Análisis: Modelo Dominio

Una empresa constructora que mantiene simultáneamente varias obras en ejecución maneja un pool de máquinas comunes que son usadas en las distintas obras. La empresa tiene además un pool de ingenieros que son asignados temporalmente a una obra dada.

Cada una de las máquinas tiene un nombre y un identificador además de otra información asociada: características, costo de operación por hora, horas de uso, horas desde última mantención etc. Una máquina puede ser operada por un cierto número de operadores que la empresa emplea en una modalidad por hora y para cada una de ellas se mantiene una historia con el detalle de las mantenciones que se le han realizado.

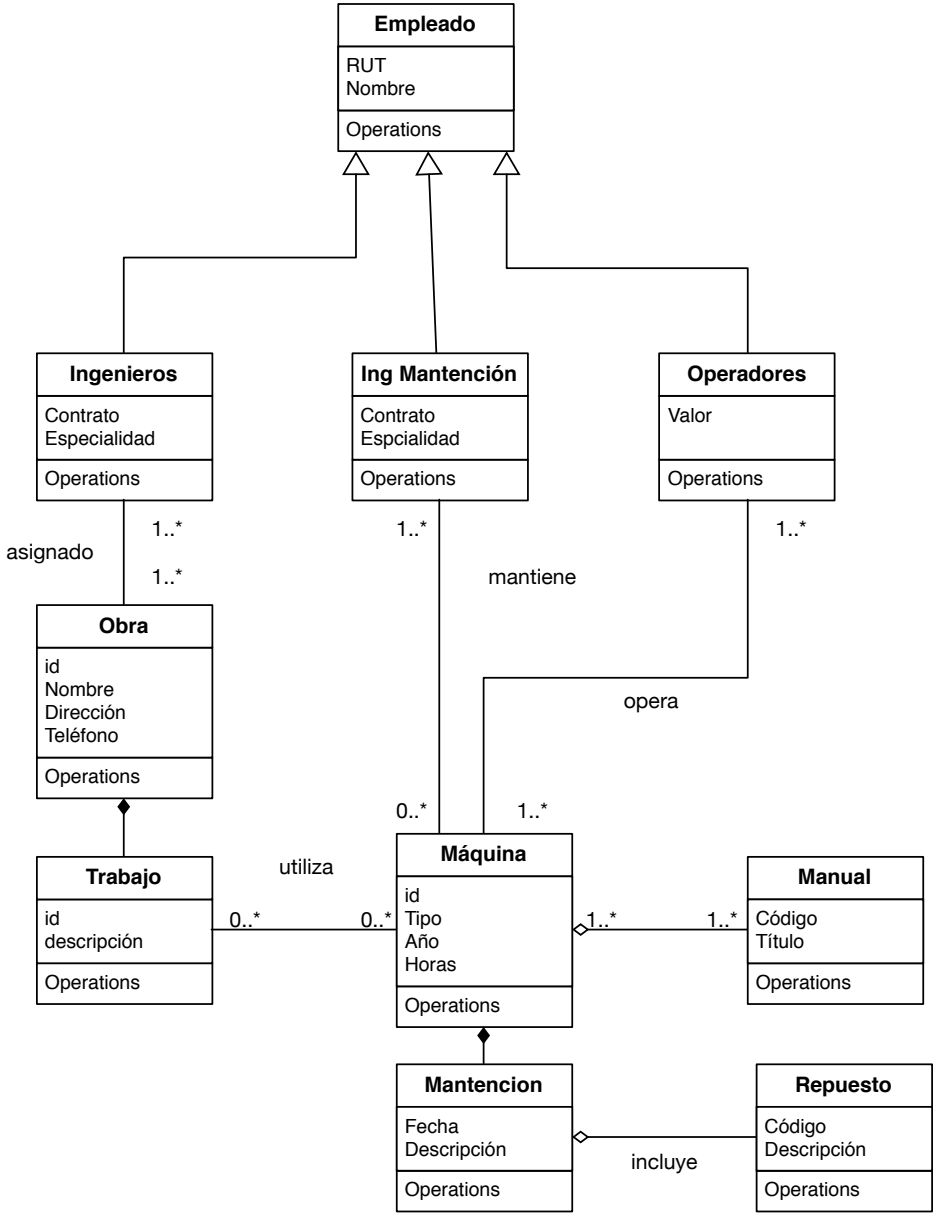
Las mantenciones son realizadas por ingenieros de mantención de la empresa constructora y para realizarlas se apoyan en manuales de servicio asociados a cada máquina (puede haber varios para cada una de ellas). En una mantención puede requerirse un número de repuestos.

Cada obra tiene una planificación (carta gantt) que lista todos los trabajos a realizar. Algunos de ellos tienen asociados la participación de máquinas y otros no. Una máquina puede estar asignada a más de un trabajo, pero siempre en la misma obra.

Cada fin de semana se debe pagar a cada operador de acuerdo al trabajo realizado para lo cual se emite un detalle de cada trabajo realizado en este lapso (obra, fecha, hora inicio, hora término, máquina asociada).

Se pide construir un modelo de dominio para este problema en forma de un diagrama de clases. Incluya en las clases los principales atributos (de dominio). Incluya las decoraciones y cardinalidades en las líneas de asociación

Solución


Empleado
RUT
Nombre
Operations
Ingenieros
Contrato
Especialidad
Operations
Ing Mantención
Contrato
Espcialidad
Operations
Operadores
Valor
Operations
1..*
asignado
1..*
1..*
mantiene
1..*
Obra
id
Nombre
Dirección
Teléfono
Operations
opera
0..*
1..*
Trabajo
id
descripción
Operations
utiliza
0..*
0..*
Máquina
id
Tipo
Año
Horas
Operations
1..*
1..*
Manual
Código
Título
Operations
Mantencion
Fecha
Descripción
Operations
incluye
Repuesto
Código
Descripción
Operations

Del Análisis al Diseño

- La pregunta fundamental en etapa de análisis es ¿qué?
- La pregunta fundamental en etapa de diseño es ¿cómo?

Componentes, Módulos, Clases

- Un diseño debe poder entenderse
- Complejidad hacer necesario descomponer la solución en unidades menores
- Modularidad es clave en lograr ese objetivo
- A menudo se requiere descomposición jerárquica: 5 subsistemas, cada uno con 4 componentes, cada una con una cierta estructura de clases
- Muchas posibles descomposiciones, ¿cual elegir?

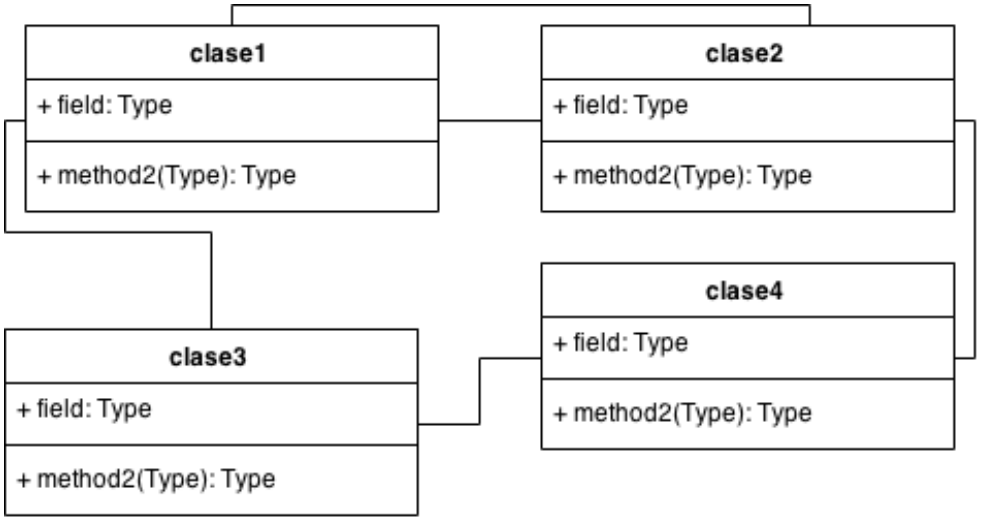
Atributos de un buen diseño

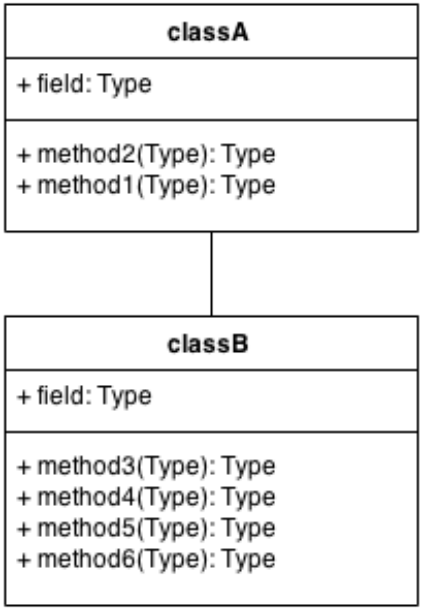
- fácil de entender
- fácil de modificar
- fácil de reutilizar
- fácil de testear
- fácil de integrar
- fácil de programar

Recordar Concepto de Deuda Técnica

- Tienes que agregar una pieza de funcionalidad
  - opción 1 - naive, rápido de implementar
  - opción 2 - diseño mas limpio pero tomará mas tiempo
- Al optar por 1 estamos contrayendo una "deuda técnica"
- Al igual que las deudas financieras se paga mas adelante pero con intereses
- El pago de la deuda va a afectar el desarrollo de nuevas features

¿Cual diseño es mejor ?





Criterio Fundamental:

Buscamos diseños con bajo acoplamiento y alta cohesión

Acoplamiento y Cohesión

Buscamos:

Bajo acoplamiento

+

Alta cohesión

Acoplamiento

- grado de interacción o interdependencia entre unidades
- bajo acoplamiento facilita entender, mantener y testear
- Categorías de mayor (peor) a menor (mejor)
  - acoplamiento por contenido (acceso a datos internos)
  - acoplamiento por variables globales
  - acoplamiento de control (influye en flujo de control del otro)
  - acoplamiento de datos (paso solo de los datos necesarios)

Tipos de Acoplamiento

Level	Type	Description
Good	No Direct Coupling	The methods do not relate to one another; that is, they do not call one another.
	Data	The calling method passes a variable to the called method. If the variable is composite (i.e., an object), the entire object is used by the called method to perform its function.
	Stamp	The calling method passes a composite variable (i.e., an object) to the called method, but the called method only uses a portion of the object to perform its function.
	Control	The calling method passes a control variable whose value will control the execution of the called method.
	Common or Global	The methods refer to a "global data area" that is outside the individual objects.
Bad	Content or Pathological	A method of one object refers to the inside (hidden parts) of another object. This violates the principles of encapsulation and information hiding. However, C++ allows this to take place through the use of "friends."

