

Report Generation System Using JasperReports and SQL Stored Procedure

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ABSTRACT

The contents of this paper mainly focus on study of the Report generation system using JasperReports, an open-source reporting tool, for realization and implementation of dynamic and reusable reports. Stored SQL procedures are used to retrieve data from database. iReport is a GUI based report designer assists the realization of the reports. The separation of the report template from report data provided by JasperReports has provided ease of development and maintenance of reports in overall system. This report system is supported by Spring framework which provides Java environment of system. This data report system can be used to generate reports dynamically and improve overall system's reusability and maintainability.

Keywords - iReport, JasperReports, Stored Procedure

1. INTRODUCTION

Report is a self-explanatory statement of facts relating to a specific subject and serves the purpose of providing information for decision making and follow up actions. Report is an important tool in project management, and its purpose is to help managers quickly grasp the raw data of the basic

elements and relationships, this is useful for making effective management decision[10].

The traditional generation method of reports is relatively curable, once the system development was completed, all reports' formats are fixed. Therefore it is not possible to change format of report according to changes in circumstances and cannot customize them of personal fashion. When content or format of the report changes, we need to modify the code constantly to adapt changes which restricts progress of the project. Therefore we generally use XML documents to give the definition, using the idea of the separation of report format and report data. Format module of reports extract XML format files from the template library of report format, data module of reports extract relevant data from the database, finally, the report was compiled and displayed by reports builder[1]. However, this kind of reports needs to develop oriented database, resulting in reliance on the data source and reducing reuse and portability of the reports. This paper focuses on JasperReports, an open source reporting tool along with a GUI based report designer, iReport. It is combined with Hibernate to create dynamic and reusable report generation system. In project which based on open-source framework of SpringMVC, we used this report system to generate reports and

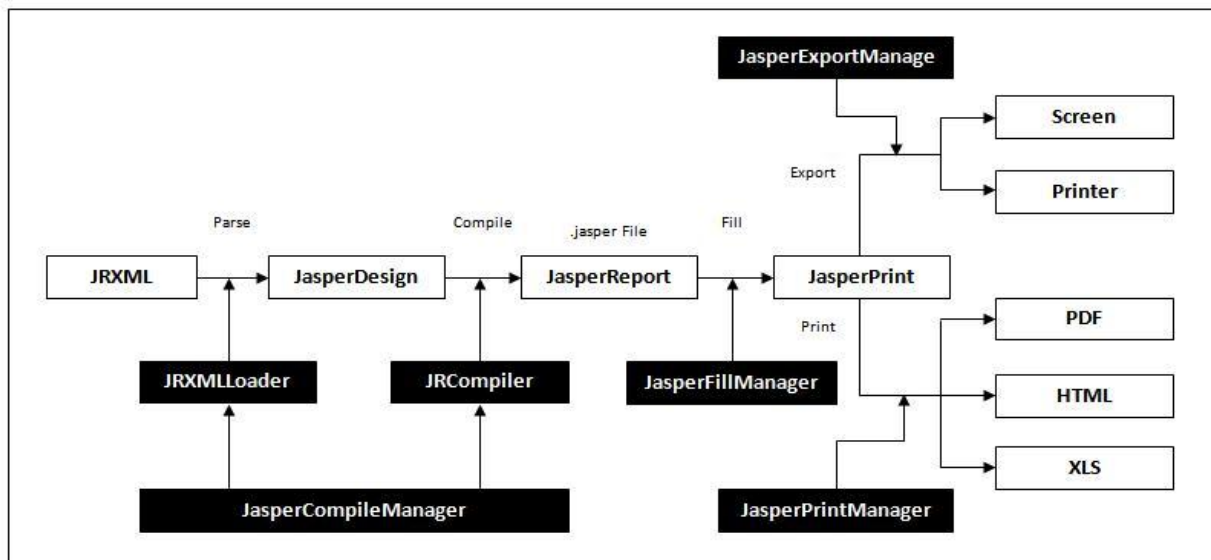


Figure 1: Process of generating reports by JasperReports

invoices and successfully constructed a stable and efficient system.

2. THE CHOICE, ANALYSIS AND APPLICATION OF THE REPORT BUILDER

2.1 Working of JasperReports

With the development of open source software, especially Linux OS, open source software being gradually accepted and respected by the people, it played an increasingly important role in IT. JasperReports is an open source report tool which written in pure Java, it can run on any Java-application environment, including J2EE and other web applications[10].

