



Overview of Fulfillment

Presenter's Name

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Agenda

- Overview of Fulfillment
- Fulfillment Messages
- Fulfillment Components

Learning Objectives

At the end of this lesson you should be able to:

- Learn about the Order Fulfillment Framework
- Understand the Order Fulfillment Process Flow
- Learn about the Fulfillment Messages and their role in the process
- Learn about the Components of the Fulfillment Framework
- Configure the Order Fulfillment Framework to fulfill hard and soft goods order items.

Section 1:

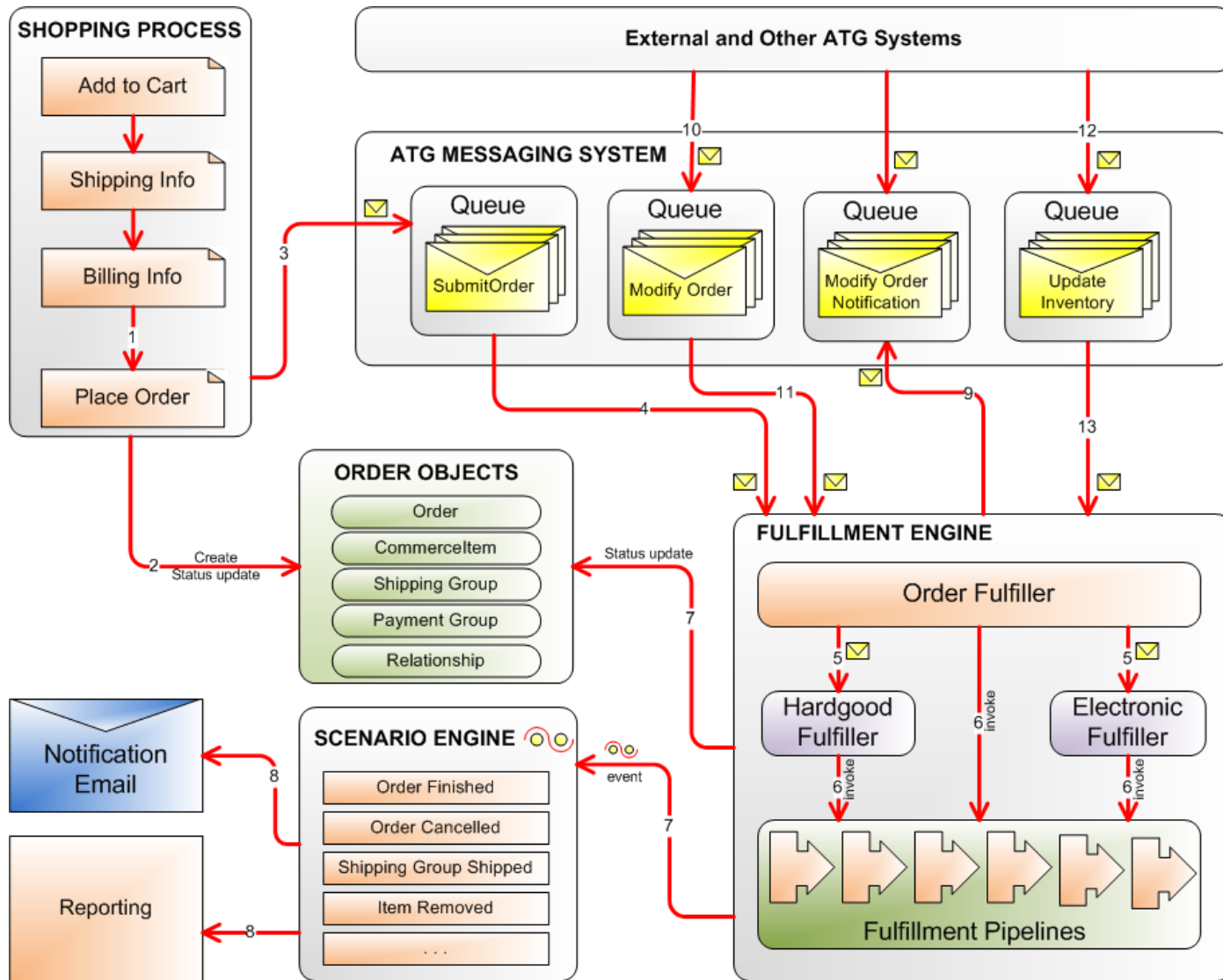
Overview of Fulfillment



Overview of Order Fulfillment

- Order fulfillment starts when the user has finished checkout then has submitted the order.
- The purchase process sends a **submitOrder** message. This message gets picked up by the fulfillment engine **asynchronously**.
- In addition, the fulfillment engine also receives and acts on **Modify Order** and **Update Inventory** messages.
- It publishes the **Modify Order notification** for external systems to help them keep in sync with changes it makes to the **order objects**.
- Finally, the fulfillment engine publishes **events** that the scenario engine can use to take appropriate actions.

