Event-Driven Architecture

Software Architecture

Richard Thomas

March 31, 2025

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



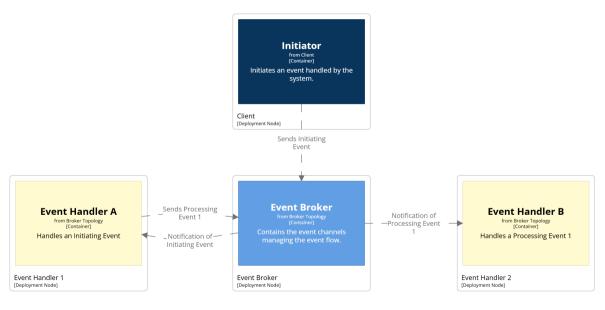
- Send message
- Continue processing
- Optionally receive response
- Complex error handling



Definition 0. Event-Driven Architecture

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

Event-Driven Architecture



Initiating Event Starts the business process

Initiating Event Starts the business process

Processing Event Indicates next step in the process can be performed

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

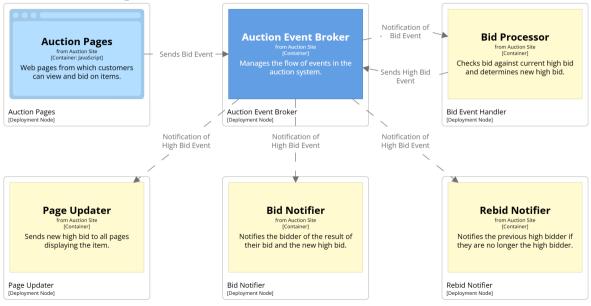
Initiating Event Starts the business process

Processing Event Indicates next step in the process can be performed

Event Channel Holds events waiting to be processed

Event Handler Processes an eventStep, or part of a step, in the business process

Auction Example



Definition 0. Event Handler Cohesion Principle

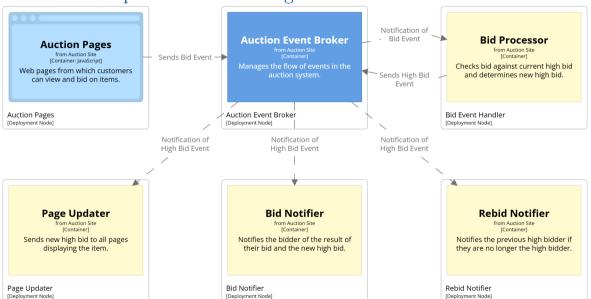
Each event handler is a simple cohesive unit that per-

forms a *single* processing task.

Definition 0. Event Handler Independence Principle Event handlers should not depend on the *implemen*-

tation 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

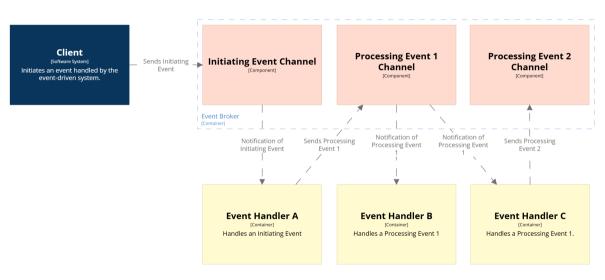
Broker All events received by event broker

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

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

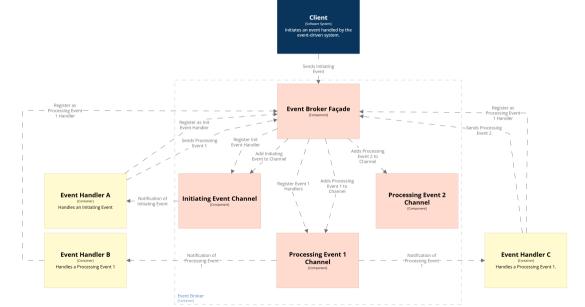
Broker Topology



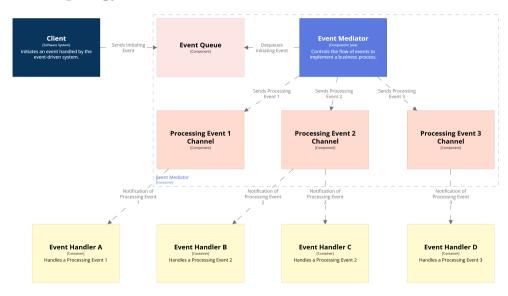
Event Broker Façade

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

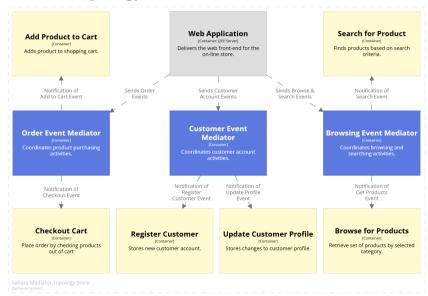
Broker with Façade Topology



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

Extensibility

• 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

Scalability

- Event handlers deployed independently
 - Scaled independently to manage load

Scalability

- Event handlers deployed independently
 - Scaled independently to manage load
- Event broker federated
 - Distributed across multiple compute nodes

Scalability

- Event handlers deployed independently
 - Scaled independently to manage load
- 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

- Channels can be implemented as queues
 - FIFO behaviour

- Channels can be implemented as queues
 - FIFO behaviour
- Multiple front of queue pointers
 - For each event handler

- Channels can be implemented as queues
 - FIFO behaviour
- Multiple front of queue pointers
 - For each event handler
- Event removed when event handlers finish
 - Retry if a handler fails

- Channels can be implemented as queues
 - FIFO behaviour
- Multiple front of queue pointers
 - For each event handler
- Event removed when event handlers finish
 - Retry if a handler fails
- Events persist until removed
 - Recovery from broker failure

- Channels can be implemented as streams
 - Events are saved permanently

- Channels can be implemented as streams
 - Events are saved permanently
- Handlers notified when event added to stream
 - Observer pattern

- Channels can be implemented as streams
 - Events are saved permanently
- Handlers notified when event added to stream
 - Observer pattern
- Handlers process events at their own pace
 - Cardiac arrest alarm vs. heart rate graph

- Channels can be implemented as streams
 - Events are saved permanently
- 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

Queues vs. Streams

- 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 dumb pipe

Broker events have occurred

Broker dumb pipe

Broker events have occurred

Mediator smart pipe

Mediator events are commands to process

Broker Advantages

- Scalability
- Reliability
- Extensibility
- Low coupling

Broker Advantages

- Scalability
- Reliability
- Extensibility
- Low coupling

Mediator Advantages

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

Pros & Cons		
Modularity Event Handlers	9	
Extensibility	9	
Reliability Event Handlers	9	
Interoperability Events		
Scalability Event Handlers		
Security	<u></u>	
Simplicity		
Deployability		
Testability Complex Interactions	Æ	