From **Software Architecture** to **N-tiers Architectures**

Philippe Collet - with 100% Slides from Sébastien Mosser

Lecture #1.2, 07.02.2020

pictures: sxc.hu

Software Architecture **Definition**

> “The **structure** of the system, which comprise **software elements**, externally **visible properties** of those elements, and the **relationships** among them.

[SAiP]

Architecture versus Design?

Architecture is a subset of design

"External" design

Software Architecture **Objectives**

- It has the **functionality** required by the customer
- It is safely buildable on the **required schedule**
- It **performs adequately**
- It is **reliable**
- It is **usable** and **safe to use**

De la presquitude des choses.

[Plonk et replonk]

thanks to Clémentine Némo for the reference

Software Architecture **Concerns**

Producibility

Functionality

Changeability

Security

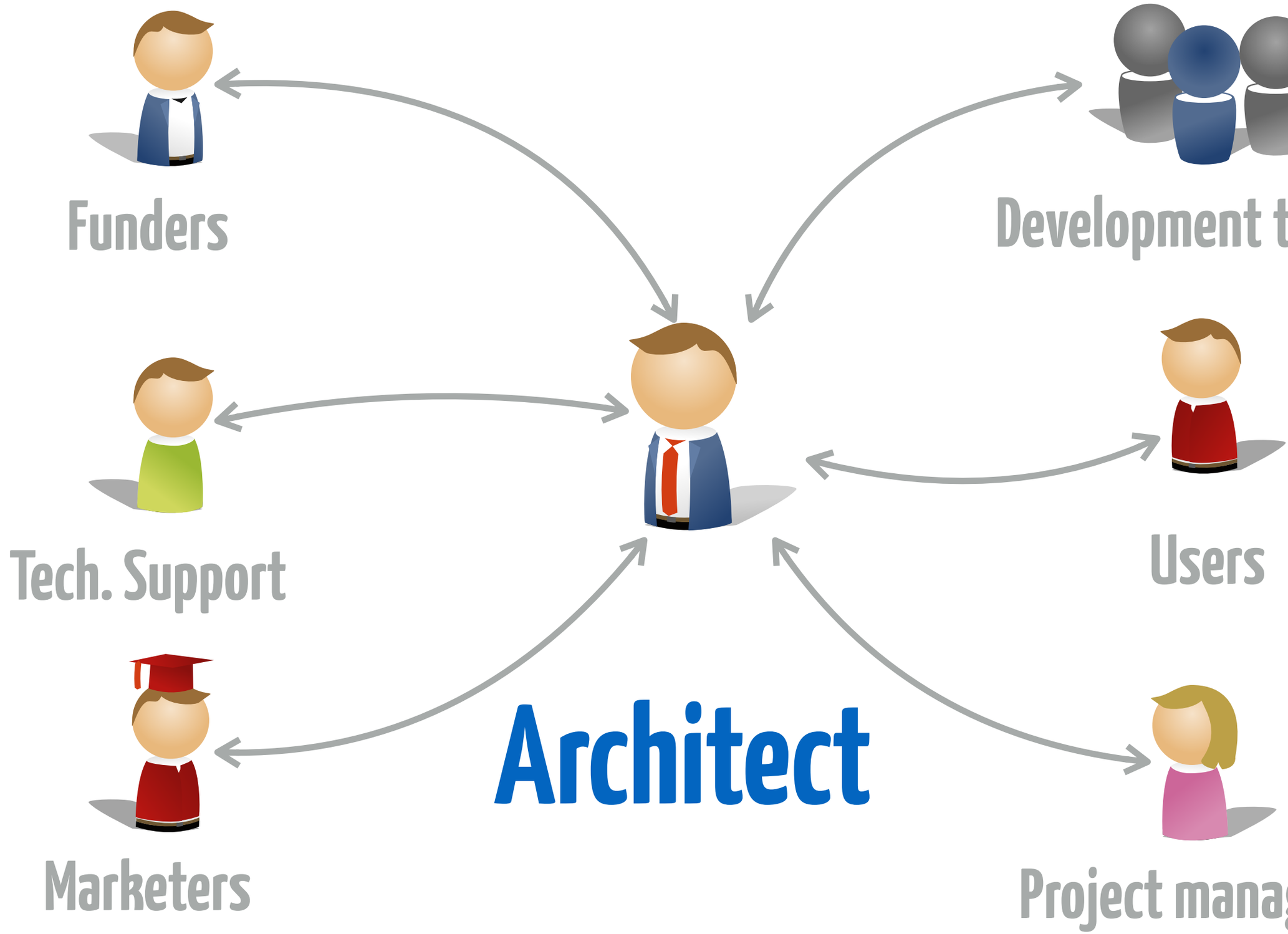
Modularity

Performance

Ecosystem

Buildability

The Architect **Ecosystem**



Expect the unexpected!

> “Parameters that were **never** going to **change** now need to be **modified**.

1 Architectural rule of thumb

2 Layered Architectures

3 Support from the UML

Architectural

rule of thumb

[Beautiful Architecture]

“

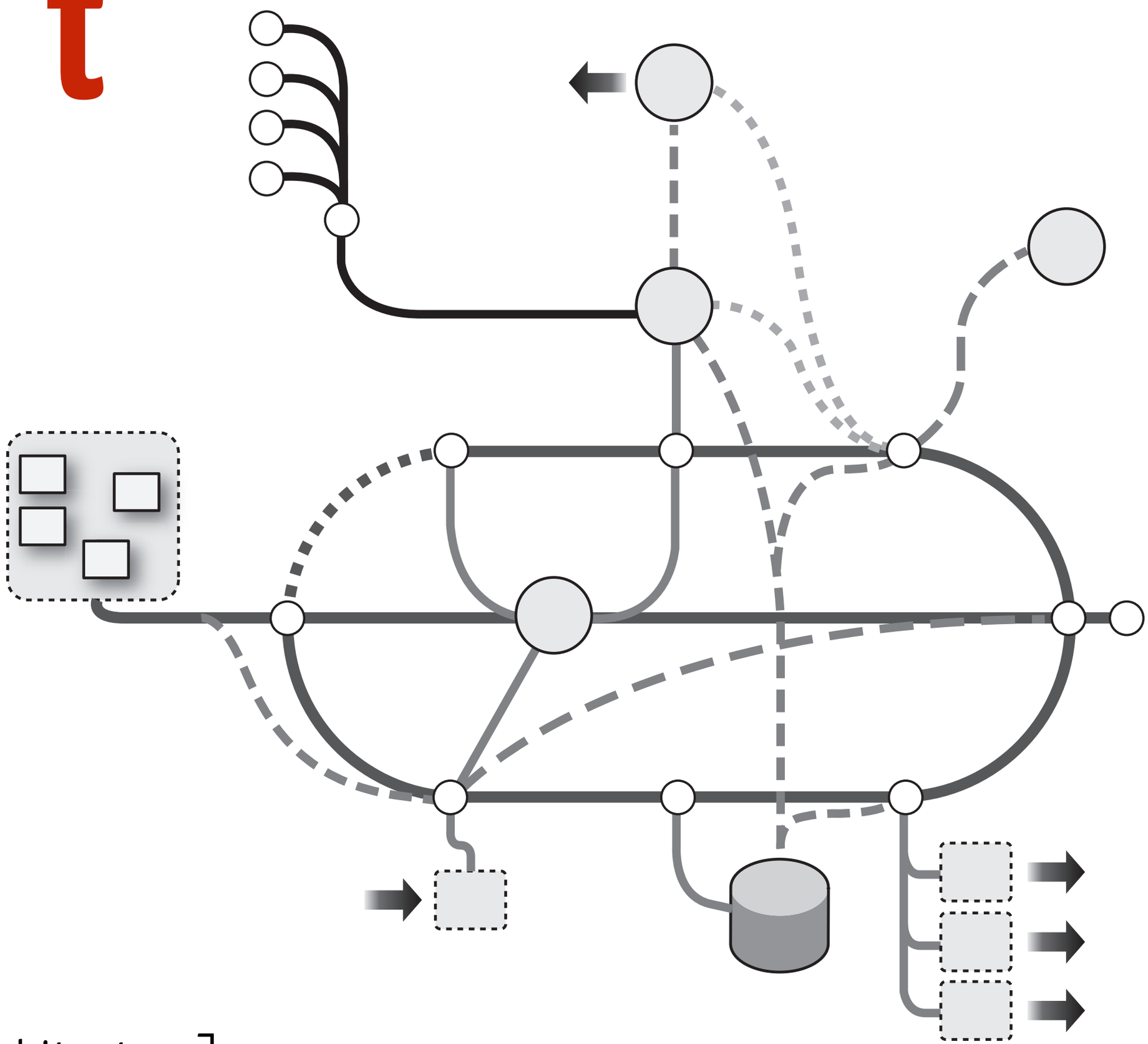
Software **architecture** is

not set in stone.

Change if you need it.

