

Mobile Based Business Rule Engine

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Abstract- Business Organization's success depends on agility of organization to cope with the dynamic business environment. Involving a software team frequently for changing the business policies is not a good idea. Such needs can be catered using rule engine. Business rules can be written separately from the application code using rule engine which makes it easy for a business user to change the rules as and when needed without the help of a programmer. Traditionally, rule engines are designed to work on high-end processors, having them on a low-end processor is a big challenge. In this era we are dealing with palmtops and iPhones, which are going to replace the bulky desktops even for computational purposes. Objective of this paper is to discuss rule engine on mobile platform, the challenges and solutions while implementing rule engine on mobile platform, particularly JRuleEngine on Android as a mobile platform.

Keywords: *Android, BRMS, JRuleEngine, JSR 94, Rule Engine.*

I. INTRODUCTION

A business rules engine is a software system that executes one or more business rules in a runtime production environment and is a component of a business rule management system (BRMS). Getting Rule Engine to work on computer is not a huge challenge because there are a lot of rule engine present on web which are designed to work on high speed processor and high memory because typically, a rule engine is a trade of memory for separation of business logic. The challenge while implementing the rule engines on mobile platform will be to create a highly flexible and configurable rule engine with a very small memory footprint.

Mobile phones have hardware constraints like less memory and poor processing speed as compared to computers. So, one need a rule engine which is light in weight and open source. Light weight rule engine practically can be used in developing mobile application. Need of Open source rule engine is just that one can extend its functionality and make a fruitful contribution to open source world.

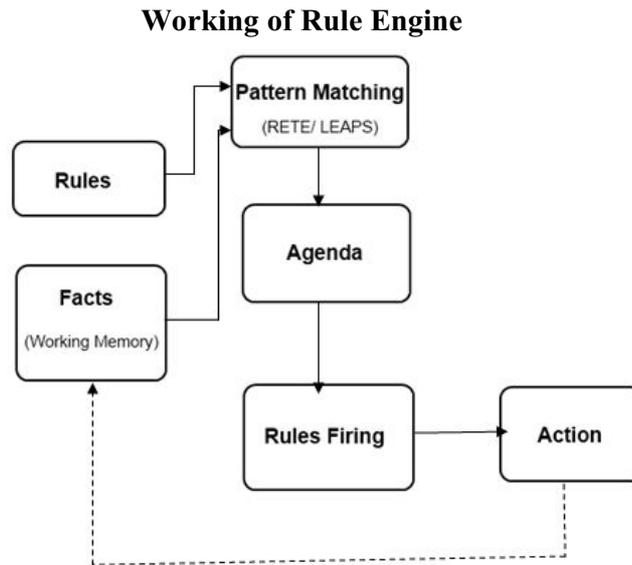


Figure 1: High Level Overview of Rule Engine

Rule engine basically deals with decision making. Rules are nothing but conditions and actions. They are stored in production memory in a separate file. Inference engine is brain of rule engine. It is a pattern matcher. It matches facts and rules. Matching is done by various matching algorithms like RETE, Leaps.

Facts are stored in working memory. Working memory contains the objects i.e. facts which we need while making a decision. It is possible to add, remove, and modify the facts.

For example, rule is:

<Condition> *if age of citizen < 18*

<Action> *Not eligible for voting*

Here fact will be object of 'citizen'. Inference engine matches this fact against given rule and finds out if the condition is satisfied. If system contains large number of rules then there might be a problem when there are multiple rules which are true. Agenda is an important part which determines the order in which the rules should be executed. This is called conflict resolution. [1]

Rule engine can be of two types as illustrated in Fig.2:

1. Forward Chaining: It is data driven approach. We arrive at a conclusion using data.
E.g. JBoss Rules

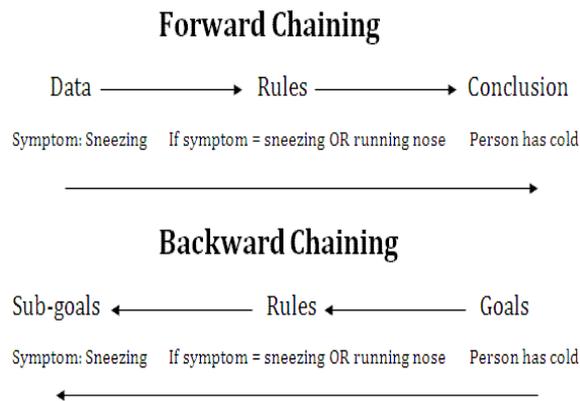


Figure 2: Forward Chaining and Backward Chaining

2. **Backward Chaining:** It is goal driven approach. System starts with a conclusion to find if something exists based on existing information. Conclusion is here called a goal and rule engine tries to satisfy the goal. If it cannot, it tries to find out sub- goals. Sub-goals will help to satisfy a part of Goal.E.g. Prolog.