Source: These types were adapted from Meilir Page-Jones, *The Practical Guide to Structured Systems Design,* 2nd ed. (Englewood Cliffs, NJ: Yardon Press, 1988); and Glenford Myers, *Composite/Structured Design* (New York: Van Nostrand Reinhold, 1978).

Cohesión

- Merriam-Webster define cohesion como *"the act or state of sticking together tightly"* , es decir el grado en que los elementos de una unidad están relacionados entre sí
- Una clase enfocada en una sola cosa es más fácil de entender, mantener y testear
- Categorías de cohesión de menor (peor) a mayor (mejor)
  - coincidencial
  - lógica
  - temporal
  - procedural
  - comunicacional
  - secuencial
  - funcional

Tipos de Cohesión

Level	Type	Description
Good	Functional	A method performs a single problem-related task (e.g., calculate current GPA).
	Sequential	The method combines two functions in which the output from the first one is used as the input to the second one (e.g., format and validate current GPA).
	Communicational	The method combines two functions that use the same attributes to execute (e.g., calculate current and cumulative GPA).
	Procedural	The method supports multiple weakly related functions. For example, the method could calculate student GPA, print student record, calculate cumulative GPA, and print cumulative GPA.
	Temporal or Classical	The method supports multiple related functions in time (e.g., initialize all attributes).
	Logical	The method supports multiple related functions, but the choice of the specific function is chosen based on a control variable that is passed into the method. For example, the called method could open a checking account, open a savings account, or calculate a loan, depending on the message that is send by its calling method.
Bad	Coincidental	The purpose of the method cannot be defined or it performs multiple functions that are unrelated to one another. For example, the method could update customer records, calculate loan payments, print exception reports, and analyze competitor pricing structure.

Source: These types were adapted from Page-Jones, *The Practical Guide to Structured Systems*, and Myers, *Composite/Structured Design*.

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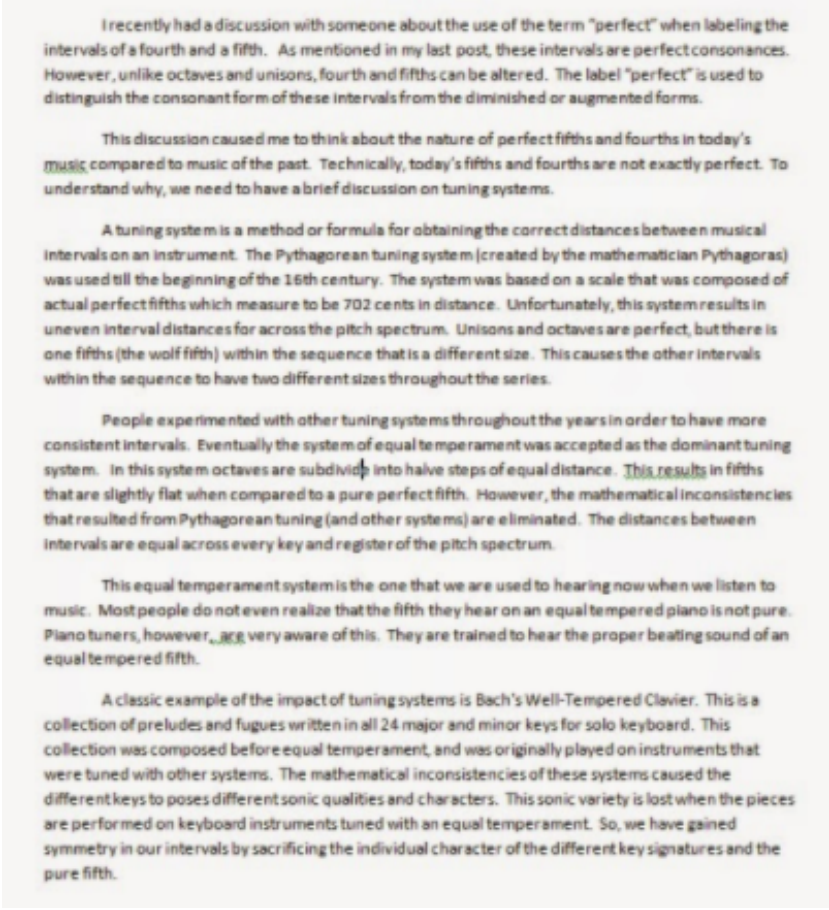
Cohesión y acoplamiento en un tren

- Carros acoplados mediante interfaz simple y pequeña
- Separación en carros permite separar contenidos cohesionados

En la literatura también

- Se buscan párrafos de alta cohesión y poco acoplamiento entre ellos



I recently had a discussion with someone about the use of the term "perfect" when labeling the intervals of a fourth and a fifth. As mentioned in my last post, these intervals are perfect consonances. However, unlike octaves and unisons, fourth and fifths can be altered. The label "perfect" is used to distinguish the consonant form of these intervals from the diminished or augmented forms.

This discussion caused me to think about the nature of perfect fifths and fourths in today's music compared to music of the past. Technically, today's fifths and fourths are not exactly perfect. To understand why, we need to have a brief discussion on tuning systems.

A tuning system is a method or formula for obtaining the correct distances between musical intervals on an instrument. The Pythagorean tuning system (created by the mathematician Pythagoras) was used till the beginning of the 16th century. The system was based on a scale that was composed of actual perfect fifths which measure to be 702 cents in distance. Unfortunately, this system results in uneven interval distances for across the pitch spectrum. Unisons and octaves are perfect, but there is one fifths (the wolf fifth) within the sequence that is a different size. This causes the other intervals within the sequence to have two different sizes throughout the series.

People experimented with other tuning systems throughout the years in order to have more consistent intervals. Eventually the system of equal temperament was accepted as the dominant tuning system. In this system octaves are subdivide into halve steps of equal distance. This results in fifths that are slightly flat when compared to a pure perfect fifth. However, the mathematical inconsistencies that resulted from Pythagorean tuning (and other systems) are eliminated. The distances between intervals are equal across every key and register of the pitch spectrum.

This equal temperament system is the one that we are used to hearing now when we listen to music. Most people do not even realize that the fifth they hear on an equal tempered piano is not pure. Piano tuners, however, are very aware of this. They are trained to hear the proper beating sound of an equal tempered fifth.

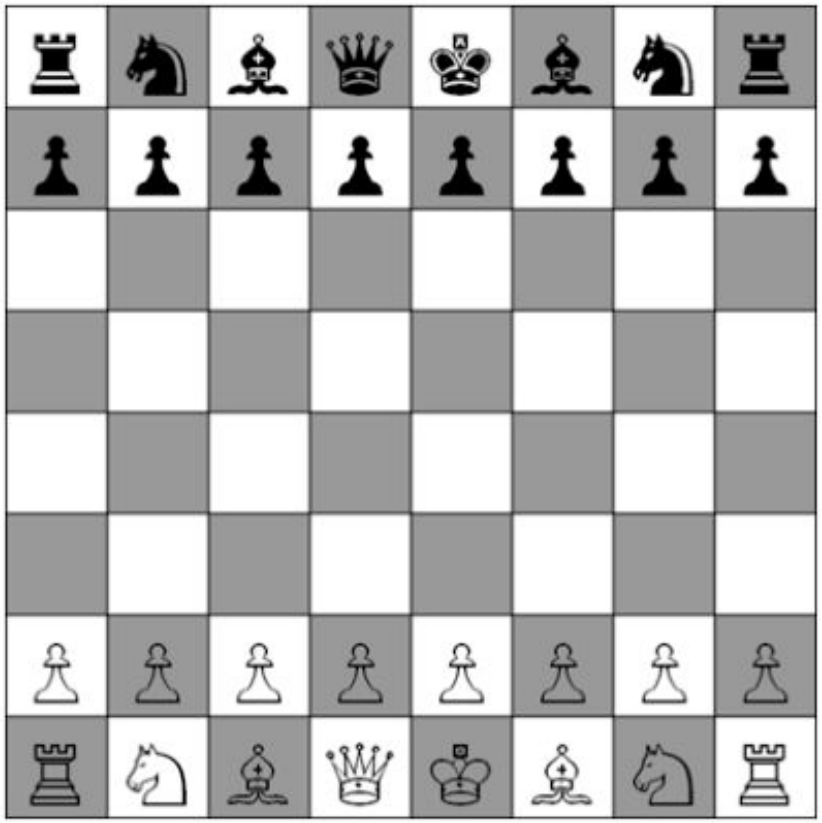
A classic example of the impact of tuning systems is Bach's Well-Tempered Clavier. This is a collection of preludes and fugues written in all 24 major and minor keys for solo keyboard. This collection was composed before equal temperament, and was originally played on instruments that were tuned with other systems. The mathematical inconsistencies of these systems caused the different keys to poses different sonic qualities and characters. This sonic variety is lost when the pieces are performed on keyboard instruments tuned with an equal temperament. So, we have gained symmetry in our intervals by sacrificing the individual character of the different key signatures and the pure fifth.

