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

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- Synchronous Communication

  - Send message
  - *Wait* for response
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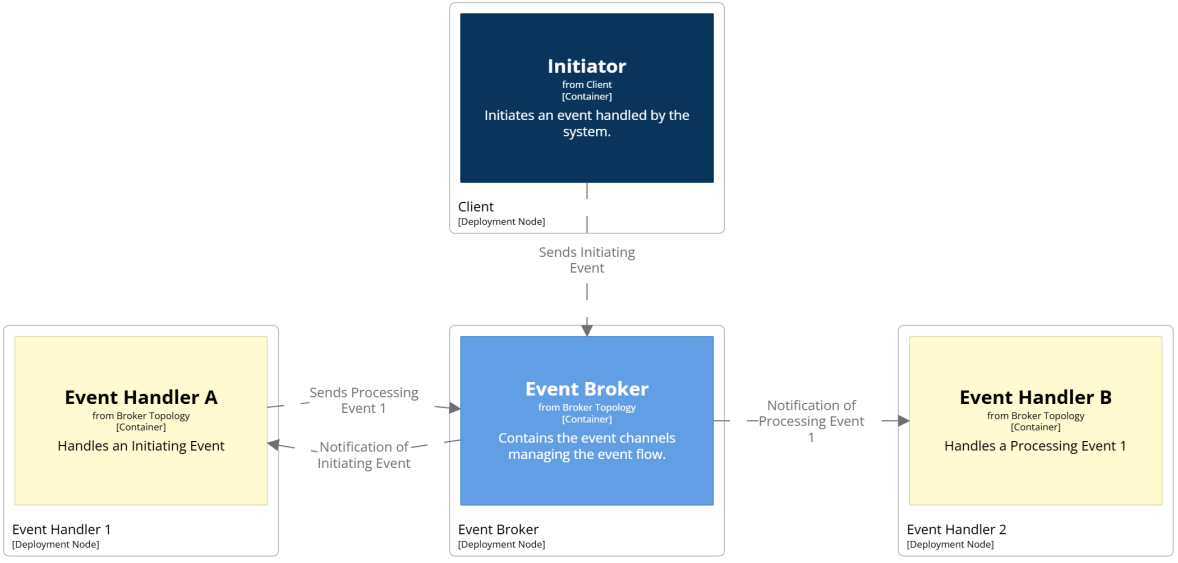
- Asynchronous Communication

  - 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

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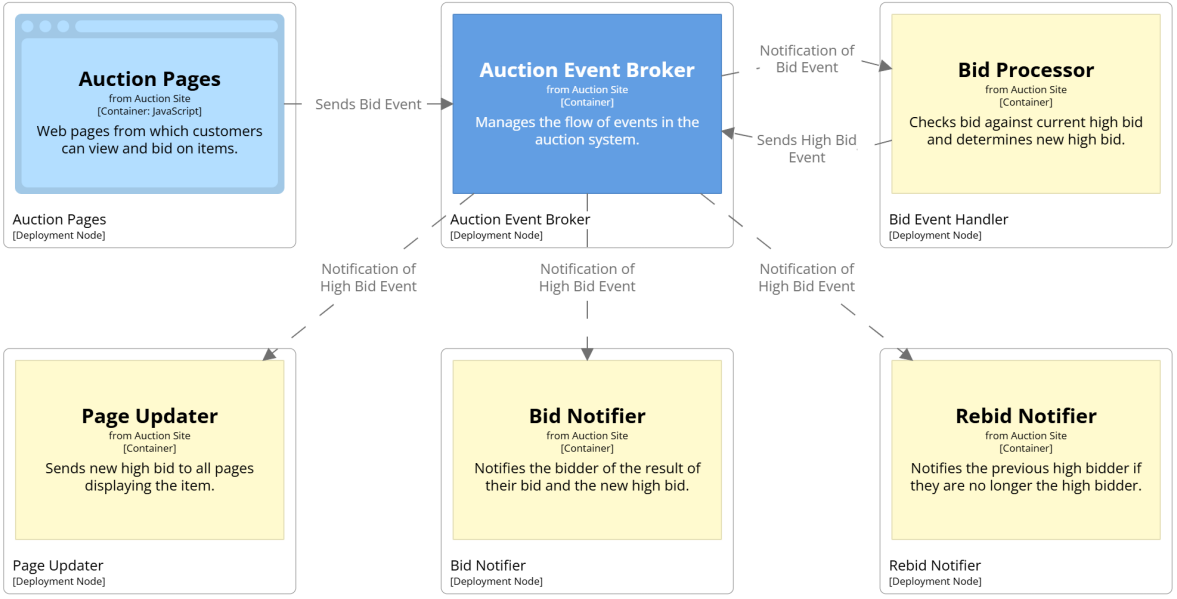
Processing Event	Indicates next step in the process can be performed
Event Channel	Holds events waiting to be processed
Event Handler	Processes an event • Step, or part of a step, in the business process

