Domain Model

Lecture 7

Introduction

- *A **domain model** is the **most important** and **classic-model** in Object Oriented Analysis*

YOUR ATTENTION PLEASE

What is a Domain Model?

- ***Problem domain :*** *area (**scope**)of application that needed to be investigated to solve the problem*
- ***Domain Model*** *: Illustrates* ***meaningful conceptual objects*** *in problem domain.*
- *So domain model are conceptual objects of the area of application to be investigated*

Domain model representation?

- *A domain model is a visual representation of **real world concepts** (real-situation objects), that could be : **idea**, **thing** , **event** or **object**…..etc .*
  - ***Business objects*** - represent things that are manipulated in the business e.g. ***Order***.
  - ***Real world objects*** – things that the business *keeps track of* e.g. ***Contact , book***.
  - ***Events*** *that come to light* - e.g. ***sale, loan*** and ***payment***.

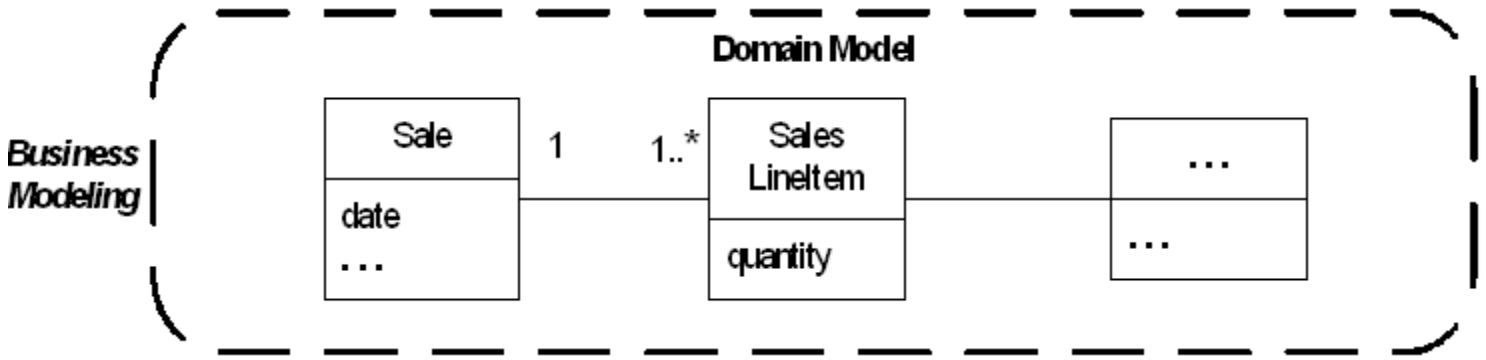
Domain model representation?

Domain Model may contain :

- Domain **objects** (conceptual classes)
  - **Attributes** of domain objects
- **Associations** between domain objects
  - **Multiplicity**

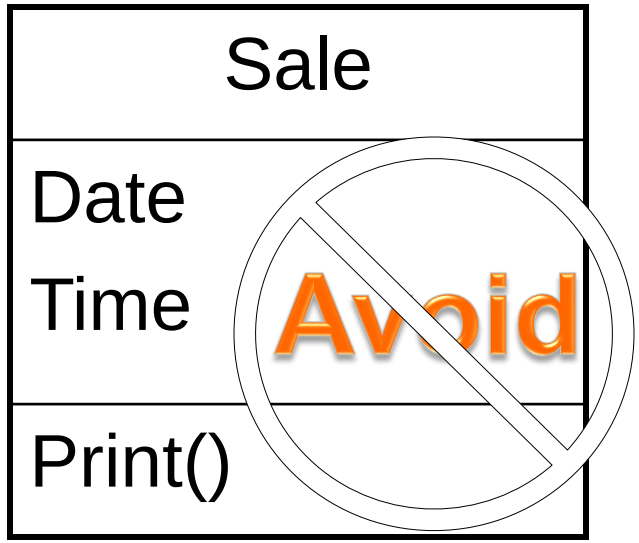
Domain Model - UML Notation

- Illustrated using a set of domain objects (conceptual classes) ***with no operations*** *(no* ***responsibility*** *assigned yet , **this will be assigned during design**)*.