Por qué alta cohesión y bajo acoplamiento

- interfaces simples
- comunicación simple
- cambios afectan a sectores limitados del código
- aumenta la reusabilidad
- aumenta la extensibilidad

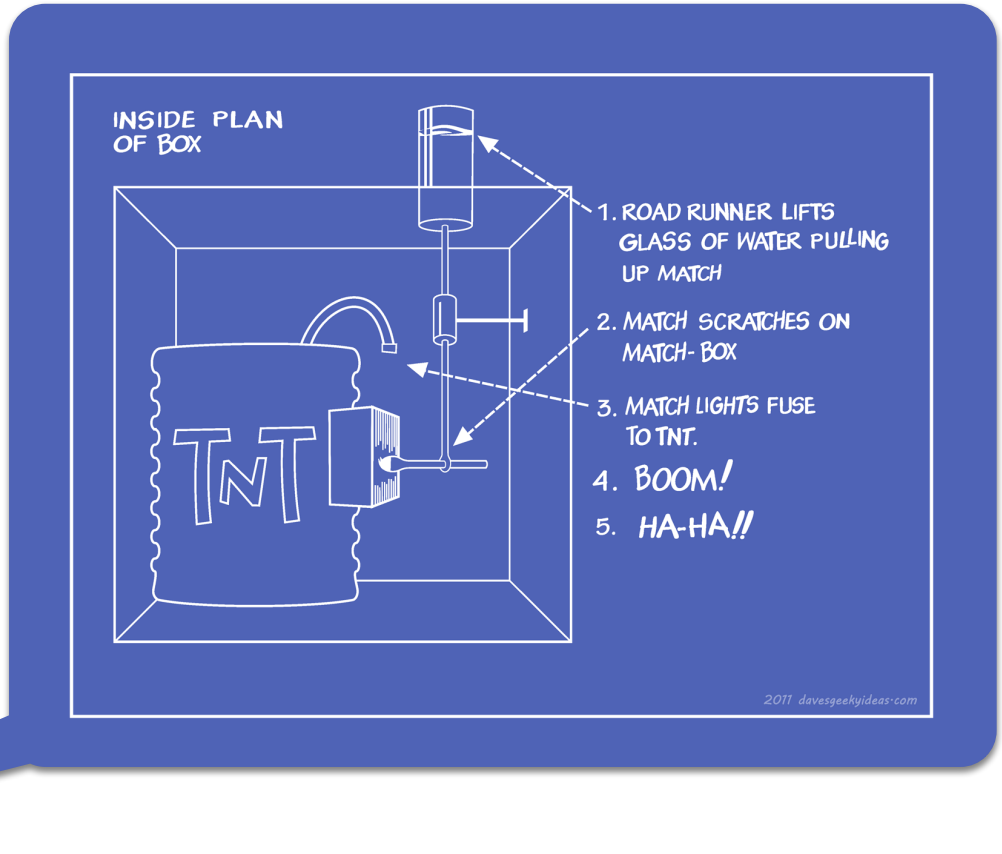
Ejercicio

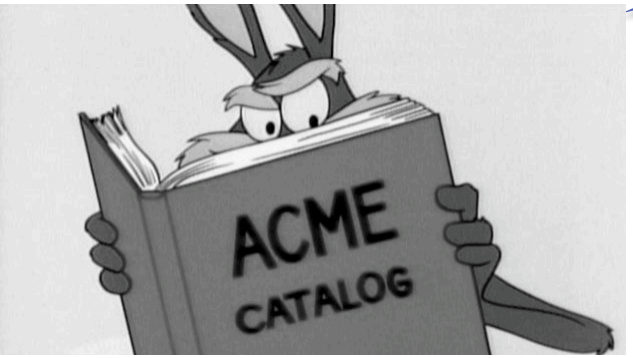
- Modelar mediante diagrar
  programa para jugar ajed
- Identificar principales clas
- Principales atributos
- Algunos métodos



Lenguaje de Modelación Unificado (UML)

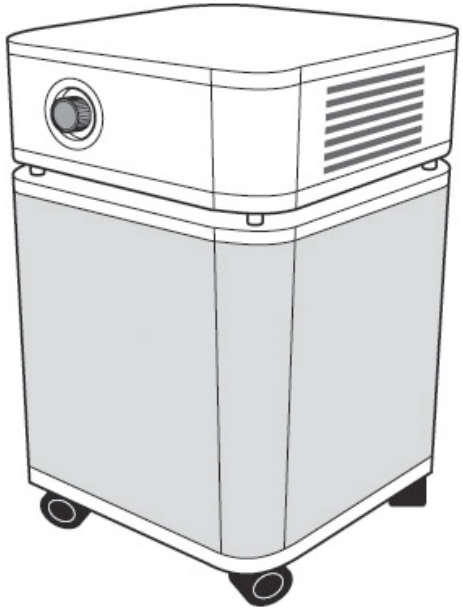
- Actividad de diseño se favorece al trabajar con un lenguaje gráfico de alto nivel



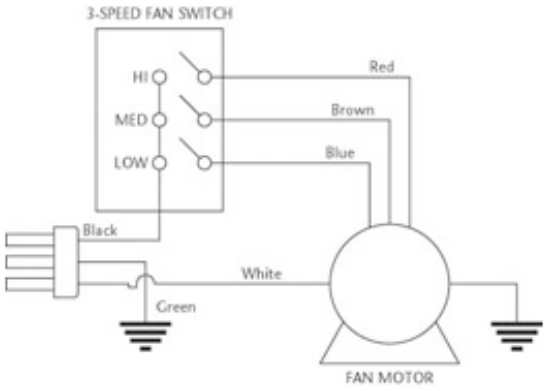


UML es un lenguaje visual para describir artefactos de software

artefacto



lenguaje visual

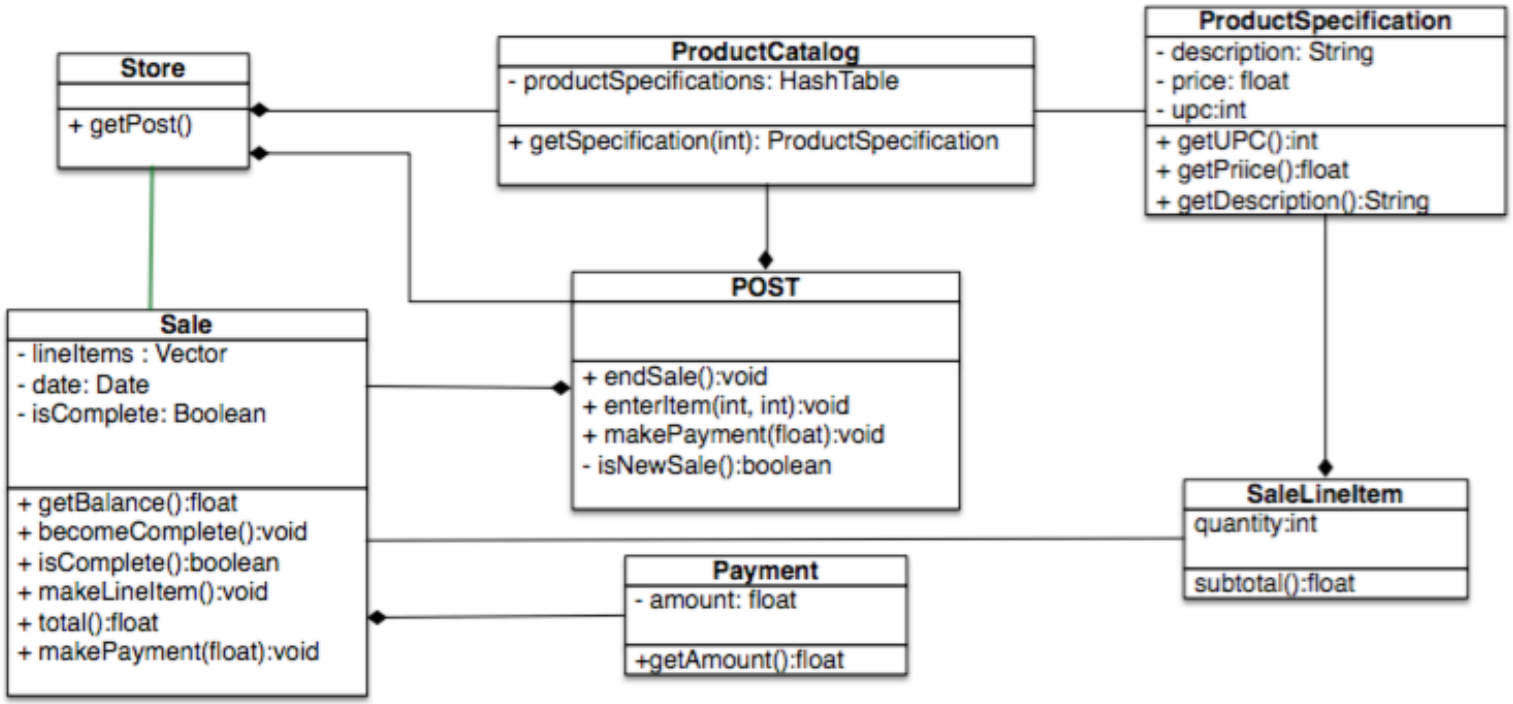


```
public class Payment {
        private float amount;
        public Payment (float cashTendered){this.amount = cashTendered;}
        public float getAmount() { return amount; }
}

public class ProductCatalog{
        private HashTable productSpecifications = new Hashtable();
        public ProductCatalog(){
            ProductSpecification  ps = new ProductSpecification(100, 1, "product 1");
            productSpecifications.put (new Integer(100), ps);
            ps = new ProductSpecification(200, 1, "product 2");
            productSpecifications.put (new Integer(200), ps);
        }

        public ProductSpecification getSpecification (int upc){
            return (ProductSpecification)productSpecifications.get(new Integer(upc));
        }
}

class POST {
        private ProductCatalog  productCatalog;
        private Sale sale;
        public POST(ProductCatalog   catalog){productCatalog   = catalog;}
        public void endSale() {sale.becomeComplete();}
        public void enterItem(int upc, int quantity){
                if (isNewSale() ) sale = new Sale();
                ProductSpecification spec = productCatalog.specification(upc);
                sale.makeLineItem(spec, quantity);
        }
        public void makePayment(float cashTendered){
                sale.makePayment(cashTendered);
        }
        private boolean isNewSale(){return (sale == null) ||(sale.isComplete() );}
}

public class ProductSpecification{
        private int upc = 0;
        private float price = 0;
        private String descripction = "";
        public ProductSpecification(int upc, float price, String descripction){
                this.upc = upc;
                this.price = price;
                this.description = description;
        }
        public int getUPC {return upc; }
        public float getPrice() {return price; }
        public String getDescription() {return description; }
}
```

```
class Sale {
        private Vector lineItems = new Vector();
        private Date date = new Date();
        private boolean isComplete = false;
        private Payment payment;
        public float getBalance () {return payment.getAmount() - total(); }
        public void becomeComplete() {isComplete = true; }
        public boolean isComplete() {return isComplete; }
        public void makeLineItem(ProductSpecification spec, int quantity) {
                lineItems.addElement(new SaleLineItem(spec, quantity));
        }
        public float total(){
                float total = 0;
                Enumeration  e = lineItems.elements();
                while(e.hasMoreElements() ) {
                        total += ( (SaleItem) e.nextElement() ).sbtotal();
                }
                return total;
        }
        public void makePayment (float cashTendered) {
                payment = new Payment (cashTendered);
        }
}

class SaleLineItem{
        private int quantity;
        private ProductSpecification productSpec;
        public SaleLineItem (ProductSpeecification spec, int quantity) {
                this.productSpec = spec;
                this.quantity = quantity;
        }
        public float subtotal() { return quantity* productSpec.getPrice(); }
}

class Store {
        private ProductCatalog productCatalog = new ProductCatalog();
        private POST post = new POST (productCatalog);
        public POST getPOST() {return post; }
}
```

