Shoes XX"}] });
```

Insert Json docs into collections.
There is no `type` field.

```
CREATE INDEX Orders_Indid ON Orders(Indid);
CREATE INDEX Individuals_Id ON Individuals(Id);
```

Create indexes into a collection.
There is no `WHERE type='Orders'`.

```
SELECT i.Name, o.Items
FROM Orders o
JOIN Individuals i ON i.Id = o.Indid;
```

Query with JOIN between collections

# SQL-like queries | MERGE

***Finds all routes for airline BA whose source airport is in France.***

- *If any flights are using equipment 319, they are updated to use equipment 797.*
- *If any flights are using equipment 757, they are deleted.*

*Collection*: **'route'**

```
{
  "id": "14452",
  "type": "route",
  "airline": "BA",
  "airlineid": "airline_1355",
  "sourceairport": "BOD",
  "destinationairport": "LGW",
  "equipment": "734 319",
  "stops": "0",
  "distance": 99.89861063028253
  "schedule": [
      {"day": 0, "utc": "19:41:00", "flight": "BA977"},
      {"day": 0, "utc": "14:03:00", "flight": "BA938"},
      {"day": 1, "utc": "08:40:00", "flight": "BA394"},
      {"day": 1, "utc": "06:54:00", "flight": "BA427"},
      {"day": 1, "utc": "06:00:00", "flight": "BA916"}
  ]
}
```

*Collection*: **'airport'**

```
{
  "id": 1264,
  "type": "airport",
  "airportname": "Merignac",
  "city": "Bordeaux",
  "country": "France",
  "faa": "BOD",
  "icao": "LFBD",
  "tz": "Europe/Paris",
  "geo": {
    "lat": 44.828335,
    "lon": -0.715556,
    "alt": 162
  }
}
```

***Before updating or deleting** some routes,*
***you first need to JOIN** route and airport because the country of the source airport is in the airport collection*

# SQL-like queries | MERGE

