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Component Contracts

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The claim

"A component is specified in terms of the interfaces it provides and the interfaces it requires."

This seems fine, but it raises a question:

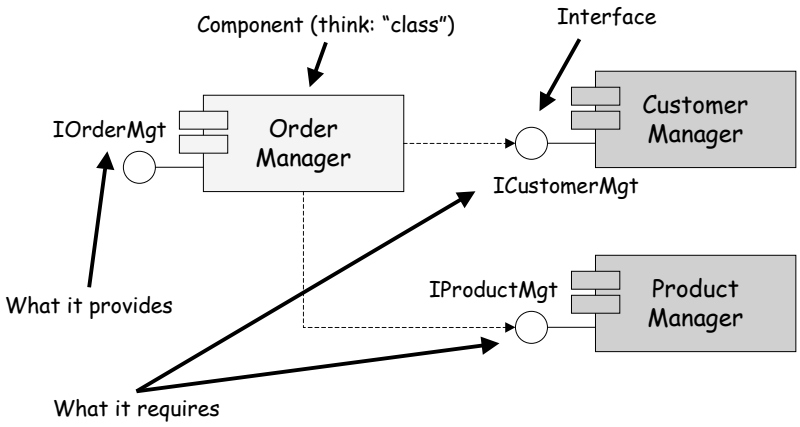
Should information about what a component *requires* form part of its contract with its clients?

No!

And this means we need to think about component specification in a completely new way...

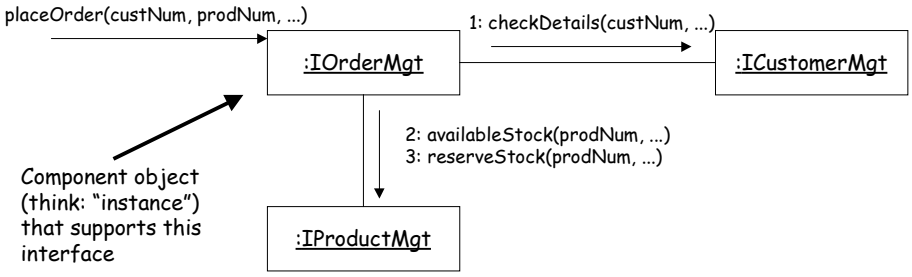
The claim in pictures

"A component is specified in terms of the interfaces it provides and the interfaces it requires."



The details

- A complete specification must contain sufficient information for the component to be built and used.
- What shall we add? How about a sequence diagram?



Interface specification

We now have these interfaces:

IOrderMgt
placeOrder(custNum, prodNum, quan) numOfOrders(custNum): Integer

IProductMgt
reserveStock(prodNum, quan) availableStock(prodNum): Integer

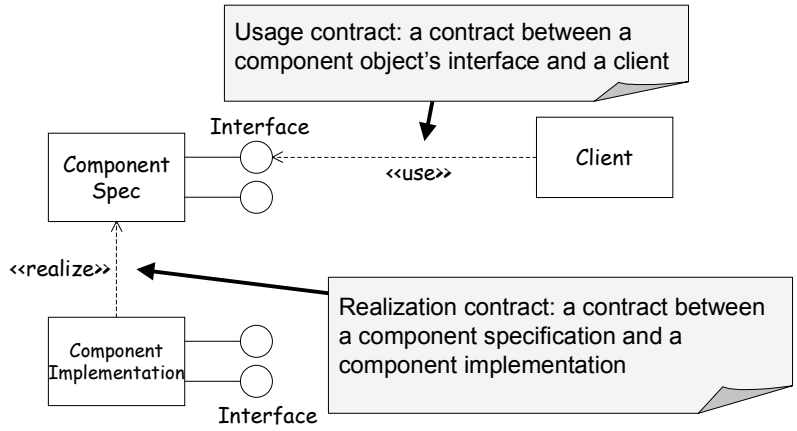
We could specify placeOrder( ) like this:

"The number of orders for the customer is increased by one and a reserveStock message is sent to the component supporting the IProductMgt interface"

