# Joining in Snowflake

INTRODUCTION TO SNOWFLAKE

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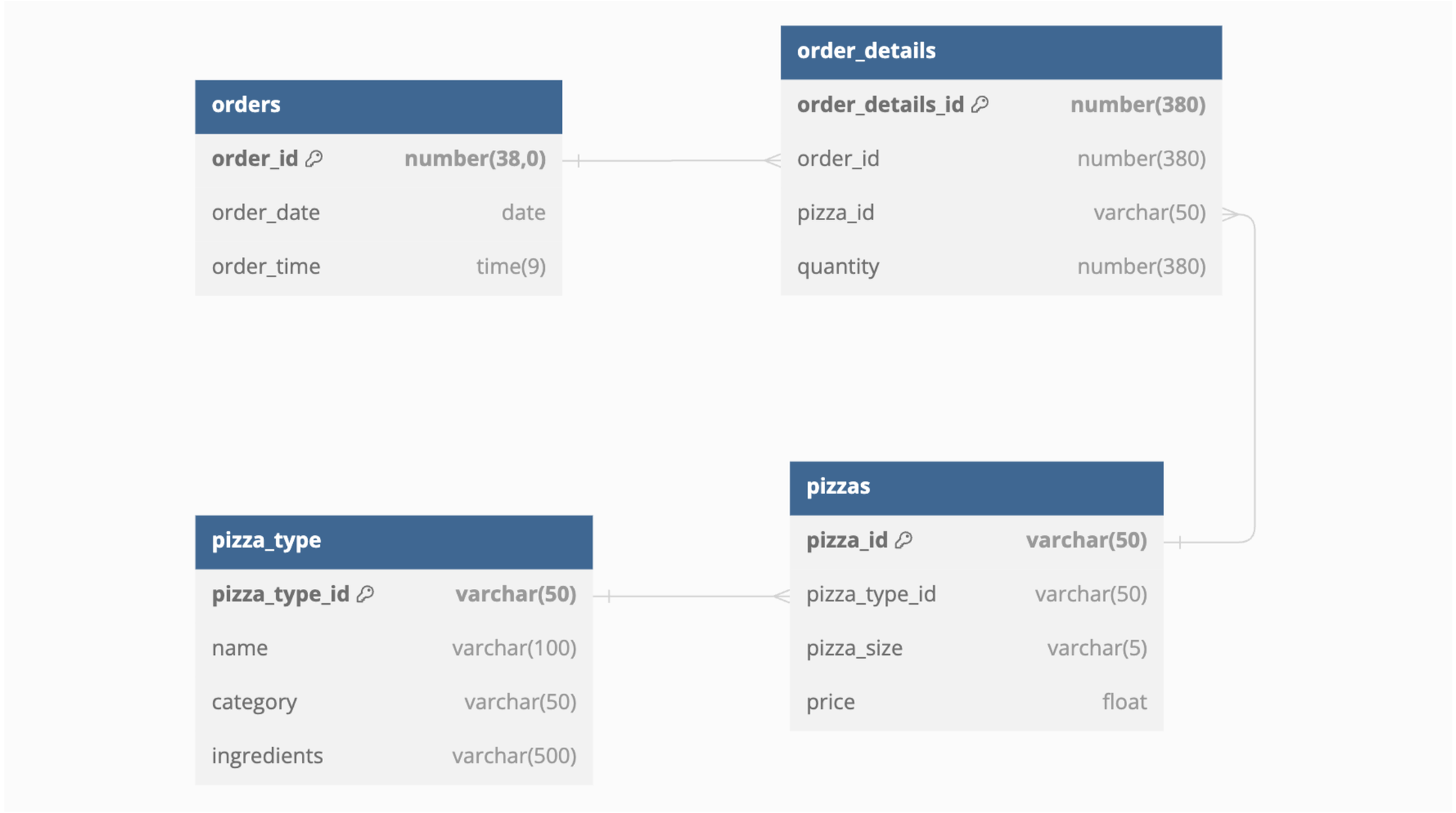
# JOINS

- INNER JOIN
- OUTER JOINS
  - LEFT OUTER JOIN or LEFT JOIN
  - RIGHT OUTER JOIN or RIGHT JOIN
  - FULL OUTER JOIN or FULL JOIN
- CROSS JOINS
- SELF JOINS
- NATURAL JOIN
- LATERAL JOIN

# Pizza dataset



# Similarities with PostgreSQL - INNER JOIN

```
SELECT
    pt.name AS pizza_type_name,
    pt.category,
    pt.ingredients,
    p.size,
    p.price
FROM
    pizza_type AS pt
INNER JOIN -- Using INNER JOIN
    pizzas AS p
    ON
      pt.pizza_type_id = p.pizza_type_id
```

| PIZZA_TYPE_NAME | CATEGORY | INGREDIENTS | SIZE | ··· | PRICE |
|---|---|---|---|---|---|
| The Barbecue Chicken Pizza | Chicken | Barbecued Chicken, Red Pe | S | | 12.75 |
| The Barbecue Chicken Pizza | Chicken | Barbecued Chicken, Red Pe | M | | 16.75 |
| The Barbecue Chicken Pizza | Chicken | Barbecued Chicken, Red Pe | L | | 20.75 |
| The California Chicken Pizza | Chicken | Chicken, Artichoke, Spinach | S | | 12.75 |
| The California Chicken Pizza | Chicken | Chicken, Artichoke, Spinach | M | | 16.75 |

# NATURAL JOIN

Syntax:

```
SELECT ...
FROM <table_one> [
                    {
                      | NATURAL [ { LEFT | RIGHT | FULL } [ OUTER ] ]
                    }
                  ]
                  JOIN <table_two>
[ ... ]
```

