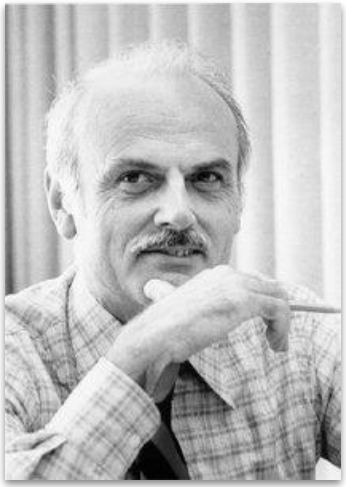
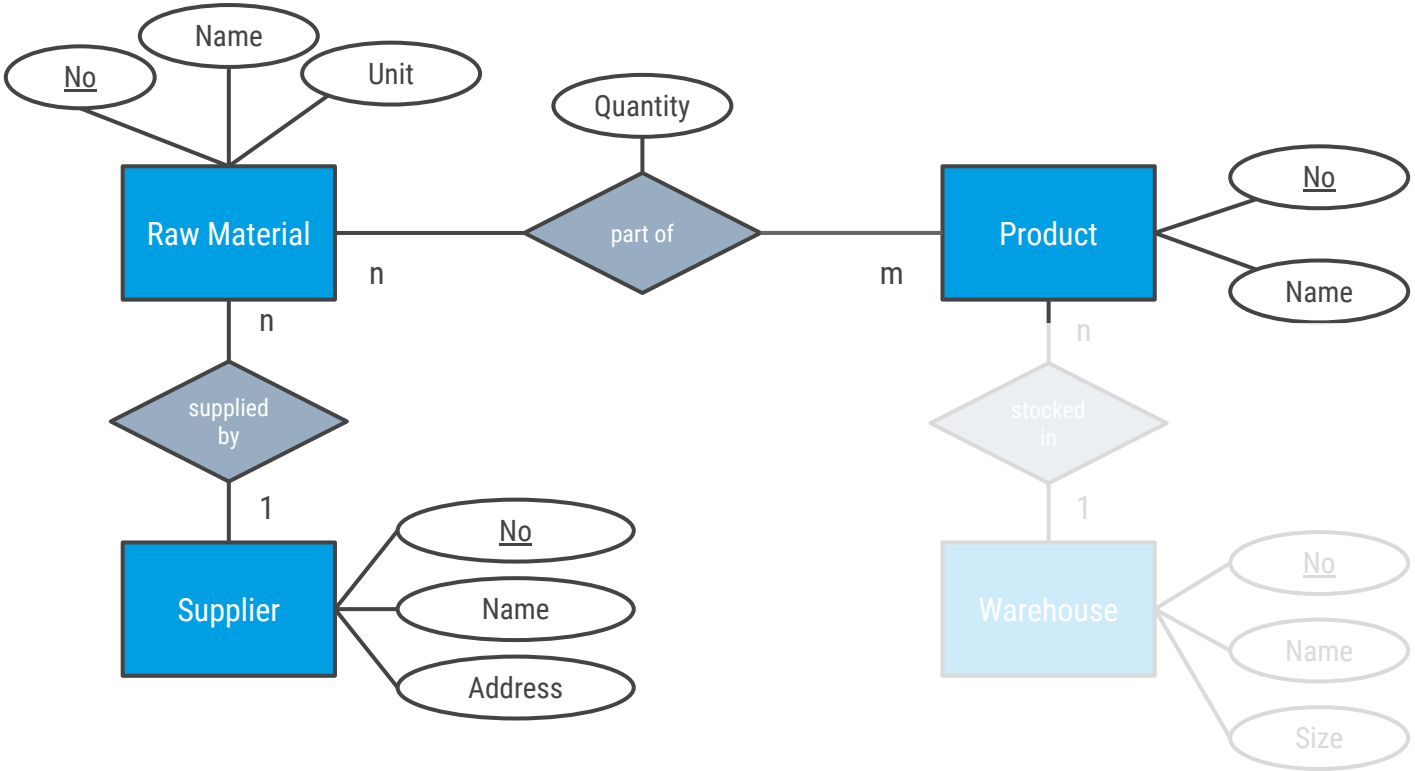
