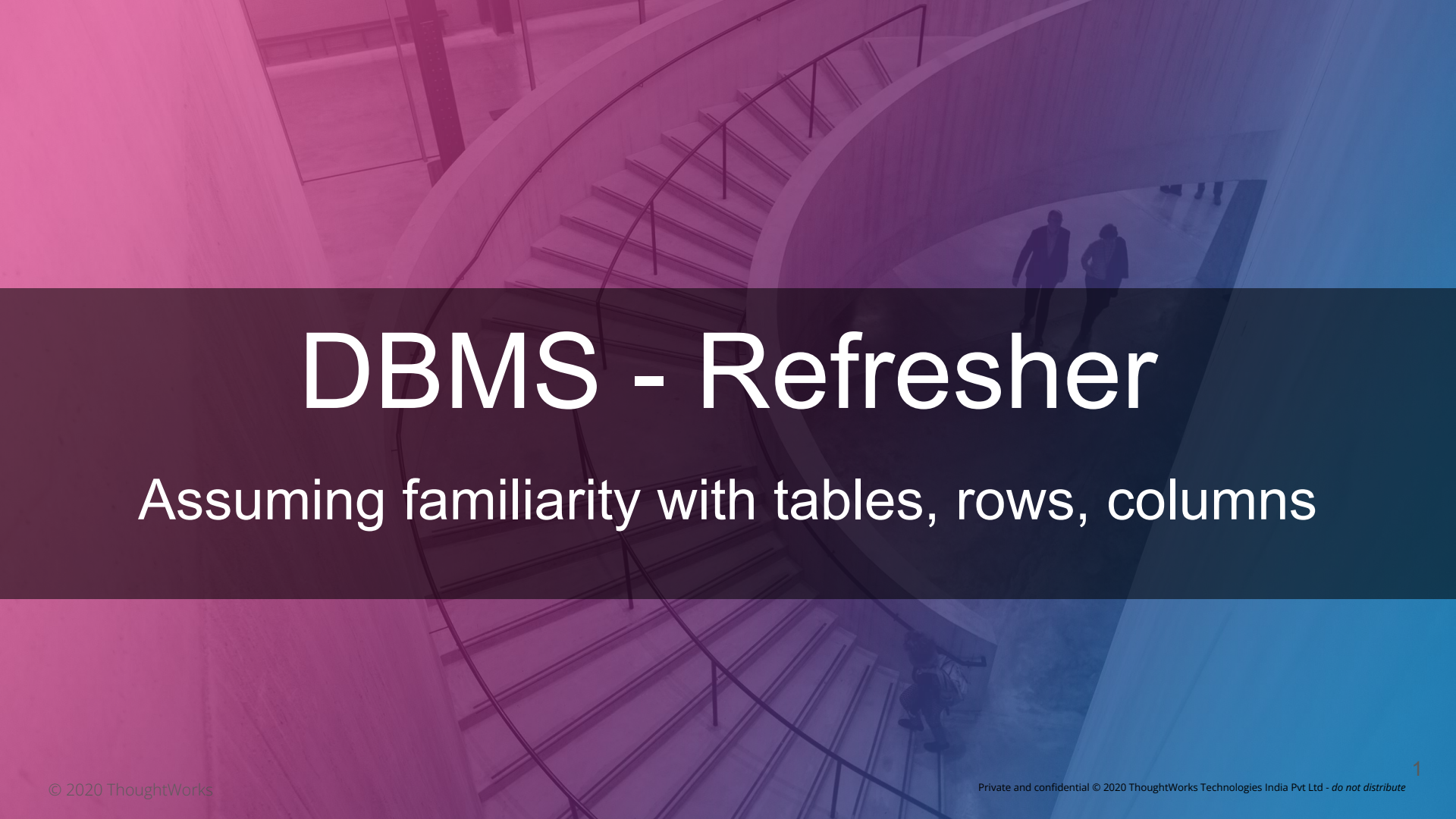


DBMS - Refresher

Assuming familiarity with tables, rows, columns

Pizza Shop

Pizza Shop

Pizzas

Pizza Shop

Pizzas

Customers

Pizza Shop

Pizzas

Customers

Orders

Pizza Shop

Pizzas (name, price)

Customers (name, address)

Orders (customer, date, pizza, quantity, price)

Pizza Shop

Pizzas

p_id	name	price

Customers (name, address)

Orders (customer, date, pizza, quantity, price)