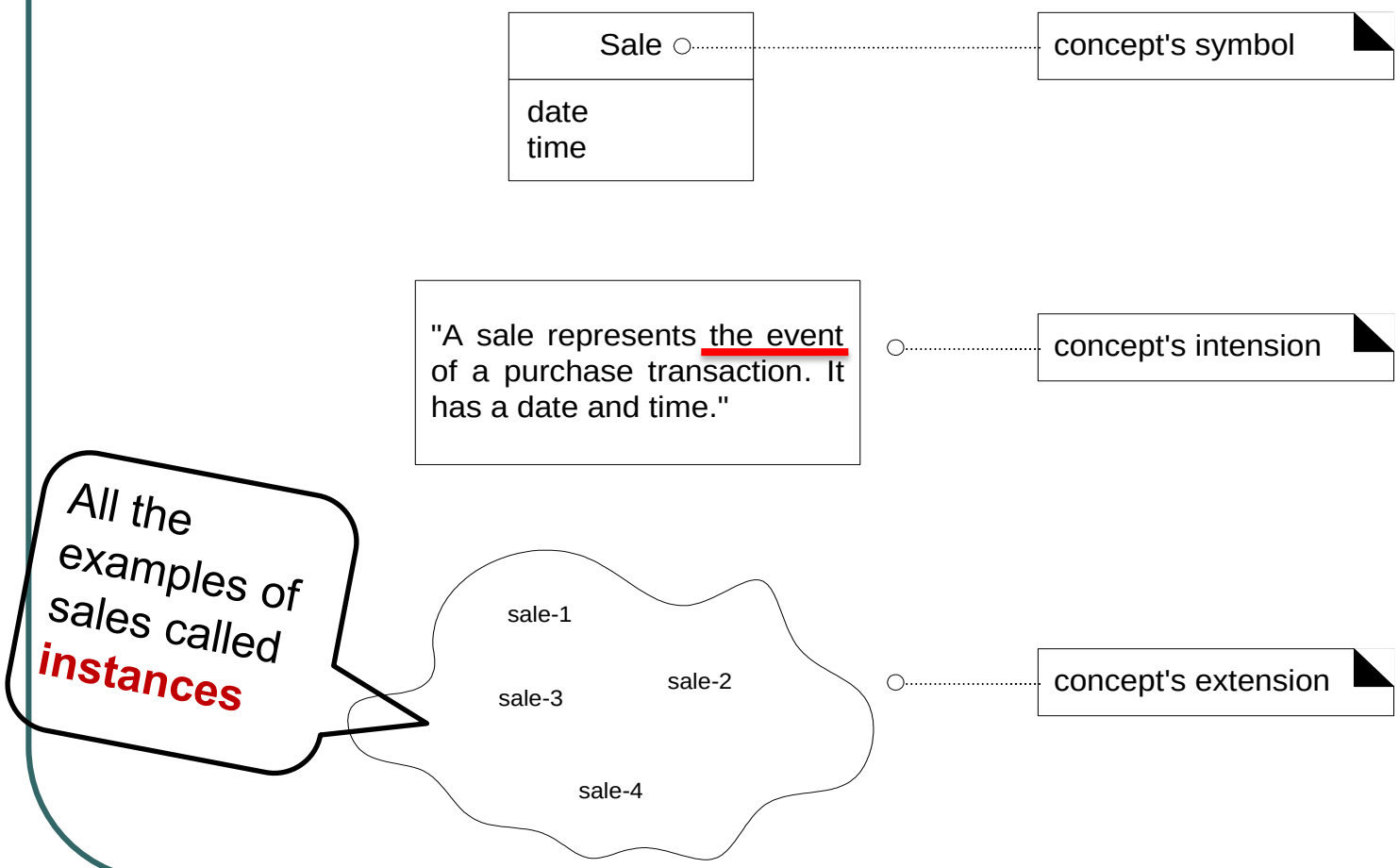


A Domain Model is not a Software document

Object **responsibilities** is not part of the domain model. (***But to consider during Design***)



Symbol, intension and extension.

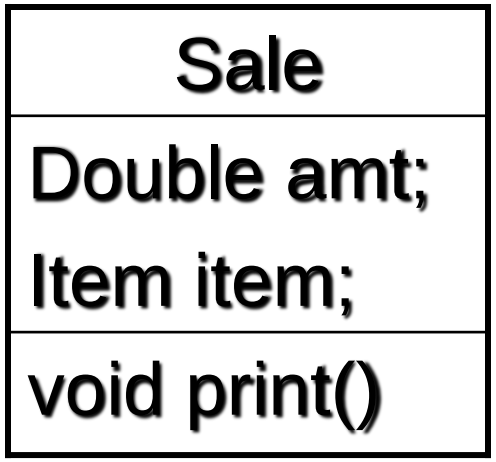


A Domain Model is Conceptual, not a Software Artifact

Conceptual Class:

Software Artifacts:

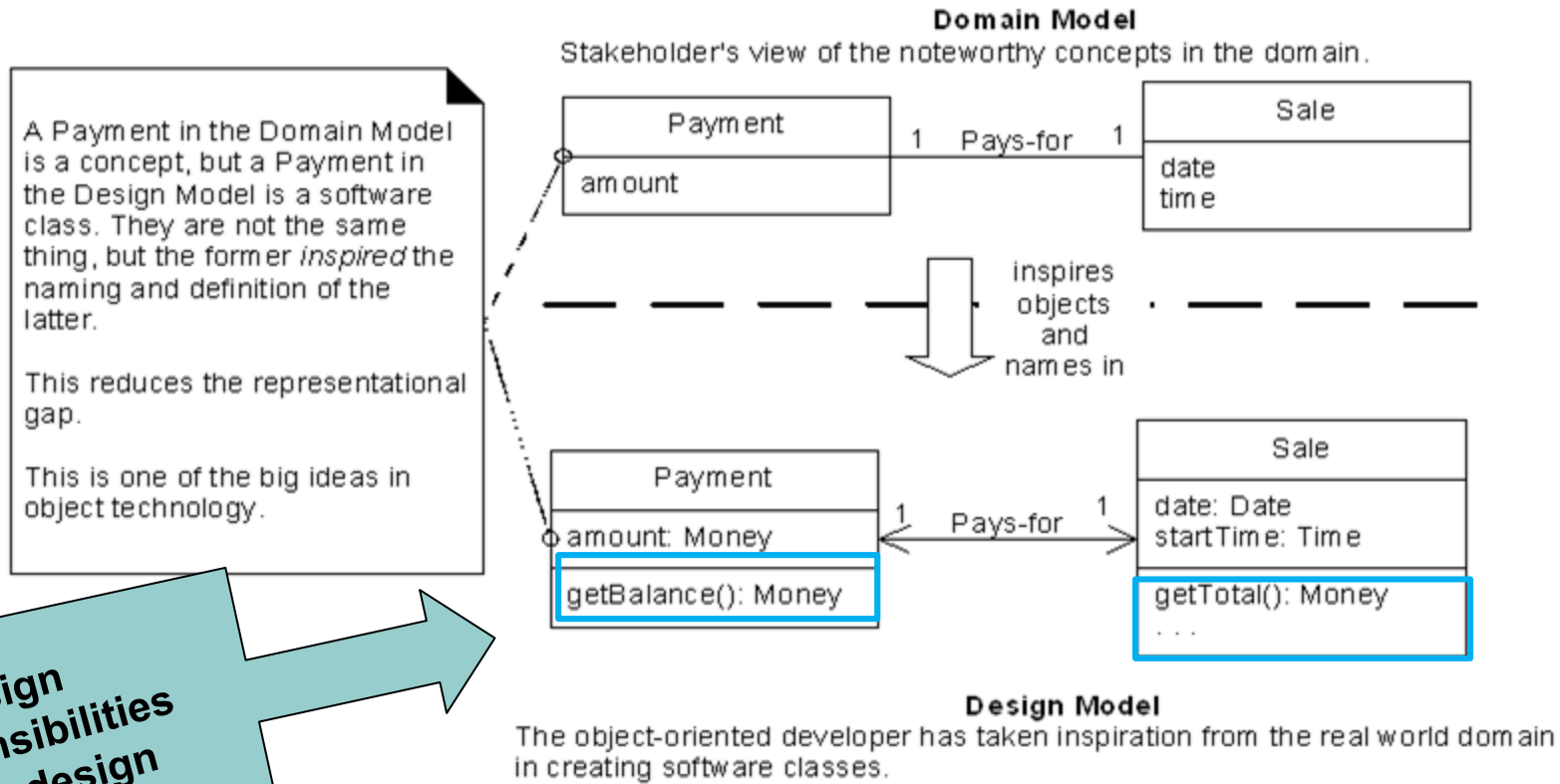
vs.



What's the difference?

Question : Why create Domain model ?

Answer : Get inspiration to create software classes



We assign responsibilities during design

How to find these conceptual classes and attributes ?

Method1: Noun Phrase Identification

- *Identify Nouns and Noun Phrases in textual descriptions of the domain that could be :*
  - *The problem definition.*
  - *The Scope.*
  - *The vision.*

Method1: Noun Phrase Identification

However,

- *Words may be ambiguous (such as : System)*
- *Different phrases may represent the same concepts.*
- *Noun phrases may also be attributes or parameters rather than classes:*
  - *If it stores state information or it has multiple behaviors, then it's a class*
  - *If it's just a number or a string, then it's probably an attribute*

Noun Phrase Identification

- Consider the following problem description, analyzed for nouns and verbs:

The ATM verifies whether the customer's card number and PIN are correct.

If it is, then the customer can check the account balance, deposit cash, and withdraw cash.

Checking the balance simply displays the account balance.

Depositing asks the customer to enter the amount, then updates the account balance.

Withdraw cash asks the customer for the amount to withdraw; if the account has enough cash, the account balance is updated. The ATM prints the customer’s account balance on a receipt.

Noun Phrase

Analyze each as follows:

- Does it represent a person performing an action? Then it's an actor, '**R**'.
- Is it also a verb (such as 'deposit')? Then it may be a method, '**M**'.
- Is it a simple value, such as 'color' (string) or 'money' (number)?

  Then it is probably an attribute, '**A**'.
- Which NPs are unmarked? Make it '**C**' for class.