SELECT pt.category, -- Calculate total_revenue SUM(p.price * od.quantity) AS total_revenueFROM order_details AS od-- NATURAL JOIN all tablesNATURAL JOIN pizzas AS p NATURAL JOIN pizza_type AS pt-- GROUP the records by category from pizza_type tableGROUP BY pt.category-- ORDER by total_revenue and limit the recordsORDER BY total_revenue DESCLIMIT 1;

# NATURAL JOIN

## Without `NATURAL JOIN`

```
SELECT *
FROM pizzas AS p
JOIN  pizza_type AS t
    ON t.pizza_type_id = p.pizza_type_id
```

| PIZZA_ID | PIZZA_TYPE_ID | PIZZA_SIZE | PRICE | PIZZA_TYPE_ID_2 |
|---|---|---|---|---|
| bbq_ckn_s | bbq_ckn | S | 12.75 | bbq_ckn |
| bbq_ckn_m | bbq_ckn | M | 16.75 | bbq_ckn |
| bbq_ckn_l | bbq_ckn | L | 20.75 | bbq_ckn |
| cali_ckn_s | cali_ckn | S | 12.75 | cali_ckn |
| cali_ckn_m | cali_ckn | M | 16.75 | cali_ckn |

## With `NATURAL JOIN`

```
SELECT *
FROM pizzas AS p
NATURAL JOIN pizza_type AS t
```

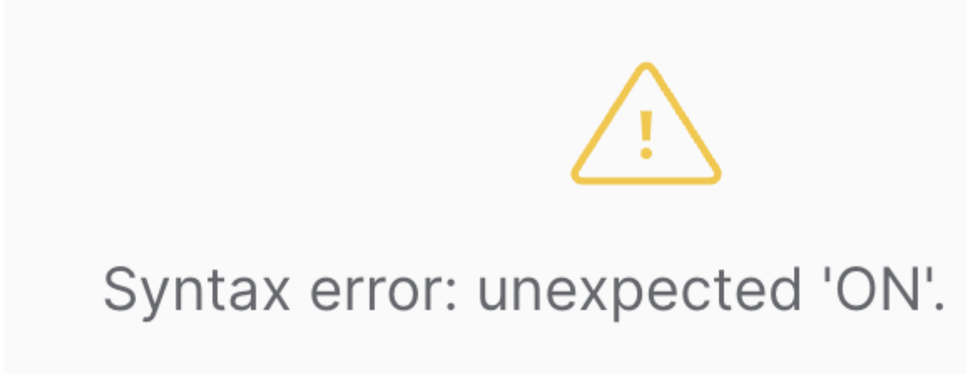
| PIZZA_TYPE_ID | PIZZA_ID | PIZZA_SIZE | PRICE | NAME |
|---|---|---|---|---|
| bbq_ckn | bbq_ckn_s | S | 12.75 | The Barbecue Chicken Pizza |
| bbq_ckn | bbq_ckn_m | M | 16.75 | The Barbecue Chicken Pizza |
| bbq_ckn | bbq_ckn_l | L | 20.75 | The Barbecue Chicken Pizza |
| cali_ckn | cali_ckn_s | S | 12.75 | The California Chicken Pizza |
| cali_ckn | cali_ckn_m | M | 16.75 | The California Chicken Pizza |

# NATURAL JOIN

```
SELECT pt.name,
      pt.category,
       o.order_date,
       -- Get max quantity from lateral query
       x.max_quantity
FROM pizzas AS pz
JOIN pizza_type AS pt ON pz.pizza_type_id = pt.pizza_type_id
JOIN order_details AS od ON pz.pizza_id = od.pizza_id
-- Join with orders table
JOIN orders AS o ON od.order_id = o.order_id,
LATERAL (
  -- Select max of order_details quantity
    SELECT MAX(od2.quantity) AS max_quantity
    FROM order_details AS od2
    -- Join with pizzas table
    JOIN pizzas AS pz2
        ON od2.pizza_id = pz2.pizza_id
    -- Filtering condition for the subquery
    WHERE pz2.pizza_type_id = pz.pizza_type_id
) AS x
WHERE od.quantity = x.max_quantity
GROUP BY pt.name, pt.category, o.order_date, x.max_quantity
ORDER BY pt.name;
```

## NOT ALLOWED

```
select *
FROM pizzas AS p
NATURAL JOIN pizza_type AS t
    ON  t.pizza_type_id = p.pizza_type_id
```



# NATURAL JOIN

## ALLOWED

- WHERE clause

```
SELECT *
FROM pizzas AS p
NATURAL JOIN pizza_type AS t
WHERE pizza_type_id = 'bbq_ckn'
```

# LATERAL JOIN

Syntax:

```
SELECT ...
FROM <left_hand_expression> , --
LATERAL
(<right_hand_expression>)
```

- `left_hand_expression` - Table, view, or subquery
- `right_hand_expression` - Inline view or subquery

# LATERAL JOIN with a subquery

```
SELECT
    p.pizza_id,
    lat.name,
    lat.category
FROM pizzas AS p,
LATERAL -- Keyword LATERAL
        ( SELECT *
          FROM pizza_type AS t
         -- Referencing outer query column: p.pizza_type_id
          WHERE p.pizza_type_id = t.pizza_type_id
        ) AS lat
```

# Why LATERAL JOIN?

```
SELECT
    *
FROM orders AS o,
LATERAL (
   -- Subquery calculating total_spent
    SELECT
        SUM(p.price * od.quantity) AS total_spent
    FROM order_details AS od
    JOIN pizzas AS p
          ON od.pizza_id = p.pizza_id
    WHERE o.order_id = od.order_id
) AS t
ORDER BY o.order_id
```

