Start Class Nov-10th 2023

Business process & stakeholder – concept definition

➢ Business process

…a collection of related, structured activities or tasks by people or equipment which in a specific sequence produce a service or product (serves a particular business goal) for a particular customer or customers. Business processes occur at all organizational levels and may or may not be visible to the customers.

(see: https://en.wikipedia.org/wiki/Business_process, visited Oct 2022)

For another definition of business process see: ITIL 2011 Glossary
https://www.axelos.com/Corporate/media/Files/Glossaries/ITIL_2011_Glossary_GB-v1-0.pdf

➢ Stakeholder

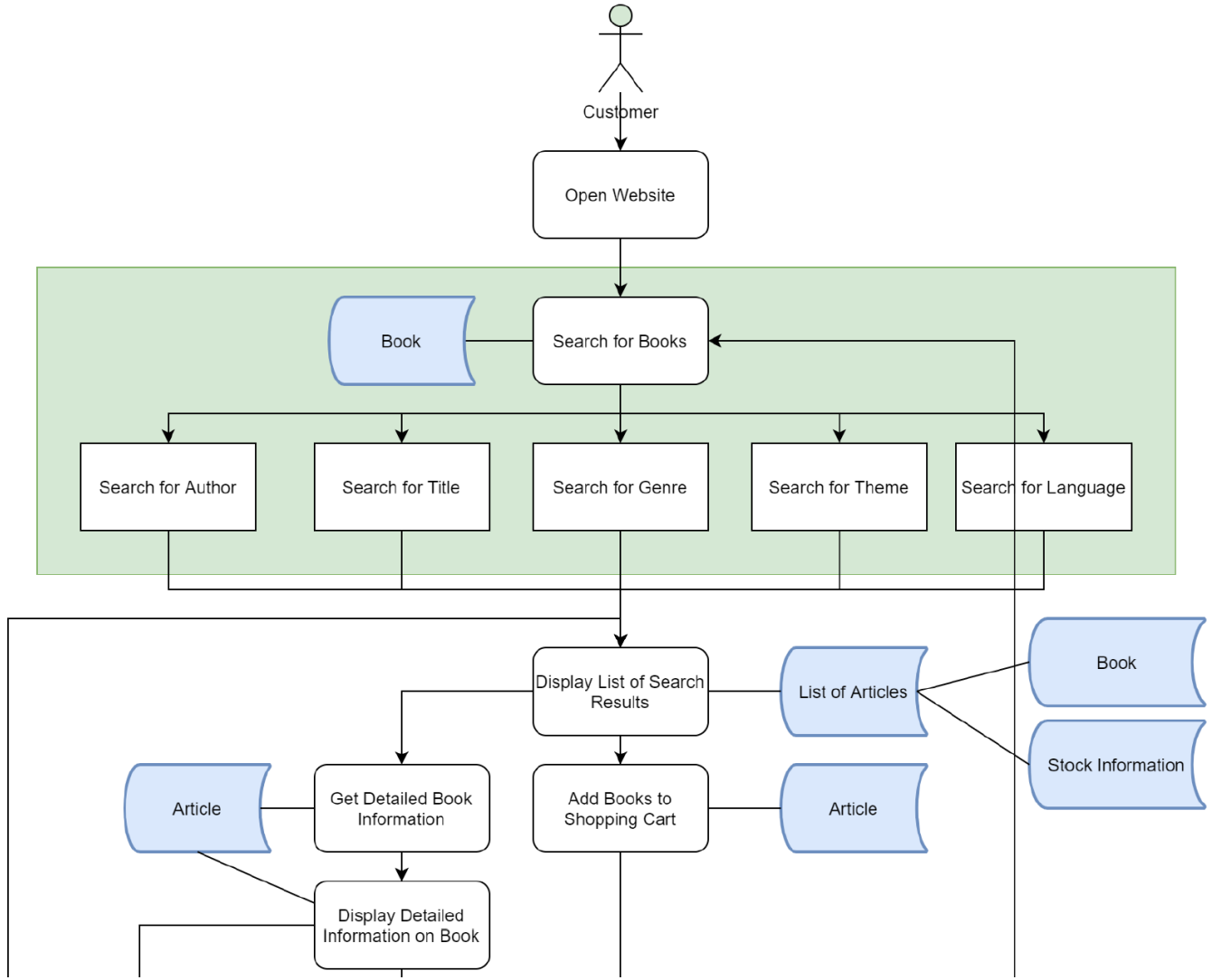
A person who has an interest in an organization, project, IT service etc. Stakeholders may be interested in the activities, targets, resources or deliverables. Stakeholders may include customers, partners, employees, share holders, owners etc.

