COSC2440 - Software Architecture Design & Implementation

Assignment

Aims of the ASSIGNMENT

This assignment is to help students gain knowledge and skills in software architecture by either researching a topic relevant to particular technologies or frameworks or building a small demonstration application, or sometime a combination of both.
This assignment will contain various topics in which each group of students will be assigned one. Students are free to form group of three and in case they could not do that lecturer will help them. If two groups are interested in the same topics, random ballot is probably to be used.

Each group of student needs to have weekly meeting with lecturers to clarify requirements and report the progress.

Assignment 1: due in Friday week 6
Assignment 2: due in Friday week 11 (can be a continuity of Assignment 1 or different topics)

Here are list of topics for selection.

Topic 1: MongoDB and Spring

Investigate MongoDB database system and Spring support of MongoDB
Write a demo web application using Spring, Struts2 and MongoDB

With the development of computing technologies, traditionally relational database management systems seems too rigid for new computer paradigms like large scale systems, cloud computing. One of the exemplified example is Google storage engine Big Table which allows to cache and host billions websites in their hundreds of thousands servers. Many big companies also follow this trend to build their own solution including IBM, Amazon, Oracle etc.
(See for example: http://nosql-database.org/)

Lots of problems of RDBMS can be solved in NoSQL approach such as scalability, replication, auto-sharding etc. Among NoSQL databases MongoDB is a very prominent competitors as "It gives you the features of noSQL –linear scalability, incremental growth, ability to add more nodes and you don't have to give up the query ability of a relational database" (http://siliconangle.com/blog/2013/03/14/3-reasons-mongodb-is-better-than-other-nosql-services/)

In this assignment you are requested to carry out an investigation on MongoDB, its features, strength and weakness in comparison with other NoSQL solution. You will also need to figure out how it can be integrated with Spring (via Spring Data component). After all, you have to build a demo application with CRUD functionalities on at least two types of collections (aka table) using MongoDB as persistence, Spring as bean containers, and Struts2 as web user interface.

Suggestion of demo application.
Citizen Identity is the current topic pushed by Ministry of Justice with the aim to build a national citizen identity system. This system will give each of newborn child a unique number and this number will go with the baby throughout his/her life. Try to investigate what information needs to be managed by this system and build a demo application to do basic CRUD functionalities. Do you recommend that this system to be built on NoSQL or RDMBS?

Topic 2: Build a modular architecture using spring, hibernate, struts2, and maven.

Modular design is one of the significant concept in large system development. By dividing a complex system into say many smaller pieces, it makes possible for a highly complicated system to be globally distributed developed with thousands of developers coordinated in a loosely scheme. The case of linux is exemplary in this situation.

In this assignment students are requested to build an skeleton of the modular architecture using spring, hibernate, struts2 and maven.
This skeleton of code must have at least two service modules and two web modules. In each module you just need to do CRUD for at least one domain object.

For example one module will deal with patient (name, dob, gender, address) and the other module will do with checkup (date time, doctor, disease)

Topic 3: Investigate EJB3 and build a demo app

Early version of EJB used to be the key technology of java enterprise platform notably known as J2EE. However due to its unnecessary complication it was soon defeated by Spring. Few year later with substantial investment, ejb3 was released with plethora of powerful features, many of them were inspired Spring and became significant competitor of Spring.

EJB3 thus worths an investigation. In this assignment students are required to learn EJB3 and use its framework to build a demo app.

Students can find a full list of tutorials on all layers of a typical EJB3 application and based on that build their assignment.
http://www.jboss.org/developer/tutorials

Suggestion of demo application.
Build an small application to manage health professionals in the countries. Information of one includes name, birthdate, gender, address, license number. Each professional will have one or many educations (what school, from date, to date, type of degree). Each professional will have one or many experiences (working place, from date, to date, position)

Topic 4: Investigate the modular design in OpenMRS

OpenMRS is one important OSS medical software systems with large user base and developer community. To distribute the development, OpenMRS also uses modular design. However, its architecture for module development is slightly different from DHIS2. Module in OpenMRS is a functional unit that has both backend and frontend (3-tiers) packed as an omod file (for **o**penmrs **mod**ule). This file can be uploaded to OpenMRS in the run time and put online without having to restart Tomcat.

In this assignment, students are required to examine the source of the OpenMRS to understand how this approach to modular design is implemented. A small demo application that implements this design is needed.

Topic 5: Investigate OSGI and Spring support of OSGI (Spring Dynamic Modules)

Jar files (with compiled class files) once loaded to JVM is hard to change or reloaded. OSGI is a standard that makes it possible to have multiple versions of jars concurrently. In this assignment, students (in group) are required to investigate OSGI and OSGI + Spring integration. Students have to make a demo application using OSGI.

Suggestion of demo is building an application that uses OSGI to manage online drug list. Information of drug includes code, drug name, generic name, dose, usage, and route. Drug is classified by drug group, drug group set (group of group), and drug categories. This app has a front end allow users to search and view any drugs in the dictionaries. The backend allows CRUD operations on drug.

Some useful examples to get started

http://www.baptiste-wicht.com/2010/07/osgi-spring-dynamic-modules-hello-world/
http://www.javacodegeeks.com/2011/11/osgi-and-spring-dynamic-modules-simple.html
http://stackoverflow.com/questions/12832697/looking-for-an-osgi-with-spring-specifically-spring-mvc-tutorial

Topic 6: Investigate TomEE and build a demo app

TomEE is a stack of technologies based on Apache Tomcat to support EJB. In this assignment, students are required to investigate TomEE and use it to build a demo application.

http://tomee.apache.org/apache-tomee.html

Students can use this list of examples as a departure

List of examples http://tomee.apache.org/examples-trunk/index.html

Suggestion of demo app

Build a system to keep track of medical services. There will be a front end for public access that allows display and search list of medical services. The backend will do the CRUD on medical service list. Each service will belong to a group, group set (parent group), and a category.

Topic 7: Port API of OpenMRS to DHIS2 platform

Concepts are important contribution of OpenMRS in terms of codify medical activities. Instead of having hardcoded tables for drug, service, disease, everything will become a concept. Concepts will be grouped into concept group such as drug, service, disease etc. Coded concept versus arbitrary text is important for electronic medical record as it makes information become measurable and ready for analysis.

Students are required to build a new DHIS2 module, this module will port all the business objects and their data from OpenMRS to DHIS2. Theses API will be used for other modules that deal with medical records.

https://wiki.openmrs.org/display/docs/Concept+Dictionary+Basics

Topic 8: Investigate the DXF standard used in DHIS2 and build an application for exchanging data between different application

In every country there are many vendors providing hospital management and EMR solutions. At the national level, aggregation of these data is important for decision making. In order to

exchange data between systems, there must be standards. However, these standards are still missing in Vietnam and many other countries.

In this assignment, students are required investigate the DXF standard used in dhis2 for sending data between systems and build sample app to demonstrate.