Spring Batch

Lessons Learned out of a real life banking system.

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trivadis
makes IT easier.

About us

Michael Beer
Senior Consultant

- Trivadis since 2001
- design and development of web based applications
- part of the Trivadis APM team

Raffael Schmid
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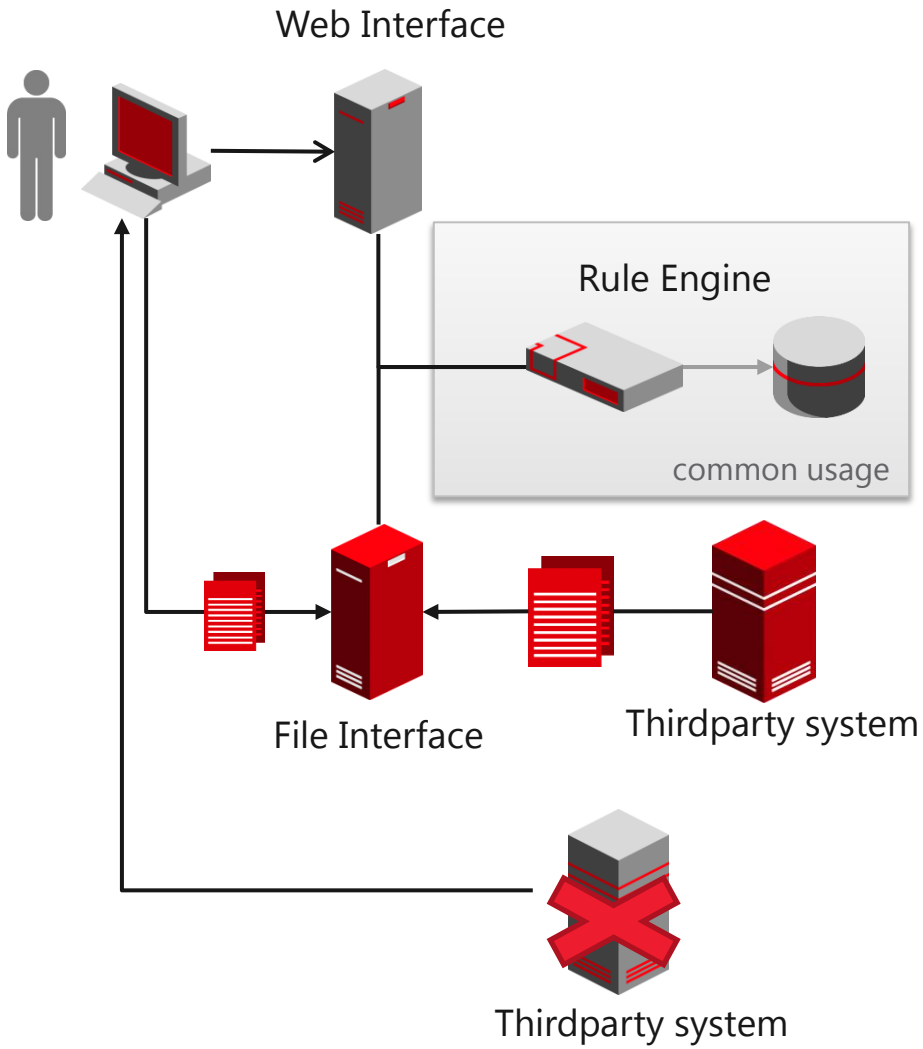
- Trivadis since 2010
- design and development of web based applications
- interested in performance related things on the JVM

AGENDA

Initial position

Initial and target system context

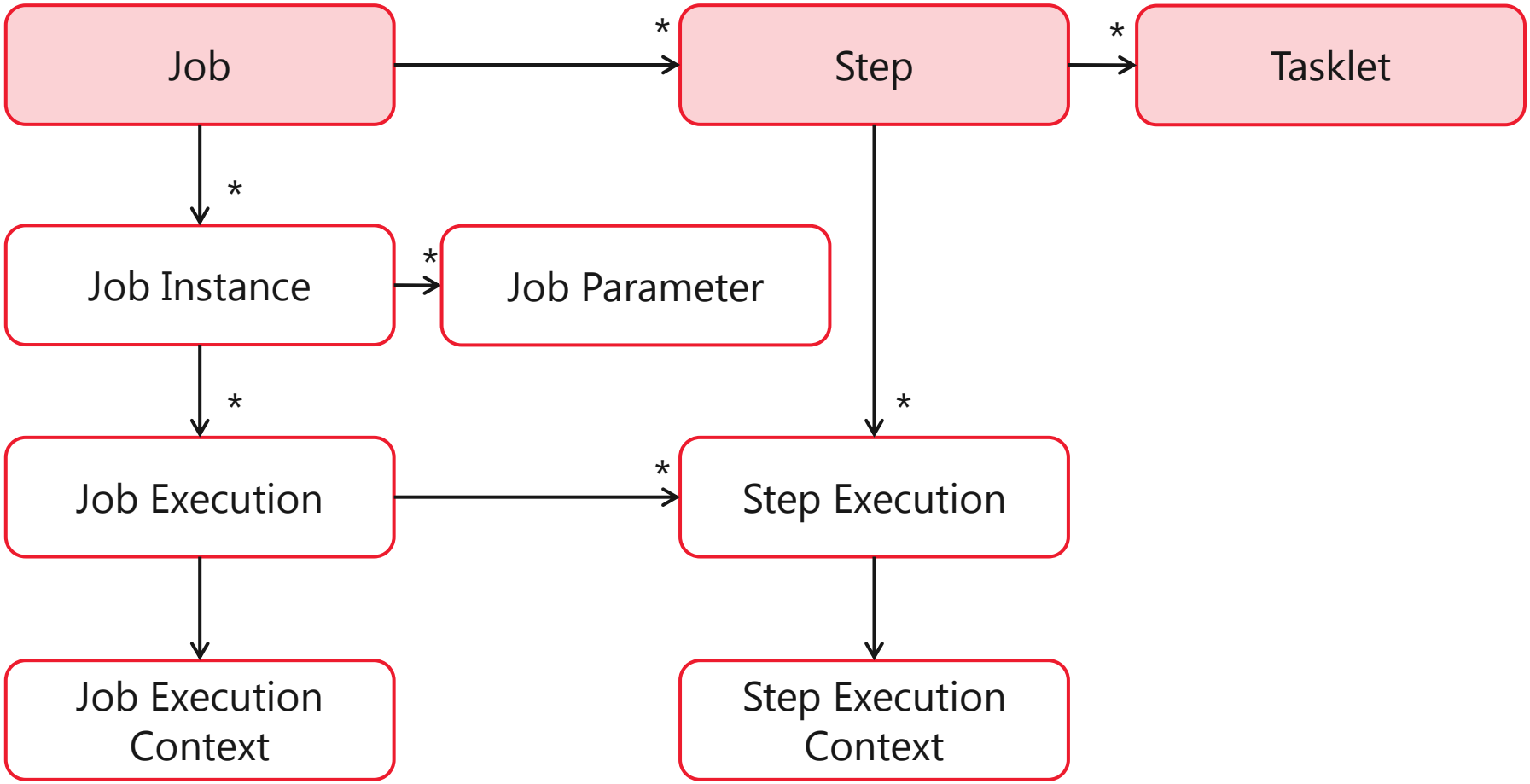


- Automatic load out of thirdparty systems
  - multiple times per day
  - export / import as CSV file
- Manual load by user
  - at irregular time intervals
- Migration load due to thirdparty system decommissioning
  - run once
  - different volumes

Why we used Spring Batch?

- It was already part of the technology stack within the customers environment.
- There were no real (free) alternatives at that time (or at least we didn‘t know any).
- Exceptional permit was needed for Spring Integration because it was shipped with Spring Batch Admin.

Terminology of Spring Batch jobs



Requirements and Topics

Requirement: Performance

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	Control load	Deactivate jobs	Inter-job dependencies

- parallelized on multiple threads
- order of execution matters
- number of threads can be changed before or after job execution

Requirement: Reprocess failed items

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	Control load	Deactivate jobs	Inter-job dependencies

- rerunning a job processes failed items (only)
- process state of item therefore needs to be maintained

Requirement: Summary mail

Performance	Reprocess failed items	**Summary mail**	Gather detailed job information
Trigger jobs	Control load	Deactivate jobs	Inter-job dependencies

- write a detailed execution log that contains
  - Exceptions
  - messages out of the Rule Engine
- aggregate to summary
  - Number of errors, warnings, etc.
  - worst status level
- send summary to submitter and operator

Requirement: Gather detailed job information

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	Control load	Deactivate jobs	Inter-job dependencies

- rerun failed single item in trace mode
- collect diagnostic information
  - e.g. out of the Rule Engine

Requirement: Trigger jobs

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	Control load	Deactivate jobs	Inter-job dependencies

- periodically
  - either fixed delay or fixed rate
- on event
  - e.g. new data arrived in database

Requirement: Control load

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	**Control load**	Deactivate jobs	Inter-job dependencies

- prevent too many jobs in parallel
- conditions might prevent job execution
- requests should prevent system shutdown

Requirement: Deactivate jobs

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	Control load	**Deactivate jobs**	Inter-job dependencies