Rule Engines Available

There are various rule engines that can be used in an application. Some of them are [2]

- JRuleEngine
- iLog
- Drools
- Jess
- Mandarax
- Blaze Advisor

Among these, many are heavy for mobile applications. Henceforth the discussion will be on JRuleEngine which is a lightweight rule engine.

JruleEngine

JRuleEngine [3] is a java rule engine. It is designed according to Java Request Specification 94 (JSR 94) [4]. JRuleEngine is based on a forward-chaining algorithm. Rules are defined in a separate xml file. It operates in two types of rule sessions. Stateful Rule session remembers the state of input objects (facts) and it can be queried again and again. Stateless rule session gives performance but doesn't remember the state of facts.

Advantages:

- 1) **Speed and Scalability:** Being lightweight, it consumes less memory thereby giving high speed and scalability.
- 2) **Understandable Rules:** Rules can be expressed in easy format. Business user can easily modify them without need of IT intervention.

Disadvantage:

- 1) It does not provide web based tools i.e. a business rules management system for advanced rule authoring, version control, and management.
- 2) Does not support multiple facts of same type i.e. if two or more objects of same type are added to working memory, it only matches the last object added against the rules.
- 3) While defining rules in xml file, the RHS part of 'then' cannot be an object.

II. IMPLEMENTING JRULEENGINE ON ANDROID

Being a popular mobile platform, android is used here as experimental platform to extend JRuleEngine. Following are the potential problems during implementation.

- A.** The sun's java compiled classes are re-compiled by packing tool into another format called DEX (Dalvik Executable) format which could be interpreted by the DVM (Dalvik Virtual Machine). Android's java is not sun's java it's the Google's implementation of java. Stateful rule session class of JRuleEngine uses component class of AWT package provided by sun's java. But Google's implementation doesn't contain AWT as in sun's java and hence the application using JRuleEngine gives error indicating missing package.

Solution: Apache harmony's java implementation was required to be used. Solution to this problem is to make use of awt.jar by apache harmony. For this purpose, awt.jar by apache harmony must be included and then imported in stateful rule session class of JRuleEngine. Then repacking jruleengine.jar and using it in android application as a library solves the problem.

- B.** As discussed in disadvantages of JRuleEngine, RHS part of then does not accept an object as its argument. It accepts a method.

Solution: It involves modifying stateful rule session to extend JRuleEngine which can support object as an argument.

- C.** As mentioned earlier, it does not support multiple facts of same type. Facts are stored in working memory using a unique key as getClass ().getName(). Obviously, objects of same fact will have the same name so; the fact added in the last wins and will be matched against rules.

Solution: To address this problem, the facts should be stored in working memory with a unique identifier. A method which will return the unique identifier for each fact is necessary. The problem can be solved by creating an abstract class and defining a method getId() which will return the unique id related to that fact. This id will be used as a key to store the fact in working memory and solves the problem. [5]

III. SAMPLE APPLICATION

Applications involving dynamic decision making can be developed using rule engine. Examples can be medical application which can be useful as first aid or an application for troubleshooting and PC repair. These involve step by step filtering of results leading to solution finally. This filtering is done by pattern matching algorithms like RETE. Example of medical application can be elaborated as follows:

At the first stage, user selects high level symptoms. Rule engine filters the results by matching the facts against rules. Then next it will go little deeper and show possible causes and then will suggest what's the proper medicine.

e.g.

Level 1 (main category) - Headache / ... / ... / ...

Level 2 (sub category) - Unbearable Headache only near the eye / ... / ... / ...

Level 3 (causes) - Possible eye strain / ... / ... / ...

Level 4 (remedies) - wash eye with warm water / check with optician / ... /

Other Areas of Application

Some of the applications that can be deployed on mobile platform using rule engine are:

1. **Advisor programs:** Make offers to clients (in insurance applications, Amazon books, filling out tax forms)
2. **Diagnostic programs:** Diagnose illness, diagnose technical problems (e.g. PC repair), telephone network faults, circuit fault diagnosis
3. **Monitoring:** Monitor intensive care patients, monitor in digitalis therapy, temperature control in a building, and monitor an operating system.
4. **Interpret Data:** Interpret oil well data, interpret geological data for selecting oil well sites, speech recognition.

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BIOGRAPHY



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