(see: ITIL 2011 Glossary, https://www.axelos.com/Corporate/media/Files/Glossaries/ITIL_2011_Glossary_GB-v1-0.pdf)

Example of business processes

- Process of enrolling new students in a university
- A production line process of assembling new bicycles
- An order-to-bill process, including everything that is required to accept an order, deliver a service and bill a customer
- An infrastructure maintenance process to perform engineering assessments on all bridges in a state on an annual basis based to identify risks and required maintenance
- An idea-to-offering process to include everything required to develop and launch a new product to market
- The process of borrowing a book from a library
- ….

Business Process Example – Purchase Books Online



A textual description of a business process

Andreas Miller takes a book he intends to borrow from the library out of the book shelf und takes it to the counter. On the counter Andreas‘s takes a scanner and reads the library pass and the signature of the books he brought. The borrowed books will be registered as „borrowed“ and at the same time the theft-label of the book will be disabled. Andreas receives a „confirmation of borrow“ and takes this together with the borrowed book and leaves the library, passing the theft control gate at the exit.

Data modeling – where to start?

1. You need to examine the processes
2. You need to examine the information flow associated with the processes – identify information entities
   - Processes can be existing or future processes
     - Processes is meant in it's generic sense
     - Do not limit "processes" to SW functionality
3. This is typically done by the means of Business Process modeling (BPM)
4. You need to assess the data requirements in order to support the business processes

Business process composition (example)

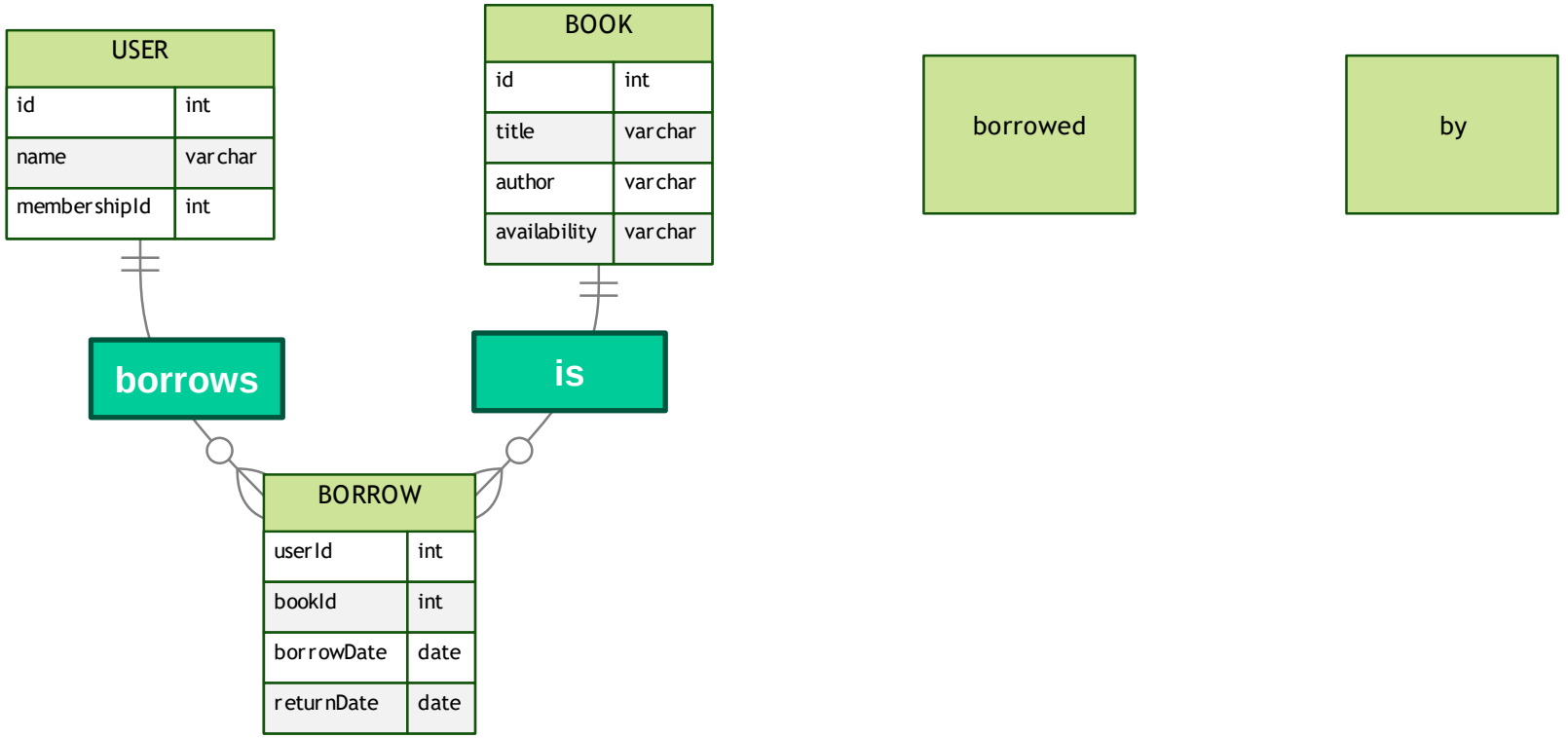
1) Take book to counter
2) Scan library pass
    2.1) Identification by attributes (name, place of birth, date of birth,…)
3) Read book signature
4) Register book as borrowed
5) Disable theft label
6) Receive confirmation of borrow
7) Leave the library with book

