Presentation slide for Sqoop User Meetup (Strata + Hadoop World NYC 2013)

Complex stories about Sqooping PostgreSQL data

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Introduction

About Me

NTT DATA

Masatake Iwasaki:

- Software Engineer @ NTT DATA:
  - NTT(Nippon Telegraph and Telephone Corporation): Telecommunication
  - NTT DATA: Systems Integrator

Developed:

- Ludia: Fulltext search index for PostgreSQL using Senna

Authored:

- “A Complete Primer for Hadoop”
  (no official English title)

Patches for Sqoop:

- SQOOP-390: PostgreSQL connector for direct export with pg_bulkload
- SQOOP-999: Support bulk load from HDFS to PostgreSQL using COPY ... FROM
- SQOOP-1155: Sqoop 2 documentation for connector development

Why PostgreSQL?

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Enterprisy
- from earlier version
- comparing to MySQL

Active community in Japan

NTT DATA commits itself to development

Sqooping PostgreSQL data

Working around PostgreSQL

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Direct connector for PostgreSQL loader:

SQOOP-390: PostgreSQL connector for direct export with pg_bulkload

Yet another direct connector for PostgreSQL JDBC:

SQOOP-999: Support bulk load from HDFS to PostgreSQL using COPY ... FROM

Supporting complex data types:

SQOOP-1149: Support Custom Postgres Types

Direct connector for PostgreSQL loader

SQOOP-390:
PostgreSQL connector for direct export with pg_bulkload

pg_bulkload:

- Data loader for PostgreSQL
- Server side plug-in library and client side command
- Providing filtering and transformation of data
- http://pgbulkload.projects.pgfoundry.org/

SQOOP-390:
PostgreSQL connector for direct export with pg_bulkload

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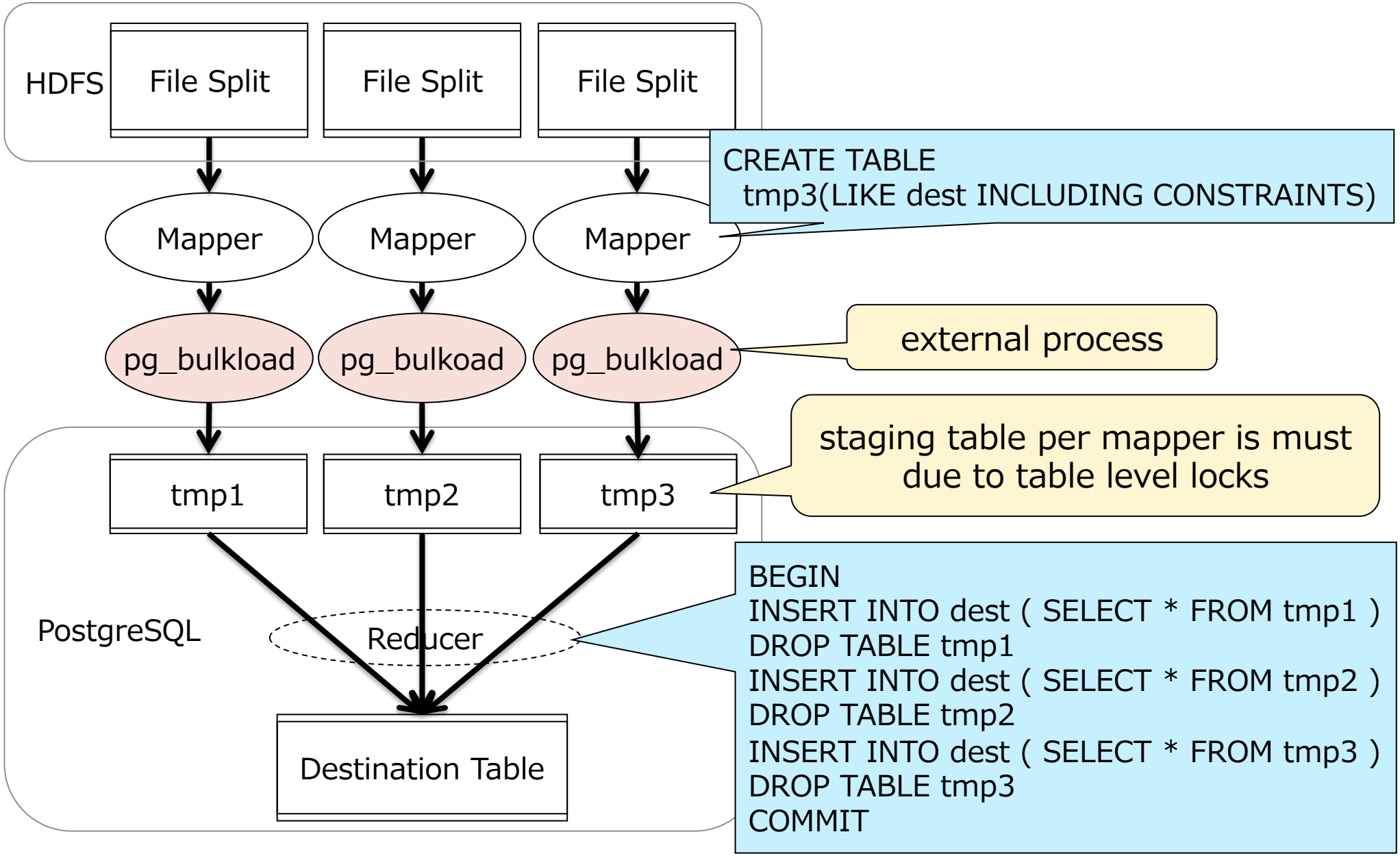