Pizza Shop

Pizzas

p_id	name	price

Customers

c_id	name	address

Orders

o_id	customer	date	pizza	quantity	price

Pizza Shop

Pizzas

p_id	name	price

Customers

c_id	name	address

Orders

o_id	customer	date	pizza	quantity	price

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy

Pizza Shop

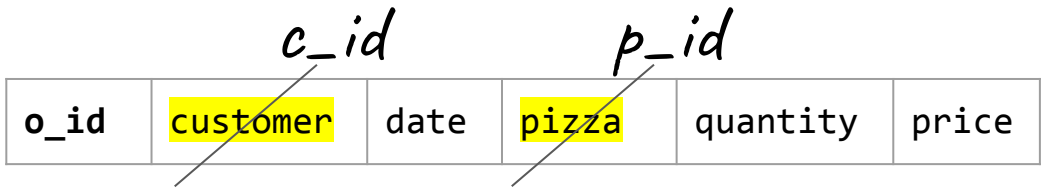
Pizzas

p_id	name	price

Customers

c_id	name	address

Orders



Pizza Shop

Pizzas

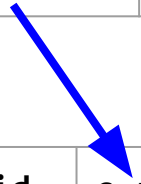
p_id	name	price

Customers

c_id	name	address

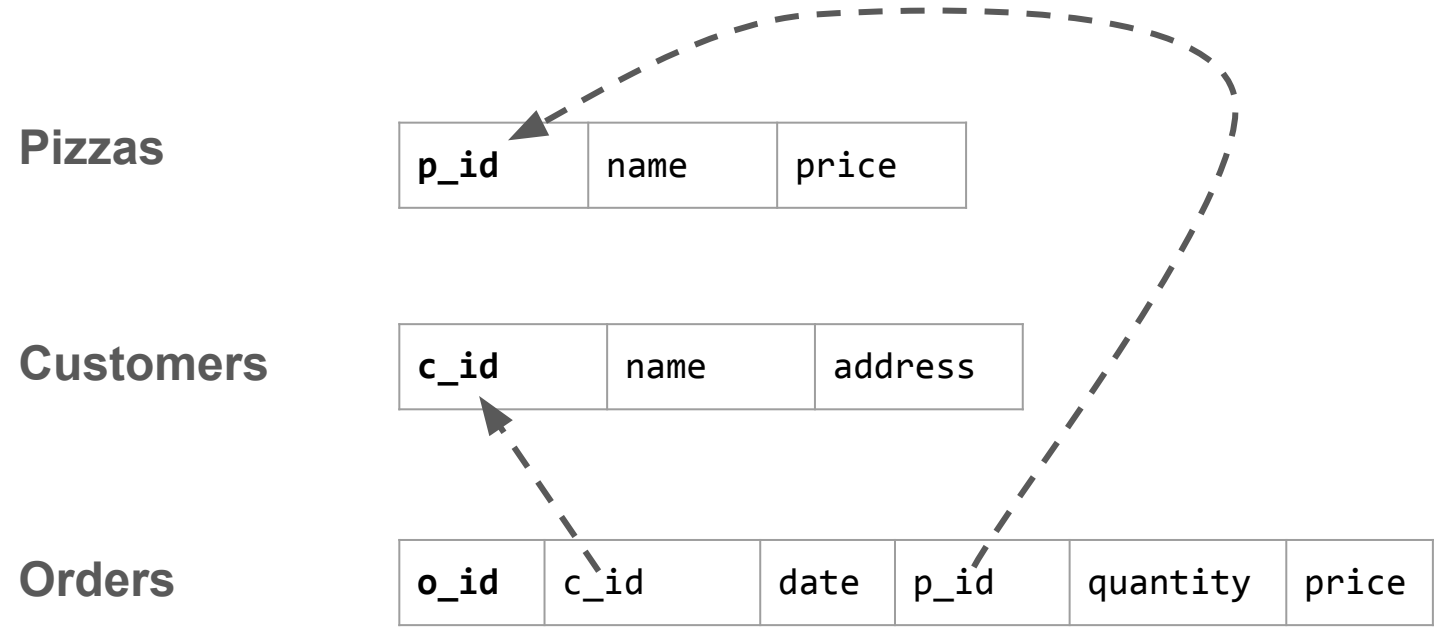
Orders

o_id	c_id	date	p_id	quantity	price



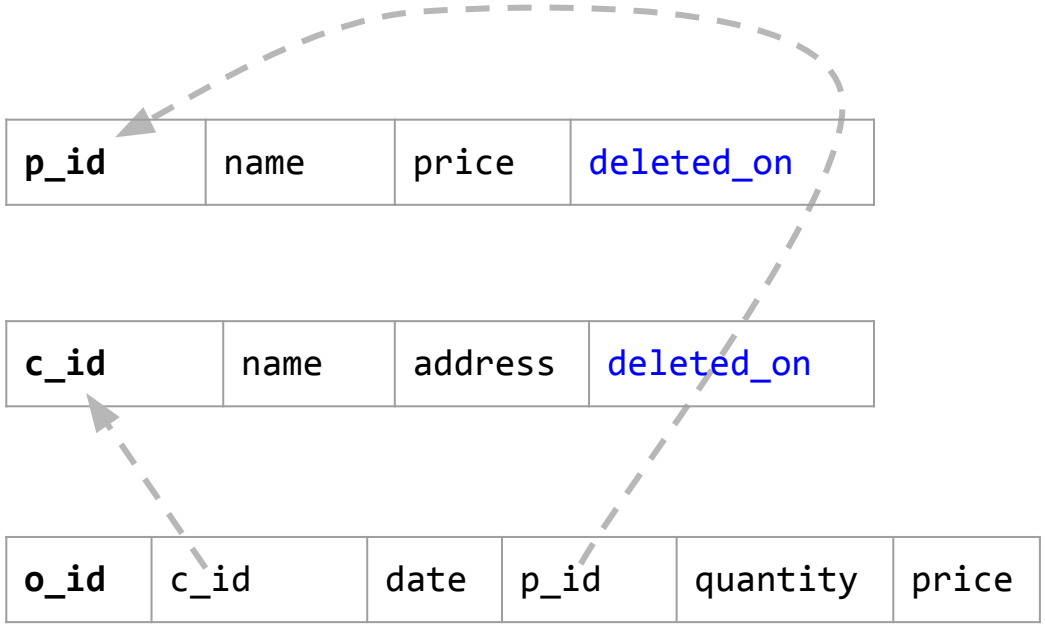
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time

Pizza Shop



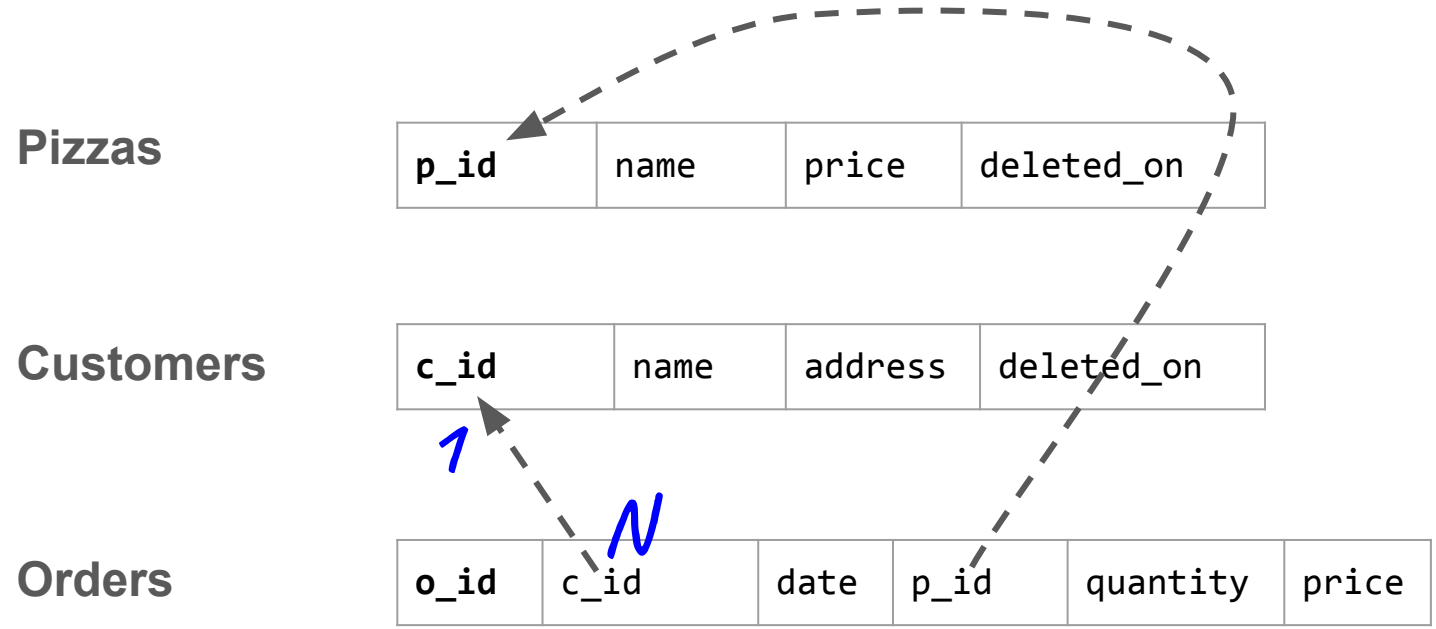
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade

Pizza Shop



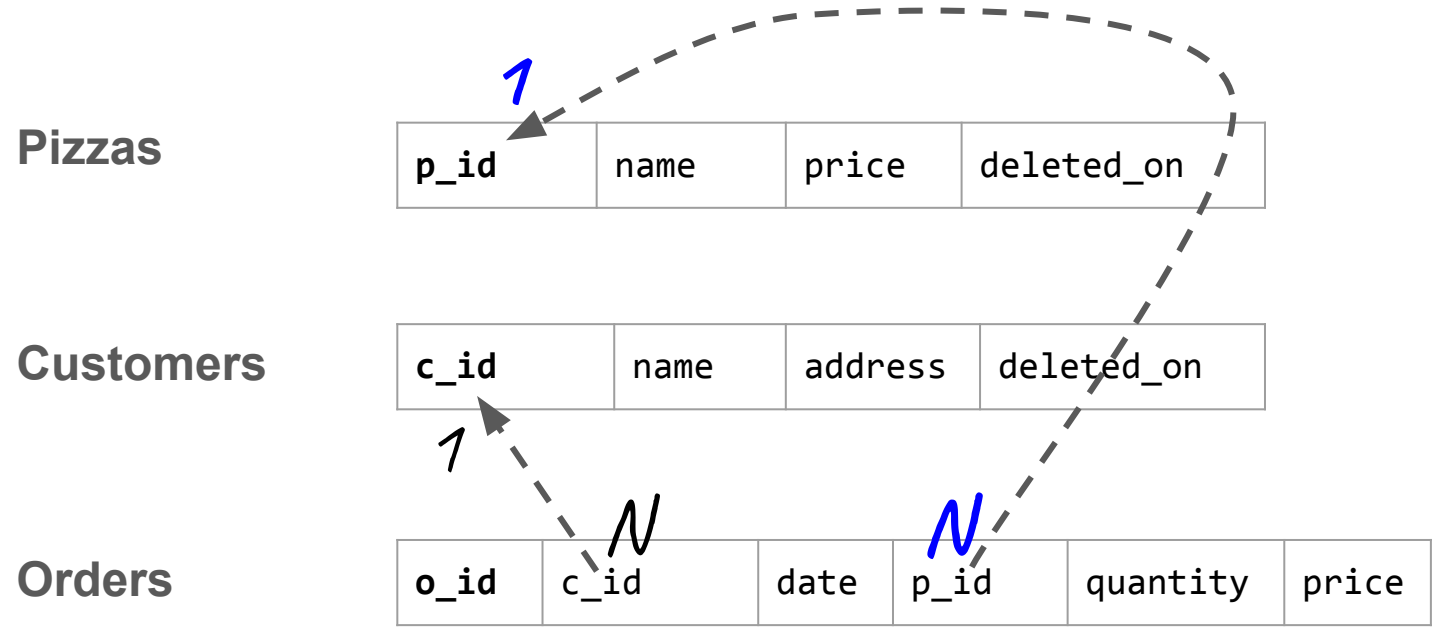
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete

Pizza Shop



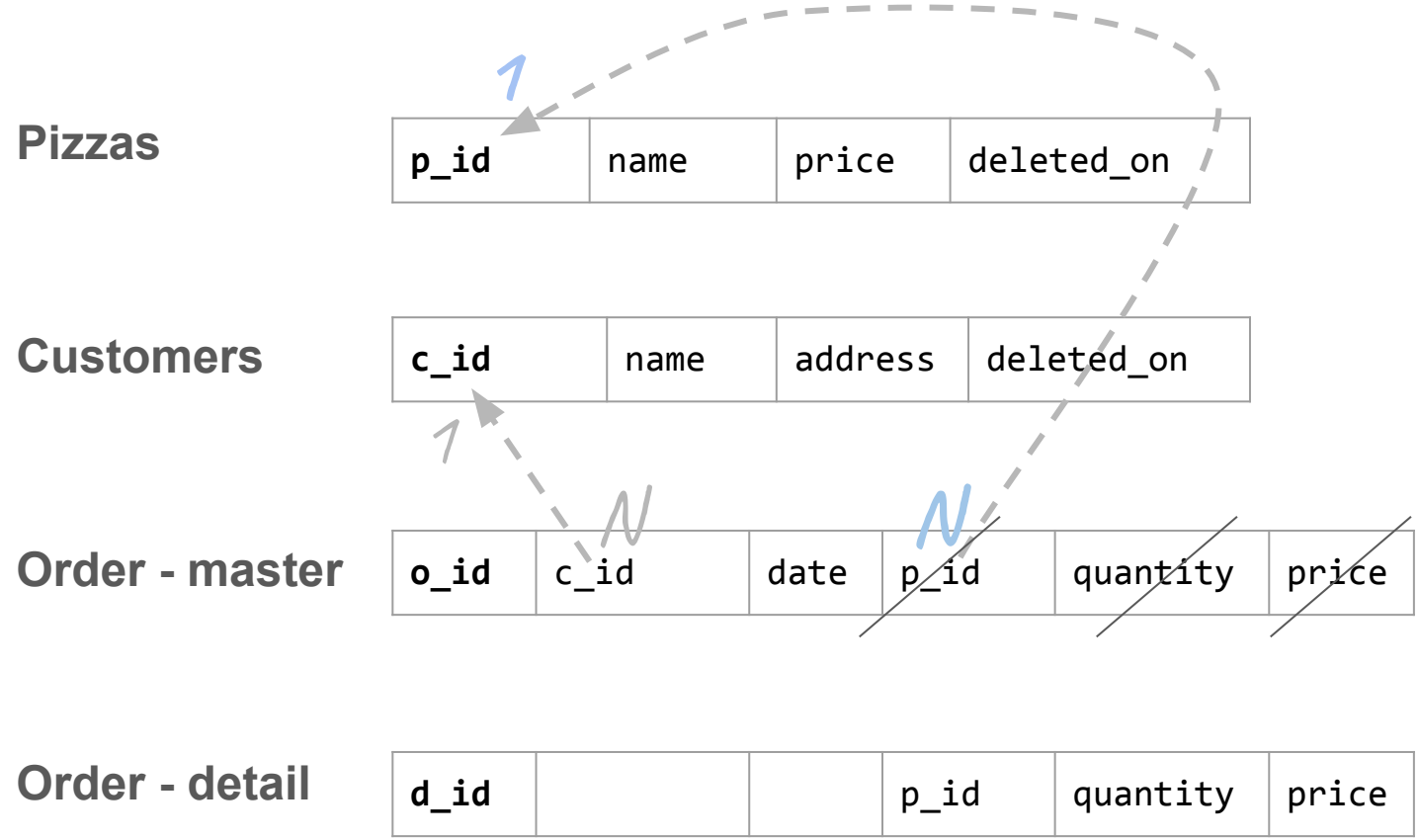
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 **1:N** **N:N**