Borrow a book – information requirement - interaction

- For the process "borrow a book", can you further assess how information is linked? (e.g. given the BOOK and USER Information Entities)

Analysis of information requirements

Business Process Example – Borrow a book – data model



Example of an entitiy relationship model (logical model)

Entity and Entity-Type – concept definition

➢ **Entity** (or Entity Instance)

"… is a thing that exists either physically or logically. An entity may be a physical object such as a house or a car (they exist physically), an event such as a house sale or a car service, or a concept such as a customer transaction or order (they exist logically—as a concept)….. Entities can be thought of as nouns. Examples: a computer, an employee, a song, a mathematical theorem, etc."

(see:https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model, visited Oct 2020)

➢ **Entity Type**

"….is a category. An entity, strictly speaking, is an ***instance*** of a given entity-type. There are usually many instances of an entity-type. Because the term entity-type is somewhat cumbersome, most people tend to use the term entity as a synonym for this term"

(see:https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model, visited Oct 2020)

Entity Attributes

- Mandatory Attribute
  - An attribute (e.g. data filed) that needs a value to be entered. i.e. now entity instance can be added to the entity type if you do not provid a value for a mandatory attribute
- Optional Attribute
  - An attribute (e.g. data field) that is not required to be filled and can be left blank or null without affecting the validity or functionality of the data record.
- Conditional attribute
  - is an attribute (e.g. data field) whose requirement for inclusion or for specific value to be entered depends on the state or value of another attribute or a set of conditions.

Entity Attributes

- *m…mandatory*
- *o…optional*
- *c… conditional*

- Book
  - Can be loaned: Yes / No (m)
  - Number of copies in library (c – depending if it can be loaned)
  - Book position library (location index)
  - Title (m)
  - Author (m)
  - ISBN (m)
  - Publishing date (m)
  - Classification / Genre (o)
  - Categories (o)
  - Publisher (m)
  - Cost of book (o)

- Library_User
  - Name
  - Address
  - ID verified
  - Library ID
  - Borrow_history
  - Date of birth
  - Categorization of user (staff, student, outsiders)

Attributes – concept definition

Entity Attributes

- Entities are represented by means of their properties, called **attributes**. All attributes have values. For example, a student entity may have name, class, and age as attributes.
- There exists a **domain or range of values** that can be assigned to attributes. For example, a student's name cannot be a numeric value. It has to be alphabetic. A student's age cannot be negative, etc.
- Types of Attributes
  - **Simple attribute** − Simple attributes are atomic values, which cannot be divided further. For example, a student's phone number is an atomic value of 10 digits.
  - **Composite attribute** − Composite attributes are made of more than one simple attribute. For example, a student's complete name may have first_name and last_name.
  - **Derived attribute** − Derived attributes are the attributes that do not exist in the physical database, but their values are derived from other attributes present in the database. For example, average_salary in a department should not be saved directly in the database, instead it can be derived. For another example, age can be derived from data_of_birth.
  - **Single-value attribute** − Single-value attributes contain single value. For example − Social_Security_Number.
  - **Multi-value attribute** − Multi-value attributes may contain more than one values. For example, a person can have more than one phone number, email_address, etc.