Fulfillment Engine Interactions



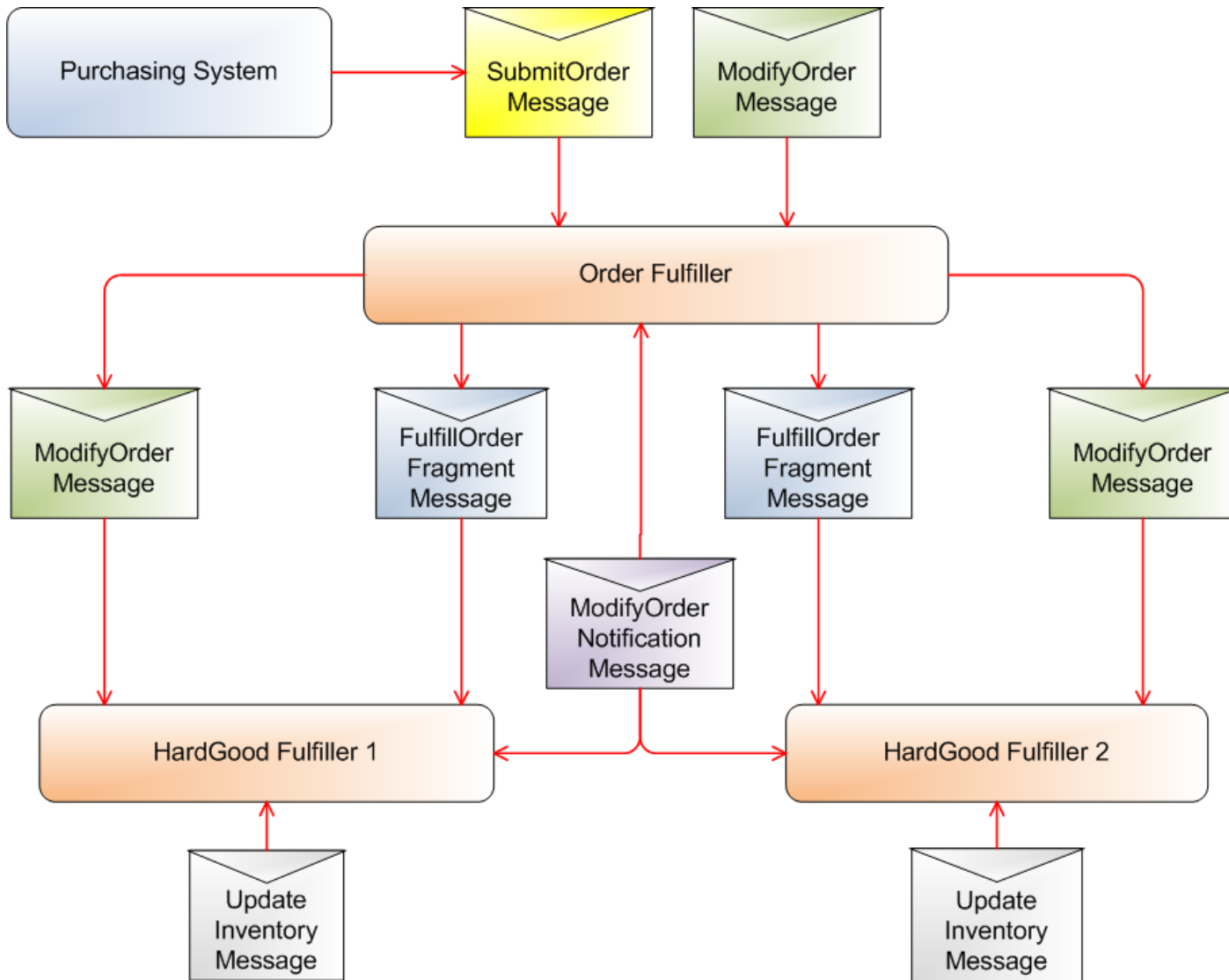
Order Fulfillment Engine

- Order fulfillment is the set of actions taken by the merchant to deliver the goods or services purchased by the customer.
- In general, merchandise can be broken up into two groups: hard goods and electronic goods.
 - Hard goods are physical goods that are shipped to the customer. Hard goods include items such as books, CDs, or toys.
 - Electronic goods are purchases that do not result in a tangible product that requires shipping. Electronic goods include software downloads, subscriptions, or gift certificates.
- ATG Commerce is designed to handle both of these situations.

Fulfillment Process

- The transition from the purchase process to the fulfillment process occurs when the `SubmitOrder` message is sent out after a successful checkout.
- The `SubmitOrder` message is a JMS `ObjectMessage` that contains the serialized order object.
- Building the fulfillment system on top of JMS provides the flexibility of a distributed fulfillment system.
- The control flow of the fulfillment process is defined based on components being responsible for order object during different points in the fulfillment process.
 - The order fulfiller relinquishes control of the order object when it messages the hardgood/softgood fulfillers.
 - Control is regained when the fulfillers set the shipping group status to `NO_PENDING_ACTION`.

Fulfillment Process Flow (1)



Fulfillment Process Flow (2)

- Order fulfillment process flow description:
 - OrderFulfiller receives a SubmitOrder message containing a serialized copy of the order.
 - The OrderFulfiller passes control of the different components to the configured fulfillers using FulfillOrderFragments.
 - While the HardgoodFulfiller controls the shipping groups, all modifications to the shipping groups take place through the HardgoodFulfiller.
 - When the shipping groups are shipped, a modifyOrderNotification message is sent. The HardgoodFulfiller gives up control of the shipping group within the order to OrderFulfiller.
 - The OrderFulfiller receives the ModifyOrderNotification message and then the order is settled.
 - After the order is settled, the OrderFulfiller changes the order state to NO_PENDING_ACTION and no longer controls the order.

Section 1



Check Your Understanding

How do the fulfillment process subsystems communicate with each other?

Answer:

Through JMS message.

Section 1



Check Your Understanding

When does the fulfillment process start?

Answer:

When the checkout process is complete and submitOrder message is sent.

Section 1



Check Your Understanding

Name a few important JMS messages sent and received during fulfillment process.

Answer:

submitOrder, modifyOrder, updateInventory, etc.

Section 1



Check Your Understanding

What are the two shipping groups in ATG Commerce?

Answer:

Hardgood and electronic.

Section 1



Check Your Understanding

When does the OrderFulfiller relinquish control of the order?

Answer:

When the FulfillOrderFragment message is sent to the various fulfillers.

Summary

- Order fulfillment starts when the user has finished checkout then has submitted the order.
- The fulfillment engine's core components are order fulfiller, HardgoodFulfiller, ElectronicFulfiller and FulfillmentPipeline.
- Building the fulfillment system on top of JMS provides the flexibility of a distributed fulfillment system.
- The control flow of the fulfillment process is defined based on components being responsible for order objects during different points in the fulfillment process.

