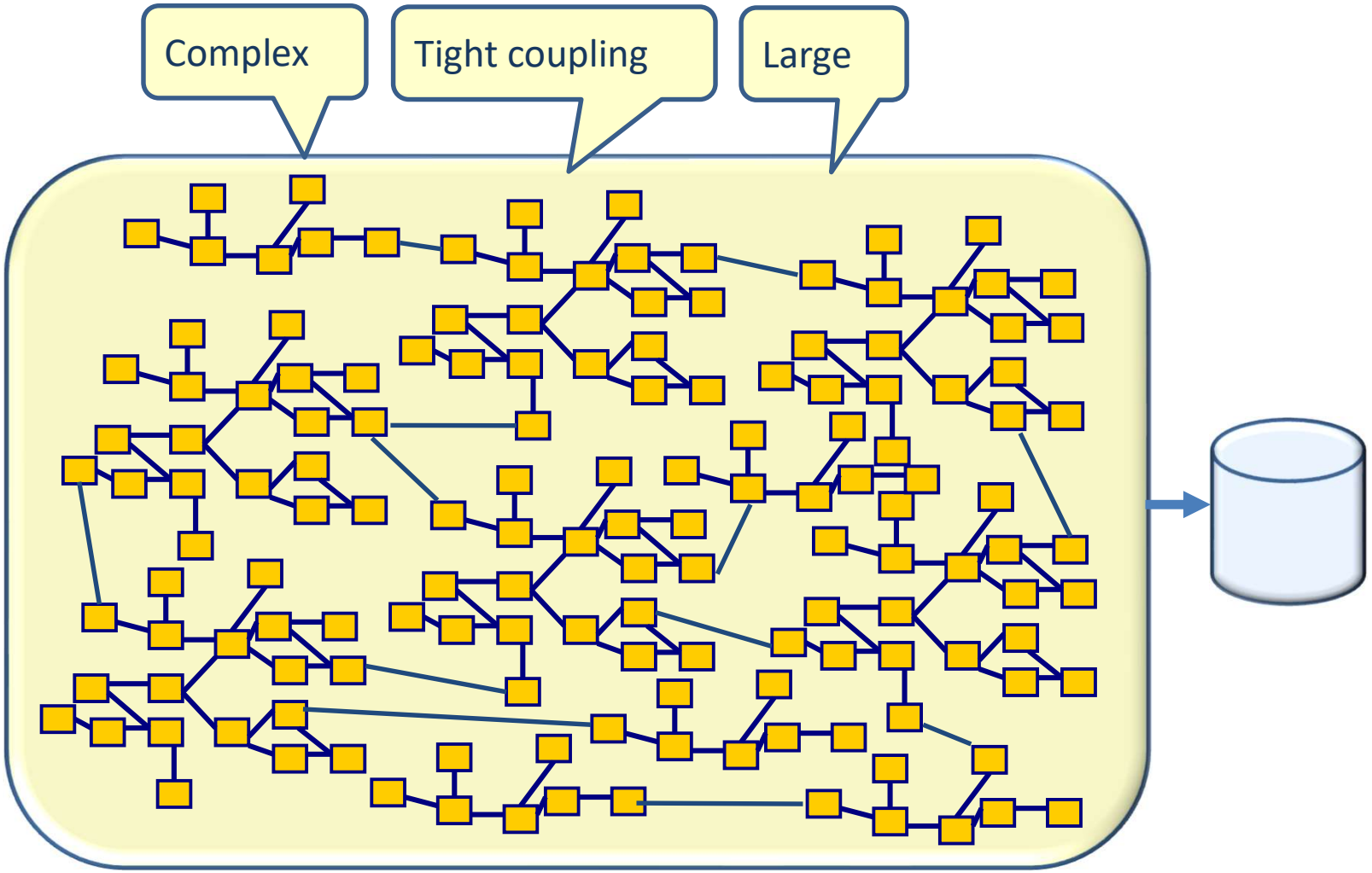
Lesson 5

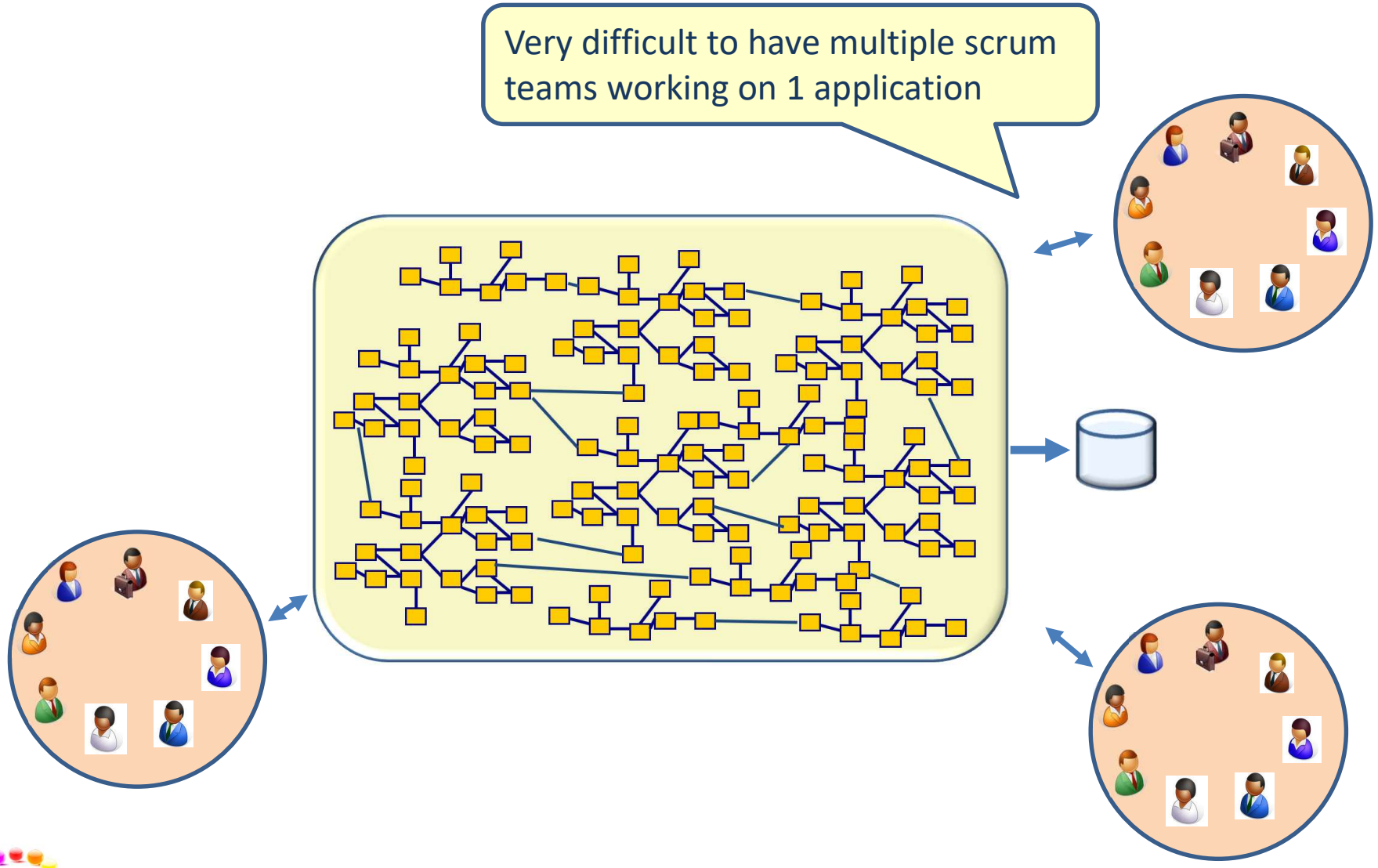
COMPONENT BASED DESIGN

PROBLEM OF 1 LARGE OO APPLICATION

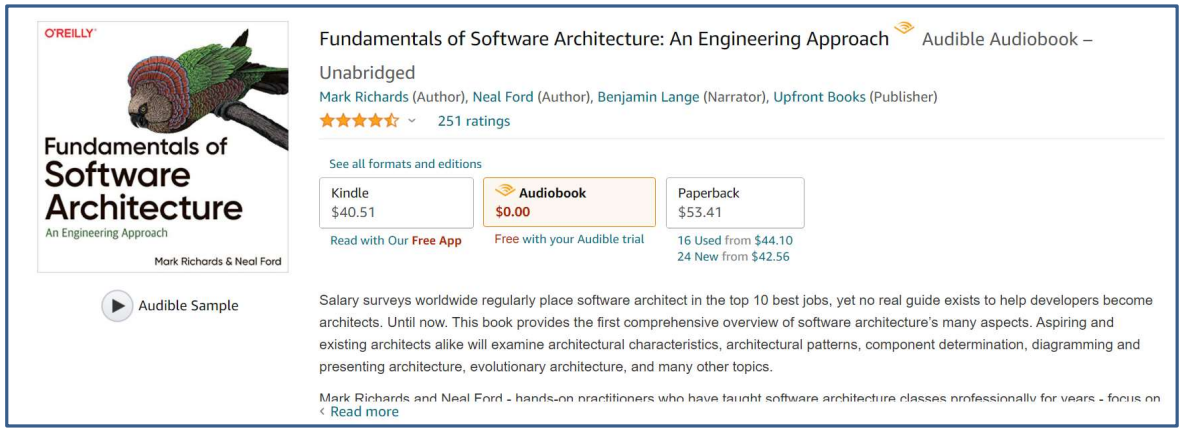
Object orientation

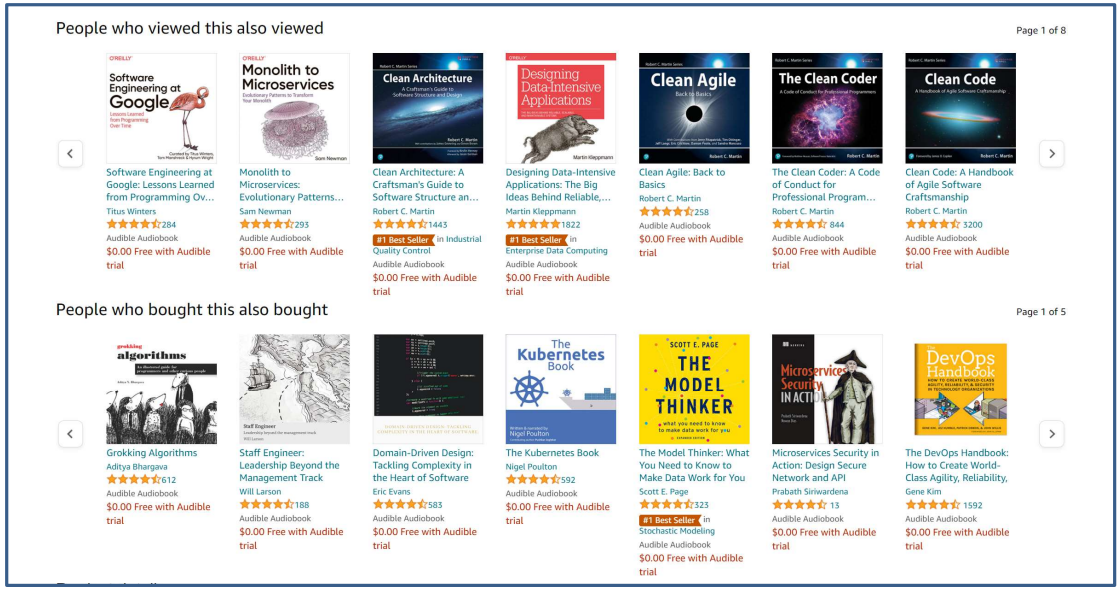


1 large monolith appliction



Amazon.com

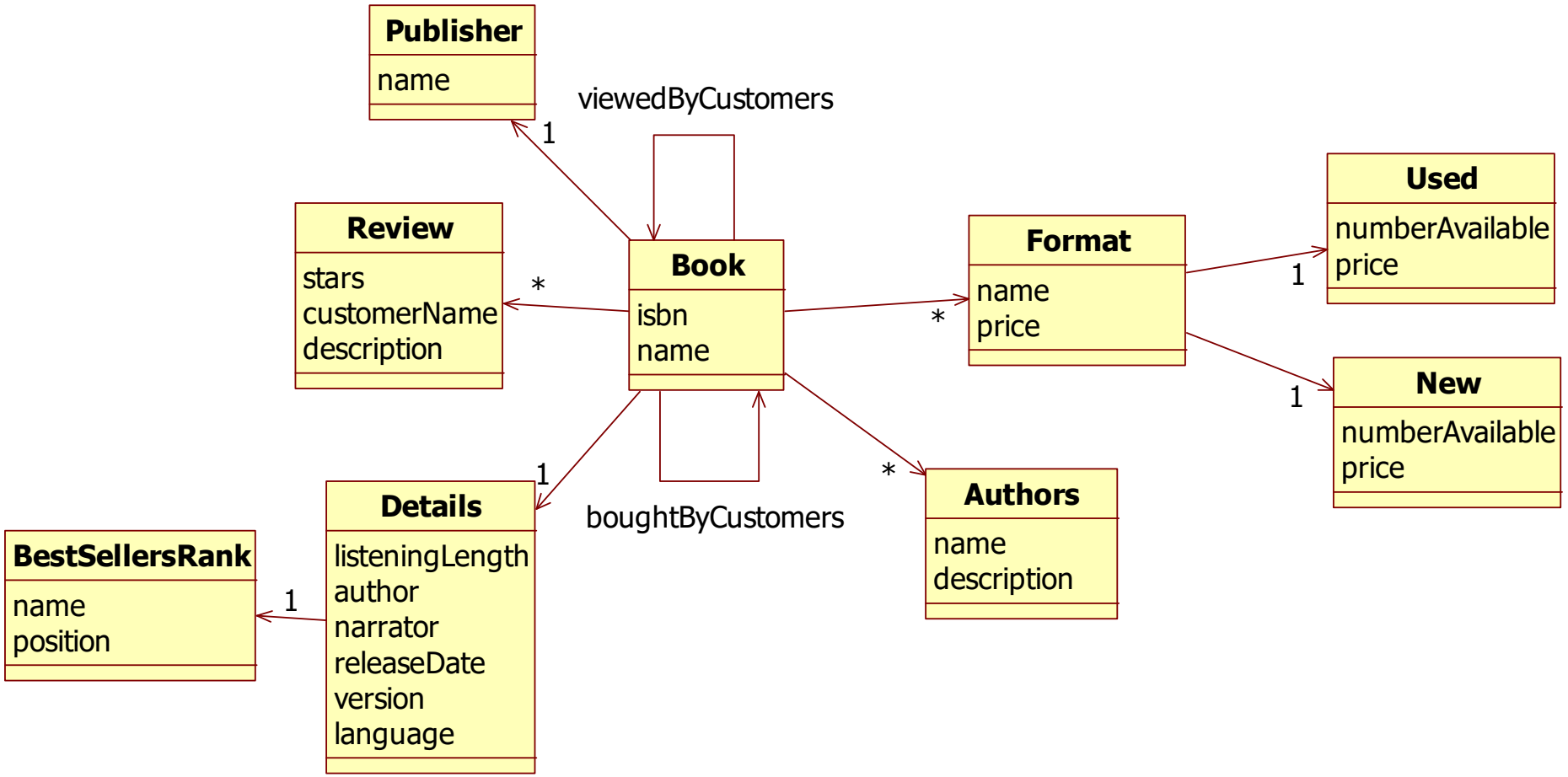




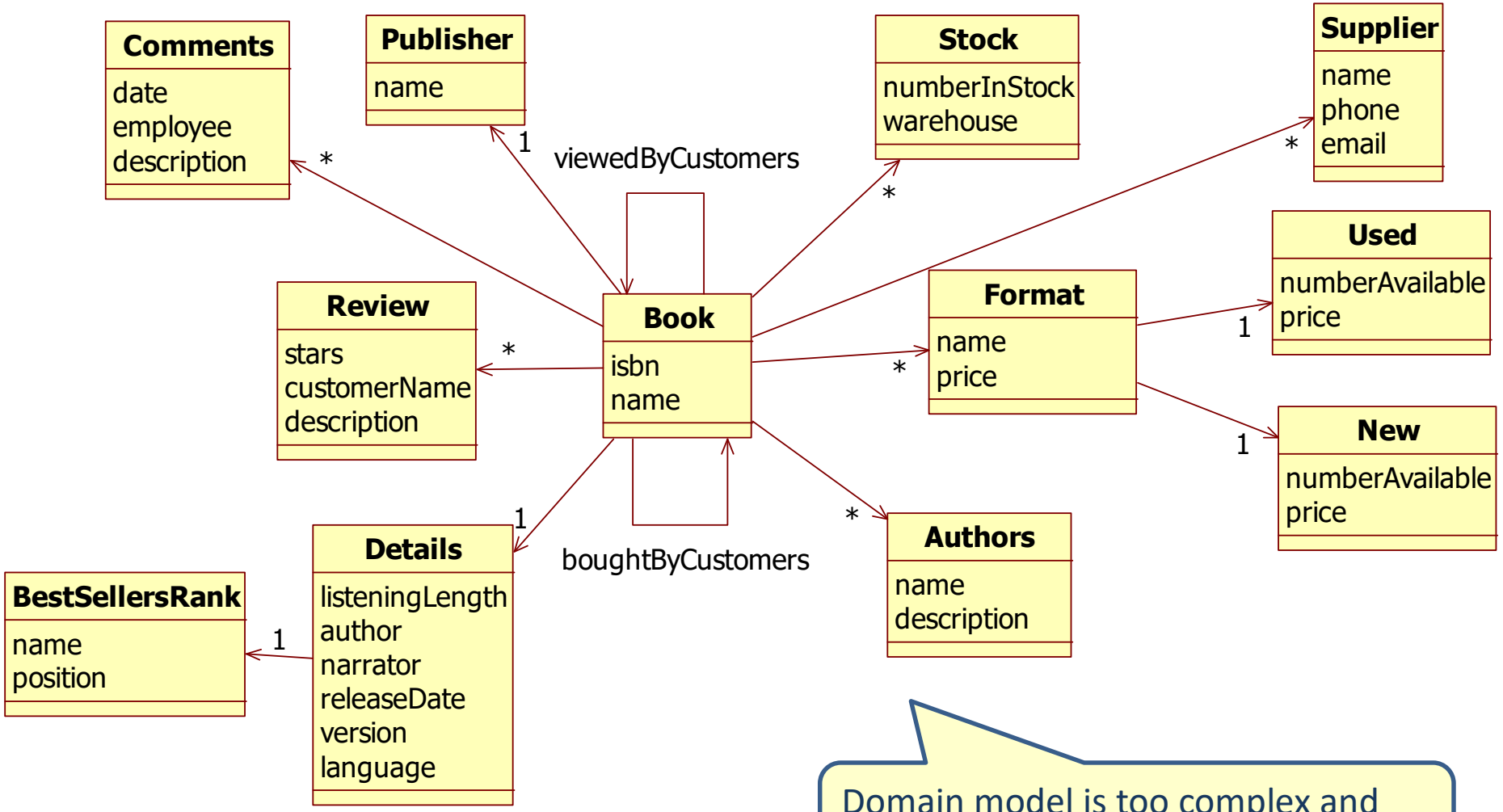
Product details

Listening Length	13 hours and 10 minutes
Author	Mark Richards, Neal Ford
Narrator	Benjamin Lange
Audible.com Release Date	February 27, 2021
Publisher	Upfront Books
Program Type	Audiobook
Version	Unabridged
Language	English
ASIN	B08X8H15BW
Best Sellers Rank	#5,062 in Audible Books & Originals (See Top 100 in Audible Books & Originals) #2 in Computer Systems Analysis & Design (Books) #3 in Software Design Tools #26 in Computers & Technology (Audible Books & Originals)