(see: https://www.tutorialspoint.com/dbms/er_model_basic_concepts.htm , visited Nov-2023)

Entity Relationship

Entity Relationship – concept definition

Relationship

… captures how entities are related to one another. Relationships can be thought of as **verbs**, **linking** two or more **nouns**.

Examples:

- an **owns** relationship between a **company** and a **computer**
- a **supervises** relationship between an **employee** and a **department**
- a **performs** relationship between an **artist** and a **song**, a **proves** relationship between a **mathematician** and a **conjecture**, etc.
- #

….Entities and relationships can both have attributes.

Example:

- an employee entity might have a Social Security Number (SSN) attribute, while a proved relationship may have a date attribute.

(see:https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model, visited Oct 2023)

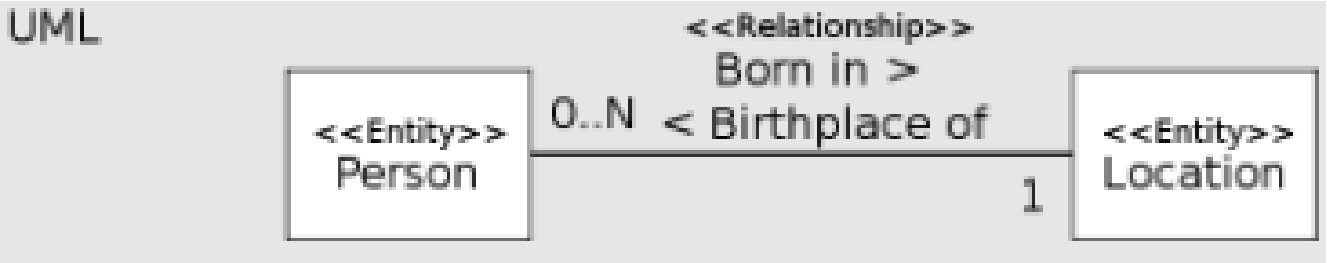
Roles – concept definition

Roles

Further specification / characterization of an entity and the relationship (i.e., based on the relationship the entity has a specific role)

Example:

- Relationship between LOCATION and PERSON. A *location* is characterized as the ***birthplace*** of a *person*. A *person* is ***born in*** a specific *location*.



Benefit:

- facilitates understanding / specification of semantics / reduction of ambiguity esp. when multiple relationships between entities are possible. For instance: A *person* can be the ***owner*** of the *car* or can be the ***driver*** of the *car*.

(see:https://en.wikipedia.org/wiki/Entity%E2%80%93relationship_model, visited Oct 2023)

