Spring Batch Workshop (advanced)

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January 21, 2012

Outline

- Overview
- XML file reading
- Item enrichment
- File reading partitioning
- File dropping launching
- Database reading partitioning
- Complex flow
- Atomic processing

Overview

- This workshop highlights advanced Spring Batch features
- Problem/solution approach
  - A few slides to cover the feature
  - A project to start from, just follow the TODOs
- Prerequisites
  - Basics about Java and Java EE
  - Spring: dependency injection, enterprise support
  - Spring Batch: what the first workshop covers
- https://github.com/acogoluegnes/Spring-Batch-Workshop

License

- Problem: reading items from a XML file and sending them to another source (e.g. database)
- Solution: using the `StaxEventItemReader`

Spring Batch's support for XML file reading

- Spring Batch has built-in support for XML files
  - Through the `StaxEventItemReader` for reading
- The `StaxEventItemReader` handles I/O for efficient XML processing
- 2 main steps:
  - Configuring the `StaxEventItemReader`
  - Configuring a Spring OXM's `Unmarshaller`

The usual suspects

```
<?xml version="1.0" encoding="UTF-8"?>
<contacts>
  <contact>
    <firstname>De-Anna</firstname>
    <lastname>Raghunath</lastname>
    <birth>2010-03-04</birth>
  </contact>
  <contact>
    <firstname>Susy</firstname>
    <lastname>Hauerstock</lastname>
    <birth>2010-03-04</birth>
  </contact>
   (...)
</contacts>
```

↓

```
public class Contact {

  private Long id;
  private String firstname,lastname;
  private Date birth;

  (...)
}
```

The StaxEventItemReader configuration

```
<bean id="reader" class="org.springframework.batch.item.xml.StaxEventItemReader">
  <property name="fragmentRootElementName" value="contact" />
  <property name="unmarshaller">
    <bean class="org.springframework.oxm.xstream.XStreamMarshaller">
      <property name="aliases">
        <map>
          <entry key="contact" value="com.zenika.workshop.springbatch.Contact" />
        </map>
      </property>
      <property name="converters">
        <bean class="com.thoughtworks.xstream.converters.basic.DateConverter">
          <constructor-arg value="yyyy-MM-dd" />
          <constructor-arg><array /></constructor-arg>
          <constructor-arg value="true" />
        </bean>
      </property>
    </bean>
  </property>
  <property name="resource" value="classpath:contacts.xml" />
</bean>
```

- NB: Spring OXM supports XStream, JAXB2, etc.

Going further...

- `StaxEventItemWriter` to write XML files
- Spring OXM's support for other marshallers
- Skipping badly formatted lines

- Problem: I want to enrich read items with a Web Service before they get written
- Solution: implement an `ItemProcessor` to make the Web Service call

Use case

- Reading contacts from a flat file
- Enriching the contact with their social security number
- Writing the whole contact in the database

The input file and the domain object

```
1,De-Anna,Raghunath,2010-03-04
2,Susy,Hauerstock,2010-03-04
3,Kiam,Whitehurst,2010-03-04
4,Alecia,Van Holst,2010-03-04
5,Hing,Senecal,2010-03-04
```

- NB: no SSN!

```
public class Contact {

  private Long id;
  private String firstname,lastname;
  private Date birth;
  private String ssn;
  (...)
}
```

The Web Service

- It can be any kind of Web Service (SOAP, REST)
- Our Web Service
  - URL: `http://host/service?firstname=John&lastname=Doe`
  - It returns

```
<contact>
  <firstname>John</firstname>
  <lastname>Doe</lastname>
  <ssn>987-65-4329</ssn>
</contact>
```