Amazon.com book



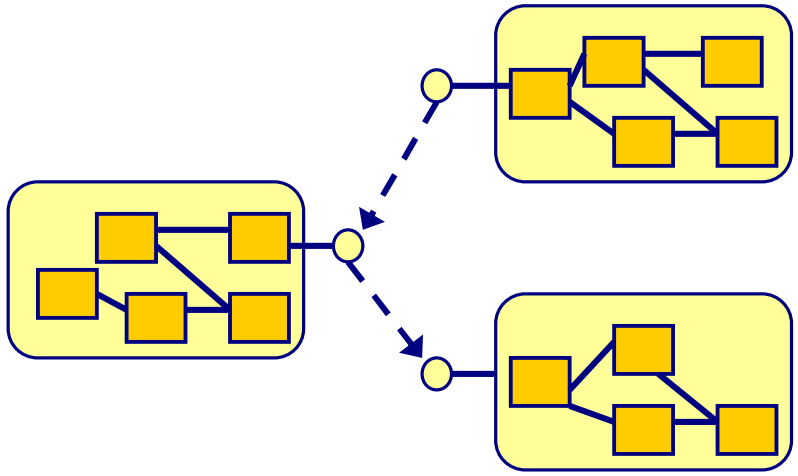
Amazon.com book



COMPONENT BASED DESIGN

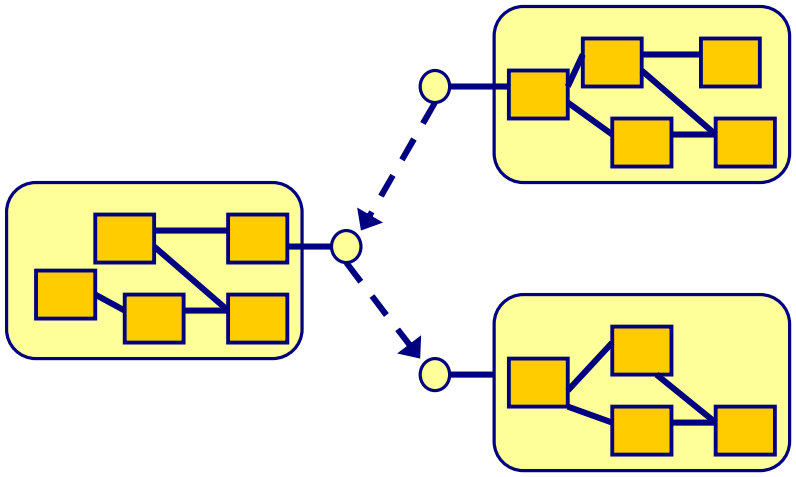
Component Based Development

- Decompose the domain in functional components



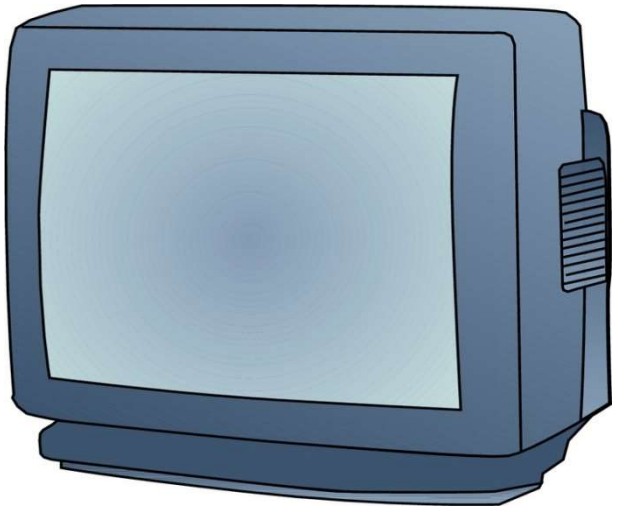
What is a component?

- There is no definition
- What we agree upon:
  1. A component has an interface
  2. A component is encapsulated
- Plug-and-play
- A component can be a single unit of deployment



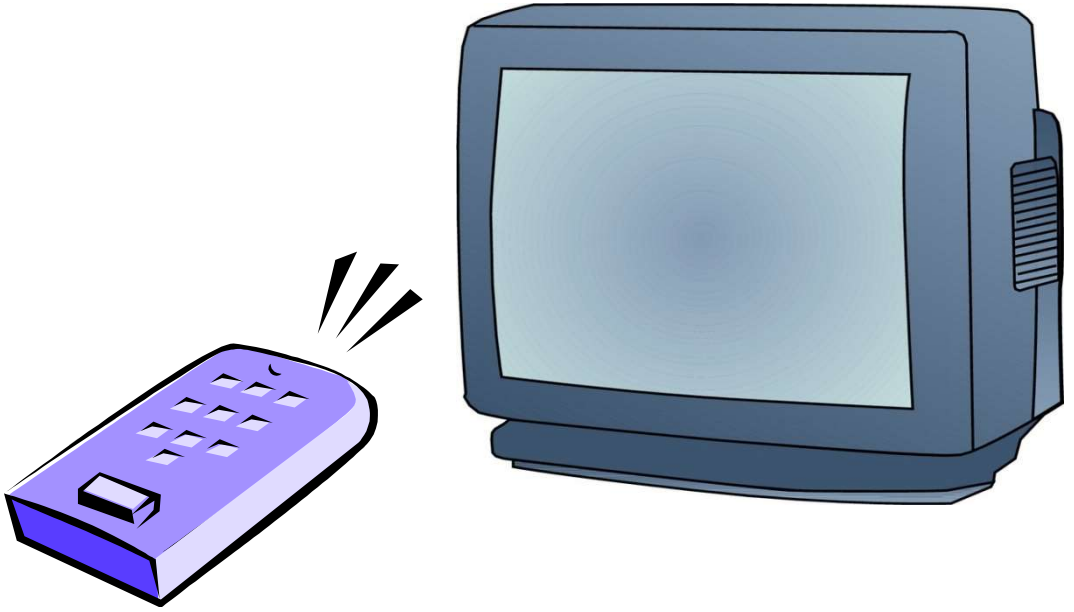
Encapsulation

- The implementation details are hidden



Interface

- The interface tells what you can do (but not how)

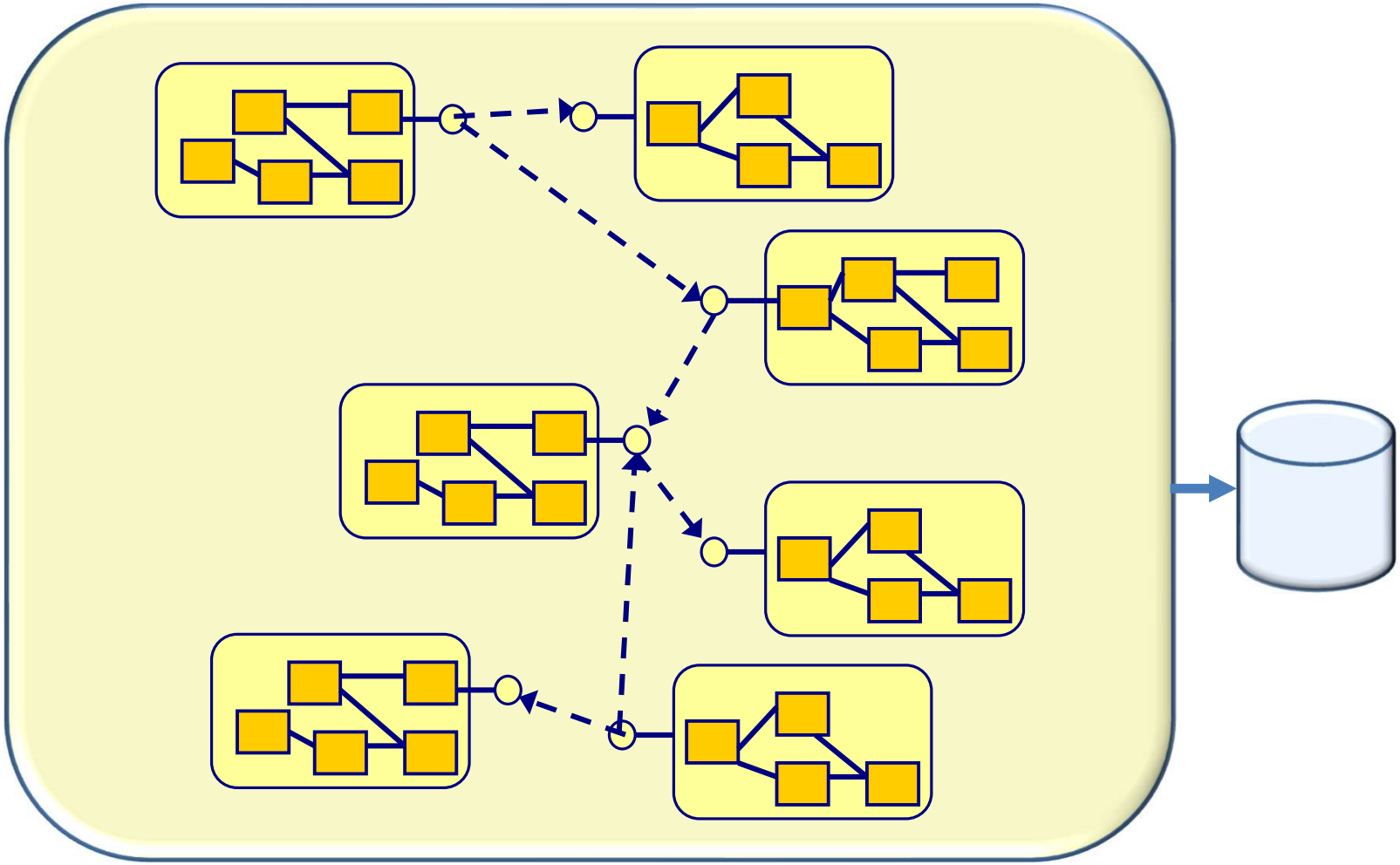


Advantages of components

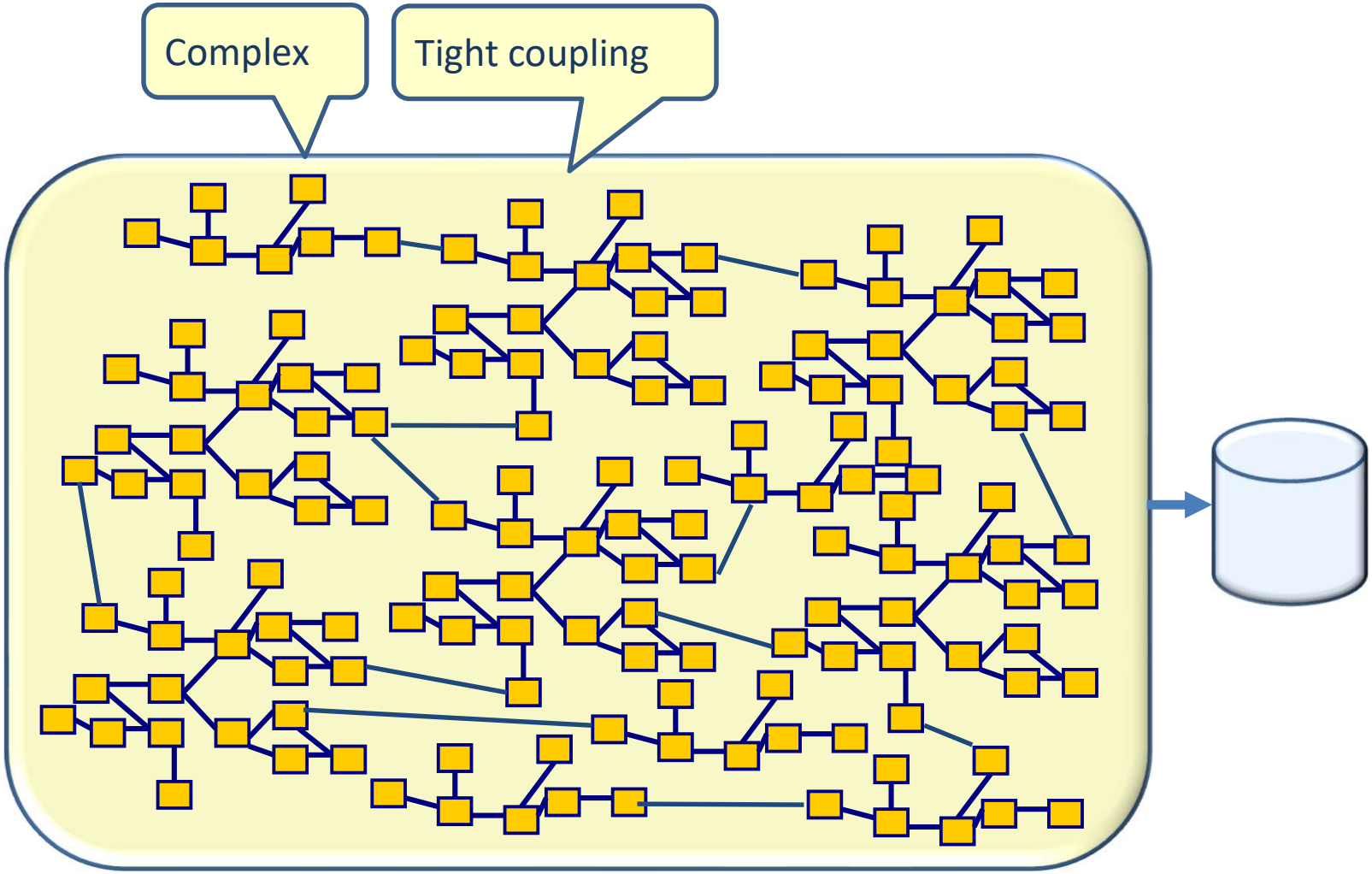
- High cohesion, low coupling
- Flexibility
- Reuse ?