The modelling stack

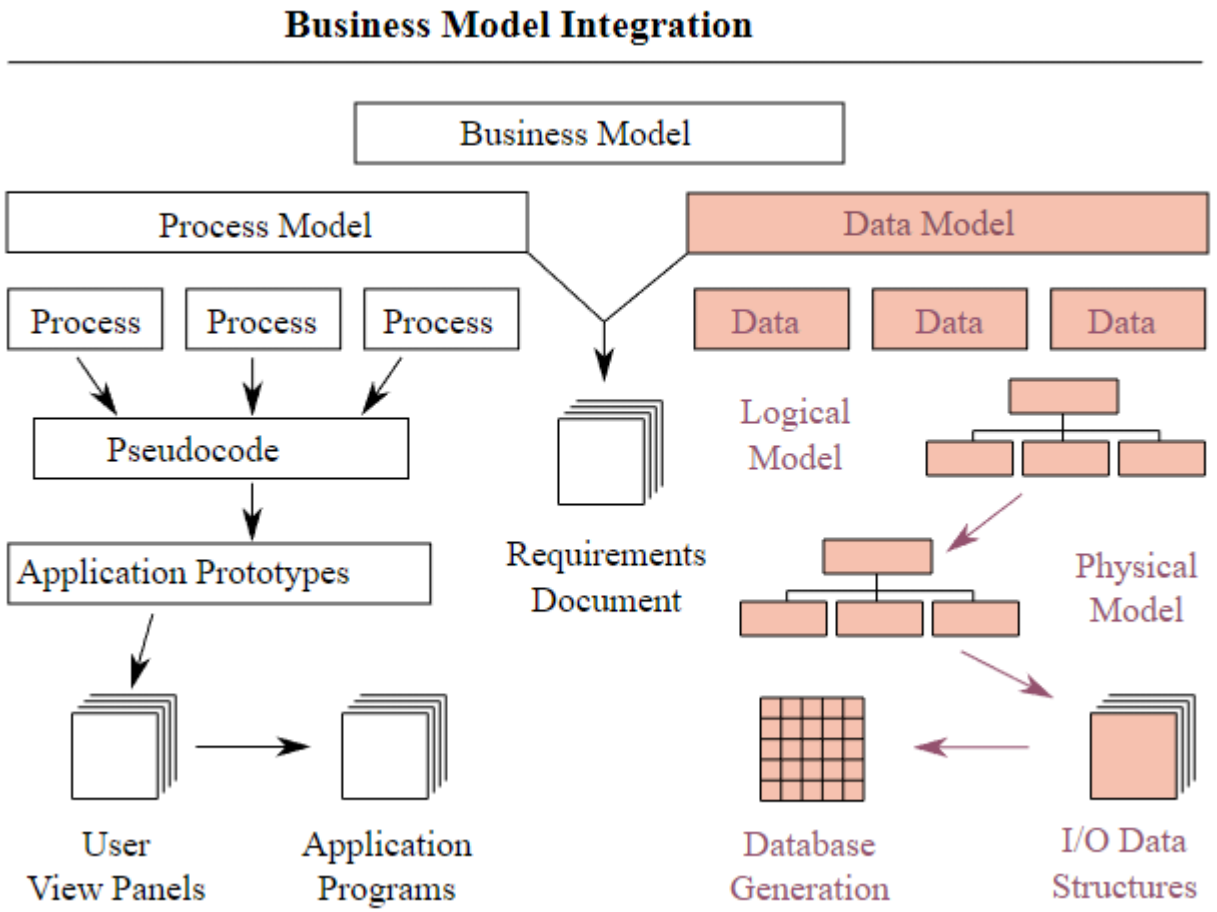
The modelling stack – from abstract to detail

Conceptual Data Model (CDM)

Logical Data Model (LDM)

Physical Data Model (PDM)

BPM and Data Modelling Stack



Conceptual Model

Conceptual Data Model (CDM)

