R'Summer – UCR Summer Sessions’ Business Administration System

R'Summer: An Efficient Business Collaboration Tool for Managing Summer Sessions through Private Cloud Computing Services

Nomination for:
Summer Sessions, University of California, Riverside

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Project Description

UC Riverside Summer Sessions, which is independent to regular 3-quarter academic year, offers continuing UCR and visiting students an opportunity to take UCR General Catalog courses to stay on track or get ahead. Visiting students from another UC, a private, out-of-state, international universities who are at least 18 years of age, as well as eligible high school students, can experience taking courses at UCR during the summer quarter. All UCR Summer Sessions courses are normally transferable to other institutions and applicable degree programs.

Problem to be Solved/Project Inspiration

When UCR Summer Sessions were restructured and moved from auxiliary education services under University Extension to regular academic administration under Vice Provost of Undergraduate Education, its operations needed to be re-engineered to meet new organization’s requirements. A minimum of 404 different documents, including Excel worksheets, Word and PDF files, Access databases, and email templates, were used and maintained by SSA just for its core course/instructional appointment data for a single summer term. Additionally, all the information between these various documents must be aligned and consistent as they are referenced in different manners for different purposes. Three quarters of the documents are associated with tracking the changes associated with running the term, which are referenced when resolving a wide variety of issues and concerns. Cross referencing different documents creates more documents as different bits of data are brought together for different needs. Utilizing such a multitude of storage points creates unnecessary workload and complexity, and is inherently prone to error.

1. Any change requires manually transferring information between documents by copy/pasting, rekeying, or using an Excel add-on merge utility when SSA were able - all of which are time consuming and prone to errors.
2. Creating reports and/or answering questions require manually matching data from different sources, which is laborious and error prone.
3. Compiling historical data is overly complicated due to the spread of information, inconsistency in data collection techniques, coding, and storage.

Managing summer sessions critical business operations and communications required manual data transition from paper forms to electronic media (often multiple times) as well as coordinating information with various UCR entities and their database systems. The convoluted systems, which had evolved over a long period of time, frequently led to redundancy, errors, inconsistency, as well as workflow overload. For example, SSA has to manually produce 1600 paper appointment letter and sent them to appointees each summer term. It was imperative that SSA should re-engineer how it does business through appropriate. Such technology should significantly reduce the man-hours associated with manually processing paperwork and juggling information between multiple data sources and manual data entries. It should interact with other existing enterprise systems (i.e. SIS+, PPS, etc.); which will reduce data duplication, increase the accuracy and consistency of information (not only for SSA but across campus), make information more readily available to those who need it, and minimize duplication of data entry and administrative processes (also across campus).
What is R'Summer?

Each year, SSA coordinates, schedules, processes, monitors, and manages approximately 1,000 courses and support sections, and hires over 1000 instructors, TAs, academic coordinators, readers, and lab supervisors, provided by upwards of 45 unique academic departments from 6 colleges for over 9000 students who are from the UC’s 10 campuses, community colleges, high schools, and colleges outside of California.

R’Summer is a new real-time technology to manage UCR’s Summer Sessions to ensure all courses offerings and instructor appointments are in alignment with applicable State, University, academic department, and college policies; compensation structures; union agreements; and in alignment with unique summer term exceptions.

R’Summer is a centralized web-based Business Process Management (BPM) system that manage data through a seamlessly interconnected business processes. It allows users to utilize information created by system and users to merge with other multiple disparate electronic sources on a single, centralized, real-time portal that automatically applies updatable business rules to provide accurate, compliant, and up-to-date information in an easy to use online format.

How R'Summer Works

Summer term course and appointee business process flow from the academic departments to Summer Sessions, which creates and manages summer course schedules and appointee compensation packages. Enrollment is taken and courses meeting minimum enrollment are run, while those that do not are canceled (CX’d).
Information about course offerings and appointments are processed through a number of states during the development and running of the summer term. In the final “Processed” state, the information has been entered into SIS+ and PPS, which means any changes require modifying the information in those systems as well. To ensure the consistency and accuracy of data across the 3 systems, once information has been “Processed” by Summer Sessions it becomes “locked” in R’Summer. If a change is needed after the information has been processed, the department will need to contact SSA.