[Beautiful Architecture]

Don’t



[Beautiful Architecture]

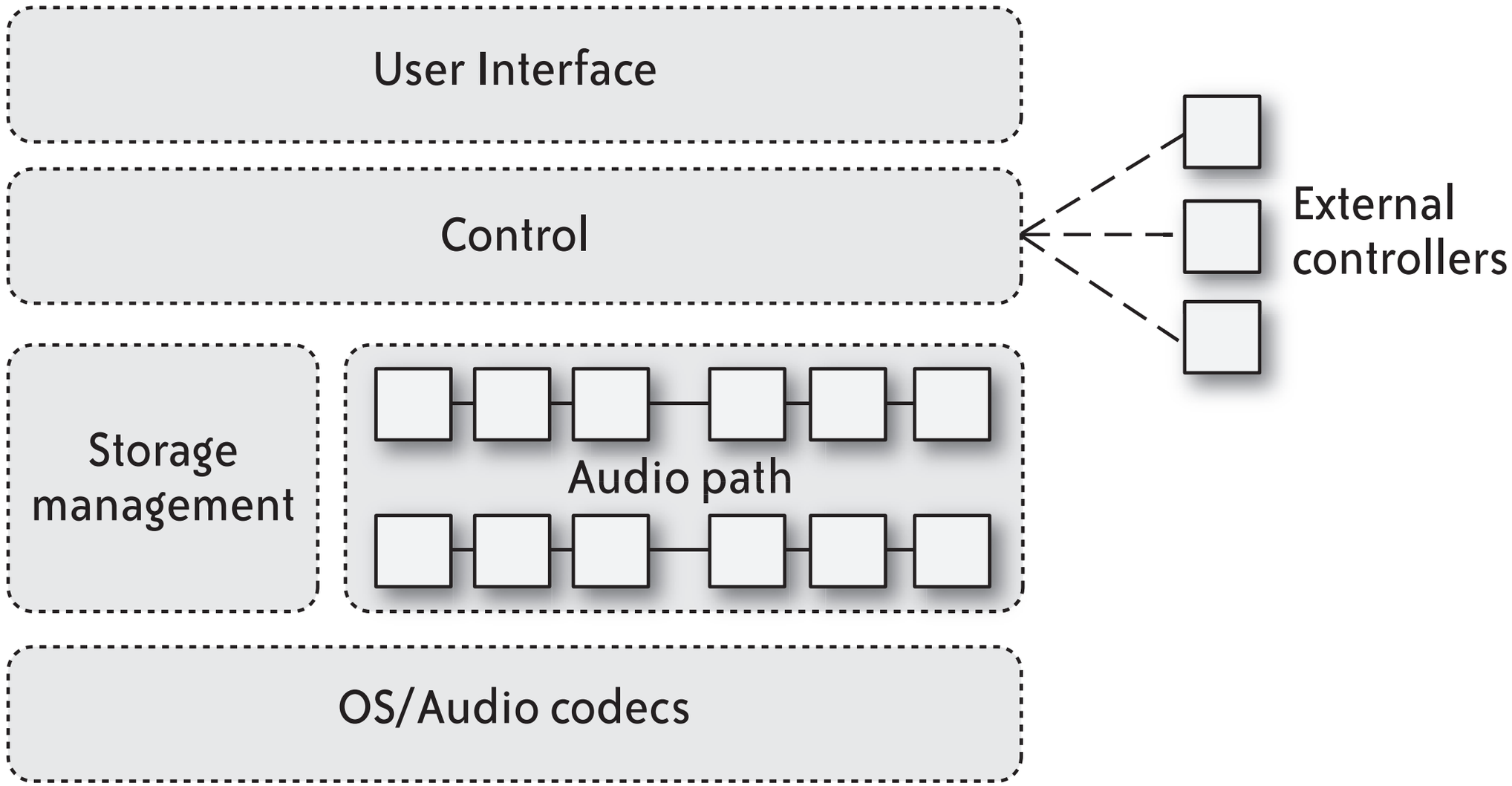
“A **fuzzy architecture** leads to **individual** code, **duplication** of code and effort.

[Beautiful Architecture]

“ **Bad** architectural **design leads to further bad** architectural **design.**

[Beautiful Architecture]

Do



[Beautiful Architecture]

“A **clear architectural** design leads to a **consistent system**.

[Beautiful Architecture]

Cohesion versus Coupling

Cohesion:

"how related functionality is gathered together".

Coupling:

"Measurement of interdependency between modules".

[Beautiful Architecture]

Low cohesion,

Strong coupling

?

Strong cohesion,

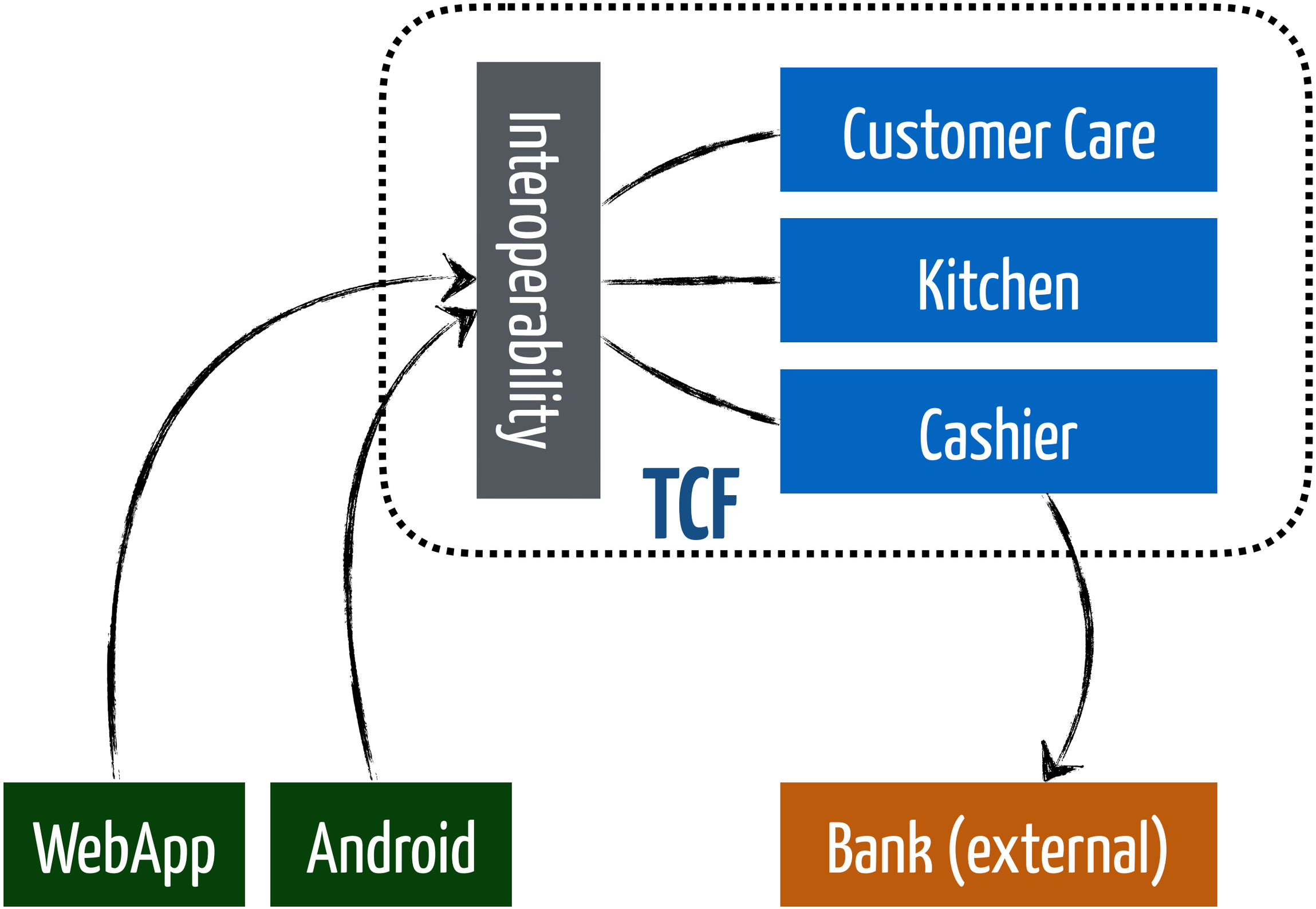
Low coupling

[Beautiful Architecture]

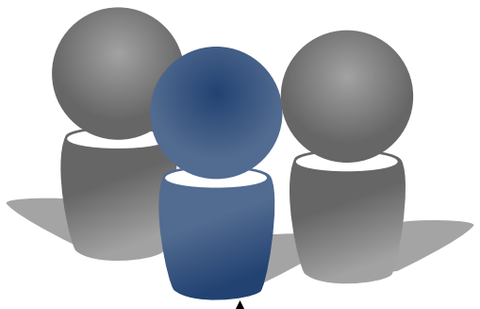
TCF : The Cookie Factory 2

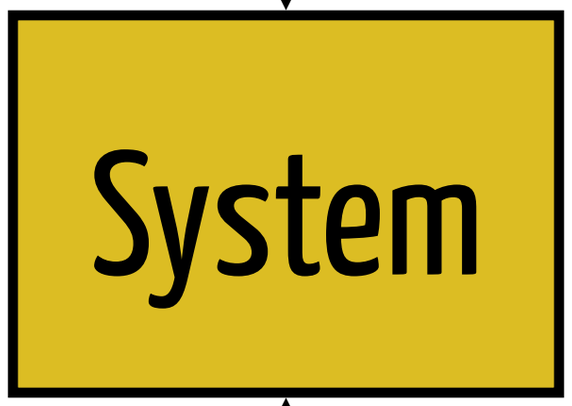
What are the “modules” in TCF?

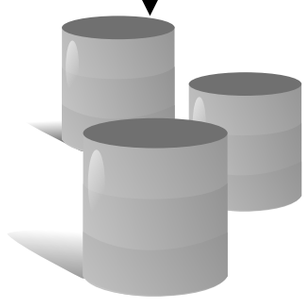
How are they related to each others?