Verbs can also be classes, for example:

- Deposit is a class if it retains state information

Noun Phrase Identification

- Consider the following problem description, analyzed for nouns and verb:

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C R A A

If it is, then the customer can check the account balance, deposit cash, and withdraw cash.
R A A A

Depositing asks the customer to enter the amount, then updates the account balance.
M R A A

Withdraw cash asks the customer for the amount to withdraw; if the account has enough cash,
M A R A C A

the account balance is updated. The ATM prints the customer's account balance on a receipt.
A C A A

Example: Simplified "Process Sale"

- Simplified scenario in **Process Sale.**

1. Customer arrives with goods
2. Cashier starts a new sale

- Possible conceptual classes: **Customer**, **Cashier**, **Item** (-> goods), **Sale**

3. Cashier enters item ID
4. System records sale line item and presents item description, price, and running total
5. At the end, Cashier tells Customer the total and asks for payment

- Possible conceptual classes: **SalesLineItem**, **ProductSpecification** (description + price + item ID), **Payment**
- item ID, description, price, total: probably too simple to be separate classes

6. Cashier enters amount given (cash)
7. System presents change due, and releases cash drawer
8. Cashier deposits cash and returns change
9. System presents receipt

- Possible conceptual classes:

Register (understood by cash drawer), **Receipt**

Main Success Scenario (or Basic Flow) of POS:

1. Customer arrives at POS checkout with goods and/or services to purchase.

2. Cashier starts a new sale.

3. Cashier enters item identifier.

4. System records sale line item and presents item description, price, and running total.

Price calculated from a set of price rules.

Cashier repeats steps 3-4 until indicates done.

5. System presents total with taxes calculated.

6. Cashier tells Customer the total, and asks for payment.

7. Customer pays and System handles payment.

8. System logs completed sale and sends sale and payment information to the external accounting system (for accounting and commissions) and Inventory system (to update inventory).

9. System presents receipt.

10. Customer leaves with receipt and goods (if any).

Extensions (or alternative Flows)

7a. Paying by cash:

1. Cashier enters the cash amount tendered.

2. System presents the balance due, and releases the cash drawer.

3. Cashier deposits cash tendered and returns balance in cash to Customer.

4. System records the cash payment.

- **Main Success Scenario (or Basic Flow) of POS:**

1. **Customer** arrives at **POS checkout** with **goods** and/or **services** to purchase.

2. **Cashier** starts a new **sale.**

3. Cashier enters **item identifier**.

4. **System** records **sale line item** and presents **item description**, **price**, and running **total**.

Price calculated from a set of price **rules**.

Cashier repeats steps 3-4 until indicates done.

5. System presents total with **taxes** calculated.

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7a. Paying by cash:

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Class of POS

Register	Item	Store	Sale
Sales LineItem	Cashier	Customer	Ledger
Cash Payment	Product Catalog	Product Description	

Important : ***There is no such things as a correct list . Brainstorm what you consider noteworthy to be a candidate. But in general , different modelers will find similar lists.***

Identification of conceptual classes

- *Identify candidate conceptual classes*
- *Go through them and :*
  - ***Exclude irrelevant features and duplications***
  - ***Do not add things that are outside the scope*** *(outside the application area of investigation)*

Method2 **: By Category List**

Common Candidates for classes include:

- ***Descriptions*** *, Roles , Places , Transactions*
- *Containers , Systems , abstract nouns , Rules*
- *Organizations, Events, Processes, catalogs , Records , services.*

Attributes

- *A logical data value of an object.*
- *Imply a need to remember information*.
  - Sale needs a **dateTime** attributte
  - Store needs a **name** and **address**
  - Cashier needs an **ID**

A Common Mistake when modeling the domain- Classes or Attributes?

Rule

- ***If we do not think of a thing as a number or text in the real world, then it is probably a conceptual class.***
- ***If it takes up space, then it is likely a conceptual class.***

