UML Class and Object Diagrams

Definitions

▸ **Class diagram** is **UML** structure diagram which shows structure of the designed system at the level of classes and interfaces, shows their features, constraints and relationships – associations, generalizations, dependencies, etc.

▸ Object diagram could be considered as instance level class diagram which shows instance specifications of classes and interfaces (objects), slots with value specifications, and links (instances of association).
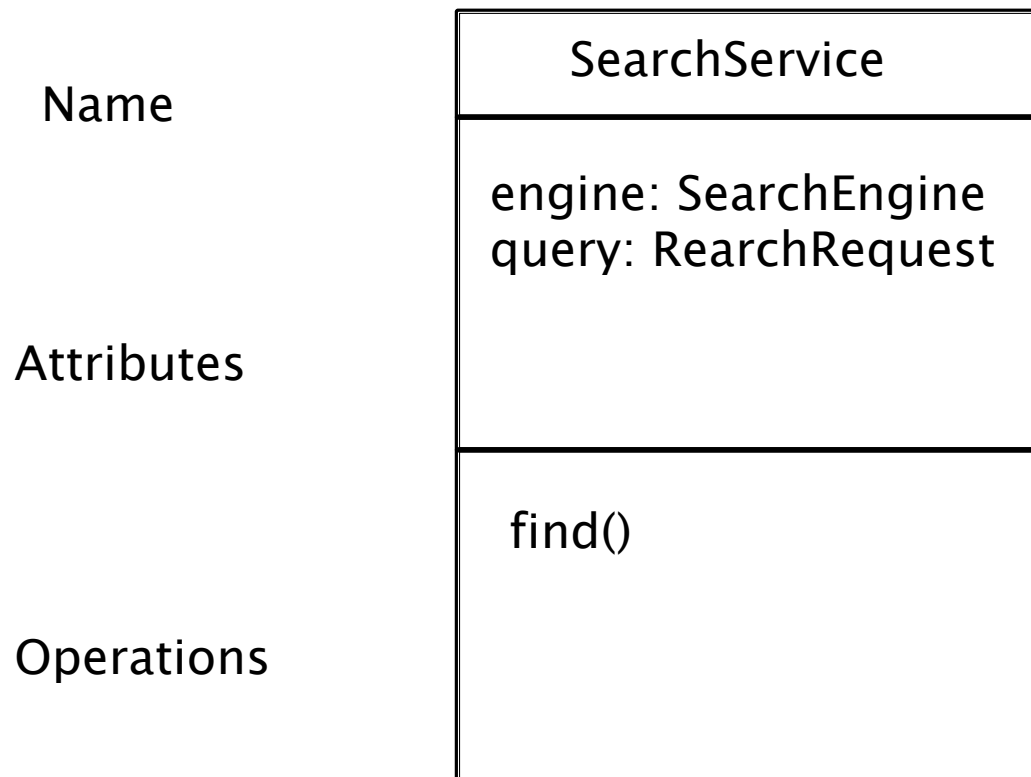
Class

- A **class** is a classifier which describes a set of objects that share the same
- features
- constraints
- semantics (meaning).

```
┌─────────────────────────┐
│                         │
│        Customer         │
│                         │
└─────────────────────────┘
```
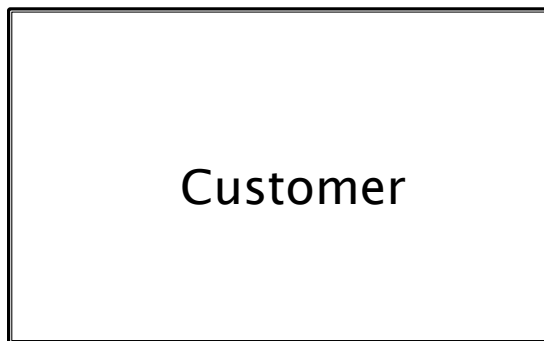
Features of a class

- **Features** of a class are **attributes** and **operations**.

Name

Attributes

Operations

SearchService
engine: SearchEngine query: RearchRequest
find()