Interoperability
Customer Care
Kitchen
Cashier
TCF
WebApp
Android
Bank (external)

Layered Architectures




System

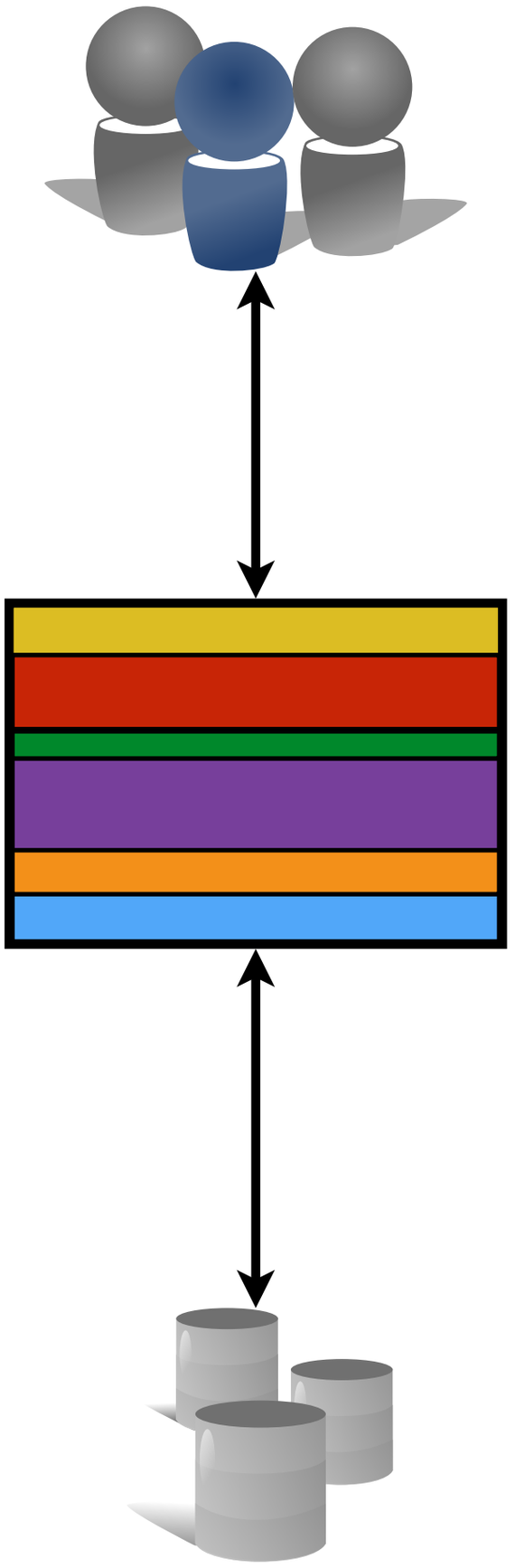


???

Layers

support

modularity



“Ma-gni-fique”

thanks to Clèm for the reference

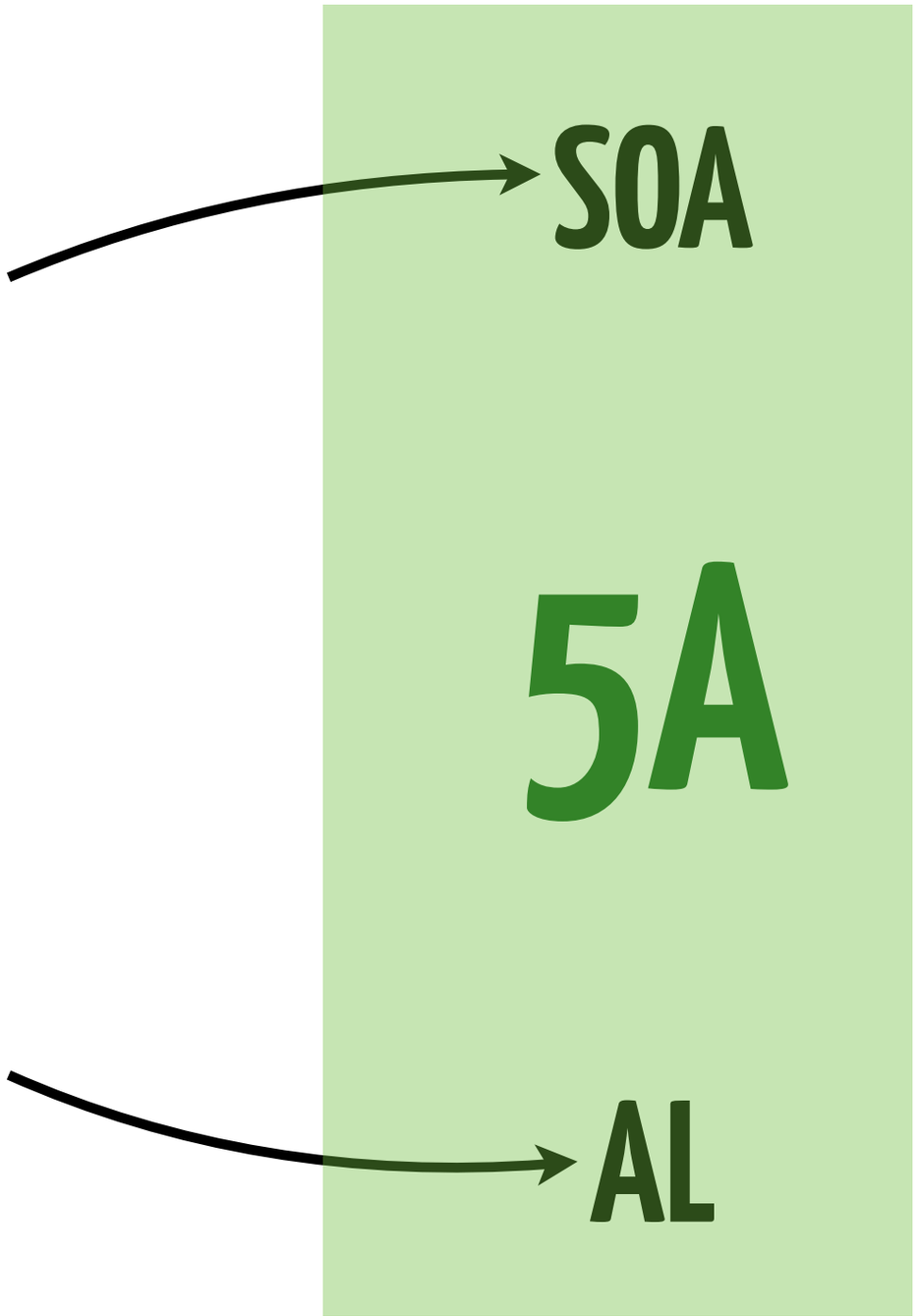
Keep

I t

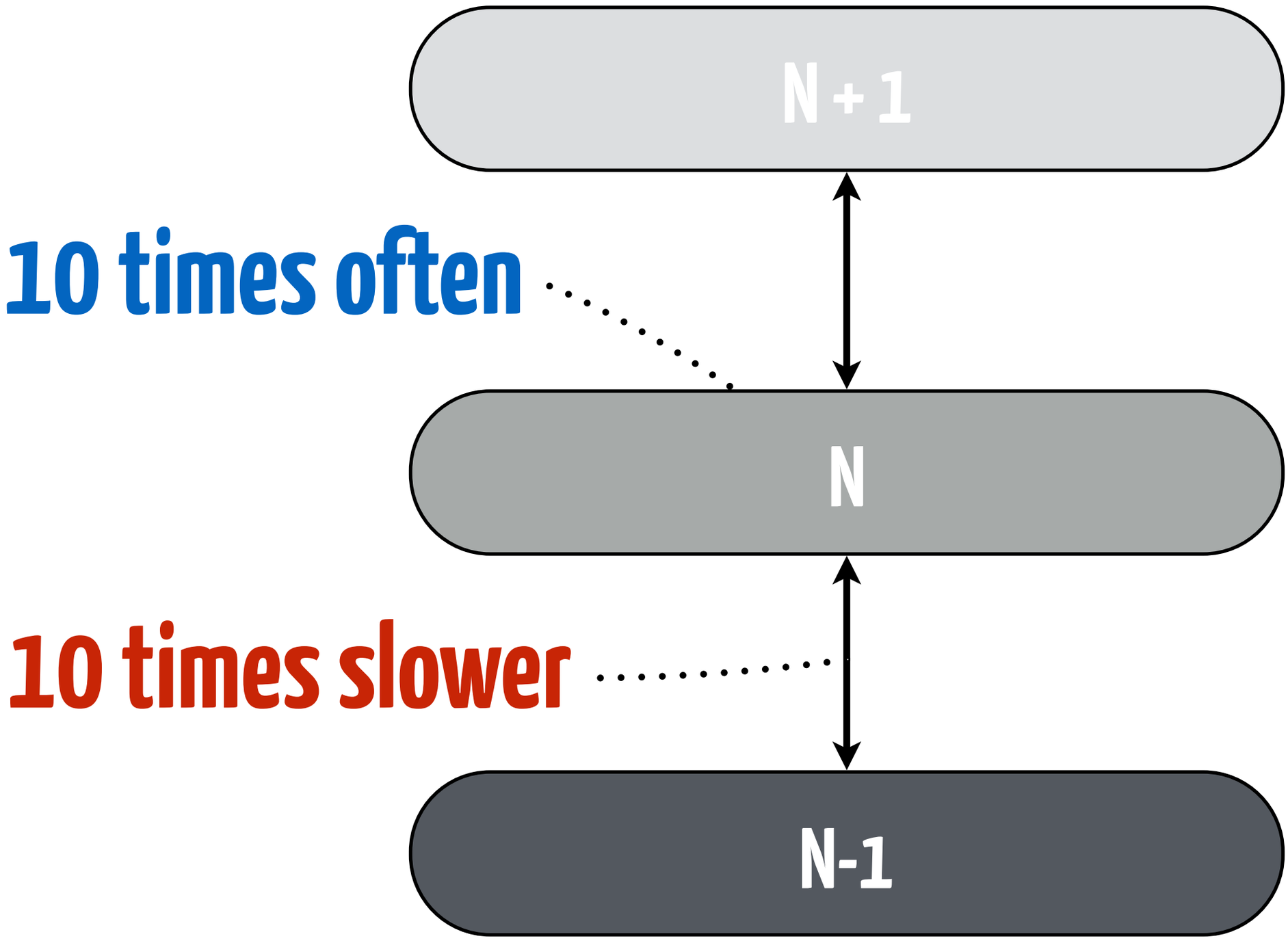
4A

S tupid,

S imple.