# Let's practice!

INTRODUCTION TO SNOWFLAKE

# Subquerying and Common Table Expressions

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# Subquerying

- Nested queries
- Used in `FROM`, `WHERE`, `HAVING` or `SELECT` clauses
- Example:

```
SELECT column1
FROM table1
WHERE column1 = (SELECT column2 FROM table2 WHERE condition)
```

- Types: Correlated and uncorrelated subqueries

# Correlated subquery

- References columns from the outer query

```
SELECT pt.name,
       pz.price,
       pt.category
FROM pizzas AS pz
JOIN pizza_type AS pt
    ON pz.pizza_type_id = pt.pizza_type_id
WHERE pz.price < (
  -- Identifies highest price for each piza category
    SELECT MAX(p2.price) -- Max price
    FROM pizzas AS p2
    WHERE -- Correlated: uses outer query column
      p2.pizza_type_id = pz.pizza_type_id
)
```

# Uncorrelated subquery

- No reference to outer or main query

```
SELECT order_id
FROM order_details AS od
WHERE pizza_id = (
  -- Uncorrelated: standalone subquery
  -- Not referencing to outer query columns
    SELECT pizza_id
    FROM pizzas
    ORDER BY price DESC
    LIMIT 1
)
```

# Correlated subquery limitations

- Can't use LIMIT with corelated subquery

```
SELECT pt.name,
       pz.price,
       pt.category
FROM pizzas AS pz
JOIN pizza_type AS pt
    ON pz.pizza_type_id = pt.pizza_type_id
WHERE pz.price < (
    SELECT p2.price -- Get price
    FROM pizzas AS p2
    WHERE p2.pizza_type_id = pz.pizza_type_id -- Correlated to outer query
    ORDER BY p2.price DESC -- Order with max price first
    LIMIT 1 -- LIMIT 1 fetches only the top record, i.e., the max price
 )
```

# Correlated subquery limitations

**Result:**

Unsupported subquery type cannot be evaluated

# Using LIMIT in uncorrelated subquery

```
SELECT pt.name,
       pz.price,
       pt.category
FROM pizzas AS pz
JOIN pizza_type AS pt
  ON pz.pizza_type_id = pt.pizza_type_id
WHERE pz.price < (
    SELECT p2.price
    FROM pizzas AS p2 -- No where clause
    ORDER BY p2.price DESC
    -- Can use limit here
    LIMIT 1
)
```

**Result:**

| NAME | PRICE | CATEGORY |
|---|---|---|
| The Barbecue Chicken Pizza | 12.75 | Chicken |
| The Barbecue Chicken Pizza | 16.75 | Chicken |
| The Barbecue Chicken Pizza | 20.75 | Chicken |
| The California Chicken Pizza | 12.75 | Chicken |
| The California Chicken Pizza | 16.75 | Chicken |
| The California Chicken Pizza | 20.75 | Chicken |
| The Chicken Alfredo Pizza | 12.75 | Chicken |
| The Chicken Alfredo Pizza | 16.75 | Chicken |

# Common Table Expressions

Basic Syntax:

```
-- WITH keyword
WITH cte1 AS ( -- CTE name
        SELECT col_1, col_2
            FROM table1
    )
    ...
SELECT ...
FROM cte1 -- Query CTE
;
```

# Common Table Expressions

```
WITH max_price AS ( -- CTE:max_price
    SELECT pizza_type_id,
           MAX(price) AS max_price
    FROM pizzas
    GROUP BY pizza_type_id
)
-- Main query
SELECT pt.name,
       pz.price,
       pt.category
FROM pizzas AS pz
JOIN pizza_type AS pt ON pz.pizza_type_id = pt.pizza_type_id
JOIN max_price AS mp  -- Joining with CTE:max_price
     ON pt.pizza_type_id = mp.pizza_type_id
WHERE pz.price < mp.max_price -- Compare the price with max_price CTE column
```

# Multiple CTEs

```
-- Define multiple CTEs separated by commas
WITH cte1 AS (
    SELECT ...
    FROM ...
),
cte2 AS (
    SELECT ...
    FROM ...
)
-- Main query combining both CTEs
SELECT ...
FROM cte1
JOIN cte2 ON ...
WHERE ...
```