Pizza Shop



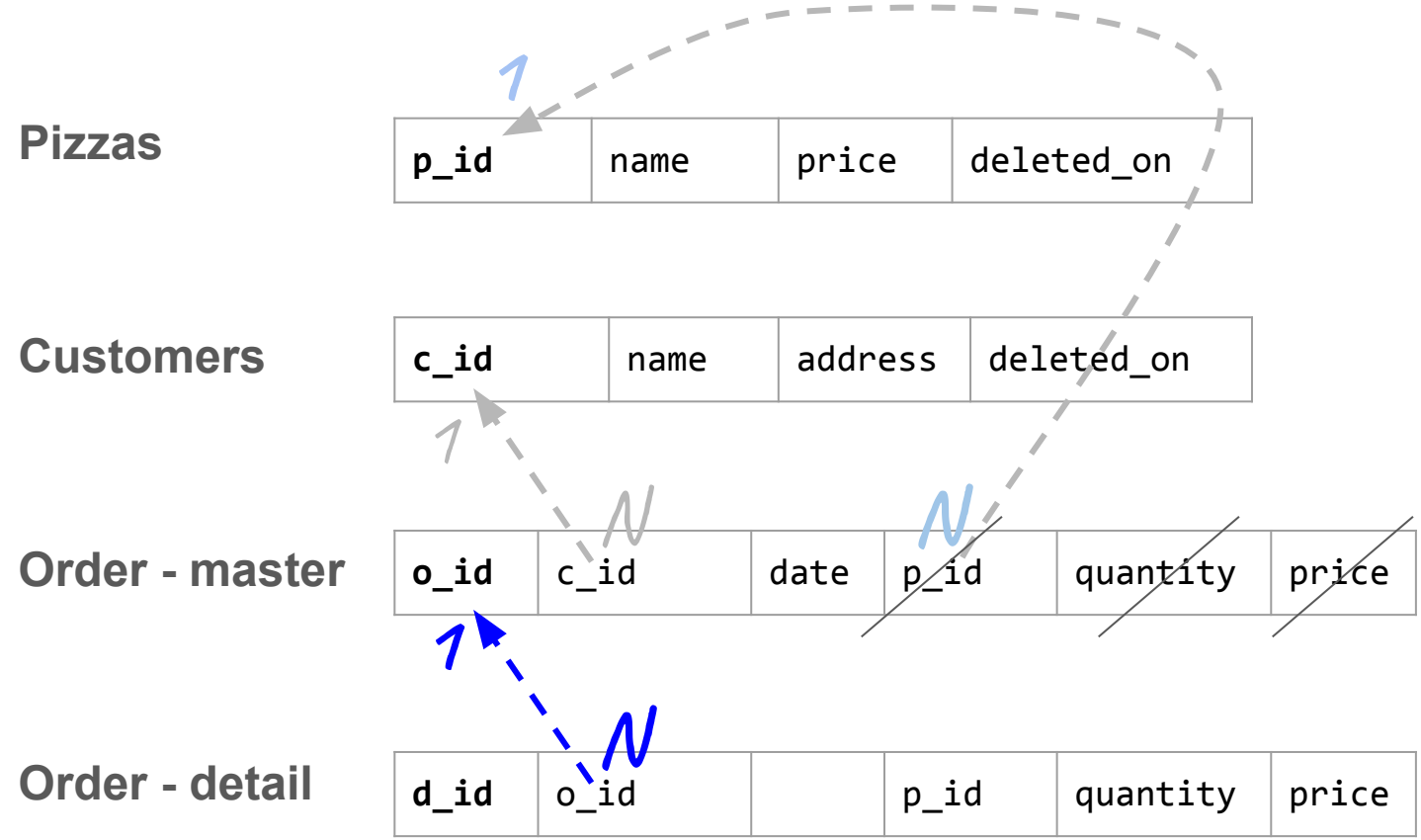
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 **1:N** **N:N**

Pizza Shop



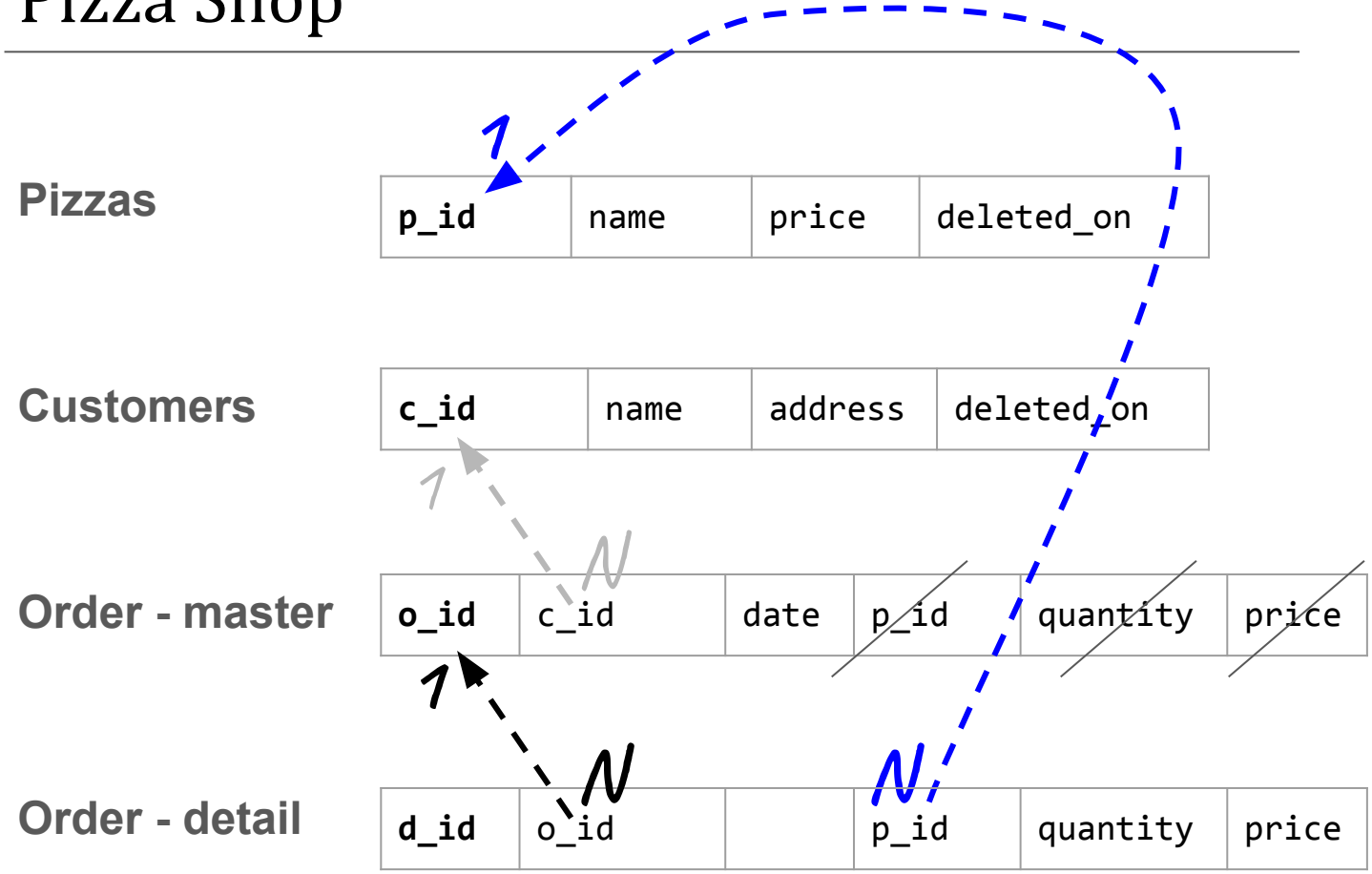
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

