DATA SCIENCE RETREAT

NOSQL overview

DATABASES

TYPES OF DATABASES

Relational data model

Highly-structured table organization with rigidly-defined data formats and record structure.

Document data model

Collection of complex documents with arbitrary, nested data formats and varying "record" format.

WHAT IS NOSQL ?

- NoSQL now stands for “Not Only SQL”
- Relational databases fulfill most engineering use-cases, but sometimes more specific solutions are required
- Fast Look Up based on a key
- High horizontal scalability
- Storing unstructured data
- Faster Aggregations on Columns

CAP Theorem

- You cannot have Consistency, Availability and Performance at the same time
- When the DB uses multiple nodes, something has to be sacrificed:
  - e.g. data just inserted may not be available to some nodes
  - e.g. data is partitioned and it’s harder to perform JOINs

FAST KEY LOOKUP

- Key-Value Store
- In-Memory, like Redis
- Distributed, like BigTable / HBase
- Document stores: Like MongoDB

FAST KEY LOOKUP

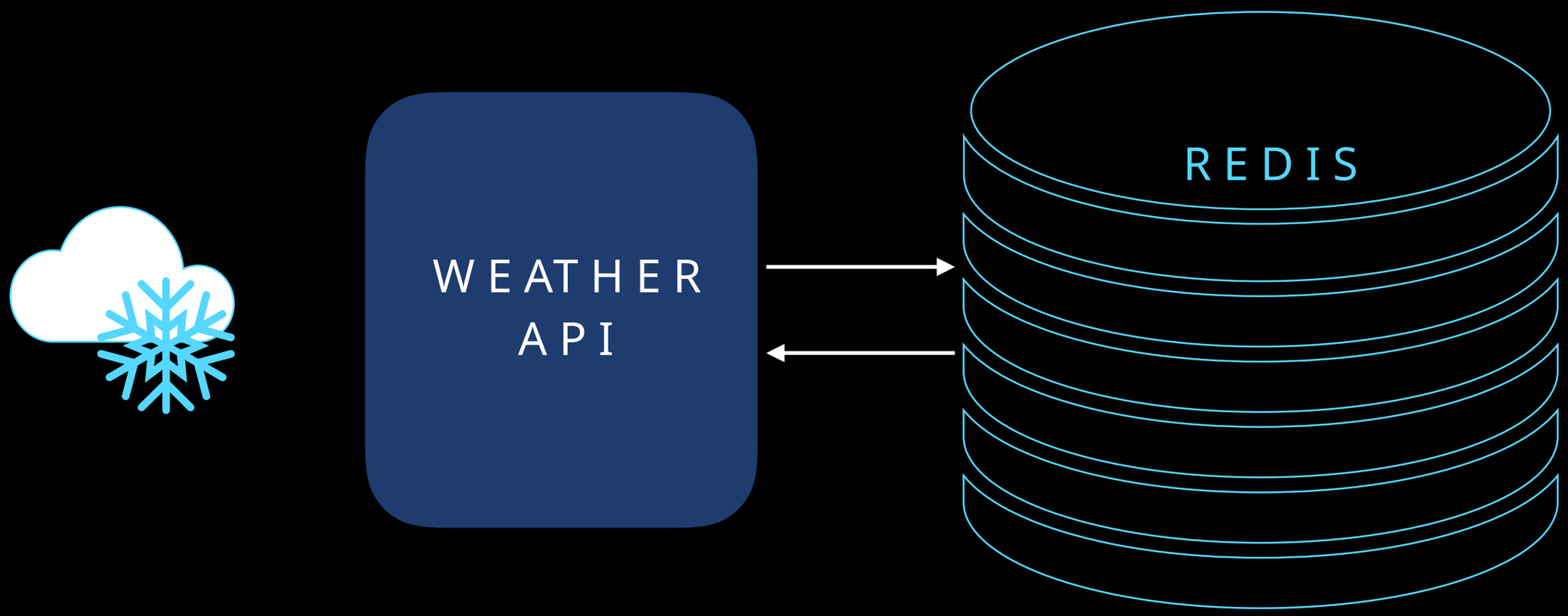
IN-MEMORY KV STORE: REDIS

Key	Value
Delhi	{'TEMP': 291.15, 'PRESSURE': 1017, 'HUMIDITY': 'TEMP_MIN': 291.15, 'TEMP_MAX': 291.15}
Berlin	{'TEMP': 294.84, 'PRESSURE': 1016, 'HUMIDITY 'TEMP_MIN': 294.15, 'TEMP_MAX': 295.15}
Nyc	{'TEMP': 294.84, 'PRESSURE': 1016, 'HUMIDITY 'TEMP_MIN': 294.15, 'TEMP_MAX': 295.15}