The ItemProcessor implementation

```
package com.zenika.workshop.springbatch;

import javax.xml.transform.dom.DOMSource;
import org.springframework.batch.item.ItemProcessor;
import org.springframework.web.client.RestTemplate;
import org.w3c.dom.NodeList;

public class SsnWebServiceItemProcessor implements
             ItemProcessor<Contact, Contact> {

  private RestTemplate restTemplate = new RestTemplate();
  private String url;

  @Override
  public Contact process(Contact item) throws Exception {
    DOMSource source = restTemplate.getForObject(url,DOMSource.class,
      item.getFirstname(),item.getLastname());
    String ssn = extractSsnFromXml(item, source);
    item.setSsn(ssn);
    return item;
  }

  private String extractSsnFromXml(Contact item, DOMSource source) {
    // some DOM code
  }
  (...)
}
```

Configuring the SsnWebServiceItemProcessor

```
<batch:job id="itemEnrichmentJob">
  <batch:step id="itemEnrichmentStep">
    <batch:tasklet>
      <batch:chunk reader="reader" processor="processor" writer="writer"
                   commit-interval="3"/>
    </batch:tasklet>
  </batch:step>
</batch:job>

<bean id="processor"
      class="com.zenika.workshop.springbatch.SsnWebServiceItemProcessor">
  <property name="url"
   value="http://localhost:8085/?firstname={firstname}&amp;lastname={lastname}" />
</bean>
```

But my Web Service has a lot of latency!

- The Web Service call can benefit from multi-threading
- Why not spawning several processing at the same time?
- We could wait for the completion in the `ItemWriter`
- Let's use some asynchronous `ItemProcessor` and `ItemWriter`
  - Provided in the Spring Batch Integration project

Using async ItemProcessor and ItemWriter

- This is only about wrapping

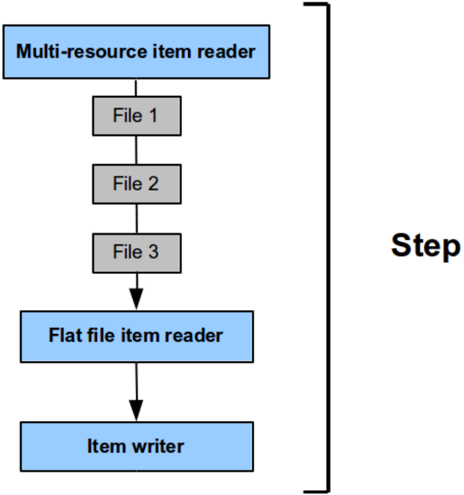
```
<bean id="processor"
      class="org.springframework.batch.integration.async.AsyncItemProcessor">
  <property name="delegate" ref="processor" />
  <property name="taskExecutor" ref="taskExecutor" />
</bean>

<bean id="writer"
      class="org.springframework.batch.integration.async.AsyncItemWriter">
  <property name="delegate" ref="writer" />
</bean>

<task:executor id="taskExecutor" pool-size="5" />
```

Going further...

- Business delegation with an `ItemProcessor`
- Available `ItemProcessor` implementations
  - Adapter, validator
- The `ItemProcessor` can filter items

- Problem: I have multiple input files and I want to process them in parallel
- Solution: use partitioning to parallelize the processing on multiple threads

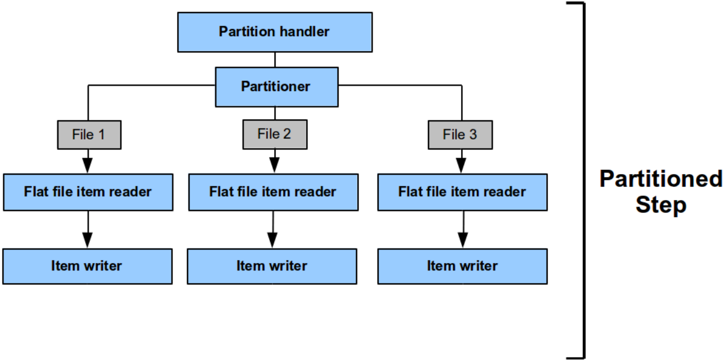
Serial processing



Partitioning in Spring Batch

- Partition the input data
  - e.g. one input file = one partition
  - partition processed in a dedicated step execution
- Partitioning is easy to set up but need some knowledge about the data
- Partition handler implementation
  - Multi-threaded
  - Spring Integration

