#### Event-Driven Architecture

Software Architecture

Richard Thomas

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## Definition 1. Event

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S	Something	that	has	happened	or	needs	to	happen.	

# Definition 2. Event Handling

Responding to notification of an event.

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

Definition 3. Asynchronous Communication Comment on how this enables parallel processing.

#### Responsiveness

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

  - Continue processing
  - Optionally receive response

  - Complex error handling





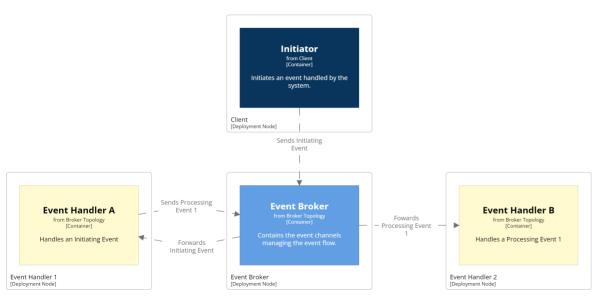




### Definition 4. Event-Driven Architecture

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

#### Event-Driven Architecture



Comment on how each container is deployed in its own compute node.

#### Terminology

Initiating Event Starts the business process

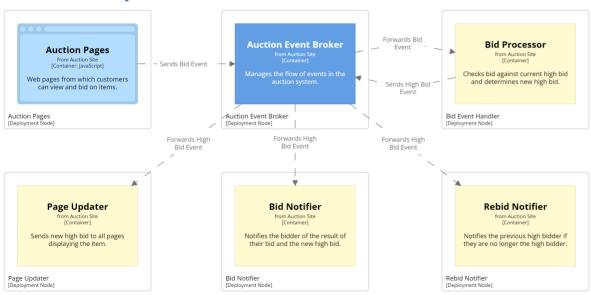
Processing Event Indicates next step in the process can be performed

Event Channel Holds events waiting to be processed

Event Handler Processes events

• Step, or part of a step, in the business process

#### Auction Example



- Step through event process.
- Highlight asynchronous messages and parallel processing.
- Bid Processor could send back a high bid event or an async message.

# Definition 5. Event Handler Cohesion Principle

forms a single processing task.

Each event handler is a simple cohesive unit that per-

# Definition 6. Event Handler Independence Principle Event handlers should not depend on the implementation of any other event handler.

#### Topologies

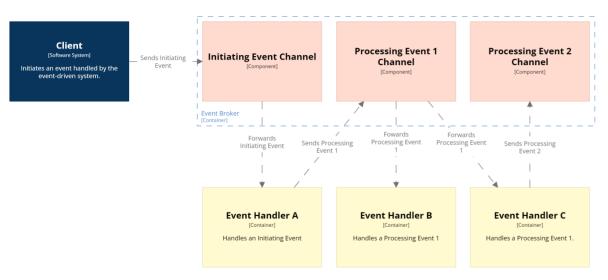
Broker All events received by event broker

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

Mediator Manages the 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

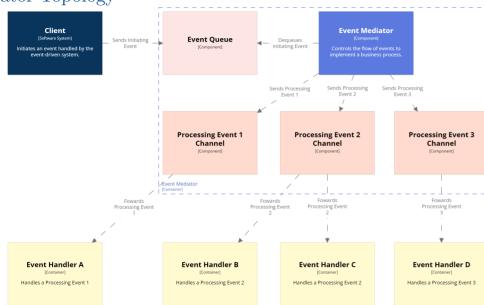


- Step through event process.
- Describe idea of channels.

#### Event Broker Façade

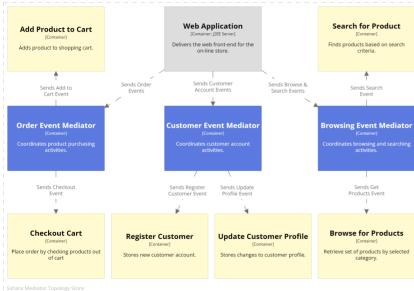
- Event handlers can register to listen for events
- Receives events and directs them to the correct channel

#### Mediator Topology



- Step through event process.
- Highlight process control performed by mediator.

#### Sahara Mediator Topology



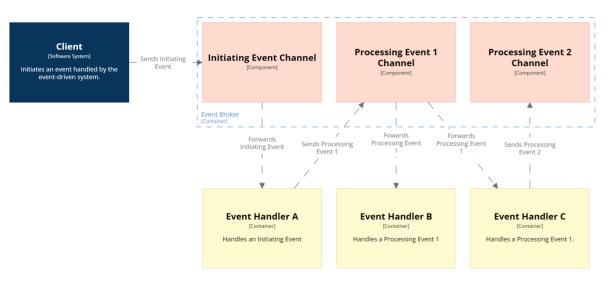
- Step through event process.
- Highlight multiple mediators as common implementation.
- Discuss internals of mediators: event queue and event channels.

#### 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

#### Broker Topology



- Step through event process.
- Describe idea of channels.

#### 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

#### Queues

- 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 persisted until removed
  - Recovery from broker failure

#### Streams

- 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
- 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

Mediator smart pipe

Mediator events are commands to process

# Broker vs Mediator Topologies

- Scalability
- Reliability
- Extensibility
- Low coupling

#### Mediator Advantages

• Error recovery

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

Pros & Cons	
Modularity Event Handlers	
Extensibility	
Reliability Event Handlers	
Interoperability Events	
Scalability Event Handlers	
Security	
Simplicity	
Deployability	
Testability Complex Interactions	