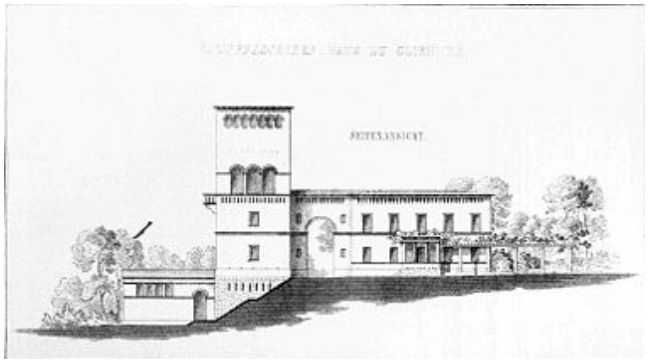
Artefacto

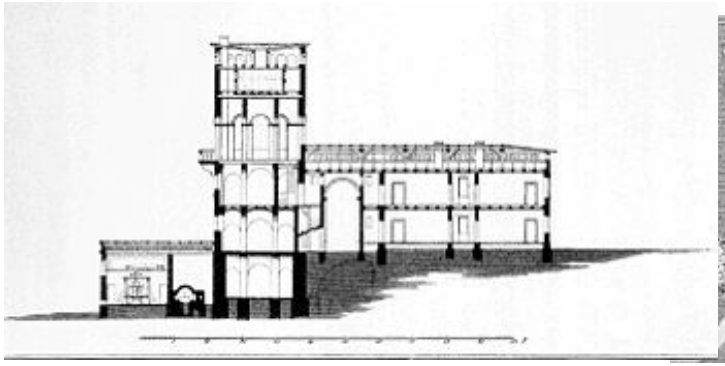
Representación Visual del Artefacto

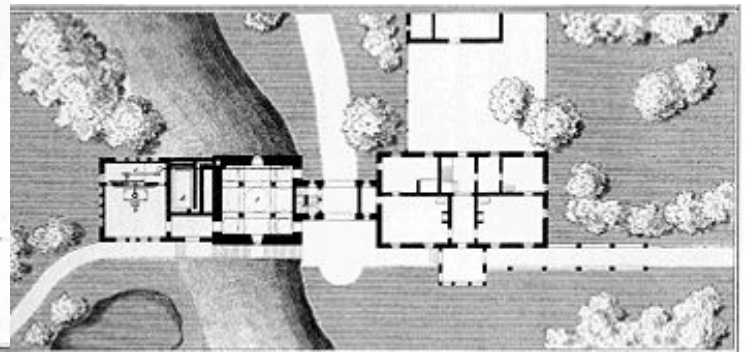


Hay mas de 10 tipos de diagramas

- Análogamente que en arquitectura se requieren distintas vistas

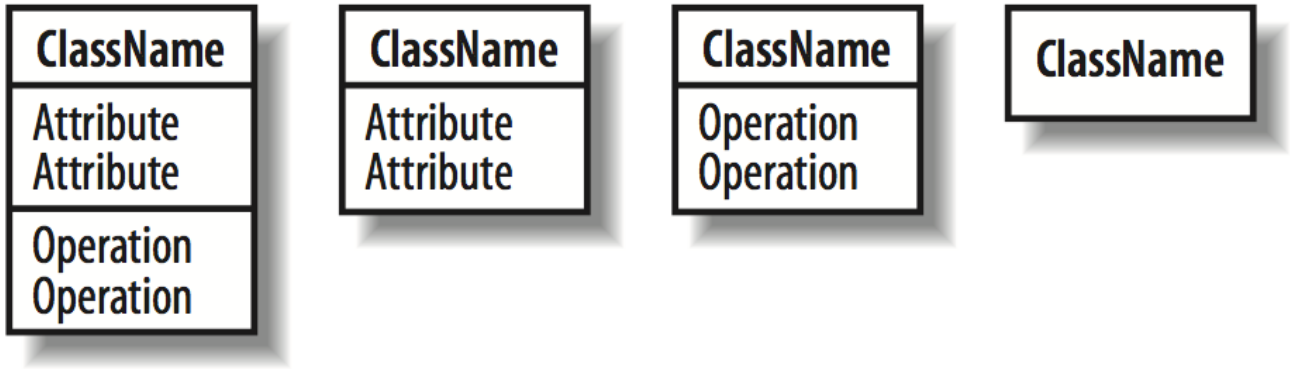




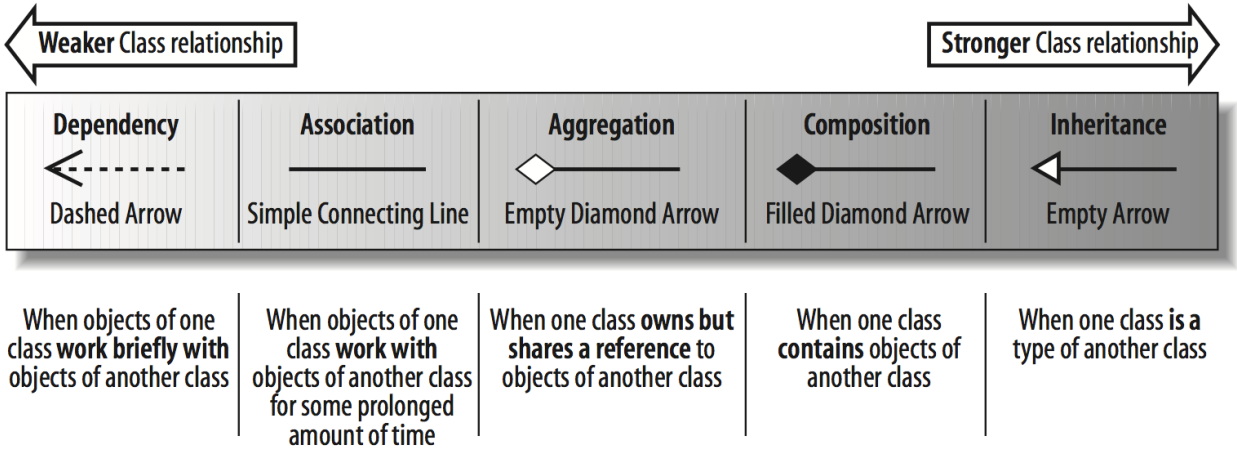


Estructura : El diagrama de clases

- Rectángulos para las clases
  - nombre
  - atributos
  - métodos



- Líneas representan asociaciones entre clases (adornos para indicar asociaciones especiales)

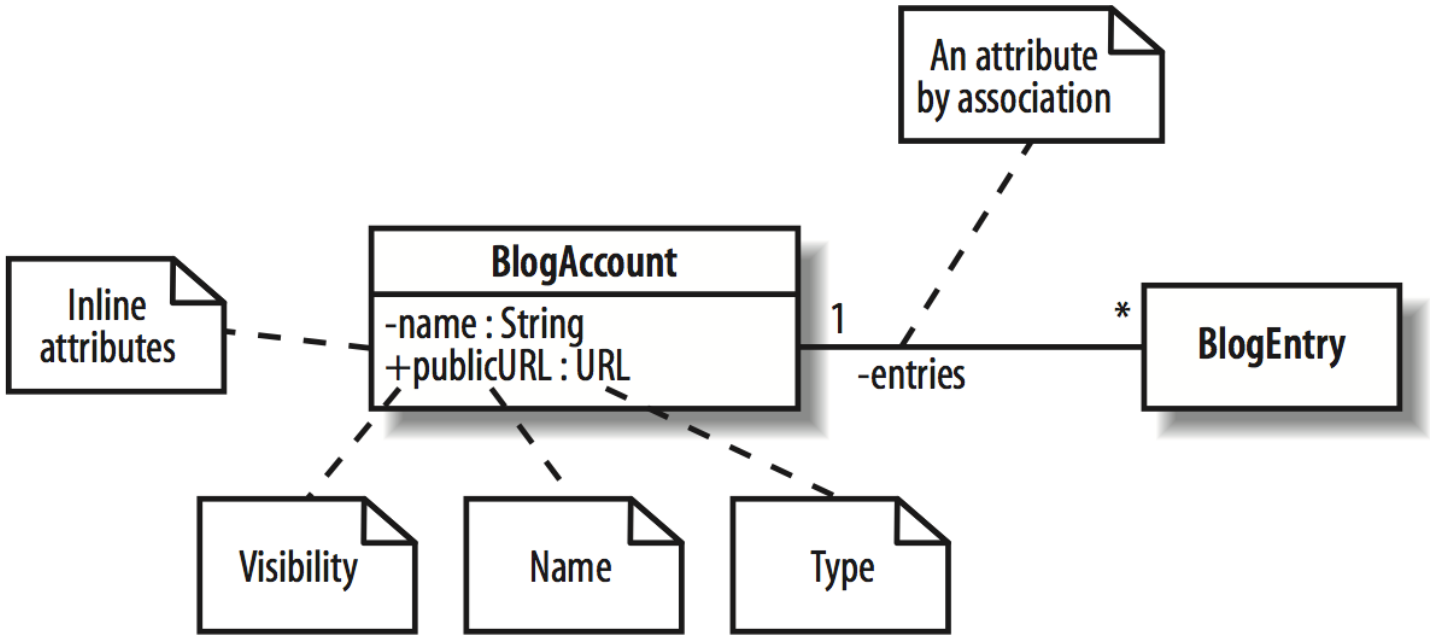


Visibilidad

- Qué partes de una clase son visibles para instancias de otras clases (encapsulación)
- Hay cuatro tipos de visibilidad
  - público (+) accesible a todos
  - protegido (#) accesible solamente a descendientes
  - privado (-) solo para uso interno
  - package (~) accesible a clases del mismo package

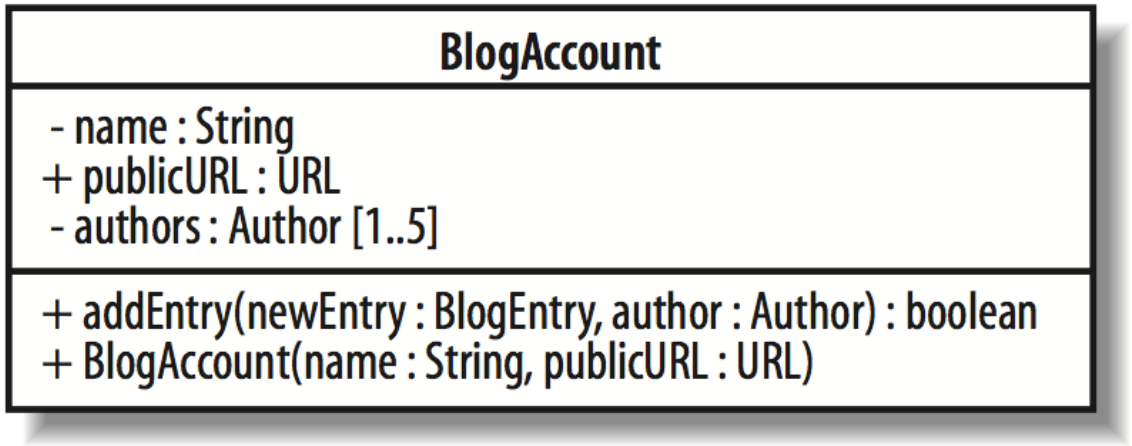
Atributos

- Nombre y tipo
- Si es estático se subraya
- Generalmente en el rectángulo
- Puede también ponerse como asociado