Direct connector for PostgreSQL loader

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Pros:

- Fast
  - by short-circuitting server functionality
- Flexible
  - filtering error records

Cons:

- Not so fast
  - Bottleneck is not in client side but in DB side
  - Built-in COPY functionality is fast enough
- Not General
  - pg_bulkload supports only export
- Requiring setup on all slave nodes and client node
- Possible to Require recovery on failure

Yet another direct connector for PostgreSQL JDBC

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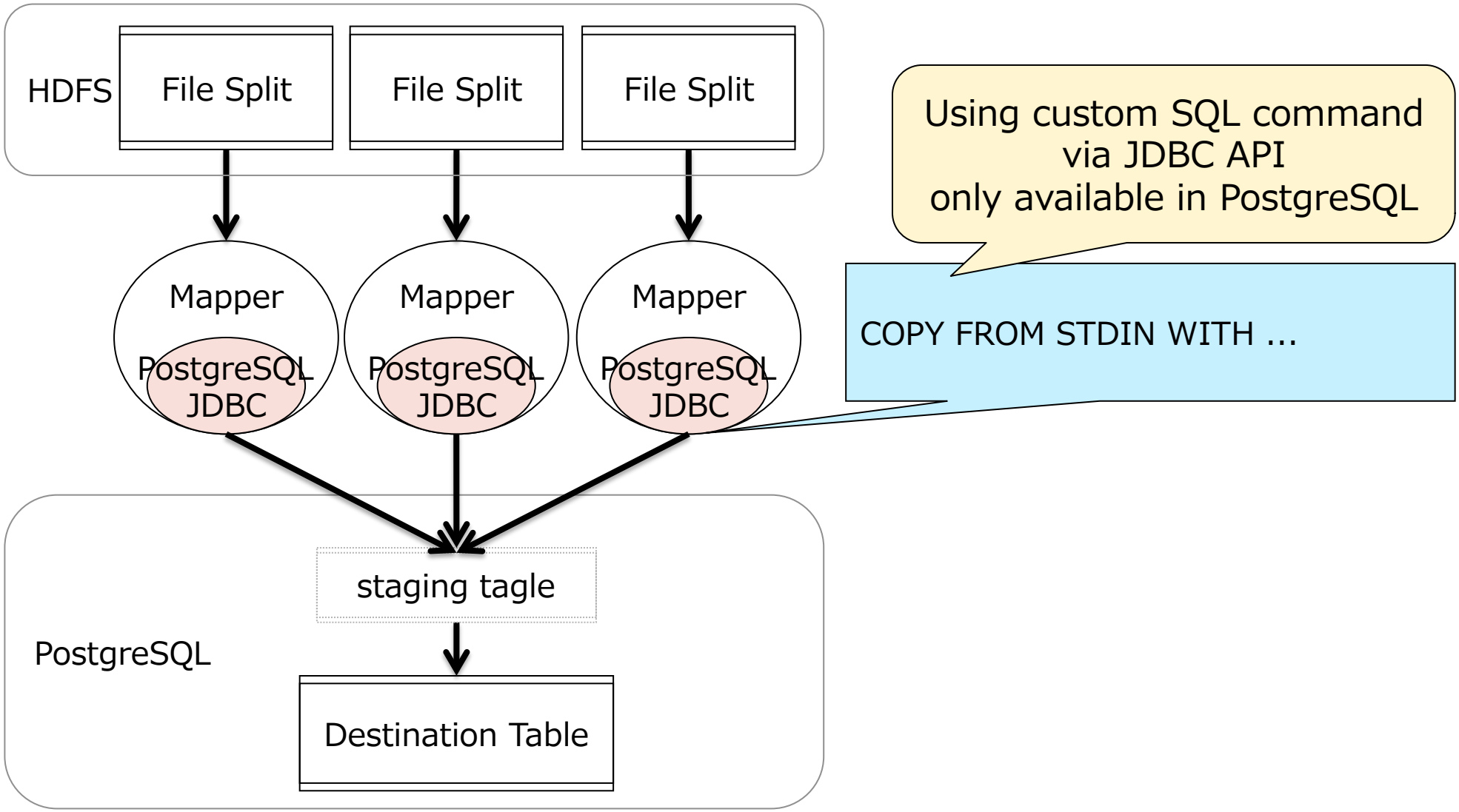
PostgreSQL provides custom SQL command for data import/export

```
COPY table_name [ ( column_name [, ...] ) ]
    FROM { 'filename' | STDIN }
    [ [ WITH ] ( option [, ...] ) ]

COPY { table_name [ ( column_name [, ...] ) ] | ( query ) }
    TO { 'filename' | STDOUT }
    [ [ WITH ] ( option [, ...] ) ]

where option can be one of:

    FORMAT format_name
    OIDS [ boolean ]
    DELIMITER 'delimiter_character'
    NULL 'null_string'
    HEADER [ boolean ]
    QUOTE 'quote_character'
    ESCAPE 'escape_character'
    FORCE_QUOTE { ( column_name [, ...] ) | * }
    FORCE_NOT_NULL ( column_name [, ...] )
    ENCODING 'encoding_name`
```

AND JDBC API

```
org.postgresql.copy.*
```

SQOOP-999:
Support bulk load from HDFS to PostgreSQL using COPY ... FROM



SQOOP-999: Support bulk load from HDFS to PostgreSQL using COPY ... FROM

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```
import org.postgresql.copy.CopyManager;
import org.postgresql.copy.CopyIn;
...
```

Requiring PostgreSQL specific interface.

```
 protected void setup(Context context)
    ...
    dbConf = new DBConfiguration(conf);
    CopyManager cm = null;

...
 public void map(LongWritable key, Writable value, Context context)
    ...
    if (value instanceof Text) {
      line.append(System.getProperty("line.separator"));
    }
    try {
      byte[]data = line.toString().getBytes("UTF-8");
      copyin.writeToCopy(data, 0, data.length);
```

Just feeding lines of text

Yet another direct connector for PostgreSQL JDBC

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Pros:

- Fast enough
- Ease of use
  - JDBC driver jar is distributed automatically by MR framework

Cons:

- Dependency on not general JDBC
  - possible licensing issue (PostgreSQL is OK, it's BSD Lisence)
  - build time requirement (PostgreSQL JDBC is available in Maven repo.)