Component Based Development

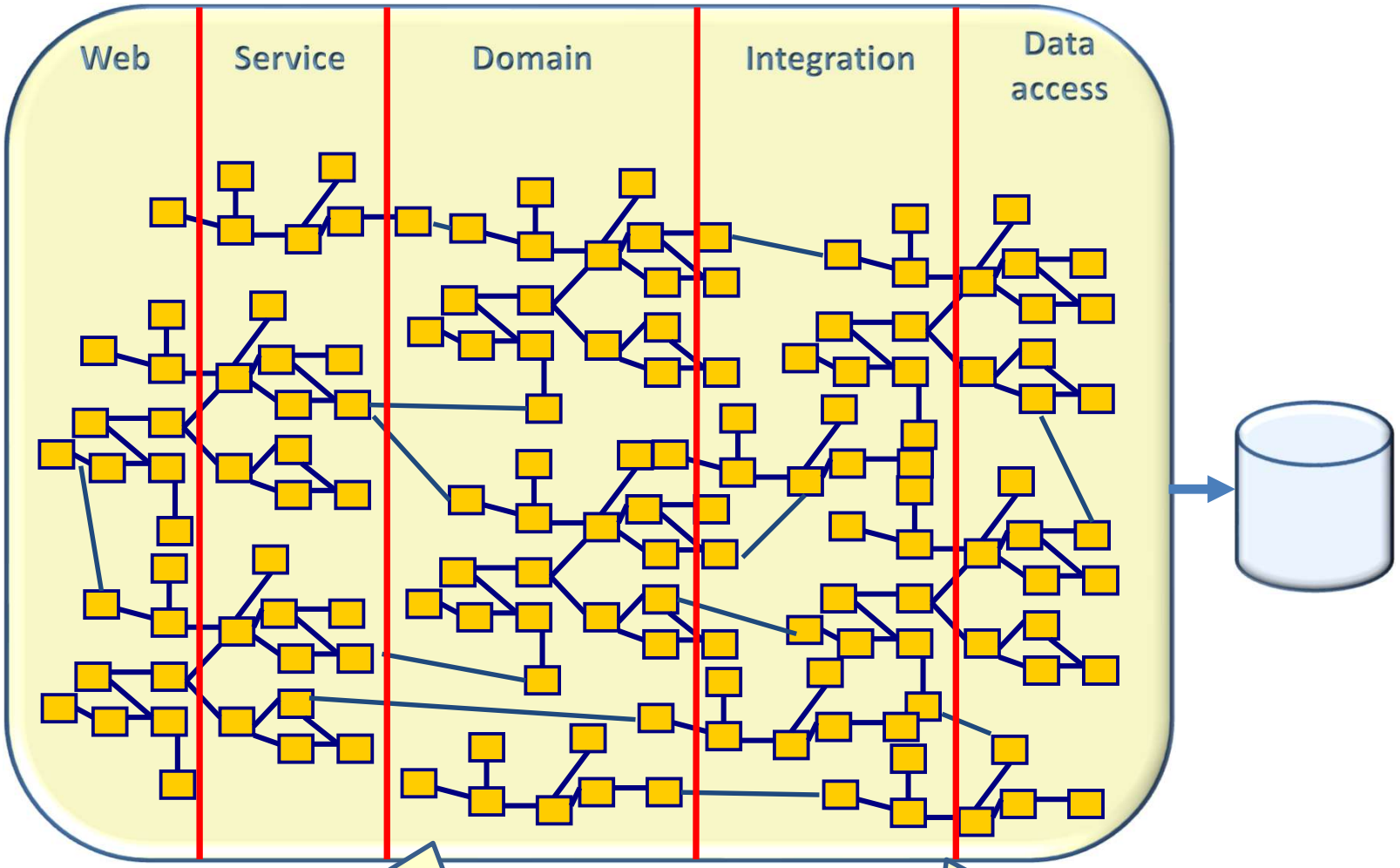
- Decompose the domain in functional components



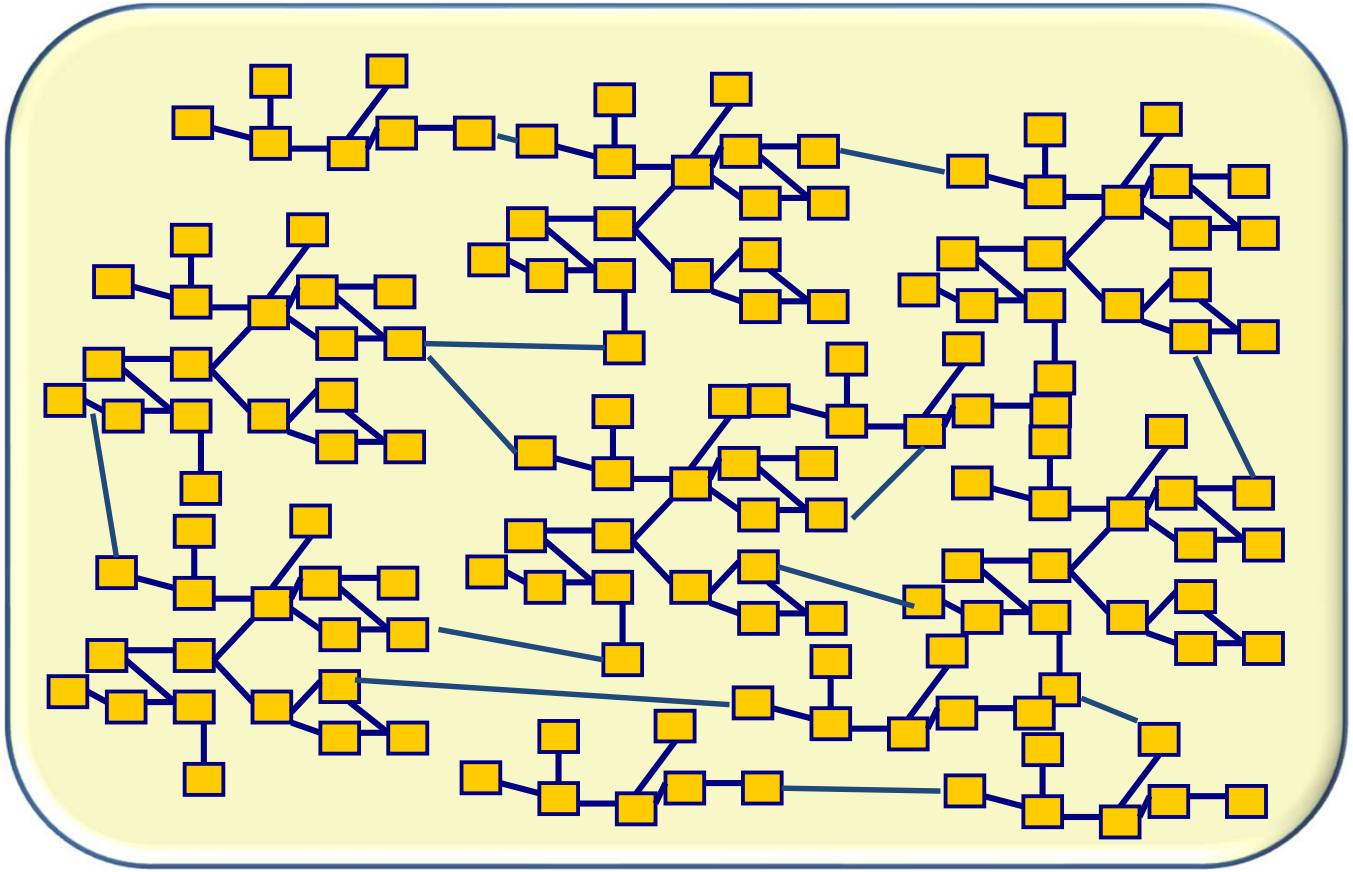
Object orientation



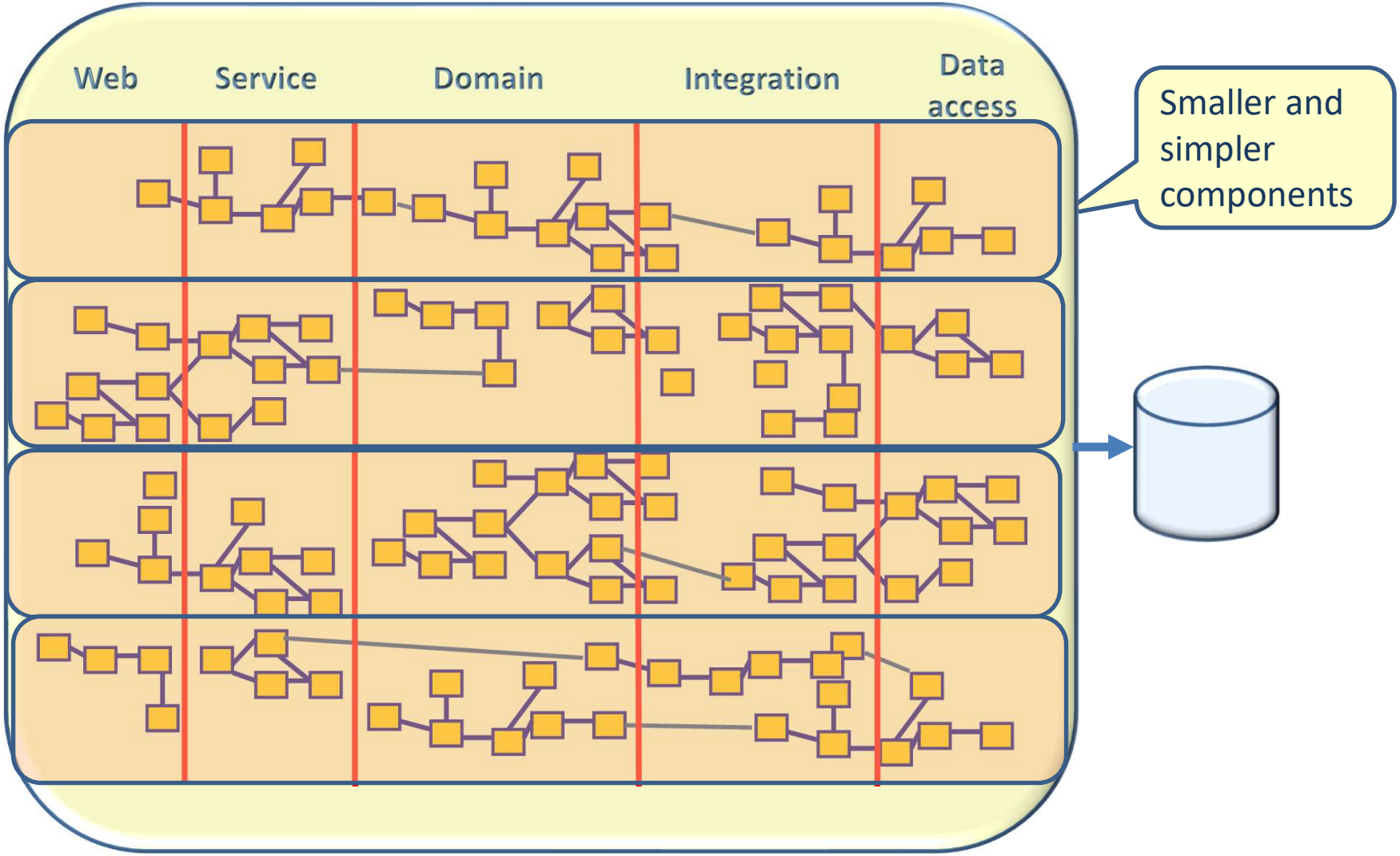
Layering



Layering



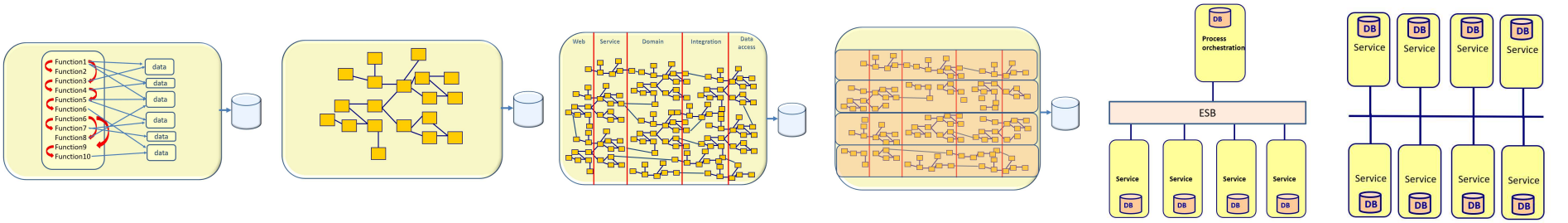
Components



Architecture evolution

Monolith

Distributed system



procedural object-oriented layering components SOA microservices

- Smaller and simpler parts
- More separation of concern
- More abstraction
- Less dependencies

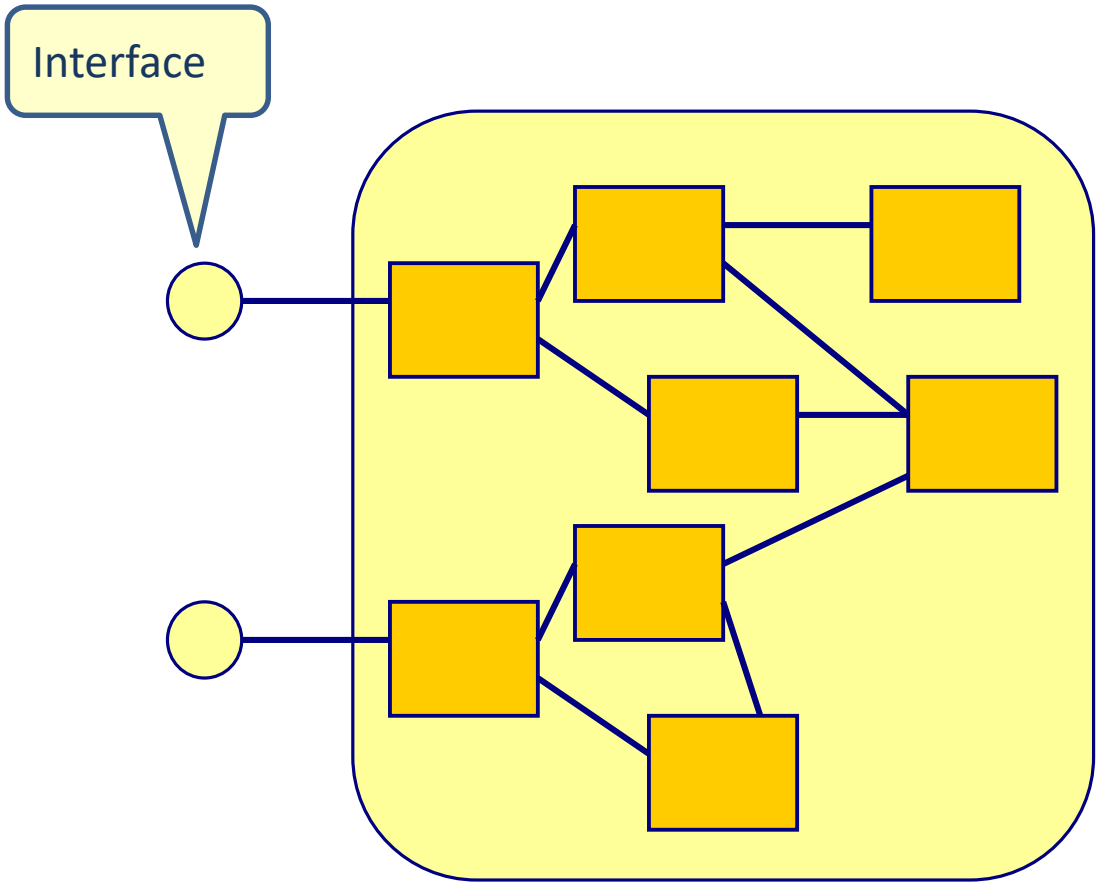
Main point

- Components are encapsulated and completely autonomous plug-and-play elements.
- The human nervous system is capable to transcend to that abstract field of pure consciousness which lies at the basis of the whole creation.