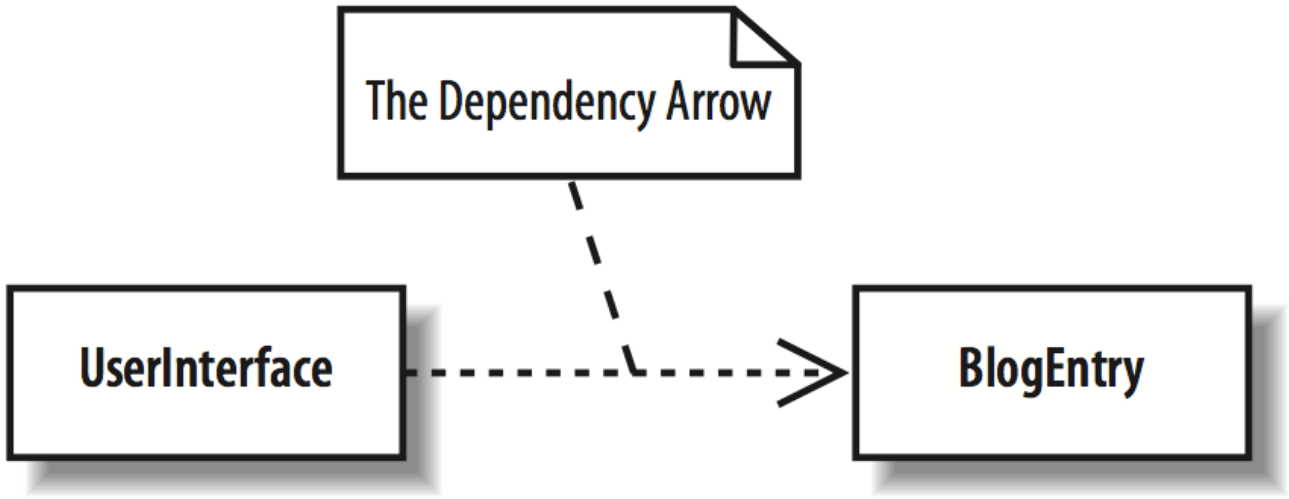
Operaciones

- Nombre
- Parámetros
- Retorno



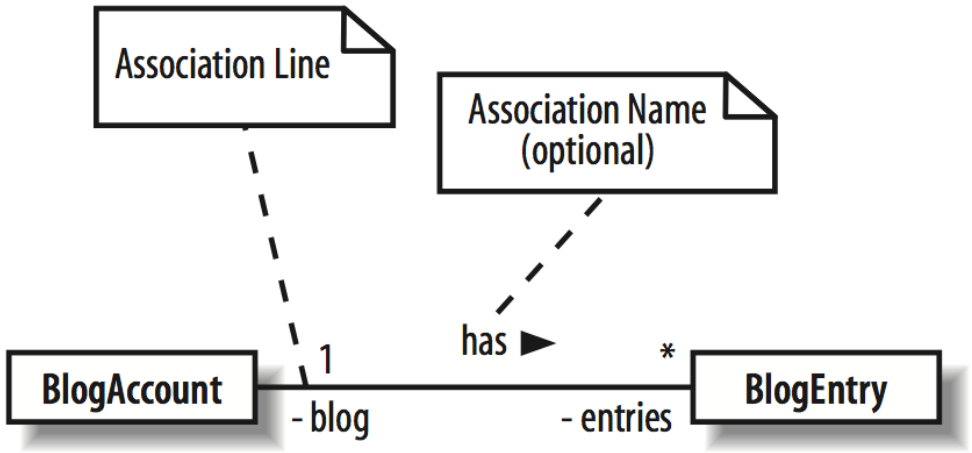
Asociaciones : Dependencia

- Una clase necesita usar objetos de otra clase

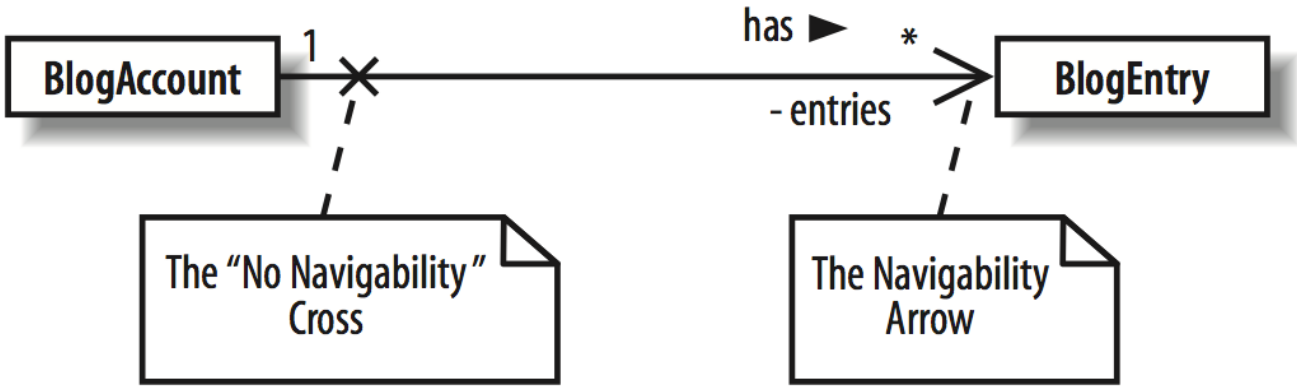


Asociaciones: Asociación

- Una clase contiene una referencia a objeto de otra clase en un atributo



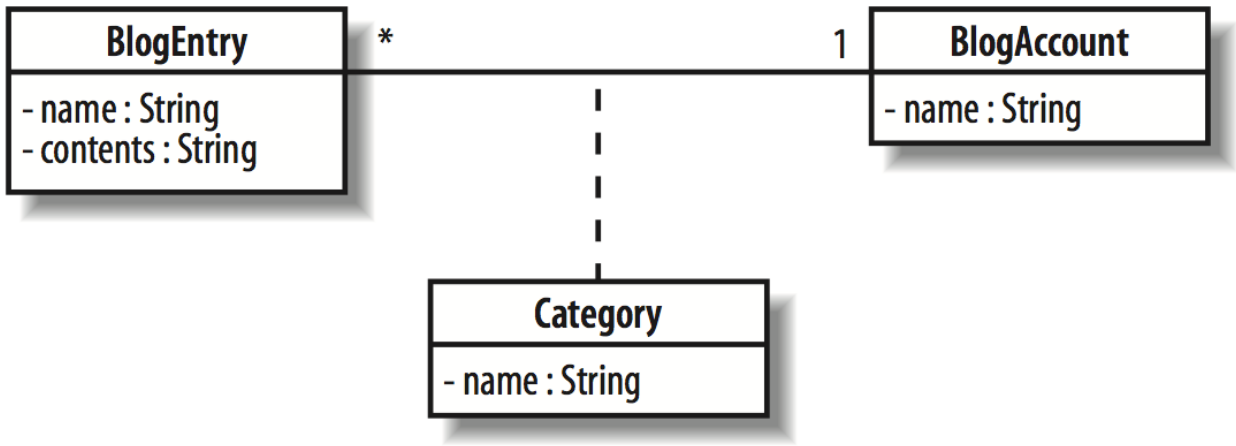
- Puede agregarse flecha para indicar dirección de navegabilidad