FAST KEY LOOKUP

IN-MEMORY KV STORE: REDIS

- Unstructured data
- Query only by Key, nothing else
- Single instance
- In-Memory

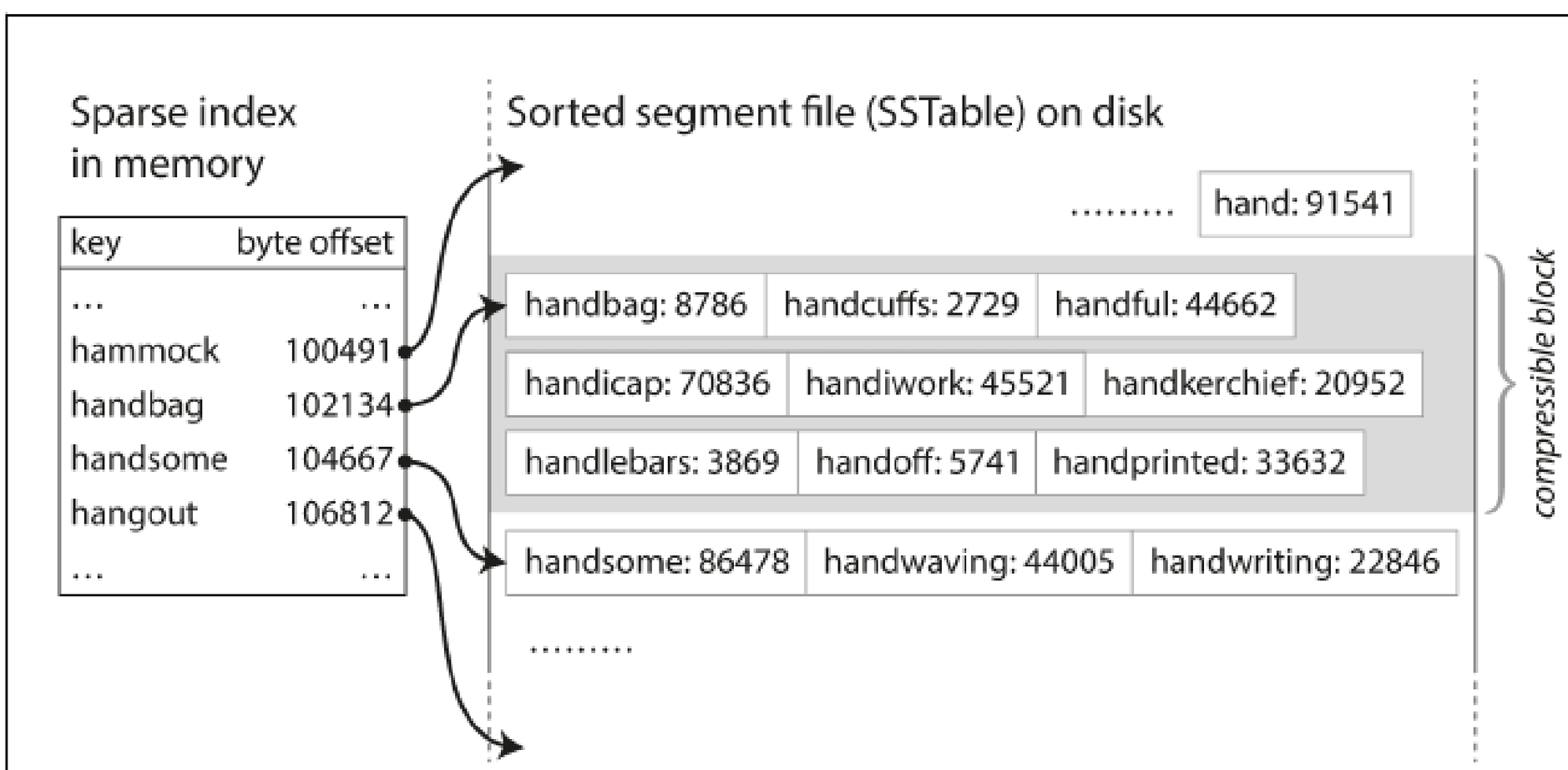


WHAT IS PARTITIONING?