Lesson 5

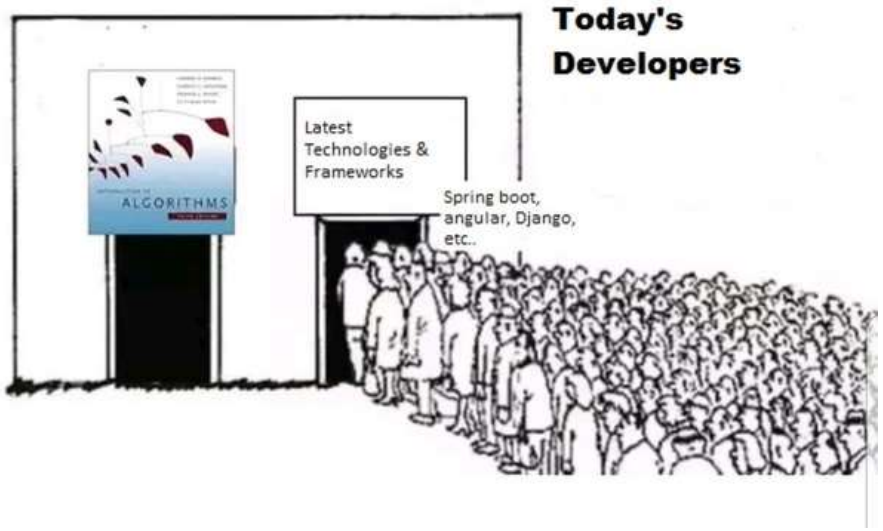
API DESIGN

Interface design



Why is API design important?

- APIs play a bigger role in software development than ever before
- Software development has shifted from
  - Designing algorithms and data structures
  - To
    - Choosing, learning, and using an ever-growing set of API's



Why is API design important?

- Good APIs increase the quality of our applications
  - Bad API design infects our complete application
- The API we use shapes our code
  - API authors are responsible for the quality of the client code

Manual versus automatic transmission

Transmission complexity is hidden

Transmission complexity is exposed to the driver

+ Simple for the driver
+ Less change on mistakes
+ Hard to misuse

- Driver has less control

- More complex for the driver
- Easier to make mistakes
- Easy to misuse

+ Driver has more control

JDBC API client

```
public void update(Employee employee) {
  Connection conn = null;
  PreparedStatement prepareUpdateEmployee = null;
  try {
      conn = getConnection();
      conn.setAutoCommit(false);
      prepareUpdateEmployee = conn.prepareStatement("UPDATE Employee SET firstname= ?,
                                                     lastname= ? WHERE employeenumber=?");
      prepareUpdateEmployee.setString(1, employee.getFirstName());
      prepareUpdateEmployee.setString(2, employee.getLastName());
      prepareUpdateEmployee.setLong(3, employee.getEmployeeNumber());

      int updateresult = prepareUpdateEmployee.executeUpdate();
      conn.commit();
  } catch (SQLException e) {
      conn.rollback();
      System.out.println("SQLException in EmployeeDAO update() :" + e);
  } finally {
      try {
          prepareUpdateEmployee.close();
          closeConnection(conn);
      } catch (SQLException e1) {
          System.out.println("Exception in closing jdbc connection in EmployeeDAO" + e);
      }
  }
}
```

Open connection

Start transaction

Send the SQL

Commit transaction

Rollback transaction

Exception handling

Close connaction

JDBC Template client

```
public void save(Product product) {
  NamedParameterJdbcTemplate  jdbcTempl = new NamedParameterJdbcTemplate (dataSource);
  Map<String,Object> namedParameters = new HashMap<String,Object>();
  namedParameters.put("productnumber", product.getProductnumber());
  namedParameters.put("name", product.getName());
  namedParameters.put("price", product.getPrice());
  int updateresult = jdbcTempl.update("INSERT INTO product VALUES ( :productnumber,
                                      :name, :price)",namedParameters);
}
```

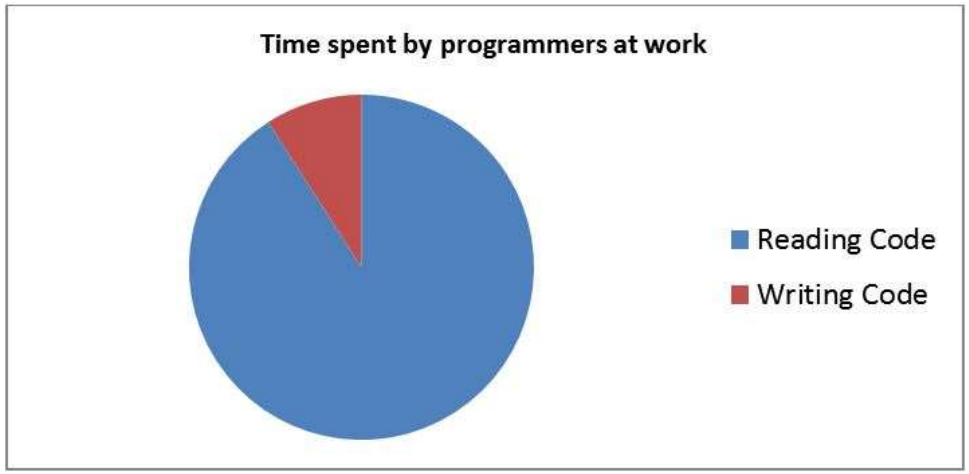
The template takes care of connection, transaction and exception handling

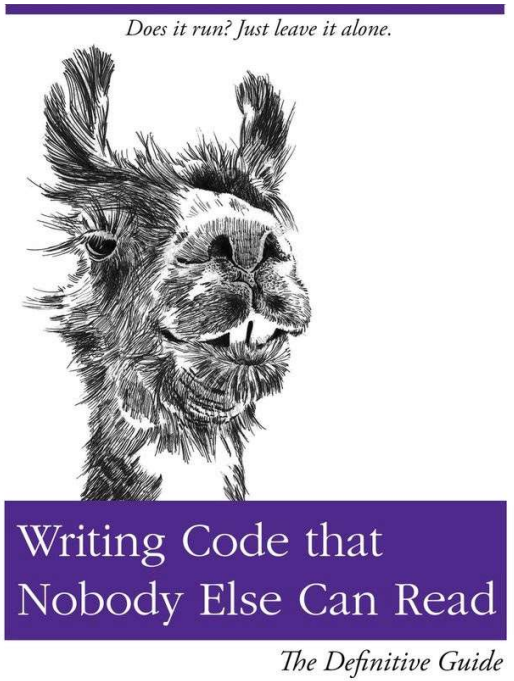
Why is API design important?

- Public APIs are forever
  - One chance to get it right

Why is API design important?

- Usually write-once, read/learn many times by many different people
  - Developers spend most of their time learning APIs, using APIs and debugging code





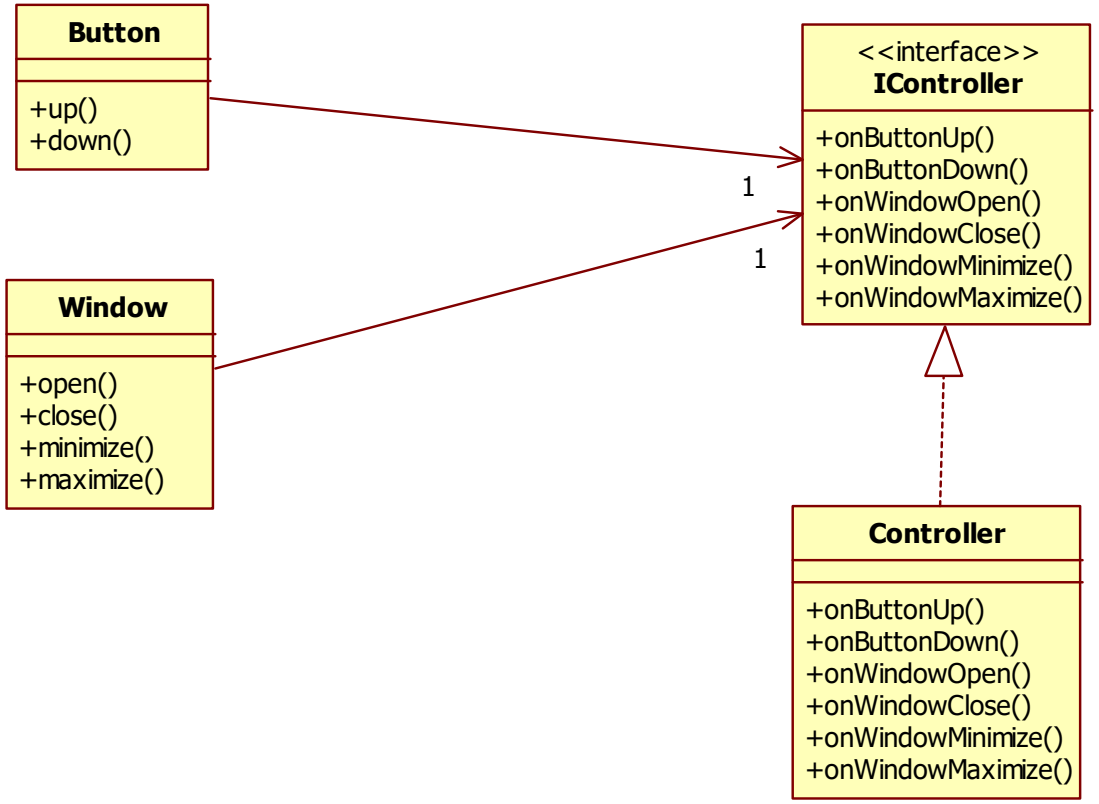
Why is API design important to you?

- If you program, you are an API designer
  - Good code is modular
  - Each module has an API
- Useful modules tend to get reused
  - Once a module has users, can't change API at will

Interface design best practices

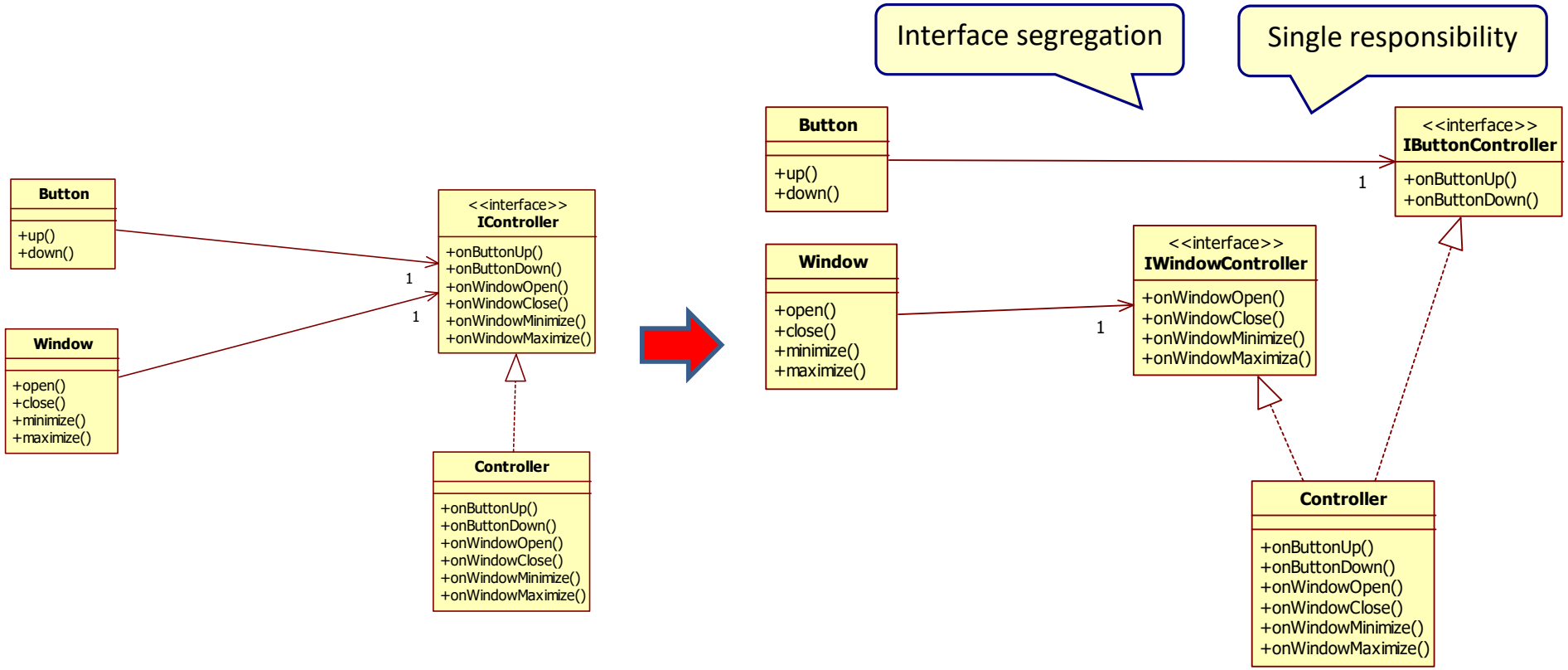
- Start with the client first
  - Single responsibility principle
  - Interface segregation principle
- Easy to use
- Easy to learn
- Hide as much as possible
- When in doubt, leave it out

What is wrong with this API?



Interface segregation principle

- Clients should not be forced to depend on methods (and data) they do not use



The interface should be easy to use

- And hard to misuse.
  - Easy to do simple things
  - Possible to do complex things
  - Impossible (or at least difficult) to do wrong things
- The interface should be simple
- No surprising behavior

Semantics

  - Don’t do anything that is relevant to the client and that you cannot derive from the names of the functions and parameters (or comments)

Easy to use

```
String findString( String text,
                   bool search_forward,
                   bool case_sensitive);
```

NOT OK

```
findString("text", true, false);
```

- Order is clear
- Self-descriptive.

```
findString("text",
SearchDirection.FORWARD,
CaseSensitivity. CASE_INSENSITIVE);
```

```
enum SearchDirection {
  FORWARD, BACKWARD
};
enum CaseSensitivity {
  CASE_SENSITIVE, CASE_INSENSITIVE
};
String findString( String text,
                   SearchDirection direction,
                   CaseSensitivity case_sensitive);
```

Prefer enums over booleans to improve code readability.

OK

The interface should be easy to learn

- Well documented
- Names matter (classes, functions, variables)
  - Clear code

```
bucket.empty()
```

NOT OK

```
getCurrValue()
getCurValue()
getCurVal()
```

```
bucket.isEmpty()

bucket.makeEmpty()
```

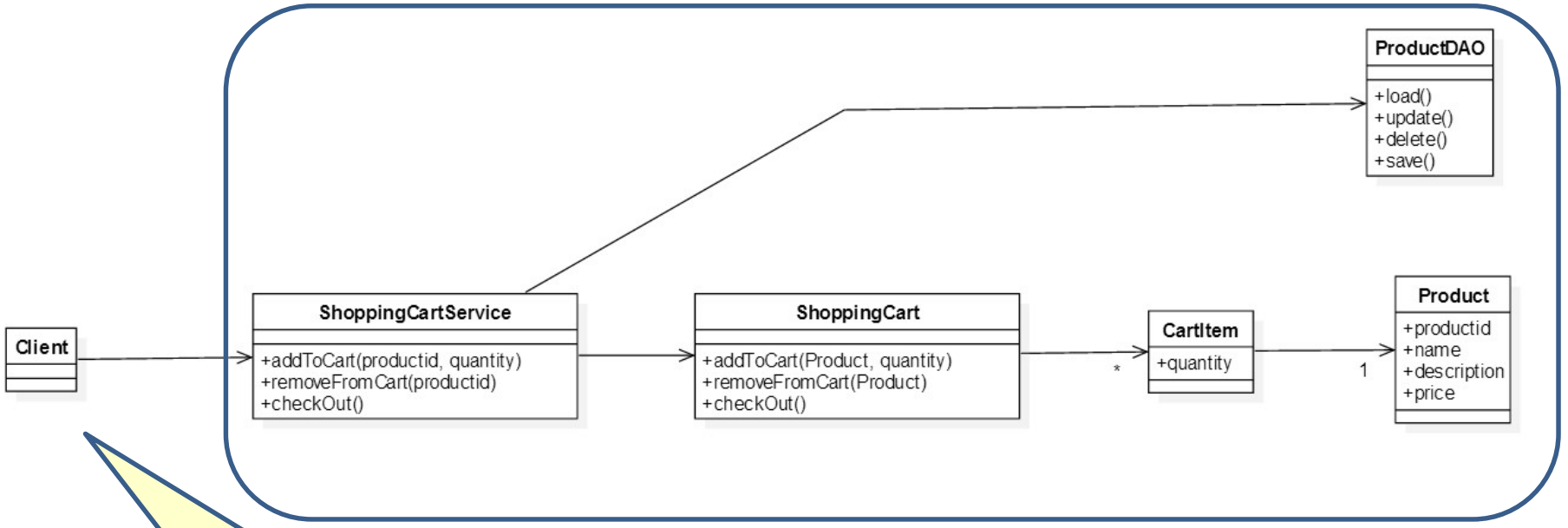
OK

```
getCurrentValue()
```

Do not expose implementation details

- The client should be independent of implementation details
  - You can change the implementation without changing the client
- Don’t let implementation details “leak” into the API
  - An API method that throws a SQL exception
  - An API method that returns a hash table

Hide Implementation Classes



The client knows nothing about CartItem, Product and data access

Minimally complete

- But no smaller
- API should satisfy its requirement
- **When in doubt, leave it out**
  - You can always add
  - You can never remove
- API should do one thing, and do it well
- Do not add extra levels of generality for the future
  - You might never need it
  - When you need it, you have a better understandability of what is needed
  - Its easier to add to a simple API than a complex API

It is tempting to expose all possible functionality you can think of.

