Spring Integration Introduction

Spring integration allows you to :
1) Let application components exchange data through in-memory messaging
2) Integrate with external applications in a variety of ways through adapters

- Builds on Enterprise Integration Patterns for both
- Build on spring portfolio & programming model

Benefits

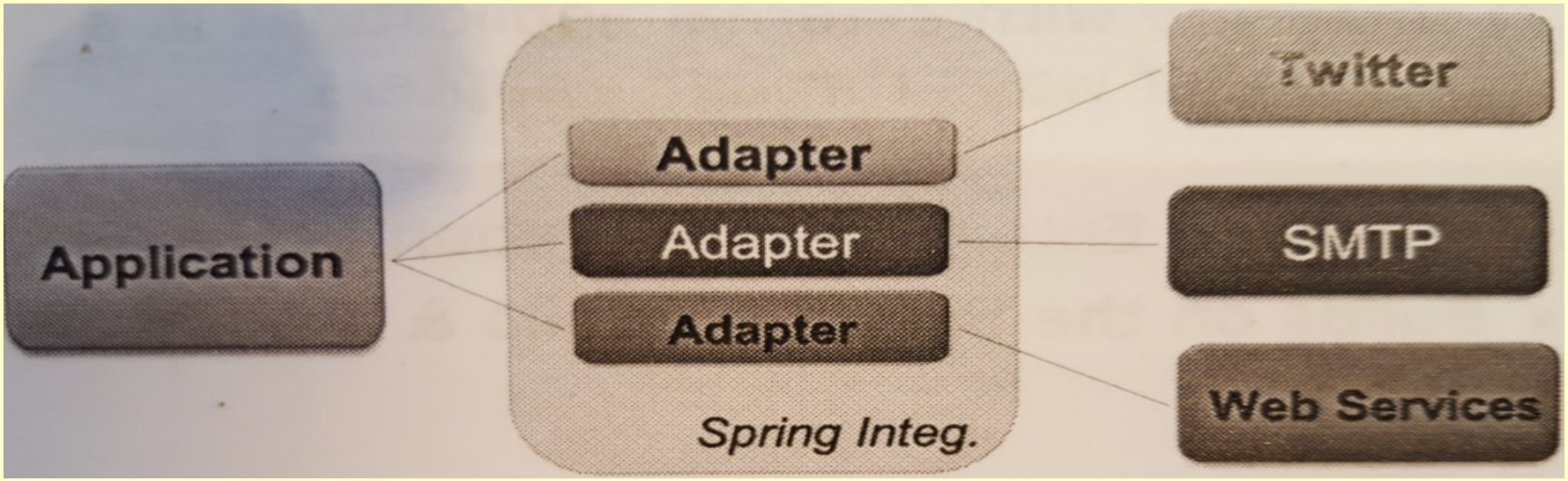
- Loose coupling between components
  - Small focused components
  - Eases testing, reuse
- Event-driven architecture
  - No hard-coded process flow
  - Easy to change or expand
- Separates integration and processing logic
  - Framework handle routing, transformation ...
  - Easily switch beetwen sync & async processing

Adapters

- Connect your application to the outside world

  - Remoting, REST, WS, File & FTP, SMTP, Twitter ...

  - For accepting input or producing output



Adapters

- External events produce incomming message

  - Incoming emails, new file (in folder), SOAP request, ...

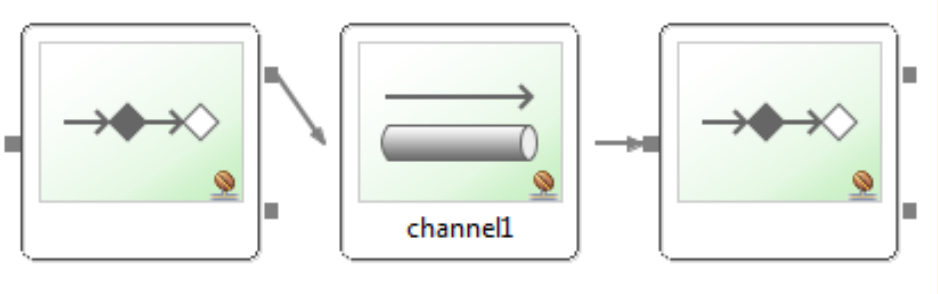
- Internal message can trigger external event

  - Calling a service, sending JMS message or email, ...

Ground rules

- Simple core API:
- A **Message** is sent by an endpoint
- **Endpoints** are connected to each other using **MessageChannles**
- An **endpoint** can receive **Messages** from a **MessageChannels**

  - by subscribing (passive) or pooling (active)



Message

- A **Message** consists of **MessageHeaders** and a **payload**

  - Some headers are pre defined

  - payload is just Java object

- A message is immutable

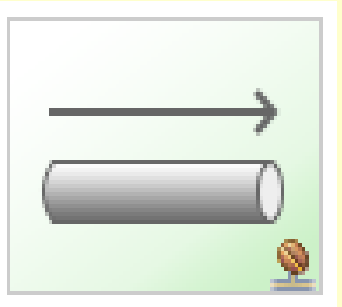
  - Let framework wrap payload for you or use a **MessageBuilder** to create it

- Each Message is created with unique ID

MessageChannels

- Connect message endpoints (loose coupling)
- Optional buffering, Interception
- Just spring beans
  - No broker needed
  - No persistance by default

MessageChannel Types



- **Point-to-point**
- Only one receiver by message
- **DirectChannel**

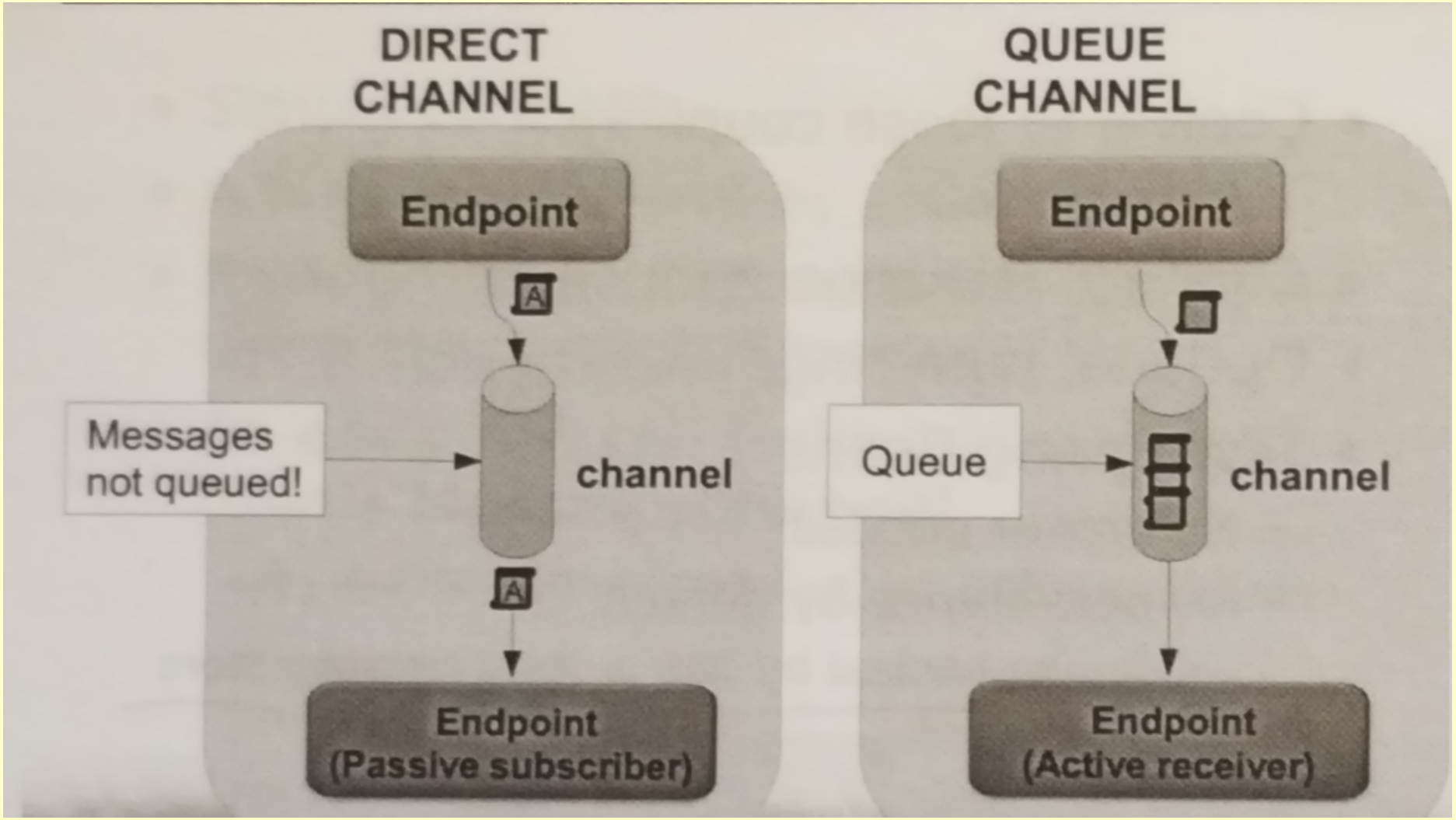
  - Message passed to receiver in senders's thread (return, exceptions), synchronous

  - passive subscriber
- **QueueChannel**

  - Message is queued, sending doesn't block

  - Active receiver polls from different thread

Direct vs Queue Channel



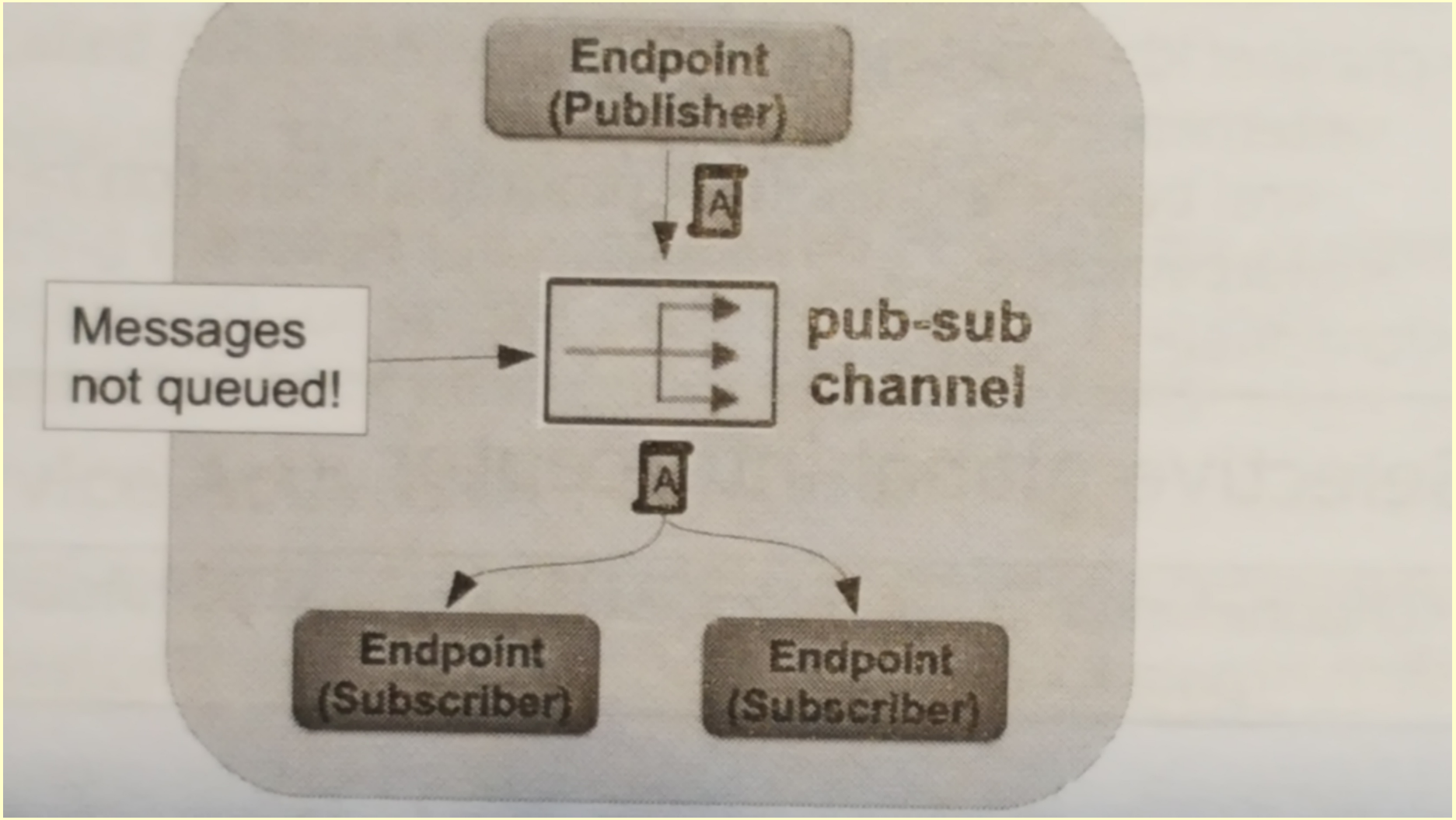
MessageChannel Types

- **Publish-subscribe**
- Multiple receivers per message
- **PublishSubscribeChannel**

  - Receivers invoked one by one in senders thread

  - Or invoked in parallel on different threads using TaskExecutor

Publish Subscribe



Defining Channels

- **DirectChannel** (sync)

  <channel id="incoming">
- **QueueChannel** (async)

  <channel id="orderedNotifications">

    <queue capacity="10"/>

  </channel>

Defining Channels

- **PublishSubscribeChannel** (sync)

  <publish-subscribe-channel id="statistics" />
- **PublishSubscribeChannel** (async)

  <publish-subscribe-channel id="appEvents"

  task-executor="pubSubExecutor" />

  <task-exacutor id="pubSubExecutor" pool-size="10" />

Channel Interceptors

- Can operate on messages

  - pre/post send , pre/post receive

  ```
  <channel id="intercepted">
      <interceptors>
          <ref bean-"someInterceptorImplementation"/>
  ```

- Selective global interceptor

  ```
  <channel-interceptor ref="interceptorForXChannels" />
  ```

Wire Tap

- Standard pattern implemented as interceptor
- Copies incomming messages to given channel

  - good for debugging and monitoring

  - often used with logging channel adapter

```
<channel id="in">
    <interceptor>
        <wire-tap channel="logger" />
<channel id="logger" />
<logging-channel-adapter channel="logger" level="DEBUG" log-full-message="true" />
```

Message Endpoints

- **Channel Adapter**: One way integration

  - message enters or leaves application

  - Called 'inbound' or 'outbund'

- **Gateway**: Two way integration

  - Bring message into application and wait for response (inbound) or invoke external system and feed response back into application (outbound)

- **Service Activator**

  - Call method and wrap message into response channel

Messaging Gateway

```
<gateway id="orederService"
    service-interface="com.example.OrderService"
    default-request-channel="orders" />

public interface OrderService {
    public OrderConfirmation submitOrder(Order order);
}
```

- Proxy for sending new messages

  - code doesn't depend on SI API

  - we can inject ordersService and call method and order will go to channel

Service Activator

- <service-activator ref="orderProcessor"

  input-channel="orders" output-channel="confirmations" />

  <beans:bean id="orderProcessor" class="broker.OrderProcessor" />
- Invoke bean method for incoming message