To provide a simple method to communicate what state any given information is in, R’Summer utilizes a text color coding system:

**Red** - - - - - - This information has not been submitted to SSA and the department may change it at will (i.e., it is “unlocked”). Summer Sessions does not see this information.

**Green** - - - - - This information has been submitted to SSA and is awaiting review and entry into SIS+/PPS. The information is still “unlocked” and the department can still change it, or retract it from submission to Summer Sessions.

**Black** - - - - - This means the information has been processed by SSA and entered into SIS+/PPS. Once the information has been processed it becomes “locked” and the department can no longer independently change it.

**Crossed Out** - - - - - The course/appointment has been canceled and is “locked.”

**Crossed Out** - - - - - The course/appointment information has not been submitted to SSA by the deadline to do so and has automatically been cancelled.

**Purple** - - - - - This means SSA has made a correction to whatever information appears in purple. When the department reviews the change, the text will revert to the default black state.

**Orange** - - - - - This means the information has been temporarily “unlocked” for the department to make a change to it. To “unlock” a schedule or appointment, please contact SSA.

To provide quick access to different parts of R’Summer, its various tools, and other available information, a number of shortcut buttons have been incorporated throughout the system.

- - - - - - - - - These are the “Edit” buttons that link to a detailed information page where various data fields can be read and/or modified.

- - - - - - - - - - This is the “History” button that provides a detailed history of the offering/appointment’s development in R’Summer.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - This is the “Unopened Notes” button that provides a link to any notes that have not been read yet.
This is the “Opened Notes” button that links to any notes that have been read.

This is the “Delete” button that will permanently delete the entry.

This is “Purge” button that will permanently purge all course and appointee information from the system. Note; if this function is used for a primary offering the system will also purge all secondary course and appointee information as well.

R’Summer is designed to streamline Summer Sessions management processes into three areas; configuration of processes, course schedules, and instructor appointments. Basic course, appointee, and contact information are stored within the “Configurations” where it is automatically referenced as needed—removing redundant data entry needs while maximizing data integrity. Each summer’s unique class schedule and appointment information are stored within the “Submissions” of the system, which offers 3 overview options containing easy drill-down links for accessing detailed information.

**Implementation Challenges, Surprises**

The project team was a diverse collection of business and technology leaders who either have been involving Summer Session operation or have deep knowledge of university policy and administration. R’Summer was determined to be by no stretch an IT-run, IT-only project. After the project team looked into business processes, it then determined that R’Summer shall be a BPM system. This BPM definition is so critical that it completely overturned the existing information-management-base business culture.

Through effective modeling and detailed evaluation of existing business practices, the project team soon realized they needed to orchestrate a series of changes to business processes and started by asking some hard questions: How should we define accountability within the whole campus processes? How do we help administrative staff see how their impact on business processes resonates with coworkers upstream and downstream? How do we change the existing business administration culture from information management to BPM? The project team started with a view of how the business process can evolve to achieve efficiency and cost-effectiveness. Once the project team began answering the business process questions, it was able to tackle the technology piece of the modernization puzzle.

Acceptance of cultural and business process changes is essential. It requires a lot of up-front work to help the UCR Community members understand and accept the ultimate goals. Education, training, and providing comprehensive information are keys to show community members how business processes would be altered and system is user friendly that will help them rather than being perceived as yet another level of complexity to their already overly strained workload. Open dialogue with the end-users provides excellent feedback for opportunities to exploit the technology. So in the end, the campus was ready for the changes.
Goals of R’Summer

The main goals of R’Summer are the following:

- Achieve accurate, timely and efficient business administrative processes. Provide better service to students, academic, and administrative units during the summer (e.g. reduced time to process and approve new, and changes to, courses/appointments/schedules/academic actions, etc.).
- Improve communications regarding the summer term to students, academic, and administrative units (e.g. consistent single source of core information that is generally available instead of being manually distributed individually as needed from SSA, enabling the immediate dissemination of changes to course schedules/locations/cancellations, etc).
- Operate business in highly “green” manner - paperless.
- Precisely tracks and logs each business process, activity, and communication between parties.
- Streamlines every part of Summer Session administration processes across UCR campus
  - Simplifies proposals and settlements with academic departments, instructors, and supporting staff
  - Synchronize UCR’s payroll system (PPS), student information system (SIS), financial system (PeopleSoft), courses approval system (CRAMS), classroom/space assignment system (SIS/Banner), financial aid system (Banner), and international service system (Visa Validation)
- Success of summer session administration in advancing the UC's fundamental missions, teaching and public services, cost-effectively

Major Features

User Groups and Major Functionalities

The four user groups in the R’Summer are: System Administrator, Summer Session Administrator, Department Manager, and Instructor/TA/Reader/Academic Coordinator/Union Rep/Lab Supervisor etc.

The System Administrator features are:
The *Summer Session Administrator* features are:

- **Instructions**: edit operation instruction for department manager
- **Configuration**
  1. Proposed sessions
  2. Set operation deadlines
  3. Schedule class meeting days and finals
  4. Define the compensation exceptions
- **Validation**: validate courses and appointee submission by academic departments
  1. **Overview**: full list of all courses submissions from department
  2. **Course scheduling**: validate SIS synchronization
  3. **Appointments**
  4. **Deadline extension** (for requested department manager on courses and/or appointment submission)
  5. **Contacts**: department submitted contact info
  6. **Export data to Excel file**
- **Payroll/Appointment**
  1. Manage payroll processes
  2. Validate PPS synchronization
- **Letters**: Send appointment letter electronically
The **Department Manager** features are:

- Instruction: operation manual
- Configuration
  1. Create courses
  2. Create Appointees (i.e. instructor/TA/reader/academic coordinator/…etc)
  3. Create Contacts (i.e. department chair, FAO/MSO, payroll specialist, scheduling ….)
- Submission
  1. Overview: view planned courses and related status
  2. Schedule classes
  3. Assign Appointees
  4. Export data to Excel file
- Assign appointee

The **Instructor** features are:

- Review / accept / deny appointment via electronic signature
- Primary course instructor defines supplemental form requirements for secondary course instructors
- Review / accept / deny supplemental form via electronic signature
- Print appointment letter
Significance of Project

Applying IT for business practices plays an increasingly important role in higher education institutions today. Web technology is especially critical for keeping UC competitive with their peers at other institutions. R'Summer has completely replaced the manual and cumbersome summer sessions business administration processes through automation, demonstrated a successful business practices reengineering model and provided a methodology for supporting University efficient business operation. UCR's summer term is an extremely complicated endeavor, involving most of the campus units, and managed by a minimal staff. Accordingly, the accuracy and timeliness of information, tightly aligned with summer administrative processes, is critical for the large number of students and instructional staff serviced by SSA to have a successful experience.

The R'Summer streamlines SSA's convoluted administrative processes and maximizes the quality and consistency associated with administrative processes. It ensures the accuracy of academic appointments and helps prevent union grievances. It also negates UCR being caught by the union "status quo" MOU clause which locks SSA into any erroneously high pay-rate. And finally, the system emphasizes a proactive administrative system throughout the entire summer term evolution.

Beside significant workload reduction, R'Summer's biggest benefit is the improvement of accuracy and efficiency of the administrative processes. Fundamental to the R’Summer is to improve communications between Summer Sessions and the entire UCR campus by consolidating information and ensuring that critical dates are accurately disseminated and that processes are timely, clear and consistent, which will reduce total campus time spent on problem solving and issue management. It has completely eliminated thousands of the print hard copies of appointment letters and supplemental forms as well as their tracking log that allow administration to operate business in more 'green' manner. R'Summer streamlines every part of summer session administration processes across the campus; simplify settlements with academic departments, instructors, and supporting staff; and synchronize information to university's PPS, SIS), financial system, courses approval system, financial aid system, and international service system. The innovative approaches that utilize and enhance the IT capabilities for supporting business operation through careful planning and technology selection have contributed to the success of SSA in advancing the university's fundamental mission cost-effectively. R’Summer also enables enrollments to be cooperatively managed between SSA and the departments to ensure optimal enrollments in each summer offering.

UCR's summer session student's experience and understanding will improve through consistent information being available by all summer term entities, as well as having targeted deadline dates regularly communicated directly to them. The course cancellation process will become a managed procedure where students are given time to make informed schedule changes—which is expected to increase student retention. In addition, it has been proven that a proactive information campaign will reduce the total number of students seeking administrative adjustments to their schedules—which will reduce the number of students seeking academic signatures.
Results

After the system was initial released for 2011-12 fiscal year, 96% department submitted their courses proposals meeting their operation deadlines comparing with 40% in past years. This more than double improvement demonstrates that R'Summer's simplicity and user friendly feature have achieved high acceptance from users and educated administrative staff to know that they are accountable for their operation. R'Summer keeps them on task. The lessons learned from this ambitious effort will help smooth future R'Summer expansion and other new system developments. R'Summer is a highly efficient and cost-effective real-time innovation that only requires 3 staff to manage about $17.5 million revenue complex administration that offers over 1000 courses and sections for over 9000 students.

R’Sumer provides UCR Summer Sessions through a comprehensive view of summer sessions operation status, and streamlines the tedious and time consuming administrative processes, eliminating a potentially high error rate, and achieving 99.9% paperless “green” goal. R'Summer re-engineered Summer Sessions’ business processes to an easy, convenient, secured, and centralized online system for the UCR community.

Technology Utilized

R'Summer is developed through enhancing Web 2.0 technology capability and Model-View-Controller (MVC) Servlet-centric Architecture to fulfill system requirements. Unified Modeling Language (UML) for data modeling to simplify the interaction with users for system requirements analysis and the implementation of the utilization of multiple-tier distributed end-to-end Java J2EE application framework. Nested multiple Finite Statement Machines (FSM) are used to streamline the business processes management.

We chose multiple-tier distributed end-to-end Java J2EE application framework because of the framework's current capabilities and Oracle's history of expanding and improving the framework's reach. We also wanted a platform with effective software development tools to handle the rapid development and integration with other existing IT solutions and computing infrastructure. To simplify and make easy to stakeholders during the processes of requirements analysis, we adopted UML for modeling to specify, visualize, modify, construct and document use cases. It allows automatic transformation to Java to save significant development time and cost. Dell and Redhat provide a reliable and powerful application server.

Architecture

The R’Summer is architected as multiple-tier distributed end-to-end Java enterprise web application. The R’Summer web application can be divided into four layers of responsibility. These layers are the presentation, persistence, business, and domain model layers. Each layer has a distinct responsibility in the R’Summer application and does not mix functionality with other layers. Each application layer is isolated from other layers, but allows an interface for communication between them as shown below.
The Model-View-Controller (MVC) architectural pattern, widely-used for interactive applications, divides applications into three functional components—model, view, and controller—and decouples their respective responsibilities. Each component handles specific tasks and has specific responsibilities to the other two components. The model encapsulates core functionality and data. The view displays the model information to the user and controls the presentation of that information. The controller handles user input (usually forwarded to it from the view) and defines the application behavior in response to the input.

By applying the MVC architecture to a Java 2 platform, Enterprise Edition J2EE application, we separate core business model functionality from the presentation and control logic that uses this functionality. Such separation allows multiple views to share the same enterprise data model, which makes supporting multiple clients easier to implement, test, and maintain in the R’Summer architecture.
At one end of the R’Sumer application is the presentation layer. The Struts, a MVC implementation that uses servlets and JavaServer Pages (JSP) technology, is responsible for:

- Managing requests and responses for a user.
- Providing a controller to delegate calls to business logic through a service locator with business or service layer and other upstream processes (UI).
- Handling exceptions from other tiers that throw exceptions to a Struts Action.
- Assembling a model that can be presented in a view.
- Performing UI validation.

At the other end of the R’Sumer application is the persistence layer. Hibernate is a powerful, high performance object/relational persistence and query service. The R’Sumer uses Hibernate framework for object-to-relational persistence and query service for Java. Hibernate persistent objects are based on plain-old Java objects and Java collections. The persistent objects java classes, data access objects (DAO) and mapping files can be generated with MyEclipse development Tools through database schemas. The Hibernate is responsible for:

- Querying relational information into objects.
- Saving, updating, and deleting information stored in a database.
- Advanced object-to-relational mapping frameworks have support for most major SQL databases, and they support parent/child relationships.

The middle component of the R’Sumer application is the business or service layer. Spring Framework is the leading full-stack J2EE application framework. The R’Sumer application uses the Spring for the objects to be wired together by a simple XML file that contains references to objects such as the transaction management handler, object factories, service objects that contain business logic, and data access objects. The business (service) layer should be responsible for the following:

- Handling application business logic and business validation
- Managing transactions
- Allowing interfaces for interaction with other layers
- Managing dependencies between business level objects
- Exposing a context to the business layer from the presentation layer to obtain business services
- Managing implementations from the business logic to the persistence layer

The domain object layer consists of objects that represent real-world business objects such as a System Administrator, R’Sumer Administrator, Department Manager and Payroll Processor, Instructor, TA, Reader, Academic Coordinator, Lab Supervisor etc. Hibernate allows you to read database information into an object graph of domain objects, so that we can present it to the UI layer in a disconnected manner. Those objects can be updated and sent back across to the persistence layer and updated within the database.

With the current architecture and implementation model, the R’Sumer can support multiple databases with a plug-table DAO layer and mapping files to connect to the
different database to meet the deferent user need for its enterprise back-end database infrastructures.

**What Sets R’S’Unique**

To manage Summer Sessions’ very complex business rules with dynamic rule change nature, R’S’ has been developed based on newly invented the Interactive Finite State Machines. There are total five interconnected FSMs in R’S’: Class Schedule, Appointment, Appointment Letter, Payroll, and Supplemental Form. Diagram below are examples of Appointment Status State Finite Machine and Class Scheduling State Finite Machine.
There are many complex conditions in courses scheduling and assigning appointees due to a primary courses may have secondary section, and an appointee can have many different roles such as primary course instructor, secondary course instructor, lab supervisor, TA, academic coordinator, or union rep. Those complex conditions will drive the rules of compensation. In addition to regular compensation rules, there are currently 111 compensation exceptions. To manage the complexity and exceptions in payroll, course, instructor and its associated personnel, a Fast Pattern Matching on Grid Algorithm (FPMGA), and an Accurate Hit and Trigger Exceptions Handling (AHTEH) technique were invented. For example, there are 111 exceptions each associated with 37 conditions (i.e. a 111x37 grid) in payroll alone that required to be managed accurately during appointment and payroll calculation. Both FPMGA and AHTEH can accept theoretically unlimited number of exception and conditions. Each exception hit is processed within a virtually unnoticeable response time. See examples of exception trigger below.
**Deploy and Runtime Environments**

The R’Sumer web application can deploy and run on any J2EE complied hardware platforms (Windows, Linux and UNIX) which support J2EE web server (Java Servlets Container such as Apache Tomcat, Oracle AS, IBM WebShpere). The R’Sumer web application and R’Sumer database can deploy and run on the same machine or on the different machines in a distributed way. The authentication for logon can use CAS or R’Sumer internal managed encryption and authentication method.

**Project Timeframe**

The project was initiated in late 2008 and approved in September 2009. The pilot system was released to support the 2012 summer. Two major enhancement releases 1.1 and 1.2 were completed the following 2013 and 2014 summer terms.

**Future Plan**

With UC Path on the way to replace PPS, Banner to replace UCR SIS, and R25 to replace classroom scheduling, R’Sumer is currently only integrated with UCR CAS system. These conditions require that all course and instructor information to be maintained within R’Sumer. When UC Path, Banner, and R25 are fully implemented, R’Sumer will be integrated with these system to further streamlining the business processes to provide a unified access to multiple disparate data sources and synchronize the business processes while maintaining data integrity in a fluid environment. Another plan is to integrate Eclipse BIRT Project based business intelligence capability to make R’Sumer be more intelligent in scheduling and planning.

R’Sumer has been designed to be flexible to adapt to typical summer sessions administration which has potential to be available for other UC summer sessions operations.