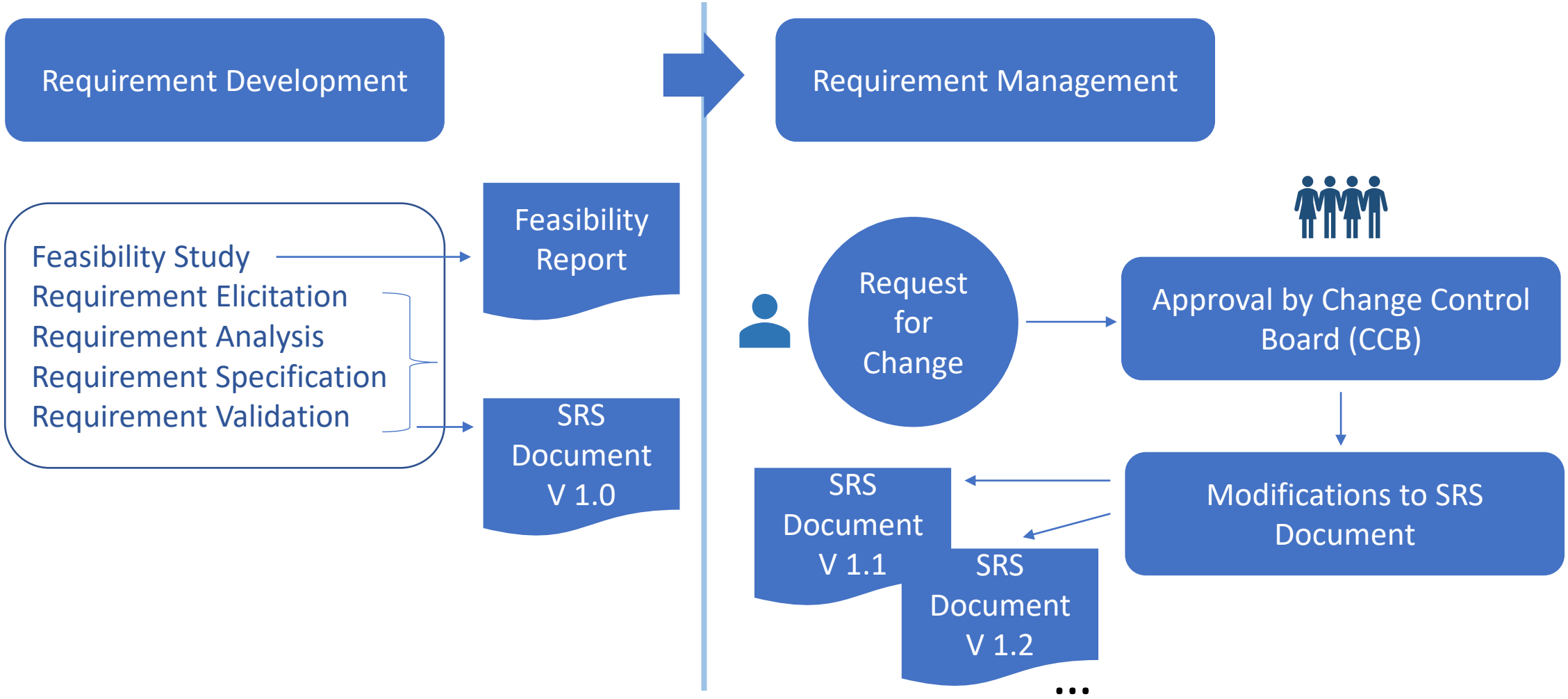
# Requirement Engineering (Continued…)

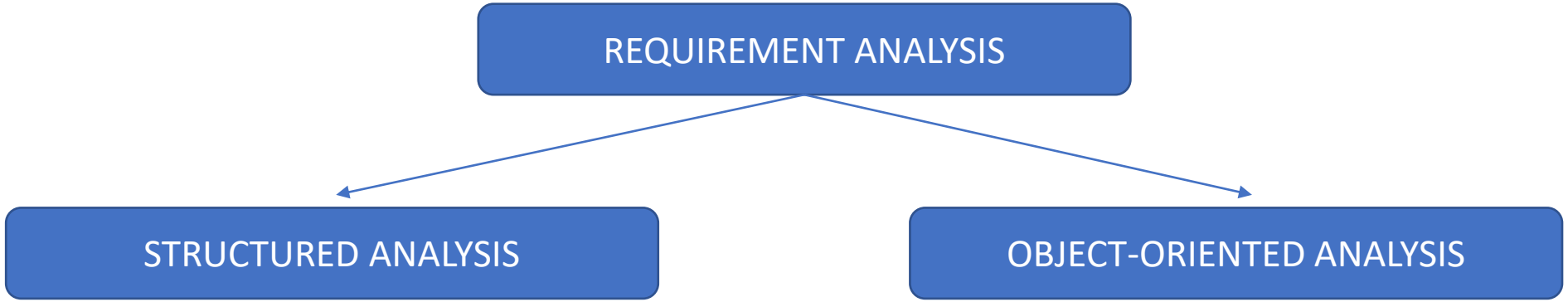
# Requirement Engineering (Contd..)