The rule of 10



Theory & Practice

Theory:

you know everything but nothing works

Practice:

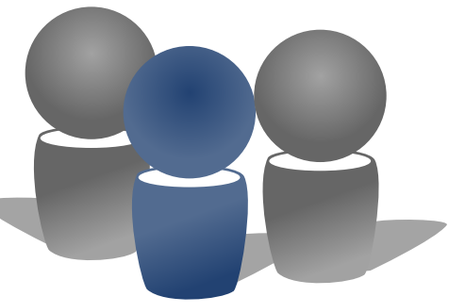
It works, but no one knows why

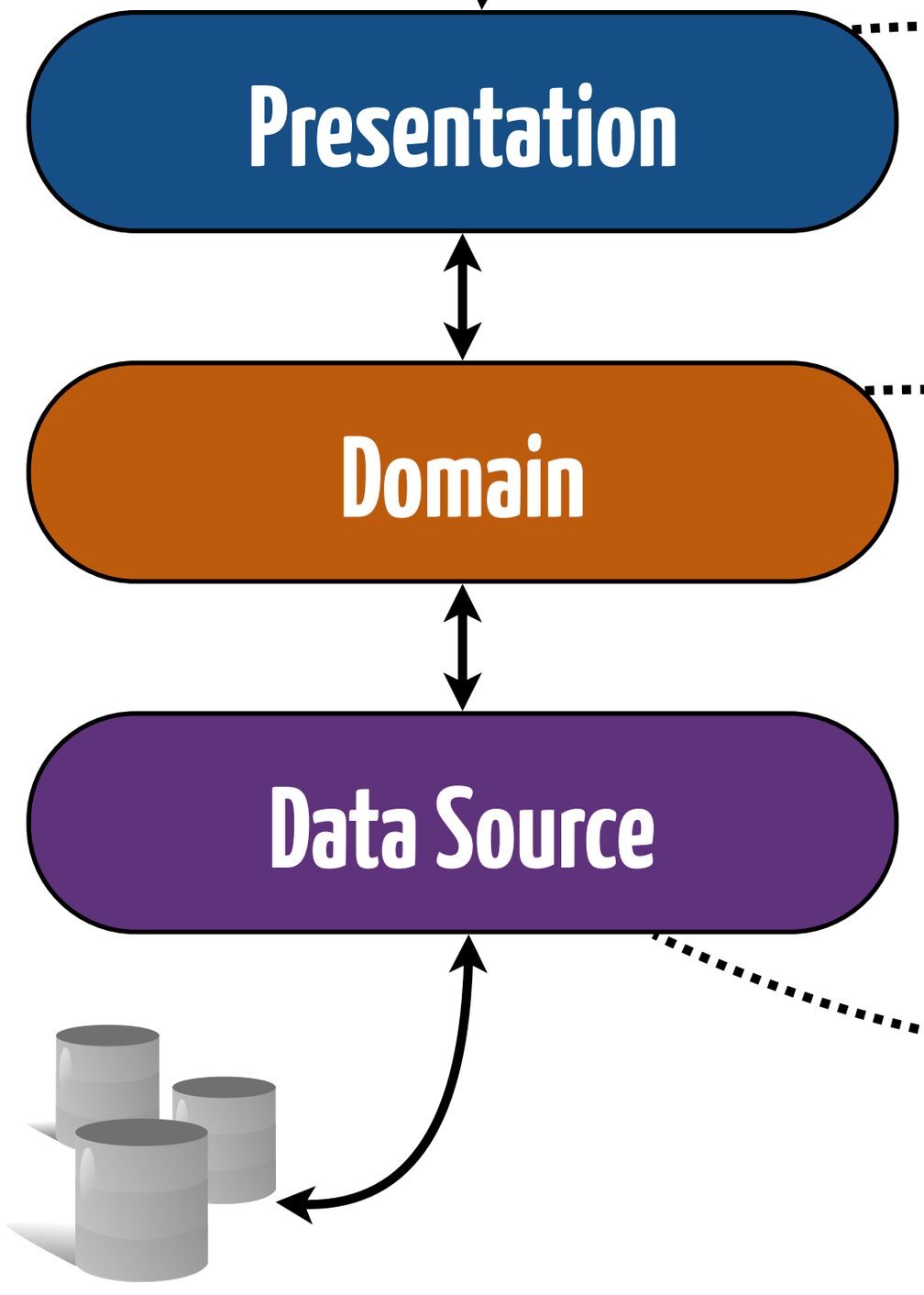
In theory, **N-tiers** architecture

In practice, N = 3

(or 5)

3-tiers architecture

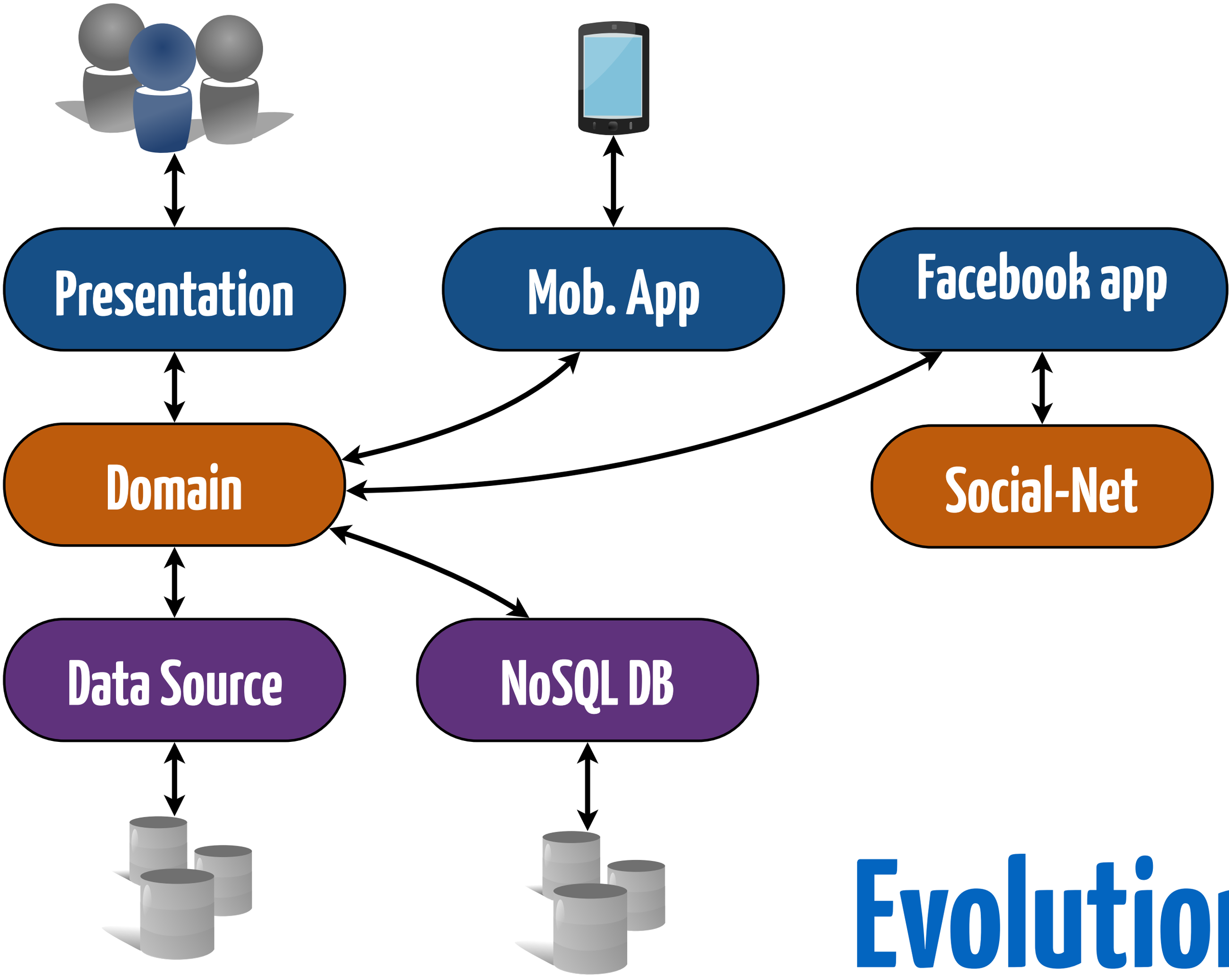




Handle users

Business functionality

Handle data storage


Presentation
Mob. App
Facebook app
Domain
Social-Net
Data Source
NoSQL DB

Evolution

Contents of the ≠ layers in TCF?

How to chose between layers?

WebApp

Android

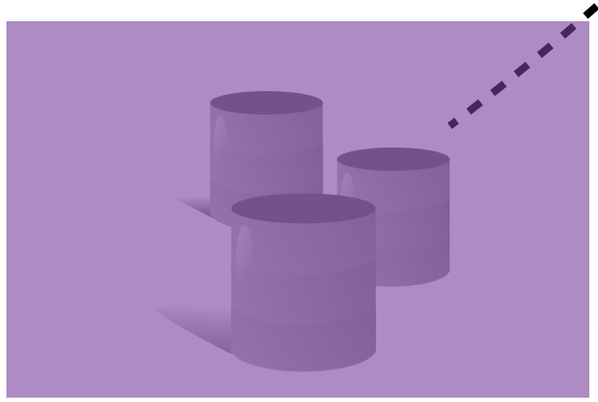
Interoperability

Customer Care

Kitchen

Cashier

Bank (external)



