

# Event-Driven Architecture

## *Software Architecture*

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*Definition 0.* Event

Something that has happened or needs to happen.

*Definition 0.* Event Handling

Responding to notification of an event.

*Definition 0. Asynchronous Communication*

Sending a message to a receiver and not waiting for a response.

# Responsiveness

- Synchronous Communication
  - Send message
  - *Wait* for response
  - Continue processing



# Responsiveness

- Synchronous Communication



- Send message
- *Wait* for response
- Continue processing

- Asynchronous Communication



- Send message
- Continue processing
- *Optionally* receive response
- *Complex* error handling



### *Definition 0.* Event-Driven Architecture

Asynchronous distributed system that uses event processing to *coordinate* actions in a larger business process.

# Event-Driven Architecture





## Terminology

Initiating Event    Starts the business process

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Processing Event Indicates next step in the process can be performed

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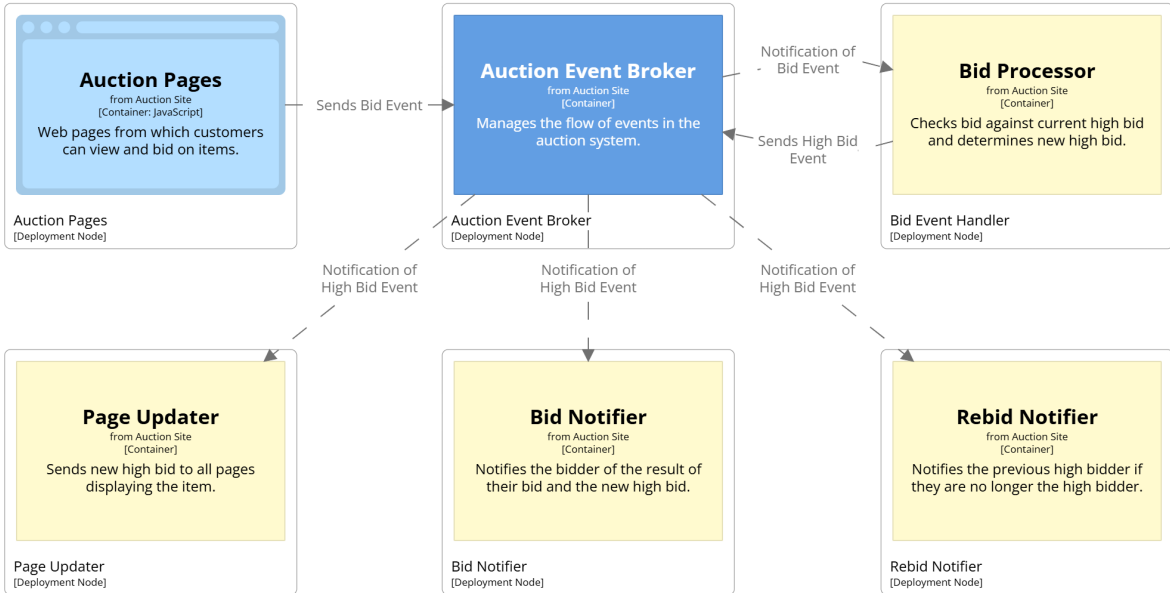
Processing Event    Indicates next step in the process can  
be performed

Event Channel    Holds events waiting to be processed

## Terminology

- |                  |                                                                                                                       |
|------------------|-----------------------------------------------------------------------------------------------------------------------|
| Initiating Event | Starts the business process                                                                                           |
| Processing Event | Indicates next step in the process can be performed                                                                   |
| Event Channel    | Holds events waiting to be processed                                                                                  |
| Event Handler    | Processes an event <ul style="list-style-type: none"><li>• Step, or part of a step, in the business process</li></ul> |