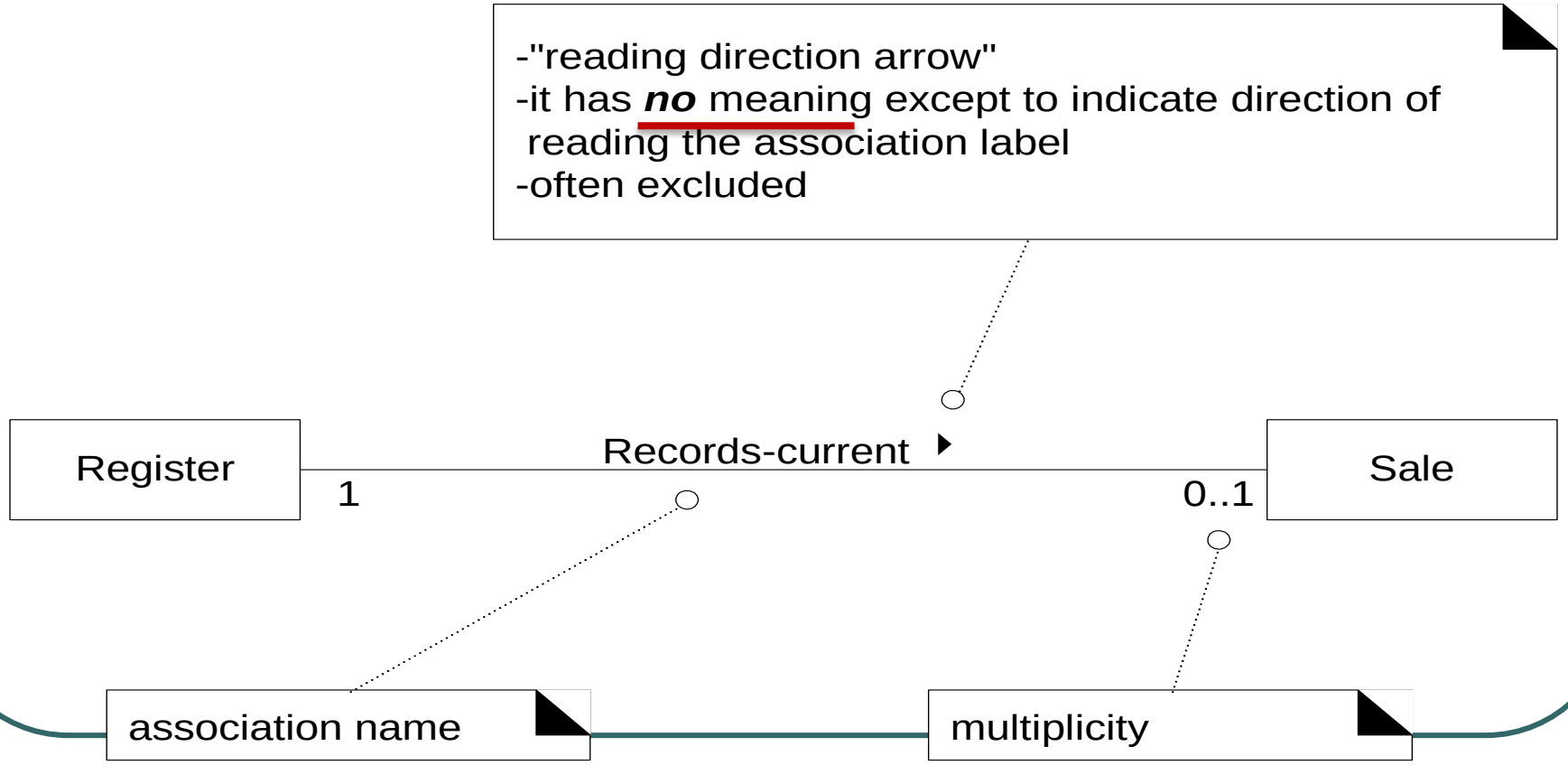
***Examples*:**

- ***Is a store an attribute of a Sale ?***
- ***Is a destination airport an attribute of a flight ?***

How to find these associations and multiplicities?

Association:

Relationship between classes (more precisely, between instances of those classes)indicating some meaningful and interesting connection)



Common association list

- A is a physical part of B .
  - Wing - Airplane
- A is a logical part of B
  - SalesLineItem - Sale
- A physical contained in B
  - Register-Sale

Common association list

- A is a logical contained in B
  - ItemDescription - Catalog
- A is a description of B .
  - ItemDescription - Item
- A is a member of B
  - Cashier – Store

Common association list

- A uses or manage B
  - Cashier-Register
- A is recorded in B
  - Sale-Register
- A is an organization subunit of B .
  - Departement - Store

Common association list

- A communicate with B
  - Customer - Cashier
- A is related to a transaction B
  - Customer - Payment
- A is a transaction related to another transaction B .
  - Payment - Sale

Common association list

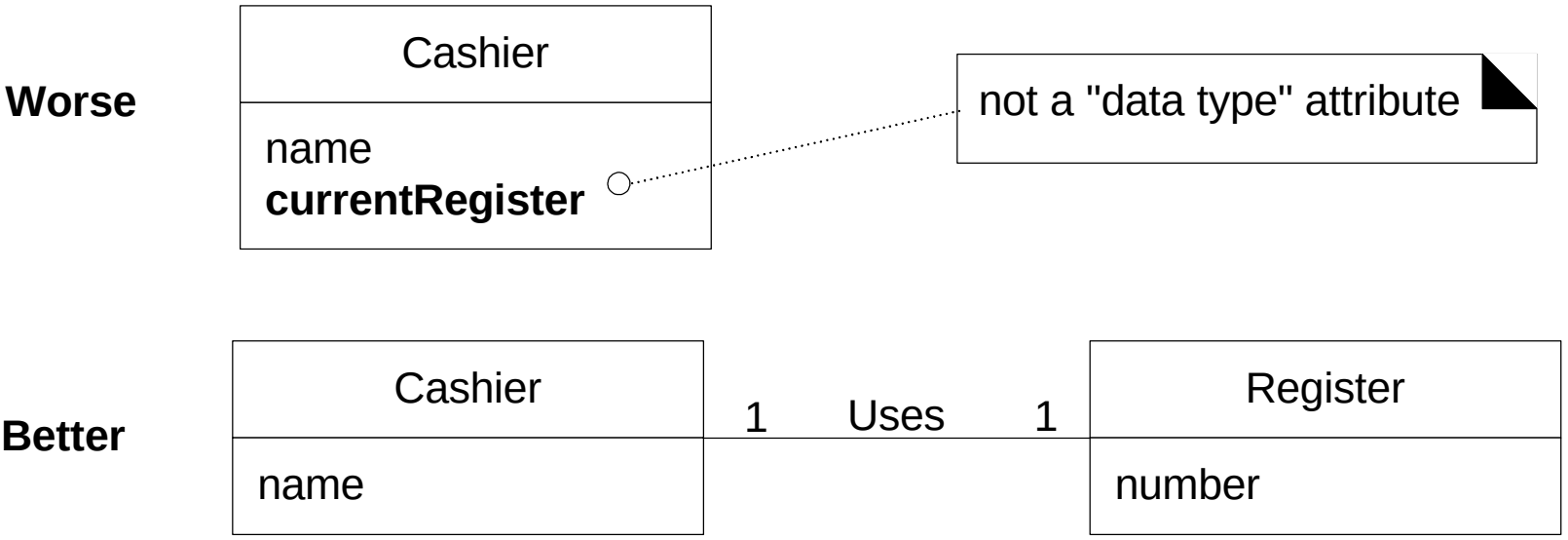
- A is owned by B
  - Register - Store
- A is an event related to B
  - Sale- Customer