```
<dependency org="org.postgresql" name="postgresql"
        rev="${postgresql.version}" conf="common->default" />
```

- Error record causes rollback of whole transaction
- Still difficult to implement custom connector for IMPORT
  - because of code generation part

Supporting complex data types

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PostgreSQL supports lot of complex data types

- Geometric Types
  - Points
  - Line Segments
  - Boxes
  - Paths
  - Polygons
  - Circles
- Network Address Types
  - inet
  - cidr
  - macaddr
- XML Type
- JSON Type

Supporting complex data types:

SQOOP-1149: Support Custom Postgres Types

not me

Constraints on JDBC data types in Sqoop framework

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```
protected Map<String, Integer> getColumnTypesForRawQuery(String stmt) {
    ...
    results = execute(stmt);
    ...
    ResultSetMetaData metadata = results.getMetaData();
    for (int i = 1; i < cols + 1; i++) {
      int typeId = metadata.getColumnType(i);
```

returns java.sql.Types.OTHER for types not mappable to basic Java data types
=> Losing type imformation

```
public String toJavaType(int sqlType) {
  // Mappings taken from:
  // http://java.sun.com/j2se/1.3/docs/guide/jdbc/getstart/mapping.html
  if (sqlType == Types.INTEGER) {
    return "Integer";
  } else if (sqlType == Types.VARCHAR) {
    return "String";
  ....
  } else {
    // TODO(aaron): Support DISTINCT, ARRAY, STRUCT, REF, JAVA_OBJECT.
    // Return null indicating database-specific manager should return a
    // java data type if it can find one for any nonstandard type.
    return null;
```

reaches here

Sqoop 1 Summary

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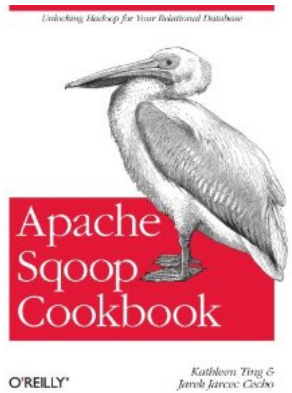
Pros:

- Simple Standalone MapReduce Driver
- Easy to understand for MR application developpers
  - except for ORM (SqoopRecord) code generation part.
- Variety of connectors
- Lot of information



Cons:

- Complex command line and inconsistent options
  - meaning of options is according to connectors
- Not enough modular
- Dependency on JDBC data model
- Security