# Why Use CTEs?

- Managing complex operations
- Readable
- Modular
- Reusable

# Let's practice!

INTRODUCTION TO SNOWFLAKE

# Snowflake Query Optimization

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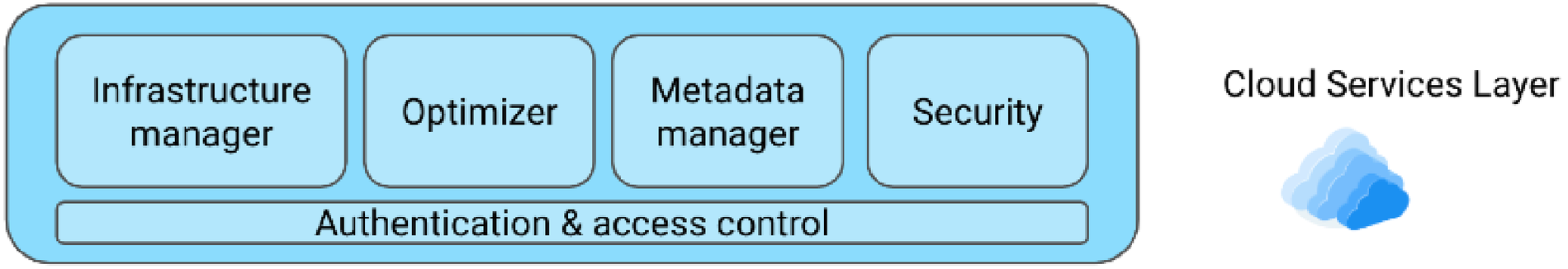
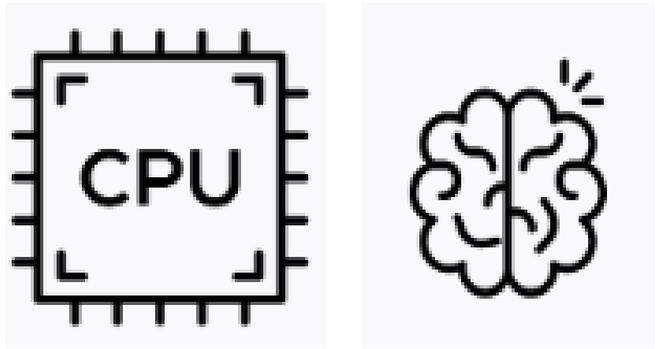
# What's Snowflake Query Optimization?

- Transforming into more efficient queries
- Snowflake's Cloud Services Layer



# Why Optimize Queries in Snowflake?

- Achieve faster results
- Cost efficiency
  - Shorter query times consumes fewer resources like CPU and memory.

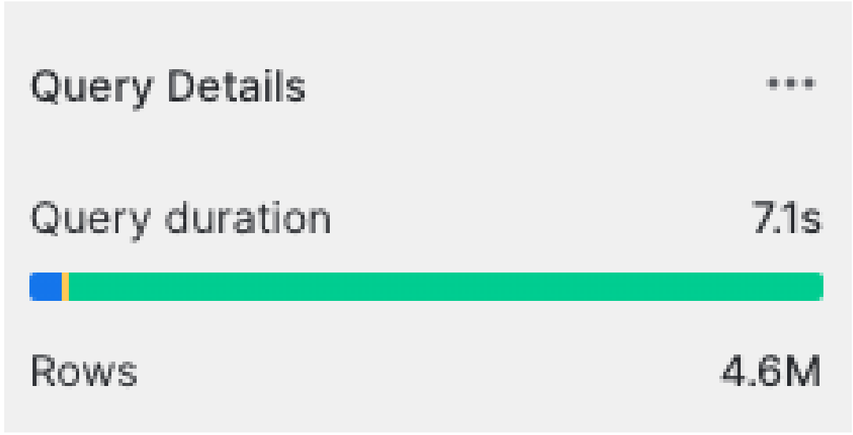



# Common query problems

- Exploding Joins: Be cautious!

**Incorrect:**

```
SELECT *
FROM order_details AS od
JOIN pizzas AS p -- Missing ON condition leading to exploding joins
```

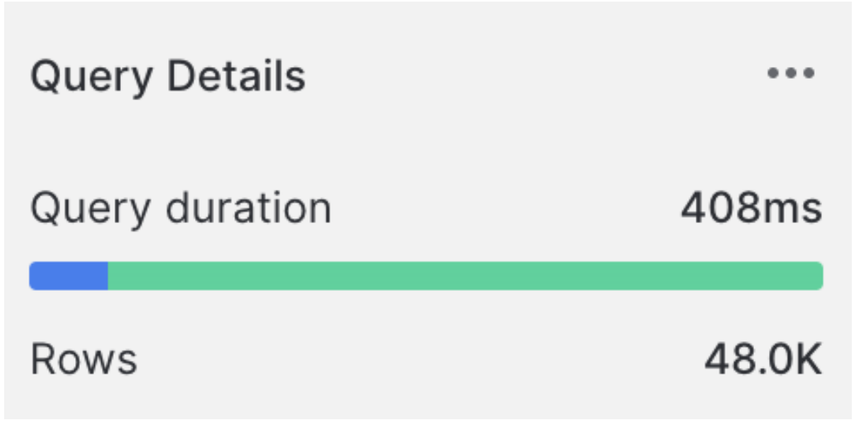


# Common query problems

- Exploding Joins: Be cautious!

**Correct:**

```
SELECT *
FROM order_details AS od
JOIN pizzas AS p
ON od.pizza_id = p.pizza_id
```



# Common query problems

- `UNION` or `UNION ALL` : Know the difference.
  - `UNION` removes duplicates, slows down the query.
  - `UNION ALL` is faster if no duplicates.
- Handling big data
  - Use filters to narrow down data.
  - Apply limits for quicker results.

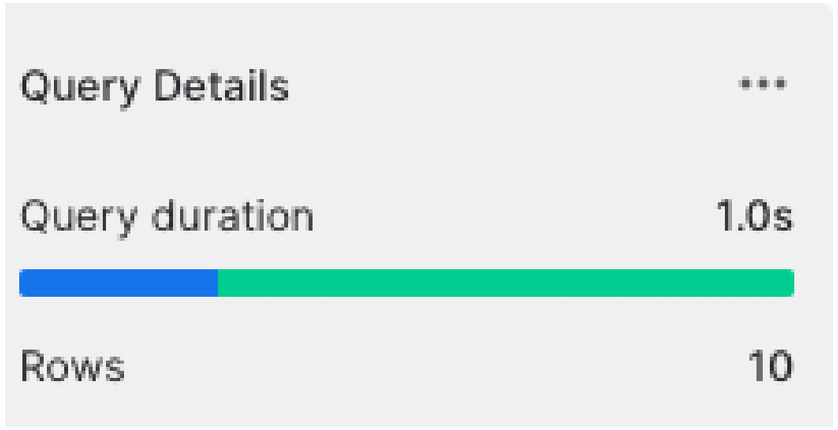
# How to optimize queries?