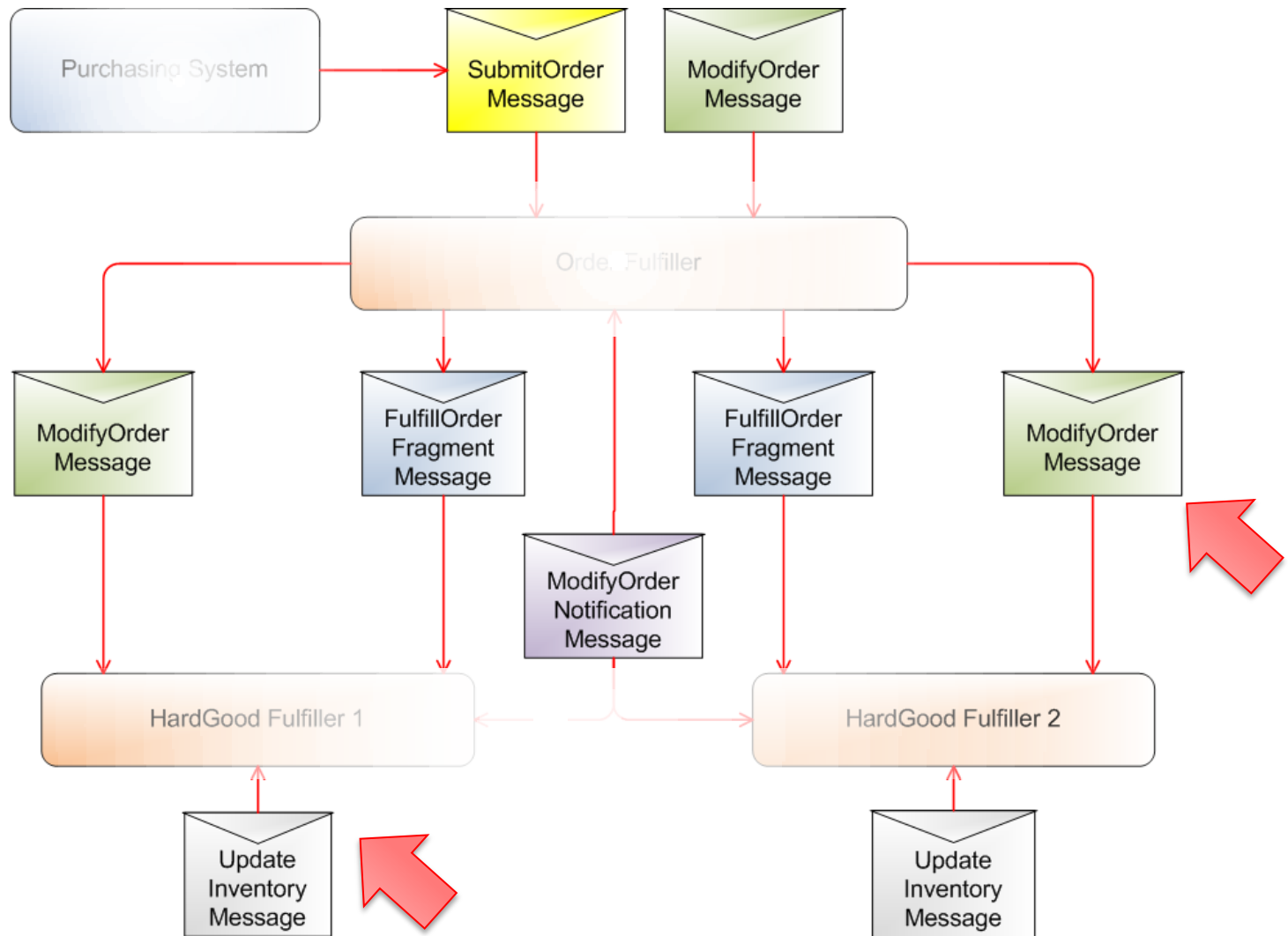


Section 2:

Fulfillment Messages



Fulfillment Messages

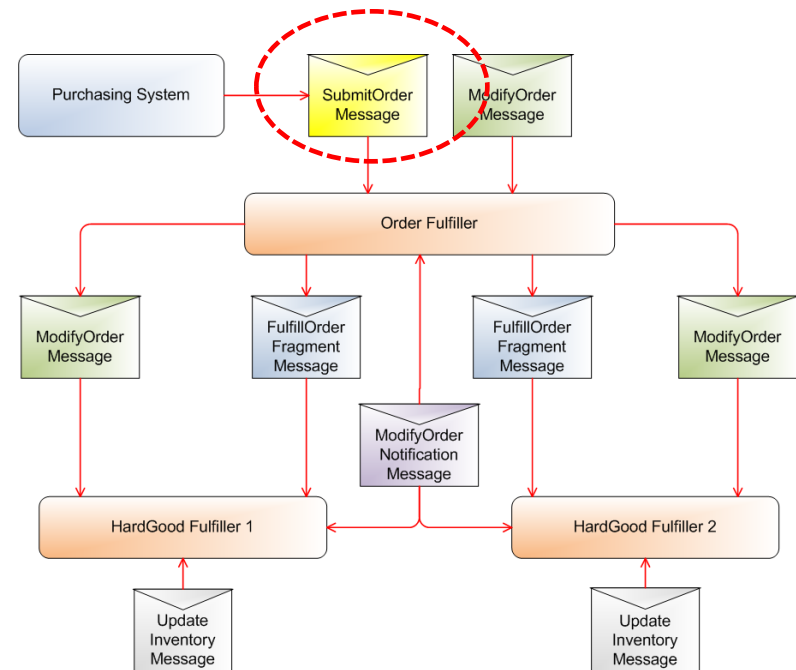


Fulfillment Messages

- CommerceMessage is the base class used by all object messages.
- The messages are:
 - SubmitOrder,
 - FulfillOrderFragment,
 - UpdateInventory,
 - ModifyOrder,
 - ModifyOrderNotification.
- Each message contains a serializable object within the JMS object message.
- The object includes a serialized order and more information on what to do with the order.

