Modelling Structure

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Discussion: Concepts and Attributes

- How can we find / What are:
  - Concepts
  - Attributes
  - Associations
- What is the difference between an *Attribute* and a *Concept*

Identifying Concepts

Category	Examples	
Physical Objects	POST	Aeroplane
Places	Store	Aerport
Transactions	Payment	Reservation
Containers	Basket	Aeroplane
Things in Container	Item	Passenger
Events	Sale	Flight
Description of Things	Sale Item	Flight Description
Records, Contracts	Receipt	Ticket

Finding Concepts

- Look for *nouns*
- Map nouns to concepts

Sources:

- Textual description of problem domain
- Requirements
- Use-cases

Cave!

- Natural language is ambiguous
- Concepts or Attributes?

Attributes

- Logical value of an element
  - Examples: *name, quantity, status, . . .*
  - Hint: Builtin data types
    - String, int, date
    - But also simple user-defined types such as *address, personnummer, . . .*
- Keep Attributes Simple

Associations

An association is a

- relationship between concepts
- indicates a meaningful and interesting connection

Types

- Need-to-know (preserved for some time; needs to maintained by software)
- Comprehension-only (used to understand domain)

Finding Associations

Category	Examples
A – is a part of – B	Salesitem – Sale
	Wing – Aeroplane
A – is contained in – B	Item – Store
	Seat – Flight
A – is a description for – B	ItemDescription – Item
	FlightInformation – Flight
A – is known/recorded in – B	Sale – POST
	Booking – Flight
A – is owned by – B	Store – Company
A – related transactions – B	Payment – Sale
	Booking – Ticket