- Requirement Development and Requirement Management
- Introduction to Requirement Analysis Modeling
  - Structured Analysis
  - Objected-Oriented Analysis ( We will discuss this at a later session)
- SRS Document

# Requirements Engineering



# Modeling Techniques with Examples




- **Data Modeling** - Entity Relationship (ER) Diagram
- **Functional Modeling** – Data Flow Diagram, Control Flow Diagram
- **Behavioral Modeling** – State Transition Diagram

- **Static Modeling** - Class Diagram, Object Diagram, Use Case Diagram
- **Dynamic Modeling** – Sequence Diagram, Collaboration Diagram, State Transition Diagram
- **Functional Modeling** – Data Flow Diagram

In this session, we will discuss specific examples with details.

# Question 1

*Any registered active user shall be able to book a ticket in any of the buses operated by the state transport corporation. Successful completion of online payment is mandatory to book a ticket.*

Which of the following is a conflicting requirement?

A. User authentication shall involve CAPTCHA *(Completely Automated Public Turing test to tell Computers and Humans Apart)* verification.
B. Any registered user shall be able to block a confirmed ticket and make payment on the day of the travel. This is because we want to have a feature that mimics 'cash-on-delivery' model.
C. Any registered user shall be able to book a maximum of ten seats per bus in a single transaction.
D. Any registered user shall be able to book tickets using Android or iOS based smart phones.

ANSWER: B

# Question 2

*Registered users can cancel tickets booked by them. However, refund amount will vary based on the time of cancellation. (24+ hours before departure – 100%, 12+ hours before departure but less than 24 hours - 50%, Otherwise 25% till the time of departure, 0% after departure).*

Which of the following indicates volatility in this requirement?

A. Cancellations shall be processed in 24 hours
B. The response time per cancellation will not exceed 20 milliseconds
C. The cancellation policy based on the time of cancellation is not applicable to senior citizens.
D. Cancellation feature will work on all days including national holidays.

ANSWER: C

# Question 3

Two most common approaches to perform software analysis are,

A. Structured Customer Analysis and Object-Oriented Analysis
B. Structured Analysis and Object Flow Analysis
C. Structured Data Analysis and Object Dynamic Analysis
D. Object Oriented Analysis and Structured Analysis

ANSWER: D

# Structured Analysis – Data Modeling

(ER Diagram, Data Dictionary)

# Entity

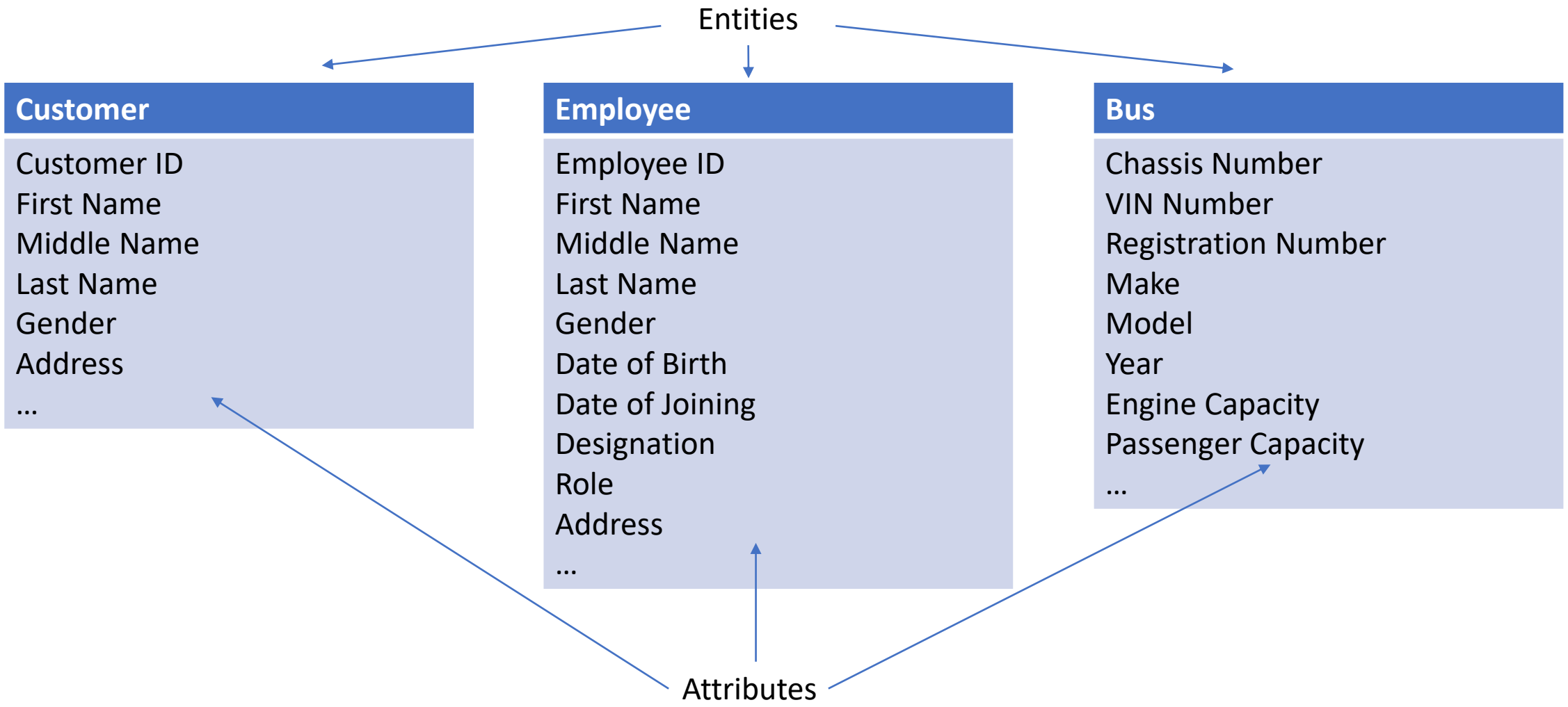
A system consists of multiple entities.