Pizza Shop



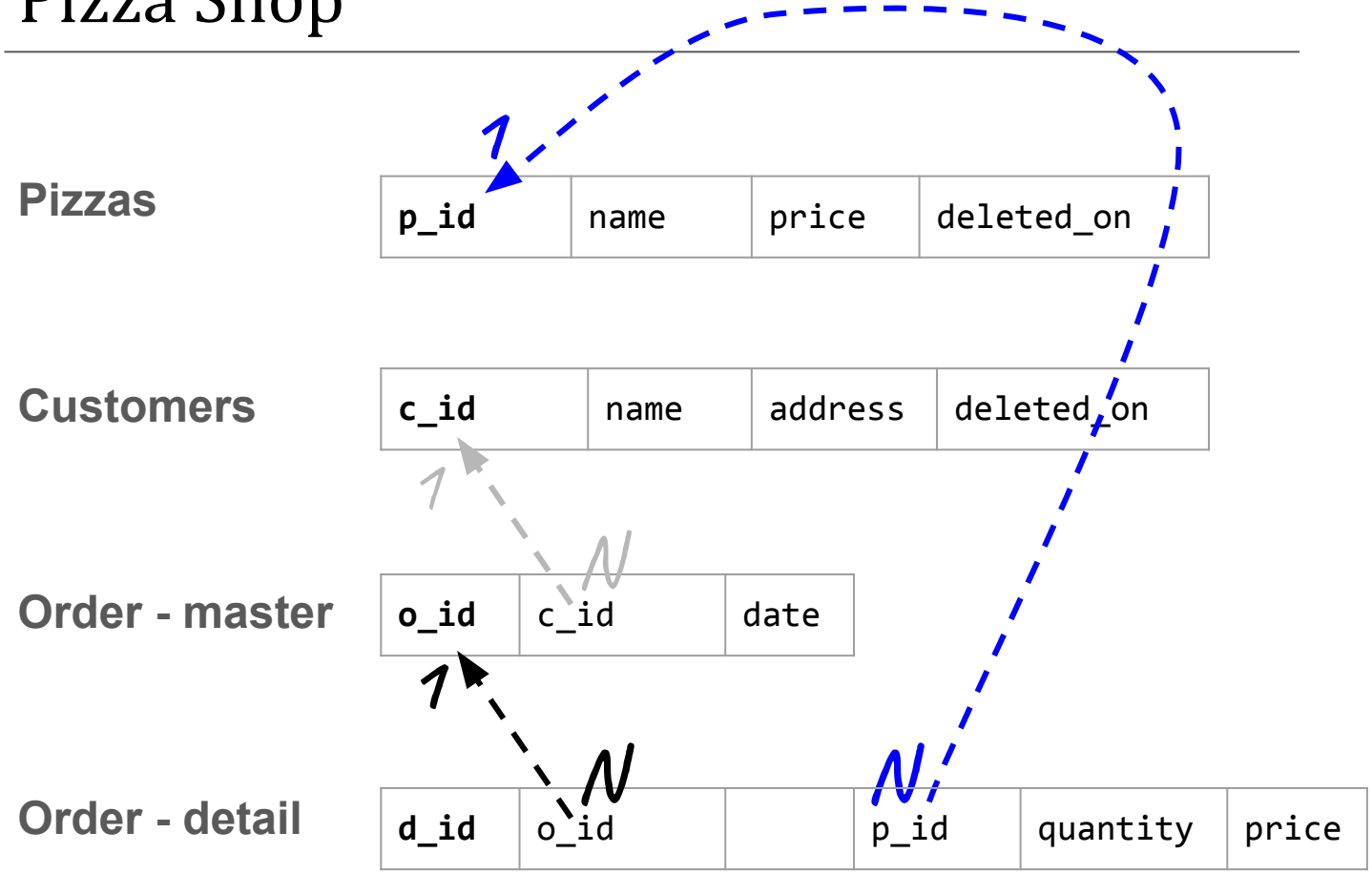
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

Pizza Shop



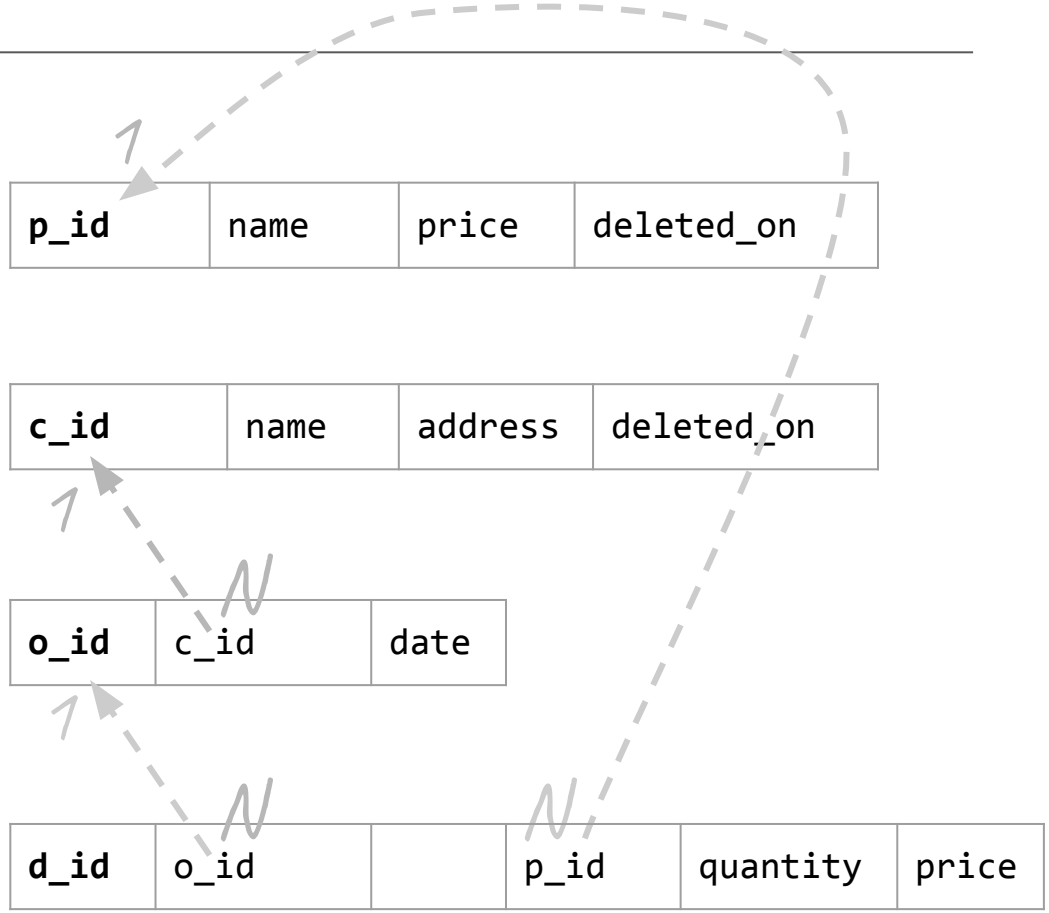
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