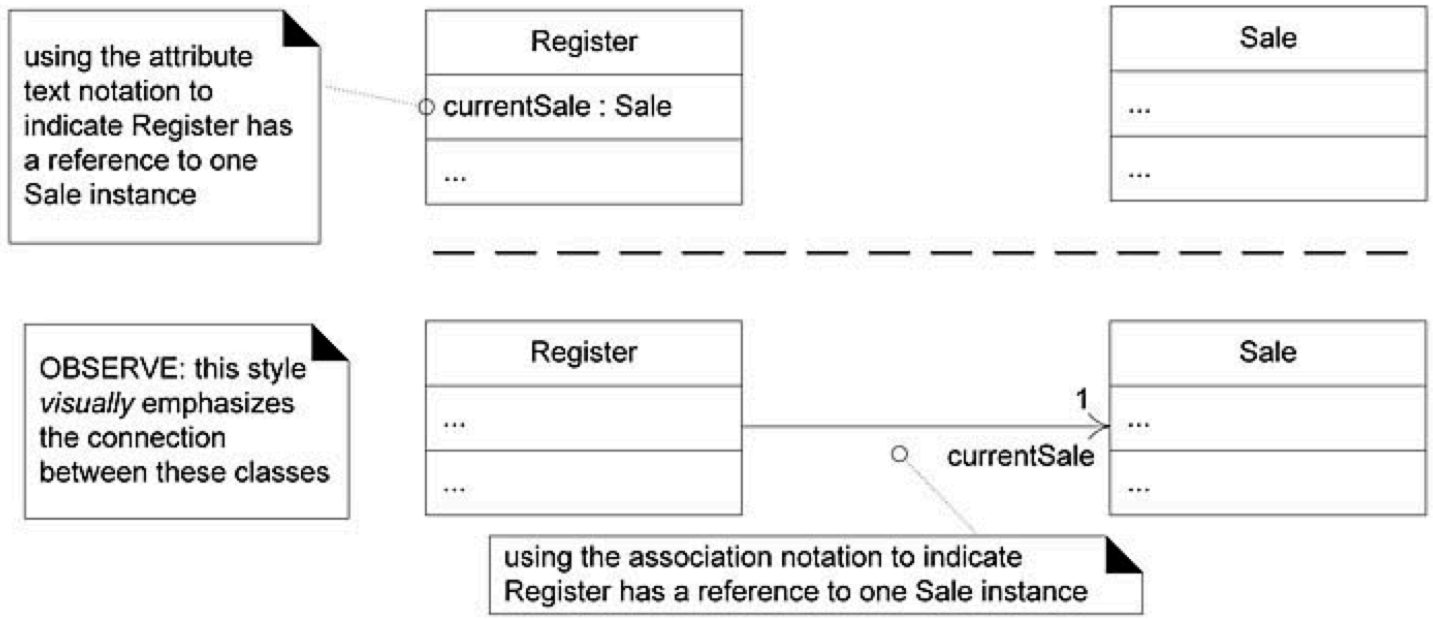
Clase de Asociación

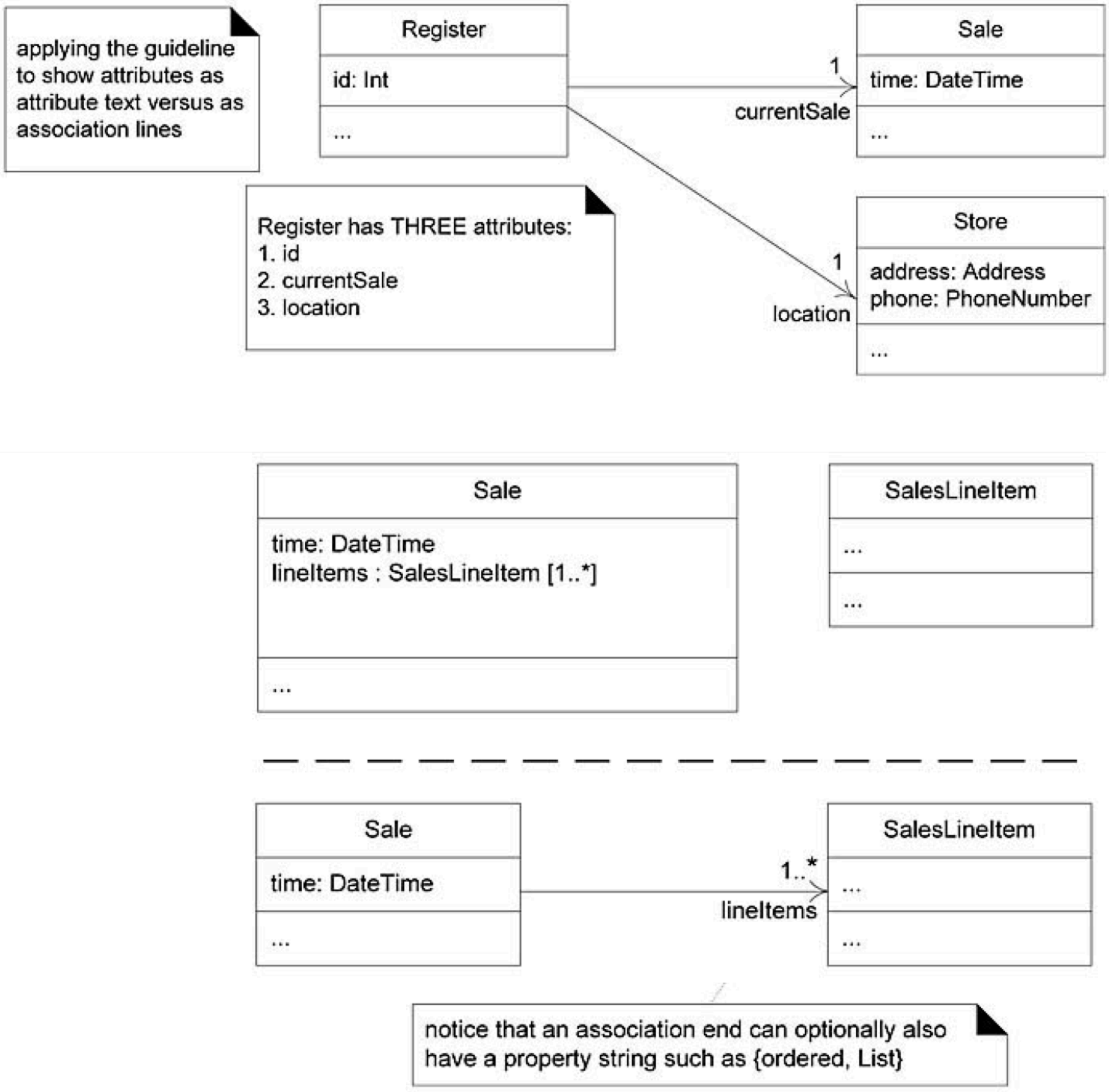
- A veces la asociación misma es compleja y puede tener atributos

```
public class BlogAccount {
   private String name;
   private Category[] categories
   private BlogEntry[] entries;
}

public class Category {
   private String name;
}

public class BlogEntry {
   private String name;
   private Category[] categories
}
```



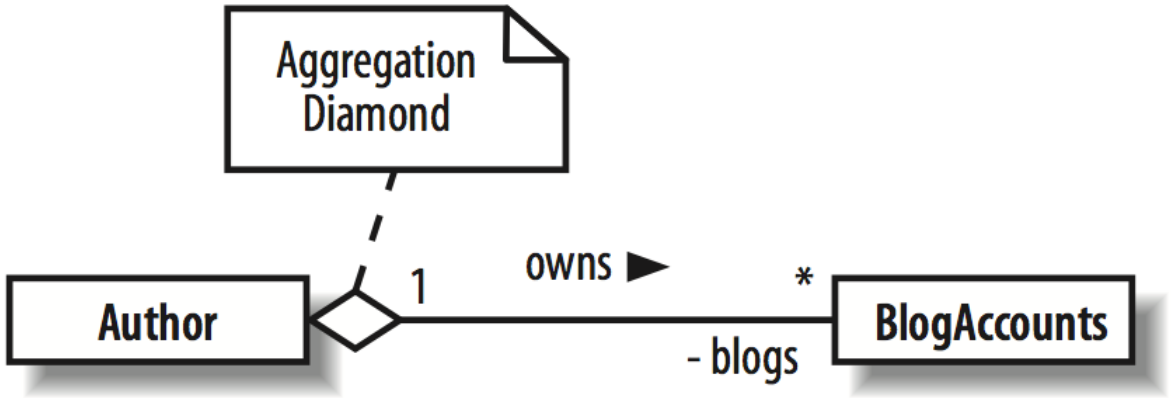
Atributos vs Asociaciones




applying the guideline to show attributes as attribute text versus as association lines
Register
id: Int
...
1
currentSale
Sale
time: DateTime
...
Register has THREE attributes:
1. id
2. currentSale
3. location
1
location
Store
address: Address
phone: PhoneNumber
...
Sale
time: DateTime
lineItems : SalesLineItem [1..*]
...
SalesLineItem
...
...
Sale
time: DateTime
...
1..*
lineItems
SalesLineItem
...
...
notice that an association end can optionally also have a property string such as {ordered, List}

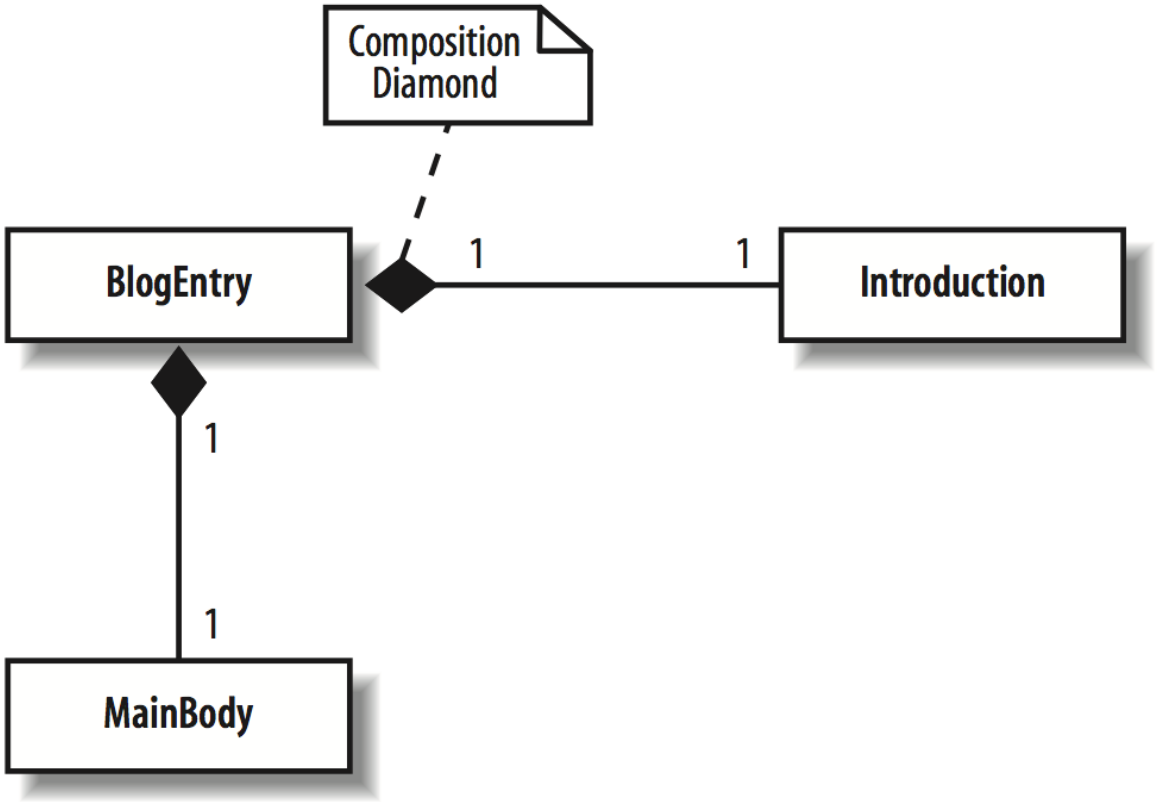
Asociaciones: Agregación

- Un poco mas fuerte que simple asociación
- Una clase es dueña de objetos de otras clase (aunque puede compartirlos)



Asociaciones: Composición

- Asociación aún más fuerte
- Una clase es dueña en forma exclusiva o contiene objetos de otra clase