Auction Example



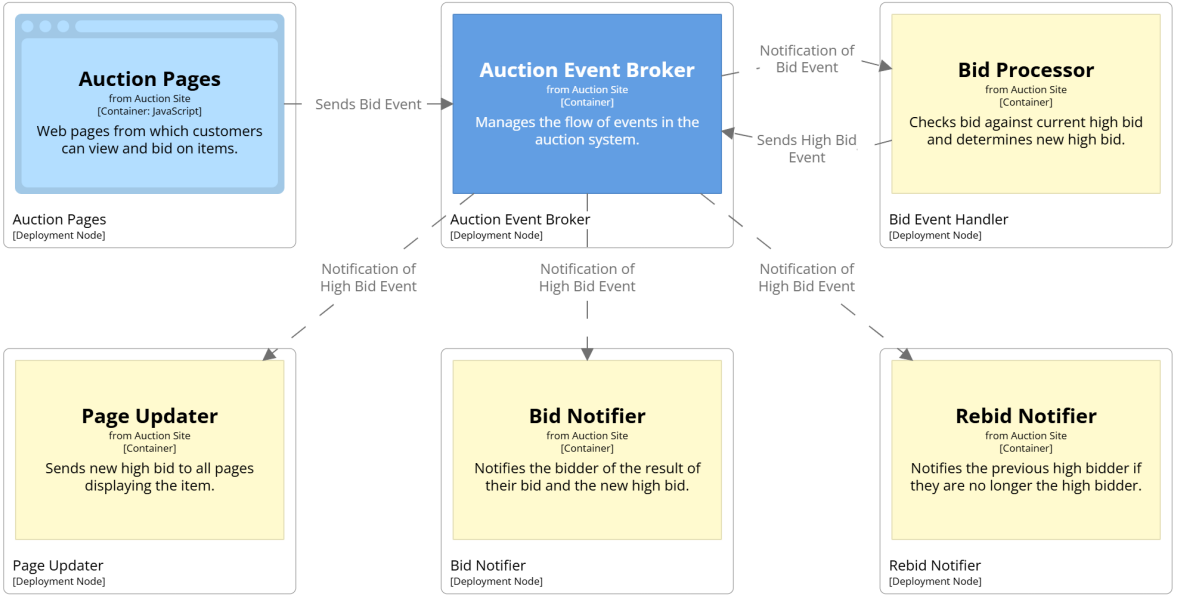
Definition 0. Event Handler Cohesion Principle

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

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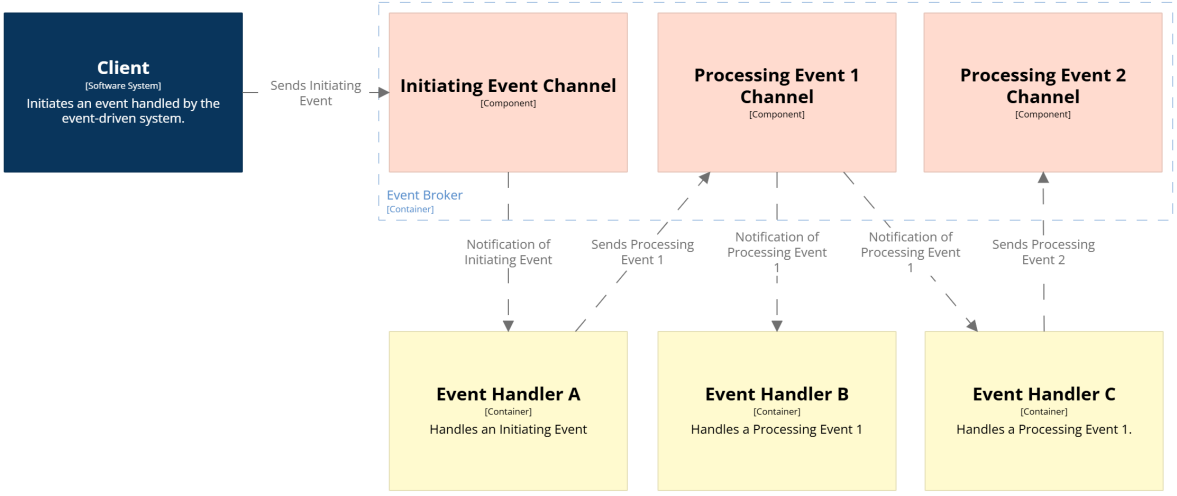
Mediator Manages business process