Multi-threaded partitioning



Partitioner for input files

```
<bean id="partitioner"
      class="o.s.b.core.partition.support.MultiResourcePartitioner">
  <property name="resources"
            value="file:./src/main/resources/input/*.txt" />
</bean>
```

The partitioner sets a context for the components

```
<bean id="reader"
      class="org.springframework.batch.item.file.FlatFileItemReader"
      scope="step">
   (...)
  <property name="resource" value="#{stepExecutionContext['fileName']}" />
</bean>
```

Using the multi-threaded partition handler

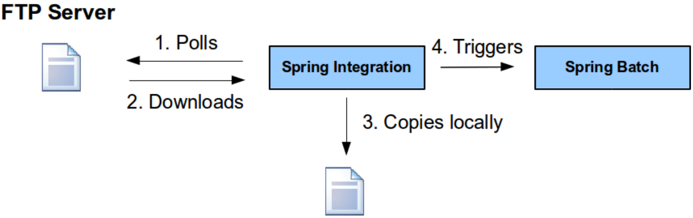
```
<batch:job id="fileReadingPartitioningJob">
  <batch:step id="partitionedStep" >
    <batch:partition step="readWriteContactsPartitionedStep"
                     partitioner="partitioner">
      <batch:handler task-executor="taskExecutor" />
    </batch:partition>
  </batch:step>
</batch:job>

<batch:step id="readWriteContactsPartitionedStep">
  <batch:tasklet>
    <batch:chunk reader="reader" writer="writer" commit-interval="10" />
  </batch:tasklet>
</batch:step>
```

Going further...

- Spring Integration partition handler implementation
- Other scaling approaches
  - parallel steps, remote chunking, multi-threaded step)

- Problem: downloading files from a FTP server and processing them with Spring Batch
- Solution: use Spring Integration to poll the FTP server and trigger Spring Batch accordingly

Using Spring Integration for transfer and triggering



The launching code

```
public class FileContactJobLauncher {

  public void launch(File file) throws Exception {
      JobExecution exec = jobLauncher.run(
        job,
        new JobParametersBuilder()
          .addString("input.file", "file:"+file.getAbsolutePath())
          .toJobParameters()
      );
  }

}
```

- The `File` is the local copy

Listening to the FTP server

```
<int:channel id="fileIn" />

<int-ftp:inbound-channel-adapter local-directory="file:./input"
    channel="fileIn" session-factory="ftpClientFactory"
    remote-directory="/" auto-create-local-directory="true">
  <int:poller fixed-rate="1000" />
</int-ftp:inbound-channel-adapter>

<bean id="ftpClientFactory"
    class="org.springframework.integration.ftp.session.DefaultFtpSessionFactory">
  <property name="host" value="localhost"/>
  <property name="port" value="2222"/>
  <property name="username" value="admin"/>
  <property name="password" value="admin"/>
</bean>
```

Calling the launcher on an inbound message

```
<int:channel id="fileIn" />

<int:service-activator input-channel="fileIn">
  <bean
    class="com.zenika.workshop.springbatch.integration.FileContactJobLauncher">
    <property name="job" ref="fileDroppingLaunchingJob" />
    <property name="jobLauncher" ref="jobLauncher" />
  </bean>
</int:service-activator>
```

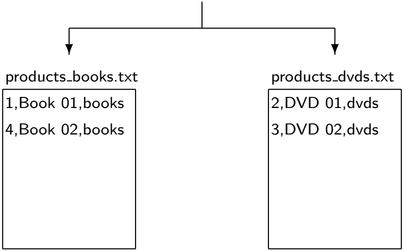
Going further...

- Checking Spring Integration connectors
  - Local file system, FTPS, SFTP, HTTP, JMS, etc.
- Checking operations on messages
  - Filtering, transforming, routing, etc.