Pizza Shop



Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

Pizza Shop



Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

Pizza Shop

```
CREATE TABLE pizza (
  p_id SERIAL PRIMARY KEY,
  name VARCHAR (100),
  price INTEGER
);
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL
CREATE, SERIAL, VARCHAR
REFERENCES,

Pizza Shop

http://sqlfiddle.com/

#!9/8ab956

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL
CREATE, SERIAL, VARCHAR
REFERENCES,

Pizza Shop

```
INSERT INTO pizza
    (name, price)
VALUES
    ('Veg Cheese Pizza', 100);
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT

Pizza Shop

http://sqlfiddle.com/

#!9/062125

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

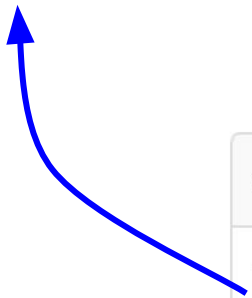
DDL, **DML**
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT

Pizza Shop

http://sqlfiddle.com/#!9/062125

```
INSERT INTO order_master
    (c_id, order_date)
VALUES
    (1, '2019-01-02');
```

```
CREATE TABLE order_master (
  ...
  c_id INTEGER REFERENCES
  customer(c_id),
  ...
)
```



customer

c_id	name	address
1	Iron man	59th Street, Broadway
2	Dr Strange	177A Bleeker Street

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, **DML**
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity

Pizza Shop

http://sqlfiddle.com/#!9/062125

customer

c_id	name	address
1	Iron man	59th Street, E

order_master

o_id	c_id	order_date
1	1	2019-01-02T00:00:00Z

```
DELETE FROM customer WHERE c_id = 1;
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, **DML**
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM

Pizza Shop

http://sqlfiddle.com/#!9/062125

customer

c_id	name	address
1	Iron man	59th Street, E

ON UPDATE CASCADE

order_master

o_id	c_id	order_date
1	1	2019-01-02T00:00:00Z

```
UPDATE customer SET c_id = 17 WHERE c_id = 1;
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, **DML**
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET ... WHERE

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

http://sqlfiddle.com/

#!9/9577dd

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

```
SELECT * FROM pizza;
```

```
SELECT COUNT(*) FROM customer;    WHERE
```

```
SELECT * FROM customer ORDER BY name;
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

```
SELECT order_date, COUNT(*)
  FROM order_master
  GROUP BY order_date;


HAVING COUNT(*) > 1

HAVING order_date = '2019-01-02'
```

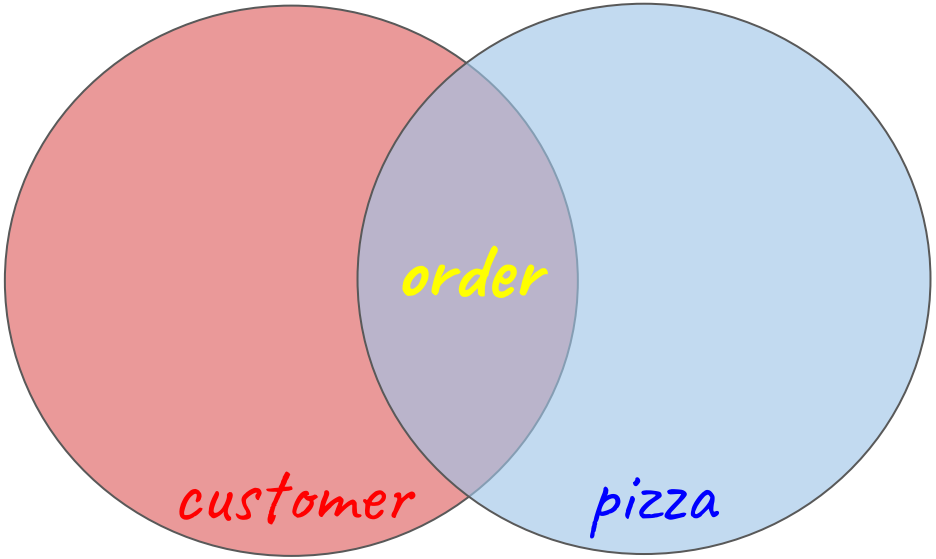
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING

Pizza Shop

http://sqlfiddle.com/#!9/9577dd



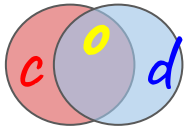
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN

Pizza Shop

http://sqlfiddle.com/#!9/9577dd



Find customers who **have** made some orders

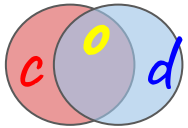
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN

Pizza Shop

http://sqlfiddle.com/#!9/9577dd



Find customers who **have** made some orders

```
SELECT c_id, name FROM customer WHERE c_id IN

    (SELECT c_id FROM order_master)
```

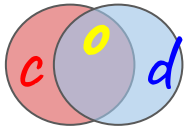
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query

Pizza Shop

http://sqlfiddle.com/#!9/9577dd



Find customers who **have** made some orders

```
SELECT customer.c_id, customer.name
    FROM customer
    INNER JOIN order_master
    ON customer.c_id = order_master.c_id
```

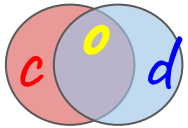
Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query

Pizza Shop

http://sqlfiddle.com/#!9/9577dd



Find customers who **have** made some orders

```
SELECT t1.c_id, t1.name
    FROM customer AS t1
    INNER JOIN order_master AS t2
    ON t1.c_id = t2.c_id
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