Features of a class
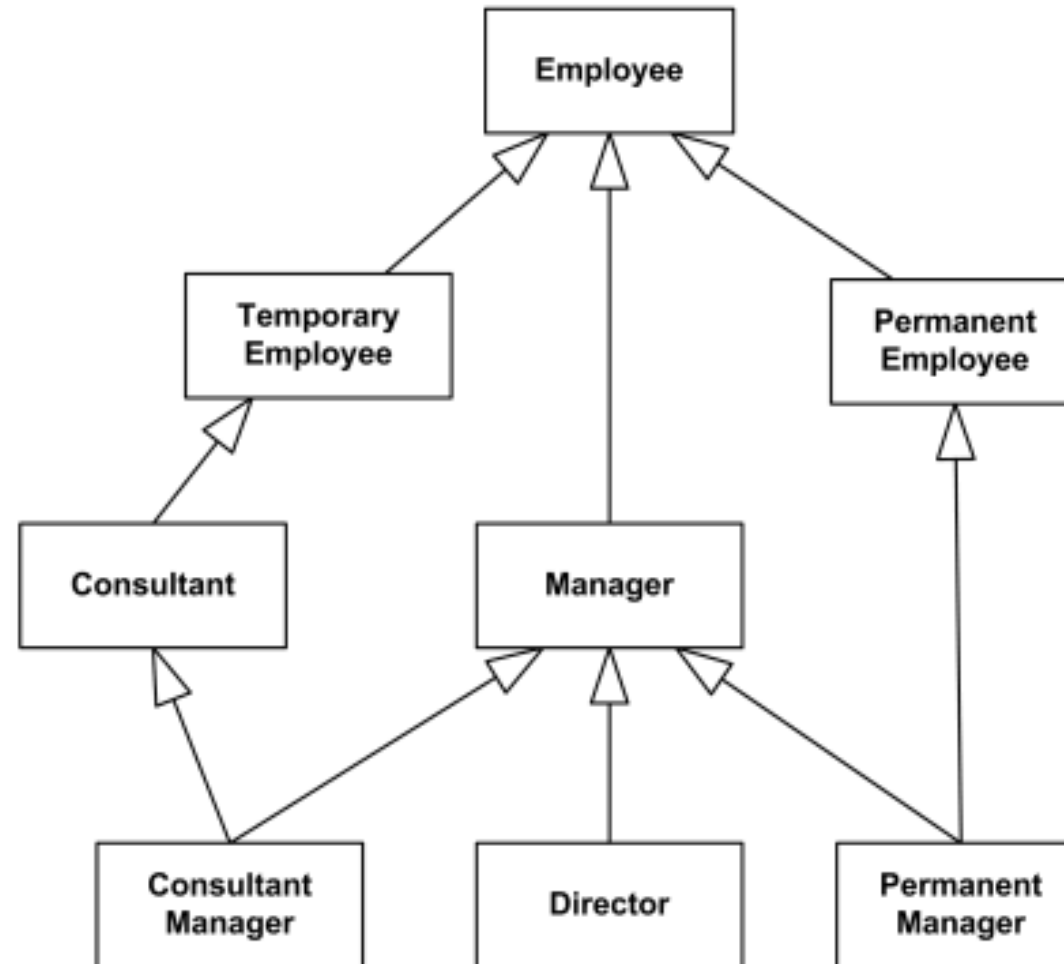
- ▸ +, #, - are used to specify visibility
  - ◦ Always list members in order from public to private in each of the sections of the class