Examples of Entities in Bus Reservation System

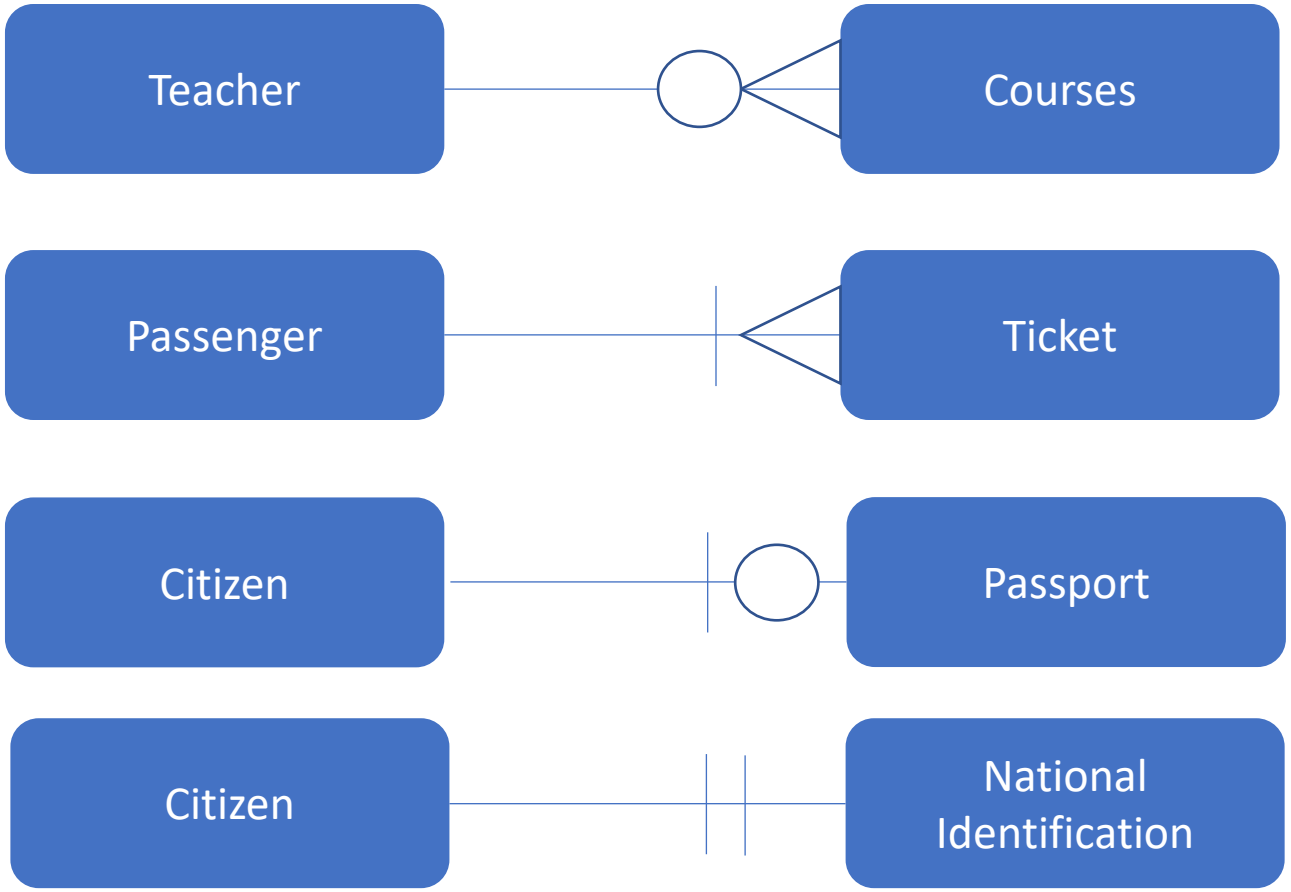
1. Customer
2. Employee
3. Bus

Each of these entities have a set of attributes.