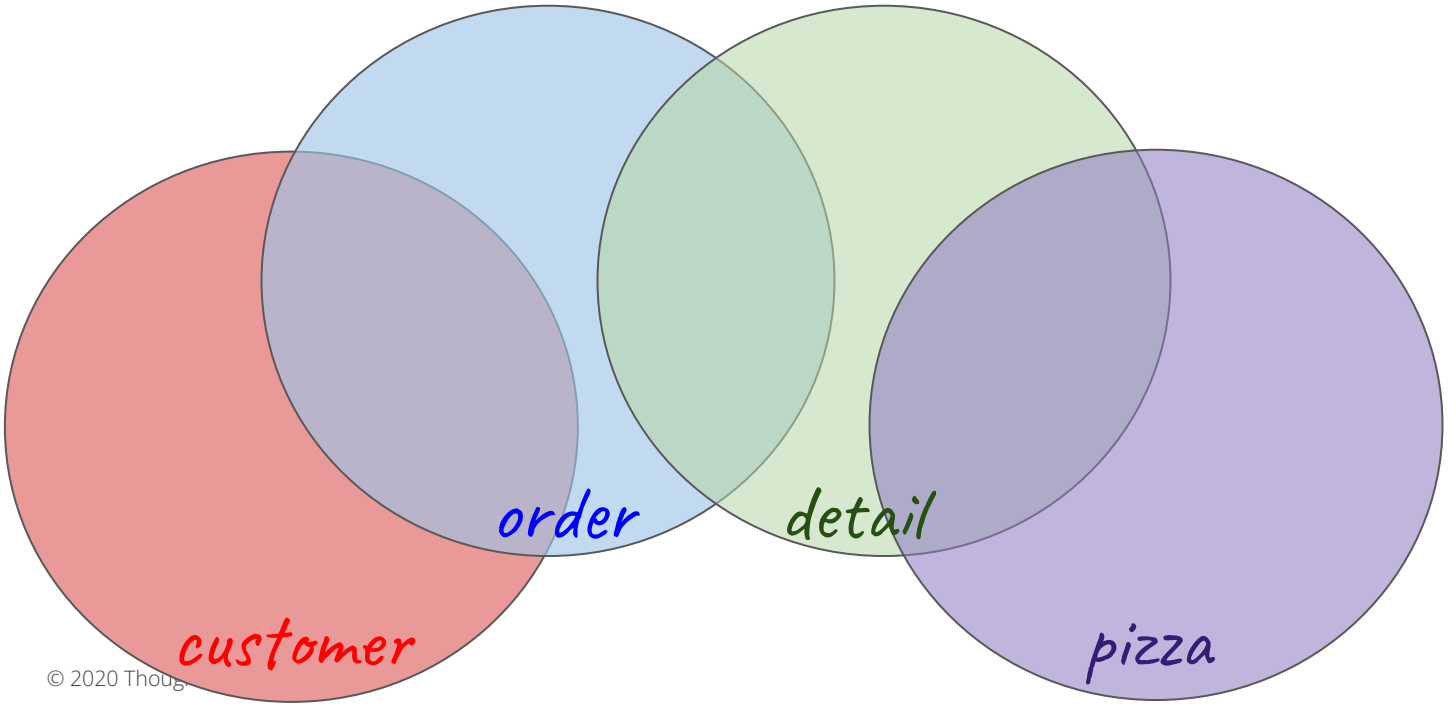
SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query
Table alias

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find which **customer** ordered which **pizza**

C-O-D-P



Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query
Table alias

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find which **customer** ordered which **pizza** C-O-D-P

```
SELECT customer.c_id, customer.name, pizza.name

    FROM customer

    INNER JOIN order_master ON customer.c_id =
order_master.c_id

    INNER JOIN order_detail ON order_master.o_id =
order_detail.o_id

    INNER JOIN pizza ON order_detail.p_id = pizza.p_id
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query
Table alias

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find customers who have **NOT** made *any* orders

```
SELECT c_id, name FROM customer WHERE c_id NOT IN
    (SELECT c_id FROM order_master)
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query
Table alias
LEFT JOIN

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find customers who have **NOT** made *any* orders

~~SELECT t1.c_id, t2.name~~

~~FROM customer AS t1~~

~~INNER JOIN order_master AS t2~~

~~ON t1.c_id = t2.c_id;~~

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query
Table alias
LEFT JOIN

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find customers who have **NOT** made *any* orders

```
SELECT   *

    FROM customer AS t1

    LEFT   JOIN order_master AS t2

    ON t1.c_id = t2.c_id;
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
CREATE, SERIAL, VARCHAR
REFERENCES,
INSERT
MULTIPLE INSERT
Referential Integrity
DELETE FROM
UPDATE ... SET … WHERE
Fill the entire data

SELECT, COUNT, ORDER BY
GROUP BY, HAVING
INNER JOIN
Sub query
Table alias
LEFT JOIN

Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find customers who have **NOT** made *any* orders