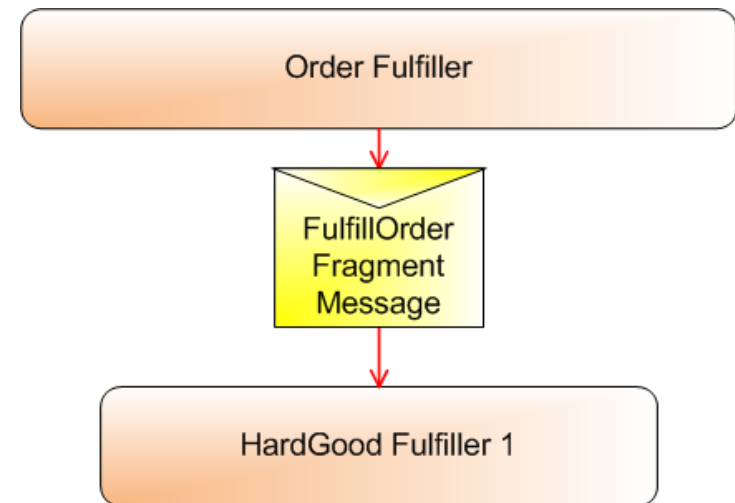
Submit Order Message

- The submit order message is sent to the OrderFulfiller when the order is submitted for fulfillment at the end of checkout process.
- The message includes a serialized order object containing all the information needed to fulfill the order.
- By default, OrderFulfiller is the only listener on a durable topic.



FulfillOrderFragment Message

- The OrderFulfiller sends the FulfillerOrderFragment message to the various fulfillment systems responsible for sending out the products in the shipping groups.
- All shipping groups in an order with the same fulfiller are sent in this message.
- This message contains a serialized order object and list of shipping group IDs.
- When this message is sent, control of the order is transferred to the system that receives the message.

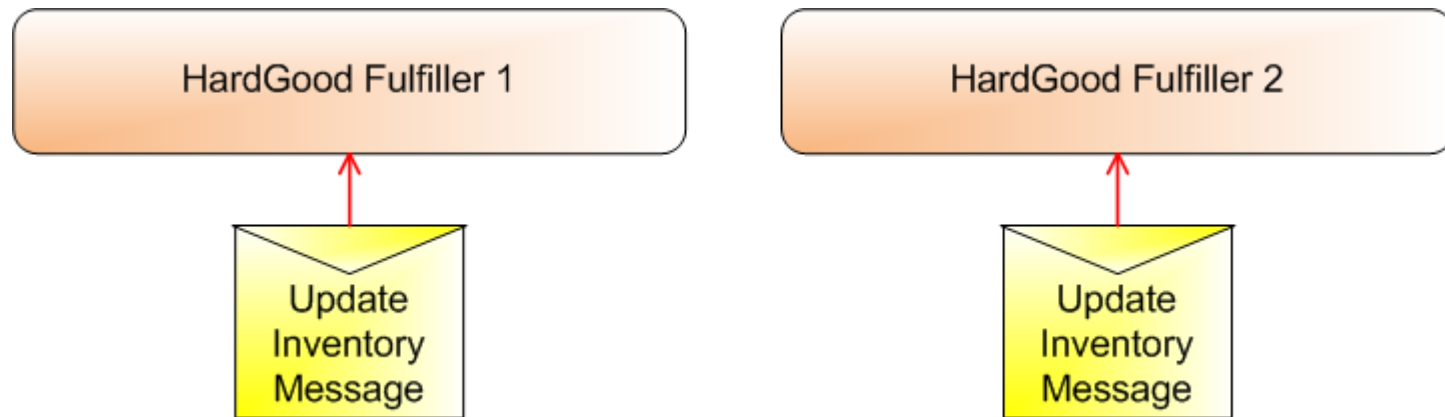


UpdateInventory Message

- Orders submitted to fulfillment might have few shipping items waiting for inventory.
- UpdateInventory message is sent by a third party system, such as inventory subsystem, to indicate that items are available.
- Also, InventoryManager has method inventoryWasUpdated. This method sends out UpdateInventory message. Applications may use this method to send out a message when new inventory becomes available for a previously unavailable item.
- It contains a list of IDs of items that were previously unavailable and are now in stock.

Handling UpdateInventory

- HardgoodFulfiller listens to UpdateInventory message and invokes chain handleHardgoodUpdateInventory.
- It queries the order repository for all shipping groups that contain items from the list that are in pre-ordered or backordered state.



ModifyOrder Messages

- The **ModifyOrder** message allows external sources to request changes to the order object.
 - A list of modifications is included in the message.
 - The recipient of the ModifyOrder is responsible for determining whether the modification is possible.
- After attempting the modifications requested, a **ModifyOrderNotification** message is sent referencing the modifications and indicating if they were successful.
 - The sender of the original request is responsible for listening for the ModifyOrderNotification.
- If a component receives a message for an object to which it has no access, the request is forwarded to the appropriate component that has access.