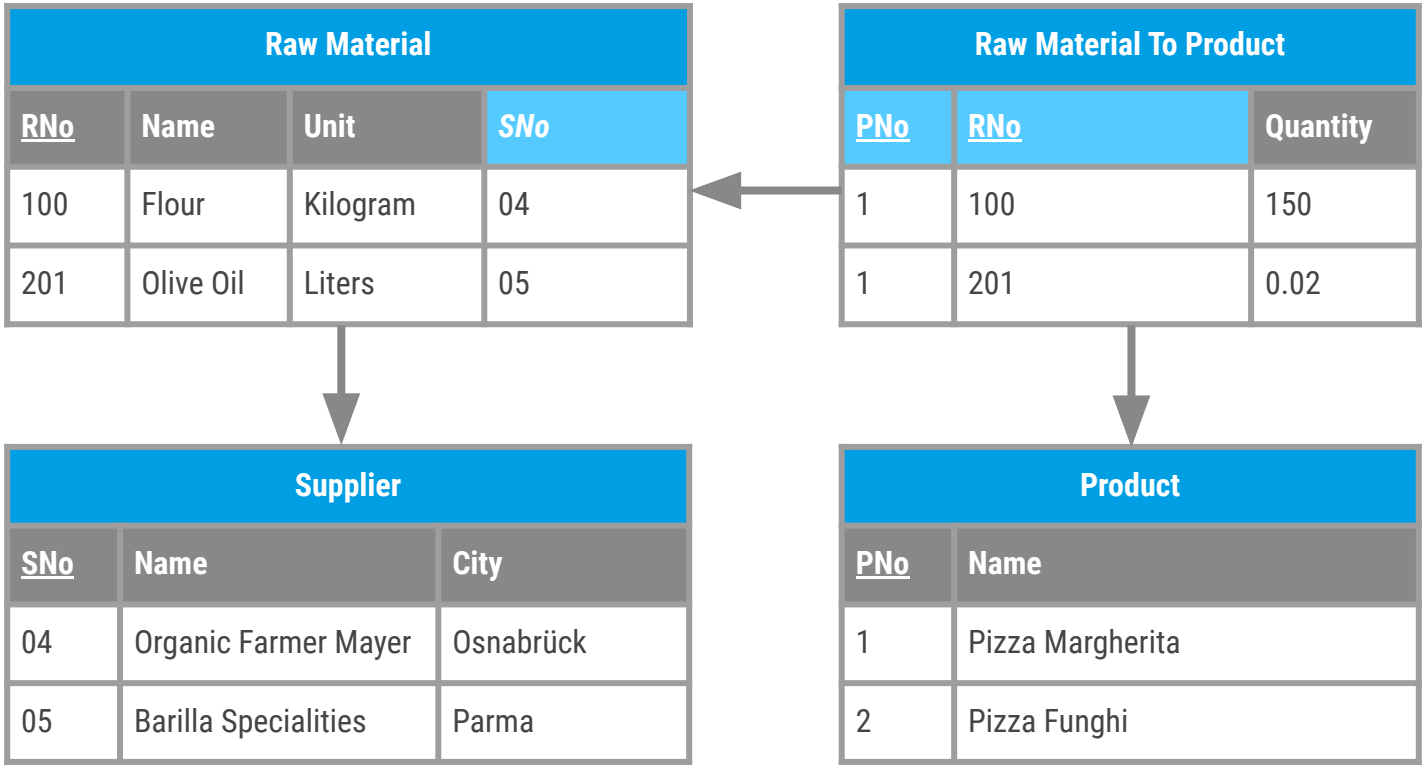
INFORMATION MANAGEMENT