Sqooping PostgreSQL Data 2

Sqoop 2

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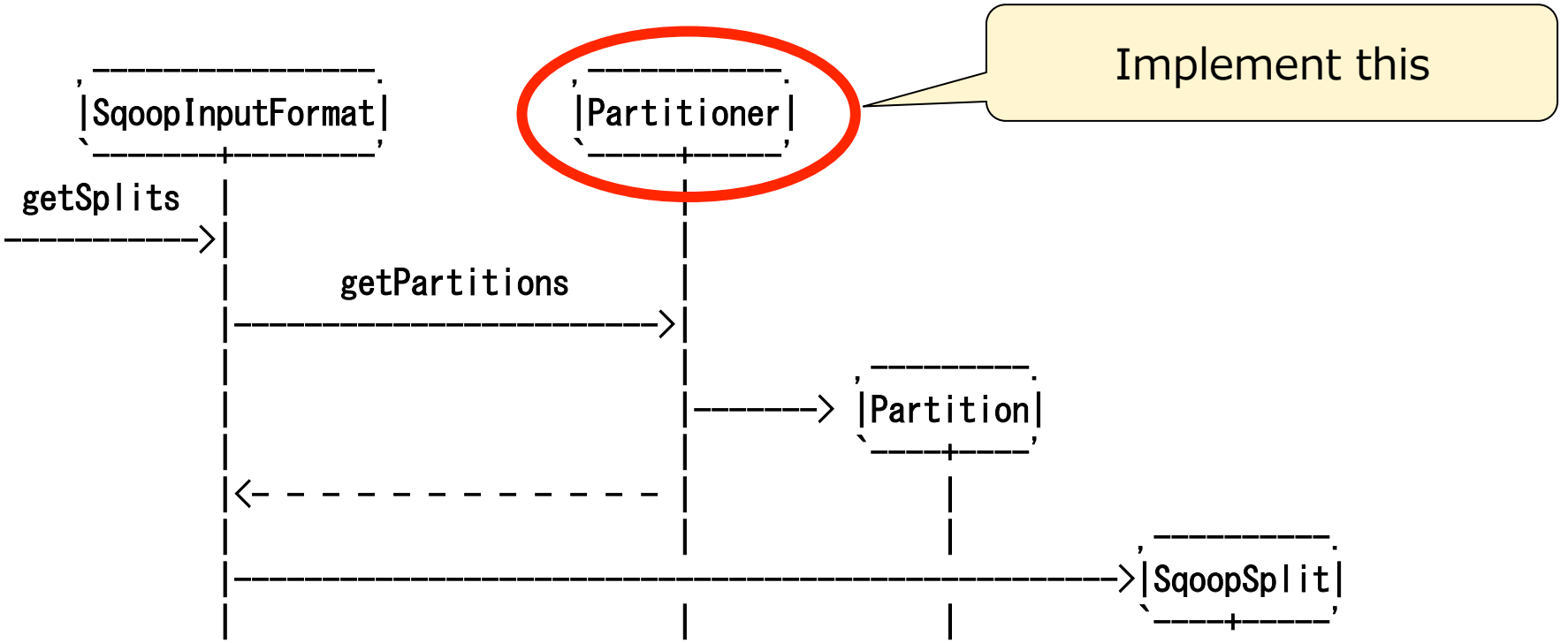
Everything are rewritten
Working on server side
More modular

Not compatible with Sqoop 1 at all
(Almost) Only generic connector
Black box comparing to Sqoop 1
Needs more documentation
    SQOOP-1155: Sqoop 2 documentation for connector development