Discussion: Multiplicity

- Go through different types of multiplicity

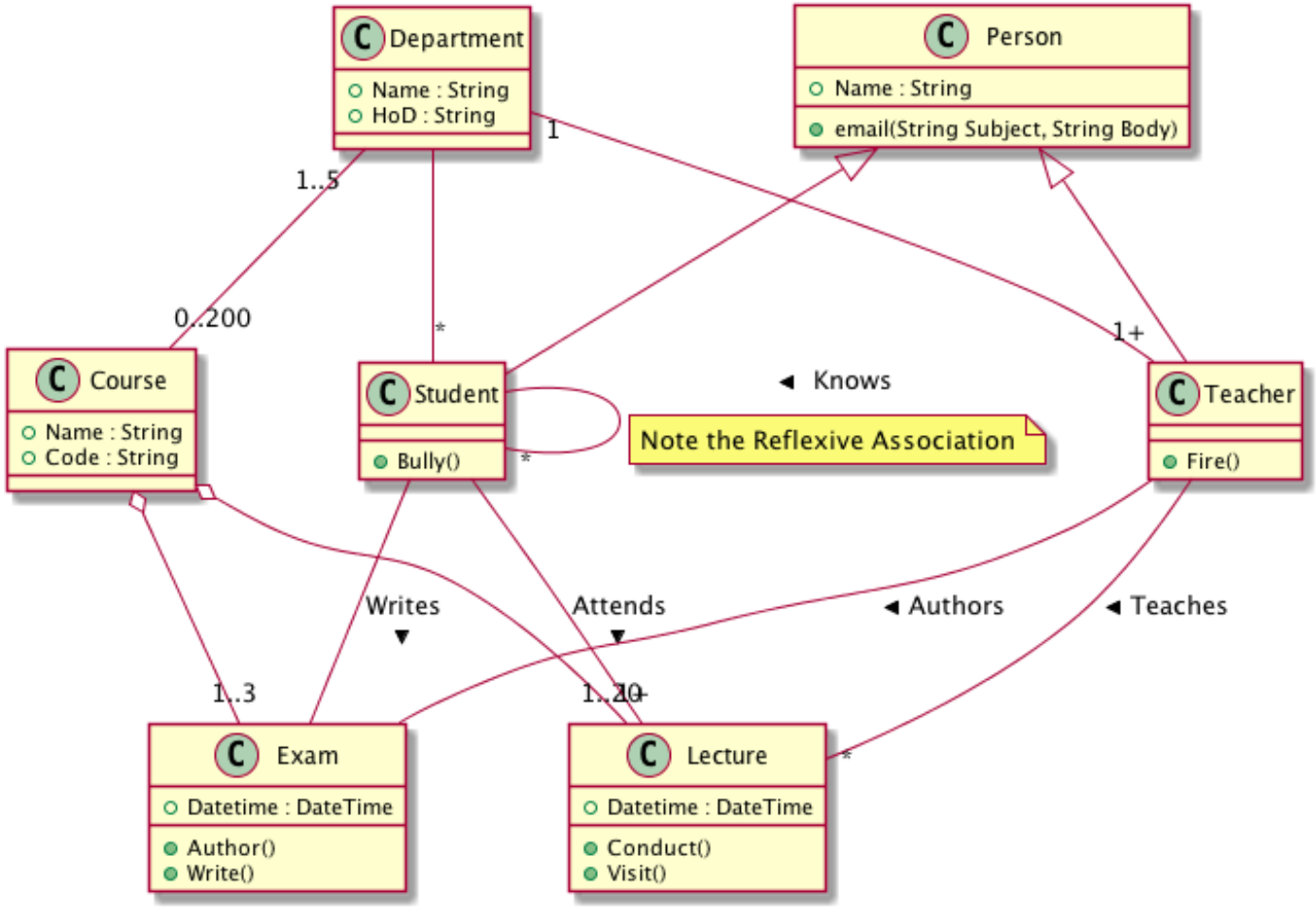
Discussion: Concept or Class

- When does a conceptual diagram become a class diagram?

Aggregation

- Aggregation
  - “Has-a”
  - Strong aggregation
- Composition
  - “Consists-of”
  - weak aggregation

Discussion: An Example



Example

- Conceptual Model for Discussion Forum Software

Generalisation (Inheritance)