```
MERGE INTO `travel-sample`.inventory.route
USING `travel-sample`.inventory.airport
ON route.sourceairport = airport.faa
WHEN MATCHED THEN
  UPDATE
  SET route.old_equipment = route.equipment,
      route.equipment = "797"
  WHERE airport.country = "France" AND route.airline = "BA" AND CONTAINS(route.equipment, "319")
WHEN MATCHED THEN
  DELETE
  WHERE airport.country = "France" AND route.airline = "BA"AND CONTAINS(route.equipment, "757")
RETURNING route.old_equipment, route.equipment, airport.faa;
```

Collection to modify

Collection to join with

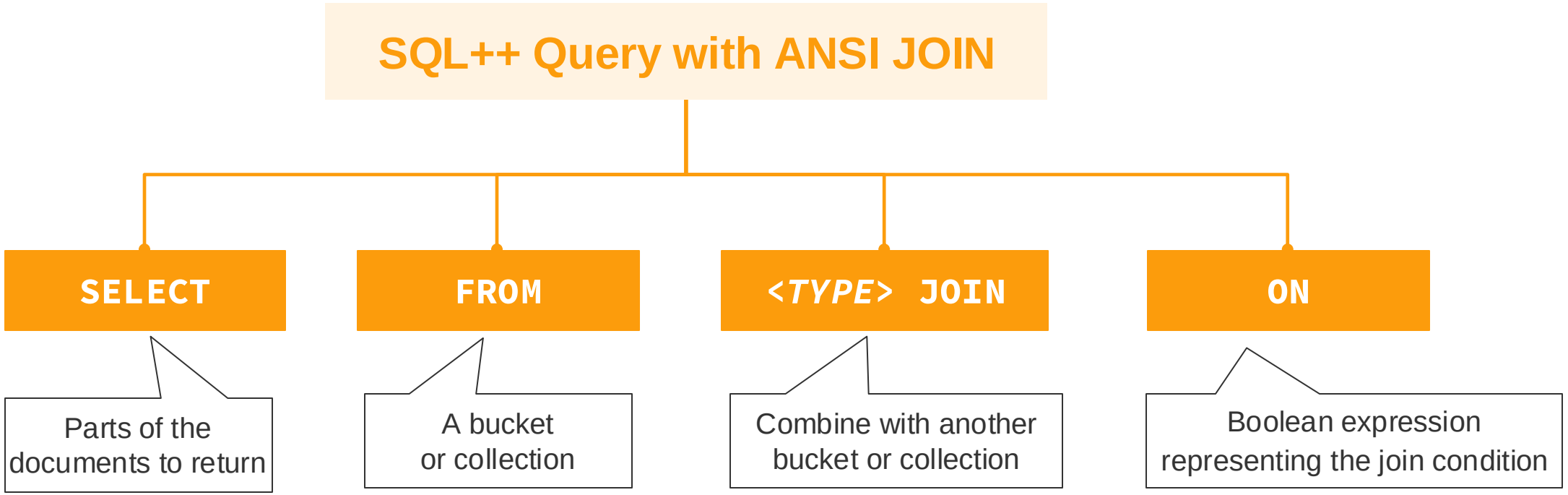
JOIN predicate

Update the routes using equipment 319

Delete routes having 757 equipment

- Provides the ability to modify a collection based on the results of a join with another collection.
- Based on a match or no match in the join, actions can be INSERT, UPDATE, DELETE.
- Multiple actions can be specified.

# **SQL-like queries** | ANSI JOINS



# SQL-like queries | ANSI JOINS

| JOIN TYPE | Examples |
|---|---|
| ANSI JOIN | SELECT .. FROM customer c<br>**JOIN** orders o **ON** o.customer_id = c.id |
| ANSI JOIN Complex | SELECT .. FROM airline<br>**JOIN** route<br>**ON** route.airlineid = "airline_" \|\| tostring(airline.id) **AND** route.type = "route" |
| ANSI JOIN with IN CLAUSE | SELECT .. FROM `travel-sample` route<br>**JOIN** airport<br>**ON** airport.faa **IN** [ route.sourceairport, route.destinationairport ] **AND** airport.type = "airport" |
| ANSI LEFT OUTER | SELECT .. FROM airport<br>**LEFT JOIN** route<br>**ON** airport.faa = route.sourceairport **AND** route.type = "route" |
| ANSI JOIN with HASH JOIN | SELECT .. FROM airport<br>**JOIN** route **USE HASH(**build**)**<br>**ON** airport.faa = route.sourceairport **AND** route.type = "route" |

ANSI JOIN can join arbitrary fields of the documents and can be chained together.

# SQL-like queries | Arrays

*Retrieve the details of KL flight schedules from Albuquerque (ABQ) to Atlanta (ATL) if any of the flights are after 23:40.*

```
SELECT *
FROM `travel-sample`.inventory.route
WHERE airline="KL"
  AND sourceairport="ABQ"
  AND destinationairport="ATL"
  AND ANY departure IN schedule
      SATISFIES departure.utc > "23:40" END;
```

```
[
  {
    "travel-sample": {
      "airline": "KL",
      "airlineid": "airline_3090",
      "destinationairport": "ATL",
      "distance": 2038.3535078909663,
      "equipment": "757 320",
      "id": 36159,
      "schedule": [
        {"day": 0, "flight": "KL938", "utc": "03:54:00"},
        // ...
        {"day": 5, "flight": "KL169", "utc": "23:41:00"},
        // ...
        {"day": 6, "flight": "KL636", "utc": "17:40:00"}
      ],
      "sourceairport": "ABQ",
      "stops": 0,
      "type": "route"
    }
  }
]
```


- Range predicates (ANY, EVERY) enable you to evaluate expressions over every element in an array
- They are particularly useful when used to evaluate expressions over an array of objects

# **SQL-like queries** | Subqueries

*Find total number of airports by country where each city has more than 5 airports.*