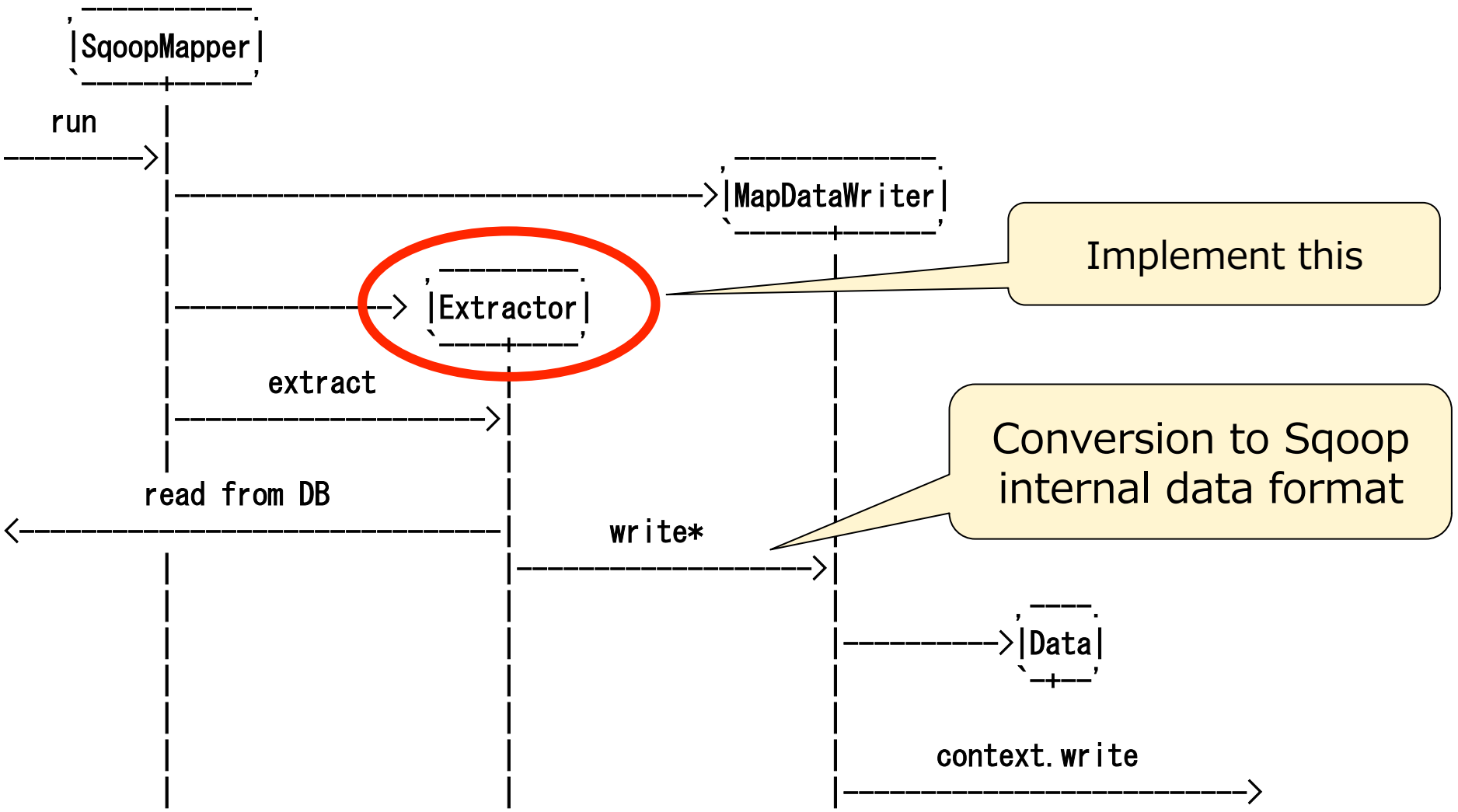
```
Internal of Sqoop2 MapReduce Job
++++++++++++++++++++++++++++++++
...
- OutputFormat invokes Loader's load method (via SqoopOutputFor

..todo: sequence diagram like figure.
```