High priority association

- A is a physical or logical part of B
- A is physically or logically contained in/on B
- A is recorded in B

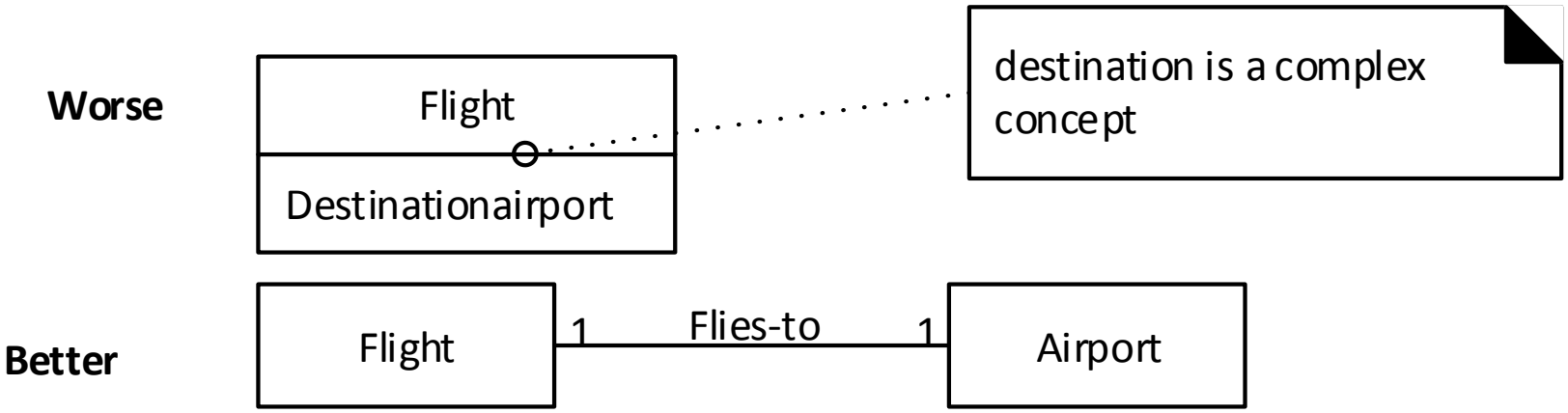
- To avoid:
  - ***Avoid showing redundant associations***
  - ***Do not overwhelm the domain model with associations not strongly required***

Association or attribute ?



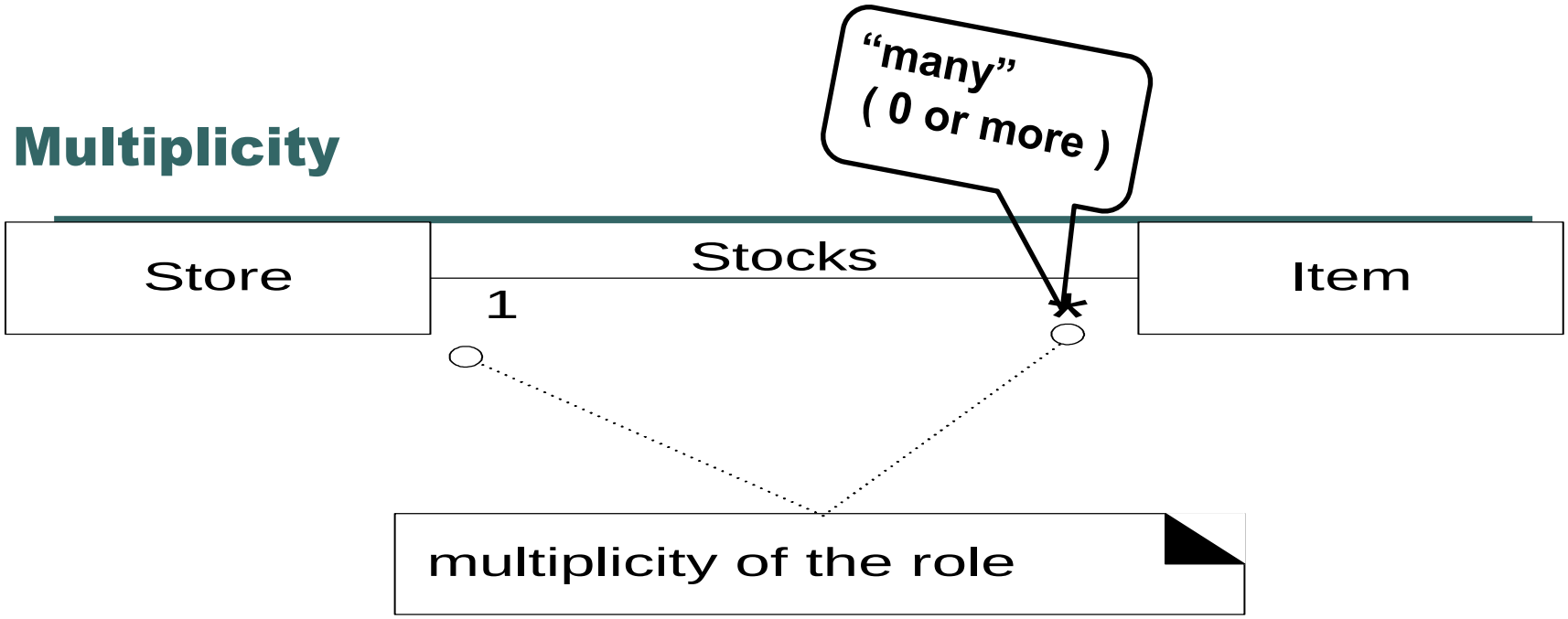
- *Most attribute type should be "**primitive**" data type, such as: numbers , string or boolean (true or false)*
- *Attribute should not be a complex domain concept(Sale , Airport)*
- *CurrentRegister is of type "Register", so expressed with an association*