```
SELECT t1.country,
       array_agg(t1.city),
       sum(t1.city_cnt) as apnum
FROM
    (SELECT city,
            city_cnt,
            array_agg(airportname) as apnames,
            country
     FROM `travel-sample`.inventory.airport
     GROUP BY city,
            country LETTING city_cnt = count(city)
     ) AS t1
WHERE t1.city_cnt > 5
GROUP BY t1.country;
```

```
[
  {
    "$1": [
      "Paris"
    ],
    "apnum": 9,
    "country": "France"
  },
  {
    "$1": [
      "London"
    ],
    "apnum": 13,
    "country": "United Kingdom"
  },
  {
    "$1": [
      "Houston",
      "New York",
      "San Diego"
    ],
    "apnum": 22,
    "country": "United States"
  }
]
```


- A subquery is a query within another query
- Subqueries can be embedded anywhere a valid expression can go

# **SQL-like queries** | Built-in Functions

| Category | Functions |
|---|---|
| Aggregate functions | ARRAY_AGG() ARRAY_AGG(DISTINCT) AVG(), AVG(DISTINCT) COUNT() COUNT(DISTINCT) MAX() MIN() SUM() SUM(DISTINCT) |
| Object functions | OBJECT_LENGTH() OBJECT_NAMES() OBJECT_PAIRS() OBJECT_INNER_PAIRS() OBJECT_VALUES() OBJECT_INNER_VALUES() OBJECT_ADD() OBJECT_PUT() OBJECT_REMOVE() OBJECT_UNWRAP() |
| Array functions | ARRAY_APPEND() ARRAY_AVG() ARRAY_CONCAT() ARRAY_CONTAINS() ARRAY_COUNT() ARRAY_DISTINCT() ARRAY_IFNULL() ARRAY_LENGTH() ARRAY_MAX() ARRAY_MIN() ARRAY_POSITION() ARRAY_PREPEND() ARRAY_PUT() ARRAY_RANGE() ARRAY_REMOVE() ARRAY_REPEAT() ARRAY_REPLACE() ARRAY_REVERSE() ARRAY_SORT() ARRAY_SUM() |
| Comparison functions | GREATEST() LEAST() |
| Conditional functions | IFMISSING() IFMISSINGORNULL() IFNULL() MISSINGIF() NULLIF() IFINF() IFNAN() IFNANORINF() NANIF() NEGINFIF() POSINFIF() |
| Number functions | ABS() ACOS() ASIN() ATAN() ATAN2() CEIL() COS() DEGREES() E() EXP() LN() LOG() FLOOR() PI() POWER() RADIANS() RANDOM() ROUND() SIGN() SIN() SQRT() TAN() TRUNC() |
| Date functions | CLOCK_MILLIS() CLOCK_STR() DATE_ADD_MILLIS() DATE_ADD_STR() DATE_DIFF_MILLIS() DATE_DIFF_STR() DATE_PART_MILLIS() DATE_PART_STR() DATE_TRUNC_MILLIS() DATE_TRUNC_STR() STR_TO_MILLIS() MILLIS_TO_STR() MILLIS_TO_UTC() MILLIS_TO_ZONE_NAME() NOW_MILLIS() NOW_STR() STR_TO_MILLIS() STR_TO_UTC() STR_TO_ZONE_NAME() |
| JSON functions | DECODE_JSON() ENCODE_JSON() ENCODED_SIZE() POLY_LENGTH() |
| Meta and UUID functions | BASE64() BASE64_ENCODE() BASE64_DECODE() META() UUID() |
| Pattern-matching functions | REG_CONTAINS() REG_LIKE() REG_POSITION() REG_REPLACE() |
| String functions | CONTAINS() INITCAP() LENGTH() LOWER() LTRIM() POSITION() REPEAT() REPLACE() RTRIM() SPLIT() SUBSTR() TITLE() TRIM() UPPER() |
| Type-Checking Functions | ISARRAY() ISATOM() ISBOOLEAN() ISNUMBER() ISOBJECT() ISSTRING() TYPE() |
| Type-Conversion Functions | TOARRAY() TOATOM() TOBOOLEAN() TONUMBER() TOOBJECT() TOSTRING() |

# **SQL-like queries** | User Defined Functions (UDF)

### Simple Inline Example