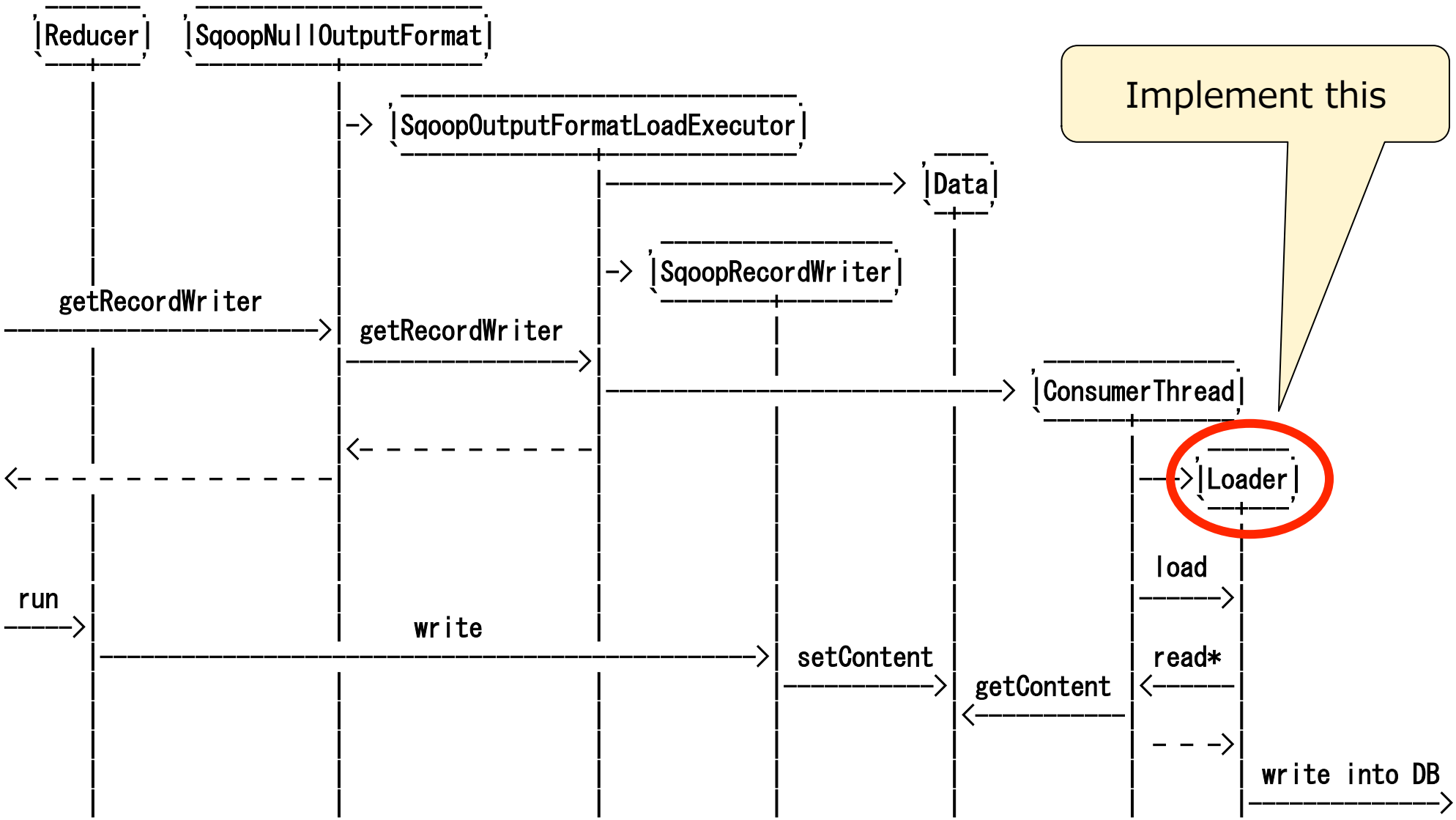
Sqoop2: Initialization phase of IMPORT job



Sqoop2: Map phase of IMPORT job



Sqoop2: Reduce phase of EXPORT job



Summary

My interest for popularizing Sqoop 2

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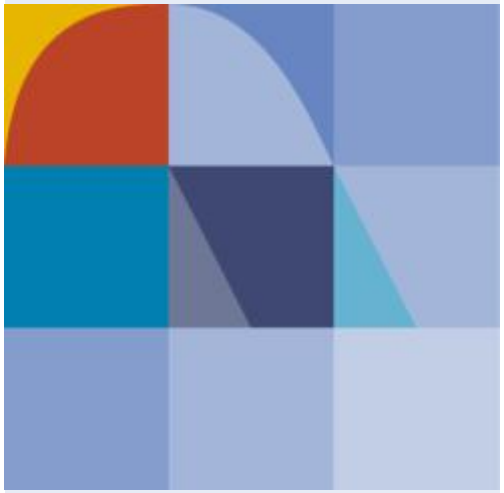
Complex data type support in Sqoop 2

Bridge to use Sqoop 1 connectors on Sqoop 2

Bridge to use Sqoop 2 connectors from Sqoop 1 CLI



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