- Problem: I want to export items from different categories from a database to files
- Solution: provide a partition strategy and use partitioning

The use case

ID	name	category
1	Book 01	books
2	DVD 01	dvds
3	DVD 02	dvds
4	Book 02	books



products_books.txt

```
1,Book 01,books
4,Book 02,books
```

products_dvds.txt

```
2,DVD 01,dvds
3,DVD 02,dvds
```

Partitioning based on categories

- 2 partitions in this case

ID	name	category
1	Book 01	books
2	DVD 01	dvds
3	DVD 02	dvds
4	Book 02	books

Partitioning logic with the `Partitioner` interface

```
public class ProductCategoryPartitioner implements Partitioner {
  (...)

  @Override
  public Map<String, ExecutionContext> partition(int gridSize) {
    List<String> categories = jdbcTemplate.queryForList(
      "select distinct(category) from product",
      String.class
    );
    Map<String, ExecutionContext> results =
      new LinkedHashMap<String, ExecutionContext>();
    for(String category : categories) {
      ExecutionContext context = new ExecutionContext();
      context.put("category", category);
      results.put("partition."+category, context);
    }
    return results;
  }
}
```

Output of the Partitioner

- Excerpt:

```
for(String category : categories) {
  ExecutionContext context = new ExecutionContext();
  context.put("category", category);
  results.put("partition."+category, context);
}
```

- Results:

```
partition.books = { category => 'books' }
partition.dvds  = { category => 'dvds' }
```

Components can refer to partition parameters

- They need to use the step scope

```
<bean id="reader"
      class="org.springframework.batch.item.database.JdbcCursorItemReader"
      scope="step">
  <property name="sql"
            value="select id,name,category from product where category = ?" />
  <property name="preparedStatementSetter">
    <bean class="org.springframework.jdbc.core.ArgPreparedStatementSetter">
      <constructor-arg value="#{stepExecutionContext['category']}]" />
    </bean>
  </property>
</bean>

<bean id="writer"
      class="org.springframework.batch.item.file.FlatFileItemWriter"
      scope="step">
  <property name="resource"
     value="file:./target/products_#{stepExecutionContext['category']}.txt" />

   (...)
</bean>
```

Configure the partitioned step

- The default implementation is multi-threaded

```
<batch:job id="databaseReadingPartitioningJob">
  <batch:step id="partitionedStep" >
    <batch:partition step="readWriteProductsPartitionedStep"
                     partitioner="partitioner">
      <batch:handler task-executor="taskExecutor" />
    </batch:partition>
  </batch:step>
</batch:job>

<batch:step id="readWriteProductsPartitionedStep">
  <batch:tasklet>
    <batch:chunk reader="reader" writer="writer" commit-interval="10" />
  </batch:tasklet>
</batch:step>
```

Going further...

- Check existing partitioner implementations
- Check other partition handler implementations
- Check other scaling strategies

- Problem: my job has a complex flow of steps, how can Spring Batch deal with it?
- Solution: use the step flow attributes and tags, as well as `StepExecutionListeners`.

The `next` attribute for a linear flow

```
<batch:job id="complexFlowJob">
  <batch:step id="digestStep" next="flatFileReadingStep">
    <batch:tasklet ref="digestTasklet" />
  </batch:step>
  <batch:step id="flatFileReadingStep">
    <batch:tasklet>
      <batch:chunk reader="reader" writer="writer" commit-interval="3" />
    </batch:tasklet>
  </batch:step>
</batch:job>
```

There's also a `next` tag non-linear flows

```
<batch:job id="complexFlowJob">
  <batch:step id="digestStep">
    <batch:tasklet ref="digestTasklet" />
    <batch:next on="COMPLETED" to="flatFileReadingStep"/>
    <batch:next on="FAILED" to="trackIncorrectFileStep"/>
  </batch:step>
  <batch:step id="flatFileReadingStep">
    <batch:tasklet>
      <batch:chunk reader="reader" writer="writer" commit-interval="3" />
    </batch:tasklet>
  </batch:step>
  <batch:step id="trackIncorrectFileStep">
    <batch:tasklet ref="trackIncorrectFileTasklet" />
  </batch:step>
</batch:job>
```

- NB: there are also the `end`, `fail`, and `stop` tags

But if I have more complex flows?