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

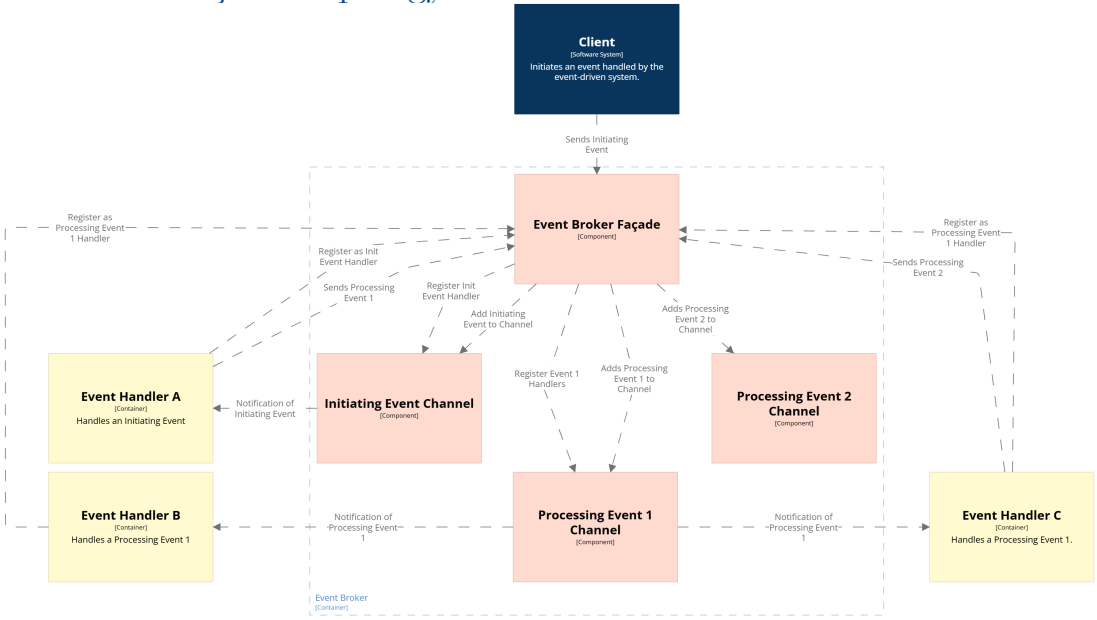
Broker Topology



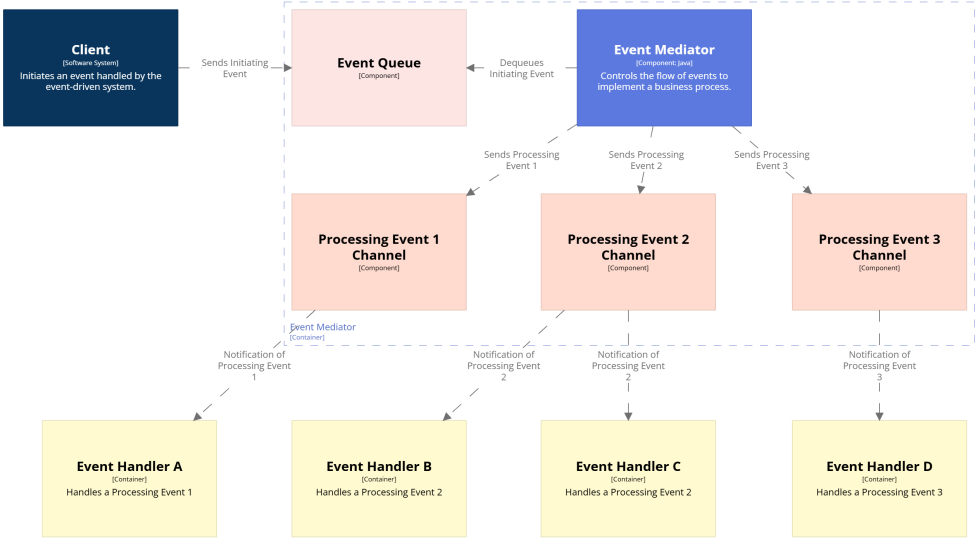
Event Broker Façade

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

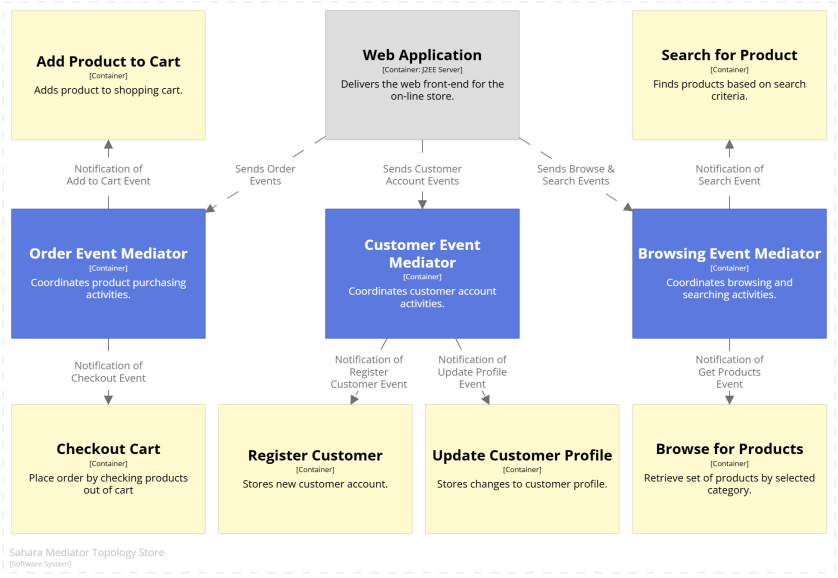
Broker with Façade Topology



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 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
  - Retry if a handler fails
- Events persist until removed
  - Recovery from broker failure

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- Handlers notified when event added to stream
  - Observer pattern
- 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
- Low coupling

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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