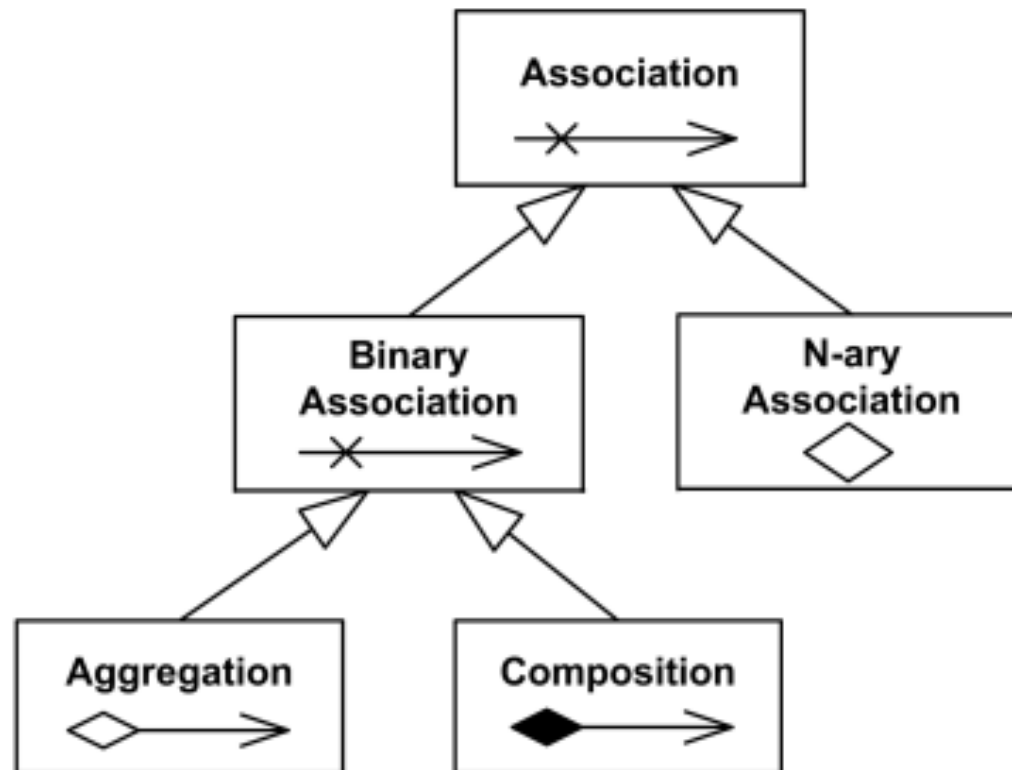- ▸ Static members are underlined

SearchService
- config: Configuration - engine: SearchEngine
+ search(query: SearchRequest): SearchResult - <u>createEngine</u>(): SearchEngine
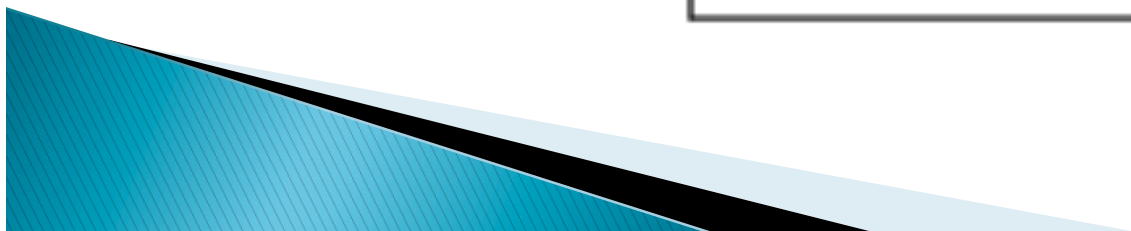
Generalisation

