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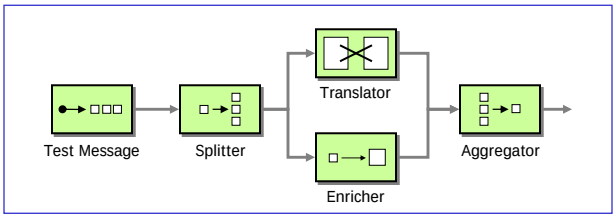
Enterprise Integration Patterns



Lab Exercises

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Objectives

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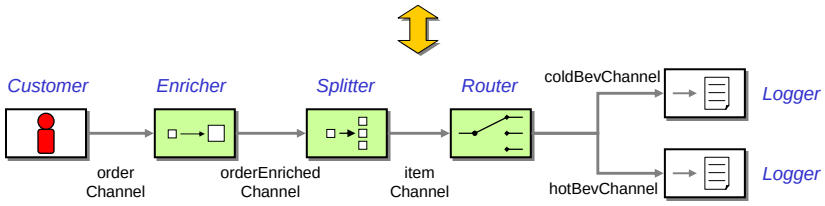
- Demonstrate the role of messaging in decoupling applications so that they can be more scalable.
- Illustrate some of the challenges that need to be addressed when adopting EDA.
- The role of messaging in addressing non-functional requirements.
- Uses pattern language described at http://www.eaipatterns.com/

Simple Messaging Toolkit

- Easy composition of solutions from a batch file or the command line
- Messaging Domain Specific Language
- See Tutorial Reference Chart

```
call Customer orderChannel
call Enricher orderChannel orderEnrichedChannel
call Splitter orderEnrichedChannel itemChannel "/Order/Item"
call Router itemChannel coldBevChannel "Item = 'FRAPPUCINO'" hotBevChannel
call Logger coldBevChannel
call Logger hotBevChannel
```



Available Pattern Components


Message Translator

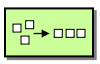

Content Enricher (special case of Translator)

Sequence Tagger


Router


Splitter


Aggregator


Resequencer


Wire Tap (Tee)


Delay

Convenience & Test Components

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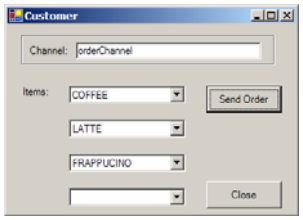
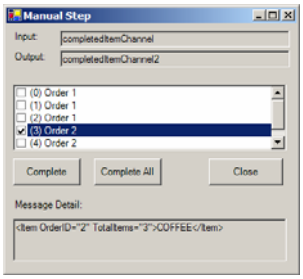
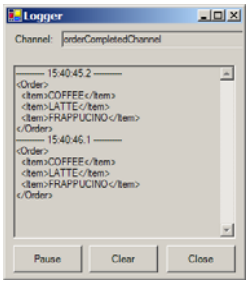
Customer	Manual Step	Logger
		
Sends order messages to specified channel	Allows inspection of messages and out-of-sequence completion	Display messages and time stamps

Coffee Shop Scenario

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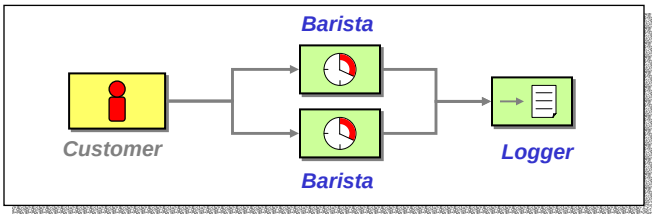
- Customer places order for drinks
- Barista prepares drinks
- Run the following commands from the command line:
  - Customer orderChannel
  - Barista orderChannel orderCompletedChannel
  - Logger orderCompletedChannel
- Place some orders
- Close the components by hitting ESC or ENTER.
- Channel names are arbitrary as long as alphanumeric
- Make sure to close all components before trying a new exercise
- You can run components directly or from a batch script

Exercise One

- Part 1
  - Connect a Customer, a Barista, and a Logger.
  - Order one drink. Track the completion time.
  - Place 10 orders. Time it again.
- Part 2
  - Add a second Baristas in parallel
  - Order one drink. Track the completion time.
  - Place 10 orders. Time it again.
  - Feel free to start more Baristas if time permits
- Observations?