## SELECT *

```
SELECT
    *
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
```


## SELECT TOP 10*

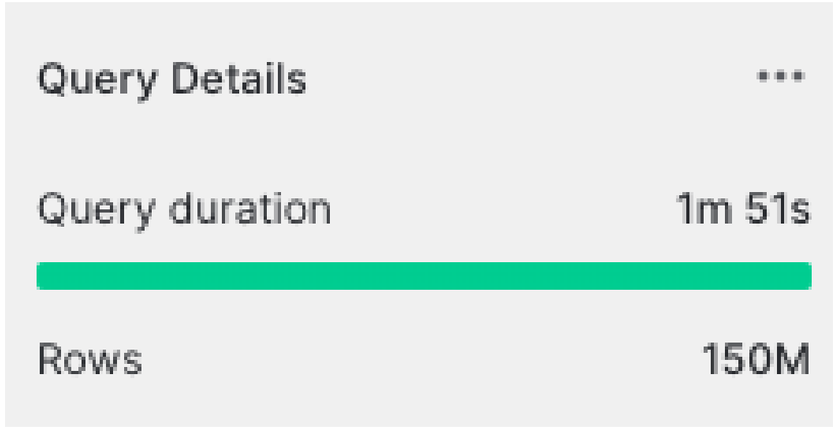
```
SELECT
    TOP 10*
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
```



# How to optimize queries?

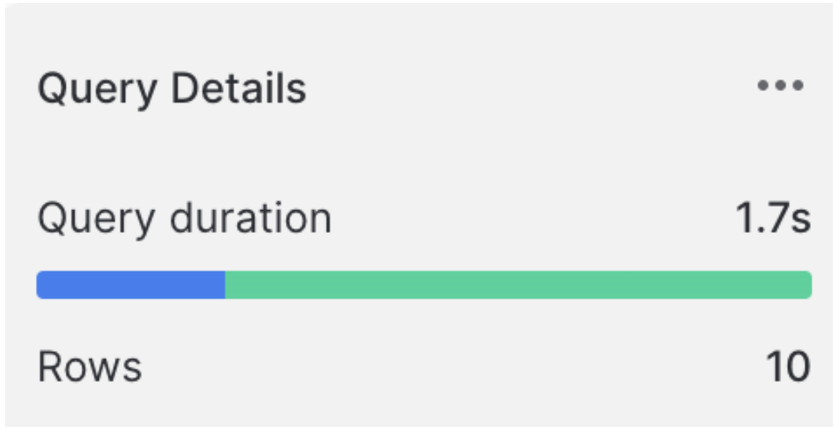
## SELECT *

```
SELECT *
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
```



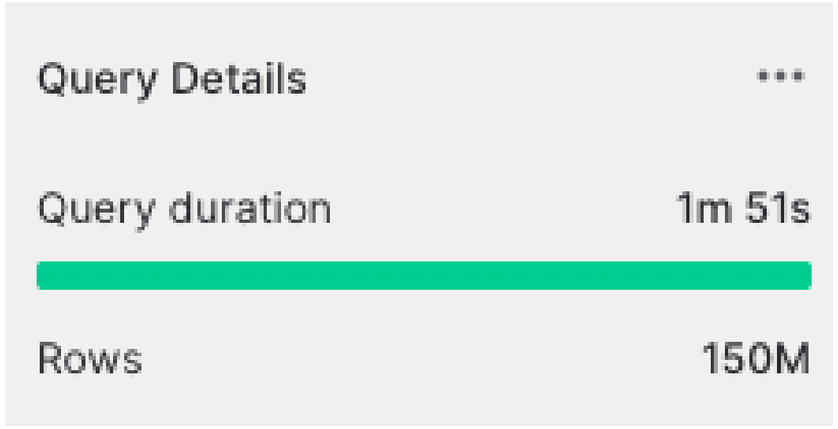

## LIMIT

```
SELECT *
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
LIMIT 10
```



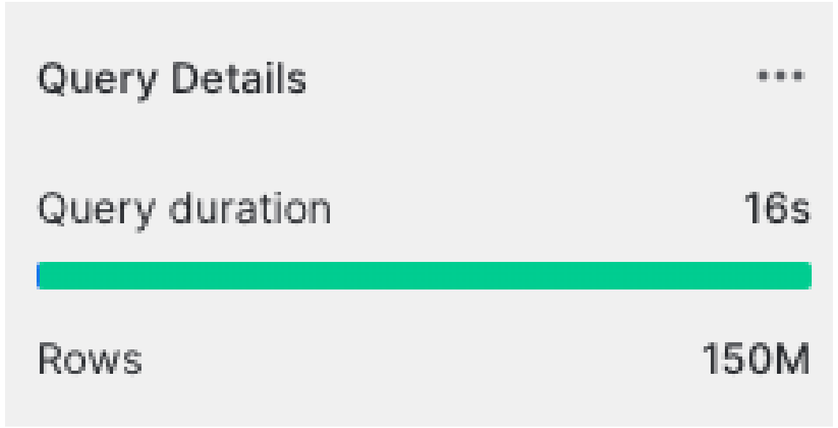
# How to optimize queries?

```
SELECT *
FROM SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
```