If it is not required, then leave it out.

The API should be as small as possible

Use immutable objects on the interface

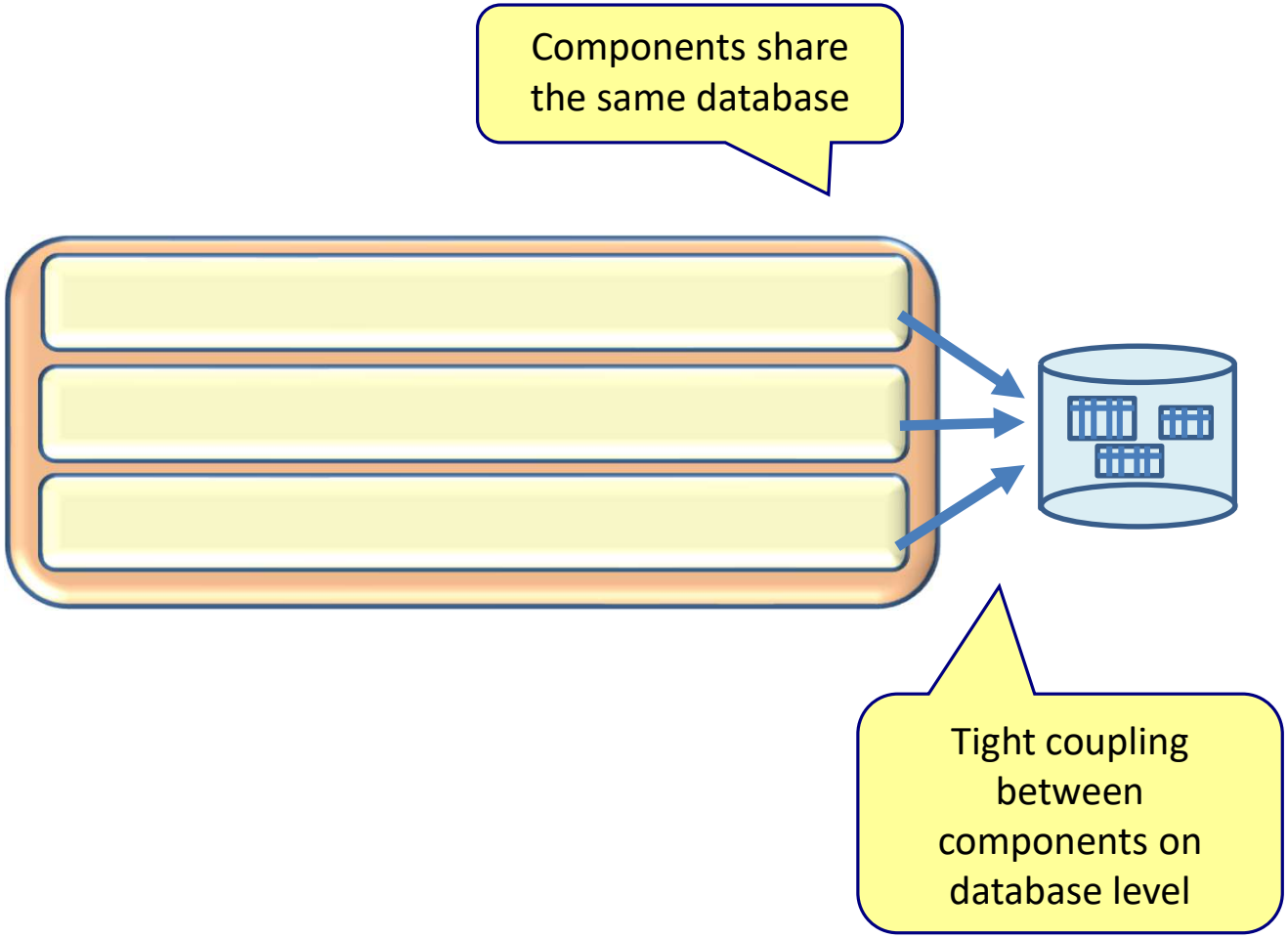
- Immutable object
  - Object whose internal state cannot be changed after its creation
- Advantages
  - Immutable objects are simple.
  - Immutable objects are inherently thread-safe; they require no synchronization.
  - Immutable objects can be shared freely.
  - Immutable objects make great building blocks for other objects

Don’t make the client do anything the module can do

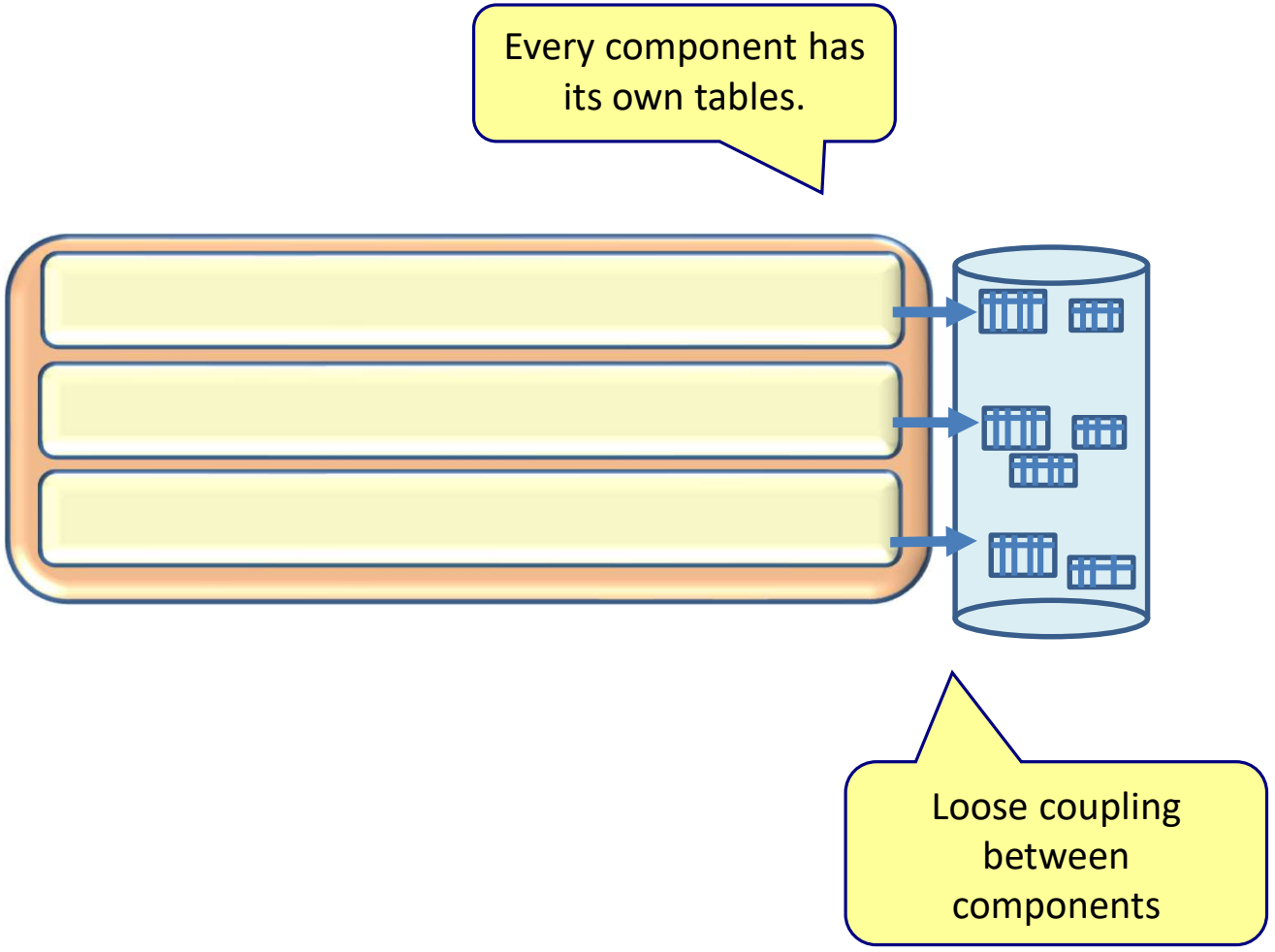
- Reduce the need for boilerplate code
  - Generally done via cut-and-paste
  - Ugly, annoying, and error-prone

COMPONENT DESIGN

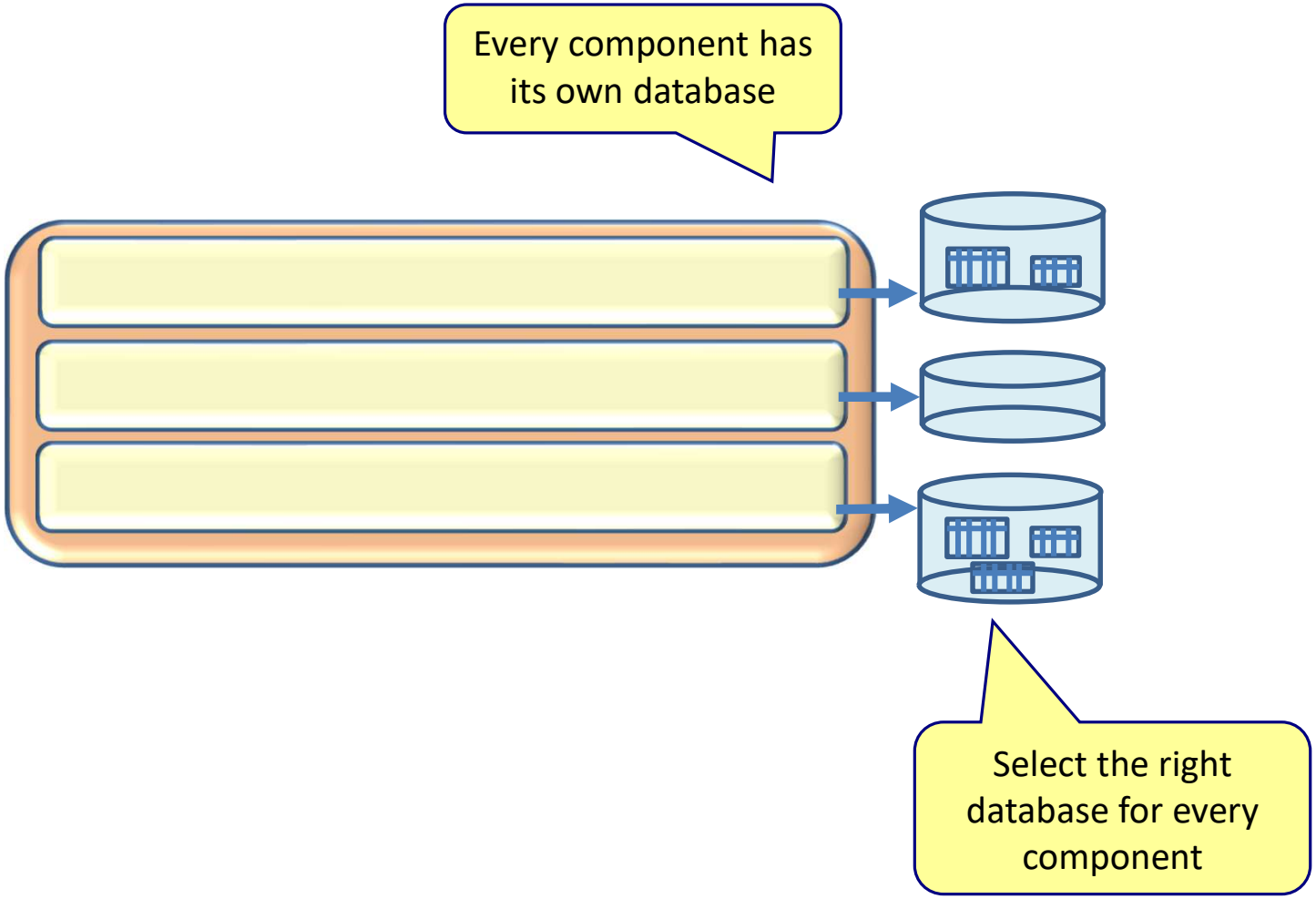
Components and database



Components and database



Components and database



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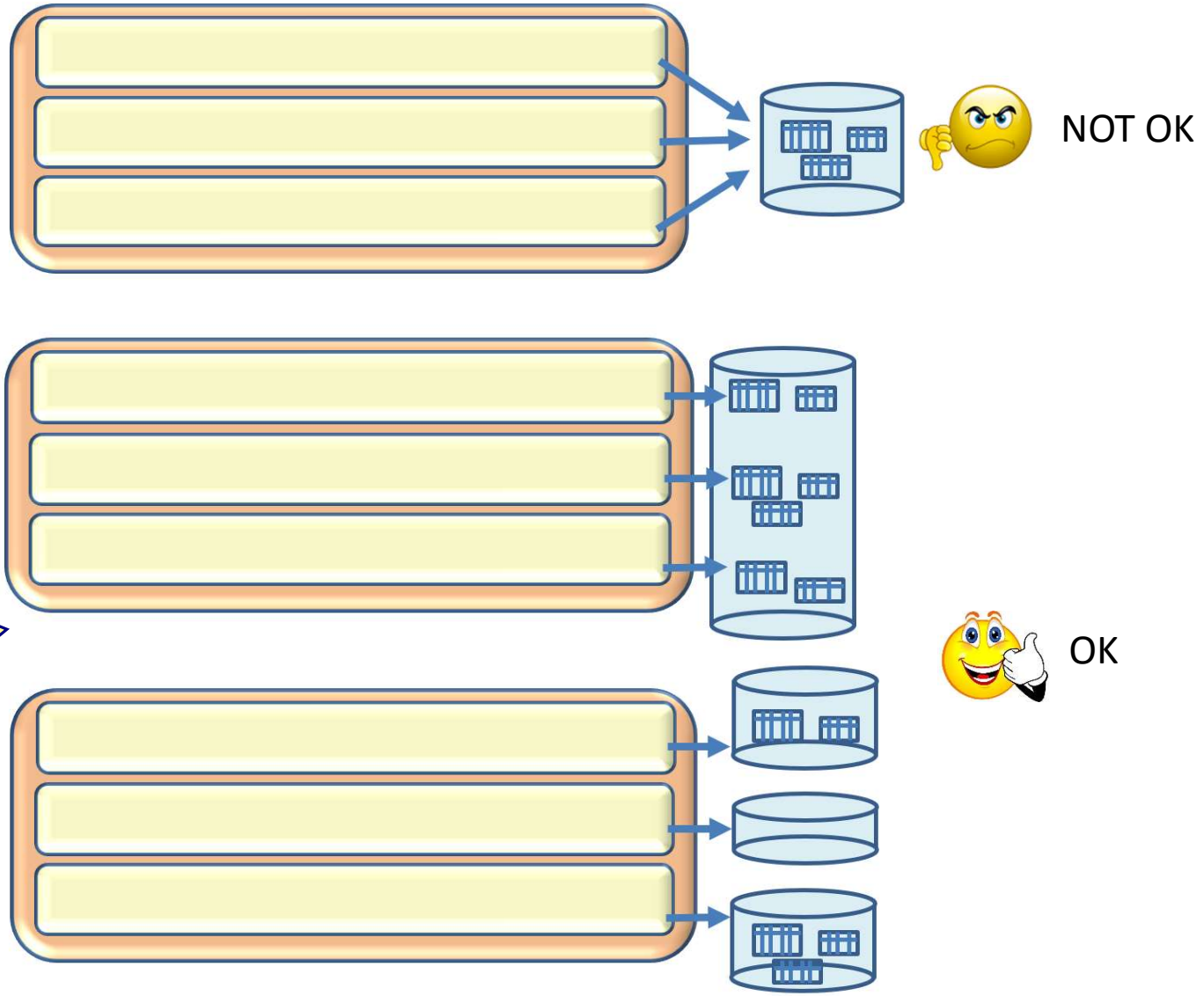
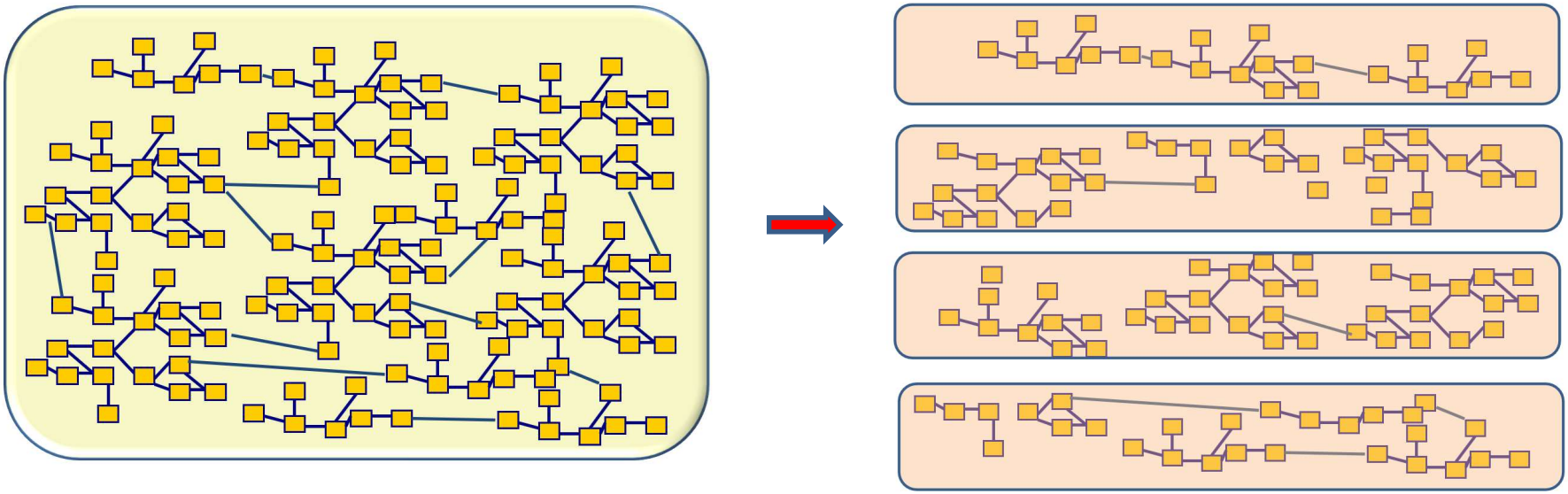
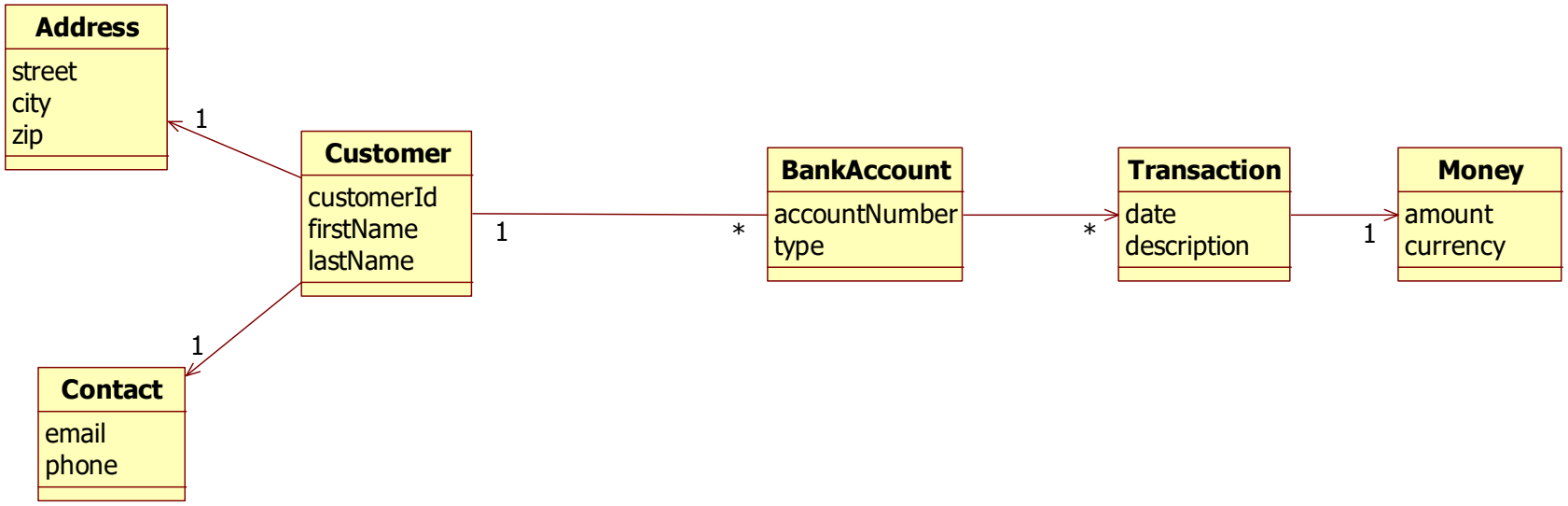


Loose coupling is the most important aspect of component based design

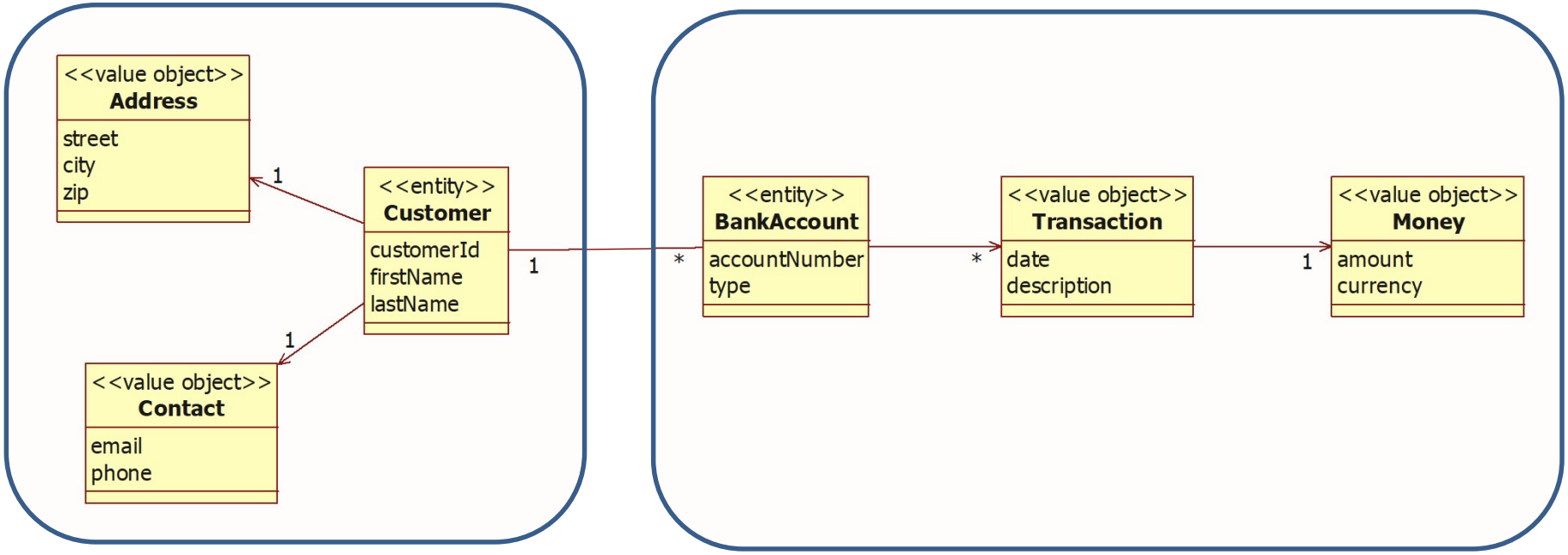
How do we split classes into components?



How do we split classes?

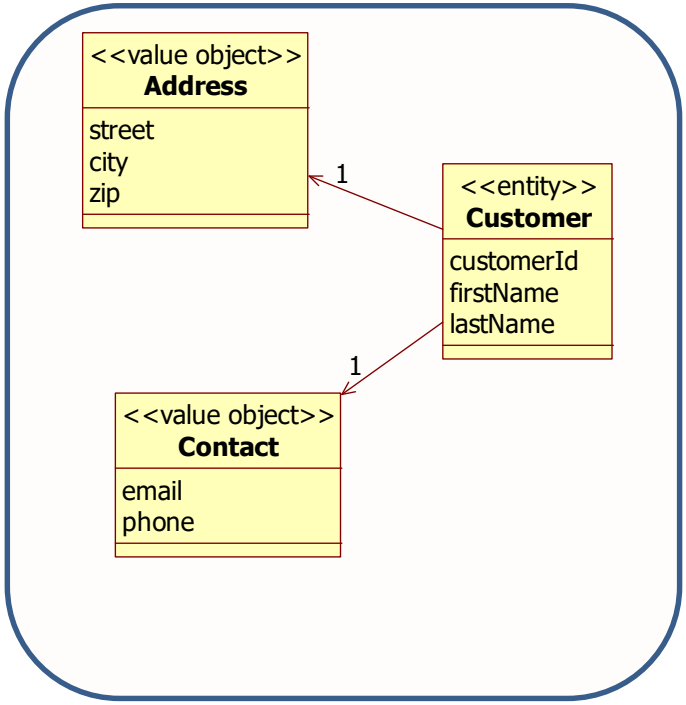


Aggregates

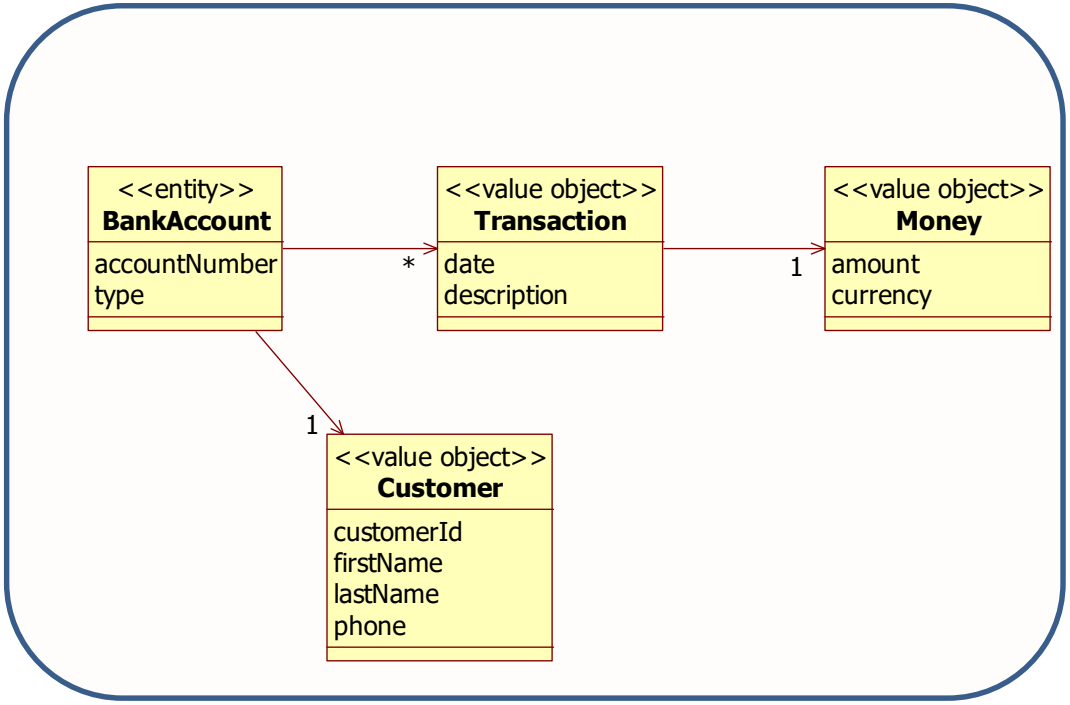


Aggregates

Customer component domain model

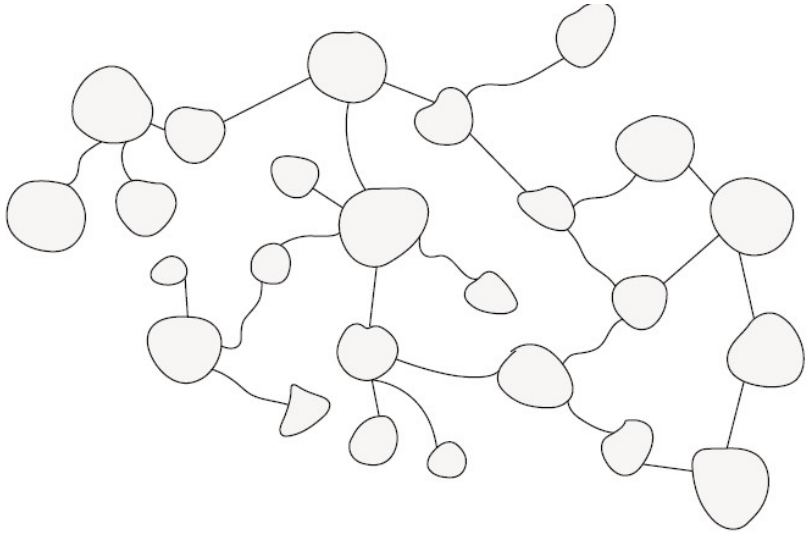


Account component domain model



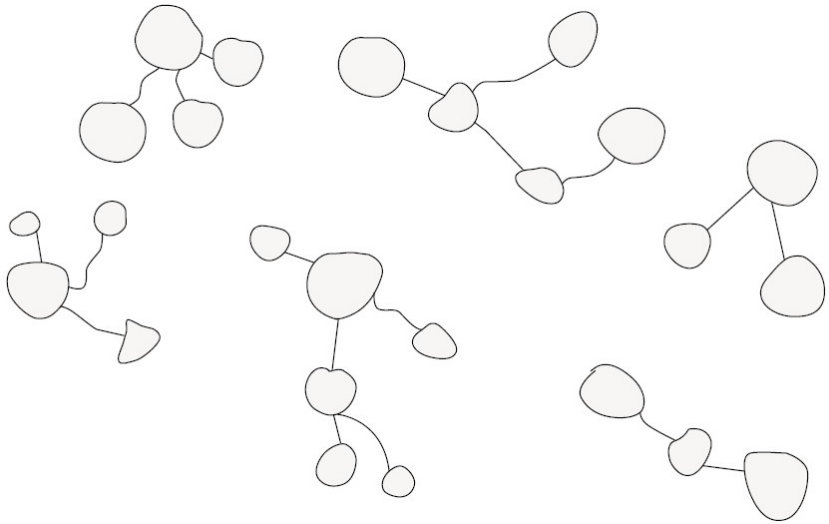
Simplicity of the domain model

NOT OK



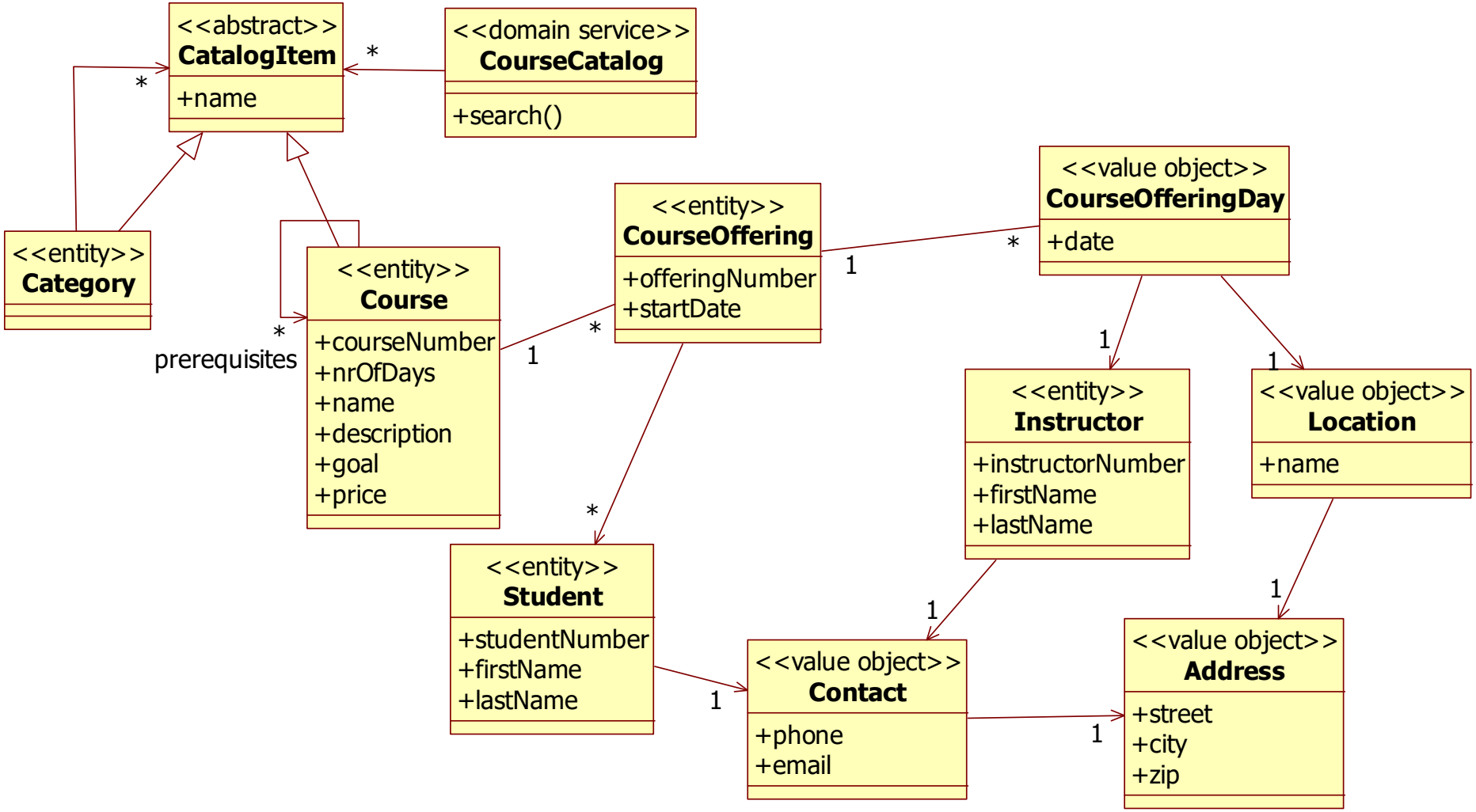
Complex domain model with many unnecessary associations

OK

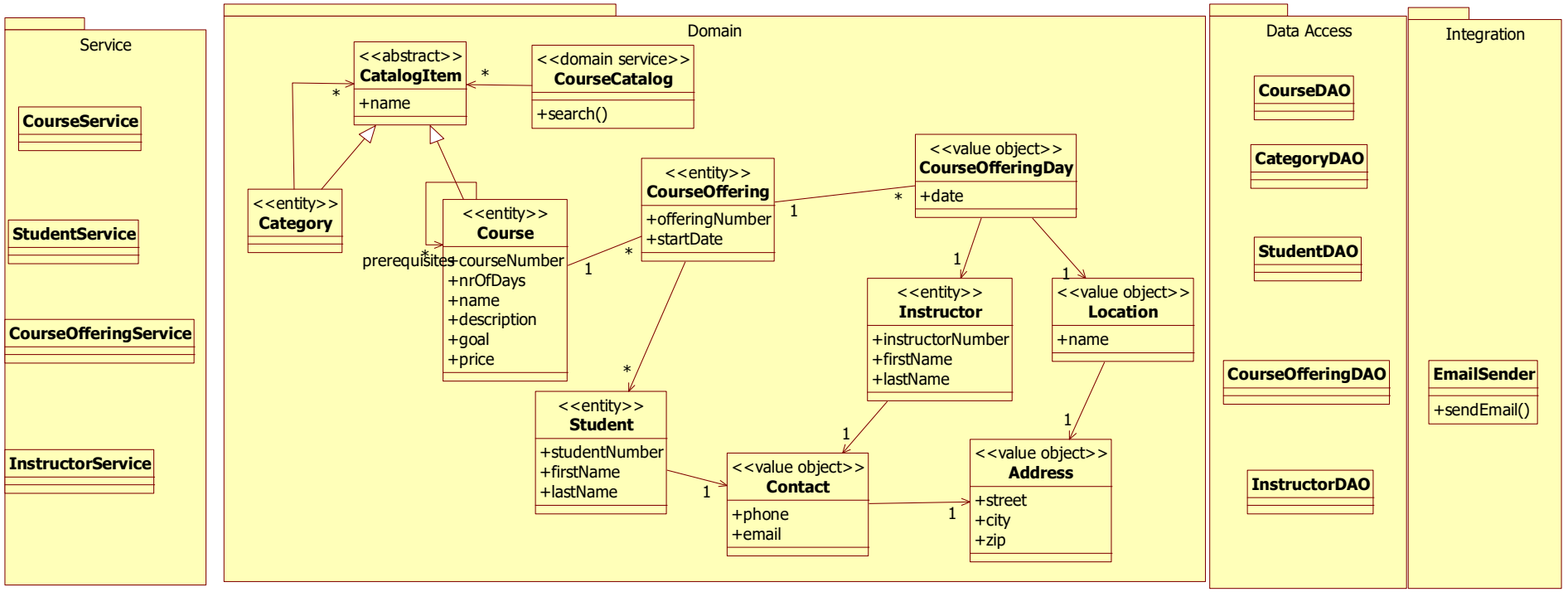


Clearer domain model with only the essential associations

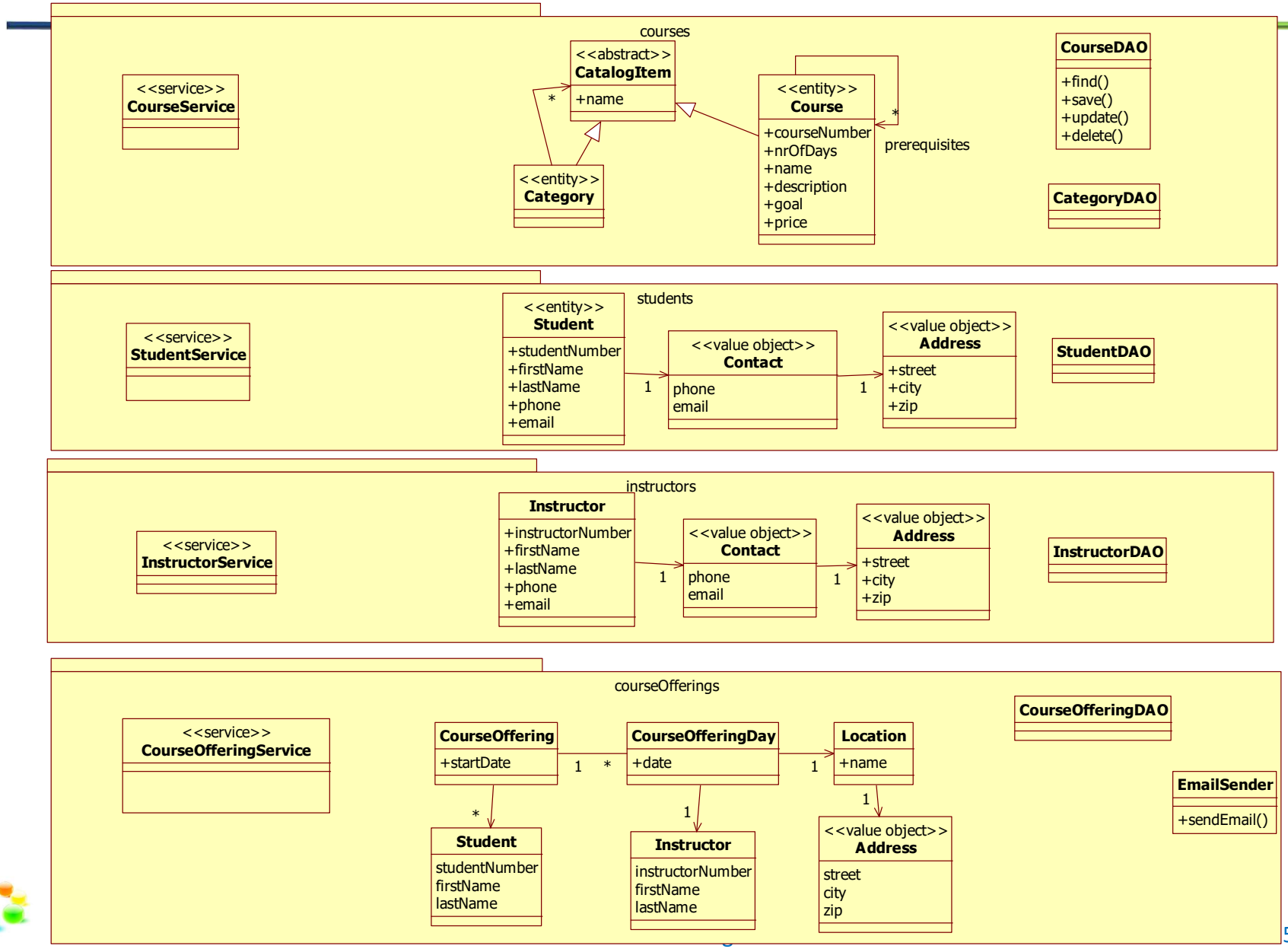
Course Registration Domain Model



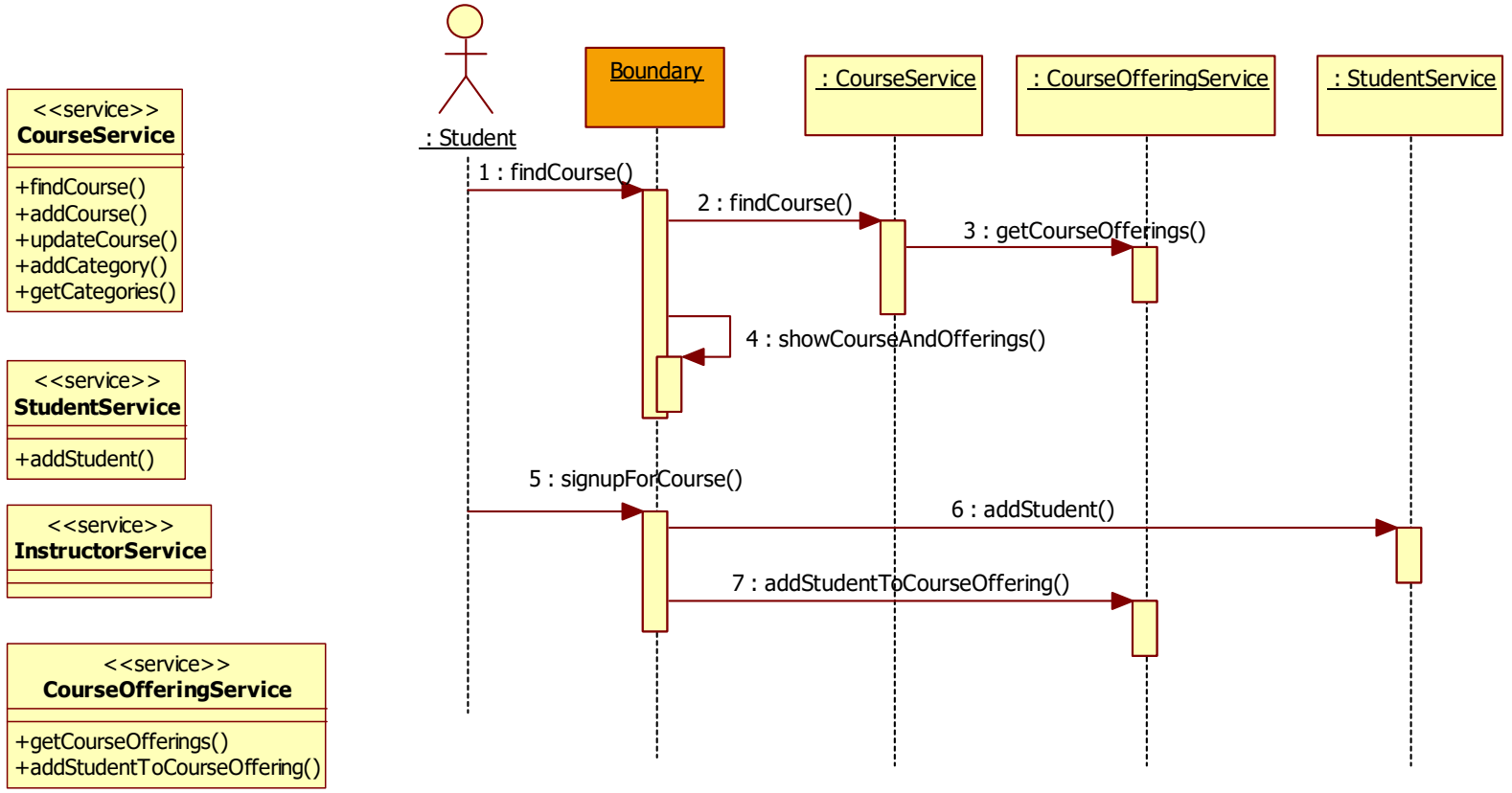
Course Registration Design



Course Registration with components

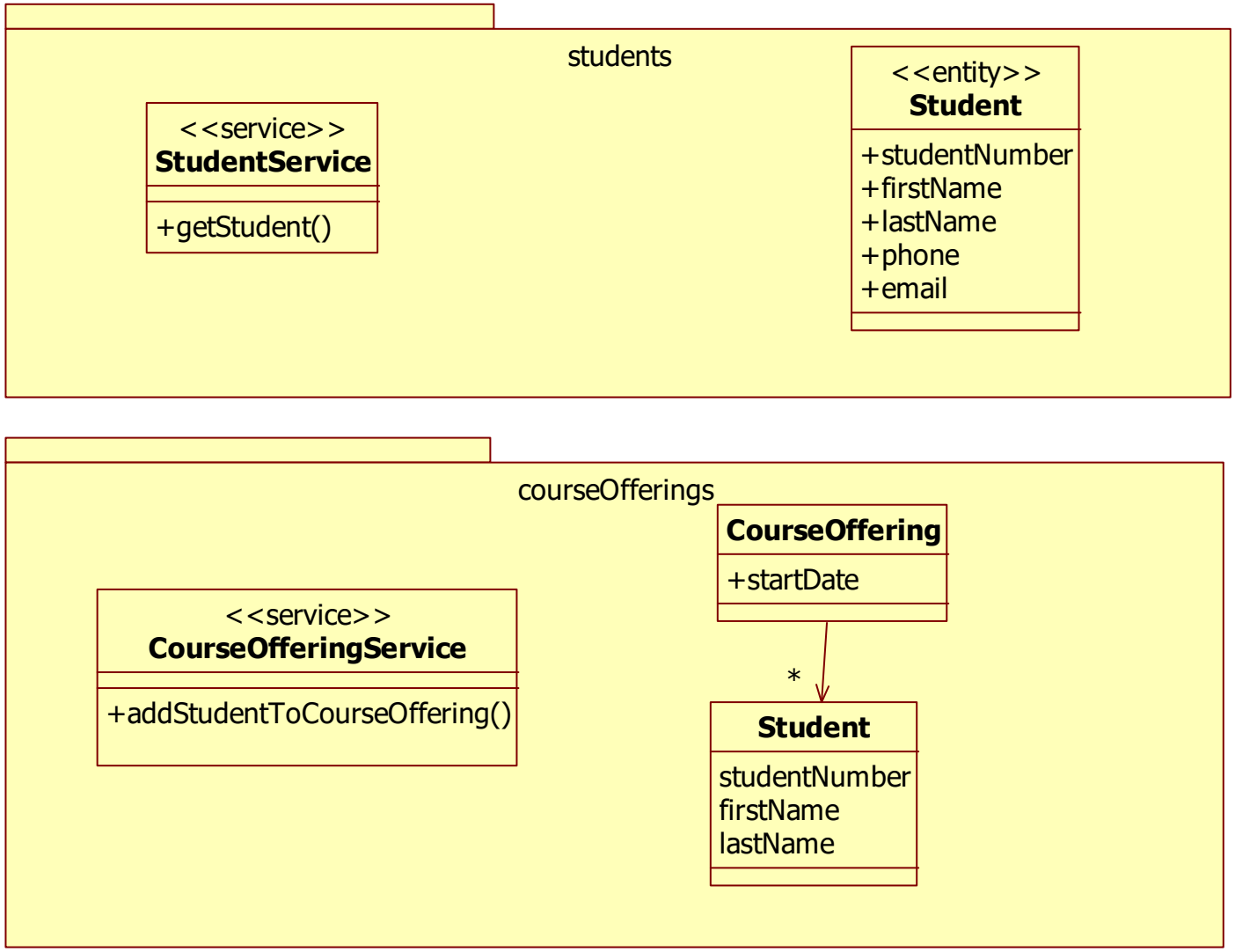


Course Registration with components



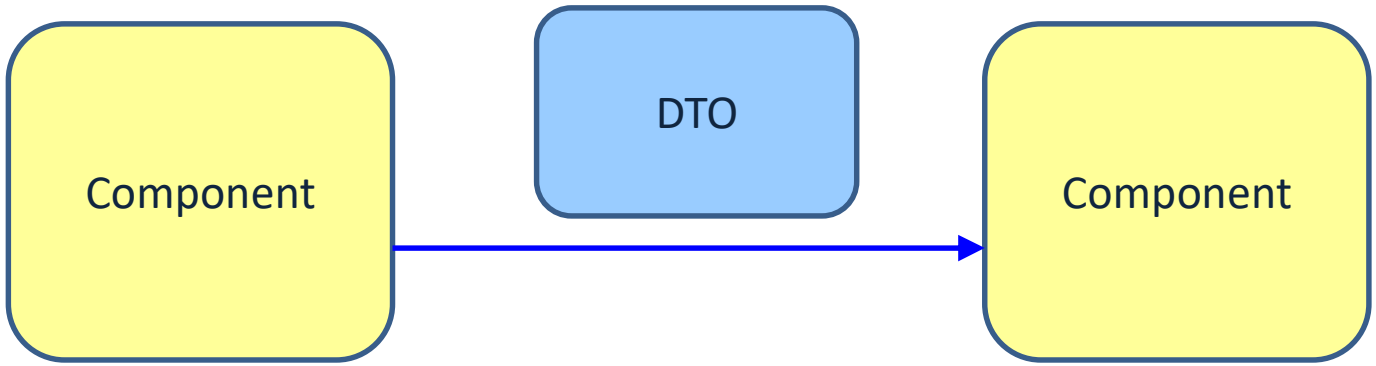
DATA TRANSFER OBJECTS (DTO)

No shared data between components

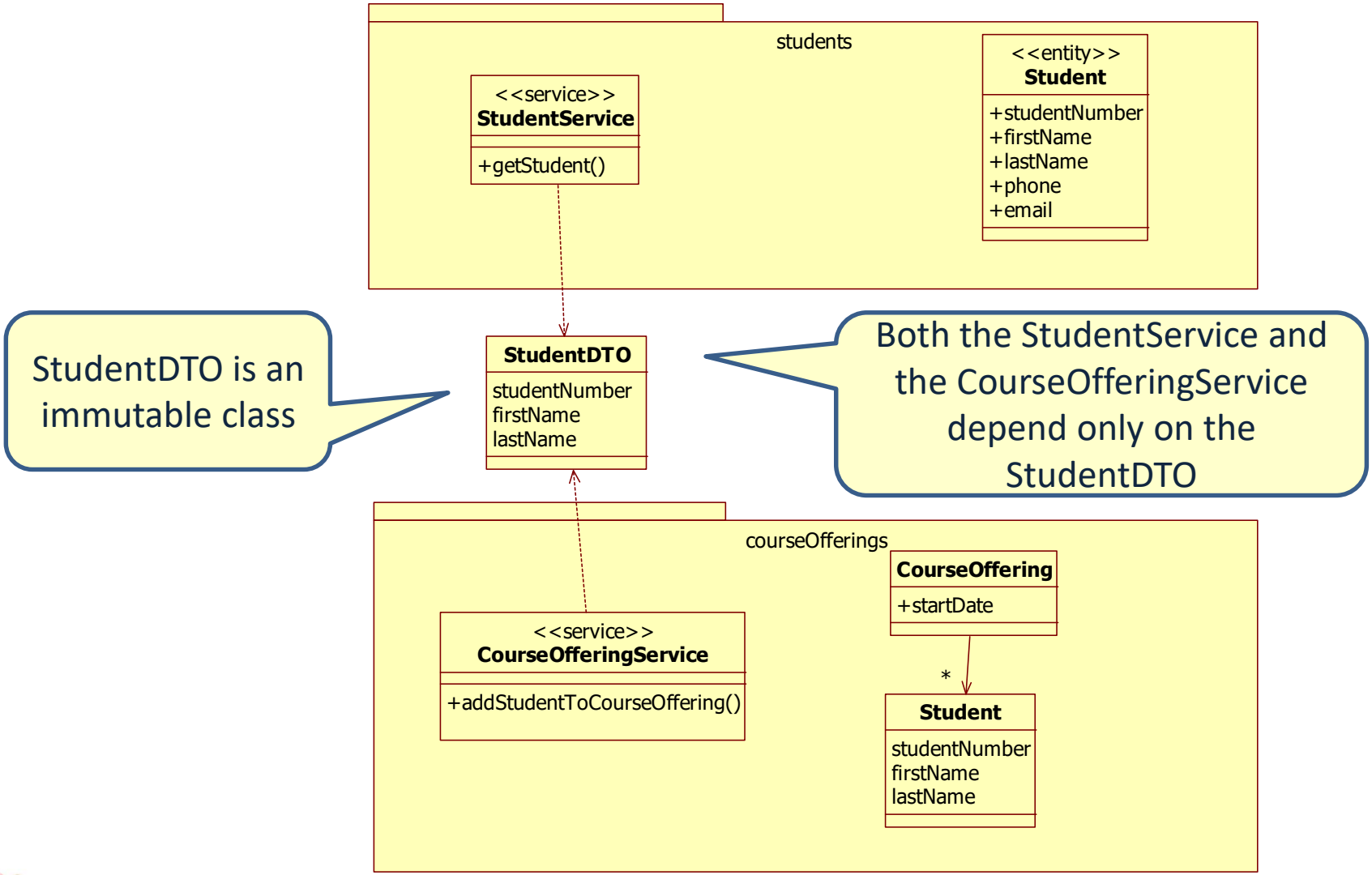


Data Transfer Objects (DTO)

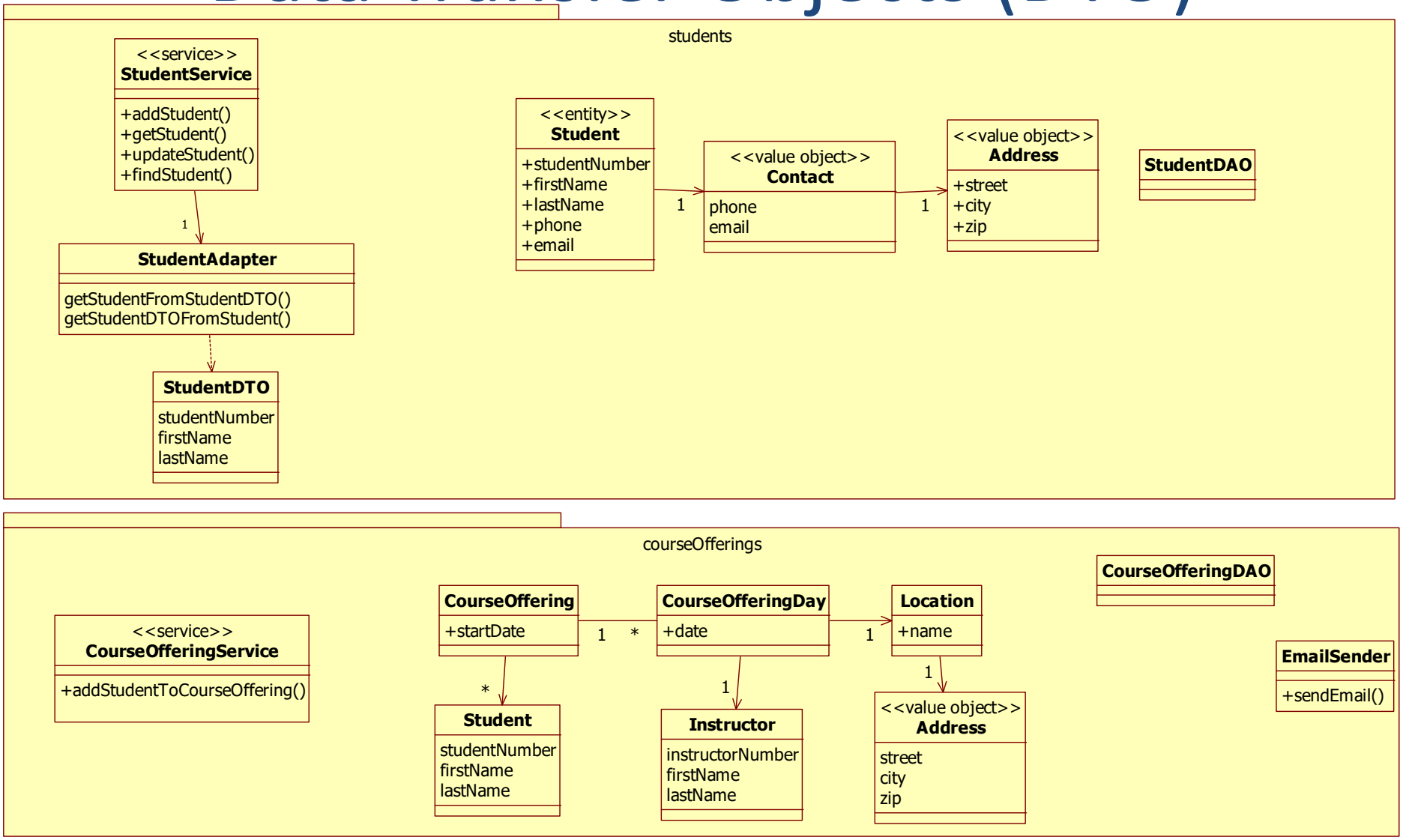
- Object that contains only attributes and getters and setters



Data Transfer Objects (DTO)

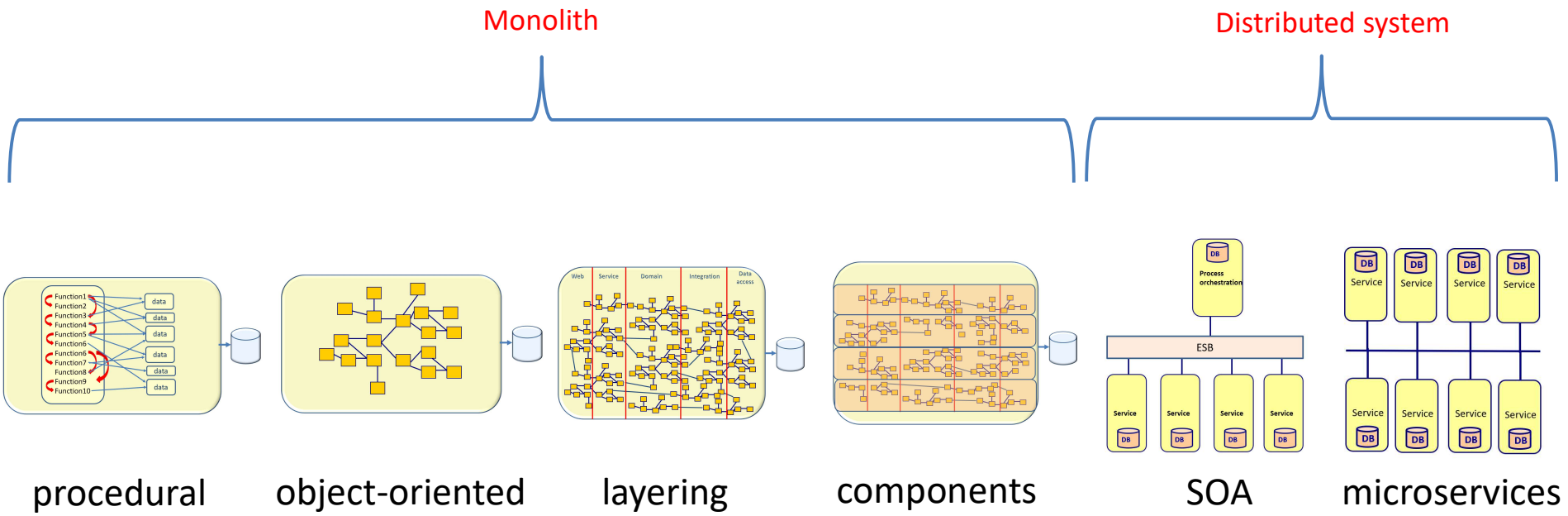


Data Transfer Objects (DTO)



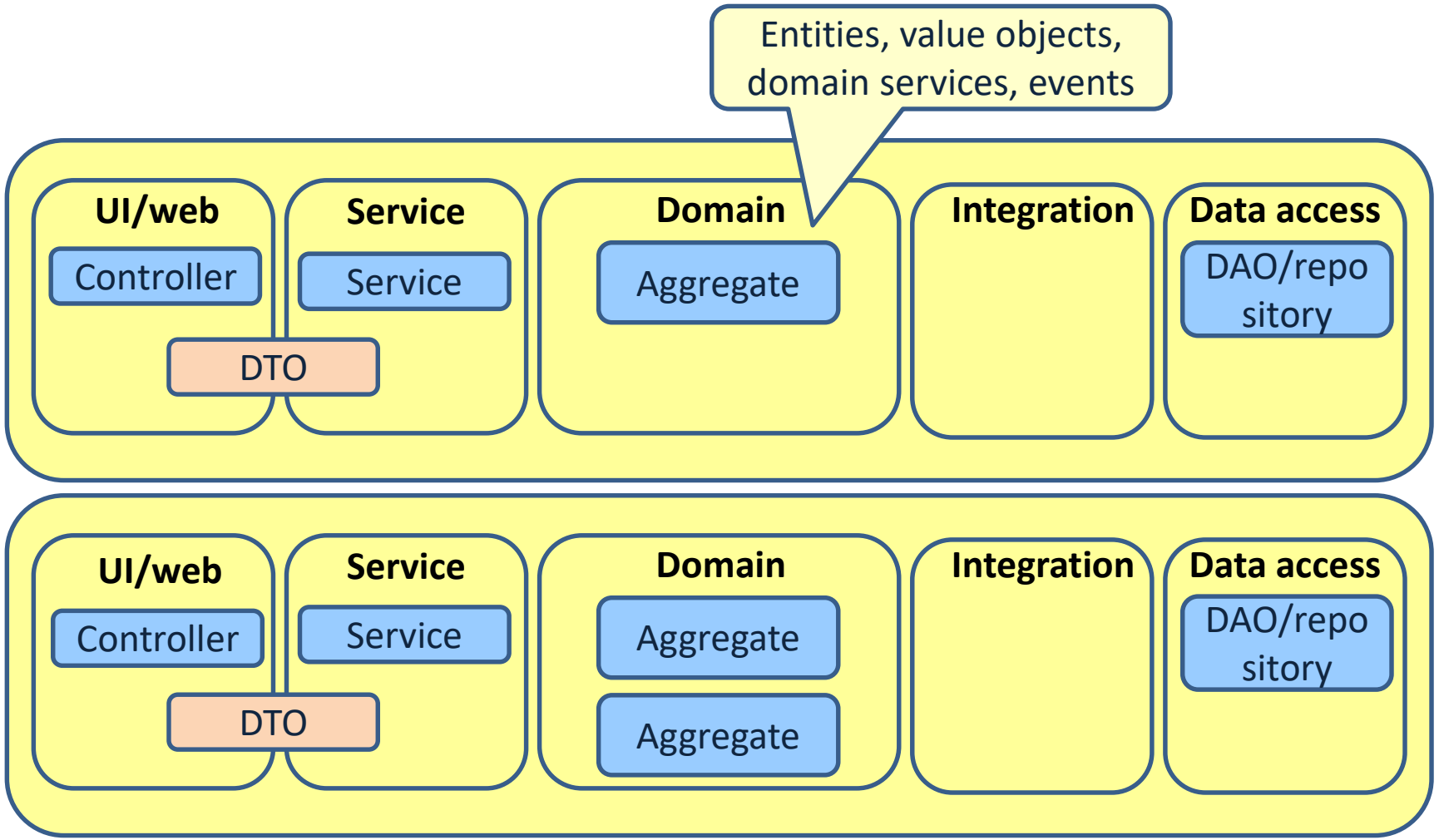
SUMMARY

Architecture evolution



- Smaller and simpler parts
- More separation of concern
- More abstraction
- Less dependencies

Component design



Connecting the parts of knowledge with the wholeness of knowledge

1. A component is a loosely coupled module which is encapsulated and has one or more interfaces
2. The only coupling between components is the interface with Data Transfer Objects

3. **Transcendental consciousness** is the source of all intelligence in nature.
4. **Wholeness moving within itself:** In Unity Consciousness, one realizes that all components in creation are just expressions of ones own Self.