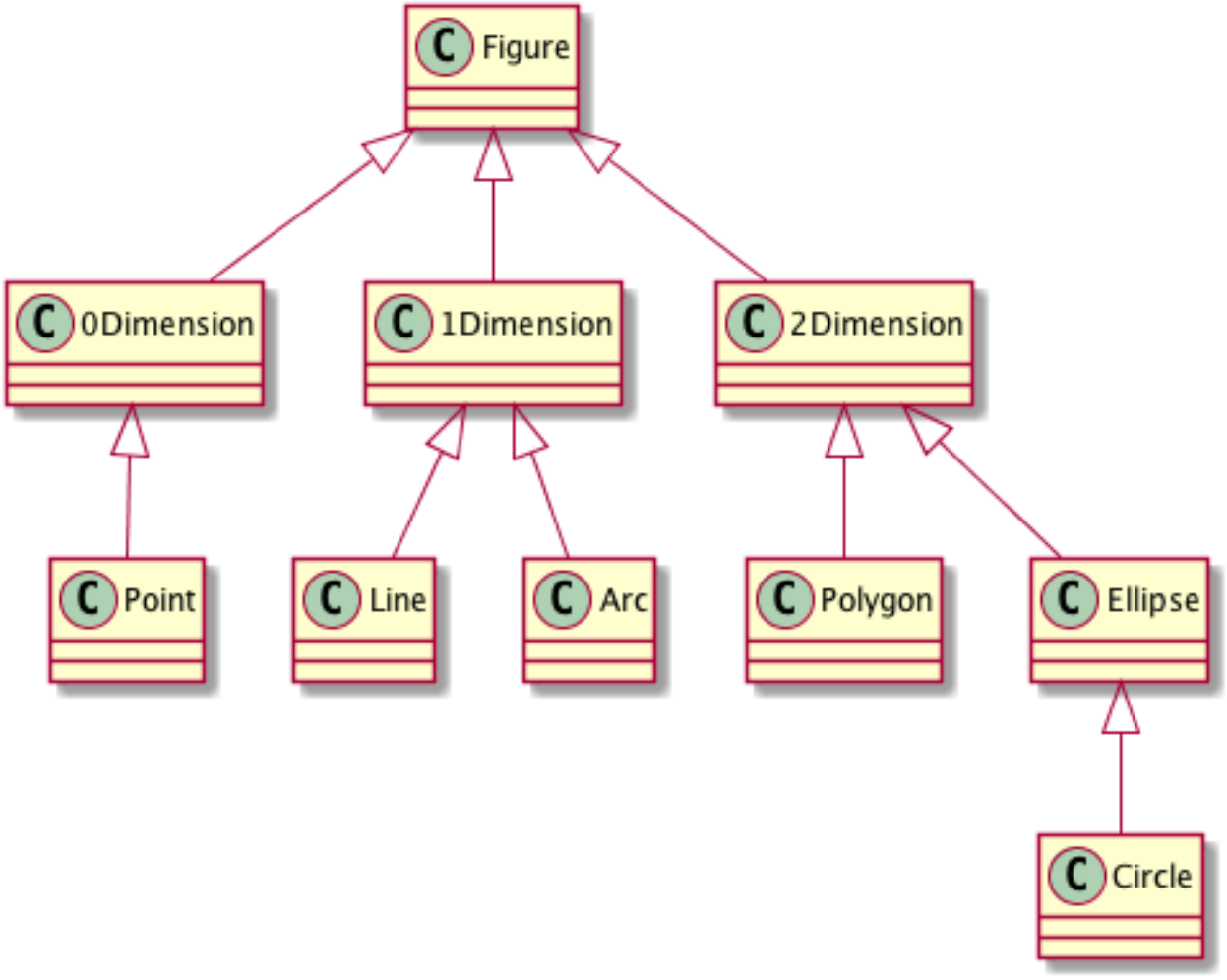
Why

- Classification among concepts (is-a)
- Code reuse, identifying commonalities