```
CREATE FUNCTION to_meters(...) {
  args[0] * 0.3048
};
```

```
SELECT airportname, ROUND(to_meters(geo.alt)) AS mamsl
FROM `travel-sample`.inventory.airport
LIMIT 5;
```

```
[
  {"airportname": "Calais Dunkerque","mamsl": 4},
  {"airportname": "Peronne St Quentin","mamsl": 90},
  {"airportname": "Les Loges","mamsl": 130},
  {"airportname": "Couterne", "mamsl": 219},
  {"airportname": "Bray","mamsl": 111}
]
```

### Inline Example with SQL++ query inside

```
CREATE FUNCTION locations(vActivity) {
  (SELECT id, name, address, city
  FROM `travel-sample`.inventory.landmark
  WHERE activity = vActivity) };
```

```
SELECT l.name, l.city
FROM locations("eat") AS l
WHERE l.city = "Gillingham";
```

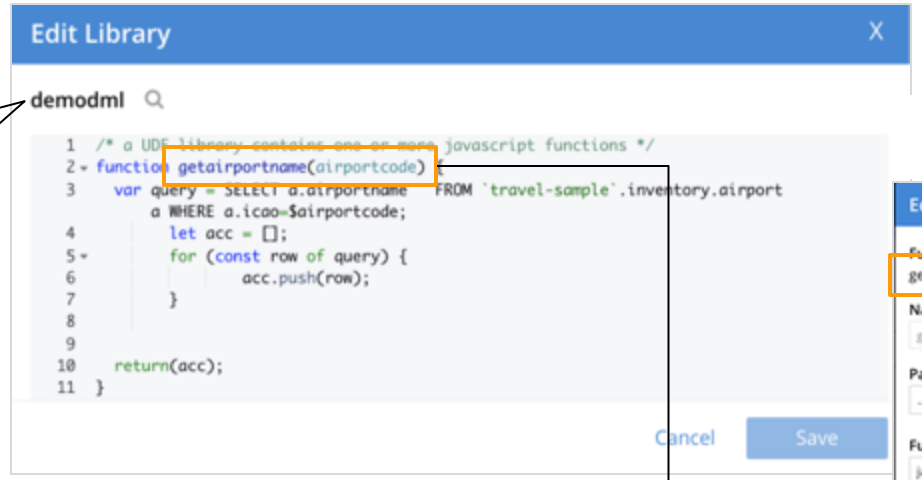
```
[
  {"city": "Gillingham","name": "Hollywood Bowl"},
  {"city": "Gillingham","name": "Thai Won Mien"},
  {"city": "Gillingham","name": "Spice Court"},
  {"city": "Gillingham","name": "Beijing Inn"},
  {"city": "Gillingham","name": "Ossie's Fish and
Chips"}
]
```

- Inline functions are defined using SQL++ expressions, including subqueries.
- You can name and reuse complex or repetitive expressions in order to simplify your queries.

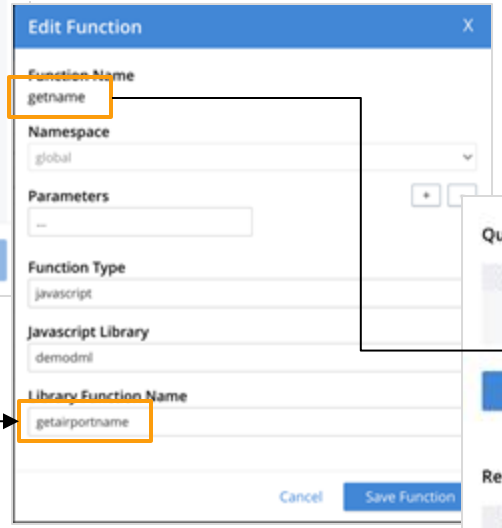
# **SQL-like queries** | UDF with JavaScript & SQL++

**Create a Javascript function in a Library**

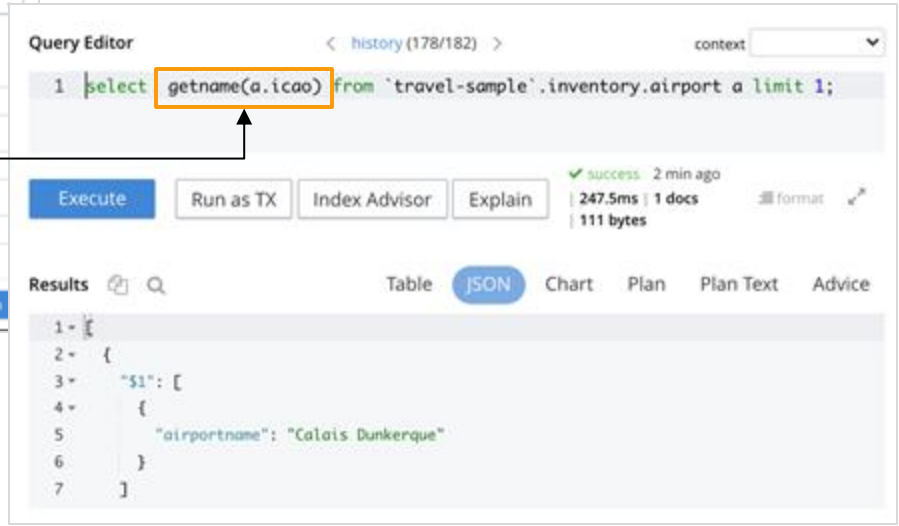
*Javascript library*




**Create a UDF Function that references it**




**Use the UDF function in SQL++ statements**




- UDFs with JavaScript allows developers to provide custom functions to extend SQL++ capabilities

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# **SQL-like queries** | Search Functions

*Find the name of the hotels in United Kingdom where the reviews match the term 'bathrobes'*

