Einführung in die Softwaretechnik 2018
Sheet 06

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1. You are designing the access control mechanism for a web-based retail store. Customers browse product information, update their profile, and purchase products. Suppliers can add new products, update product information, and create, process, and examine orders. The store administrator sets the retail prices, makes tailored offers to customers based on their purchasing profiles, and provides marketing services. You have to deal with four actors: StoreAdministrator, Supplier, registered Customer, and unregistered WebUser. Design an access control mechanism for all actors. Customers are already registered. Suppliers need to be registered by the StoreAdministrator. Unregistered web users can only get information about the product and can register by creating the customer info.

Actors / Objects	Product	Order	Offer	Profile	Marketing
Store Administrator	set retail Price		«create» make offer	read purchase info* «create» register Supplier	provide marketing services
Supplier	«create» add product update product info	«create» create order process examine			
registered Customer	browse product information purchase product			update profile	
unregistered WebUser	browse product information			«create» register user	

* As the StoreAdministrator needs to be able to make offers based on a Customers purchasing history ha has to able to read the data from the profile method. Therefore this extra functionality is added.

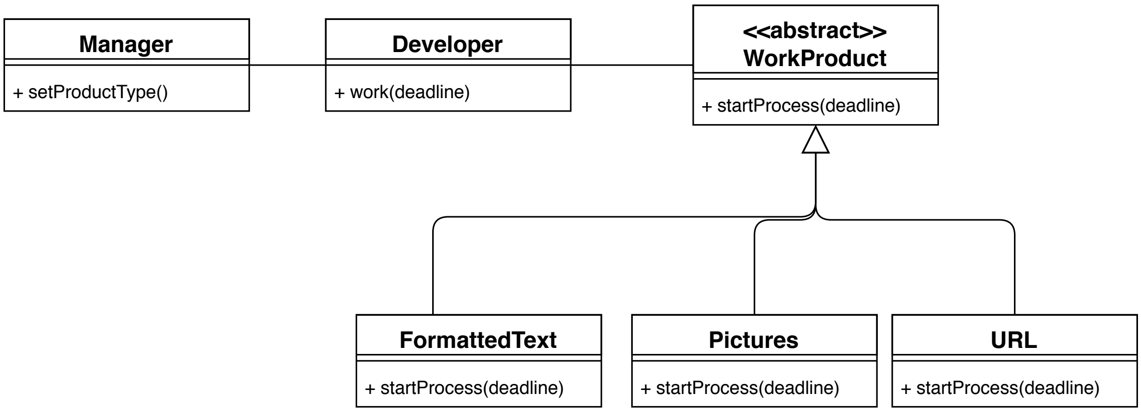
2. Given the following sentences, which inheritance mechanisms (specification or implementation inheritance) would be appropriate?

- A Rectangle class inherits from a Polygon class.
- A Set class inherits from an existing BinaryTree class.
- A Set class inherits from a Bag class (a Bag is defined as an unordered collection).
- A Player class inherits from a User class.

- Rectangle inherits form Polygon
  As Polygon is more abstract than the Rectangle specification inheritance is used. This is the case because a Rectangle is polygon but only the specification of that functionality is reused.
- Set inherits from BinaryTree
  Here implementation inheritance is used as BinaryTree is a concrete implementation of an Algorithm and set reusing this provided functionality.
- Set inherits from Bag
  Here specification inheritance is used as bag is an abstract definition of an unordered collection and Set implements it. Therefore only the specified functionality is reused.
- Player inherits form User
  Here specification is used as User is a more abstract concept than Player. Because of this the functionality specified in the User class is implemented in the Player.

3. Consider a workflow system supporting software developers. The system enables managers to model the process the developers should follow in terms of processes and work products. The manager assigns specific processes to each

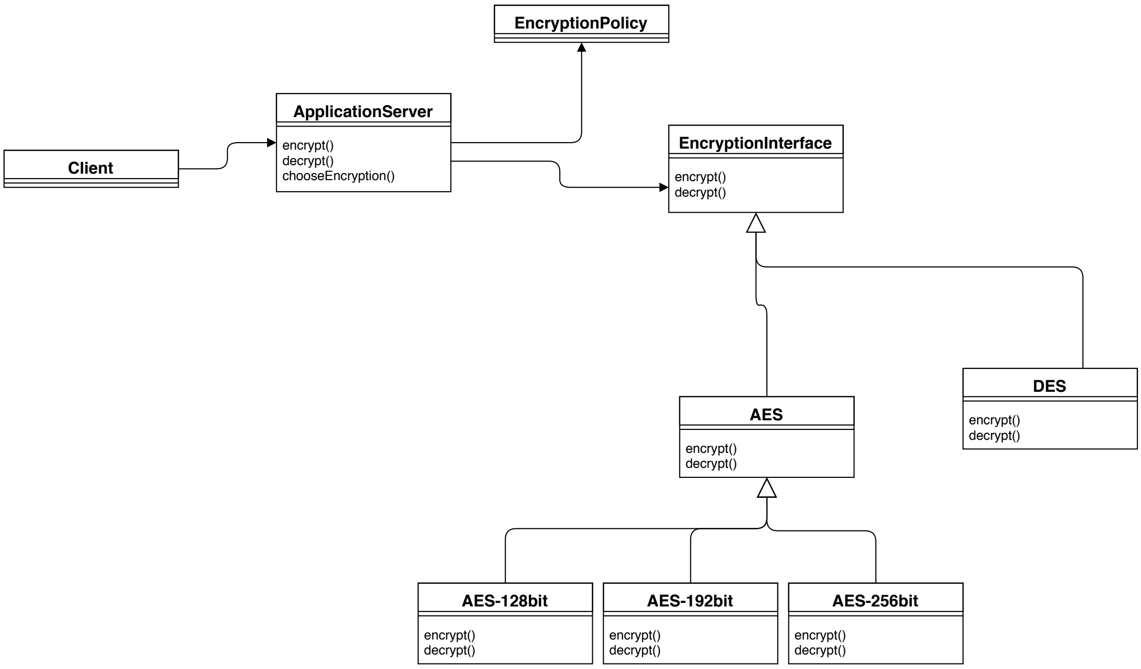
developer and sets deadlines for the delivery of each work product. The system supports several types of work products: formatted text, pictures, and URLs. The manager, while editing the workflow, can dynamically set each work product's type at run-time. Assuming one of your design goals is to design the system so that more work product types can be added in the future, which design pattern would you use to represent work products? Justify your choice and model this design pattern using a UML class diagram.



This system is realized with the bridge patten as the concrete implementation of a work product needs to be chosen at runtime. The choice of this pattern is reinforced as the list of possible WorkProduct Types needs to be easily extensible.

Therefore once a Manager assigns a WorkProduct via the `work(deadline)` method with a specified deadline, the Corresponding WorkProduct implementation is chosen. As all of them have the `startProcess(deadline)` method a specification with an interface is done.

4. A server offers a method to perform an encryption. A variety of clients can use this method. At run-time, the server application selects the AES or DES encryption algorithm. AES supports a variety of key lengths with 128, 192, to 256-bit, whereas DES only supports 56-bit keys. The server has to deal with clients that require backward compatibility and clients that require high security. Draw a UML class diagram depicting the classes and methods, and explain your model.



When a connection is initiated the Client connects to the application server and an encryption strength is decided upon by the `chooseEncryption()` Method. It uses the encryption policy to decide upon the right encryption to use at runtime. This is based on the capabilities of the client. If it is a legacy one DES is used, otherwise AES.

Once the encryption type (AES / DES) is chosen the strongest possible cypher length is chosen. Then the corresponding object is instantiated and used to encrypt the message. The result is then send back to the client. Decryption is handled the same way except that the encryption policy always choses the encryption type of the encrypted message to be able to get back at the original message.

5. Explain the differences between inheritance and delegation.

When utilizing inheritance an existing class is extended and functionality can be added or modified. This allows the reuse of functionality implemented in the super class. This feature of most programming languages is straightforward to use and makes it easy to implement new functionality in existing classes. However during this process the public methods of the parent class are exposed on each subclass and changes in a parent class also affect all children.

Delegation mediates access to an object via a Receiver. The Clients class it are then passed on to the Delegate and modified if necessary. This process makes sure that it is impossible to for the client to misuse the features of the Delegate object. The pattern also allows the exchange of any object (Receiver or Delegate) as long as they are of the same type. This flexibility comes at the cost of efficiency as objects are encapsulated in this pattern.