# Entities and Attributes



# Relationship Notations




A teacher can be associated with zero or more courses.

A passenger can hold either one or more tickets.

A citizen of a country that does not allow dual citizenship can hold zero or one passport

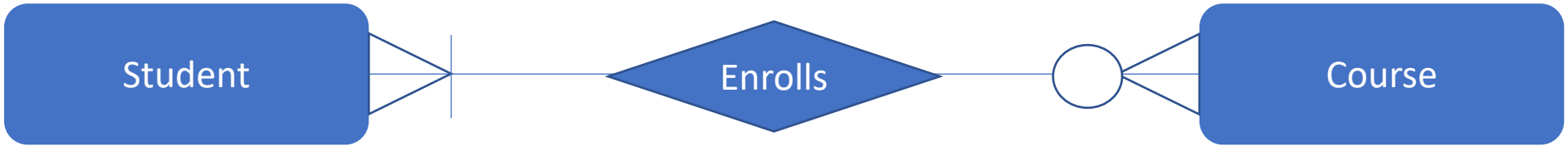
A citizen can have one and only one National ID.

# Cardinality

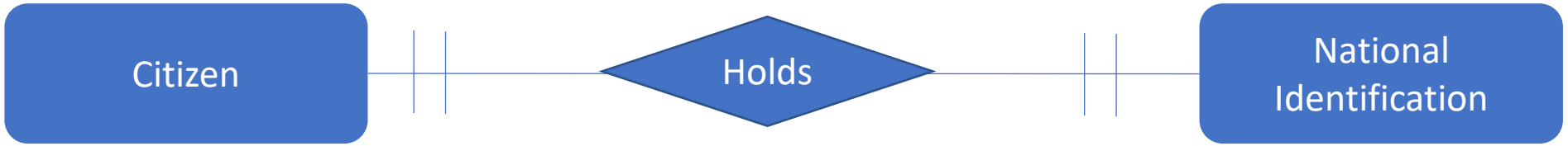
Cardinality determines whether a relationship is

- One-to-one (1:1) or
- One-to-many (1:N) or
- Many-to-many (M:N)

# Examples



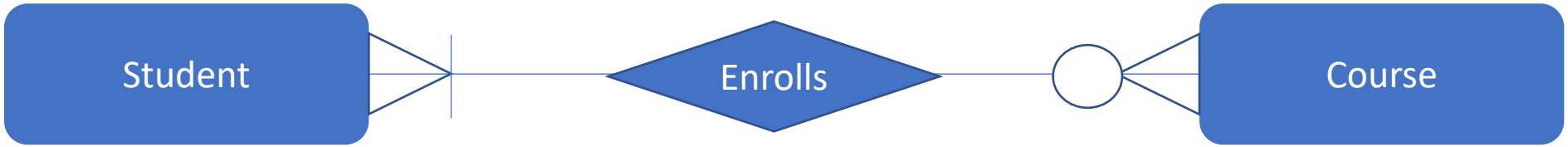

A student can enroll to zero or more courses. For example, a student who is doing a fulltime project will not enroll into any course. A course includes one or more students.




A citizen holds only one national id. A national ID is held by only one citizen.


A professor teaches zero or more courses in a semester. A course is taught by one professor only.

# Cardinality and Modality




A student can enroll to zero or more courses. For example, a student who is doing a fulltime project will not enroll into any course. A course includes one or more students.