# Baristas	1 Order [secs]	10 Orders [secs]

Exercise One - Observations



- Single Barista
  - One coffee takes about 1 second
  - Ten coffees take about 10 seconds
  - Throughput 1 coffee per second
- Two Baristas
  - One coffee still takes about 1 second
  - Ten coffees take about 5 seconds
  - Throughput 2 coffees per second

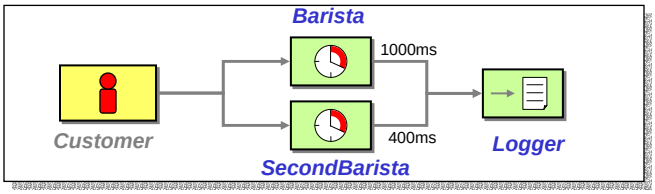
Exercise One - Discussion

- Messaging architectures scale out through *Competing Consumers*
- Scalability: Adding more baristas did not require any changes to the architecture or existing components
- Distinguish Throughput from Latency
- They are different, though both elements of perceived performance
- Messaging architectures can provide very high throughput

- Latency can be longer than non-distributed solutions
  - Networking overhead
  - Serialization / deserialization

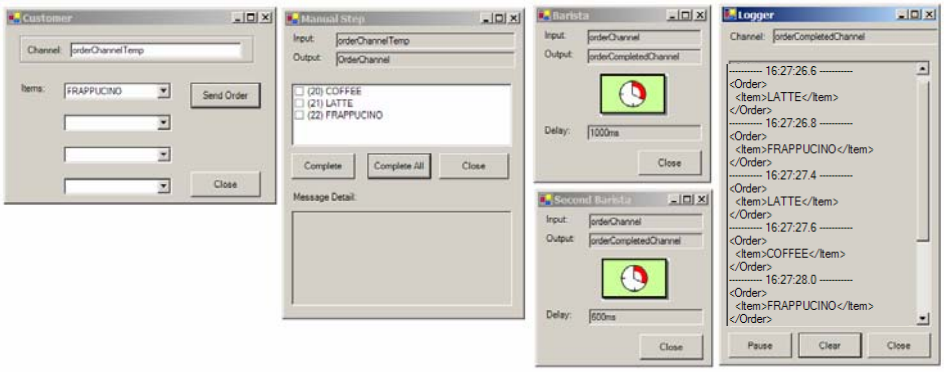
Exercise Two

- Let's assume we can tune the second Barista for higher throughput
- Simulate by using SecondBarista command (400 ms)



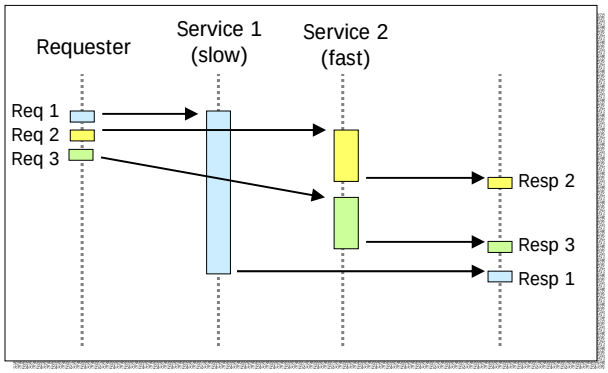
- Send a rapid series of orders through the Baristas and observe the sequence of messages
- How can you tell the proper sequence?
  - You can start some components later than others
  - You can use a manual step ("Complete All" preserves order)
  - You can use two customers

Exercise Two - Example



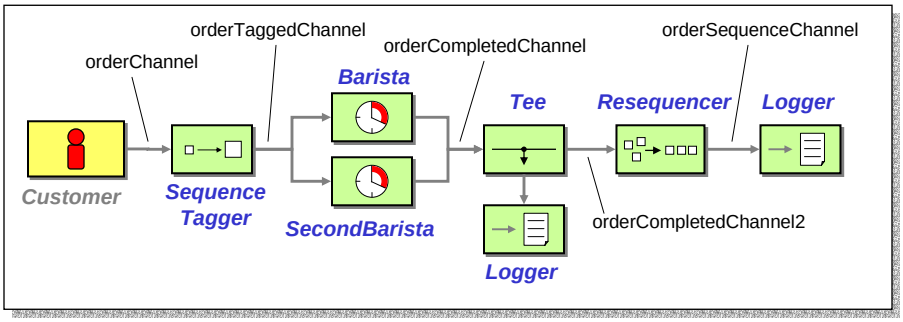

```
call Customer orderChannelTemp
call ManualStep orderChannelTemp OrderChannel "/Order/Item"
call Barista orderChannel orderCompletedChannel
call SecondBarista orderChannel orderCompletedChannel
call Logger orderCompletedChannel
```


Exercise Two - Observations



- Parallel processing causes messages to get out of order
- Correct the problem (using available patterns) so orders arrive at final logger in order
- Verify correct behaviour by inserting a manual step to reshuffle the orders