JasperReports has a good cross platform and compatibility. It can dynamically display reports of various styles and formats. It also can display rich content of the page and convert these pages into XLS, RTF, PDF, HTML and XML format, showing its applicability. Moreover, iReport as a production tool of front-end interface, it has made a considerable improvement by providing facility to create charts, sub-tables, meet schedules, and other more complex reports[3].

Figure 1 describes the process of report generation by JasperReports. Report generation starts with JRXML file which is also called as Report template. JRXML file contains the report structure information. JRXML file parsed by JRXMLLoader and converted into JasperDesign Object. JasperDesign Object contains only design information of the report. After compiling JasperDesign Object using JRCompiler it gets converted into Jasper Report without Data. Now Data filled into empty JasperReport Object using RS(Result Set) and it will be converted into JasperPrint Object. From JasperPrint Object you have two options: JasperPrintManager from which you can print the report or view the report on the screen else JasperExportManager from which you can export report in HTML, PDF, XLS format.

2.2 iReport: Visual Report Designer Studio

Process of report generation starts from JRXML file. This JRXML can be written manually but it is complex and time consuming. Moreover we need to learn how to structure JRXML file as per syntax and semantics of JasperReports. Therefore we choose iReport, a front page showing and producing tool that matches with JasperReports[11].

It is mainly used in the visual design and generation of JRXML file in statements form used by JasperReports, as JasperReports itself did not provide a good visual statements design tools, the appearance of iReport has just make up for the deficiencies. At the same time, iReport can call the JasperReports

library and apply it to any kind of Java application process. iReport is distributed, and described by pure Java which correspondence with GNU General Public License. iReport provides a relatively perfect platform for visual editing of report template, using it we just need a simple operation to design the demand interface. It can graphically edit JRXML documents and support for PDF, RTF, XML, XLS, CSV, HTML and many other formats, and it also can support for the realization of XML data sources. The relationship between the content and performance of report is configured by JRXML file; this can bind different domains and different databases, so that reports can be applied under different datasource environment.

iReport also compiles JRXML file to form '.JASPER' file which is used to fill data from datasource. This method provides separation between template of the report and data of the report i.e. report template is independent of the data displayed by the report. It avoids complexity and is perfect for rapid production of the reports.

3. USE OF STORED PROCEDURE TO FILL REPORTS

3.1 Introduction to Stored Procedure

A stored procedure is a subroutine available to applications that access a relational database system. A stored procedure or in simple a proc is a named PL/SQL block which performs one or more specific task. This is similar to a procedure in other programming languages. A procedure has a header and a body. The header consists of the name of the procedure and the parameters or variables passed to the procedure. The body consists or declaration section, execution section and exception section similar to a general PL/SQL Block. A procedure is similar to an anonymous PL/SQL Block but it is named for repeated usage.

Stored Routines (Procedures and Functions) are supported in version MySQL 5.0. Stored Procedure is a set of statements, which allow ease and flexibility for a programmer because stored procedure is easy to execute than reissuing the number of individual SQL statements. Stored procedure can call another stored procedure also. Stored Procedure can very useful where multiple client applications are written in different languages or it can be work on different platforms but they need to perform the same database operations.

Store procedure can improve the performance because by using the stored procedure less information needs to be sent between the server and the client. It increases the load on the database server because less work is done on the client side and much work is done on the server side.

We can pass parameters to procedures in three ways, viz. IN-parameters, OUT-parameters and INOUT-parameters

The parameter list is available within the parentheses. Parameter can be declared to use any valid data type, except that the COLLATE attribute cannot be used. By default each parameter is an IN parameter. For specifying other type of parameter used the OUT or INOUT keyword before the parameter name.

An IN parameter is used to pass the value into a procedure. The procedure can change the value but when the procedure returns the value then modification is not visible to the caller. An OUT parameter is used to pass the value from the procedure to the caller but its visible to the caller. An INOUT parameter is initialized by the caller and it can be modified by the procedure, and any change made by the procedure is visible to the caller.

For each OUT or INOUT parameter you have to pass a user defined variable because then the procedure returns the value then only you can obtain its values. But if you invoke the procedure from the other procedure then you can also pass a routine parameter or variable as an IN or INOUT parameter.

The procedure body contains the valid SQL procedure statement that can be a simple statement like SELECT or INSERT or they can be a compound statement written using BEGIN and END. Compound statement can consist of declarations, loops or other control structures.

```
CREATE [OR REPLACE] PROCEDURE  
proc_name [list of parameters]  
IS  
  Declaration section  
BEGIN  
  Execution section  
EXCEPTION  
  Exception section  
END;
```

3.2 Benefits of Stored Procedures

Precompiled execution. SQL Server compiles each stored procedure once and then reutilizes the execution plan. This results in tremendous performance boosts when stored procedures are called repeatedly.

Reduced client/server traffic. If network bandwidth is a concern in your environment, you'll be happy to learn that stored procedures can reduce long SQL queries to a single line that is transmitted over the wire.

Efficient reuse of code and programming abstraction. Stored procedures can be used by multiple users and client programs. If you utilize them in a planned manner, you'll find the development cycle takes less time.

Enhanced security controls. You can grant users permission to execute a stored procedure independently of underlying table permissions.

3.3 Using Stored Procedure with JasperReports

Jasper Reports is unable to call Oracle stored procedures directly, because procedures do not return standard result sets. As a solution, in Oracle, you can use a stored function to retrieve the results of a stored procedure. There are a few more steps to do this than if you were able to use a stored procedure, but it currently is the only option, if the query you need to do can't be done with a standard SQL query.

In order to use stored functions to retrieve the result set of a stored procedure, you will need to use a temp table to hold the results, and then return the results using types and tables of types. In iReport designer go to Tools. Under Options, go to Classpath Tab. Click Add JAR and add the OJDBC14.jar to the classpath. Go to Query Executer tab and set the Language as PLSQL. Select Database JDBC Connection. Select Oracle as the JDBC Driver as shown in the image below and verify the connection by clicking the Test button. Create a blank report by giving a report name and save it. Open the report in the designer and right click on the report name and click on Edit Query. Call your procedure with in { }

```
a. {call  
PUBLISHER_AND_BOOKS(&P(P_PUBLISHER_ID),  
                    &P(ORACLE_REF_CURSOR))}.  
P_PUBLISHER_ID is of type string and  
SYS_REFCURSOR is of type java.sql.ResultSet data  
type custom parameter. You need to import  
'java.sql.*' in JRXML file. This has to be done by  
editing XML file manually. You can create this by  
clicking the New Parameter button. If you have more  
input parameters use ',' as your delimiter as shown in  
the above example. Click Ok and proceed with the  
report design. In the designer window right click on  
Fields and add click Add Fields and make sure all the  
field name matches the column name in your stored  
procedure. Now right click on the parameters and add  
the parameters matching the stored procedure NOTE:  
make sure you uncheck the "Use for Prompt" in the  
property for your out parameter in our example its  
SYS_REFCURSOR is the out parameter. Drag and  
drop the fields in the report detail band.
```

4. SYSTEM ARCHITECTURE AND ITS ADVANTAGES

4.1 Process of report generation

The system uses architecture of SpringMVC which is an open-source framework. Function modules of system can be divided into: user management module, system management module, project management module, schedule management module, query and statistics report module. SpringMVC framework is one of the best MVC frameworks by far, it has a strong Servlet control functions, its page navigation structure that based on xwork.xml configuration files is very clear, response speed of its jump control function is also very fast. And SpringMVC has a flexible view of expression

and can support for report output of JasperReports, so that it can greatly simplify and speed up report development[8].

System accesses data through SpringMVC and Hibernate, besides SpringMVC will monitor the request of Spring affairs. Business layer uses

type which is object-oriented, then return to the JasperReports to generate report view engine. Module 2 provides report templates in the form of .JRXML file generated through iReport to JasperReports Engine.

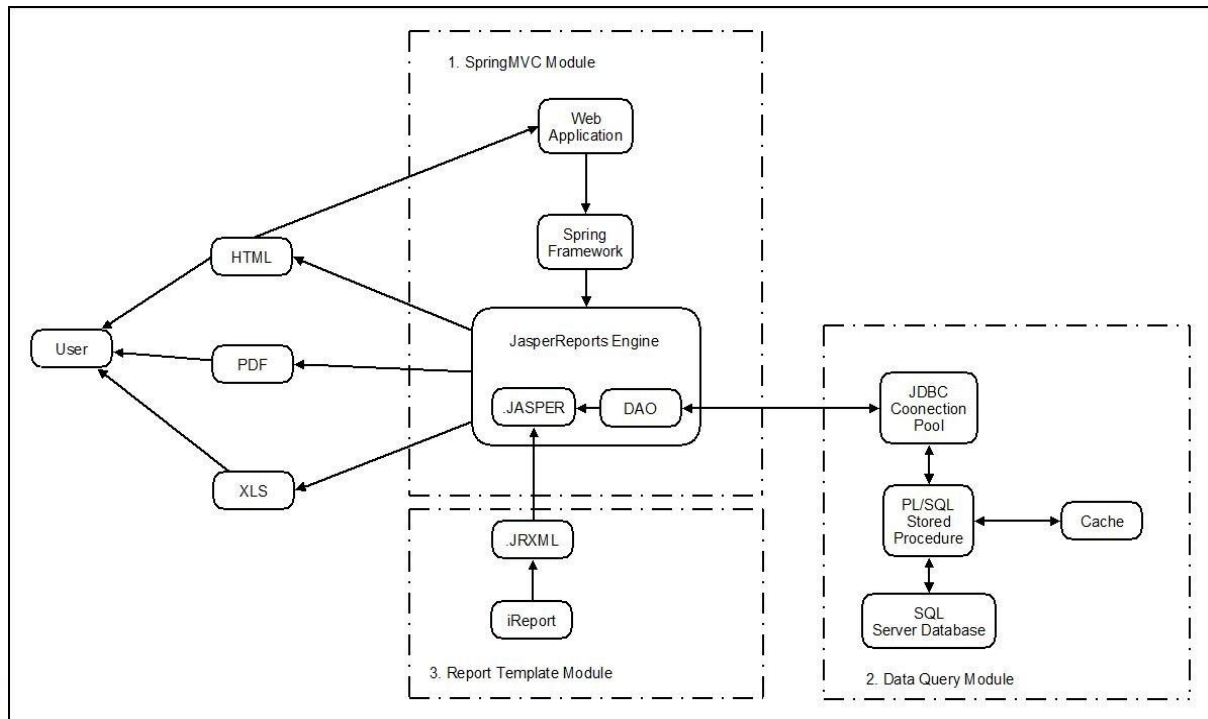


Figure 2: Flow of report generation system using JasperReports in Spring Framework

construction function of Spring, we use it to manage the data source and the establishment and recovery of database connection pool. Data persistent layer integrates Hibernate in the SpringMVC framework. This has realized a changement from a relational query to an object-oriented query, and Hibernate largely optimize a query process. Chart of system framework and process of JasperReports generating report shown in Figure 2.

Figure 2 is divided into module 1,2 and 3. Module 1 has responsibility to accept request from client and pass it to module 2. Module 1 basically forms Controller part of the MVC framework. Web application accepts HTTP requests from client passes it to the Spring framework. Spring framework has a controller implementation for each type of request. By analyzing the request and parameters packed with the request, an appropriate call is made to the JasperReports Engine. JasperReports Engine is provided with DAO and path of .JRXML file. Compilation of the .JRXML file is responsibility of JasperReports Engine. JasperReports Engine makes call to database through DAO. Module 2 achieves data access and model package: integrate the Hibernate which is the open source O/R relational mapping tools and bases on Spring framework, package the relationship data that obtained by JDBC connection pool into the object instance of JavaBean

4.2 Advantages

From figure 2 we can see that JasperReports in the SpringMVC framework has two modules to generate a report: module 2 and module 3. If we want to develop different reports, only have to package the data in the module 2 into different JavaBean data model, such a development process well reflects parallel design pattern of the MVC, it can greatly improve the development efficiency of report. Module 3 realizes style design of reports by iReport, that's easy to design reports according to business needs, then enabling the division and parallel development of the data and view[10].

Data query module is extremely important module in this system. Data retrieving is done by this module. Data retrieval is done using SQL stored procedure. Problem with JRXML file is that it needs to be compiled whenever any modifications are made to file. It is applicable even when query written to access data is changed. Therefore if query keeps changing, we need to compile file the JRXML file as many times the query changes. On the other hand, if we use stored procedure, we just need to make a call from JRXML file and collect the records in Result set. On the database side we change the logic in stored procedure without disturbing JRXML file.

When we change stored procedure, we can compile it without restarting the database server. But if we change the JRXML file, we need to restart application server to compile it. We do not need to compile JRXML file as long procedure name and/or its parameters do not change. Therefore it is good option to use stored procedure to fill data in report.

5. CONCLUSION

This paper mainly focuses on an open-source reporting tool JasperReports and visual report designer iReport. This data report system separates report template from report data. This helps to achieve flexibility in reports. The report template can be changed irrespective of the report data displayed by report. Stored procedures retrieve data to fill in the report. Currently this idea has been applied to the open-source SpringMVC framework. This data report system has helped to meet business needs of the project and has provided a fast and scalable data report system.

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