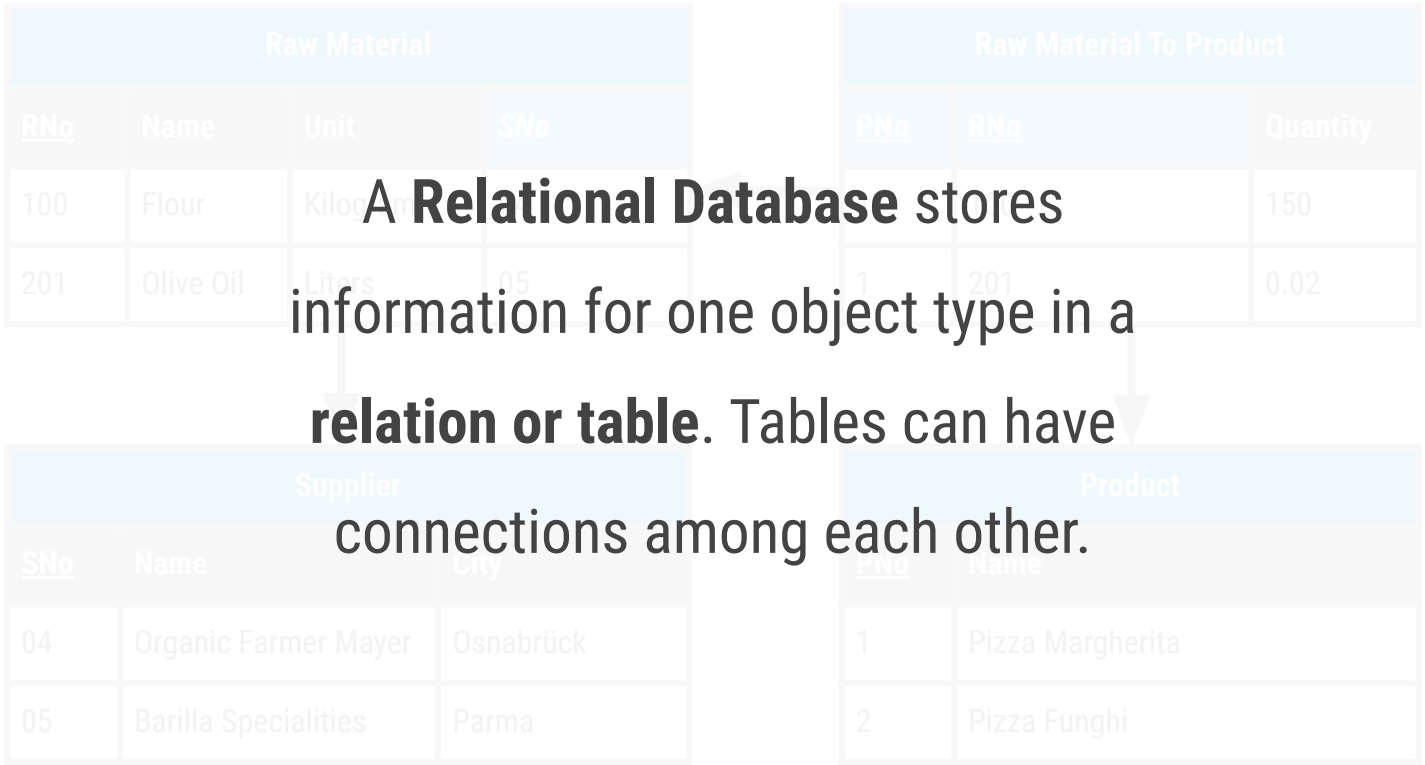
RELATIONAL DATABASES



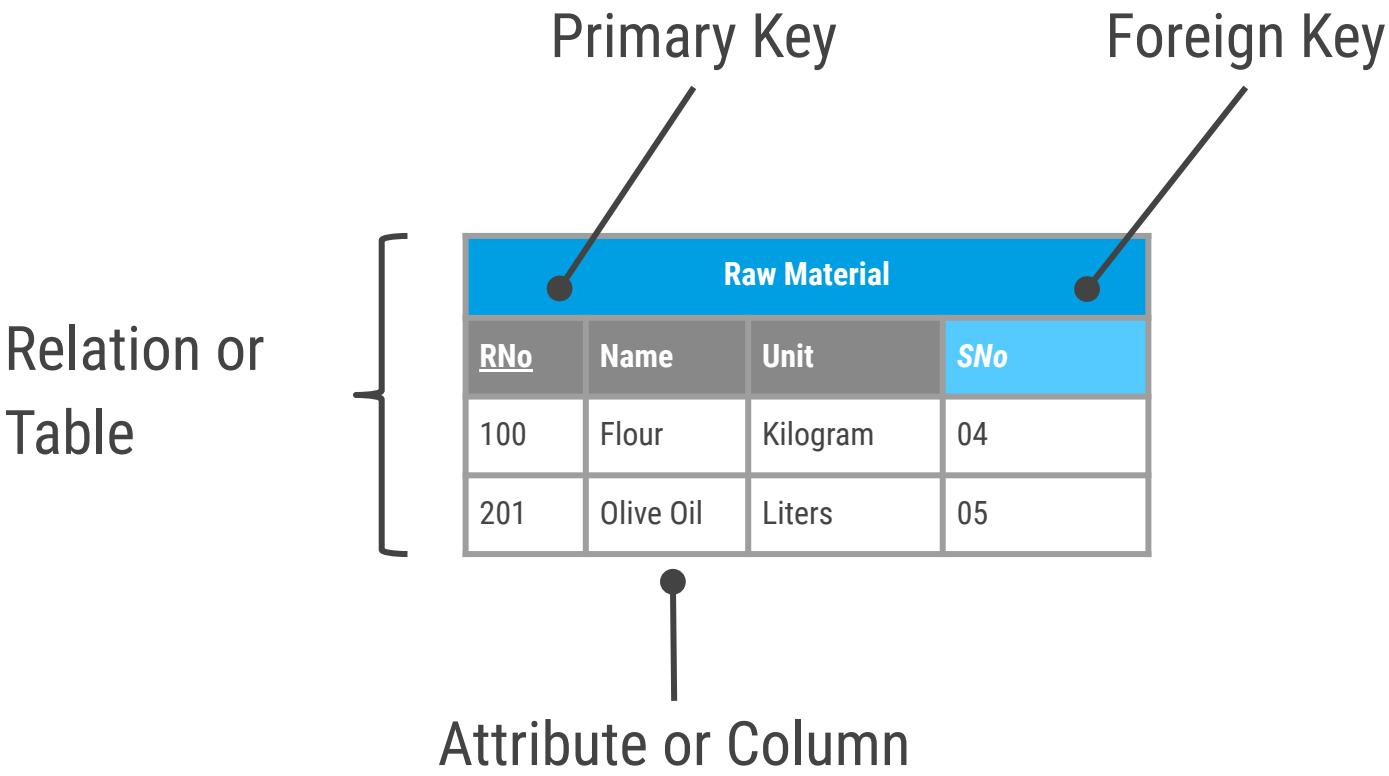
Codd, E. F., A Relational Model of Data for Large Shared Data Banks, Communications of the ACM, Band 13, Ausgabe 6, Juni 1970, S. 377 – 387, WEBLINK.


Name
No
Unit
Quantity
Raw Material
part of
Product
No
Name
n
m
n
n
supplied by
stocked in
1
1
No
Supplier
Name
Address
Warehouse
No
Name
Size


Raw Material
RNo
Name
Unit
SNo
100
Flour
Kilogram
04
201
Olive Oil
Liters
05
Raw Material To Product
PNo
RNo
Quantity
1
100
150
1
201
0.02
Supplier
SNo
Name
City
04
Organic Farmer Mayer
Osnabrück
05
Barilla Specialities
Parma
Product
PNo
Name
1
Pizza Margherita
2
Pizza Funghi



A **Relational Database** stores information for one object type in a **relation or table**. Tables can have connections among each other.


Primary Key
Foreign Key
Relation or Table
Raw Material
RNo
Name
Unit
SNo
100
Flour
Kilogram
04
201
Olive Oil
Liters
05
Attribute or Column

In the relational model, there are two special types of attributes:

Primary Key

Every table (relation) has exactly one primary key. The value for this key must be unique for all rows in the table. A primary can be a combination of multiple columns.

Foreign Key

Foreign keys connect tables. The value of a foreign key in one table corresponds to the value of the primary key in the referenced table.

The primary goal of the relational model is consistency

The first relational databases were developed to manage information in operational processes. Here, it was important that:

- … the data is correct
- … transactions are handled safely
- … data can be changed efficiently

These goals are achieved mainly through **normalization** of the the data model.

3 goals of normalization

Reduce complexity

- Group information that belongs together
- Reality compliant modeling

Eliminate redundancy

- Store information only once
- Enable reuse

Efficient data operations

- Changes affect only one location
- No dependencies on deleting data

Reality check: data modeling in practice

Wrong understanding

- “No redundancy? Disk space doesn’t cost much!”
- “The user is responsible for data quality!”
- “We validate data only in the frontend on entry.”