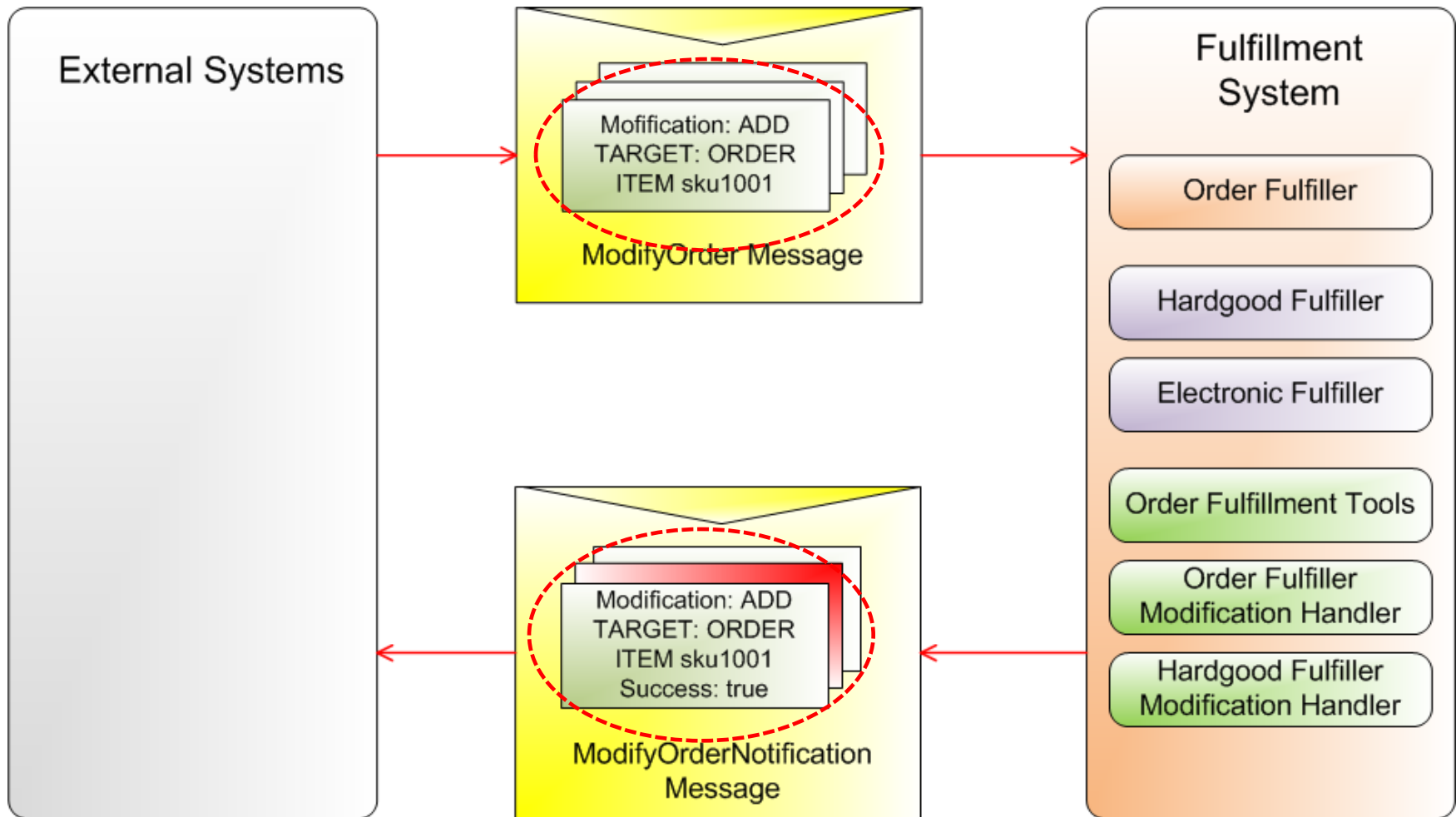
ModifyOrderNotification Message

- **ModifyOrderNotification** message provides a running record of all changes to the order or any of its sub-components.
- All changes to the system are recorded and distributed in this message.
- One use is to notify an external system of the result of a **ModifyOrder** message.
- Fulfillment control flow defines which components are responsible for order objects during different points.
- This notification mechanism allows all other distributed systems to keep their various databases synchronized.
- As an example, if HardgoodFulfiller changes the state of a shipping relationship to BACK ORDERED, this message is sent.

The Modification Class

- An array of **Modification** objects is present in ModifyOrder and ModifyOrderNotification messages.
- Modification class is the base class of these objects. It encapsulates a change to a target object.
- There are five types of modification objects:
 - GenericAdd,
 - GenericRemove,
 - GenericUpdate,
 - ShippingGroupUpdate,
 - PaymentGroupUpdate.
- Each modification has a target. Possible values are:
 - TARGET_ITEM,
 - TARGET_SHIPPING_GROUP and TARGET_PAYMENT_GROUP,
 - TARGET_ORDER,
 - TARGET_RELATIONSHIP.

Modification Objects



Modification Classes

- **GenericAdd** is used to add a target specified by ID or value to a target specified by ID or value.
- **GenericRemove** is used to remove an object specified by ID from a container specified by ID.
- **GenericUpdate** contains the information that describes a property change for an object.
- ***ShippingGroupUpdate*** is special modification that notifies the fulfillment system of any changes within a Shipping Group that happen externally.
- ***PaymentGroupUpdate*** is special modification that notifies the fulfillment system of any changes within a PaymentGroup that happen externally.

Section 2



Check Your Understanding

How do you communicate the success or failure of a ModifyOrder message?

Answer:

After attempting the modifications requested, a ModifyOrderNotification message is sent referencing the modifications and indicating if they were successful.

Section 2



Check Your Understanding

How does the OrderFulfiller communicate with the ElectronicFulfiller?

Answer:

OrderFulfiller sends a FulfillOrderFragment to any registered fulfiller including softgood/electronic fulfiller.

Section 2



Check Your Understanding

Which component handles the UpdateInventory message?

Answer:

HardgoodFulfiller listens to UpdateInventory message and invokes chain handleHardgoodUpdateInventory.

Section 2



Check Your Understanding

What is the modification object and how do you access it?

Answer:

Modification object represents a change to a TARGET object. It is present in the ModifyOrder and ModifyOrderNotification and can be accessed through these objects.

Section 2



Check Your Understanding

What are the different types of modification class?

Answer:

GenericAdd, GenericRemove, GenericUpdate, ShippingGroupUpdate, and PaymentGroupUpdate.