Association or attribute ?



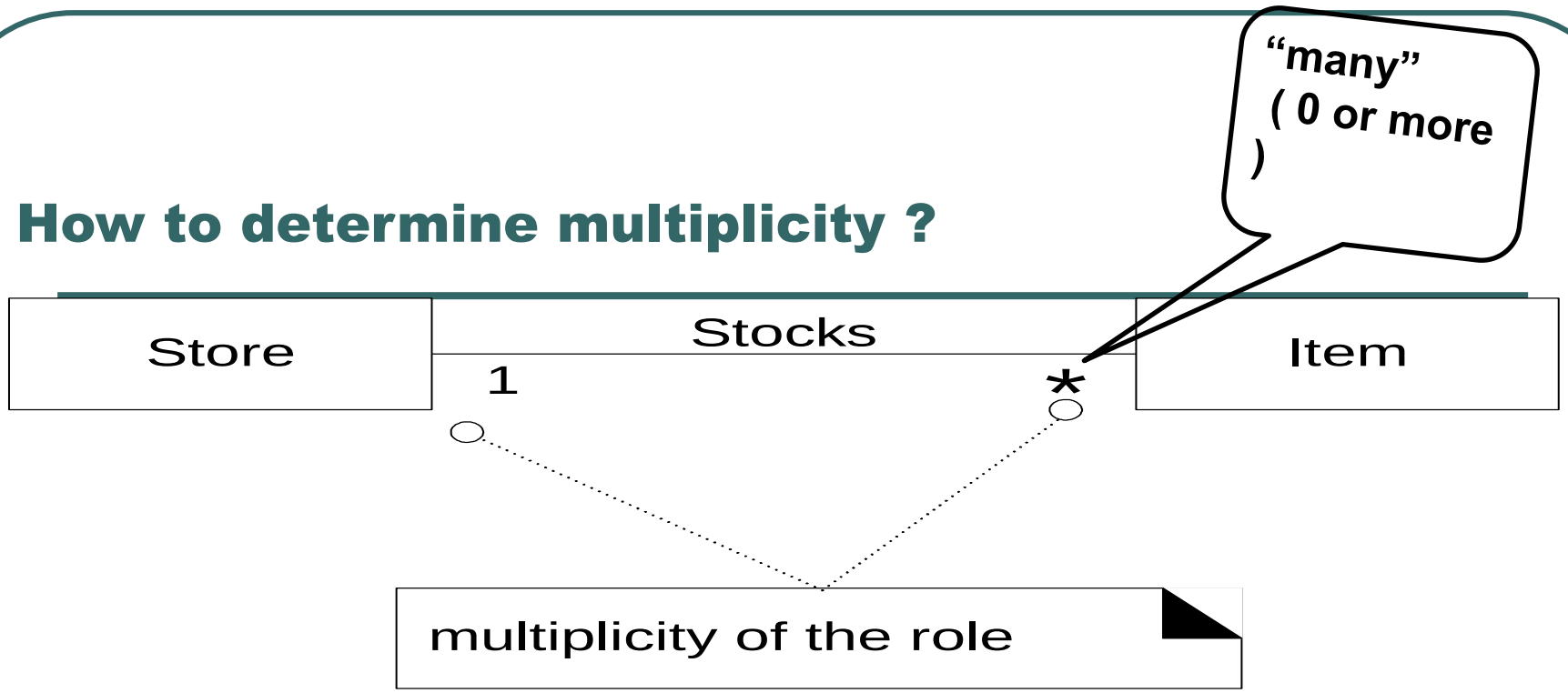
A destination airport is ***not a string***, it is a complex thing that occupies many square kilometers of space. So “Airport” should be related to “Flight” via an association , not with attribute