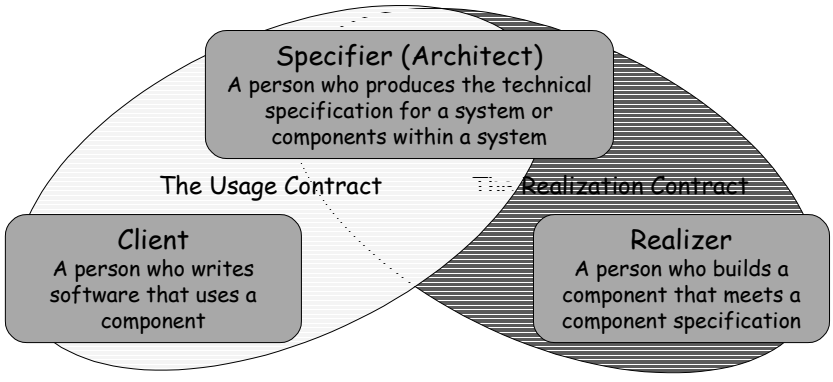
But...

- The client of a component is not supposed to depend on the nature of its implementation
- An interface can be supported by many different components, and each component can:
  - make its own implementation choices and
  - be subject to different implementation constraints
- The specification of placeOrder( ) contains information about the required implementation of the operation
- Therefore: We need to separate the needs of the client from the needs of the implementer

Two distinct contracts



Contracts and roles



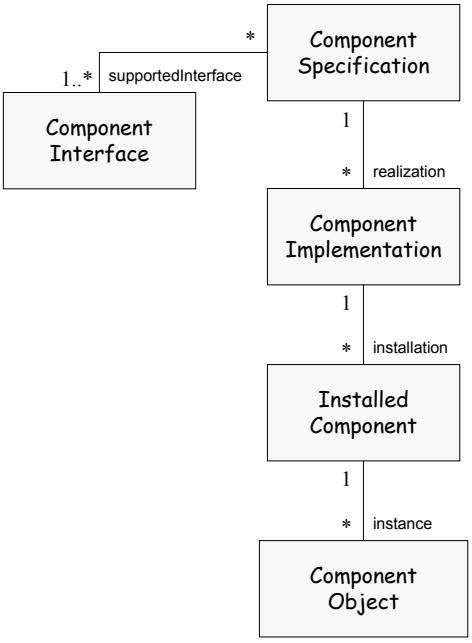
Separation of specification concerns

"The number of orders for the customer is increased by one and a reserveStock message is sent to the component supporting the IProductMgt interface"

The client cares about this - it affects the subsequent result of numOfOrders( ). Therefore it is part of the usage contract

The client does not care about this - but the implementer does.
Therefore it is part of the realization contract

Component Concepts



Interfaces vs Component Specs

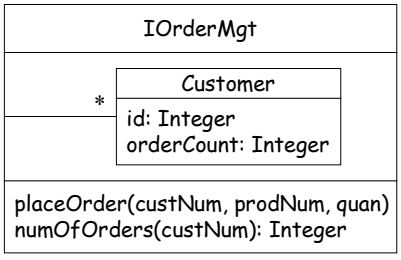
Component Interface

- Represents the usage contract
- Provides a list of operations
- Defines an underlying logical information model specific to the interface
- Specifies how operations affect or rely on the information model
- Describes local effects only

Component Specification

- Represents the realization contract
- Provides a list of supported interfaces
- Defines the run-time unit
- Defines the relationships between the information models of different interfaces
- Specifies how operations should be implemented in terms of usage of other interfaces

Specifying the usage contract



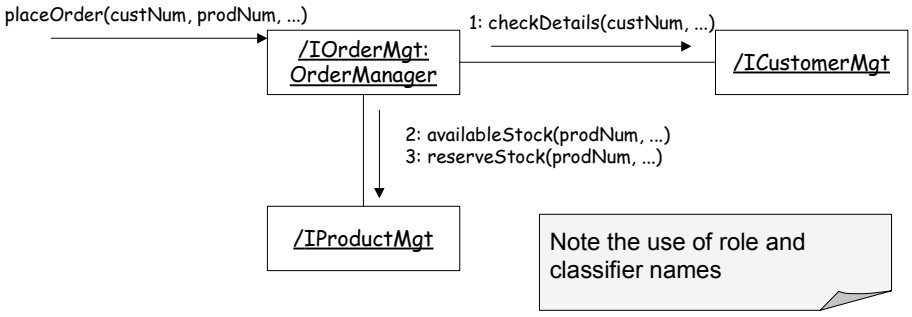
We create an information model for the interface that abstractly represents the (partial) state of the component object offering this interface

context IOrderMgt::placeOrder(custNum, prodNum, quan)
pre: -- custNum and prodNum are valid ids
post: -- the orderCount of Customer with id=custNum has increased by 1