```
SELECT   *
    FROM customer AS t1
    LEFT   JOIN order_master AS t2
    ON t1.c_id = t2.c_id
    WHERE t2.o_id IS NULL;
```

Data modelling
Relational data model
Primary key
Natural key
Surrogate key
Domain
Redundancy
Atomicity
Foreign key
Referential Integrity
Quality of data over time
On delete/update : Cascade
Soft delete
Cardinality
1:1 1:N N:N
Many to many
Master-detail tables

DDL, DML
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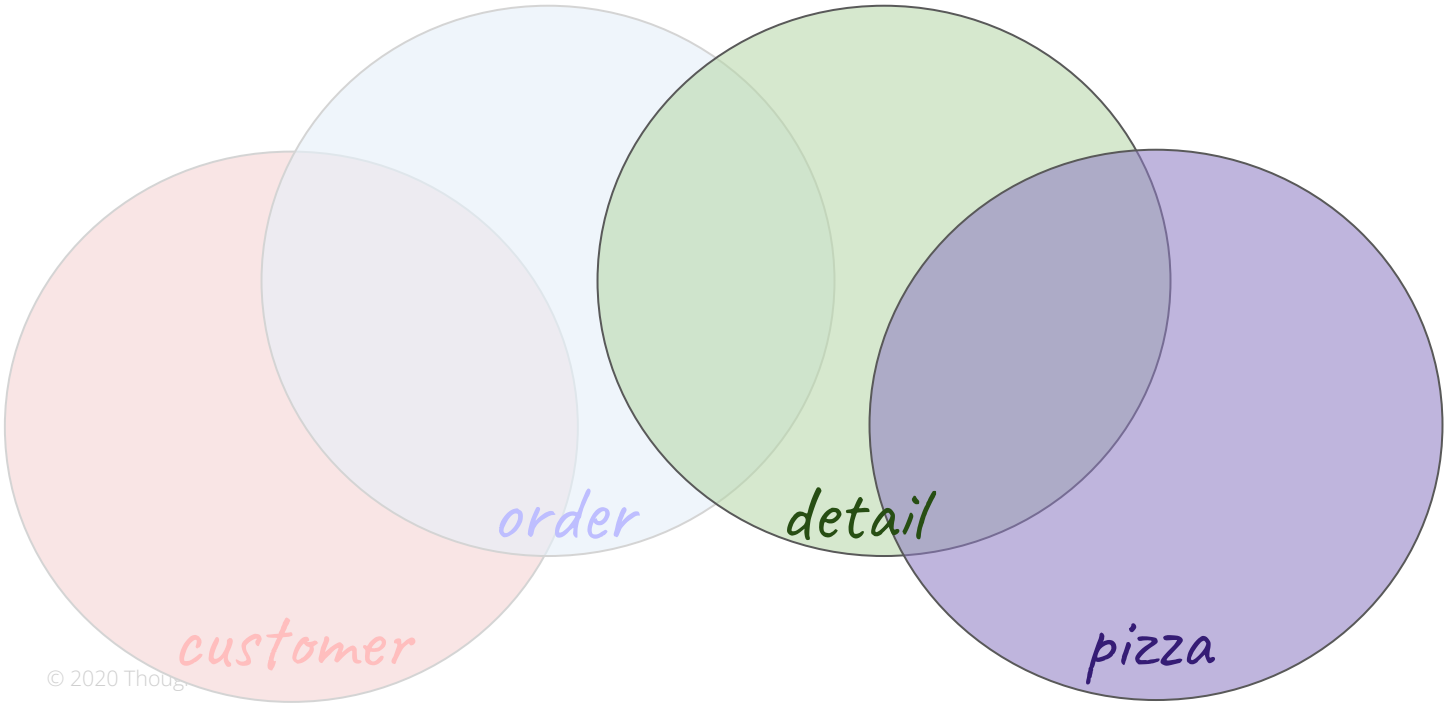
Pizza Shop

http://sqlfiddle.com/#!9/9577dd

Find pizzas which have **NEVER** been ordered



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NoSQL

- Non SQL or non relational (sometimes referred to as Not only SQL)
- Different mechanism than the traditional tabular relations
- Highly scalable - horizontal scaling
- Used when data is unstructured or the structure might change
- Various types:
  - Key-value
  - Document
  - Time series
  - Graph
  - Wide Column

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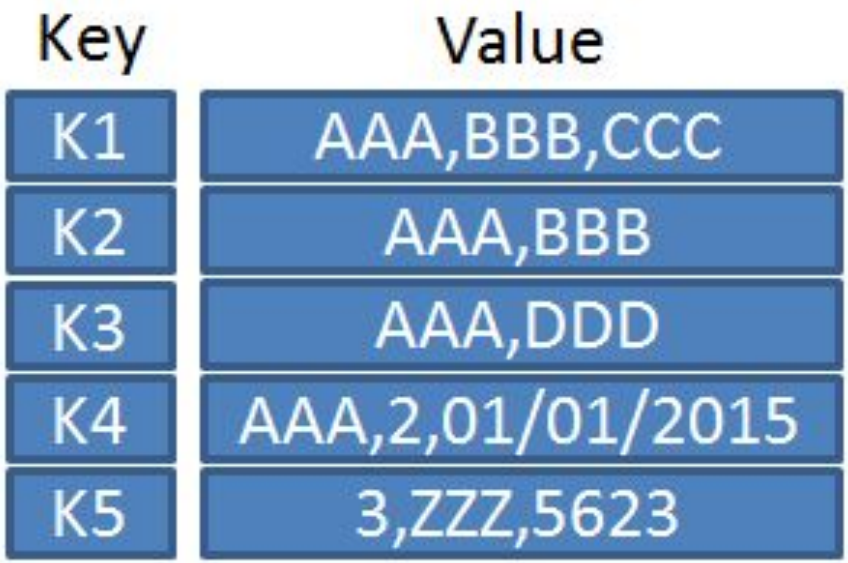
Key Value Store



Eg: Redis

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Document Store

```
{
  "address": {
     "building": "1007",
     "coord": [ -73.856077, 40.848447 ],
     "street": "Morris Park Ave",
     "zipcode": "10462"
  },
  "borough": "Bronx",
  "cuisine": "Bakery",
  "grades": [
     { "date": { "$date": 1393804800000 }, "grade": "A", "score": 2 },
     { "date": { "$date": 1378857600000 }, "grade": "A", "score": 6 },
     { "date": { "$date": 1358985600000 }, "grade": "A", "score": 10 },
     { "date": { "$date": 1322006400000 }, "grade": "A", "score": 9 },
     { "date": { "$date": 1299715200000 }, "grade": "B", "score": 14 }
  ],
  "name": "Morris Park Bake Shop",
  "restaurant_id": "30075445"
}
```

Eg: MongoDB

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Some more examples

Key - value: DynamoDB

Document: CosmosDB

Timeseries: Influx DB

Graph: Neo4j

Wide column: Cassandra

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Acronyms

- ACID
  - Atomicity
  - Consistency
  - Isolation
  - Durability
- ORM
  - Object Relational Mapping

Installing MySQL on OSX

- Download the package from: https://dev.mysql.com/downloads/mysql/
- Run the installer
- Remember the root password
- For detailed instructions, follow: https://dev.mysql.com/doc/mysql-installation-excerpt/8.0/en/osx-installation-pkg.html
- Check if mysql server is running:
  ```
  sudo /usr/local/mysql/support-files/mysql.server status
  ```
- Download and install MySQL workbench: https://dev.mysql.com/downloads/workbench/

Installing sqlite on OSX

- Download the package from: https://sqlitebrowser.org/blog/version-3-12-1-released/
- Run the installer

Exercise makes everything better!

Let’s build something like Spotify or Gaana

Don’t worry, we’ll keep it simple for now

Requirements

We need to represent the following in our database:

- Users
- Playlists
- Tracks
- Artists

Requirements

Users	(user_id,user_name, email)
Playlists	(playlist_id,playlist_name, description, user_id, created_on)
Artist	(artist_id,artist_name)
Tracks	(track_id,track_name, duration, artist_id)
Playlist_Track	(playlist_id, track_id)

Let’s create the Database first

- Enter the console:
  `/usr/local/mysql/bin/mysql -u root -p`
- Create a Database
  `CREATE DATABASE <database_name>`
- Create a test user
  `CREATE USER 'testuser'@'localhost' IDENTIFIED BY 'some_password'`
- Grant privileges to testuser
  `GRANT ALL PRIVILEGES ON <database_name>.* TO 'testuser'@'localhost'`

Create tables

Create tables….

Let’s add some data

Add some data….

Let’s answer some questions

- How many users have registered with our app?
- What playlist is the latest one?
- Tracks count per playlist
- Details of the playlist for a given user name
- Most popular artist’s name (Most tracks by that artist)
- Longest track (in terms of time)
- Which users have no playlists?
- Details of playlists which are empty

What to submit

- Create queries
- Insert data queries
- Sql statements for questions in prev