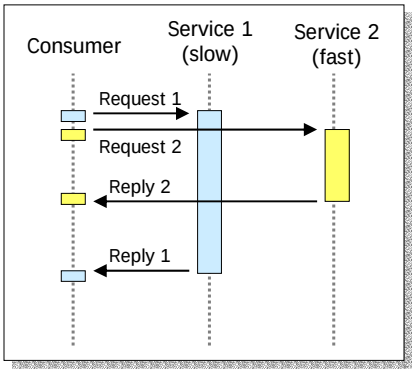
Exercise Two - Example Solution




```
call Customer orderChannel
call SequenceTagger orderChannel orderTaggedChannel "/Order/@OrderID"
call Barista orderTaggedChannel orderCompletedChannel
call SecondBarista orderTaggedChannel orderCompletedChannel
call Resequencer orderCompletedChannel orderSequenceChannel "/Order/@OrderID"
call Logger orderSequenceChannel
```


Exercise Two - Learnings

- Parallel processing causes messages to get out of order
- Use a Resequencer to bring messages back into order
- Resequencing increases latency because it holds messages
- A Resequencer is a stateful component and needs to persist messages to be robust

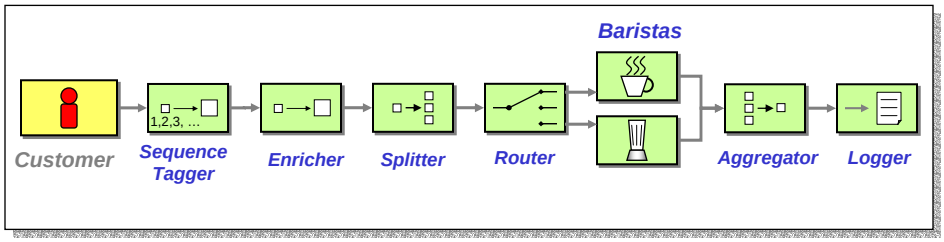


- One missing message can stall everything
- Carefully consider scope of resequencing -- sometimes correlation suffices.

Exercise Three

- Processing a whole order at one time limits our scaling options
- Creating a specialized Barista each for iced beverages and for hot beverages allows us to fine-tune baristas
- Create a new solution using the following commands
  - HotBevBarista (400 ms)
  - ColdBevBarista (800 ms)
- These Baristas can only process a single <item>, not a complete <order>
- Still deliver complete orders in one piece to the customer

Exercise Three – Example Solution




```
call Customer orderChannel
call SequenceTagger orderChannel orderTaggedChannel "/Order/@OrderID"
call Enricher orderTaggedChannel orderEnrichedChannel
call Tee orderEnrichedChannel orderEnrichedChannel2 logEnrichedChannel
call Logger logEnrichedChannel
call Splitter orderEnrichedChannel2 orderItemChannel "/Order/Item"
call Tee orderItemChannel orderItemChannel2 logItemChannel
call Logger logItemChannel
call Router orderItemChannel2 orderItemColdChannel "Item = 'FRAPPUCINO'" orderItemHotChannel
call ColdBevBarista orderItemColdChannel orderItemCompletedChannel
call HotBevBarista orderItemHotChannel orderItemCompletedChannel
call Aggregator orderItemCompletedChannel orderCompletedChannel
call Logger orderCompletedChannel
```

Exercise Three - Tuning

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- Assume each customer orders one Coffee and one Frappucino
- Assume the Hot Bev Barista is limited to one instance (for now)
- How many Cold Bev Baristas should you run for optimum performance?
- Discuss the optimum number first, then run tests with 10 orders in rapid sequence

# Cold Bev Bar.	First Test [sec]	Second Test [sec]

Exercise Three - Discussion

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- Splitting allows different message types to be processed individually.
- Separating tasks into smaller pieces can improve throughput for the application and support greater scalability.
- Messages will get out of order and have to be re-correlated and re-aggregated.
- Global sequencing constraints can hurt performance.
- Loosely coupled systems can be hard to debug.
- Flexibility and composability make it hard to diagnose problems.
- You don’t need a huge solution to realize the complexities.

For Extra Credit

- Copy your solution scripts to folder ExercisesViz
- Start Visualizer.bat
- Open Graph.htm
- Run your script
- Watch Graph.htm

Summary

- Patterns are a good way to describe messaging solutions
- Messaging solutions can be highly dynamic
- Messaging architectures can address scalability issues
- Messaging introduces new problems

- Pattern references: http://www.eaipatterns.com/