Agregación vs Composición

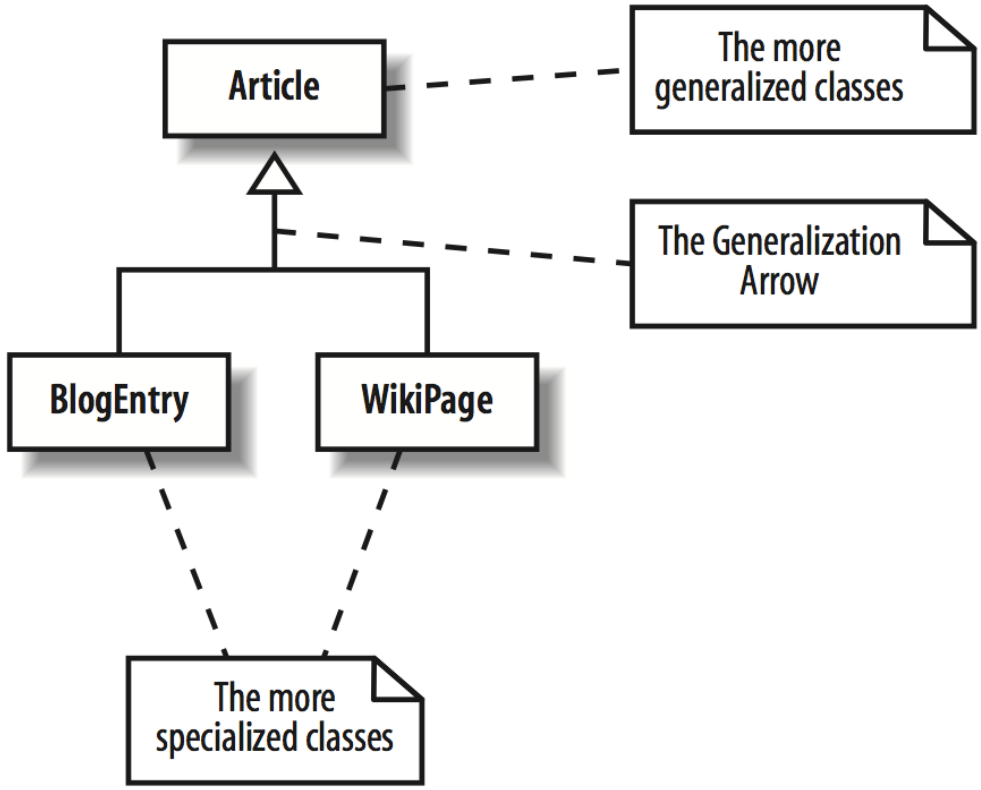
	Asociación	
	Agregación	**Composición**
Vida	propia	la del dueño
Relación	tiene	es parte de
Ejemplo	Auto tiene Conductor	Motor es parte de Auto

Ejemplos

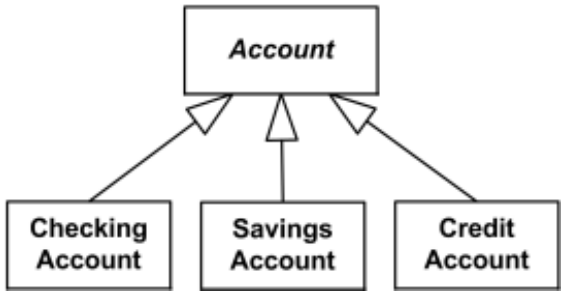
- Asociación
  - Estudiante - Profesor
- Agregación
  - Profesor - Departamento
- Composición
  - Escuela - Sala

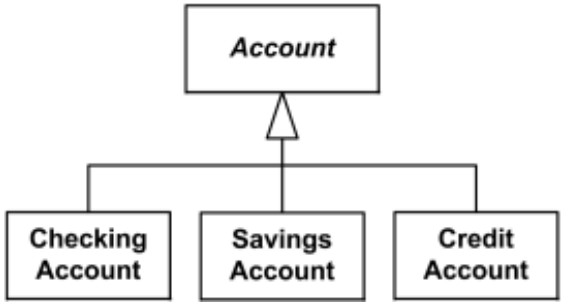
Asociaciones: Generalización

- tambien se le suele llamar (incorrectamente) “herencia”
- agregación y composición obedece a relación “has a”
- generalización es mas bien “is a” o “is a type of a “



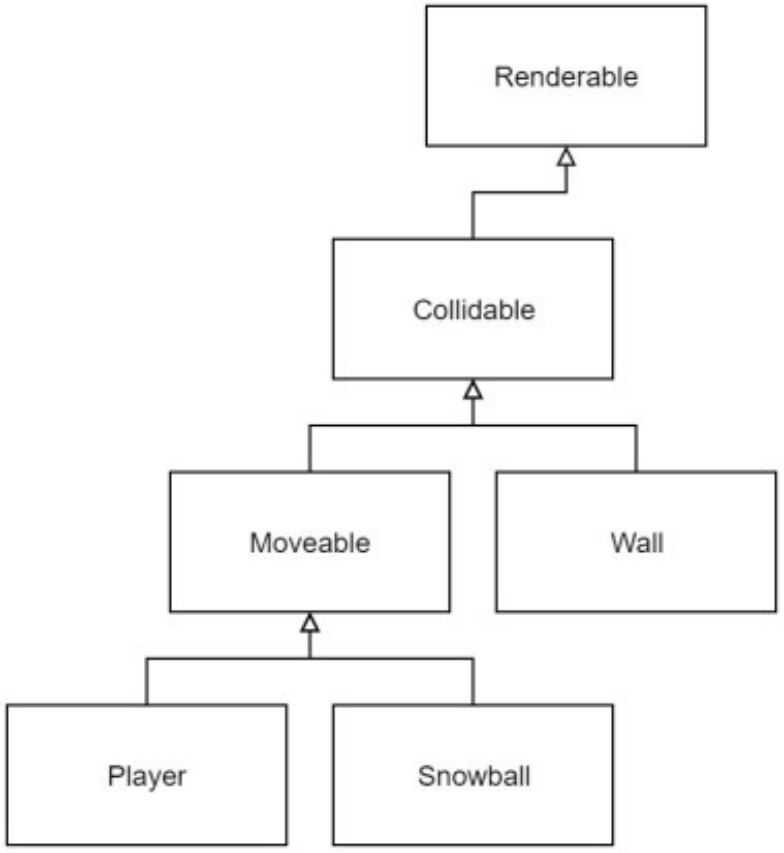
Simplificación en Diagramas





Recomendaciones

- Usar solo cuando hay una clara relación de tipo-subtipo (is-a)
- No usar cuando lo que se busca es reusar código
- Evitar largas jerarquías

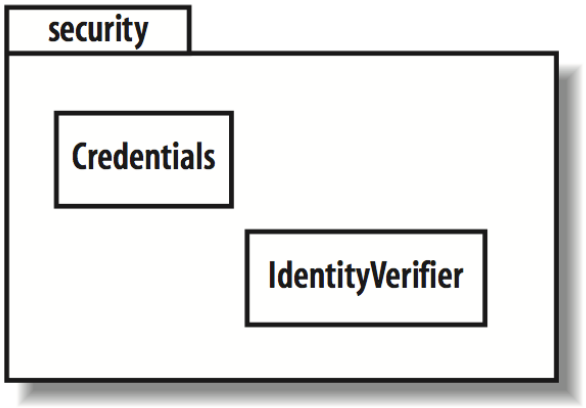


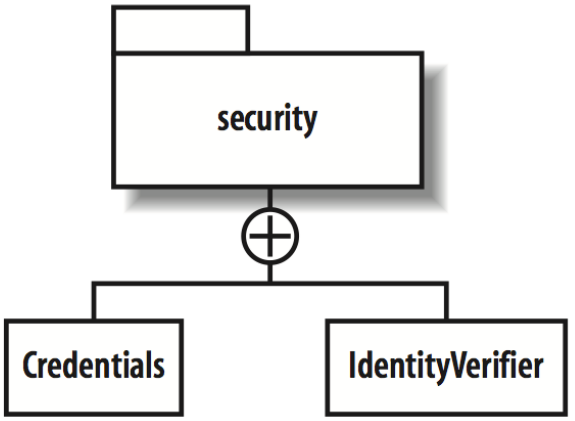
Packages

- Una forma de agrupación de elementos
- Se usa principalmente para clases pero puede usarse para agrupar otros elementos también
- Ejemplo

```
package security;
public class Credentials {
    ...
```

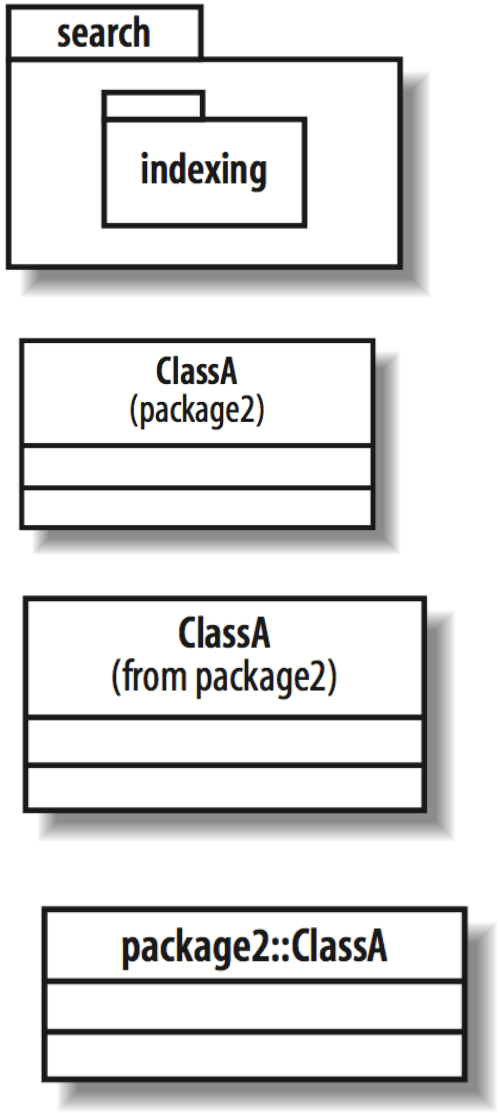
- Clases pueden dibujarse dentro o fuera del package …