## Avoid `SELECT *`

```
SELECT
    o_orderdate,
    o_orderstatus
FROM
    SNOWFLAKE_SAMPLE_DATA.TPCH_SF100.ORDERS
```



# How to optimize queries?

## Filter Early

- Use `WHERE` Clause Early On.
- Apply filters before `JOIN` s

# Without early filtering

```
SELECT orders.order_id,
       orders.order_date,
       pizza_type.name,
       pizzas.pizza_size
FROM orders
JOIN order_details
ON orders.order_id = order_details.order_id
JOIN pizzas
ON order_details.pizza_id = pizzas.pizza_id
JOIN pizza_type
ON pizzas.pizza_type_id = pizza_type.pizza_type_id
WHERE orders.order_date = '2015-01-01';  -- Filtering after JOIN
```

# With early filtering

```
WITH filtered_orders AS (
  SELECT *
  FROM orders
  WHERE order_date = '2015-01-01'  -- Filtering in CTE before JOIN
)
SELECT filtered_orders.order_id,
       filtered_orders.order_date,
       pizza_type.name,
       pizzas.pizza_size
FROM filtered_orders -- Joining with CTE
JOIN order_details
ON filtered_orders.order_id = order_details.order_id
JOIN pizzas
```

# Query history

- Query History
  - `snowflake.account_usage.query_history`

```
SELECT
    query_text,
    start_time,
    end_time,
    execution_time
FROM
   snowflake.account_usage.query_history
WHERE query_text ilike '%order_details%'
```

| QUERY_TEXT ... | START_TIME | END_TIME | EXECUTION_TIME |
|---|---|---|---|
| SELECT * FROM order_details AS od JOIN pizzas AS p ON od.pizza_id = p.pizza_id | 2023-09-01 03:44:37.233 -0700 | 2023-09-01 03:44:38.309 -0700 | 529 |
| SELECT * FROM order_details AS od JOIN pizzas AS p; | 2023-09-01 03:43:37.899 -0700 | 2023-09-01 03:43:47.369 -0700 | 8,747 |

# Query history

- Spot slow or frequently running queries

```
SELECT
    query_text,
    start_time,
    end_time,
    execution_time
FROM
   snowflake.account_usage.query_history
WHERE
   execution_time > 1000
```

| QUERY_TEXT ··· | START_TIME | END_TIME | EXECUTION_TIME |
|---|---|---|---|
| select * from customer | 2023-08-08 10:21:24.128 -0700 | 2023-08-08 10:21:53.826 -0700 | 29,176 |

# Let's practice!

INTRODUCTION TO SNOWFLAKE

# Handling semi-structured data

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# Structured versus semi-structured

## Example of structured data

| cust_id | cust_name | cust_age | cust_email |
|---|---|---|---|
| 1 | cust1 | 40 | cust1***@gmail.com |
| 2 | cust2 | 35 | cust2***@gmail.com |
| 3 | cust3 | 42 | cust3***@gmail.com |

## Example of semi-structured data

```
{
  "cust_id": 1,
  "cust_name": "cust1",
  "cust_age": 40,
  "cust_email": "cust1***@gmail.com"
},
{
  "cust_id": 2,
  "cust_name": "cust2",
  "cust_age": 35,
  "cust_email": [
    "cust2***@gmail.com",
    "cust2_alternate***@gmail.com"
  ]
}
```

# Introducing JSON

- JavaScript Object Notation
- **Common use cases:** Web APIs, Mobile Apps, Config files.
- **JSON data structure:**
  - Key-Value Pairs, e.g., `cust_id: 1`

```
{
  "cust_id": 1,
  "cust_name": "cust1",
  "cust_age": 40,
  "cust_email": "cust1***@gmail.com"
}
```

# JSON in Snowflake

- Native JSON support
- Flexible for evolving schemas

**Comparisons:**

- Postgres: Uses `JSONB`
- Snowflake: Uses `VARIANT`

# How Snowflake stores JSON data

- `VARIANT` supports OBJECT and ARRAY data types
  - OBJECT: `{ "key": "value"}`
  - ARRAY: `["list", "of", "values"]`
- Creating a Snowflake Table to handle JSON data

```
CREATE TABLE cust_info_json_data(
  customer_id INT,
  customer_info VARIANT -- VARIANT data type
);
```

# Semi-structured data functions

- `PARSE_JSON`
  - `expr` : JSON data in string format.
  - Returns: `VARIANT` type, valid JSON object.

# PARSE_JSON

Example:

```
SELECT PARSE_JSON(
        ' -- enclosed in strings
         {
           "cust_id": 1,
           "cust_name": "cust1",
           "cust_age": 40,
           "cust_email":"cust1***@gmail.com"
          }
        '-- enclosed in strings
) AS customer_info_json
```

| CUSTOMER_INFO_JSON |
| --- |
| { "cust_age": 40, "cust_email": "cust1***@gmail.com", "cust_id": 1, "cust_name": "cust1" } |

# OBJECT_CONSTRUCT

- `OBJECT_CONSTRUCT`
  - Syntax: `OBJECT_CONSTRUCT( [<key1>, <value1> [, <keyN>, <valueN> ...]] )`
  - Returns: JSON object

```
SELECT OBJECT_CONSTRUCT(
        'cust_id', 1,
        'cust_name', 'cust1',
        'cust_age', 40,
        'cust_email', 'cust1***@gmail.com'
)
```

- Customer info data stored in table

| ID | CUSTOMER_INFO |
|---|---|
| 2 | { "cust_age": 40, "cust_email": "cust1***@gmail.com", "cust_id": 1, "cust_name": "cust1" } |

# Querying JSON data in Snowflake

- Simple JSON Data
- `:`

```
SELECT
  customer_info:cust_age, -- using colon to access data from column
  customer_info:cust_name,
  customer_info:cust_email,
FROM
  cust_info_json_data;
```

| CUSTOMER_INFO:CUST_AGE | CUSTOMER_INFO:CUST_NAME | CUSTOMER_INFO:CUST_EMAIL |
|---|---|---|
| 40 | "cust1" | "cust1***@gmail.com" |