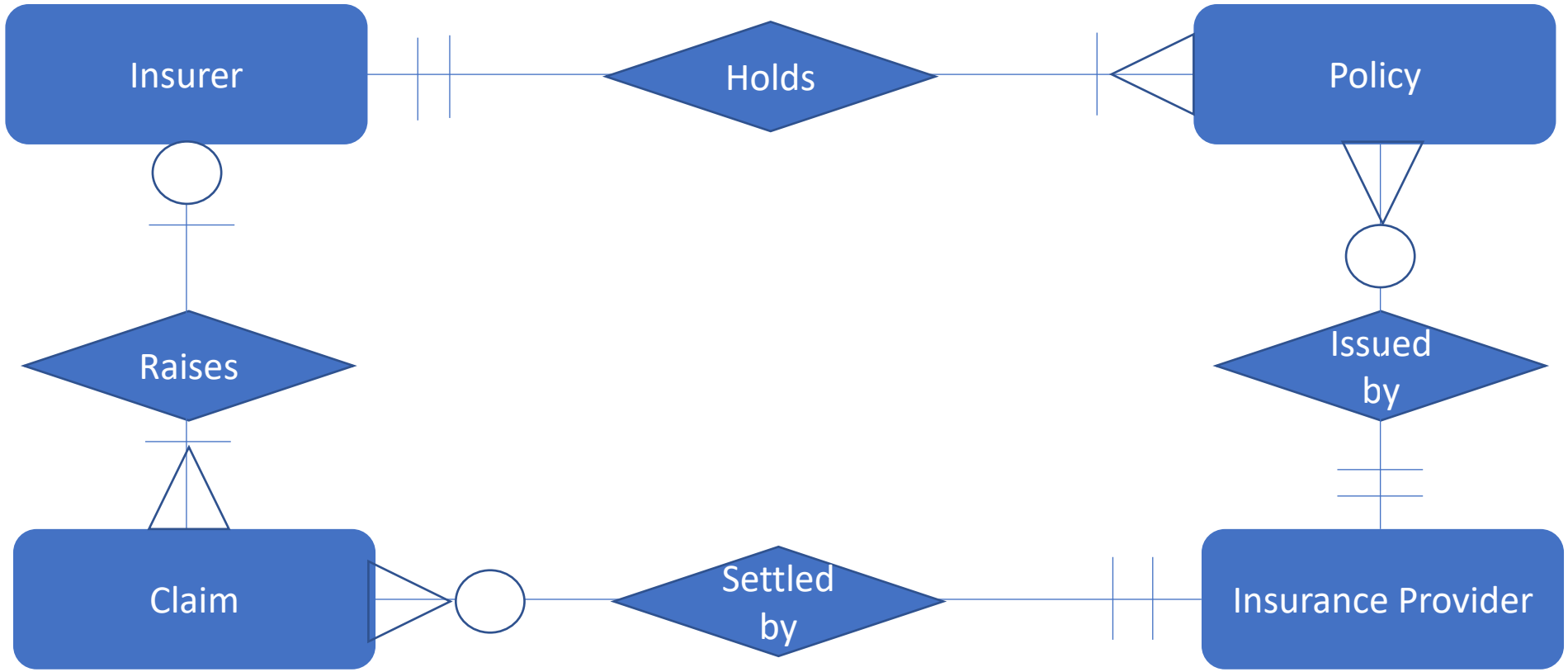
**Question:** How many courses can a student enroll into?
**Answer:** Many

This helps you understand cardinality. Cardinality is the maximum number of courses that can be taken by a student.

**Question:** What is the minimum number of courses can a student enroll into?
**Answer:** Zero

This helps you understand modality. Modality is the minimum number. It also helps us check whether two entities are related are not. For example, 'Passenger' and 'Driver' are not related (directly).

# ER Diagram - Example



# Question 4

There can be three possible relationships between two entities. They are,

A. 0-to-many, 1-to-many,  many-to-many
B. Many-to-many, many-to-1, 1-to-many
C. 1-to-1, 1-to-many , many-to-many
D. M-N, M-1, N-M

ANSWER: C

# Data Dictionary

It includes description of information about all entities and their attributes.