  - Specify method attribute if there are multiple methods

Gateways and Adapters

- Remember the dfference:

  - Channel adapter is one way (in or out)

  - Inbound Gateway awaits internal reply and returns it in-band

  - Outbound Gateway awaits external response and puts it on a channel in invoking thread

- Often use or add message headers

  - inbound HTTP: copies request header to SI headers

  - outbound JMS: copies SI headers to JMS headers

Temporary Reply Channel

- Temporary reply channels created automatically for inbound gateways if not explicitly defined

  - anonymous point to point channel
- Reply channel removed automatically after receiving reply message

Integration Namespaces

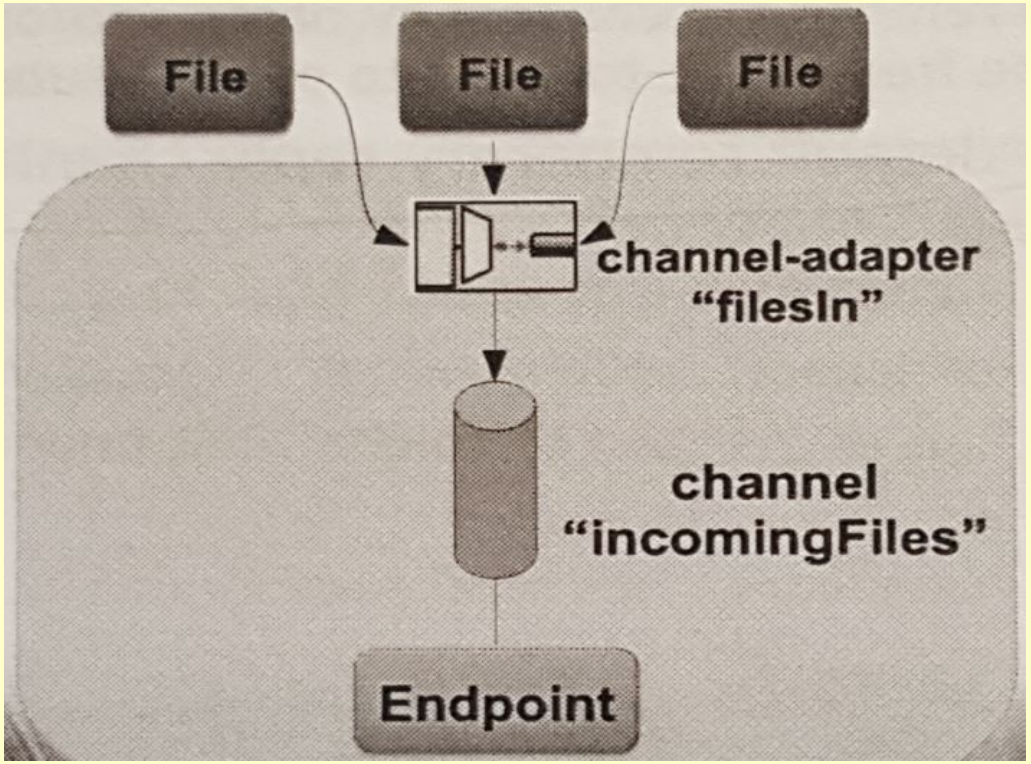
- Spring integration has dedicated namespaces for different integration types
- For example :