- The `next` attribute decision is based on the exit code
- You can use your own exit codes
- A `StepExecutionListener` can modify the exit code of a step execution

Modifying the exit code of a step execution

```java
package com.zenika.workshop.springbatch;

import org.springframework.batch.core.ExitStatus;
import org.springframework.batch.core.StepExecution;
import org.springframework.batch.core.StepExecutionListener;

public class SkipsListener implements StepExecutionListener {

  @Override
  public void beforeStep(StepExecution stepExecution) { }

  @Override
  public ExitStatus afterStep(StepExecution stepExecution) {
    String exitCode = stepExecution.getExitStatus().getExitCode();
    if (!exitCode.equals(ExitStatus.FAILED.getExitCode()) &&
              stepExecution.getSkipCount() > 0) {
      return new ExitStatus("COMPLETED WITH SKIPS");
    } else {
      return null;
    }
  }
}
```

Plugging the SkipsListener

```
<step id="flatFileReadingStep">
  <tasklet>
    <chunk reader="reader" writer="writer"
           commit-interval="3" skip-limit="10">
      <skippable-exception-classes>
        <include
         class="org.springframework.batch.item.file.FlatFileParseException"/>
      </skippable-exception-classes>
    </chunk>
  </tasklet>
  <end on="COMPLETED"/>
  <next on=”COMPLETED WITH SKIPS” to=”trackSkipsStep”/>
  <listeners>
    <listener>
      <beans:bean class=”com.zenika.workshop.springbatch.SkipsListener” />
    </listener>
  </listeners>
</step>
```

Going further...

- The `JobExecutionDecider` and the `decision` tag
- The `stop`, `fail`, and `end` tags

- Problem: I want to process an input file in an all-or-nothing manner.
- Solution: Don't do it. Atomic processing isn't batch processing! Anyway, if you really need an atomic processing, use a custom `CompletionPolicy`.

Why atomic processing is a bad idea?

- You loose the benefits of chunk-oriented processing
  - speed, small memory footprint, etc.
- On a rollback, you loose everything (that's perhaps the point!)
- The rollback can take a long time (several hours)
- It all depends on the amount of data and on the processing

I really need an atomic processing

- Rollback yourself, with compensating transactions
- Use a transaction rollback
    - It's only a never ending chunk!

Quick and dirty, large commit interval

- Set the commit interval to a very large value
- You should never have more items!

```
<batch:chunk reader="reader" writer="writer" commit-interval="1000000"/>
```

Use a never-ending `CompletionPolicy`

- Spring Batch uses a `CompletionPolicy` to know if a chunk is complete

```java
package org.springframework.batch.repeat;

public interface CompletionPolicy {

  boolean isComplete(RepeatContext context, RepeatStatus result);

  boolean isComplete(RepeatContext context);

  RepeatContext start(RepeatContext parent);

  void update(RepeatContext context);

}
```

Plugging in the CompletionPolicy

```
<batch:job id="atomicProcessingJob">
  <batch:step id="atomicProcessingStep">
    <batch:tasklet>
      <batch:chunk reader="reader" writer="writer"
                   chunk-completion-policy=”atomicCompletionPolicy” />
    </batch:tasklet>
  </batch:step>
</batch:job>
```

- NB: remove the `commit-interval` attribute when using a `CompletionStrategy`

Which CompletionPolicy for my atomic processing?

```
<bean id="atomicCompletionPolicy"
      class="o.s.b.repeat.policy.DefaultResultCompletionPolicy" />
```

Going further...

- Flow in a job
- `SkipPolicy`, `RetryPolicy`