Presentation

Domain

Data Source

Support from the

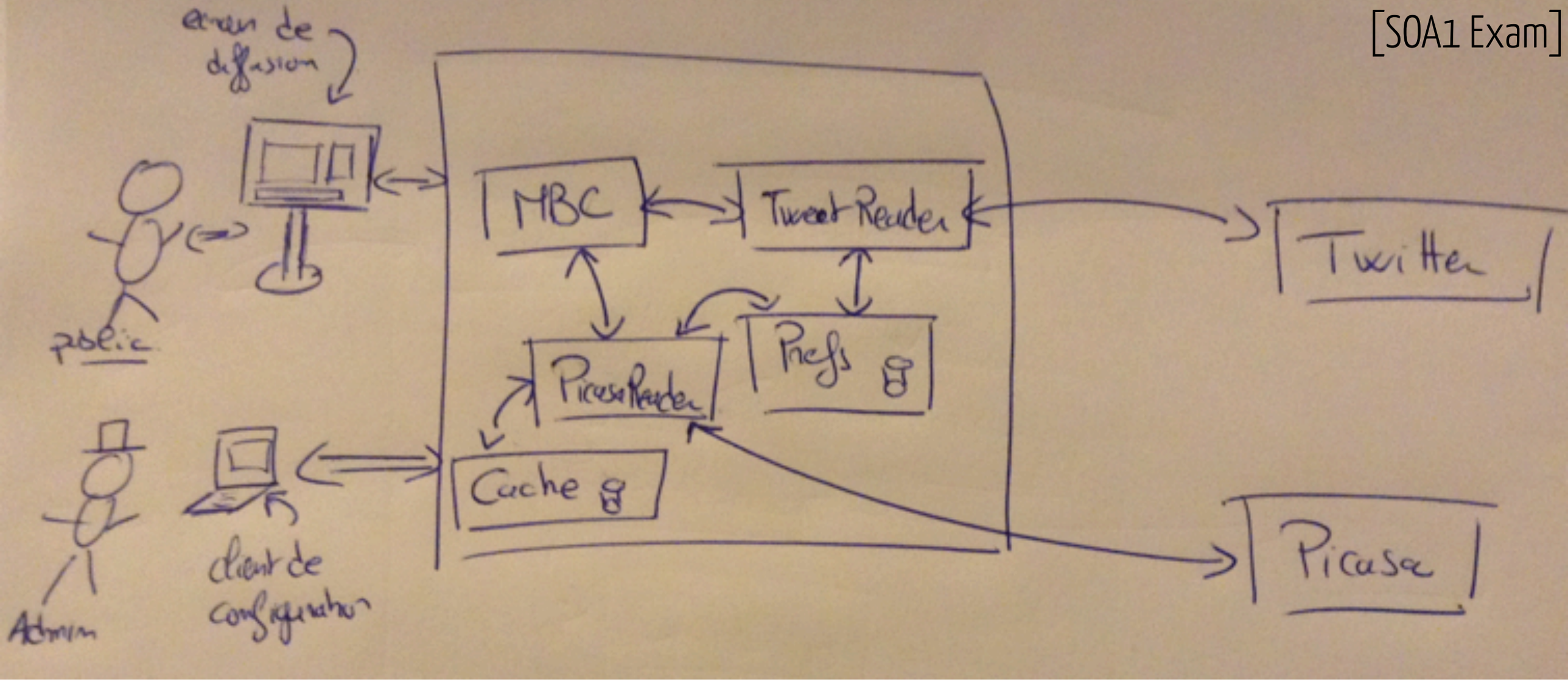
UNIFIED MODELING LANGUAGE™

The **UML** is just a

standard syntax

for modeling

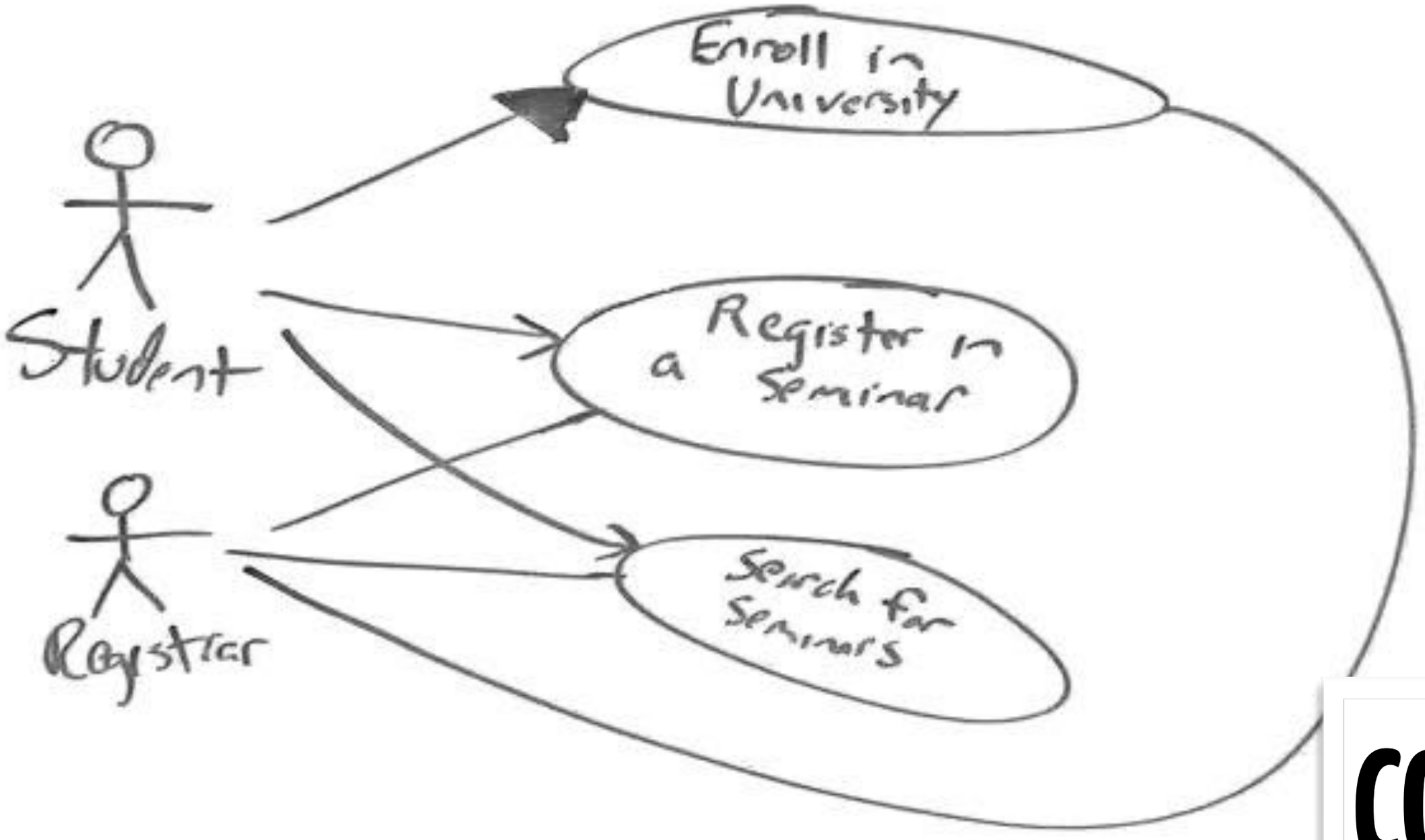
[SOA1 Exam]



One can design a Software Architecture

without the UML

Use cases diagrams

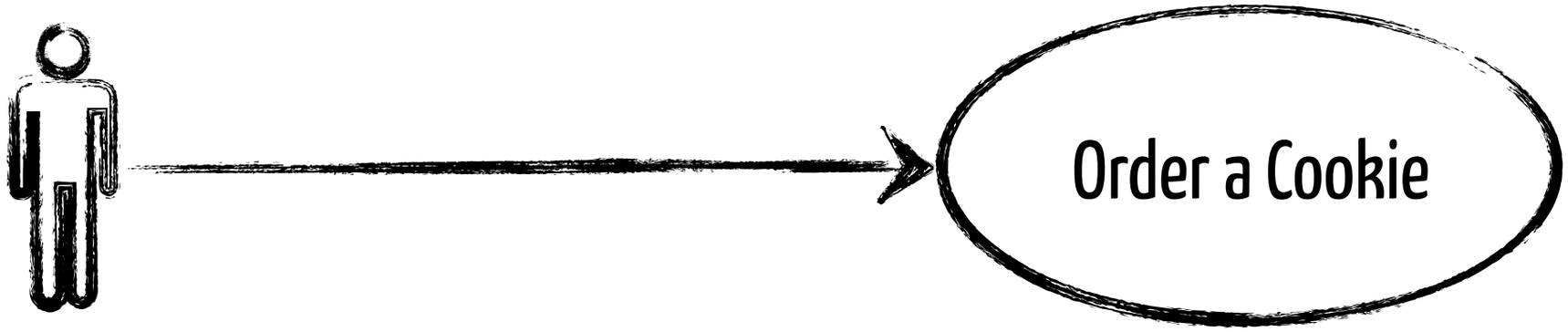


COO

http://www.agilemodeling.com/artifacts/useCaseDiagram.htm

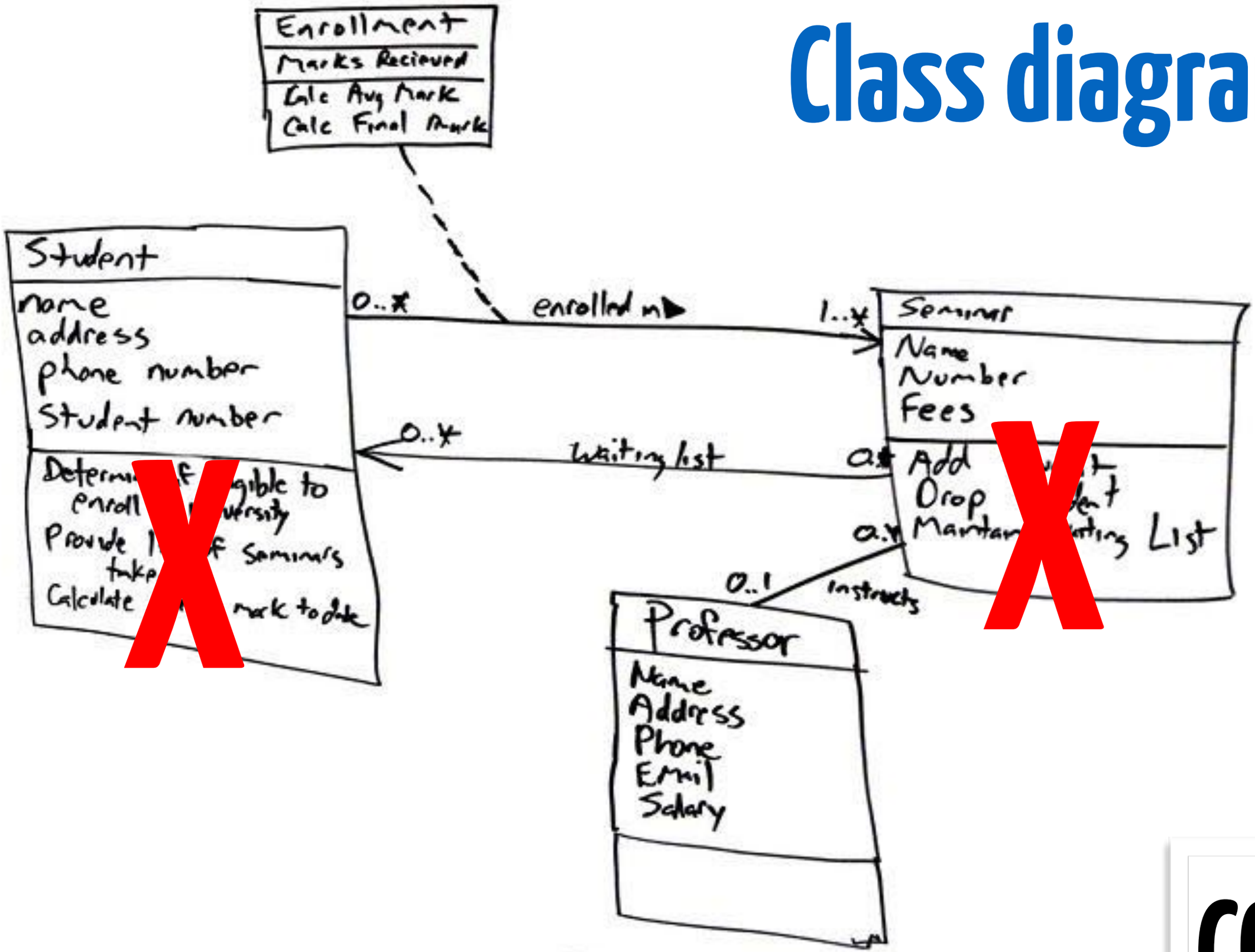
TCF MVP

Minimal & Viable Use Case ?