Association

Dependency
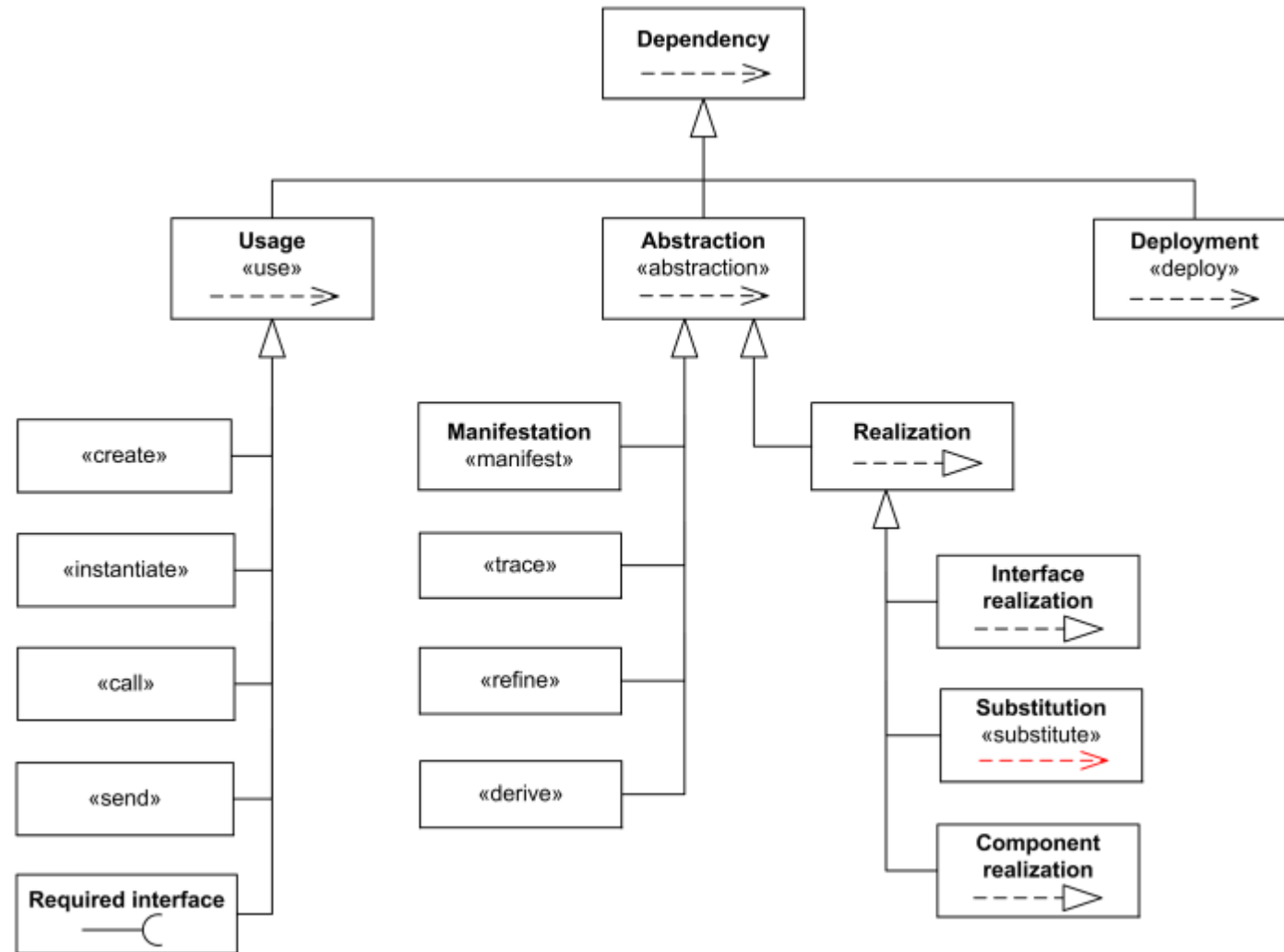
Multiplicity

▸ If the multiplicity is associated with an element the multiplicity range is placed within square brackets as part of the text string specifying the element.

▸ If the multiplicity is related to generalisation, association or dependency the multiplicity range is written on the connection line without other punctuation

Multiplicity	Option	Cardinality
0..0	0	Collection must be empty
0..1		No instances or one instance
1..1	1	Exactly one instance
0..*	*	Zero or more instances
1..*		At least one instance
5..5	5	Exactly 5 instances
m..n		At least m but no more than n instances

UML class diagram for a library domain model, annotated with labels: abstract class, reading order, attributes, enumeration data type, generalization, multiplicity, stereotyped class, association, aggregation, composition, interface realization, usage dependency.

Book (abstract class)
- ISBN: String[0..1] {id}
- title: String
- summary
- publisher
- publication date
- number of pages
- language

Author
- name: String
- biography: String

1..* ◄ wrote 1..*

«enumeration» AccountState
- Active
- Frozen
- Closed

«entity» Book Item
- barcode: String [0..1] {id}
- tag: RFID [0..1] {id}
- isReferenceOnly

0..12 ◄ borrowed

0..3 ◄ reserved

«entity» Account
- number {id}
- history: History[0..*]
- opened: Date
- state: AccountState

«use»

account

accounts *

Library
- name
- address

1

Patron
- name
- address

records

1

Catalog

«interface» **Search**

«interface» **Manage**

Librarian
- name
- address
- position

«use»

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Objects and their slots

- Anonymous instance of a Customer class

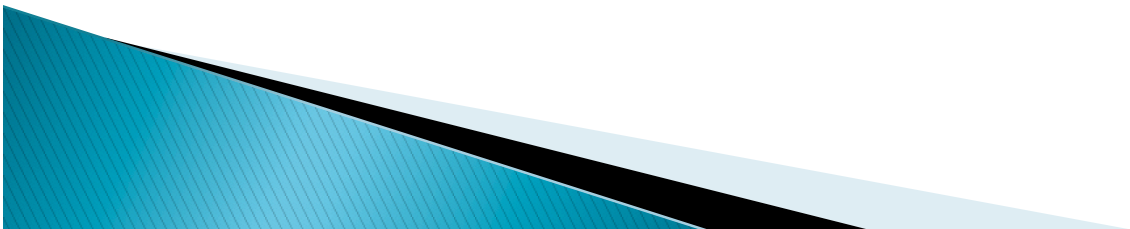| :Customer |
| --- |

- Instance of an unknown/unspecified class

newPatient:

- Instance that has slots with values specified

newPatient: Patient
id: String = "38-545-137" name = John Doe gender: Gender = male

Objects and their links

▸ Link **Wrote** between instance **p** of **Professor** playing **author** role and instance **b** of **Book** in the **textbook** role.

instance specification
log of class Logger

log: Logger

-log

loginCtrl: com.abc.user::LoginController

-attemptLimit: Integer = 5
-lockoutTime: Integer = 30
-loginURI = "/users/sign-in"
-logoutURI = "/users/sign-out"

slots with value
specification

link, non-navigable
backward

-log

«interface» :**UserManager**

- digester: PasswordDigester
-authorizationRules: Rules[7] {unique}

anonymous instance
of UserManager interface

defaultURI: String
"/users/profile"

named instance with
value specification

-cookieMgr

link, navigable
forward

5 {ordered,
unique}

:com.abc.user::**CookieManager**

+cookieMaxAge: Integer = 1814400
+cookieDomain = "abc.com"
-crypto: Cryptograph

+createUserCookie(user: User,
Boolean rememberMe): Cookie

-cookieMgr

collection of 5 unique
anonymous instances
of unknown classifier

slots with value
specification

link