Multiplicity



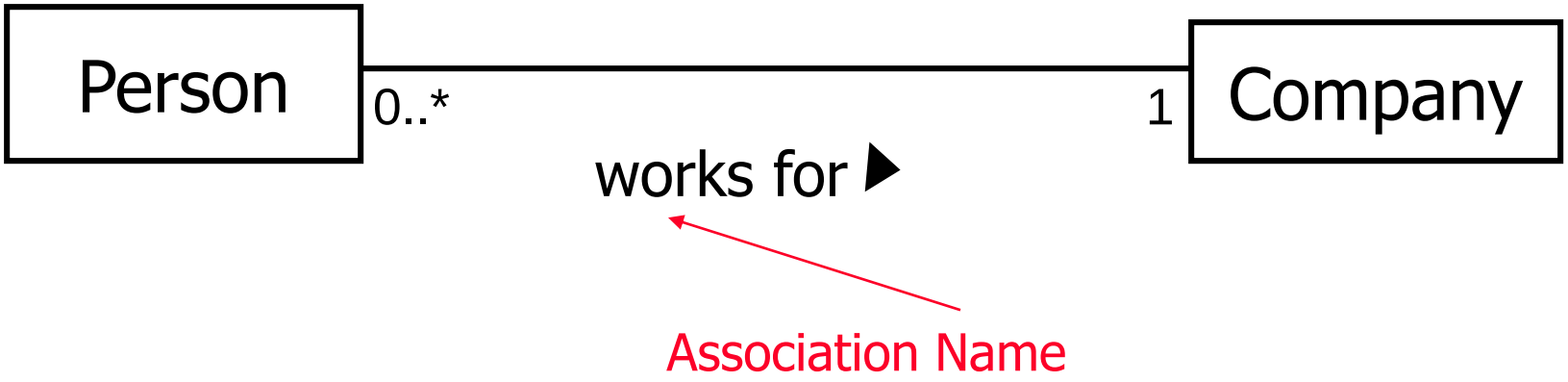
- ***Multiplicity*** *indicates how* ***many instances*** *can be validly associated with another instance, at* ***a particular moment****, rather than over a span of time.*

How to determine multiplicity ?

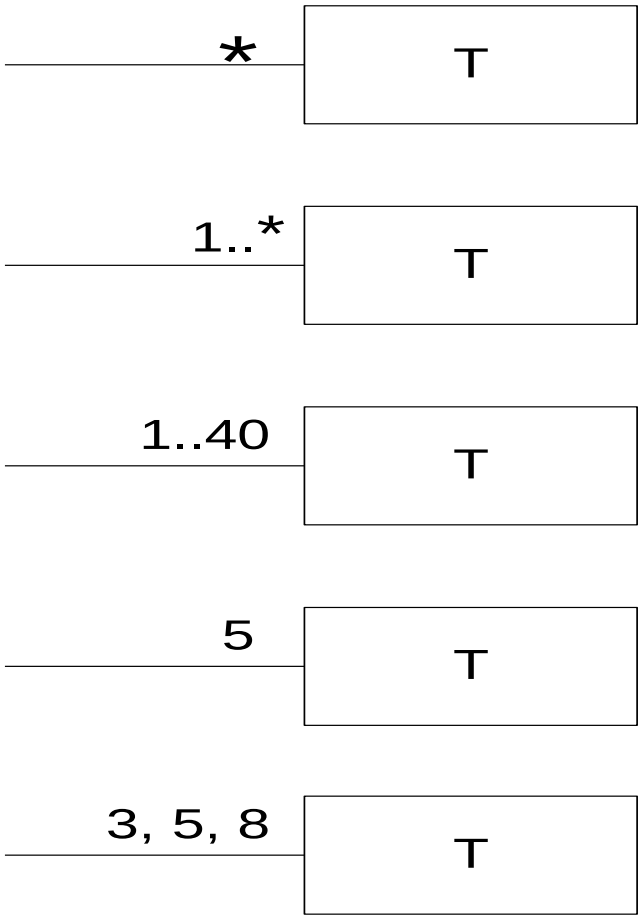


- *Ask these 2 questions :*
  - *1 store may stock how many item ?*
  - *1 item may be stocked in how many stores ?*

How to determine multiplicity ?



Multiplicity



How to create a domain model

- *Identify candidate conceptual classes*
- *Go through them*
  - ***Exclude irrelevant features and duplications***
  - ***Do not add things that are outside the scope***
- *Draw them as classes in a UML class diagram*
- *Add associations necessary to record the relationship that must be retained*
- *Add attributes necessary for information to be preserved*

But remember

- *There is no such thing as a single correct domain model. All models* ***are approximations of the domain*** *we are attempting to understand.*

- *We* ***incrementally evolve a domain model*** *over several iterations on attempts to capture all possible conceptual classes and relationssships*.