Summary

- During the fulfillment process, the fulfillment system sends and receives various **JMS messages**.
- The **Submit Order Message** is sent to the OrderFulfiller when the order is submitted for fulfillment at the end of check out process.
- The OrderFulfiller sends the **FulfillerOrderFragment** message to the various fulfillment systems responsible for sending out the products in the shipping groups.
- **UpdateInventory** message is sent by a third party system, such as inventory subsystem, to indicate that items that were unavailable are now available.
- The **ModifyOrder** message allows external sources to request changes to the order object.
- **ModifyOrderNotification** message provides a running record of all changes to the order or any of its subcomponents.



Section 3:

Fulfillment Components



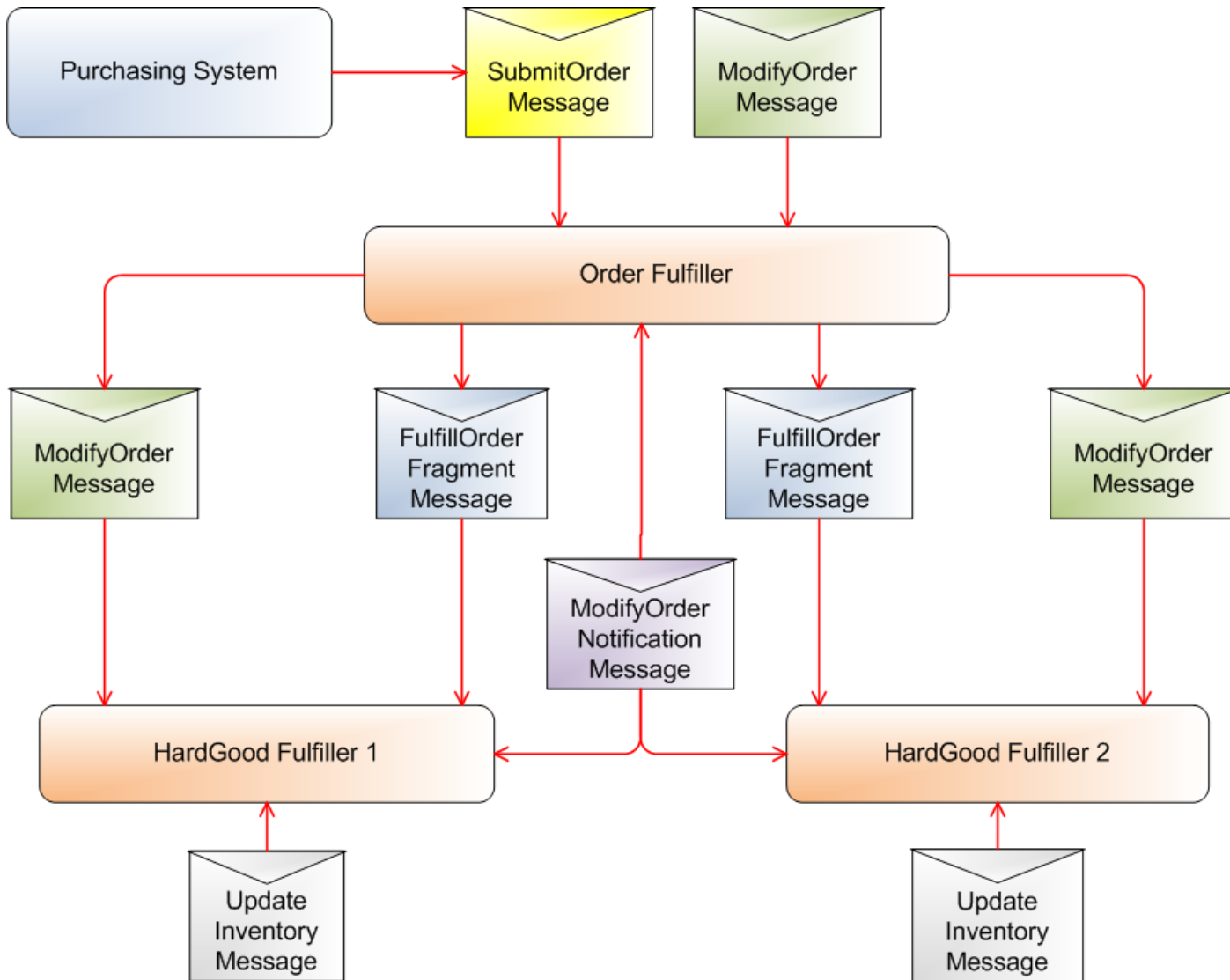
Fulfillment Components

- The fulfillment system consists of the following components:
 - OrderFulfiller,
 - HardgoodFulfiller,
 - SoftgoodFulfiller (uses the ElectronicFulfiller class).
- It also has the following helper components:
 - OrderFulfillmentTools,
 - OrderFulfillerModificationHandler,
 - HardgoodOrderFulfillerModificationHandler.

Order Fulfiller Component

- The OrderFulfiller receives the SubmitOrder message, which marks the start of the fulfillment process.
- There should be only one OrderFulfiller in place to receive the message.
- The following methods handle different messages:
 - **handleSubmitOrder** handles the SubmitOrder Message.
 - ModifyOrder message handling is delegated to the **handleModifyOrder** of the OrderFulfillerModificationHandler class.
 - ModifyOrderNotification message handling is delegated to the **handleModifyOrderNotification** of the ModificationHandler class.
 - **handleNewMessageType** handles any new message. Usually this is an empty method for future extensions.

Fulfillment Process Flow



OrderFulfiller Processing (1)

- When the OrderFulfiller receives the SubmitOrder message:
 - The states of the order and each shipping group are set to PROCESSING.
 - OrderFulfiller determines the fulfiller for each shipping group. If the items in a shipping group have more than one fulfiller, then that shipping group is split. After the split, each shipping group can be fulfilled by exactly one fulfiller.
 - The OrderFulfiller creates FulfillOrderFragment messages and sends the messages to each fulfiller. These messages include the shipping group IDs that the fulfiller is responsible for fulfilling.
 - After sending the FulfillOrderFragment messages, the OrderFulfiller relinquishes control of the order and listens for all ModifyOrderNotification messages for events notifying it that the fulfiller is finished.