- Split by Hash of Key

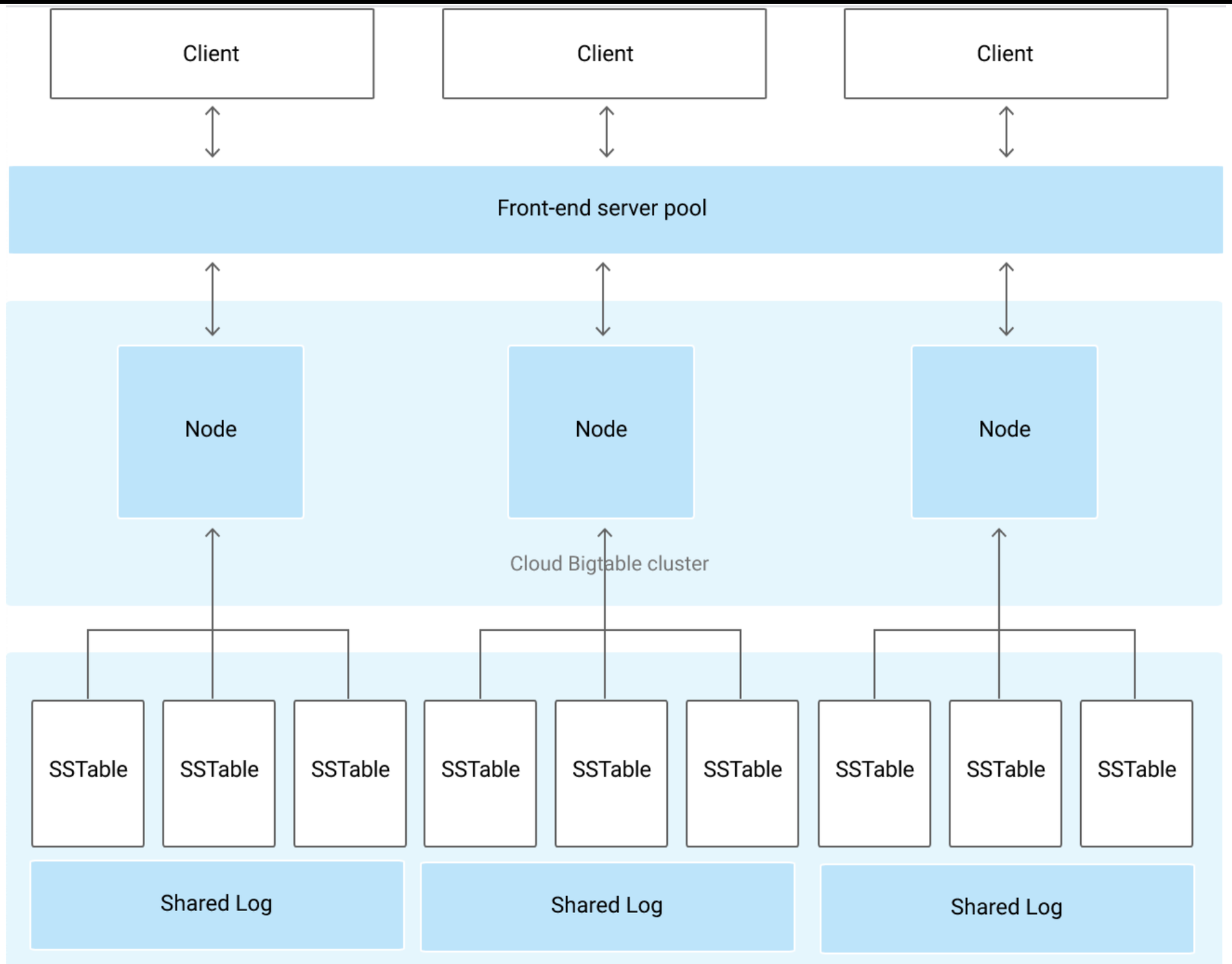
  OR

- SSTable: Stored in sorted segments



FAST KEY LOOKUP

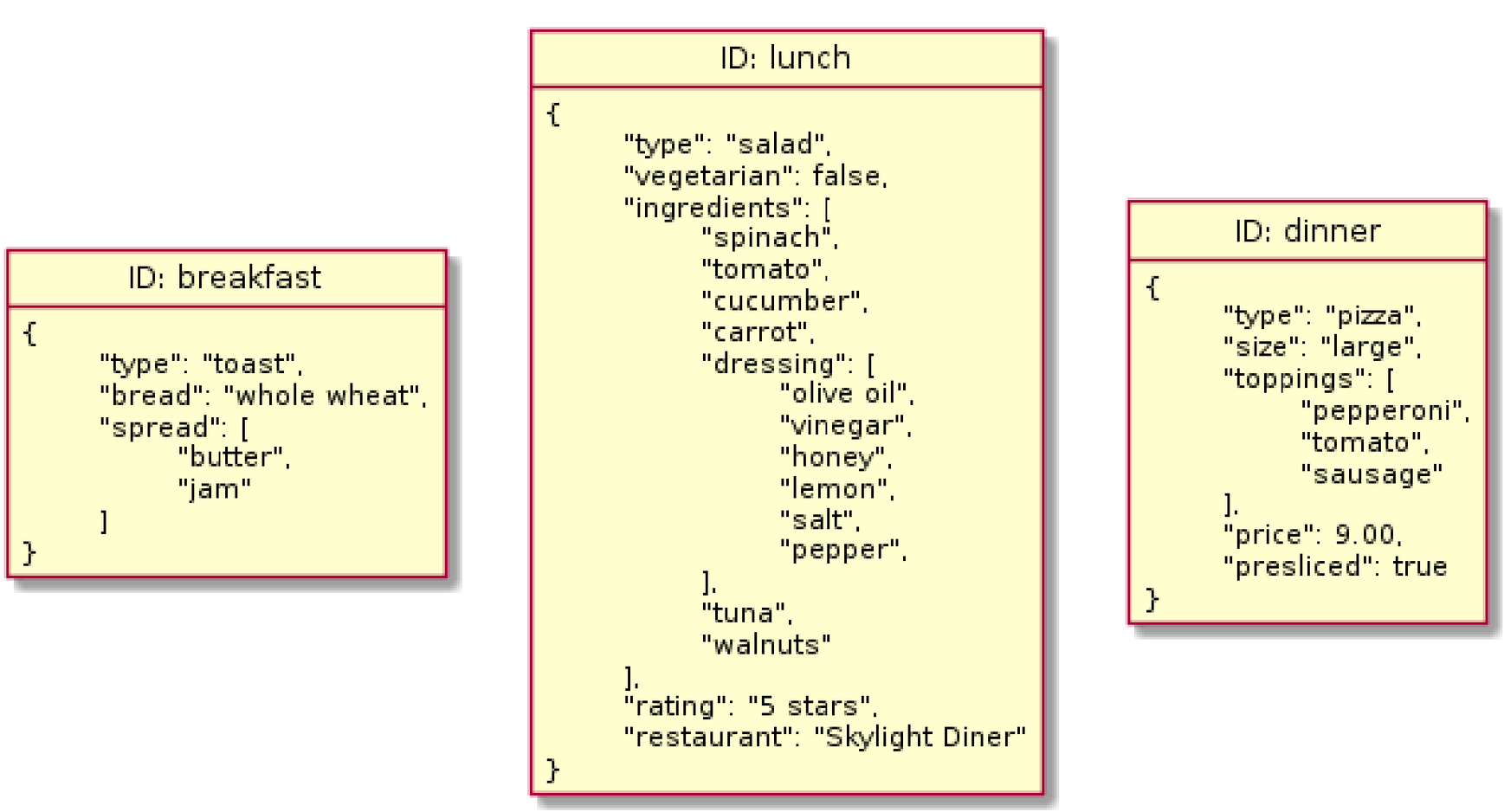
DISTRIBUTED KV STORE: BIGTABLE / HBASE / CASSANDRA



FAST KEY LOOKUP

DOCUMENT STORE

- Special case of Key Value Stores
- Flexible “Schema”, Nested values



DOWNSIDES OF NOSQL

- You are responsible for managing your schema
- Constraints are either enforced on primary keys, or not at all. No unique columns, no foreign keys.
- Query optimized for specific use-cases, not generic

COLUMN ORIENTED DATABASES

- Relational Databases are used for transactional purposes.
  For example: Recording each sale that happens in an H&M Store.

- Column databases are used for analytical purposes.
  For example: Getting a report on revenue of all H&Ms across the world

- Examples: Amazon RedShift, Google BigQuery, InfoBright

COLUMN ORIENTED DATABASES

Logical table representation

a	b	c
a1	b1	c1
a2	b2	c2
a3	b3	c3
a4	b4	c4
a5	b5	c5

Row layout

Column layout

RELATIONAL VS COLUMN-ORIENTED

- Writing data:
  - In row-oriented database, data is added row by row and appended to a file
  - In column-oriented database, first data needs to be split by columns, and then it is added to the file for each column.
    Writing a single row is much more expensive.

RELATIONAL VS COLUMN-ORIENTED

- Reading data:
  - In row-oriented database, first all data for a row is loaded from disk, and then required columns are selected from that row
  - In column-oriented database, first all data for required columns is loaded. And then some rows are filtered out, if needed.
    Reading only a few columns and doing aggregations is much faster.

EXERCISE

- Choose one of the following Database Types:
  - Relational Database (MySQL / Postgres)
  - In-Memory KV (Redis)
  - Distributed KV (BigTable / HBase / Cassandra)
  - Column Oriented Databases (RedShift / BigQuery / InfoBright)

EXERCISE - CONTINUED

- Choose an appropriate database type for each application:
  - An application that needs to store the most recent products viewed by each user on Amazon.de
  - An application to manage a blog with blog posts, tags, comments, etc.
  - An application to create reports on global statistics of a dating app: top 5 countries, most used feature, busiest hour of the week