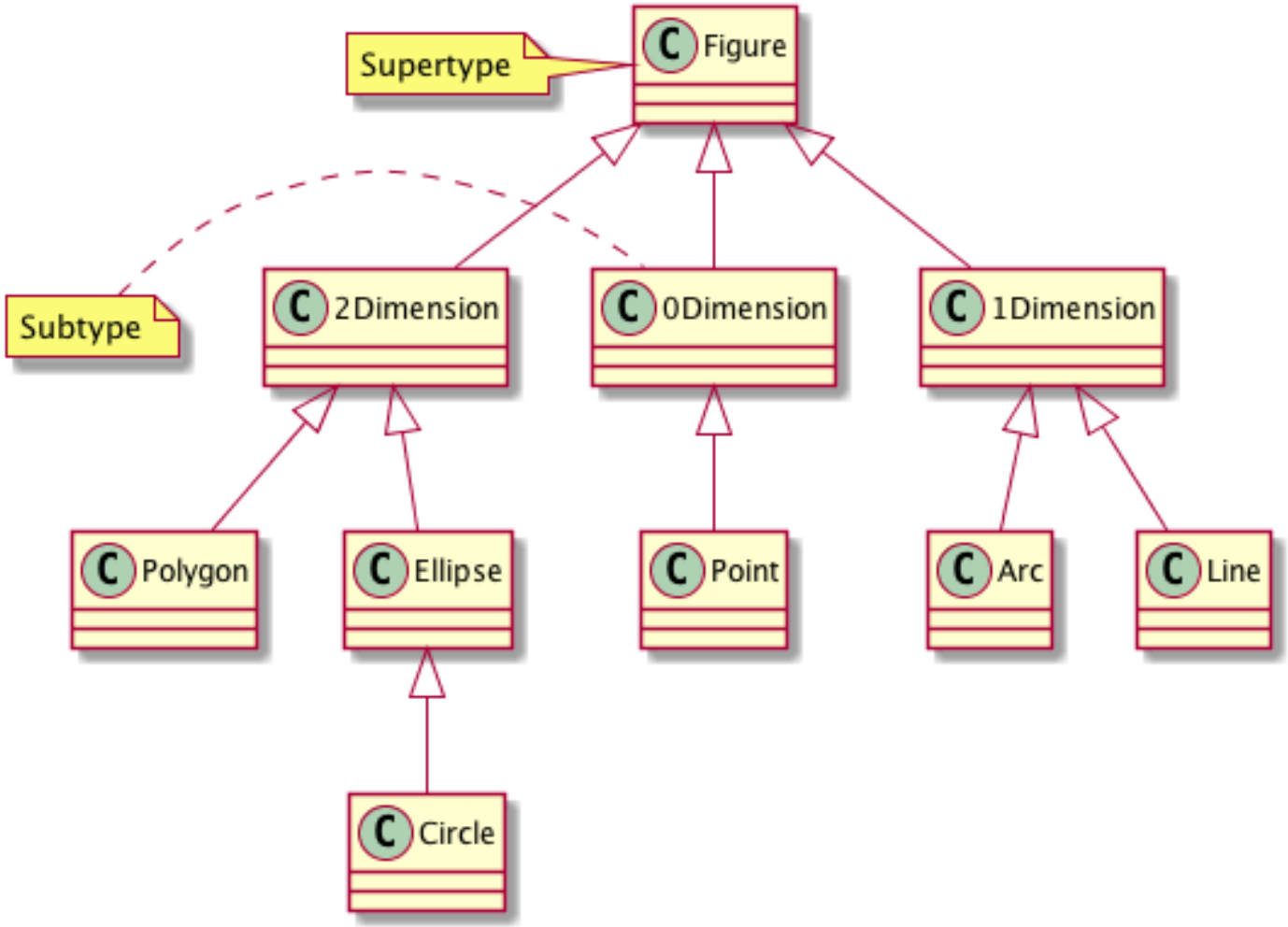
Example

- Vector Graphics Drawing Programme
  - Point, Line, Arc, Polygon, Ellipse, Circle