OrderFulfiller Processing (2)

- The OrderFulfiller regains control of an order in the following two scenarios:
 - Shipping groups state is set to NO PENDING ACTION. Or,
 - Shipping groups state is set to PENDING MERCHANT ACTION.
- If the shipping group state is set to NO PENDING ACTION after shipping the order to the customer,:
 - The OrderFulfiller checks if the order can be settled and cost of the order is charged to the customer.
- If the shipping group state is set to PENDING MERCHANT ACTION because of an error,:
 - The OrderFulfiller will set the order's state to PENDING MERCHANT ACTION.
 - The customer service representative must change this state back to PROCESSING. The system will then be notified to reprocess each shipping group.

Settling an Order

- When all the shipping groups have been set to NO PENDING ACTION, the order fulfiller regains control of the order.
- It then proceeds to settle the order.
- ATG Commerce allows two types of settlement:
 - After the first shipping group has shipped. Or,
 - After all the shipping groups have shipped.
- The settlement type is configurable and should be chosen based on the business requirements.
- If the OOTB behaviour does not meet the business requirements, the settlement process can be extended.

HardgoodFulfiller and SoftgoodFulfiller

- **HardgoodFulfiller** is used to fulfill any type of good that is required to be physically delivered.
- **SoftgoodFulfiller** based on the class **ElectronicFulfiller** is used to fulfill any type of good that is delivered electronically such as gift certificates.
- Both fulfillers receive a FulfillOrderFragment message and begin fulfillment process for the shipping groups listed within the message.
- HardgoodFulfiller handles HardgoodShippingGroup whereas ElectronicFulfiller handles ElectronicShippingGroup.
- These fulfillers call appropriate pipeline chains to change the state of the shipping group and send out a ModifyOrderNotification message detailing the changes.

Using the Fulfiller

- ATG Commerce includes two fulfiller objects: the HardgoodFulfiller and the ElectronicFulfiller.
- The fulfiller's responsibility for an order begins with the receipt of the FulfillOrderFragment message.
- The first method called is:

```
public void receiveMessage (String pPortName,  
                           Message pMessage) throws JMSEException
```

- All that this method does is get the JMS object message that was sent, check the contained objects type, and call the appropriate method to begin the processing of each shipping group included in the FulfillOrderFragment.

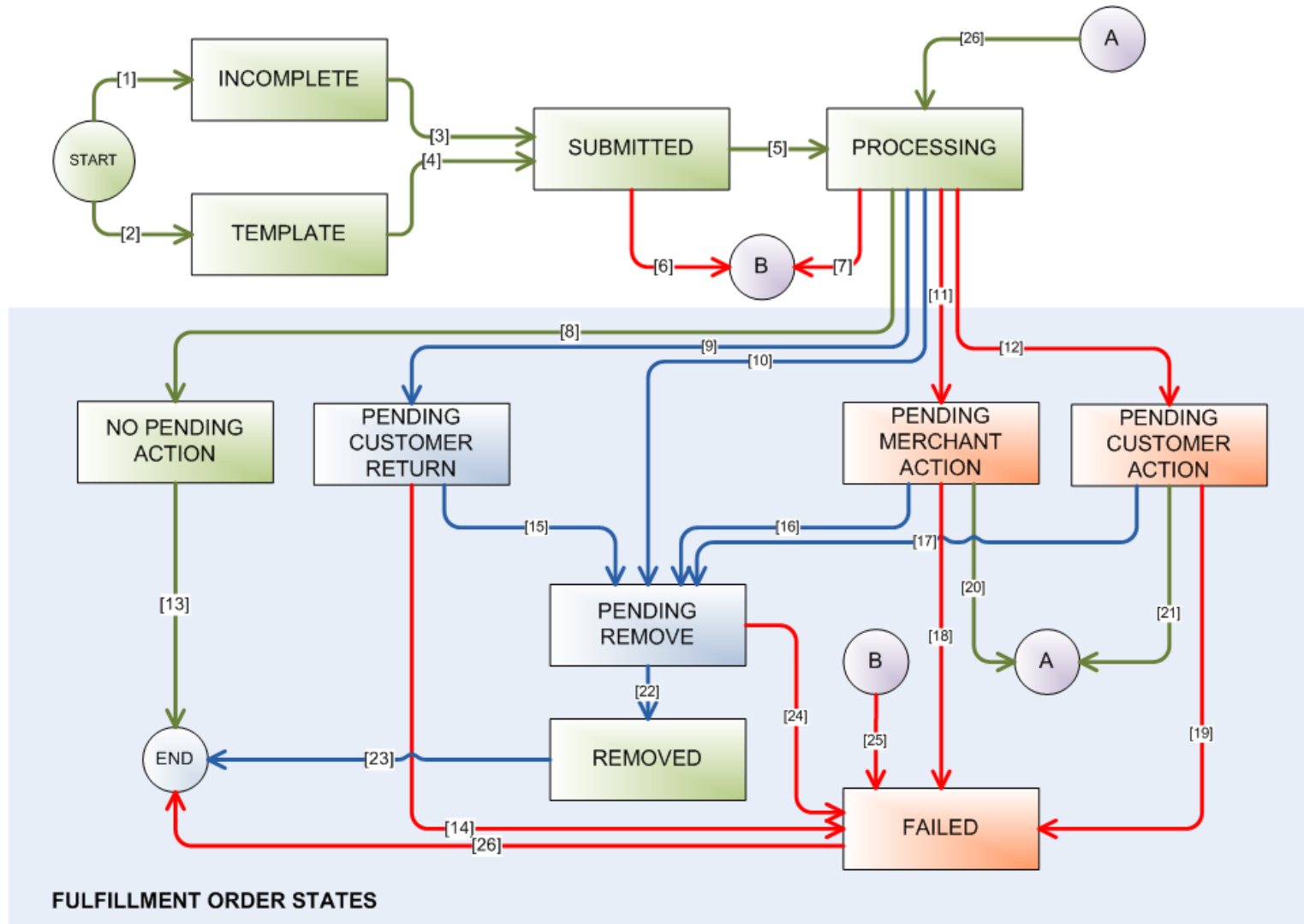
Helper Component: OrderFulfillmentTools

- OrderFulfillmentTools contain convenience methods for commonly performed tasks in fulfillment such as:
 - Create messages,
 - Modify objects,
 - Manipulate the states in commerce objects and relationships.
- This class is primarily used by fulfillment **pipelines**.
- OrderFulfillmentTools maintains a mapping of fulfillers to port names.
 - These are used by the OrderFulfiller to send FulfillOrderFragment messages to the correct fulfiller.
 - Messages sent through these ports are written to different topics.