```
SELECT t1.name, meta().id
FROM `travel-sample`.inventory.hotel AS t1
WHERE SEARCH(t1, {
  "match": "bathrobes",
  "field": "reviews.content",
  "analyzer": "standard"
})
AND country="United Kingdom"
LIMIT 3;
```

```
[
  {
    "id": "hotel_12068",
    "name": "Castle Hotel"
  },
  {
    "id": "hotel_18819",
    "name": "Bistro Prego With Rooms"
  },
  {
    "id": "hotel_3622",
    "name": "Premier Inn Birmingham Central East"
  }
]
```

- Search functions enable you to use full text search (FTS) queries directly within a SQL++ query.
- It is recommended that you create suitable full text indexes for the searches that you need to perform.

# **SQL-like queries** | Prepared Statement

**Positional Parameters**

```
PREPARE NumParam AS
SELECT * FROM `travel-sample`.inventory.hotel
WHERE city=$1 AND country=$2;
```

```
EXECUTE NumParam
USING ["Paris", "France"];
```

**Named Parameters**

```
PREPARE NameParam AS
SELECT * FROM `travel-sample`.inventory.hotel
WHERE city=$city AND country=$country;
```

```
EXECUTE NameParam
USING {"city": "Paris", "country": "France"};
```

- You can add placeholder parameters to a statement, so that you can supply variable values when you run the statement.
- If you need to run a statement more than once, you can prepare the execution plan for the statement.

# **SQL-like queries** | Transactions

**Ensures database consistency when multiple documents are updated in a single or multiple SQL++ statements**

```
START TRANSACTION;
UPDATE customer SET balance = balance + 100 WHERE cid = 4872;
SELECT cid, name, balance  FROM customer;
SAVEPOINT s1;
UPDATE customer SET balance = balance - 100 WHERE cid = 1924;
SELECT cid, name, balance FROM customer;
ROLLBACK WORK TO SAVEPOINT s1;
SELECT cid, name, balance FROM customer;
COMMIT;
```

Couchbase provides the following statements for transactions:

- BEGIN TRANSACTION
- SET TRANSACTION (optional)
- SAVEPOINT
- ROLLBACK TRANSACTION
- COMMIT TRANSACTION

# 수고하셨습니다.

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