Short-term thinking

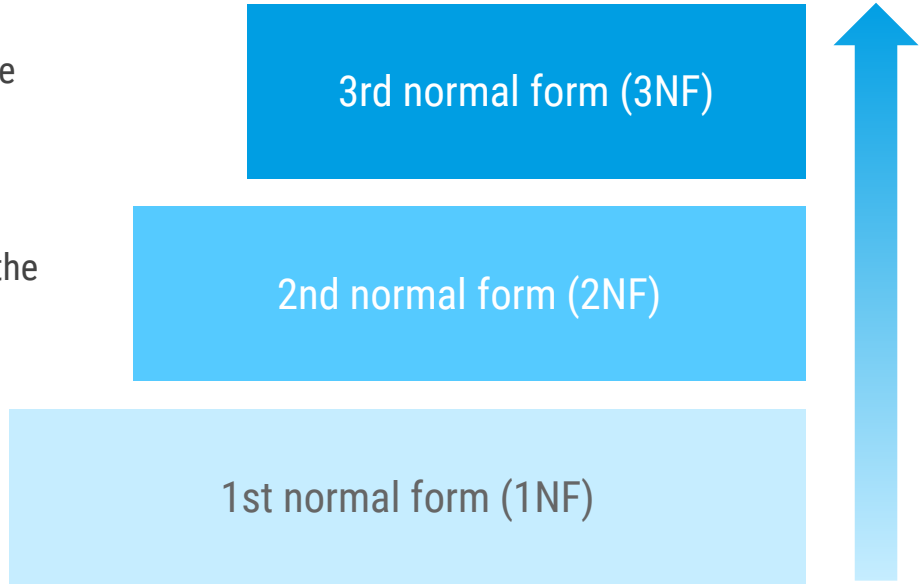
- IT systems are developed under time pressure
- “Make it work, make it nice!”
- “This is just a temporary solution anyways.”

Competing interests

- The user pays, so his wishes (features) come first
- The frontend developer also models the data

The first three normal forms (1NF, 2NF, 3NF)

- No attribute is transitively dependent on the primary key
- All attributes are functional dependent on the whole primary key of the table
- Every attribute (column) contains atomic values



Example for bad data modeling

Production Orders									
OrderNo	Date	CNo	FirstName	LastName	PNo	PName	Qty	WNo	WName
101	04.05.2015	42	Wim	Mayer	20	Stool	5	1010	Finished Goods
101	04.05.2015	42	Wim	Mayer	40	Leg	20	1012	Intermediate Goods
101	04.05.2015	42	Wim	Mayer	45	Seat	5	1012	Intermediate Goods
102	05.05.2015	51	Katrin	Scholz	20	Stool	2	1010	Finished Goods
102	05.05.2015	51	Katrin	Scholz	40	Leg	8	1012	Intermediate Goods
102	05.05.2015	51	Katrin	Scholz	45	Seat	2	1012	Intermediate Goods

Example for bad data modeling: 2NF

Orders				
OrderNo	Date	CNo	FirstName	LastName
101	04.05.2015	42	Wim	Mayer
102	05.05.2015	51	Katrin	Scholz

Order Positions		
OrderNo	PNo	Qty
101	20	5
101	40	20
101	45	5
102	20	2
102	40	8
102	45	2

Products			
PNo	PName	WNo	WName
20	Stool	1010	Finished Goods
40	Leg	1010	Intermediate Goods
45	Seat	1012	Intermediate Goods

Example for bad data modeling: 3NF

Orders

OrderNo	Date	CNo
101	04.05.2015	42
102	05.05.2015	51

Order Positions

OrderNo	PNo	Qty
101	20	5
101	40	20
101	45	5
102	20	2
102	40	8
102	45	2

Products

PNo	PName	WNo
20	Stool	1010
40	Leg	1010
45	Seat	1012

Customers

CNo	FirstName	LastName
42	Wim	Mayer
51	Katrin	Scholz

Warehouses

WNo	WName
1010	Finished Goods
1022	Intermediate Goods