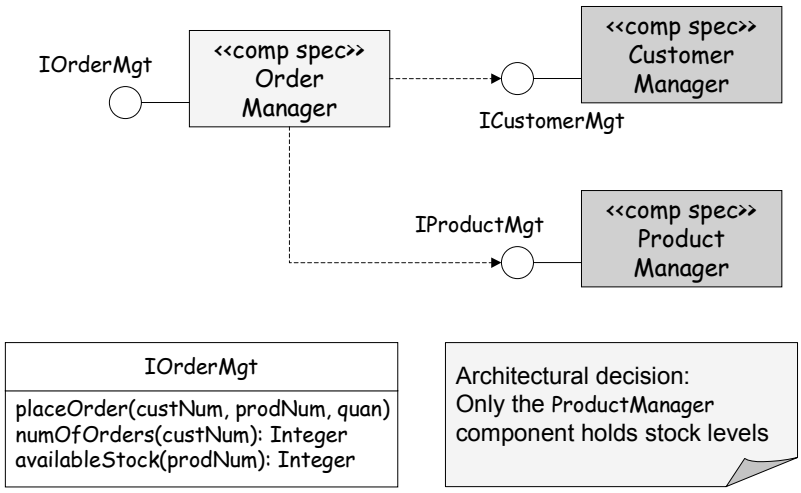
context IOrderMgt::numOfOrders(custNum): Integer
pre: -- custNum is a valid customer id
post: -- result = the orderCount of the Customer with id=custNum

Specifying the realization contract

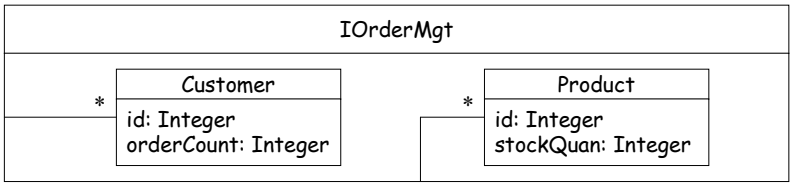
- We can use interaction diagrams, one or more per operation, focused on the component being specified
- These specify how the operations must be implemented



A more complex example



Specifying the usage contract

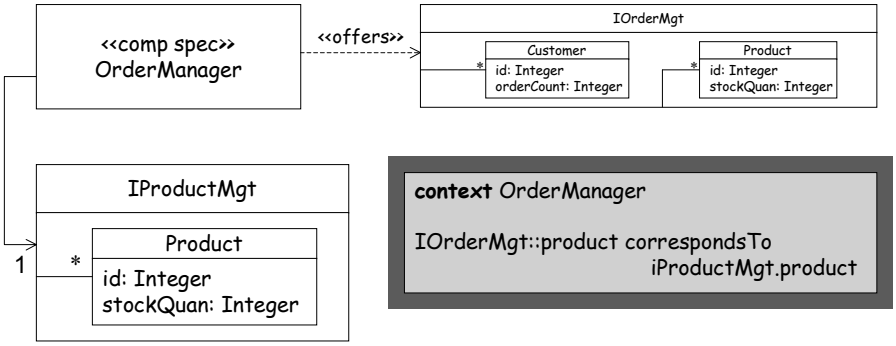


context IOrderMgt::availableStock(prodNum): Integer
pre: -- prodNum is a valid product id
post: -- result = the stockQuan of the Product with id=prodNum

We extend the information model to describe products, even though the *OrderManager* component is not responsible for holding stock levels

Specifying the realization contract

- We want to specify that the *OrderManager* gets stock information from the ProductManager
- We could provide an interaction diagram for availableStock( ), but that might be overspecification
- Instead, we can constrain the relationship between the information models of the two interfaces. This allows a variety of implementions



Want to know more?

- Forthcoming book by John Cheesman and John Daniels, Addison-Wesley, October 2000
- Tutorial tomorrow!
- Tutorial and workshop at OOPSLA 2000, Minneapolis, October 2000