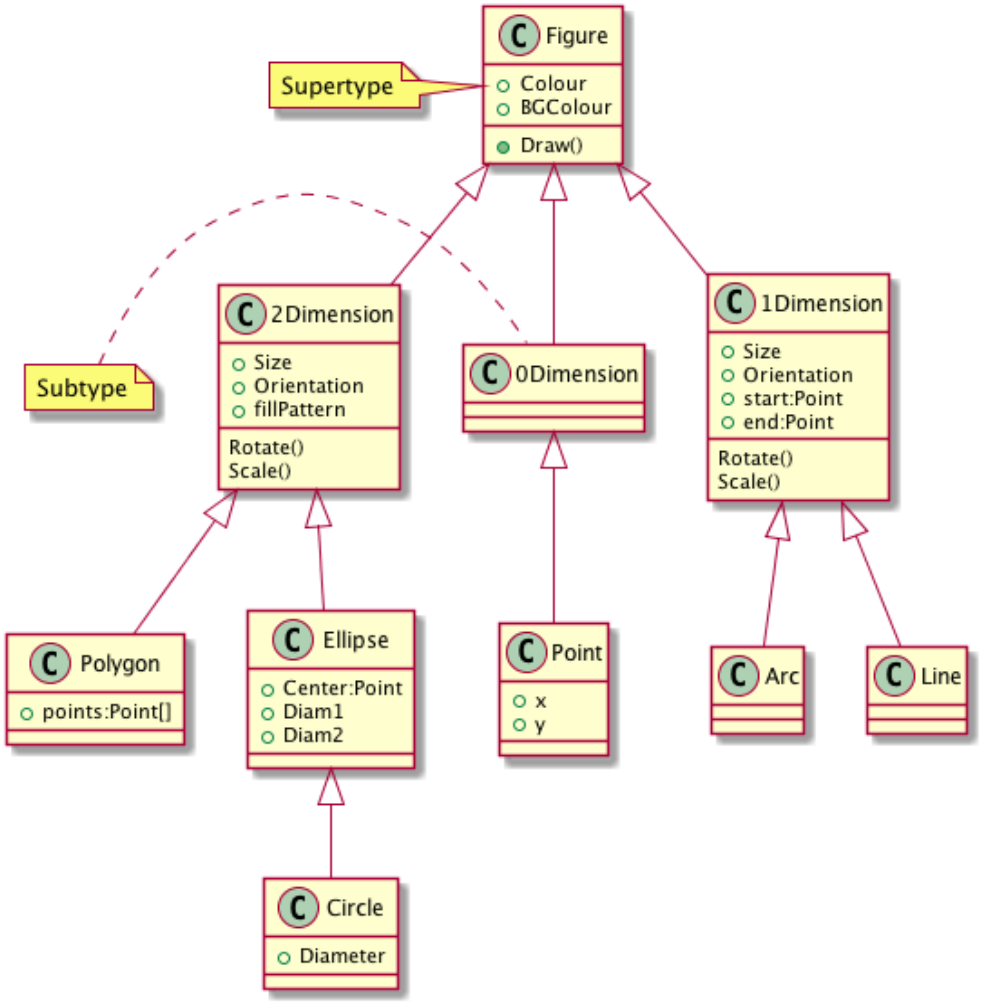
Generalisation: Hierarchy



Generalisation: Hierarchy II

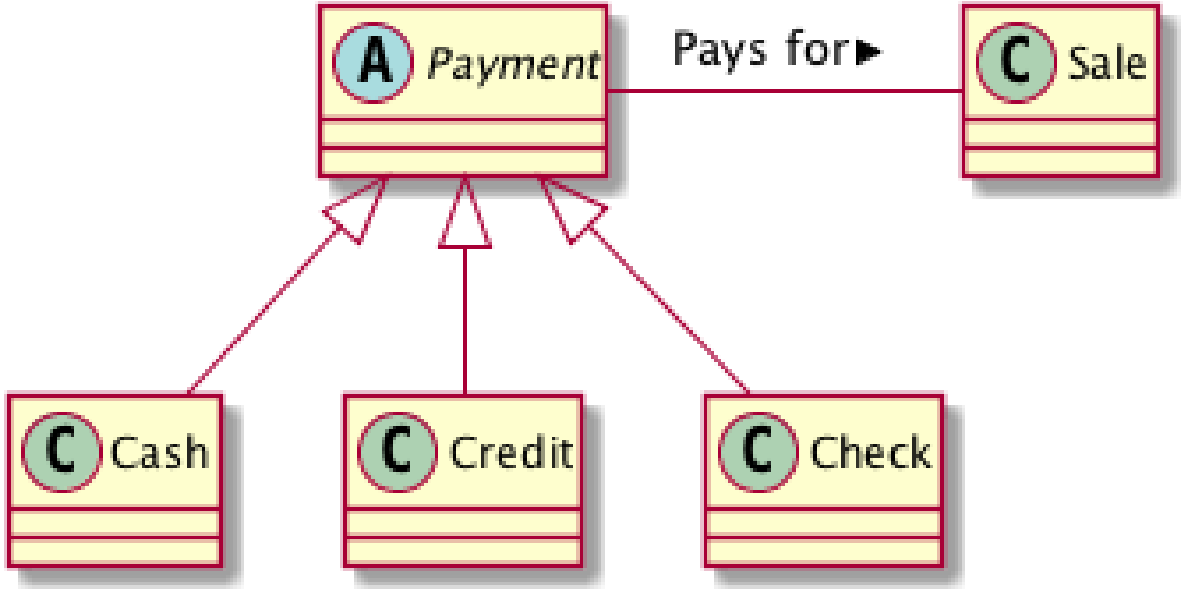


Generalisation: Hierarchy III

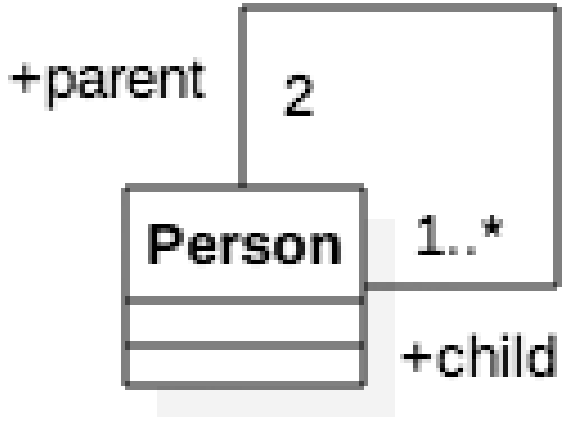


Abstract Types

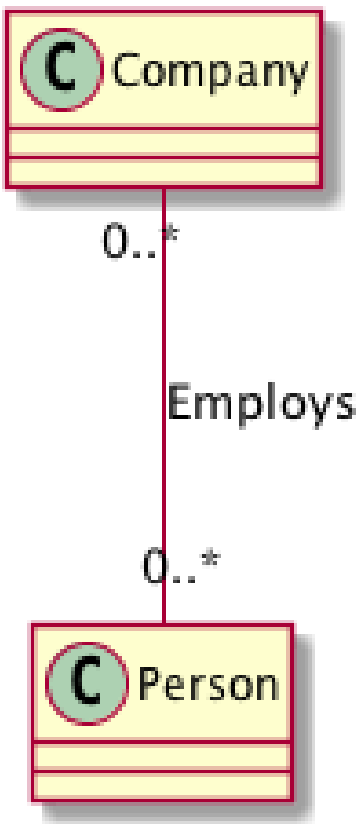
- When no instances of the base class are desirable.
- Example: There are no instances of the generic “Figure” base class.