  file, http, xml, jms, ip, twitter

Sample : Inbound File Adapter

- It is triggered on new files in directory

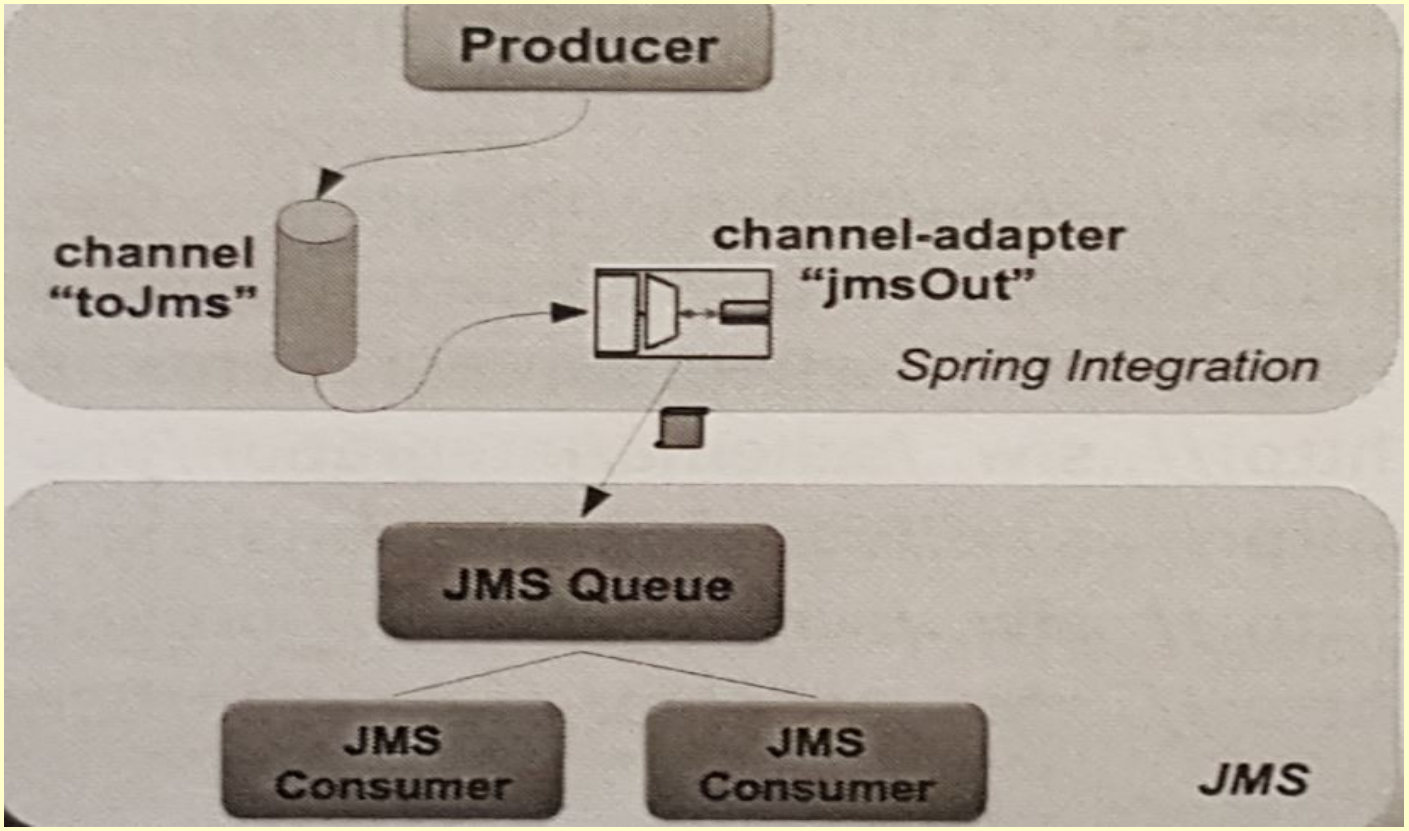
```
<int-file:inbound-channel-adapter id="filesin"
    channel="incommingFiles"
    directory="file:C:/inputResource" />
```



Sample: Outbound JMS Adapter

Adapter translate to jms message

```
<int-jms:outbound-channel-adapter id="jmsOut"
    channel="toJms" destination="jmsQueue" />
```

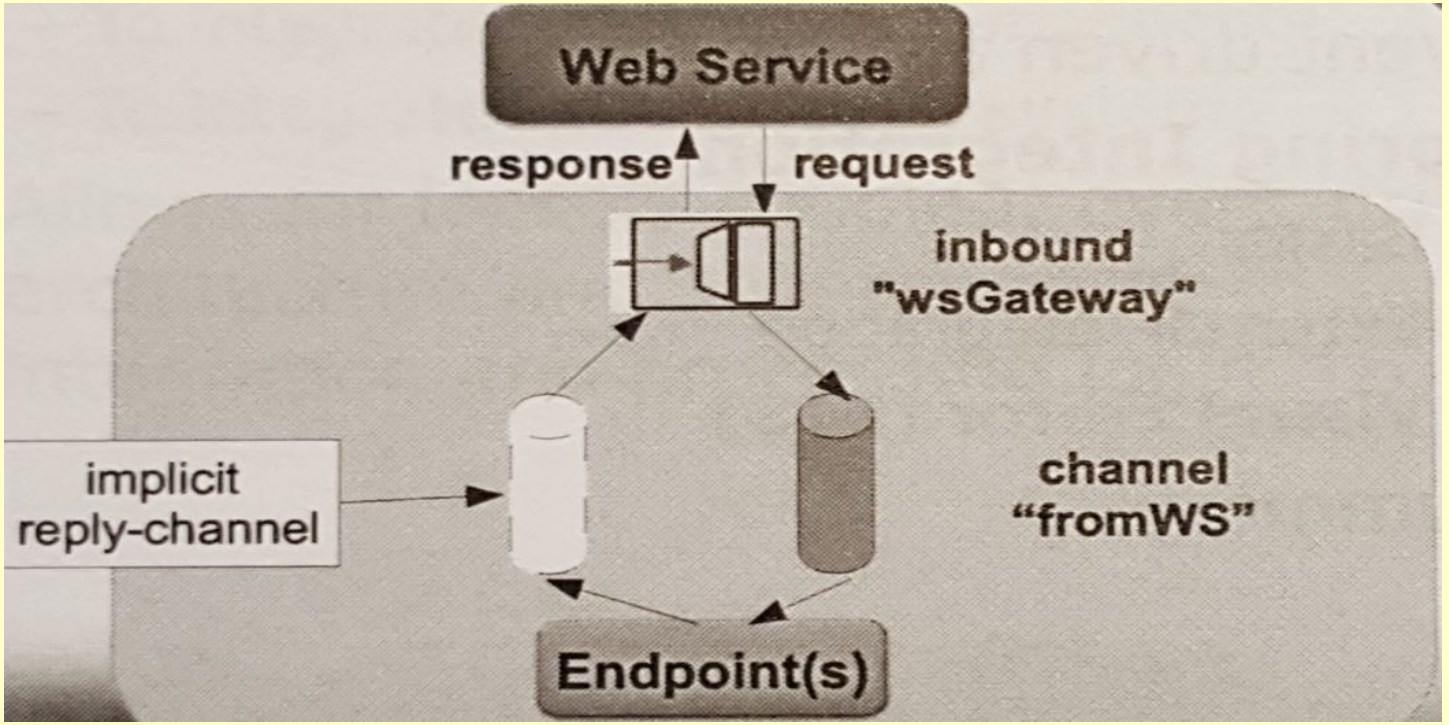


Sample : Inbound Web Service Gateway

<**int-ws:inbound-gateway** id="wsGateway" channel="fromWS" marshaller="jaxb2" unmarshaller="jaxb2" />

<**oxm:jaxb2-marshaller** id="jaxb2" contextPath="com.example.xml" />

- In com.example.xml we can fing xsd



Sample: Combining Components - call

```
@Controller
public class OrderController {
    @Autowired OrderService orderService;

    @PostMapping("/orders")
    @ResponseStatus(CREATED)
    public void placeOrder(@RequestBody Order order)
        Confirmation conf = orderService.submitOrder(order)
    ...
}
```

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```

Sample: Combining Components

Message is processed by service adapter and additionaly send to jms queue :

```
<gateway default-request-channel="new-orders"
    service-interface="com.example.OrderService" />
<publish-subscribe-channel id="new-orders"/>
<service-activator input-channel="new-orders" requires-reply="true" ref="orderProcessor"
method="processOrder" />
<int-jms:outbound-channel-adapter channel="new-orders" destination-name="queue.orders" />
```

Sample: Combining Components

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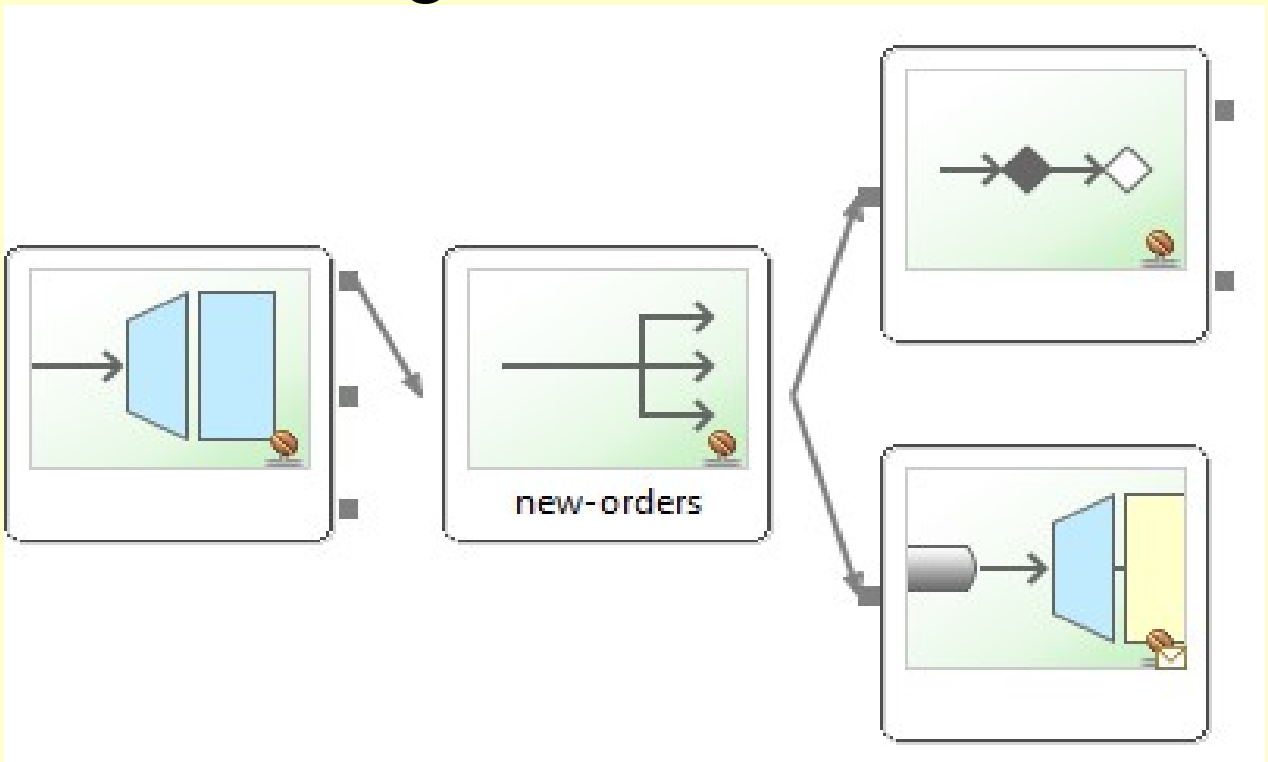
STS Visual Editor

- SpringSource Tool Suite includes a visual editor for Spring Integration flows
- Select 'integration-graph' tab on open Spring Integration configuration file



Summary

- Spring Integration provides the base components to implement EPI

  - To integrate application components

  - To integrate with external systems

- Allows for loosely coupled, event-driven architecture
- separation of integration and processing logic

LAB