Helper Component: Modification Handlers

- ***OrderFulfillerModificationHandler*** is configured to handle the ModifyOrder and ModifyOrderNotification messages for the OrderFulfiller class.
- ***HardgoodFulfillerModificationHandler*** deals with the ModifyOrder and ModifyOrderNotifications messages received by the HardgoodFulfiller.
- The ModificationHandler property in the two fulfillers points to this class. It can be changed.
- The handling of the messages is delegated to the handleModifyOrder and handleModifyOrderNotification methods in these modification handlers.

Fulfillment Order State Transition



Fulfillment Order States

- The OrderFulfiller and the hardgood/ electronic fulfillers are responsible for setting the states of the order and its component's objects.
- When an order is received by the fulfillment engine, the OrderFulfiller sends out the shipping groups to the respective fulfillers.
- The fulfillers set the state of the shipping groups.
- When they are done, the order is settled and its state is set to NO PENDING ACTION.
- The state may also go to PENDING MERCHANT ACTION and PENDING CUSTOMER ACTION.

Settling an Order

- When all the shipping groups have been set NO PENDING ACTION, the order fulfiller regains control of the order.
- It then proceeds to settle the order.
- ATG Commerce allows two types of settlement:
 - After the first shipping group has shipped. Or,
 - After all the shipping groups have shipped.
- The settlement type is configurable and should be chosen based on the business requirements.
- If the OOTB behaviour does not meet the business requirements, the settlement process can be extended.

Example 1: HardGoodFulfiller

- An order is received with one item that is IN STOCK:
 - FulfillOrderFragment received with one shipping group.
 - The one item in the shipping group successfully allocates. The ShippingGroupCommerceItemRelationship's state is set to PENDING DELIVERY.
 - The state of the ShippingGroup is set to PENDING SHIPMENT.
 - The group ships. When the HardgoodFulfiller is notified, the shipping group is set to NO PENDING ACTION and the item is set to DELIVERED.
- When all shipping groups are set to NO PENDING ACTION, the order is settled and it is set to NO PENDING ACTION as well.

Example 2: HardGoodFulfiller

- HardgoodFulfiller.outOfStockIsError=false and an order is received with one item that is OUT OF STOCK:
 - FulfillOrderFragment received with one shipping group.
 - The 1 item in the shipping group fails to allocate but is successfully backordered. The state of ShippingGroupCommerceItemRelationship is set to OUT OF STOCK.
 - Some time later, an UpdateInventory message is received notifying the HardgoodFulfiller that the item has new inventory available. The item is reallocated.
 - The state of the ShippingGroup is set to PENDING SHIPMENT.
 - The group ships. When the HardgoodFulfiller is notified, the shipping group is set to NO PENDING ACTION and the item is set to DELIVERED.

Example 3: HardGoodFulfiller States

- An order is received with one item that has no information in the inventory system:
 - FulfillOrderFragment received with one shipping group.
 - The one item in the shipping group is not found. The state of ShippingGroupCommerceItemRelationship is set to ITEM NOT FOUND.
 - The state of ShippingGroup is set to PENDING MERCHANT ACTION.

Section 3



Check Your Understanding

What is the final state of the order that has been fulfilled?

Answer:

NO PENDING ACTION.

Section 3



Check Your Understanding

When does the OrderFulfiller regain control of an order?

Answer:

When the shipping group state is either NO PENDING ACTION or PENDING MERCHANT ACTION.

Section 3



Check Your Understanding

Which classes are used to handle the ModifyOrder and ModifyNotificationOrder messages?

Answer:

The OrderFulfillerModificationHandler and HardgoodFulfillerModificationHandler.

Section 3



Check Your Understanding

What is the class for the SoftgoodFulfiller component?

Answer:

ElectronicFulfiller class.

Section 3



Check Your Understanding

What are the two settlement options that ATG ships with?

Answer:

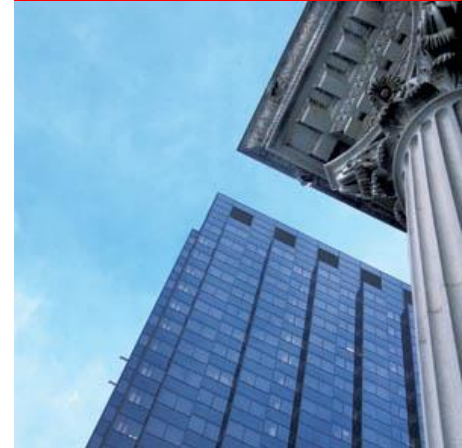
After the first shipping group has shipped or after all the shipping groups have shipped.

Summary

- The Fulfillment System consists of OrderFulfiller, HardgoodFulfiller and SoftgoodFulfiller components.
- It has helper classes OrderFulfillmentTools, OrderFulfillerModificationHandler, and HardgoodOrderFulfillerModificationHandler.
- The **OrderFulfiller** receives the SubmitOrder message and delegates the appropriate order fragments to the other fulfillers.
- **HardgoodFulfiller** is used to fulfill any type of good that is required to be physically delivered.
- **SoftgoodFulfiller** based on the class ElectronicFulfiller is used to fulfill any type of good that is delivered electronically such as gift certificates.



Q&A





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