customer

Class diagrams



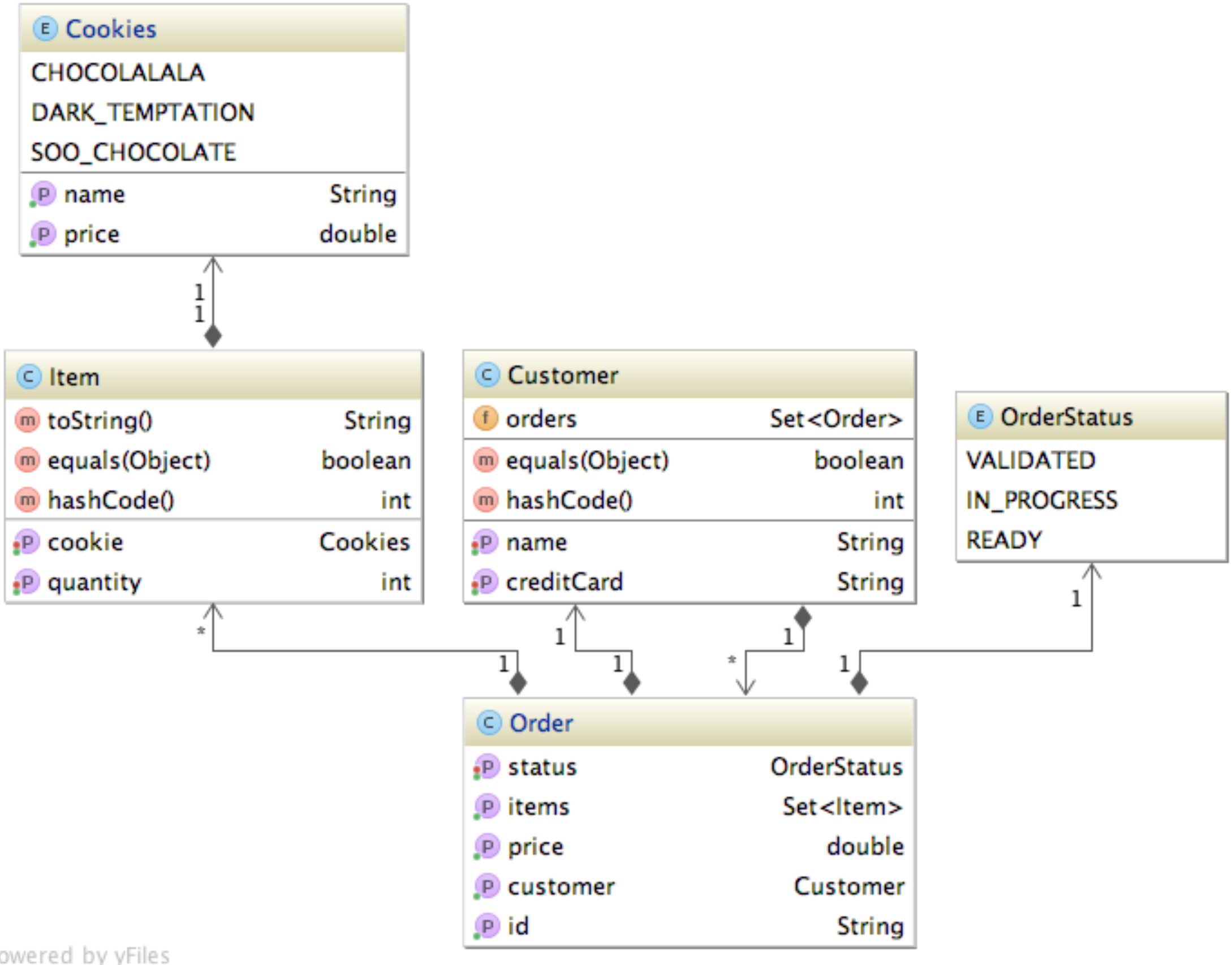
Business objects => **no methods**

COO

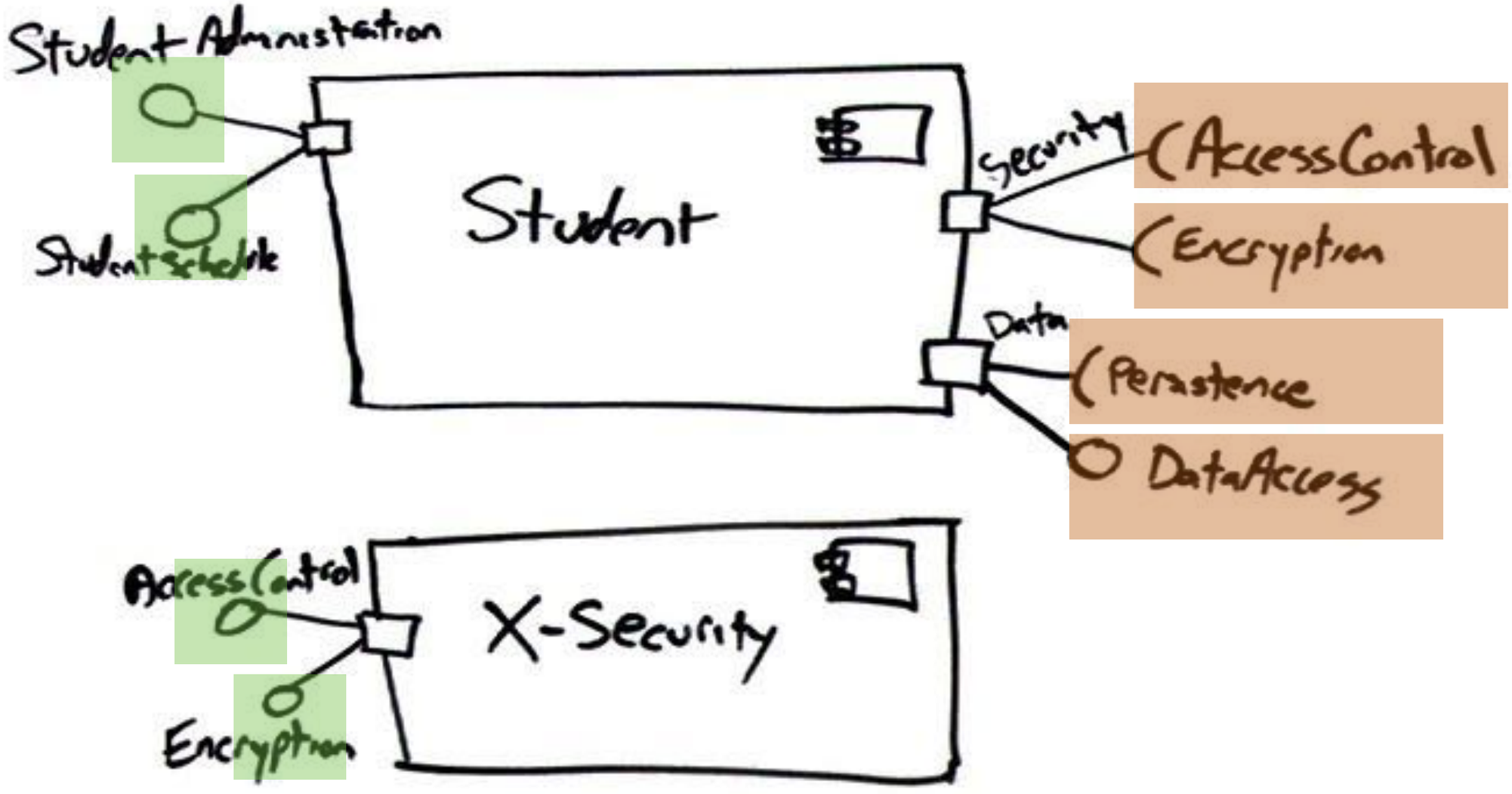
http://www.agilemodeling.com/artifacts/classDiagram.htm

TCF MVP

Business Objects (≠ “objects” as in COO)


Cookies
CHOCOLALALA
DARK_TEMPTATION
SOO_CHOCOLATE
name String
price double
1
1
Item
toString() String
equals(Object) boolean
hashCode() int
cookie Cookies
quantity int
Customer
orders Set<Order>
equals(Object) boolean
hashCode() int
name String
creditCard String
OrderStatus
VALIDATED
IN_PROGRESS
READY
Order
status OrderStatus
items Set<Item>
price double
customer Customer
id String
Powered by yFiles

Components diagrams



Provided Interface

Required Interface

http://www.agilemodeling.com/artifacts/componentDiagram.htm

I & D of the **SOLID** principles

3A

Initial	Stands for	Concept
S	SRP[4]	**Single responsibility principle** a class should have only a single responsibility (i.e. only one potential change in the software's specification should be able to affect the specification of the class)
O	OCP[5]	**Open/closed principle** "software entities … should be open for extension, but closed for modification."
L	LSP[6]	**Liskov substitution principle** "objects in a program should be replaceable with instances of their subtypes without altering the correctness of that program." See also design by contract.
I	ISP[7]	**Interface segregation principle** "many client-specific interfaces are better than one general-purpose interface."[8]
D	DIP[9]	**Dependency inversion principle** one should "depend upon abstractions, [not] concretions."[8]