Reflexive Associations



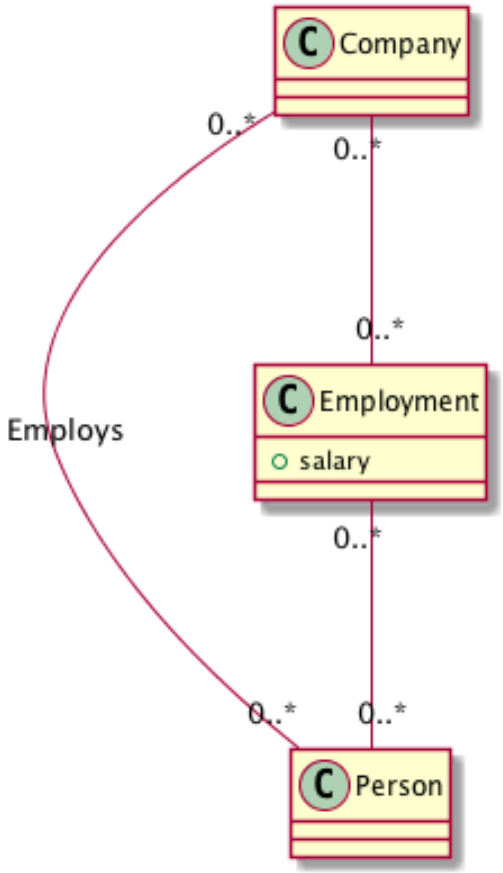
Exotic UML: Association Attributes



Where do we put the attribute salary?
in Person: implies you can ony work in one place
in Company: implies one salary for all

Exotic UML: Association Attributes

One solution:



Exotic UML: Association Attributes

Proper Solution: