# What's new in Spring Integration 4.x?

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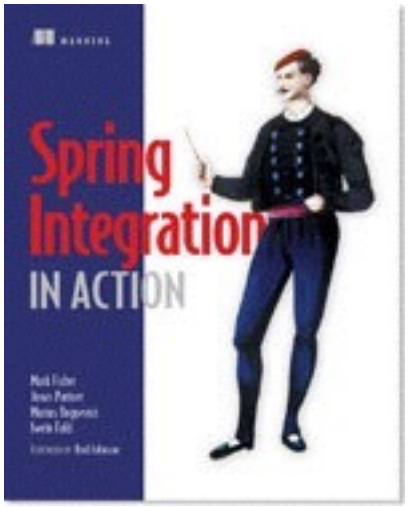
# About me

- **Current**
  - Staff Engineer @ Pivotal
  - Spring XD team
- **Past**
  - Open source: SpringSource, JBoss/RedHat, Pivotal
  - Spring Integration contributor
    - co-author “Spring Integration in Action, Manning, 2012”
  - Finance, Asset Management, Mobile Messaging, etc.







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# Spring Integration - continuously evolving




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# ENTERPRISE INTEGRATION

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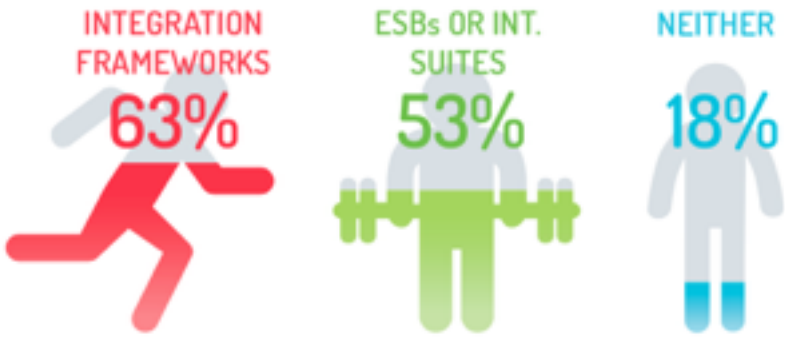
3SCALE ca MuleSoft redhat WSO2

## ESBs VS LIGHTWEIGHT INTEGRATION FRAMEWORKS




**LIGHTWEIGHT EIP FRAMEWORKS ARE THE NORM FOR MOST SYSTEMS** Out of all integration frameworks (EIP), ESBs, and integration suites, Spring Integration is the most popular (42%) and Apache Camel is a close second (38%). The three most popular ESBs are Mule ESB (16%), WebSphere ESB (15%), and Oracle ESB (13%). Overall, 63% of respondents use an integration framework (e.g. Spring Integration, Camel) and 53% use an ESB or Integration Suite (e.g. Mule ESB, Biztalk), while 18% say they use neither. *Note that 69% of respondents are from large organizations, where bigger integration scenarios would be more common.*

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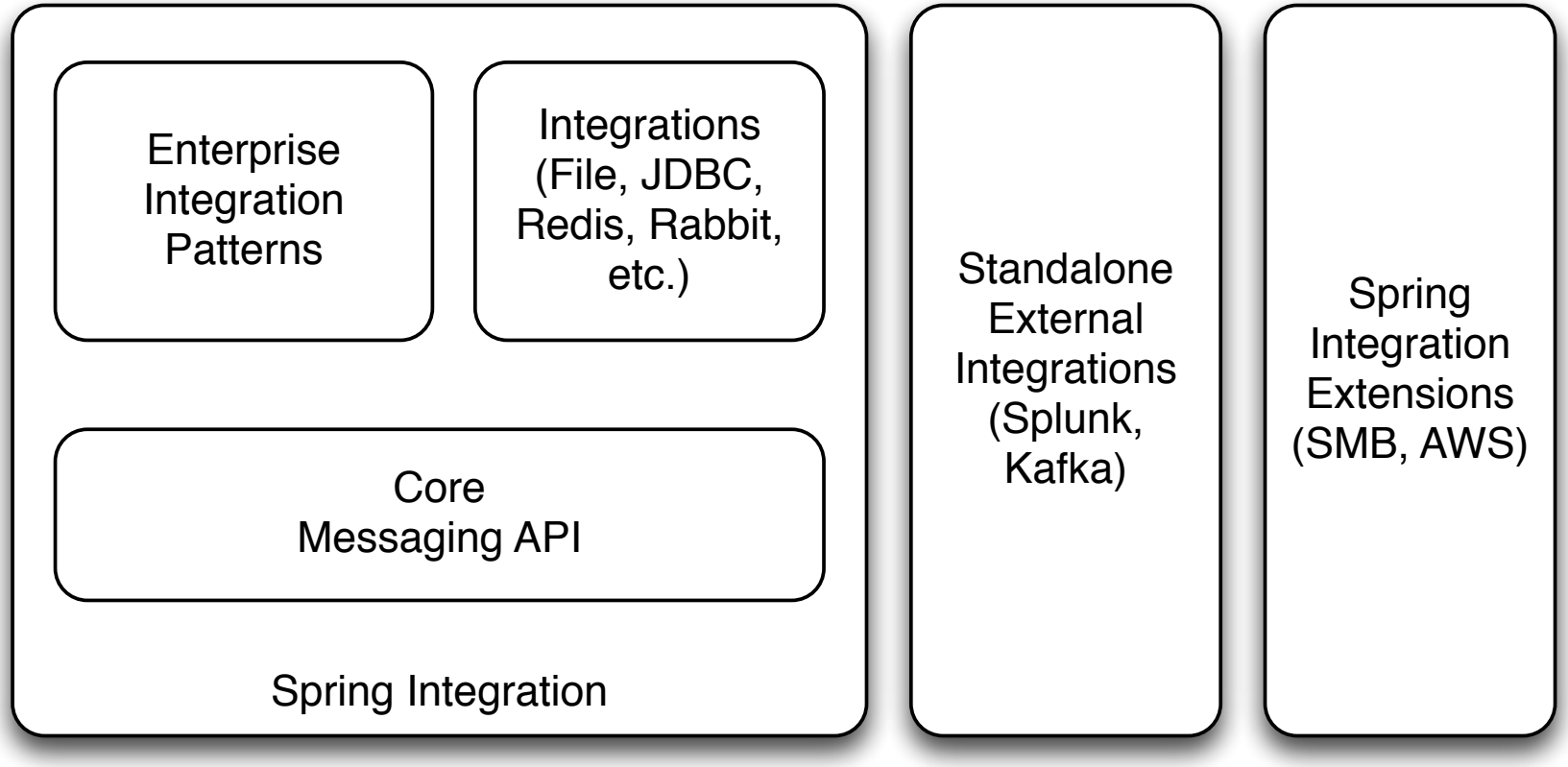
# Spring Integration Ecosystem







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# Early releases: 1.0 and 2.0

- **Spring Integration 1.0**
  - First implementation of the framework!
  - Core components: Message, MessageChannel, MessageHandler
  - Core Enterprise Integration Patterns:
    - Filter, Splitter, Aggregator, Resequencer, Service Activator, Gateway
  - Integrations: XML, File, JMS, Mail and more
- **Spring Integration 2.0**
  - Spring 3 and SpEL support
  - More Enterprise Integration Patterns
  - More Integrations
  - Enhanced namespace and annotation support




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# Spring Integration 3.0 and 4.x

- **Rapid sequence of changes**
- **Spring Integration 3.0 - October 2013**
- **Spring Integration 4.0, 4.1 throughout 2014**
  - Our topic today!
- **4.2 Forthcoming**




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# Spring 4.x Evolution Themes




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# Architectural consolidation and internal refactoring




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# Messaging API moved to Spring Framework 4

- **New packages in Spring Framework 4**
  - `org.springframework.messaging`
    - `Message, MessageHeaders`
    - `MessageHandler`
    - `MessageChannel,PollableChannel,SubscribableChannel`
    - `MessagingException,MessageHandlingException, MessageDeliveryException`
    - `MessagePostProcessor`
  - `org.springframework.messaging.support`
    - `ChannelInterceptorAdapter`
    - `GenericMessage,ErrorMessage`
    - `ChannelResolver`
- **Spring Integration 4 depends on Spring 4**




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# Advantages

- **Shared messaging abstractions with other Spring components, e.g. Spring Core**
  - WebSocket
  - STOMP
  - SockJS
- **Spring Integration 4 internals make use of the new abstraction**




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# New integration patterns




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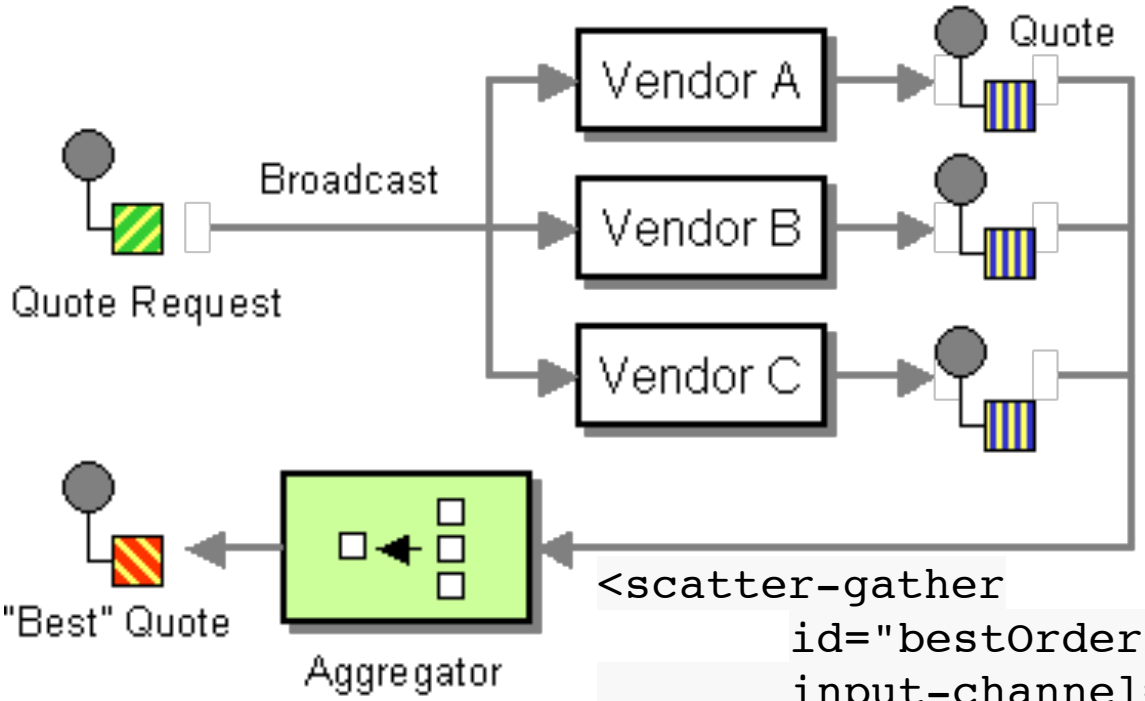
# Scatter-Gather




```
<scatter-gather
        id="bestOrder"
        input-channel="orders"
        output-channel="bestOrder" >
            <scatterer>
              <recipient channel="vendorA"/>
              <recipient channel="vendorB"/>
              <recipient channel="vendorC"/>
            </scatterer>
            <gatherer ref="bestOrderCompute">
</scatter-gather>
```

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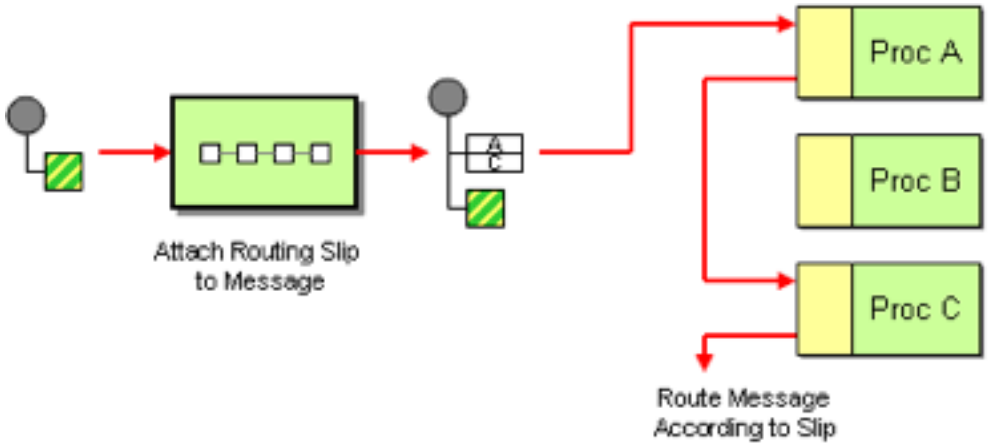
# Routing Slip




```
<header-enricher input-channel="input" output-channel="process">
        <routing-slip value="procA; procB; procC; finishChannel”/>
</header-enricher>
```

SpEL expressions are supported, too

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# Idempotent Receiver

- Messages with the same ID, played only once
- Useful in retry, execute at most once scenarios

```
<idempotent-receiver
      id="receiver"
      endpoint="orderProcessor"
      discard-channel="failures"
      metadata-store="metadataStore"
      key-expression="#{payload.orderId}"/>
```




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# Java DSL, Java 8 and Boot

# New annotations for configuring endpoints

- @MessageGateway
- @GlobalChannelInterceptor
- @IntegrationConverter
- @Poller
- @InboundChannelAdapter




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# Java Configuration Support

- **@Configuration**
  - @EnableIntegration
  - @IntegrationComponentScan
  - @EnableMessageHistory
  - @EnableIntegrationMBeanExport
  - @BridgeFrom
  - @BridgeTo
- **Spring Boot**
  - via **spring-boot-starter-integration**
    - some adapters included by default (file, stream, http, ip)
    - others must be added explicitly
  - @EnableAutoConfiguration




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# Spring Integration Java DSL

- Fluent API for creating Integration flows
- Perfect complement for @Configuration and Spring Boot
- Core concept of `IntegrationFlow`

```
@Bean
IntegrationFlow flow() {
        return IntegrationFlows.from(foo())
                .transform("payload + payload")
                .handle(String.class, (p, h) -> p.toUpperCase())
                .get();
}
```




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# Demo time




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# ListenableFuture and Asynchronous Programming

- Since Spring Integration 4
- ListenableFuture from Spring Core Framework 4

```
@MessagingGateway(defaultReplyTimeout = 0)
public interface MathGateway {

  @Gateway(requestChannel = "gatewayChannel")
    ListenableFuture<Integer> multiplyByTwo(int number);

}
```

```
ListenableFuture<String> result = this.asyncGateway.async("foo");
result.addCallback(new ListenableFutureCallback<String>() {

    @Override
    public void onSuccess(String result) {
        ...
    }

    @Override
    public void onFailure(Throwable t) {
        ...
    }
});
```




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# Reactor Promise<?>

- Based on Project Reactor Promise
- Streaming component (not Java 8) for reactive programming

```
@MessagingGateway(defaultReplyTimeout = 0, reactorEnvironment = "reactorEnv")
  public interface MathGateway {
    @Gateway(requestChannel = "gatewayChannel")
    Promise<Integer> multiplyByTwo(int number);
}
```

```
Streams.defer(Arrays.asList("1", "2", "3", "4", "5"))
            .env(this.environment)
            .get()
            .map(Integer::parseInt)
            .mapMany(integer -> testGateway.multiply(integer))
            .collect()
            .consume(integers -> ...)
            .flush();
```




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# Distributed processing




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# Distributed Metadata Stores

- **What is a Metadata Store ?**
  - Maintains state across restarts
  - Used by Twitter, File, FTP channel adapters, Idempotent receiver
- **MetadataStore abstraction available since 2.0**
- **Distributed implementations for operating in a cluster**
  - Redis (since 3.0)
  - Gemfire (since 4.0)




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# Distributed Lock Registries

- **Global lock support in a clustered environment**
- **Used by Aggregator, Resequencer (and any subclass of AbstractCorrelatingMessageHandler)**
- **LockRegistry available since 2.1.1**
- **Distributed implementations for operating in cluster**
  - Redis (since 4.0)
  - Gemfire (since 4.0)
  - Forthcoming: Zookeeper (4.2), Hazelcast (incubating)

# Internet of Things




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# WebSockets

- **Based on Spring Framework WebSocket support**
- **Channel adapters:**
  - Inbound
  - Outbound
- **Integrate in Spring Web Applications through the Message abstraction**

```
<int-websocket:inbound-channel-adapter … />

<int-websocket:outbound-channel-adapter … />

@MessagingGateway
@Controller
public interface WebSocketGateway {

    @MessageMapping("/greeting")
    @SendToUser("/queue/answer")
    @Gateway(requestChannel = "greetingChannel")
    String greeting(String payload);

}
```




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# MQTT support

- **Inbound message gateway**
- **Machine-to-machine connectivity protocol**
  - Large net of small devices that need to be monitored remotely
- **Lightweight pub-sub**
- **Device data collection,**
  - Sensors
  - Smartphones
  - Cars

```
<int-mqtt:message-driven-channel-adapter id="mqttInbound"
    client-id="${mqtt.default.client.id}.src"
    url="${mqtt.url}"
    topics="sometopic"
    client-factory="clientFactory"
    channel="output"/>
```




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# Data Streaming




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# Apache Kafka Integration

- **Available as extension via spring-integration-kafka**
- **High performance messaging platform**
  - Distributed commit log
- **Heavy reliance of linear disk writes**
- **High data retention**
- **Consumer-controlled read positioning**

http://engineering.linkedin.com/distributed-systems/log-what-every-software-engineer-should-know-about-real-time-datas-unifying




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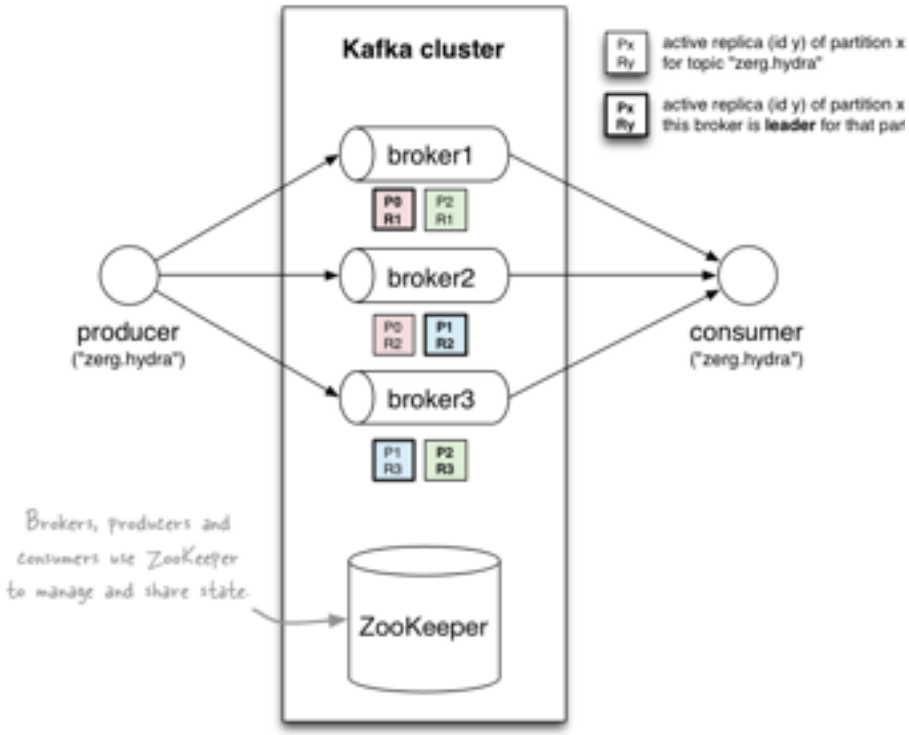
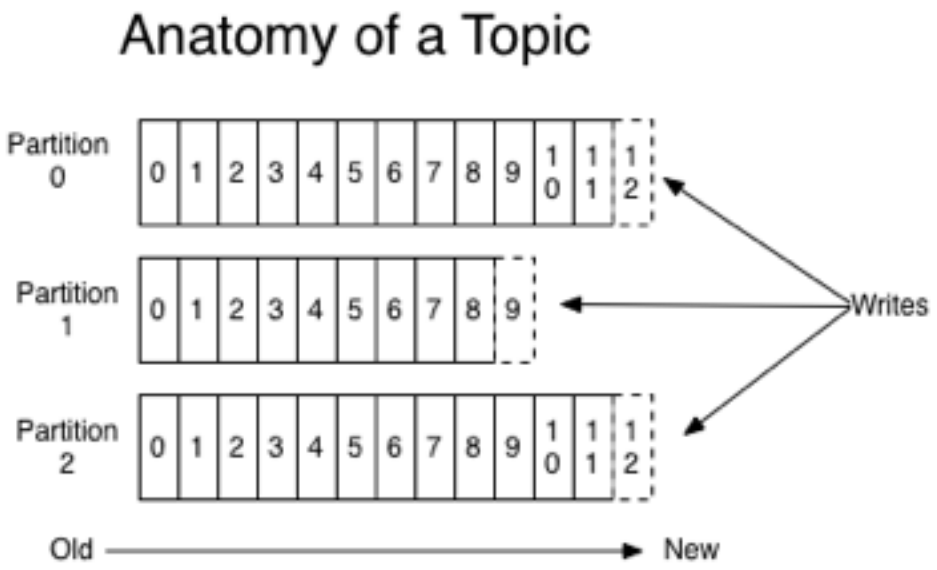
# Apache Kafka in a nutshell




http://www.michael-noll.com/blog/2013/03/13/running-a-multi-broker-apache-kafka-cluster-on-a-single-node/

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# Spring Integration Kafka Support

- **Message Source (based on high level consumer)**
- **Producer Channel Adapter**
- **Event-Driven Channel Adapter**
  - Offset Control and Replay
  - Pluggable Offset Management
  - Listened Partition Control
  - Guaranteed ordering by partition

```
<int-kafka:message-driven-channel-adapter
                id="kafkaListener"
                channel="“output"
                connection-factory="connectionFactory"
                key-decoder="keyDecoder"
                payload-decoder="payloadDecoder"
                offset-manager="offsetManager"
                concurrency="${concurrency:10}"
                topics="${topics:foo,bar}"/>
```




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# Spring XD

# Common problems

Batch and Streaming often handled by multiple platforms

Fragmented Big Data Ecosystem

Simple things are not simple






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SPRING XD
EXTREME DATA
"One stop shop for developing and deploying Big Data Applications"

# Spring XD in a nutshell

- **Spring eXtreme Data**
- **Unified, distributed and extensible service for:**
  - Data Ingestion
  - Real time analytics
  - Batch processing
  - Data export
- **Built on existing solutions**
  - Spring Integration
  - Spring Batch
  - Spring Platform (Core, Boot, Data, etc)




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# Stream processing


HTTP
Tail
File
Mail
Twitter
Gemfire
Syslog
TCP
UDP
JMS
RabbitMQ
MQTT
Trigger
Reactor TCP/UDP

Filter
Transformer
Object-to-JSON
JSON-to-Tuple
Splitter
Aggregator
HTTP Client
JPMML Evaluator
Shell
Groovy
Python
Java

File
HDFS
JDBC
TCP
Log
Mail
RabbitMQ
Gemfire
Splunk
MQTT
Dynamic Router
Counters




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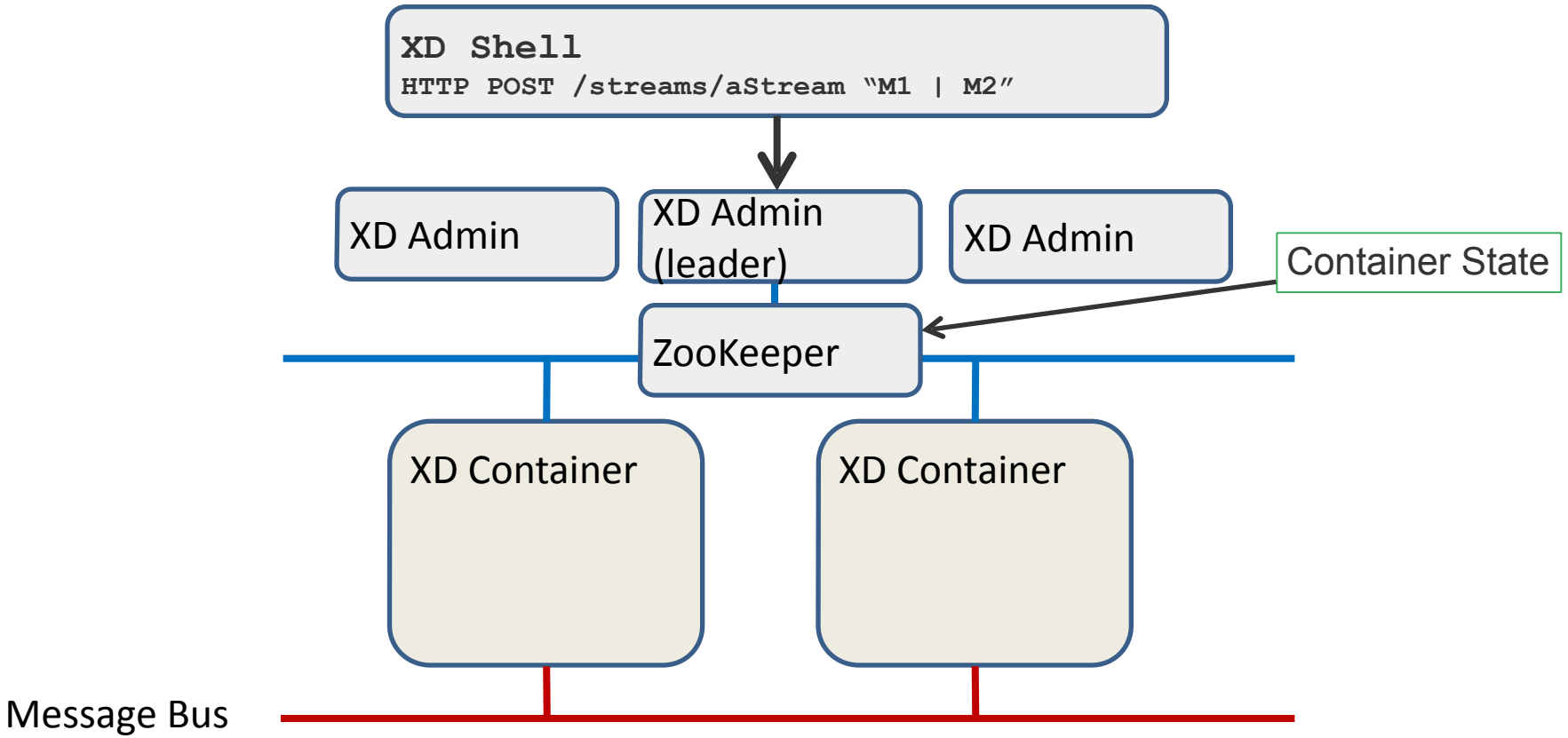
# Distributed runtime







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# Spring XD and Spring Integration

- **Spring Integration is a foundational component of Spring XD**
  - Message Bus based on Spring Integration Channels
  - Modules are Spring Integration contexts
    - Automatically bridged together in Streams
    - Conventions for Input and Output Channels
    - Runtime designed for concurrency/scaling/failover
- **Spring XD is designed for distributed, modular solutions**
  - Spring Integration components are a natural fit
  - Most Spring XD integrations are reusing Spring Integration channel adapters
- **Spring XD is for less extreme data too :)**




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# Into the future




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# Spring 4.2 Roadmap (tentative)

- Rework of JMX monitoring and management for performance
- Spring Integration AWS based on Spring Cloud AWS
- More adapters based on existing Spring Data Support
- Kafka enhancements
- Reactive programming support




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# Learn More.  Stay Connected.


**GitHub:** github.com/spring-projects/spring-integration

**GitHub:** github.com/spring-projects/spring-integration-samples

**Twitter:** twitter.com/springcentral

**YouTube:** spring.io/video

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