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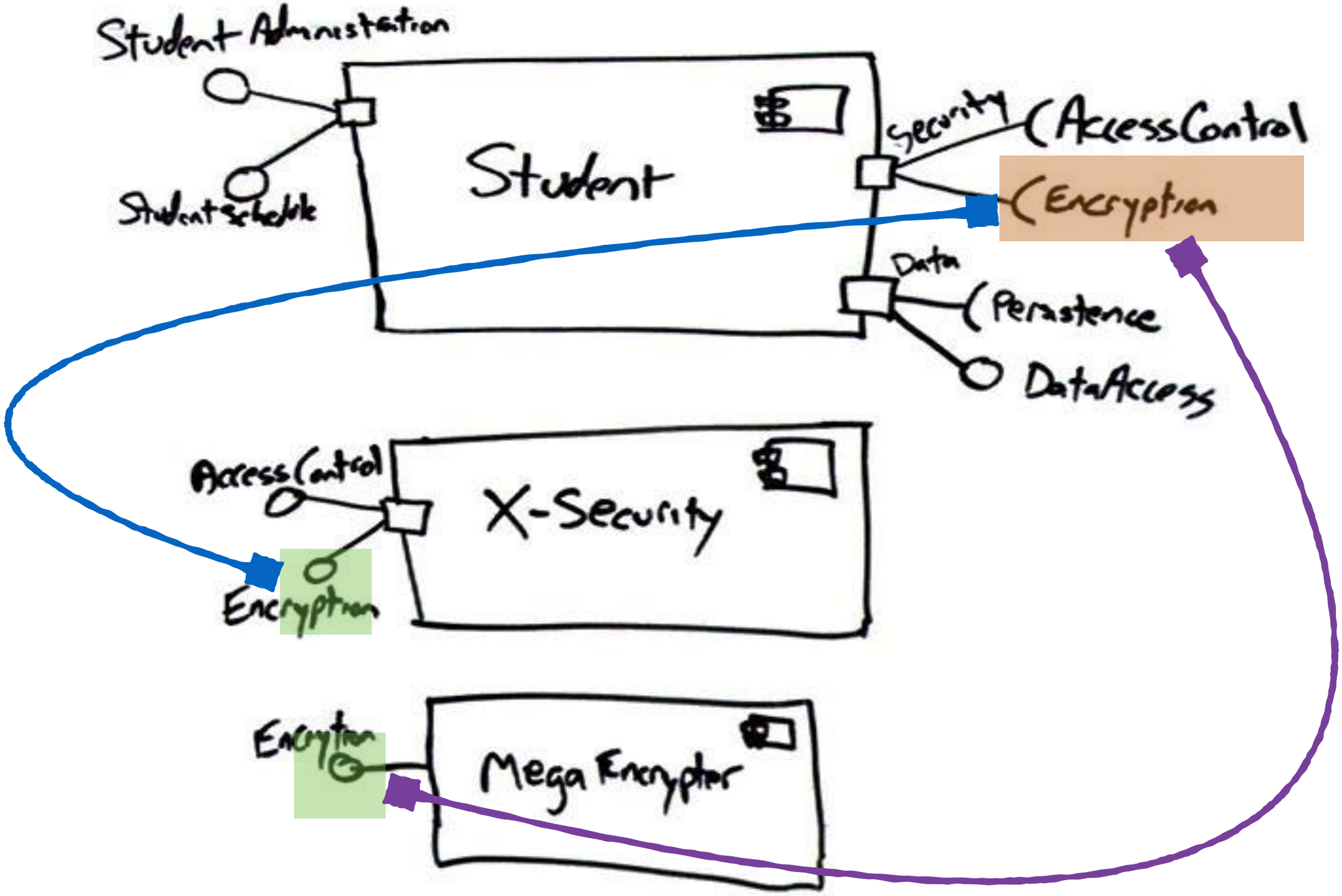
https://en.wikipedia.org/wiki/SOLID_(object-oriented_design)

Binding Components



http://www.agilemodeling.com/artifacts/componentDiagram.htm

Example of Implementation

```
class Student implements
      StudentAdministration, StudentSchedule {

  Encryption e = new MegaEncrypter(…)

}
```

```
class Student implements
      StudentAdministration, StudentSchedule {

  AssemblyContext ctx = …
  Encryption e = ctx.inject(Encryption.class)

}
```

Teaser: Annotation-based injection

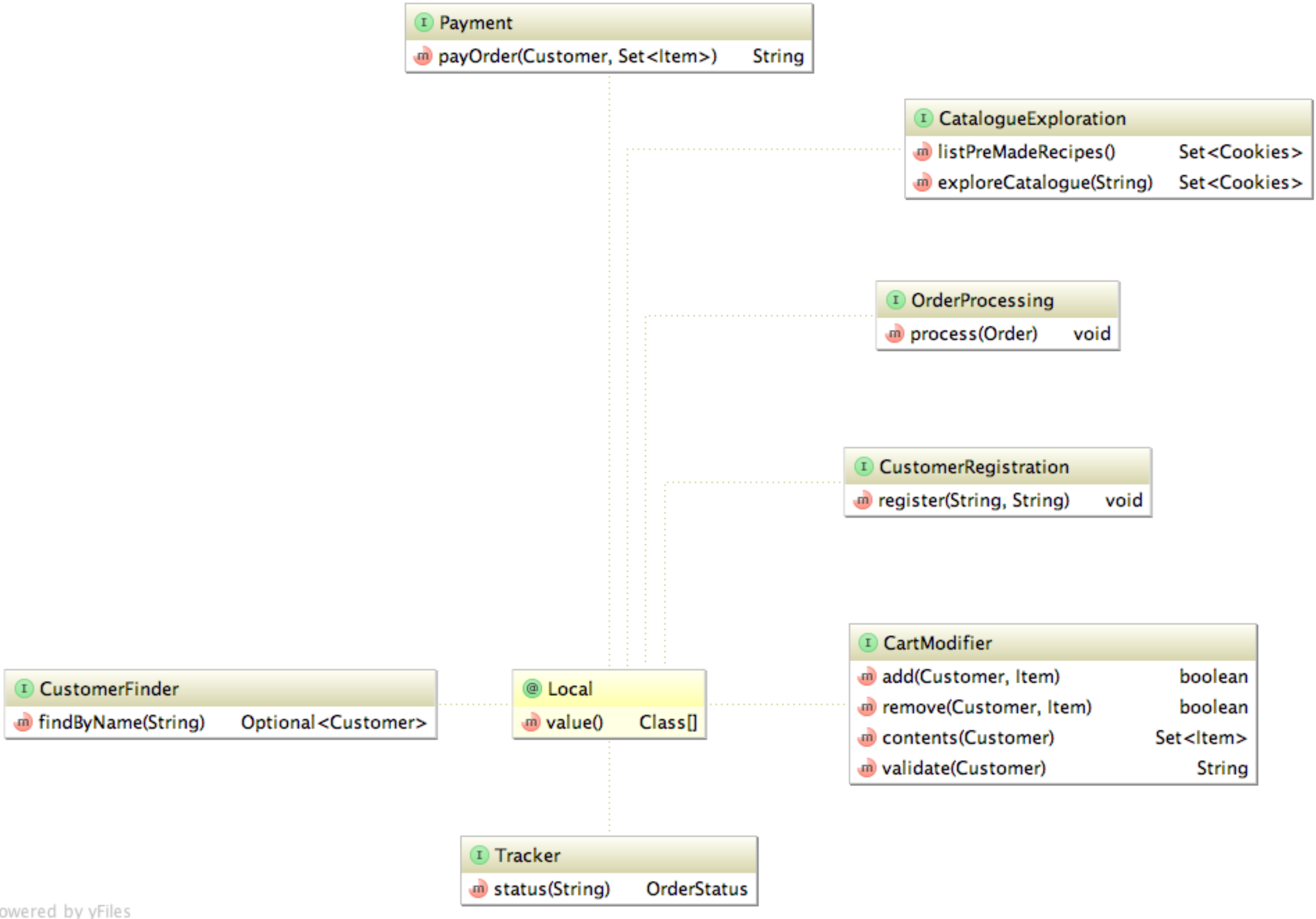
Provided Interface

```
class Student implements
        StudentAdministration, StudentSchedule {

  @Inject
  private Encryption e;

}
```