| Customer | A registered user who may or may not have a reservation |
|---|---|
| Customer ID | Used to uniquely identify a customer |
| First Name | First name of the customer |
| Middle Name | Middle name of the customer |
| Last Name | Last name of the customer |
| Gender | Denotes the gender |
| Address | Address includes door number, street, city, district, pin code and state |
| … | |

Example of a Simple Data Dictionary

# Question 5

Which of the following is not part of ER diagram?

A. Entities
B. Notations of ER diagram
C. Relationships
D. Data flow

ANSWER: D

# Structured Analysis – Functional Modeling

(Data Flow Diagram, Control Flow Diagram)

# Data Flow Diagram (DFD)

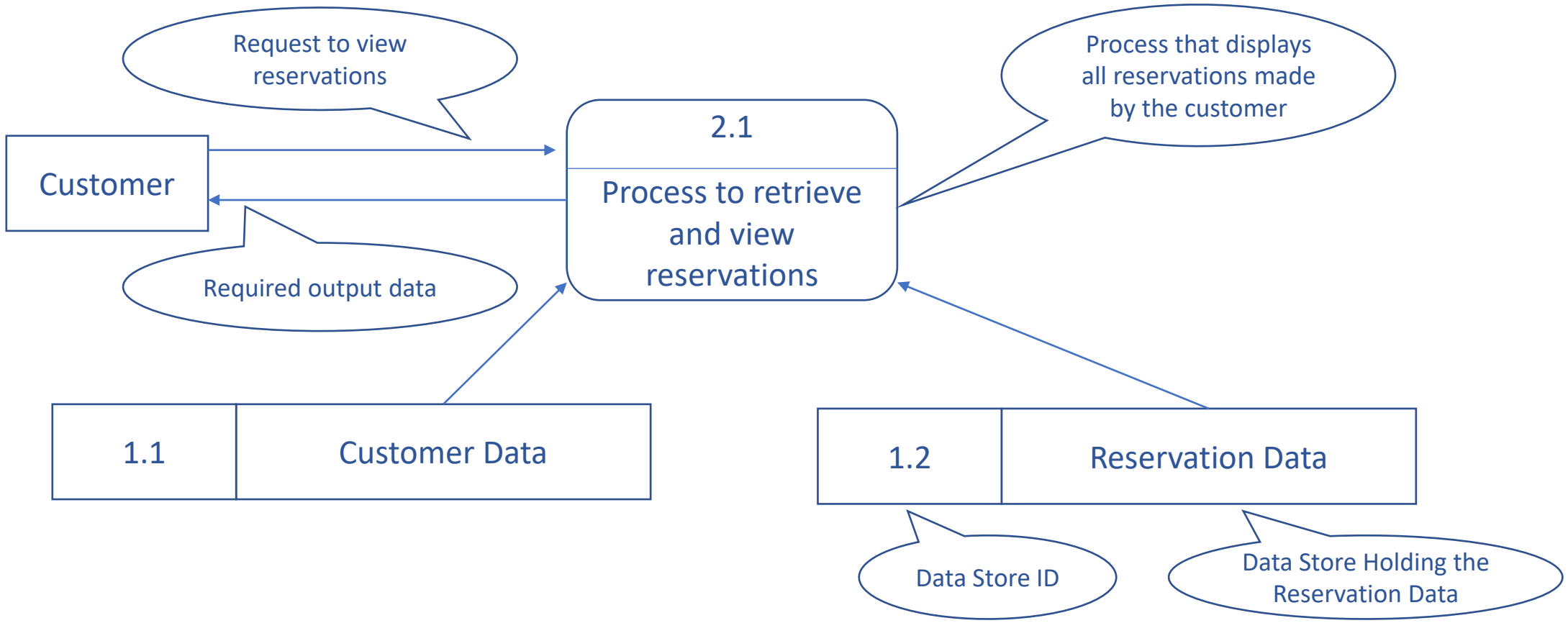
Shows how data flows and indicates how data gets processed at a high level.