# Querying nested JSON Data in Snowflake

Example of nested object

```
{
  "cust_id": 1,
  "cust_name": "cust1",
  "cust_age": 40,
  "cust_email": "cust1***@gmail.com",
  "address": {
    "street": "St1",
    "city": "Cityv",
    "state": "Statev"
  }
}
```

- Colon: `:`
- Dot: `.`

# Querying nested JSON using colon/dot notations

## Accessing values using colon notation

```
<column>:<level1_element>:
<level2_element>:<level3_element>
```

```
SELECT
    customer_info:address:street AS street_name
FROM
    cust_info_json_data
```

| STREET_NAME |
| --- |
| "St1" |

## Accessing values using dot notation

```
<column>:<level1_element>.
<level2_element>.<level3_element>
```

```
SELECT
    customer_info:address.street AS street_name
FROM
    cust_info_json_data
```

| STREET_NAME |
| --- |
| "St1" |

# Let's practice!

INTRODUCTION TO SNOWFLAKE

# Wrap-up

## INTRODUCTION TO SNOWFLAKE

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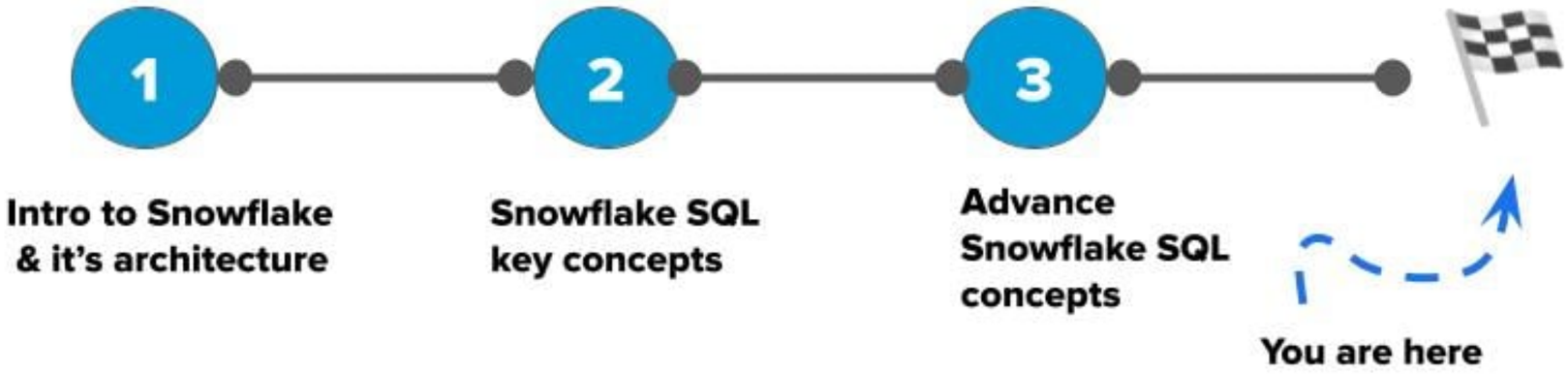
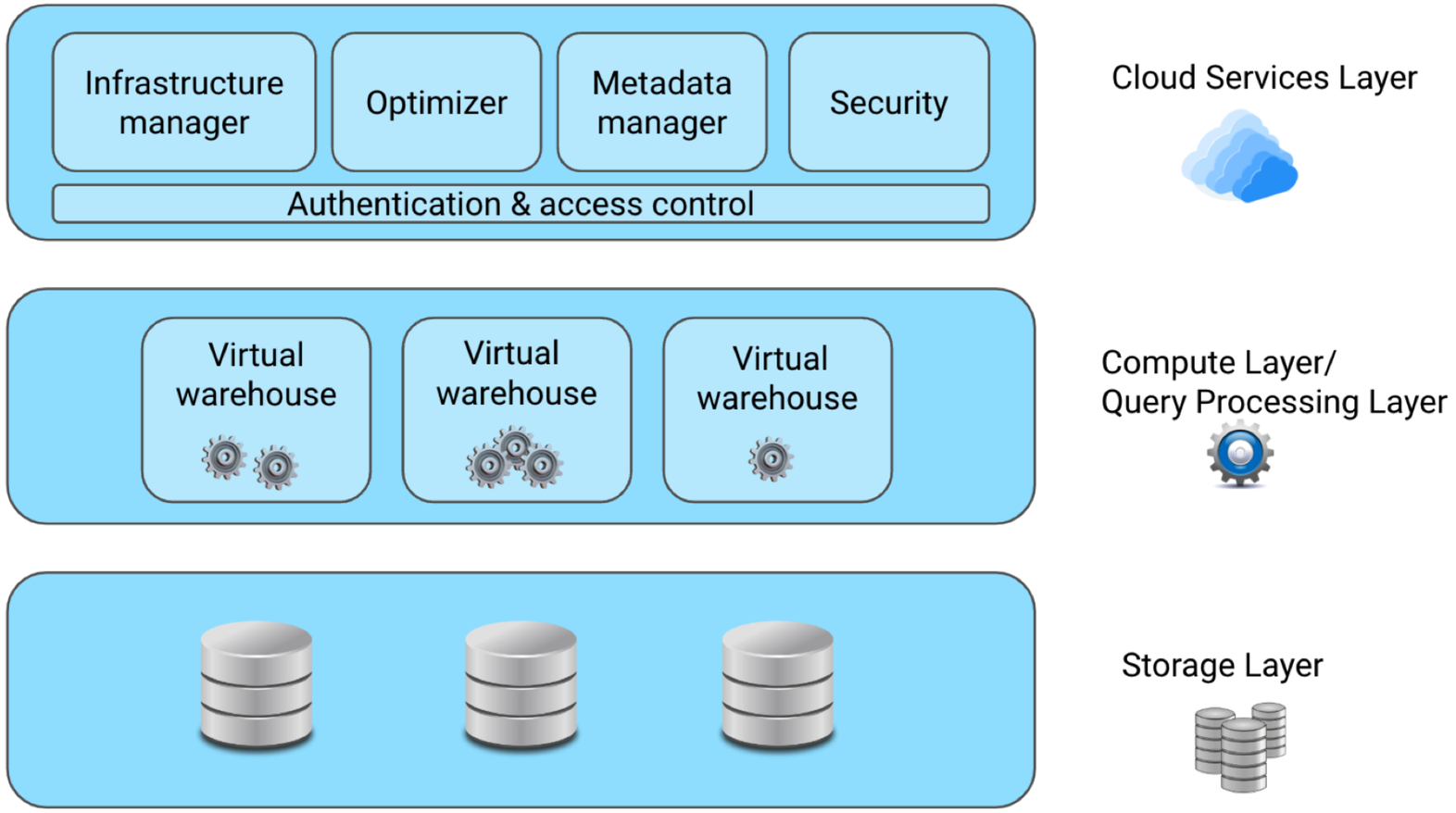
# Journey