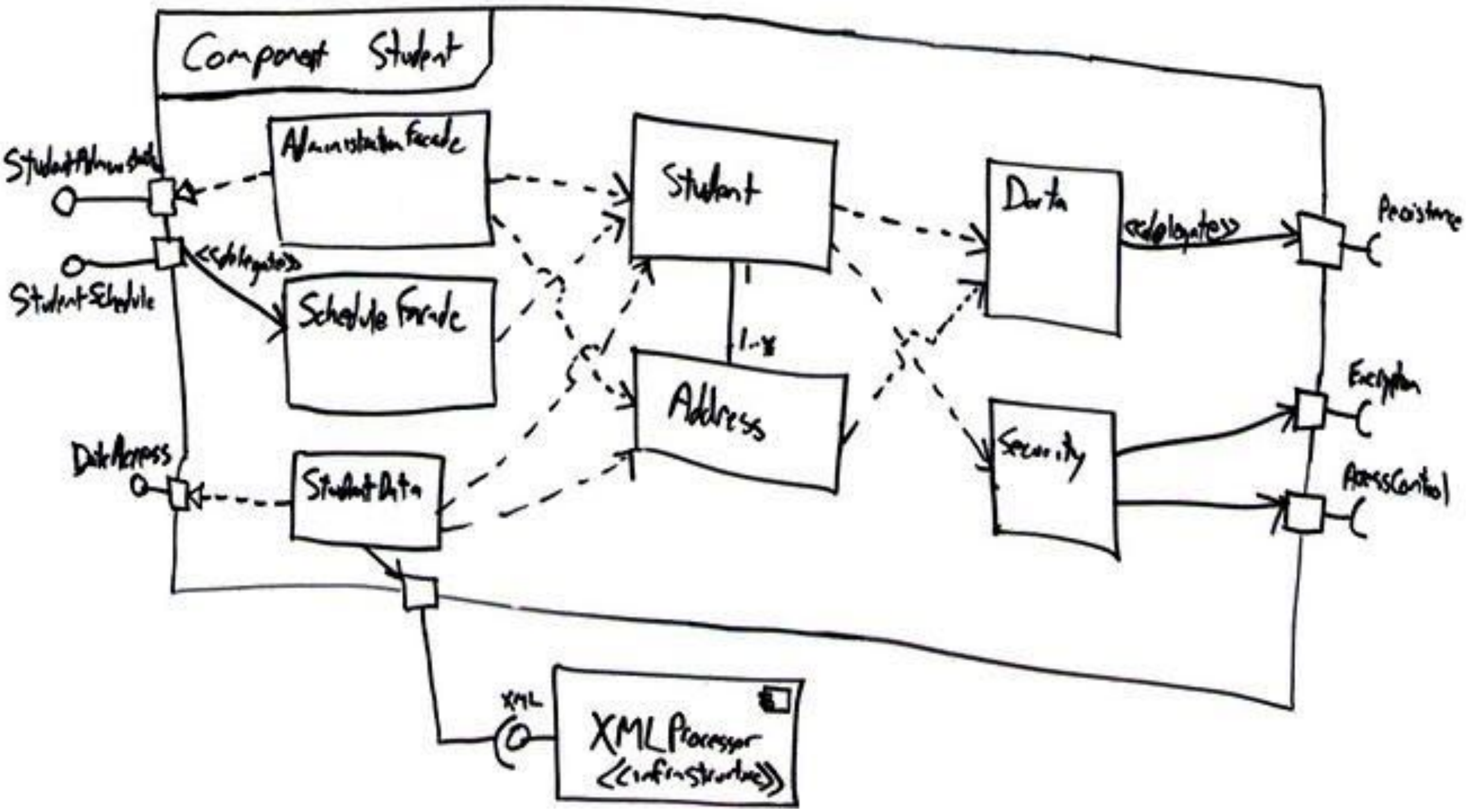
Required Interface

TCF MVP

Functional Interfaces for TCF ? Components ?



Components Assembly



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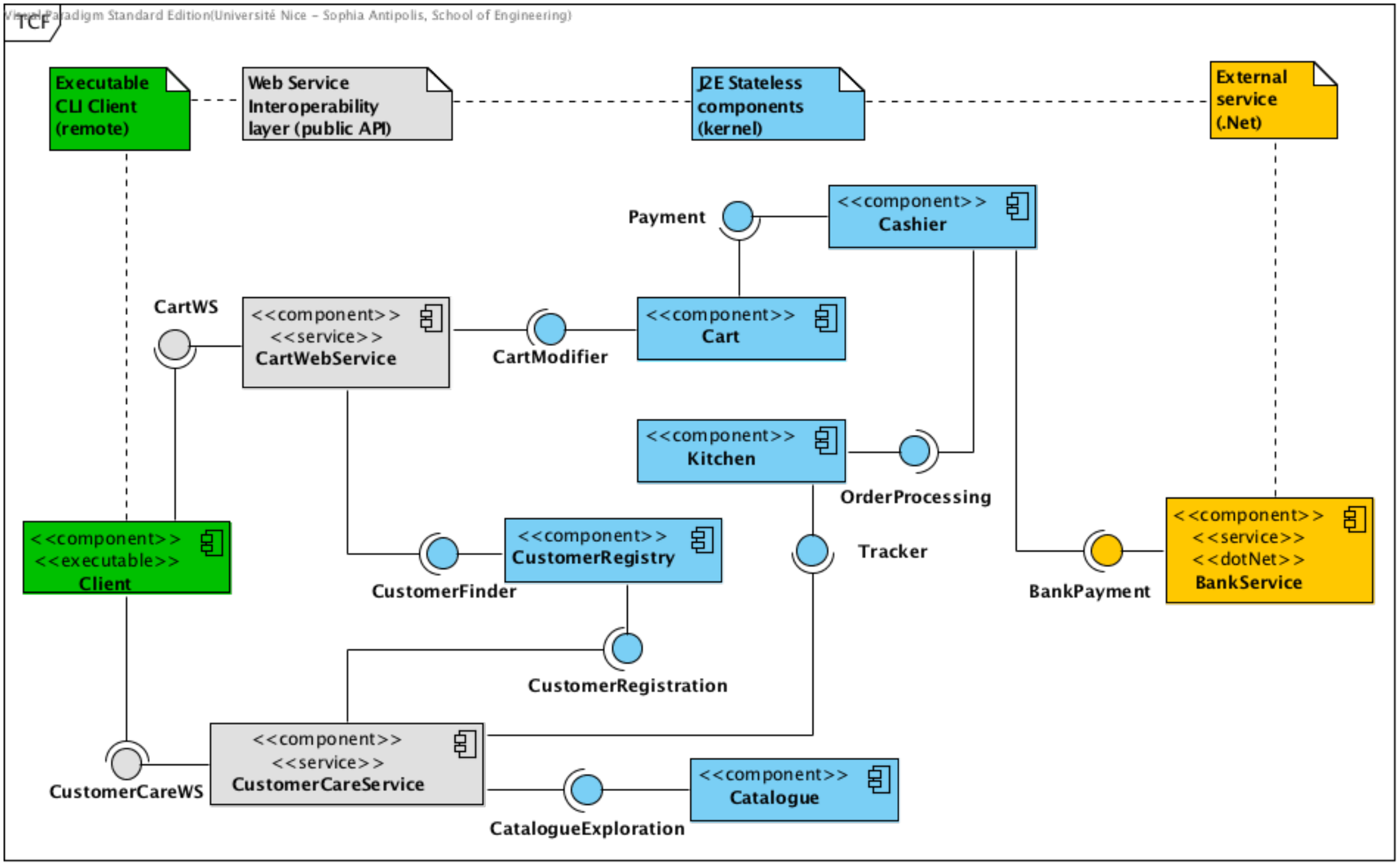
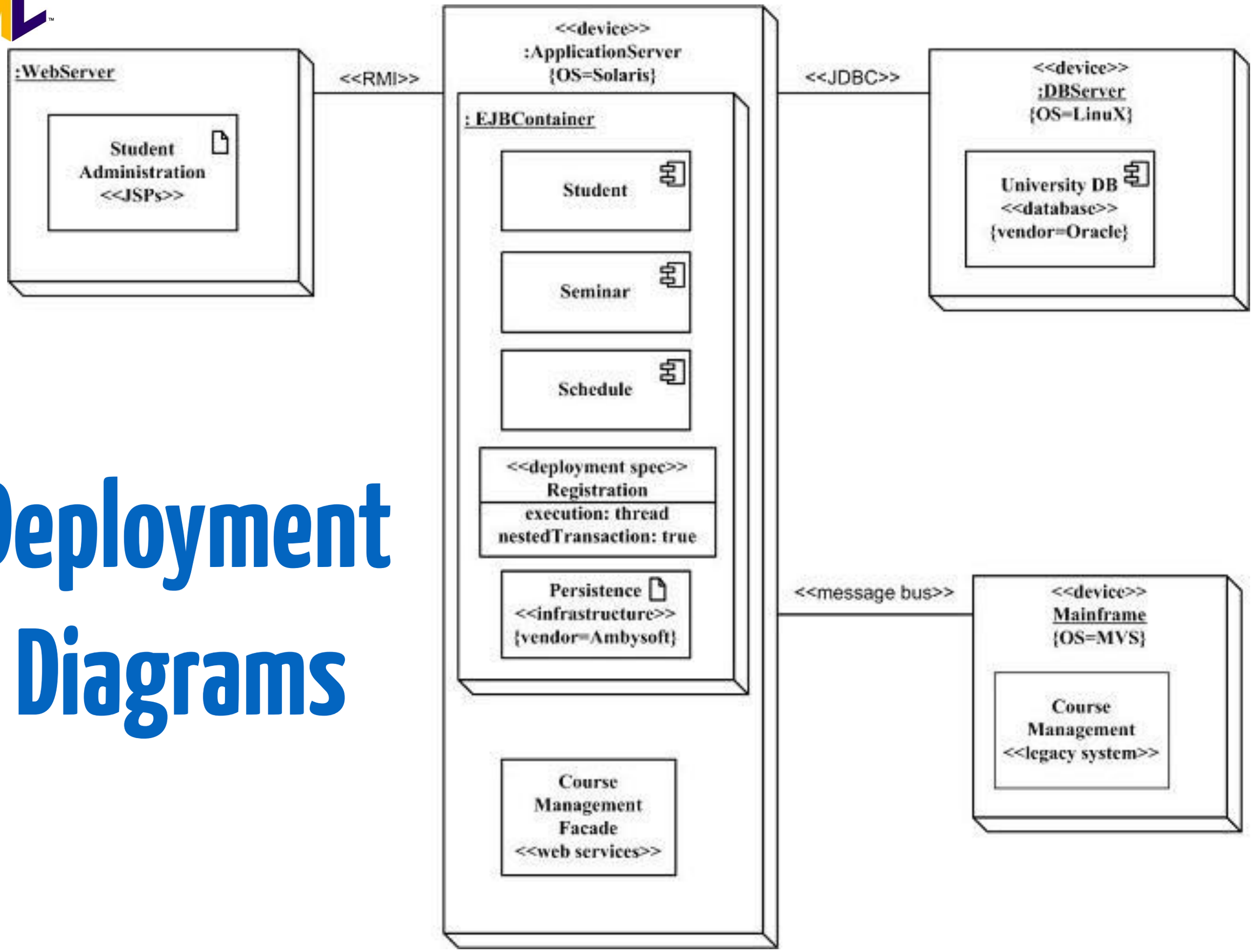
TCF MVP

Component Assembly ?



Deployment Diagrams



http://www.agilemodeling.com/artifacts/deploymentDiagram.htm

TCF MVP

How to deploy TCF ?