Helps us understand how input data is received, processed and output is produced.  In addition, it helps us understand all sub-processes involved.

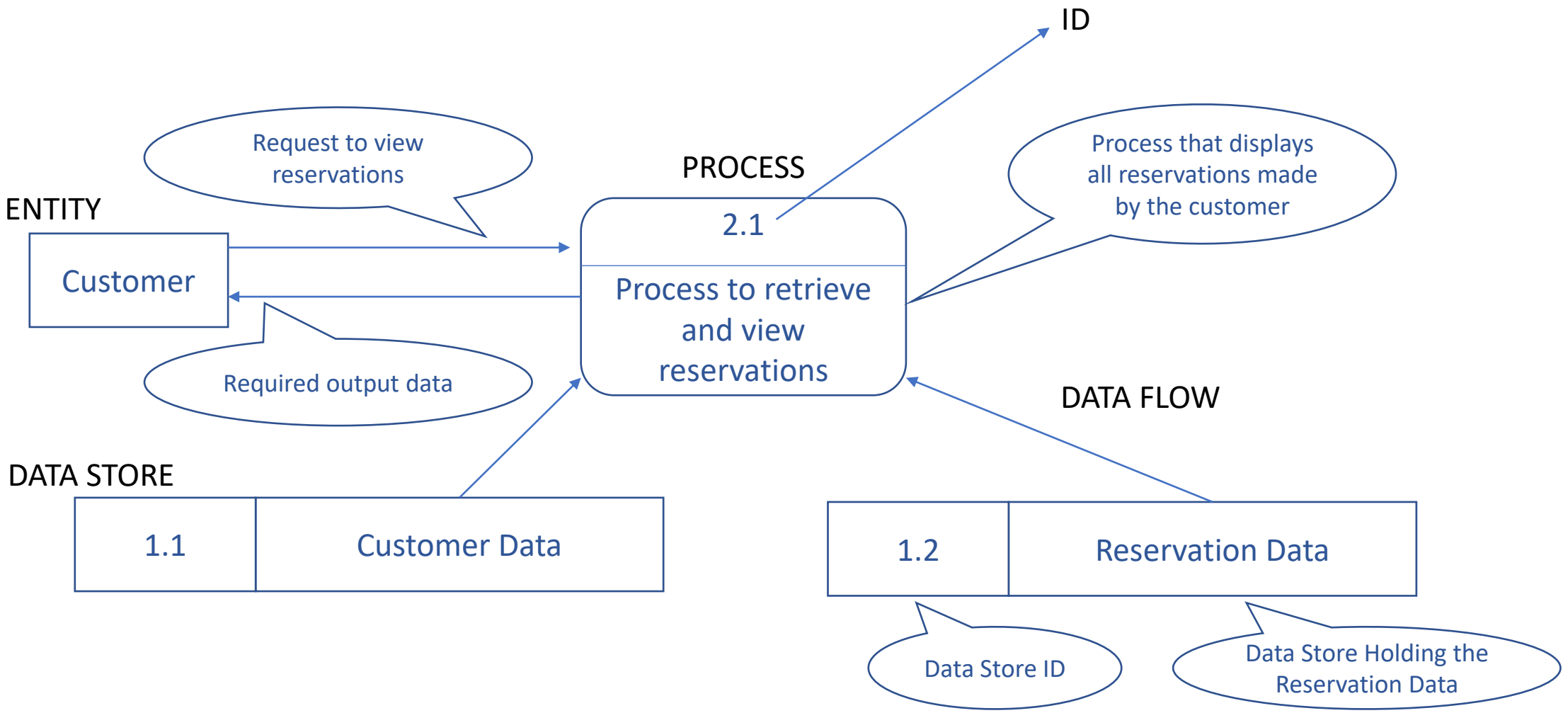
Includes

- Entities
- Processes
- Data Flow
- Data Store

# Data Flow Diagram



# Data Flow Diagram

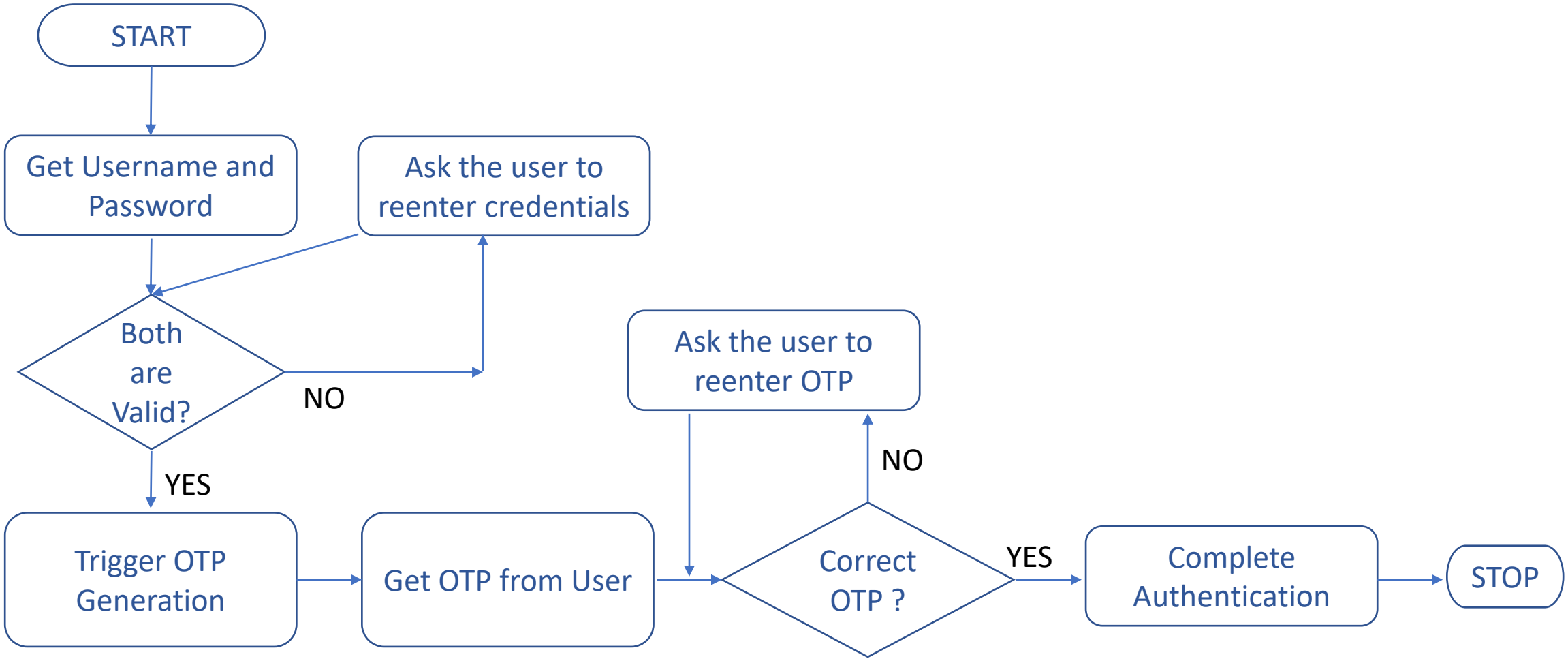


# Control Flow Diagram

Control flow diagram help us define the flow of control,  understand the steps or processes involve and underlying conditions to execute the flow.

It can correspond to a business process or a system requirement that needs to be analyzed or modeled.

# Control Flow Diagram



# Question 6

Which of the following provides a good start for data modeling?

A. ER Diagram
B. Data Flow Diagram
C. Control Flow Diagram
D. State Transition Diagram

ANSWER: A

# Question 7

Data flow diagram is for

A. Data Modeling
B. Control Flow
C. Functional or flow-oriented modeling
D. Design Analysis

ANSWER: C

# Structured Analysis – Behavioral Modeling

(State Transition Diagram)