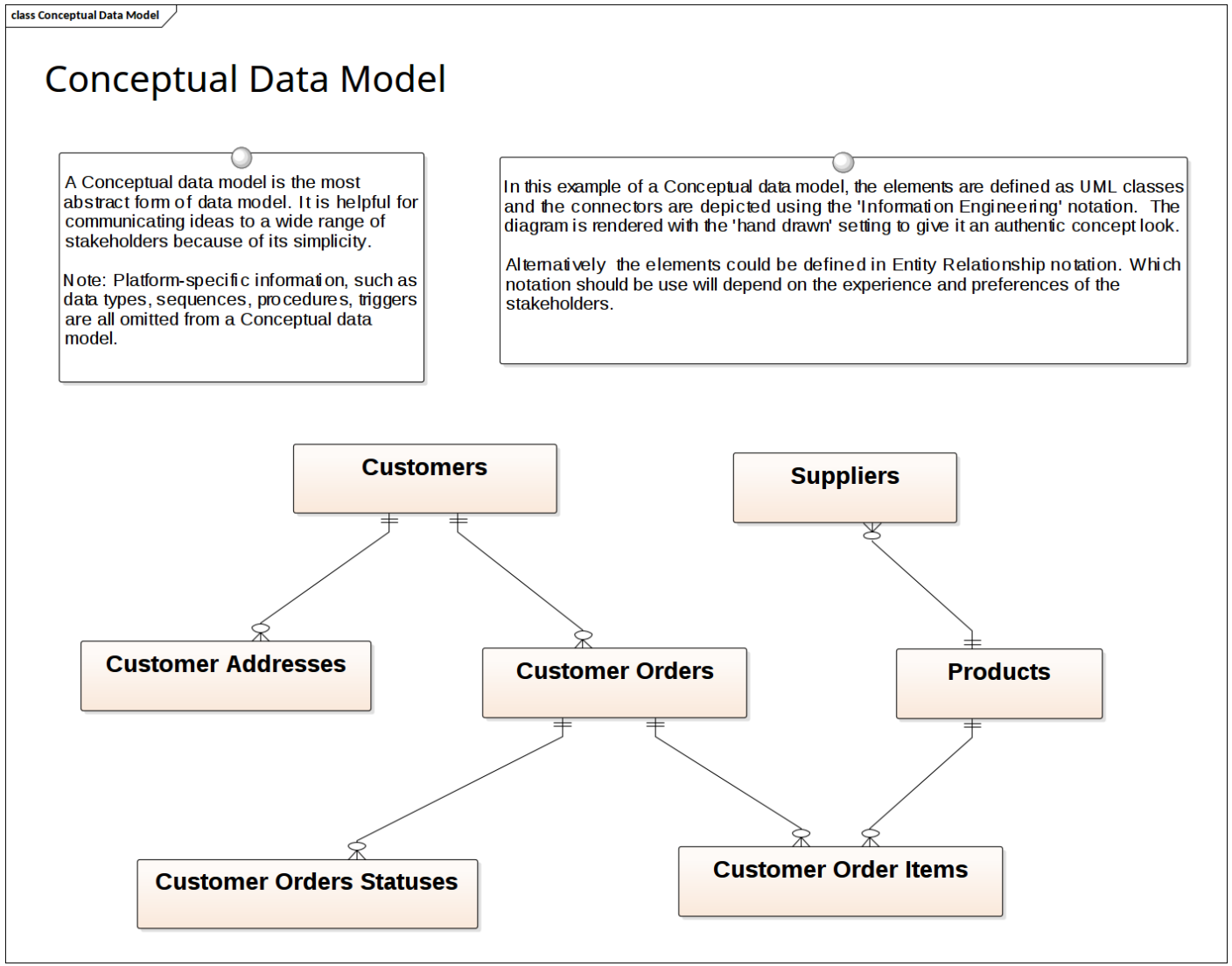
Conceptual Data Model:

- A ***conceptual schema*** or ***conceptual data model*** (CDM) is a map of concepts and their relationships used for databases. This describes the semantics of an organization and represents a series of assertions about its nature. Specifically, it describes the things of significance to an organization (entity classes), about which it is inclined to collect information, and characteristics of (attributes) and associations between pairs of those things of significance (relationships).
  (see: http://en.wikipedia.org/wiki/Conceptual_schema , Nov.2023)

- A conceptual model defines
  - Things of significance
  - Concepts / Entities and their semantic
  - the associations between

  Note: Unnecessary details are not covered

Example of a CDM



(Example taken from: https://sparxsystems.com/resources/gallery/diagrams/software/sw-data_modeling_-conceptual_data_model.html , visited Nov 2023)

Note:

under the above link you find good examples of other data models

Class interaction – Concept definition – possible solution

Concept	Description
book	A written work of fiction or nonfiction, provided as sheets of paper (usually fasted or bound together with covers) or in an electronic format (i.e. eBook)
customer	a person who purchases goods or services from another (relates to: buyer, purchaser)
address	The location where a person / organization is located, usually identified by country, name of the city, the respective zip code, the street name and the number of the house in the street.
billing address	The location where a bill belongs to
shipping address	The location where goods / services should be sent to
article	An item for sale

Example of class interactin: Concept Definition for an online book selling store

Class interaction – Concept definition

- From our previous example, take at least one entity and describe clearly the entity (i.e. semantic meaning -> the concept)
  - we identified entities like: book, customer, article, shipping address, billing address
  - Make sure that the concepts are clearly / unambiguously described
  - Try to do it without google ;-)

- Let us take about 5-10min

Concept definition – Why?

- Even the name of the concept is different, the meaning might be identical
  - customer / buyer / purchaser …. have the same meaning
  - Danger to acquire the same data under a different name -> data redundancy – which is expensive and typically leads to data quality degradation

- Even the name of the concept is the same, the meaning might vary significantly
  - article – has many meanings
    - a distinctive piece of writing on a particular subject in a newspaper or magazine
    - A grammatical concept in many languages used for the identification of things
    - An item for sale
- The use of data is severely limited in case the concepts are not understood (e.g. data exchange)