Think Big: Scale Your Business Rules Solutions Up to the World of Big Data

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Business Rules and Big Data

• Where Business Rules fit in the World of Big Data

• Think Big Use Case - Border Control

• Business Rules Blueprints
  • Generalities
  • in Hadoop MapReduce
  • in Apache Spark

• Rule coverage, Analytics and ML
Big Data and Business Rules

**Big Decision**

Map/reduce  
Cluster engine  
Analytical algorithms

**Big data** is defined as extremely large data sets ... **analyzed computationally** to reveal patterns, trends, and associations, especially relating to human behavior.  

Google

A **BRMS** or Business Rule Management System is used to define, deploy, execute ... **decision logic**

Wikipedia
Big Decision Use Cases at a glance

- Automate massive decision making **batches**
- Running business policies **simulations** on large historical dataset
- Detect situations **on data lakes**
- **Invent** new algorithm combinations to solve new classes of enterprise problems at scale
Enterprise Use cases

• A bank simulates new mortgage segmentation policies against ten million customers in under 30 seconds

• A credit/debit card tests new fraud detection rules on hundreds of millions of past transactions

• A financial service company brings together data science and operational decision teams to build an end to end practice and platform

• A border control agency simulates and applies profiling rules on international travelers to detect terrorists
Concept of Operations of ODM Rules in Big Data

- Rules are authored in Decision Composer, Decision Center or Rule Designer.
- Rules are versioned and deployed over HTTP(S) to a Rule Execution Server.
- Big Data App fetches the latest deployed decision service.
- At runtime the Big Data App applies the Decision Service against a large data set executing in parallel.
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- A Border Control use case
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Think Big Use Case - Border Control

Passenger travel will double from 3.8 billion to 7.2 billion in 2035. 20 Million per day.

Source: International Air Transport Association (IATA)

IBM Case Study: The European Passenger Name Record Directive White Paper
Use Case - Border Control

By profiling passenger data, a tiny minority can be detected and prevented from flying.

- National
  - < 1 M passengers per day

- Cross Border
  - 20 Million passengers per day
  - Advanced profiling
THINK BIG USE CASE: BORDER CONTROL

Bag Weight
Seat no

Advance
Passenger
Information (API)

Passenger Booking Record (PNR)

Flight Date
Destination
Passport no
DOB

Social Media
Government feeds

ODM
Big Data

Risk Score

Check in
Hadoop Enhances Conventional Architecture

Same rules used against data lake and live feed

Data Lake
- Simulate
- Refine Rules

Live Feed
- Apply Rules
- Target Individuals

{ Batch Hadoop

{ Micro Batch Spark
The DMN Model - Decision Composer

- Decision Composer is a new experimental tool to create rules
- Uses DMN (Decision Modelling Notation) to design and model your decisions
- Build and deploy from the tool directly to Bluemix runtime
- Good for rapid prototyping and simple rulesets
Example Stateless Rules

```
if
tweet contains "crystal meth"
   and the age from 'date of birth' is between 18 and 30
then
set score to score + 1;
```

```
if
   'passport number' is one of{"U468924610", "F607631362"}
then
set response to response + " ,Passenger: " +
   'customer name' + " on watch list. Flight " +
   'flight number' + " flying at " + 'flight date';
```
### Example Stateful Rules

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Let’s Create a Hadoop Super Computer on Bluemix!

**Management Nodes**

- **CPU (# of cores)**: 24 Cores
  - $2 \times 12 = 24$ Cores ($2690V3$)
- **RAM**: 256 GB
  - $16 \times 16$ GB = 256 GB
- **OS disk**: 8 TB
  - $4 \times 4$ TB = 16 TB (RAID 10)
- **Network**: 10 GB

**Compute Nodes**

- **CPU (# of cores)**: 24 Cores
  - $2 \times 12 = 24$ Cores ($2690V3$)
- **RAM**: 256 GB
  - $16 \times 16$ GB = 256 GB
- **Data disk**: 32 TB
  - $8 \times 4$ TB = 32 TB
- **OS disk**: 8 TB
  - $4 \times 4$ TB = 16 TB (RAID 10)
- **Network**: 10 GB
Performance

PNR Validation on BigInsights Apache Hadoop on Bluemix.

One Day, 20 Million PNRs:
• 3 compute nodes: \(2\text{min }46\text{secs} (120,000 \text{ per second})\)

One Year, 7.2 Billion PNRs:
• 30 compute nodes: \(1.5 \text{ hours} (1.2M \text{ per second})\)
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  • landscape
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Call a Local Rule Engine in Hadoop

• Each Map job is given a part of the data (the split)

• The Map sends the split to an instance of the rule engine where it is processed.

• The Rule Engine can either be embedded within the Map job, or called externally.

• Data created by the rules are combined by the Reduce jobs.
Calling the Bluemix Business Rules Service from Hadoop

The Rule Engine is executed via a REST API external to the Map Job.

**Advantages:**

- Unleashes multi-threading capability of RES to handle parallel invocations from multiple map jobs
- No need to rebuild Hadoop job for each rule change
- Versioning and management of rules managed within RES
- Licencing managed by RES
- Works well with Bluemix and cloud solutions.

**Disadvantages:**

- Serialization and remoting penalty
Execute with a local Rule Engine

The REST API extracts the latest version of the ruleset from the RES. The ruleset is executed against an embedded engine in the Map Job.

Advantages:

- Versioning and management of rules within RES
- No need to rebuild Hadoop executable for each rule change
- Embedded engine gives high performance
- Can leverage full Hadoop stack – e.g. Hbase

Disadvantages:

Embedded engine for each Hadoop job requires careful management of PVU costs.
ODM/Hadoop Asset

Integration of ODM and Hadoop provided as a free asset:

1. Define ruleset signature
2. Create rule service
3. Deploy
4. Upload data
5. Configure and run job
6. Examine results

Think Big! Developerworks article
Think Big! Developer works Article

Think big! Scale your business rules solutions up to the world of big data

Build an app that uses Business Rules and Apache Hadoop services on IBM Bluemix.

Nigel Crowther
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Where ODM Rules fits in Big Data OSS ecosystem

Run ODM within:
- Apache Spark
- Hadoop map/reduce
- Flume
Business Rules in Data Science Experience

- Apply Big Data and Business rules to determine loan approval rates
Rules & Machine Learning

- Fuzzy logic based on reasoning
- Unstructured data
- Signal processing
- Correlation
- Dealing with uncertainty
- Perception, Classification, Regression

Example: Fraud detection in filed company financial reports
Wrap up

• Combine **Today** business rules and Big Data into Big Decision in Hadoop and Apache Spark

• **Detect situations** on data lakes

• Join Data Scientists and decision management teams together

• Automate **massive** decision making in standard compute grids

• Running **simulations** on large historical dataset with parallel metric and KPI computation

• **Invent** new business rule algorithm combinations to solve new classes of enterprise AI at scale
References

• ODM on Hadoop

• ODM on Spark article

• Bluemix
  • https://console.ng.bluemix.net/catalog/services/apache-spark
  • https://console.ng.bluemix.net/catalog/services/biginsights-for-apache-hadoop

• Data Science Experience
  • http://datascience.ibm.com/
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