# Auction Example



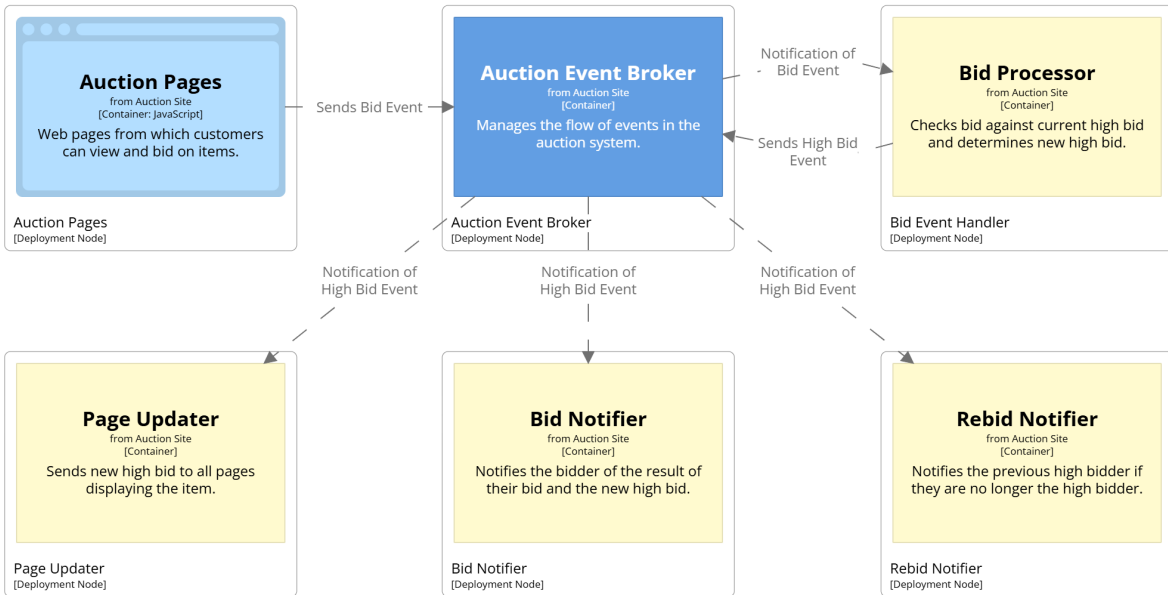
*Definition 0.* Event Handler Cohesion Principle

Each event handler is a simple cohesive unit that performs a *single* processing task.

*Definition 0.* Event Handler Independence Principle

Event handlers should not depend on the *implementation* of any other event handler.

# Auction Example – Error Handling





# Topologies

Broker All events received by event broker

- Notifies event handlers of events
- Event handlers send processing events when they finish processing

# Topologies

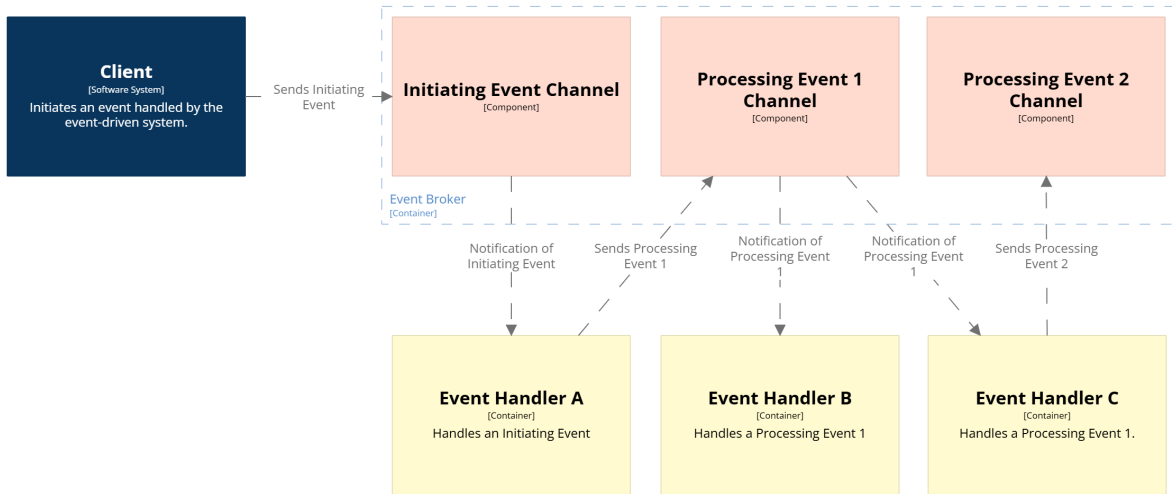
**Broker** All events received by event broker

- Notifies event handlers of events
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**Mediator** Manages business process

- Event queue of initiating events
- Event mediator sends processing events to event handlers
- Event handlers send async messages to mediator to report process finished