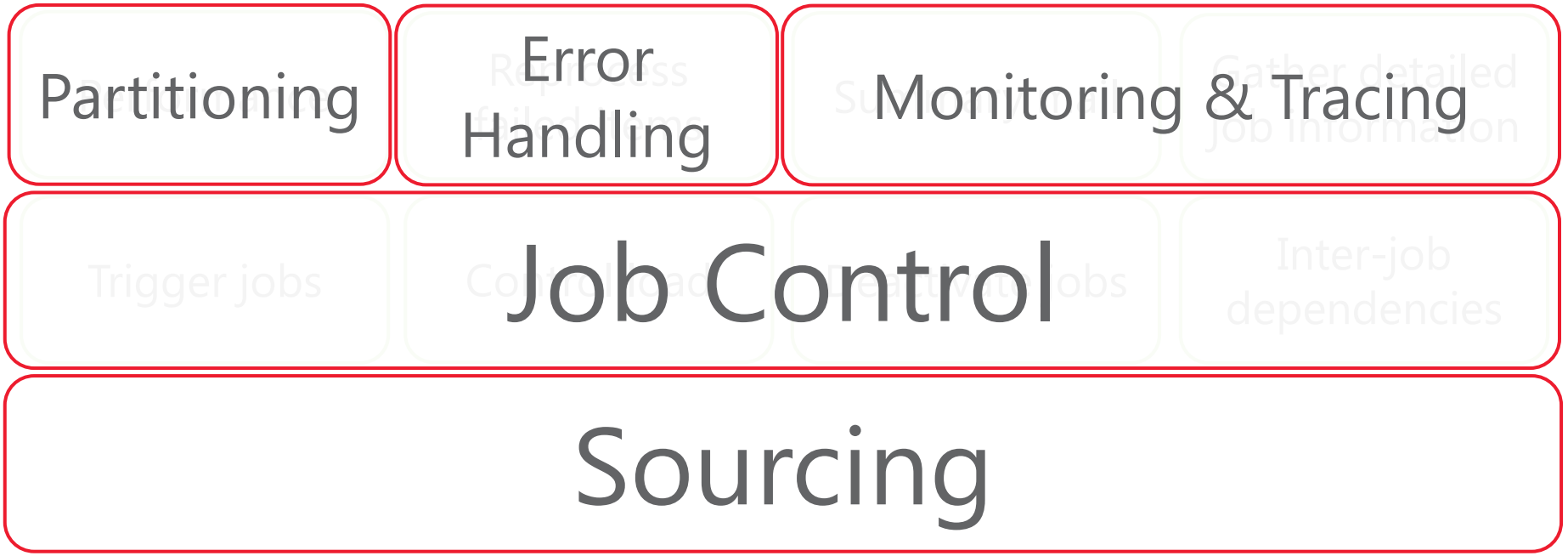
- deactivate job execution
- set job execution on hold

Requirement: Inter-job dependencies

Performance	Reprocess failed items	Summary mail	Gather detailed job information
Trigger jobs	Control load	Deactivate jobs	Inter-job dependencies

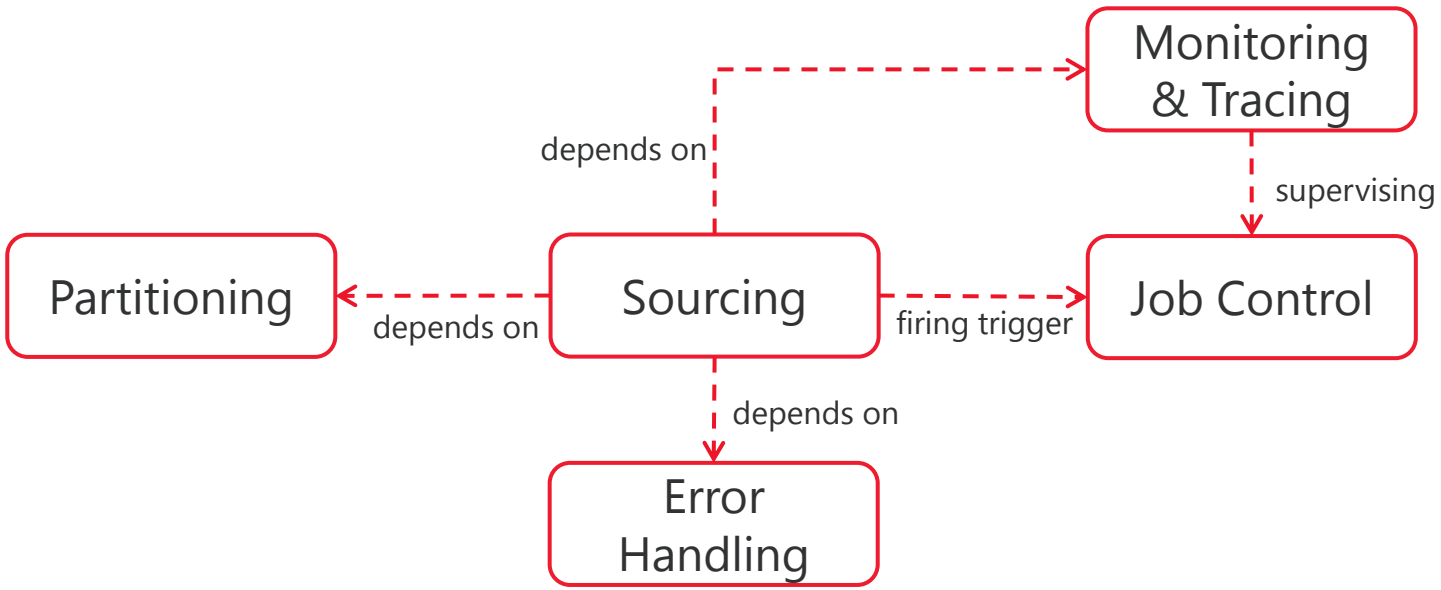
- finished jobs might trigger dependencies

Requirements grouped into five different topics

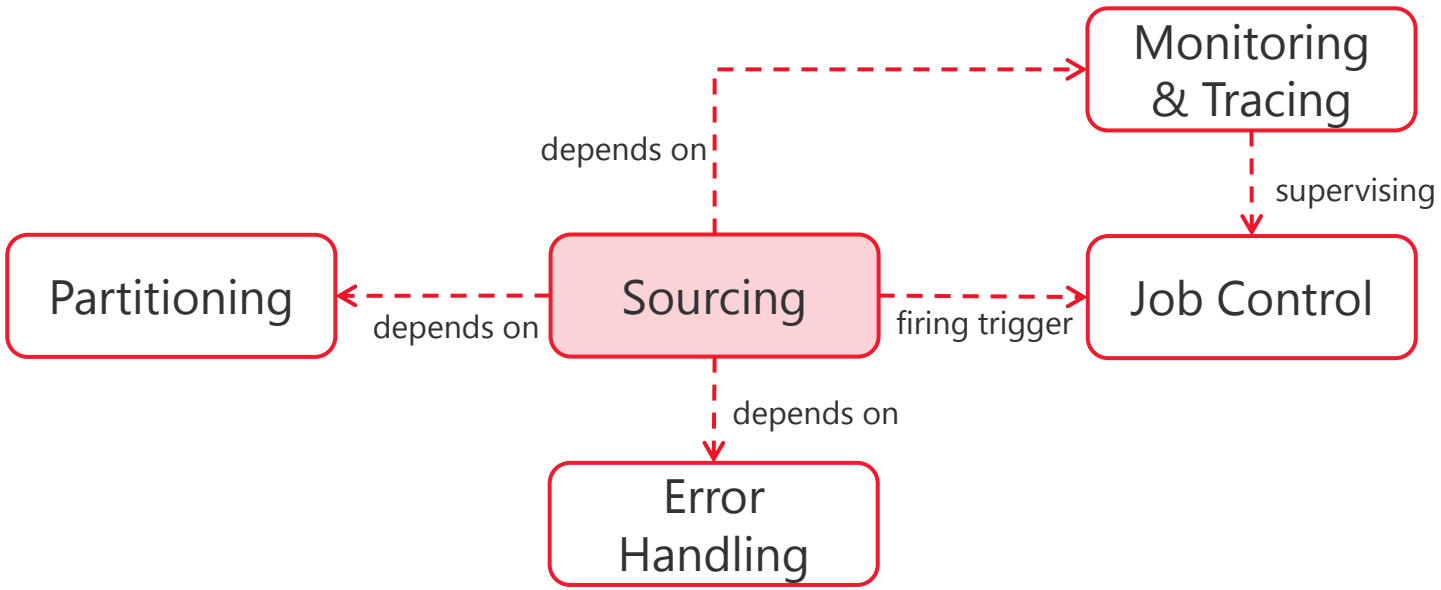


Lessons learned

Topics we will cover



Sourcing



Load data into staging table


```
CAT_ID     | PERSON_ID   | AMOUNT | CURRENCY | VALID_FORM | LAST_CHANGE|
310        | 2908        | 200000 | USD      | 03.12.2013 | 02.02.2013 |
310        | 1608        | 100000 | CHF      | 03.12.2013 | 02.01.2013 |
311        | 1608        | 100000 | CHF      | 03.12.2013 | 02.01.2013 |
```

PARTITION	LINE	TYPE	STATE	FIELD01	FIELD02	FIELD03	FIELD04
PT_000122	171	D	02	441	1804	400000	EUR
PT_000122	172	D	02	441	1002	221000	EUR
PT_000123	1	H	01	CAT_ID	PERSON_ID	AMOUNT	CURRENCY
PT_000123	2	D	01	310	2908	200000	USD
PT_000123	3	D	01	310	1608	100000	CHF
PT_000123	4	D	01	311	1608	100000	CHF

Allows partitioning, single record execution

PARTITION	LINE	TYPE	STATE	FIELD01	FIELD02	FIELD03	FIELD04
PT_000123	1	H	01	CAT_ID	PERSON_ID	AMOUNT	CURRENCY
PT_000123	2	D	01	310	2908	200000	USD
PT_000123	3	D	01	310	1410	100000	CHF

- Partitioning out of the box

```
SELECT * FROM LOAD
         WHERE PARTITION ='PT_000123'
         AND LINE BETWEEN 0 AND 99;
```

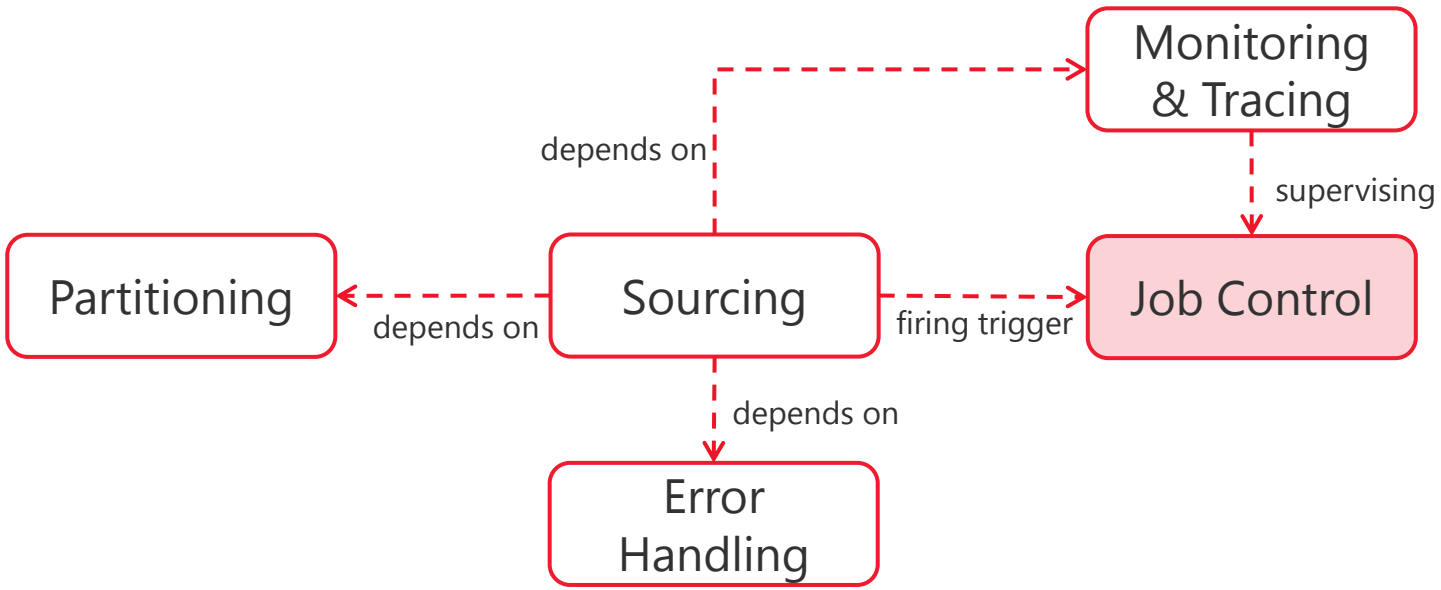
- Reexcution of failed records

```
SELECT * FROM LOAD
         WHERE PARTITION ='PT_000123'
         AND STATE = '01'
```

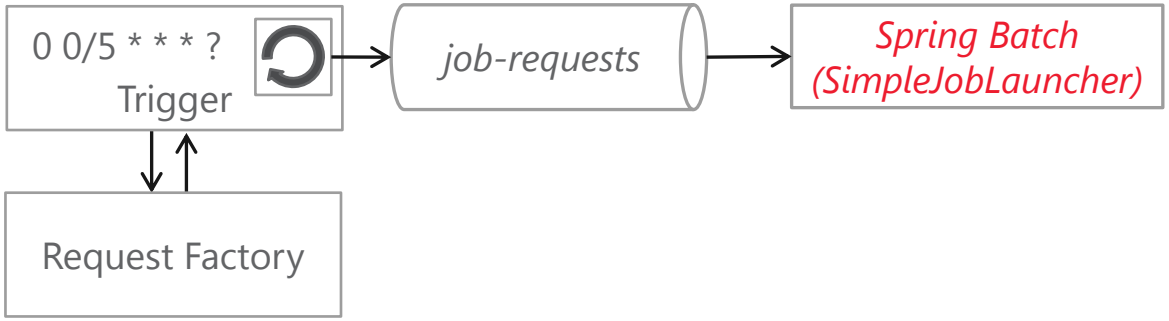
- Execution of single record

```
SELECT * FROM LOAD
         WHERE PARTITION ='PT_000123'
         AND LINE = 8
```

Job Control



Simplest way of triggering a job



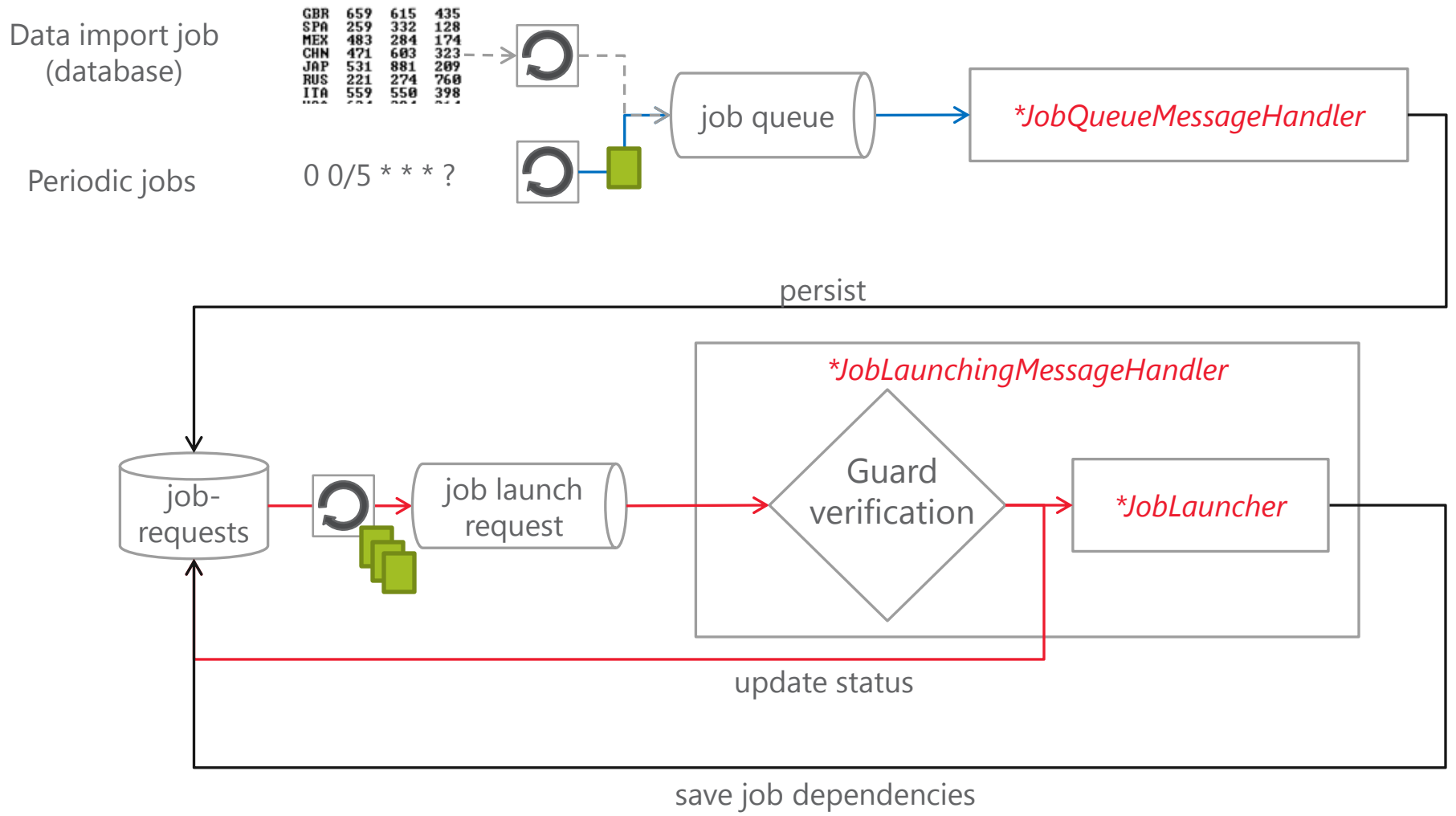
- Define polling channel adapter (CronTrigger)

```
<int:inbound-channel-adapter method="create" channel="job-requests"
ref="requestFactory">
  <int:poller cron="0 0/5 * * * ?" />
</int:inbound-channel-adapter>
```

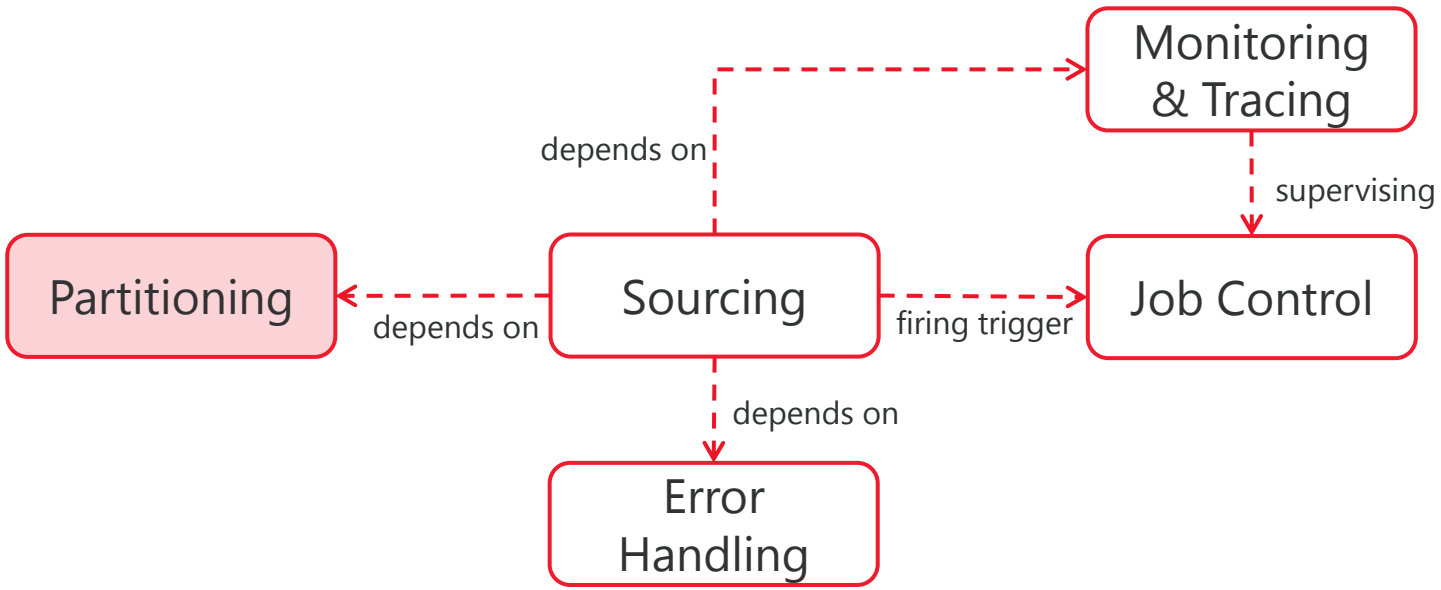
- Or even simpler (PeriodicTrigger)

```
<int:inbound-channel-adapter method="create" channel="job-requests"
ref="requestFactory">
  <int:poller fixed-rate="300000"/>
</int:inbound-channel-adapter>
```

Persist job launch requests into database



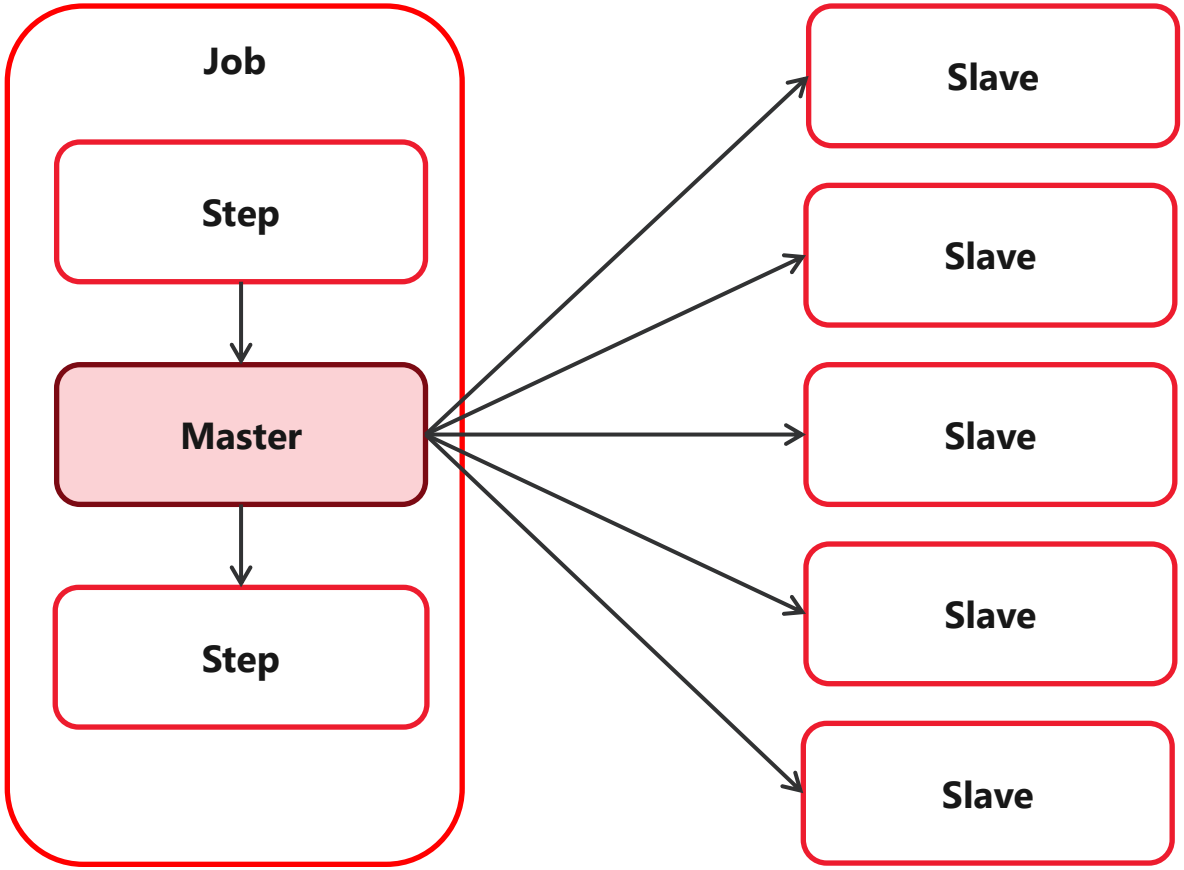
Partitioning



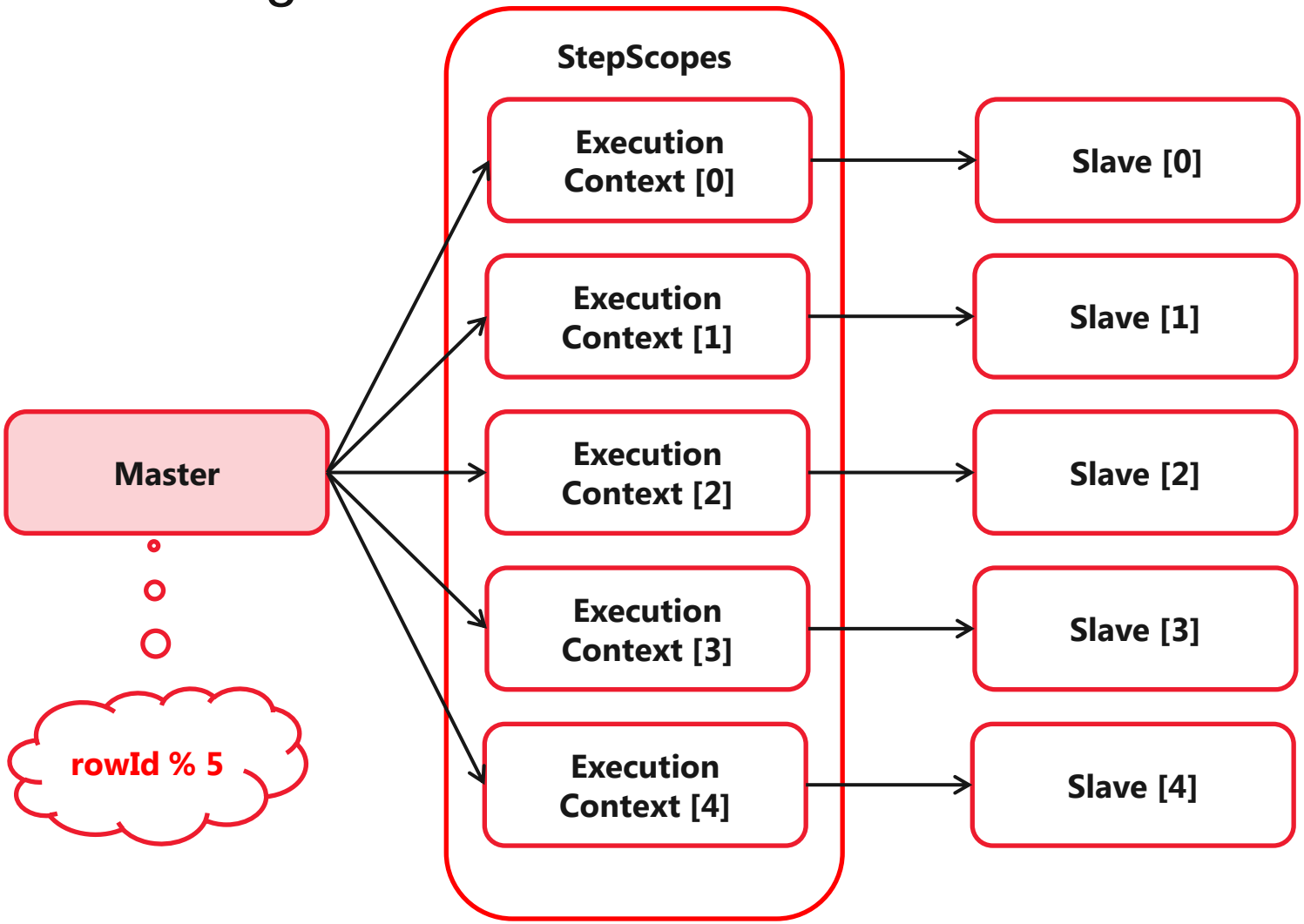
Performance

Type	Local/Remote	Description
Multi-threaded Step	Local	A step is multithreaded (TaskExecutor)
Parallel Steps	Local	Executes steps in parallel using multithreading
Partitioning Step	Local Remote	Partitions data and splits up processing
Remote Chunking	Remote	Distributed chunk processing to remote nodes

Partitioning overview



Partitioning detail



Characteristics of data

There might be dependencies between records. The order of execution matters at some point.

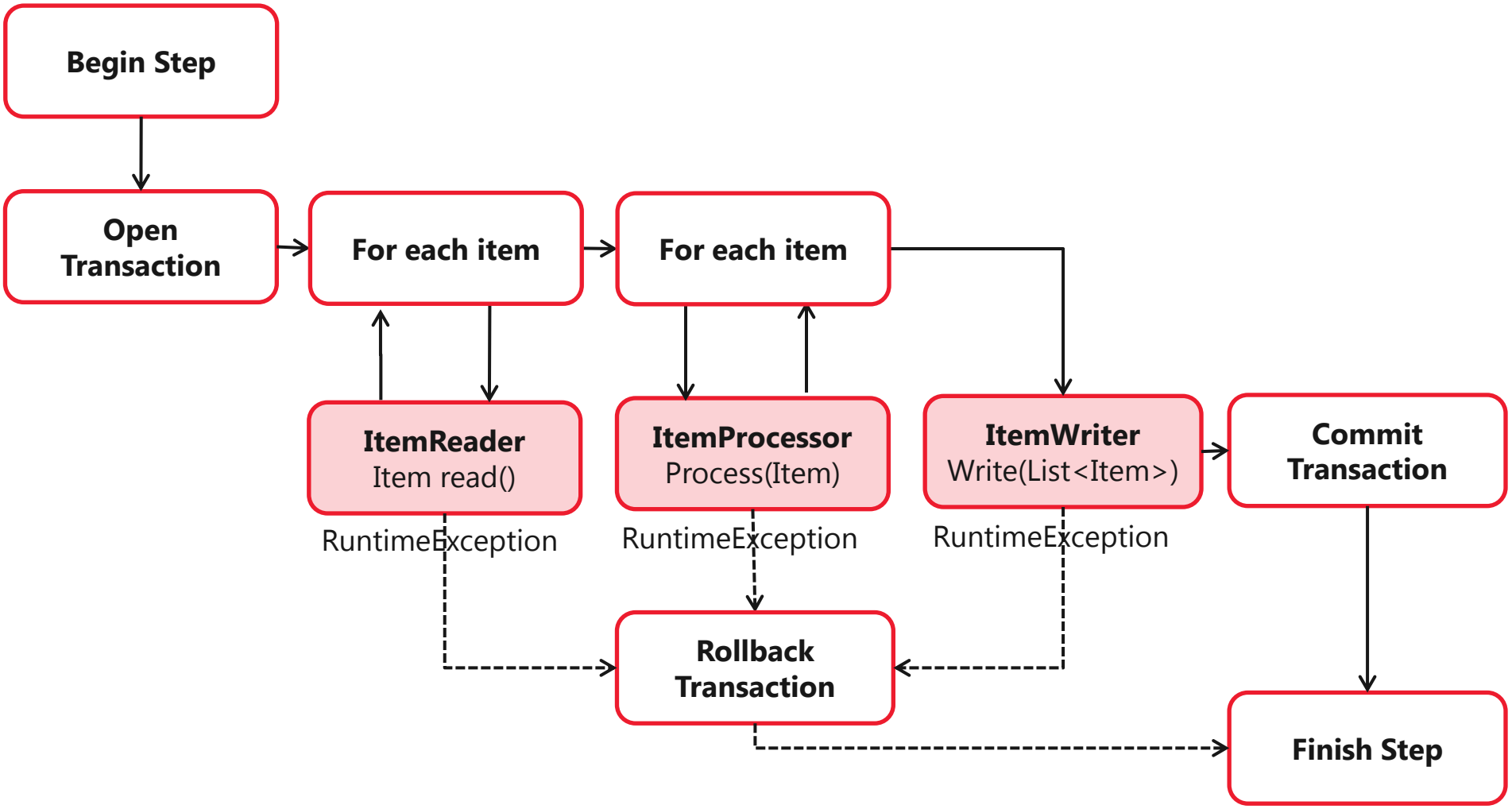
CAT_ID	PERSON_ID	AMOUNT	CURRENCY	VALID_FORM	LAST_CHANGE
310	2908		**Insert**	03.12.2013	02.02.2013
310	1608	100000	CHF	03.12.2013	02.01.2013
311	1608	100000	CHF	03.12.2013	02.01.2013
312	1608	100000	CHF	03.12.2013	02.01.2013
313	1608	100000	CHF	03.12.2013	02.01.2013
310	1410	100000	CHF	03.12.2013	02.01.2013
390	1108	100000	CHF	03.12.2013	02.01.2013
310	2908		**Update**	04.12.2013	03.02.2013

Partitioning detail – Spring Batch Admin

Property	Value
ID	0
Job Name	csv-partition-sample-job
Job Instance	0
Job Parameters	1=2
Start Date	2013-09-25
Start Time	13:50:45
Duration	00:00:00
Status	COMPLETED
Exit Code	COMPLETED
Step Executions Count	6

StepName	Reads	Writes	Commits	Rollbacks	Duration	Status
partitionMaster	20	20	15	0	00:00:00	COMPLETED
partitionSlave:partition3	4	4	3	0	00:00:00	COMPLETED
partitionSlave:partition2	4	4	3	0	00:00:00	COMPLETED
partitionSlave:partition4	4	4	3	0	00:00:00	COMPLETED
partitionSlave:partition1	4	4	3	0	00:00:00	COMPLETED
partitionSlave:partition0	4	4	3	0	00:00:00	COMPLETED

Performance – Read / Write / Process



Performance

No error

Property	Min	Max	Mean	Sigma
Duration	22,957	22,957	22,957	0
Commits	101	101	101	0
Rollbacks	0	0	0	0
Reads	1,000	1,000	1,000	0
Writes	1,000	1,000	1,000	0
Filters	0	0	0	0
Read Skips	0	0	0	0
Write Skips	0	0	0	0
Process Skips	0	0	0	0

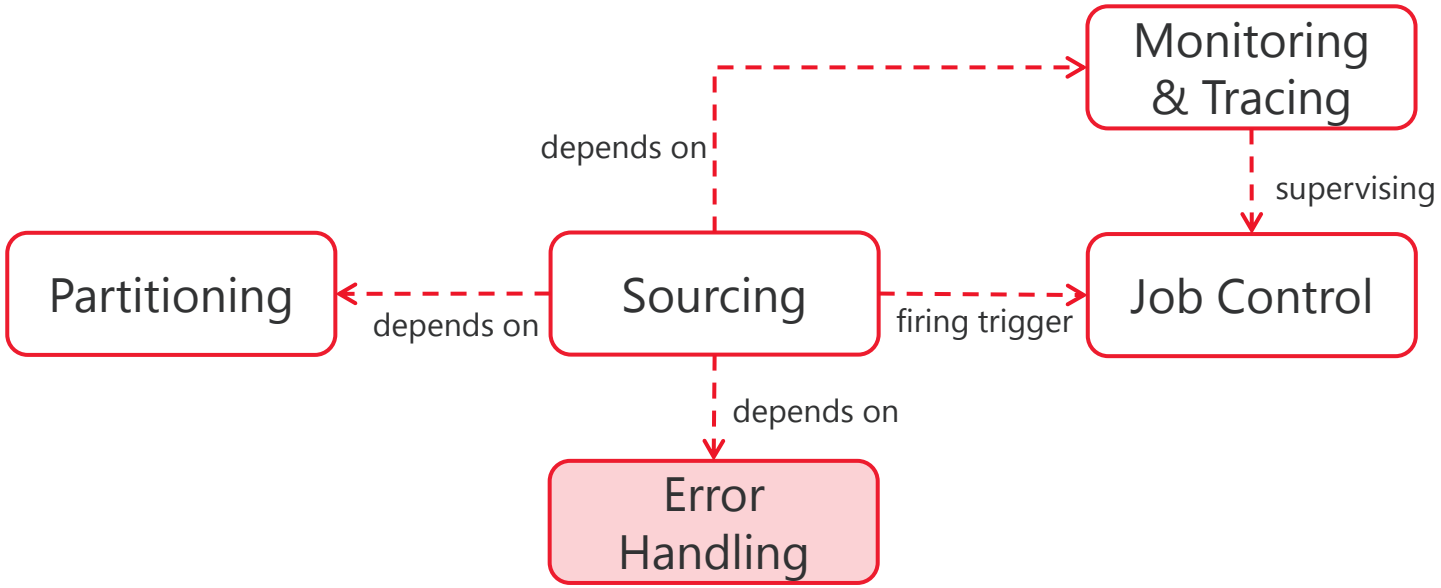
- ~ 22 sec
- 0 Rollbacks

Error on each item

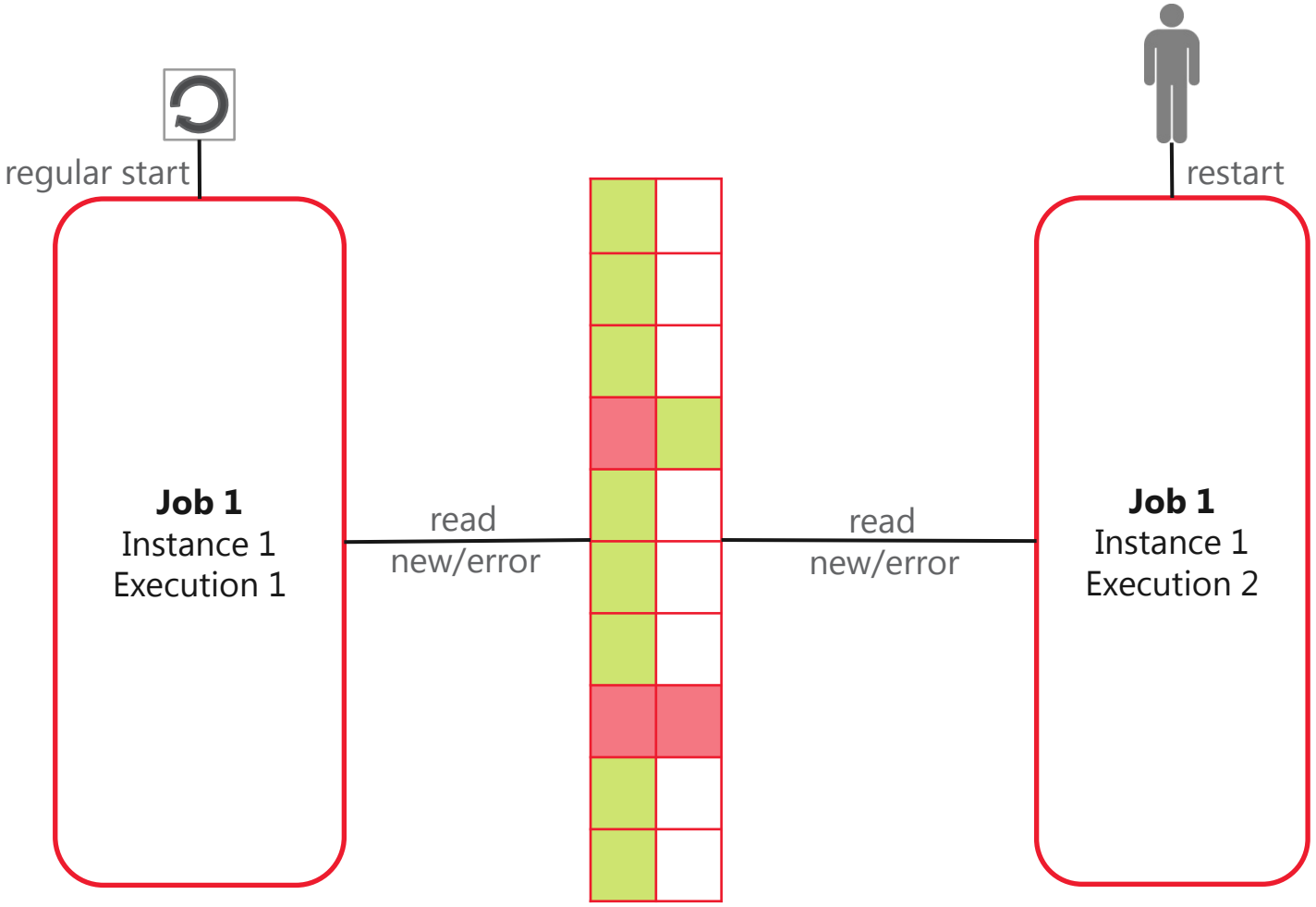
Property	Min	Max	Mean	Sigma
Duration	50,331	50,331	50,331	0
Commits	101	101	101	0
Rollbacks	1,100	1,100	1,100	0
Reads	1,000	1,000	1,000	0
Writes	0	0	0	0
Filters	5,500	5,500	5,500	0
Read Skips	0	0	0	0
Write Skips	1,000	1,000	1,000	0
Process Skips	0	0	0	0

- ~ 50 sec
- 1‘100 Rollbacks
- 5‘500 Filter
- 1‘000 Write Skips

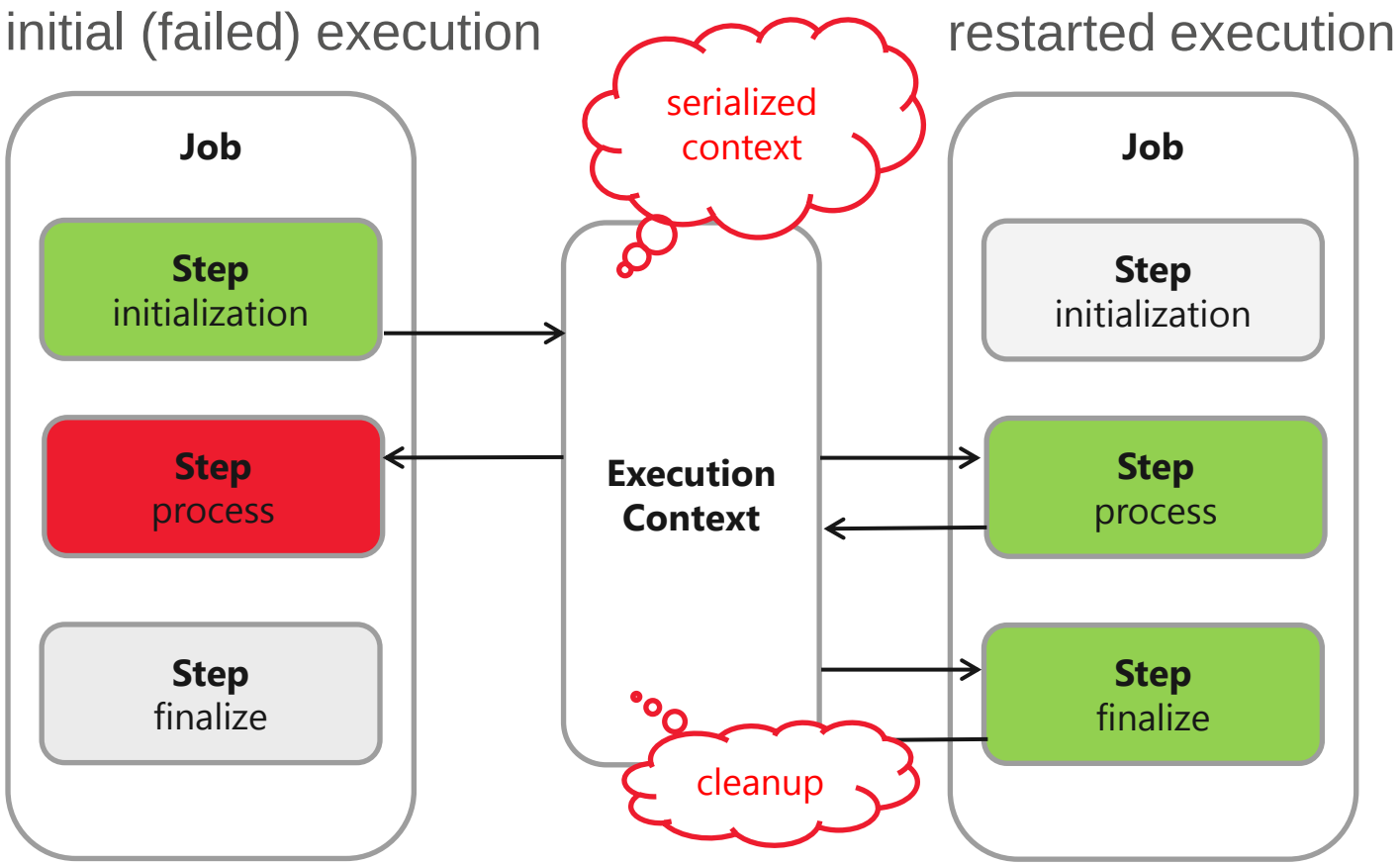
Error Handling



Restartability



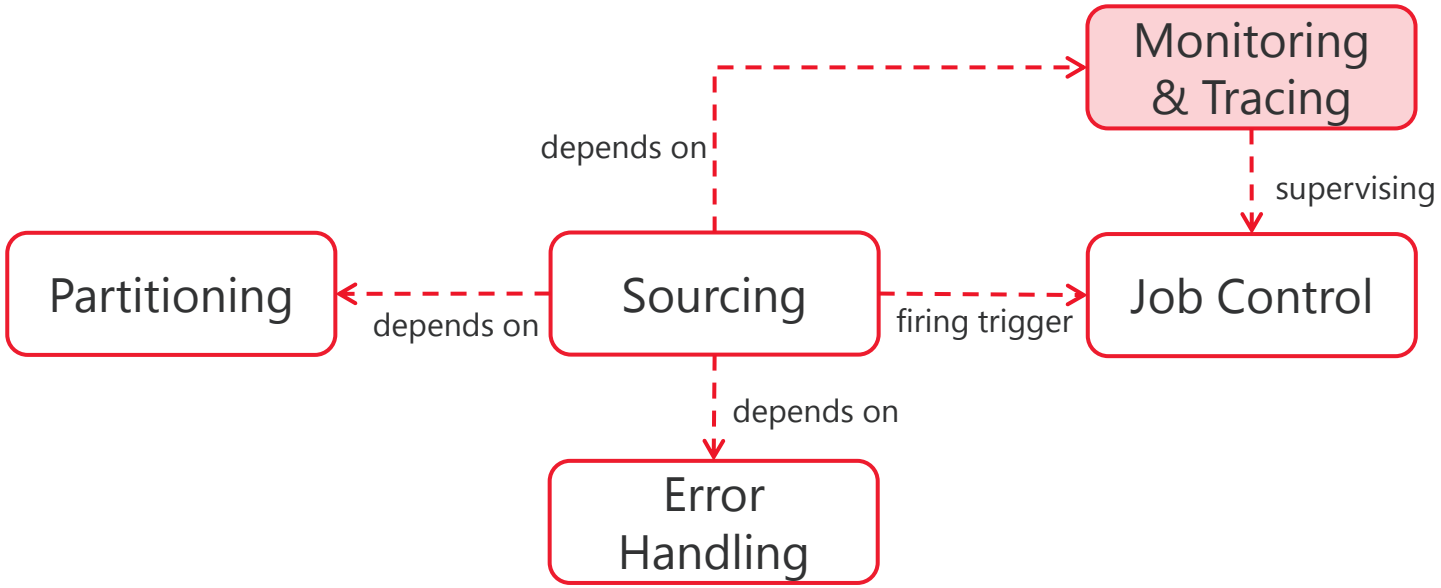
Restartability configuration



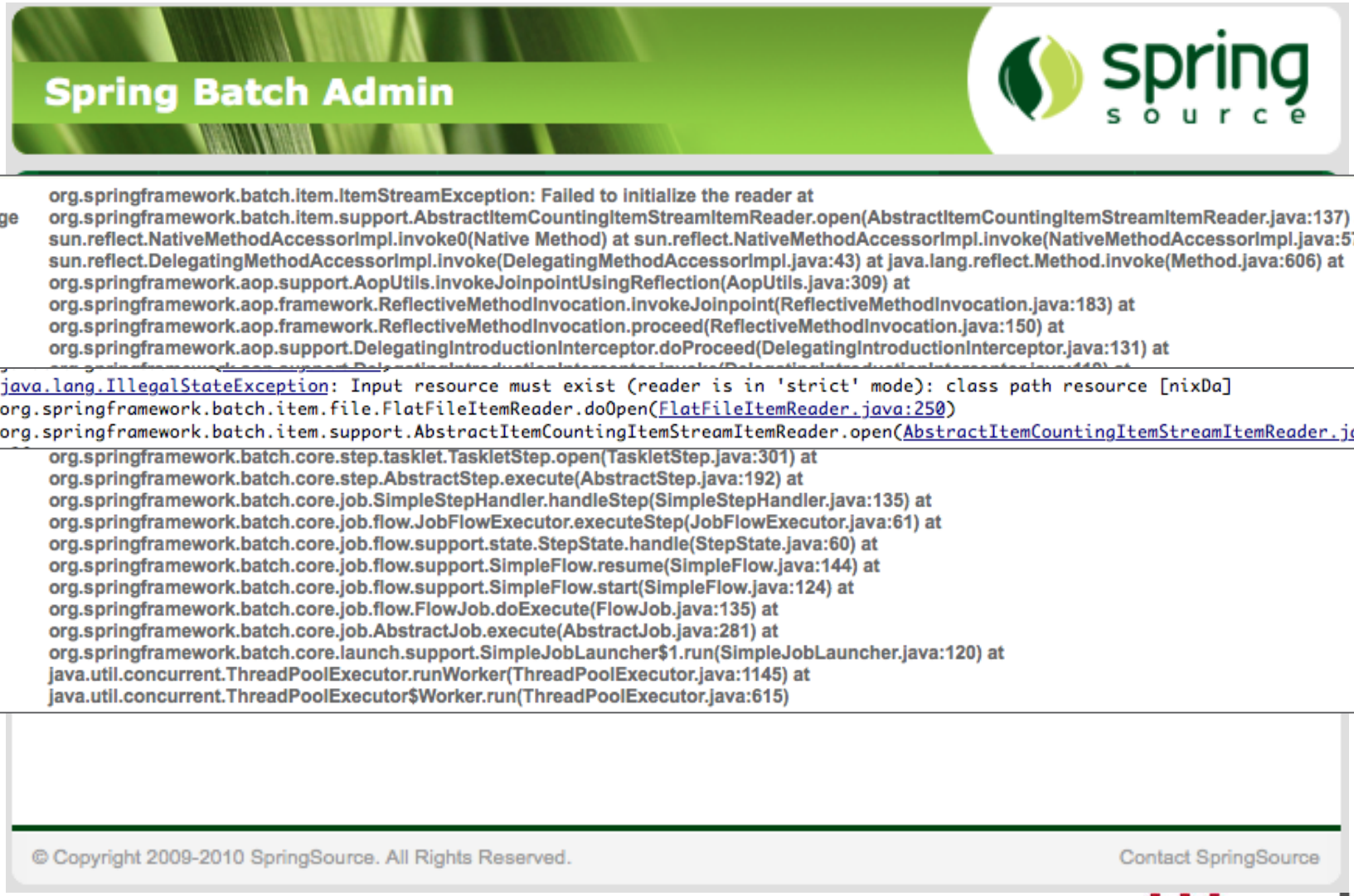
Item based error handling

Feature	When?	What?	Where?
Skip	For nonfatal exceptions	Keeps processing for an incorrect item	Chunk-oriented step
Retry	For transient exceptions	Makes new attemps on an operation	Chunk-oriented step, application code

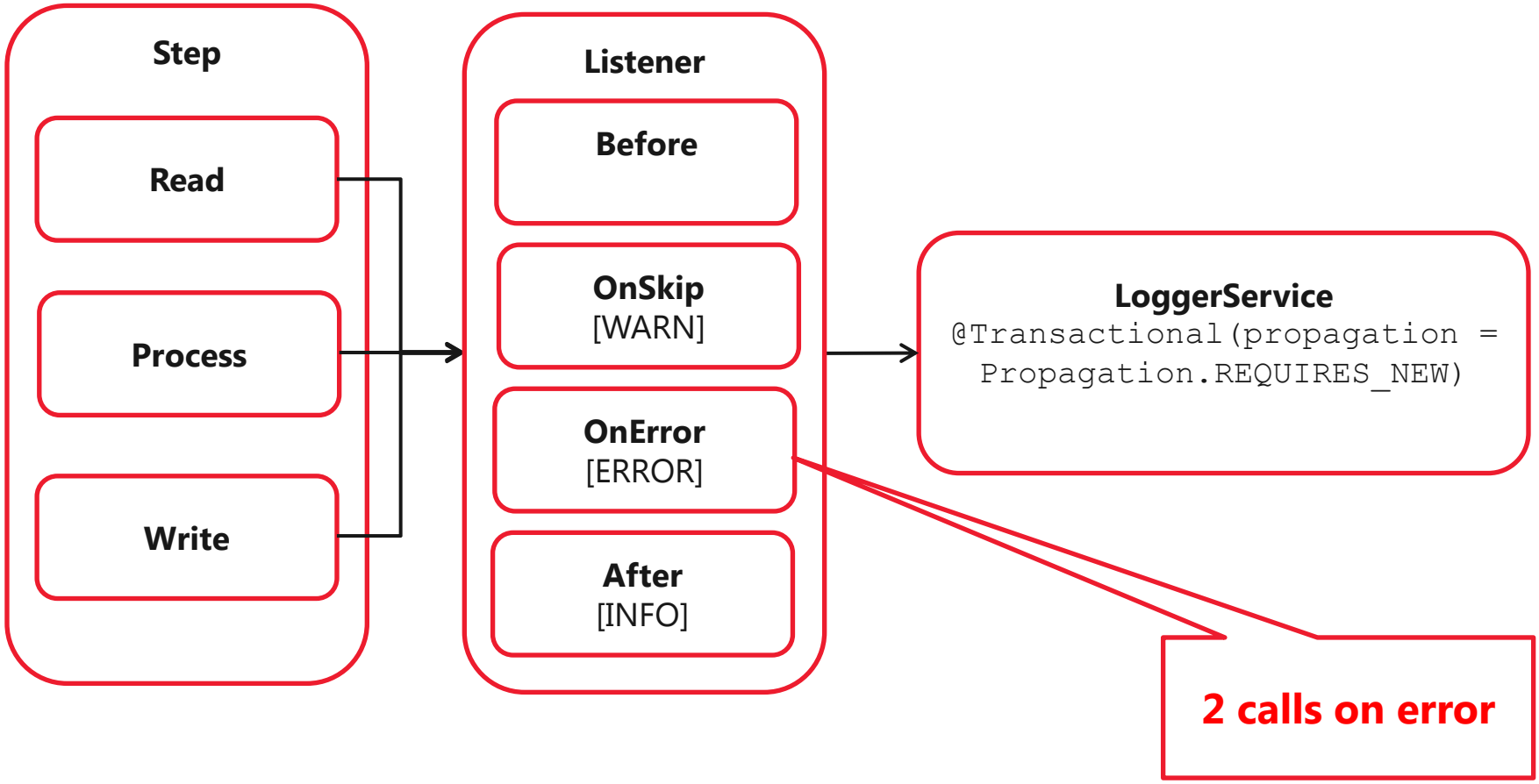
Monitoring



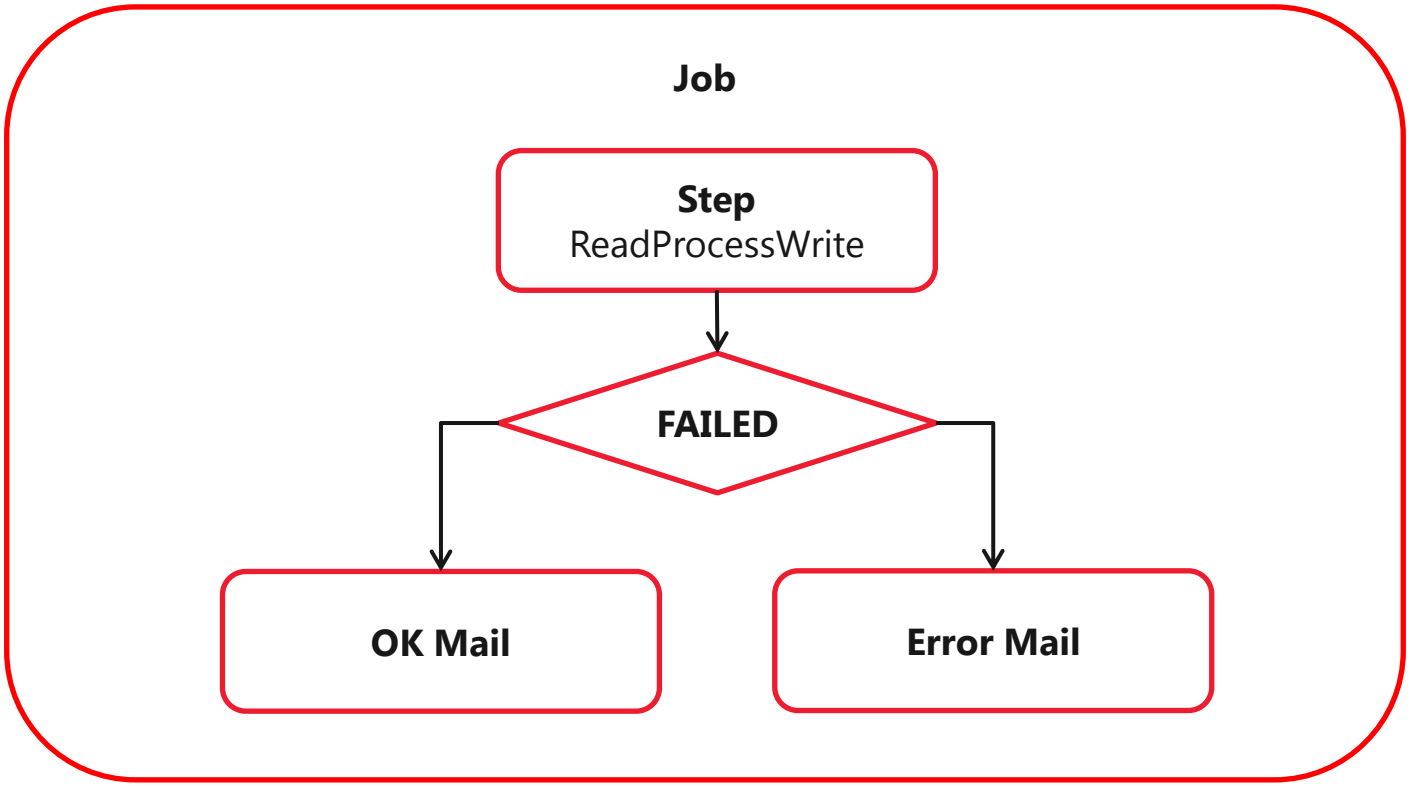
Monitoring – Spring Batch Admin



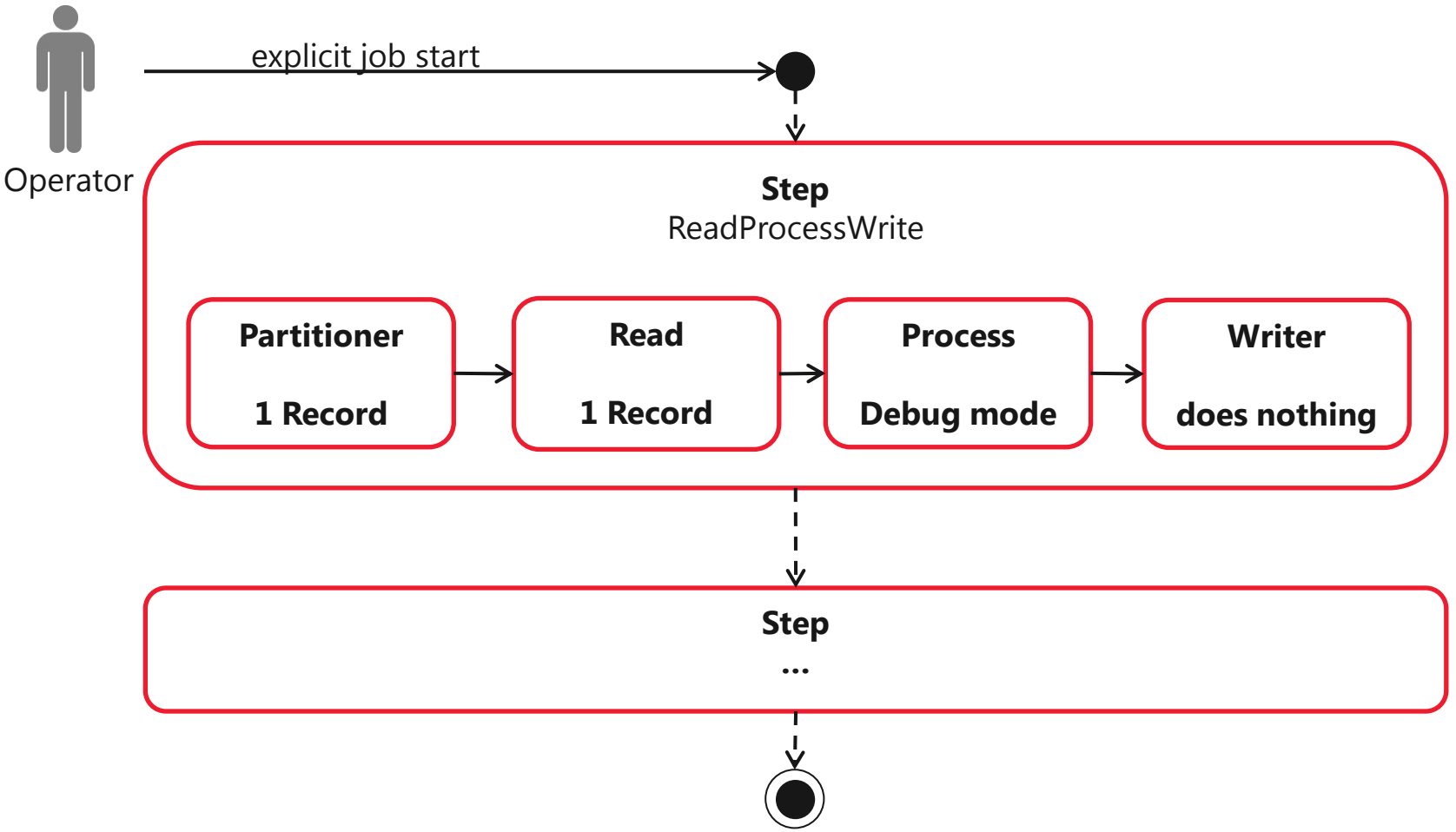
Monitoring – logging to a database



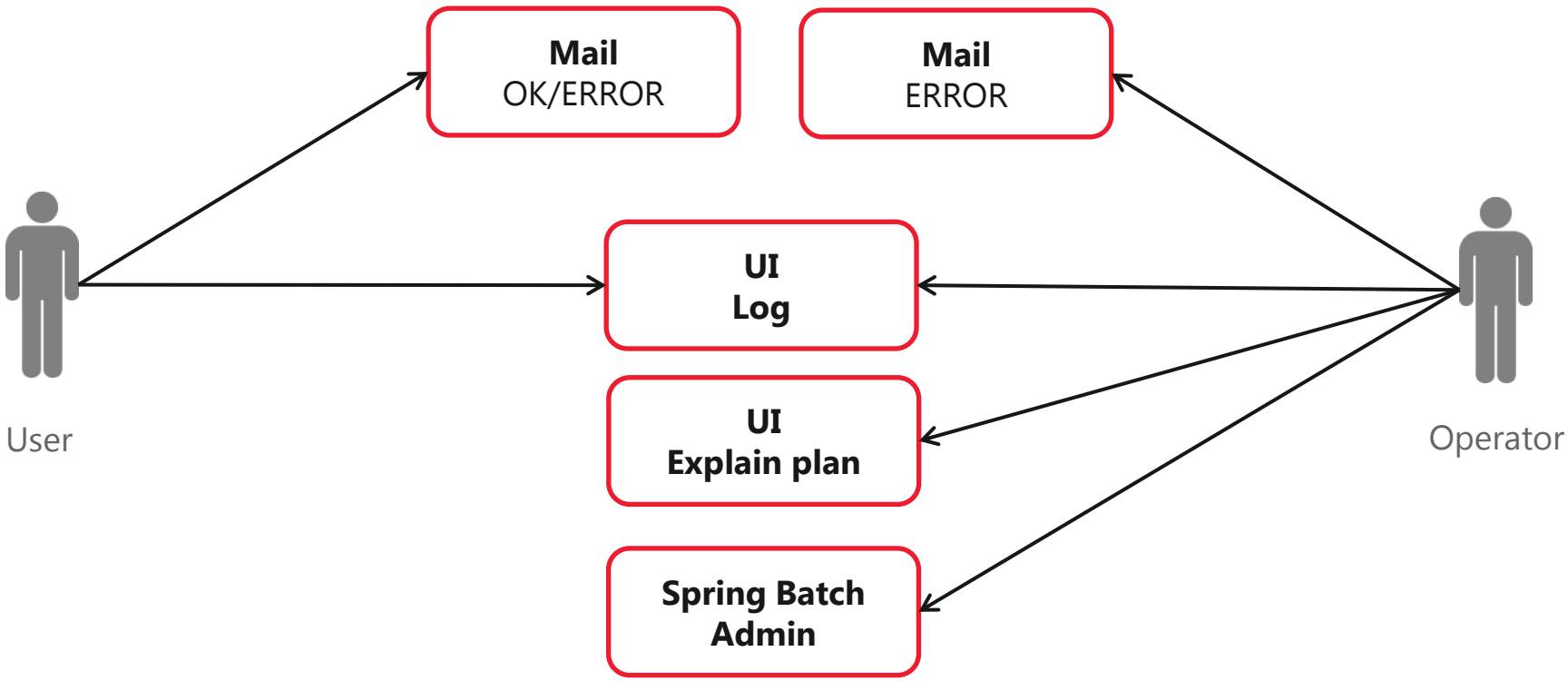
Monitoring - Mail



Tracing – Explain plan



Monitoring / Tracing summary



Conclusion

Challenges – Error Handling

- Fire and forget
  - Commit until first error
    - Skip
    - Retry
- Depending on the characteristic of data
  - Rollback
    - Whole job
    - Partition
    - Chunk
- Job flow
  - Deciders
- Operator takes care about the errors

Why we still use Spring Batch

Out of 155 SE tests in the JSR-352 TCK, Spring Batch 3.0 (milestone 1) passes 70.

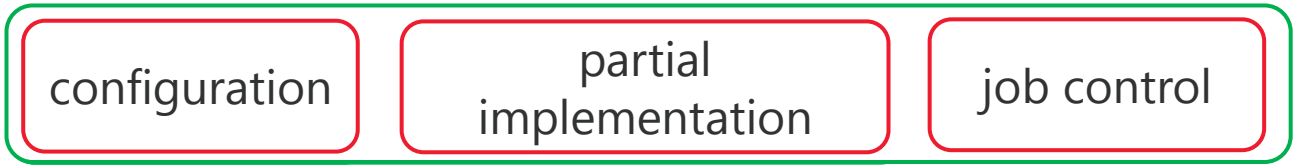
The terminology stays more or less the same: Job, Step, Chunk, Item, ItemProcessor, JobInstance, JobExecution.

Spring Batch	JSR 352	Comments
Tasklet	**Batchlet**	
ItemReader / ItemStream	**ItemReader**	JSR-352's ItemReader includes Spring Batchs ItemStream capabilities
ItemWriter / ItemStream	**ItemWriter**	JSR-352's ItemReader includes Spring Batchs ItemStream capabilities
JobExecutionListener	**JobListener**	
StepExecutionListener	**StepListener**	

Suitable for different applications

Spring Batch supports implementing reliable batch jobs with small effort. In few cases even no Java code is necessary.

It’s very easy to customize existing parts at your needs. Different level of customization is possible:



Questions and answers ...

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