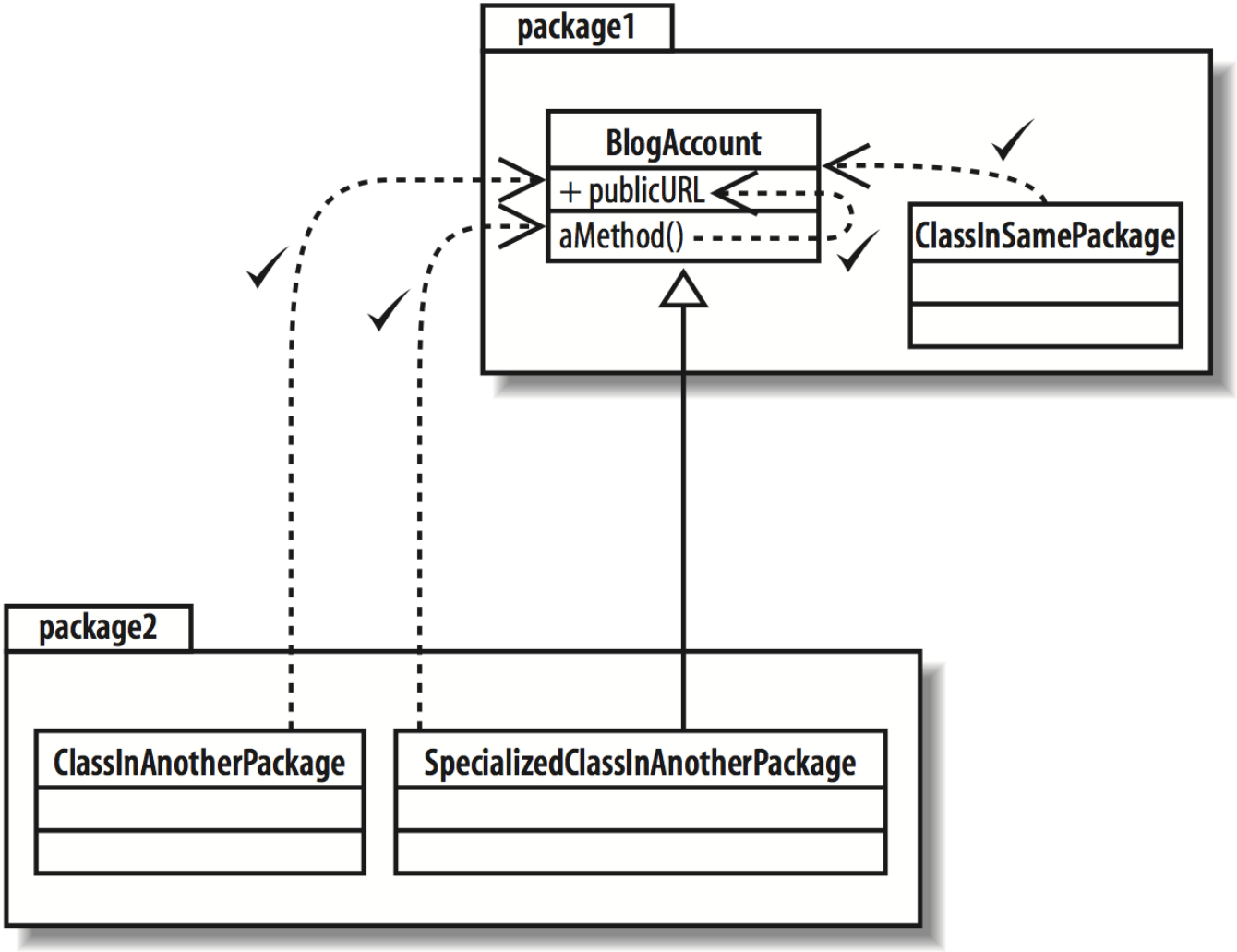


más sobre packages

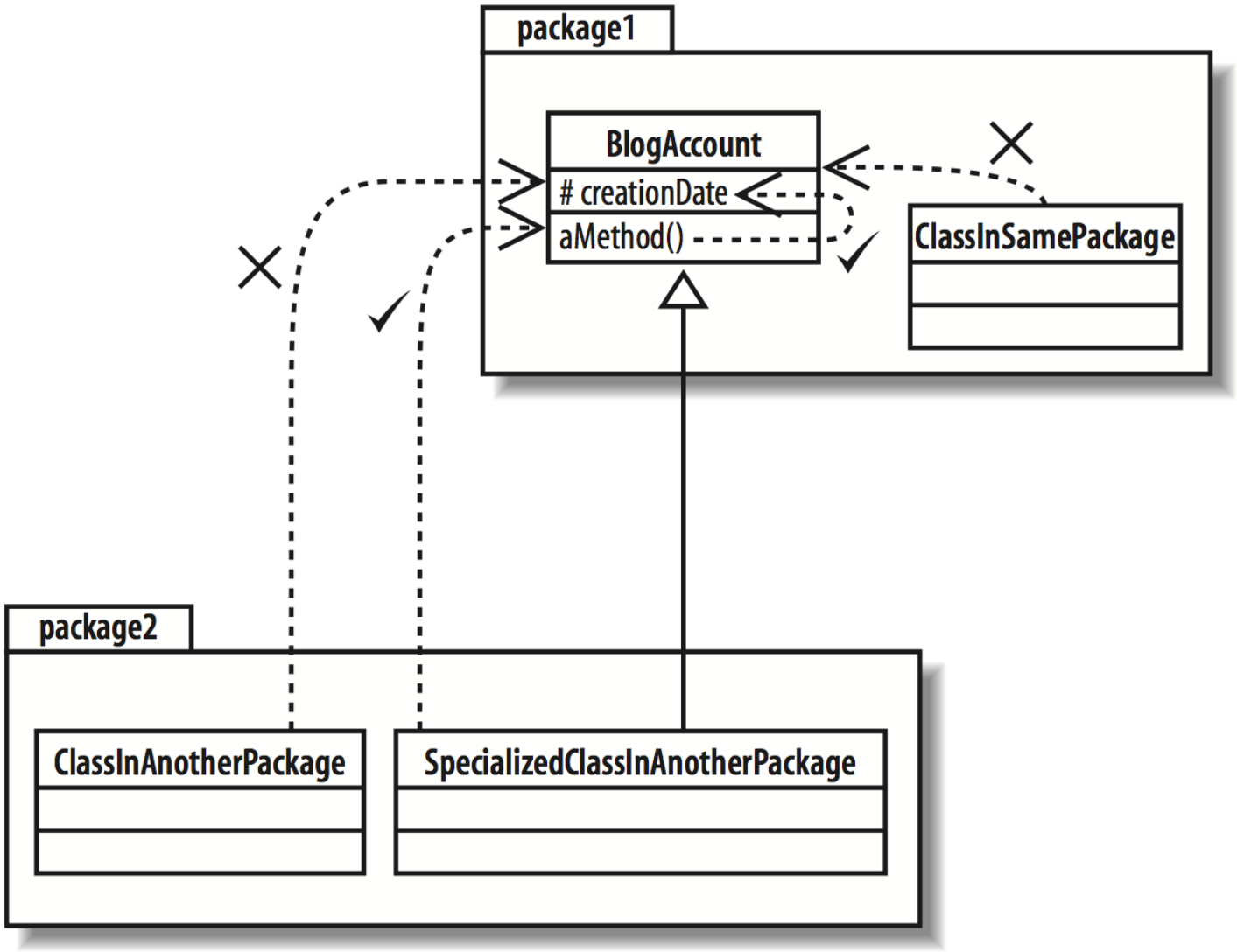
- pueden anidarse
- puede haber indicación del package en el nombre
- package proporciona espacio de nombres



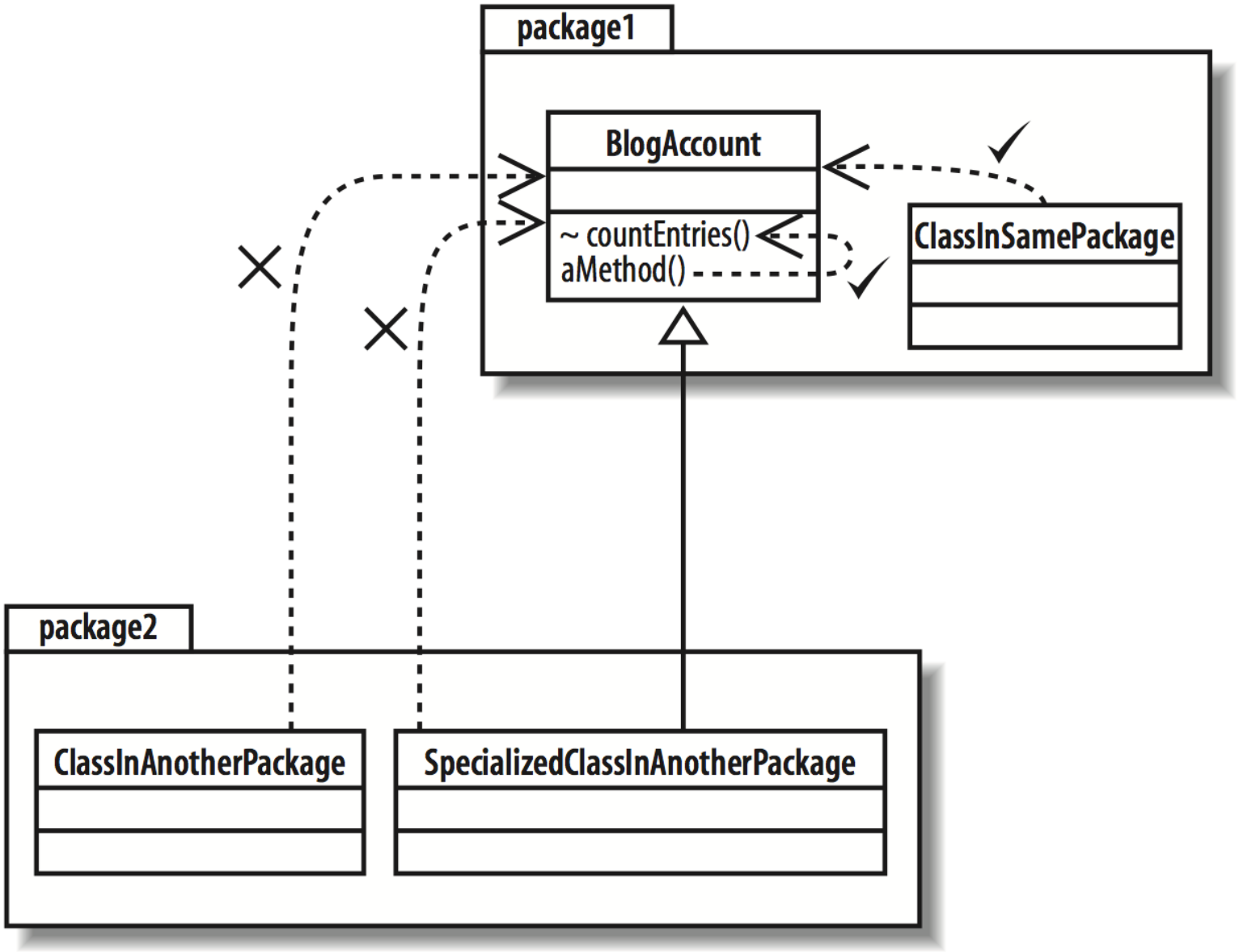
Visibilidad Pública



Visibilidad Protegida



Visibilidad de Package



Visibilidad Privada