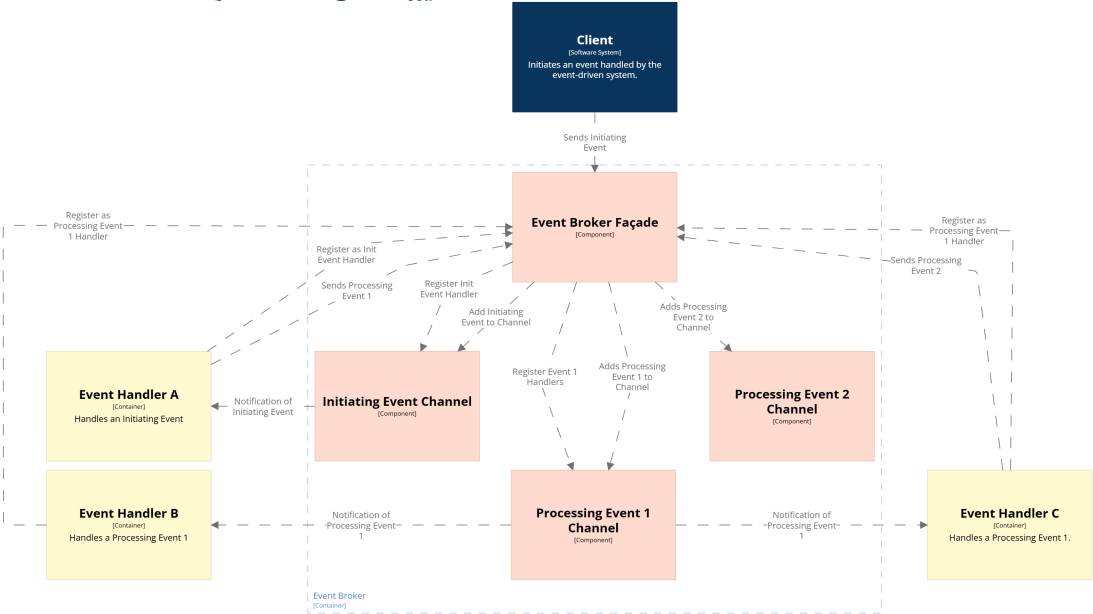
# Broker Topology



## *Event Broker Façade*

- Event handlers register to *listen* for events
- Receives events and *directs* them to the correct channel

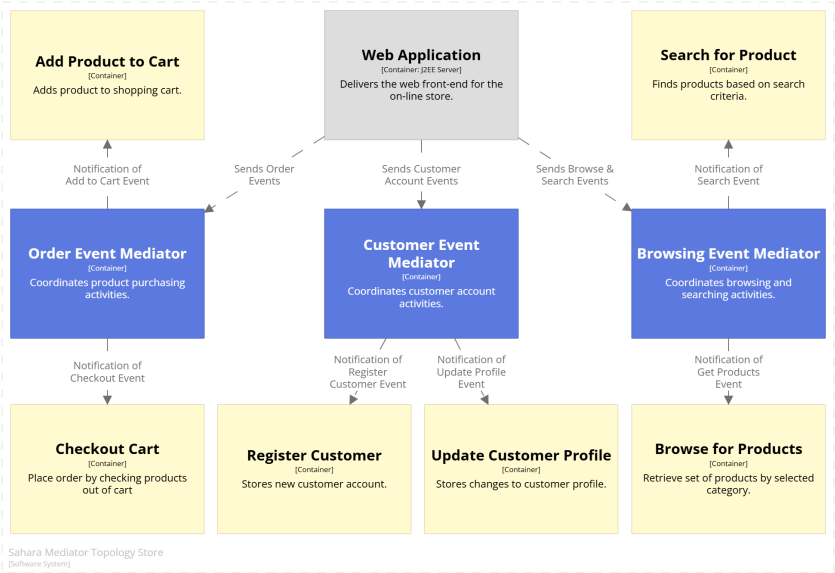
# Broker with Façade Topology



# Mediator Topology



# Sahara Mediator Topology



## Extensibility

- New behaviour for existing event
  - Broker** Implement event handler & register with broker
    - Existing ignored event hooks
  - Mediator** Implement event handler & modify mediator logic



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- New behaviour for existing event
  - Broker** Implement event handler & register with broker
    - Existing ignored event hooks
  - Mediator** Implement event handler & modify mediator logic
- New event
  - Broker** Implement event & event handler, create event channel, modify broker façade
  - Mediator** Implement event & event handler, modify mediator logic

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- Event broker federated
  - Distributed across multiple compute nodes
- Event mediators for different domains
  - Distributes loads by domain  
(e.g. browse & search, account, & order events)
    - Scaled independently to manage load

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  - FIFO behaviour

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- Event removed when event handlers finish
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- Events persist until removed
  - Recovery from broker failure



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- Handlers notified when event added to stream
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- Handlers process events at their own pace
  - Cardiac arrest alarm vs. heart rate graph
- Events history
  - Redo processing
  - Review processing activities

## Queues vs. Streams

- Queue
  - Known steps in business process
  - Easier sequencing of steps in business process
  - “Exactly once” semantics
  - eCommerce system

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- Queue
  - Known steps in business process
  - Easier sequencing of steps in business process
  - “Exactly once” semantics
  - eCommerce system
- Stream
  - Very large number of events or handlers
  - Handlers can ignore events
  - Analysis of past activity
  - Event sourcing

## Broker vs. Mediator Topologies

Broker dumb pipe

Broker events have occurred

## Broker vs. Mediator Topologies

Broker dumb pipe

Broker events have occurred

Mediator smart pipe

Mediator events are commands to process



## Broker vs. Mediator Topologies

### *Broker Advantages*

- Scalability
- Reliability
- Extensibility
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### *Mediator Advantages*

- Complex business process logic
- Error handling
- Maintain process state
- Error recovery

## Pros & Cons

Modularity Event Handlers



Extensibility



Reliability Event Handlers



Interoperability Events



Scalability Event Handlers



Security



Simplicity



Deployability



Testability Complex Interactions