1
2
3
Intro to Snowflake & it's architecture
Snowflake SQL key concepts
Advance Snowflake SQL concepts
You are here

# Chapter 1: Architecture, Competitors, and SnowflakeSQL



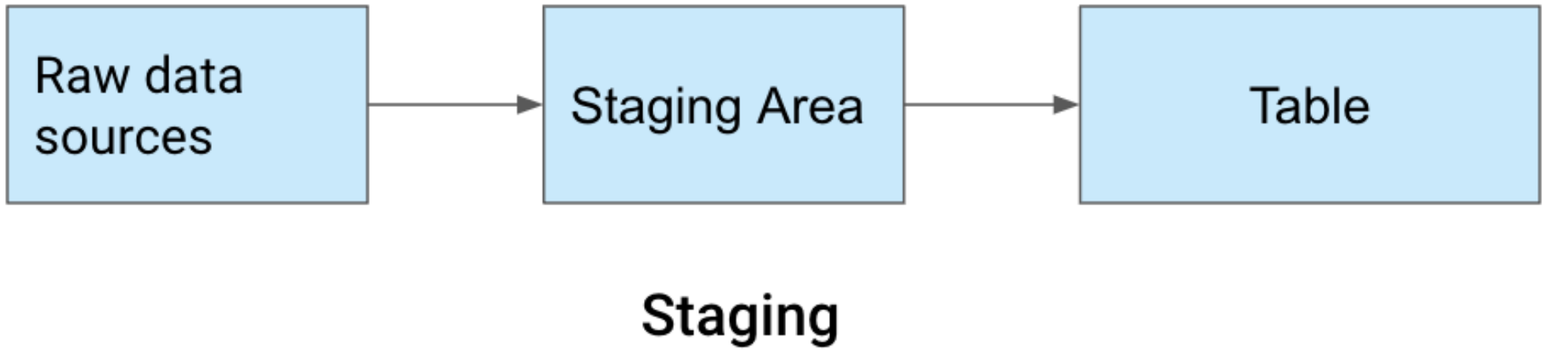
# Chapter 1: Architecture, Competitors, and Snowflake SQL




# Chapter2: Snowflake SQL and key concepts

Connecting to Snowflake

- WEB UI
- Drivers & Connectors
- SnowSQL



# Chapter2: Snowflake SQL and key concepts

Data Definition Language (DDL)

- `CREATE`
- `ALTER`
- `DROP`
- `RENAME`
- `COMMENT`

Database structures and DML commands

- `SHOW`
- `DESCRIBE`
- `INSERT`
- `UPDATE`
- `MERGE`
- `COPY`

# Chapter2: Snowflake SQL and key concepts

- `VARCHAR`
- `NUMERIC`
- `INT`
- `DATE`
- `TIME`
- `TIMESTAMP`
- `VARIANT` -> Semi-structured data

Data Type conversion - What, Why, How?

Conversion Fucntions: `TO_VARCHAR` , `TO_DATE`

STRING functions: `CONCAT` , `UPPER` , `LOWER`

DATE & TIME functions: `CURRENT_DATE` , `CURRENT_TIME`

EXTRACT functions: `GROUP BY ALL`

# Chapter 3: Advance Snowflake SQL Concepts

## JOINS

- `NATURAL JOIN`
- `LATERAL` JOIN

## Subquerying

## CTEs

# Chapter 3: Advance Snowflake SQL Concepts

## Snowflake Query Optimization

- **Common query problems:** Exploding Joins, `UNION` vs `UNION ALL`
- **Rewriting queries:** `TOP` , `LIMIT` , Early filtering, Avoid `Select *`

## Semi structured data

- `PARSE_JSON` , `OBJECT_CONSTRUCT`
- Querying JSON data in Snowflake

# Is this all?

- Much more to unfold.

**Not addressed**

- Setting context
- Roles, Users
- Setting up Virtual Warehouses
- Window functions
- Query profiling
- Materialized Views
- Clustering

...

# Useful resources

- Snowflake documentation: https://docs.snowflake.com/
- Snowflake forums: https://community.snowflake.com/s/forum

# This is just the beginning!

INTRODUCTION TO SNOWFLAKE