# State Transition

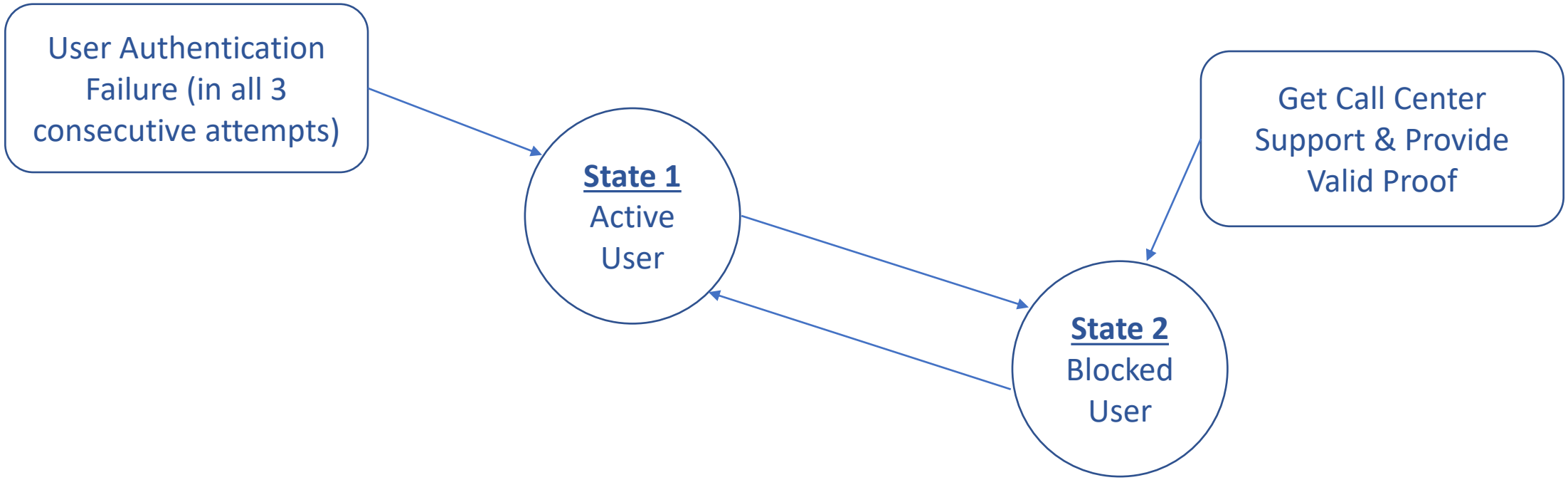
A light switch has two states on/off.

Depending on the state of the switch, we see a behavioral change in the bulb.

Think about a two-way switch.  There is a single bulb upstairs. For this bulb we have switches in two places – upstairs as well as downstairs. One can use either of the switches to either switch on or off.  The behavior of the bulb depends not only the switch you operate but also on the state of the other switch.

# Registered User - Active or Blocked

If user authentication fails thrice, block the user.



# System Requirements Specification (SRS) Document

# SRS Document – Typical Sections

**1. Introduction**

1.1 Purpose
1.2 Document Conventions
1.3 Intended Audience and Reading Suggestions
1.4 Product Scope
1.5 References

**2. Overall Description**

2.1 Product Perspective
2.2 Product Functions
2.3 User Classes and Characteristics
2.4 Operating Environment
2.5 Design and Implementation Constraints
2.6 User Documentation
2.7 Assumptions and Dependencies

**3. External Interface Requirements**

3.1 User Interfaces
3.2 Hardware Interfaces
3.3 Software Interfaces
3.4 Communications Interfaces

**4. System Features**

4.1 System Feature 1
4.2 System Feature 2 (and so on)

**5. Other Nonfunctional Requirements**

5.1 Performance Requirements
5.2 Safety Requirements
5.3 Security Requirements
5.4 Software Quality Attributes
5.5 Business Rules (Operational)

**6. Other Requirements**

**Appendix A: Glossary**
**Appendix B: Analysis Model**

# Key Characteristics of SRS Document

- Correctness
- Completeness
- Consistency (no conflicts)
- Verifiability
- Clarity and ease of understanding (single interpretation, analysis models, glossary…)
- Prioritization of Requirements
- Modifiability ( simplicity in structure, language, models )

# SRS - Review and Update (Rework)

## 3 TYPES: Review, Walkthrough, Inspection

- **Review:** The SRS document is shared with a reviewers. They go through the document and share their observations or issues or comments with the author or owner of the document. The author updates the document
- **Walkthrough:** Author of the document presents it to a group of reviewers. The observations or issues or comments are noted down. Corrective action is taken to update the document.
- **Inspection:** More structured way of review. Non-conformances or issues found in the document are listed as defects and tracked until the defects are closed.

# Question 8

SRS document consists of

A. Very clear and concise written text to illustrate requirement
B. Different sections that include the analysis and design aspects of a system
C. Analysis models created while preforming requirement analysis
D. Well-structured sections with written text as well as analysis models in order to meet all required characteristics

ANSWER: D

# Question 9

SRS review is a very important activity that helps identify defects or issues in the document and fix all of them because it is least expensive to fix requirements related defect at early stages.

A. True
B. False

ANSWER: A

# Question 10

Which of the following is not an NFR? (Non-Functional Requirement)

A. Performance
B. Maintainability
C. Categories of Users
D. Security

ANSWER: C

# Summary

- Requirement Development and Requirement Management
- Introduction to Requirement Analysis Modeling
  - Structured Analysis
  - Objected-Oriented Analysis ( We will discuss this at a later session)
- SRS Document

# Thank You!
# Wish You a