SAN FRANCISCO STATE UNIVERSITY

FLORIDA ATLANTIC UNIVERSITY

SOFTWARE ENGINEERING

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INFINITY METRICS

AUTOMATIC COLLABORATION METRICS FOR JAVA.NET PROJECTS

REQUIREMENTS SPECIFICATION MILESTONE 1

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2008-09-28	0.1	Marcello de Sales	Template Creation
2008-09-28	0.2	Marcello de Sales	Modifying template according to specification (See Requirements documentation under Milestone 1 folder at the Directories and Files PPM-8 java.net)
2008-10-04	0.3	Andres Ardila & Marcello de Sales	Adding information on sections 2, 3, 4, 5, 6.
2008-10-16	1.0	Marcello de Sales	Revision with the feedback from Gary Thomson and Prof. Petkovic
2008-10-07	1.1	Andres Ardila	Final Revision: Implemented feedback corrections (java.net capitalization, Use Case syntax), renaming project name (branding on images to be changed on next Milestone documentation).

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EXECUTIVE SUMMARY

Software Engineering is one of the fastest growing fields today's global economy. This rapidly-evolving industry requires educational institutions to adopt innovative changes in their curriculums in order to provide students with the necessary competitive skills and experience required in today's job market. Precisely due to this globalization, more and more companies are developing software in virtual, distributed environments that transcend national boundaries. As a consequence, educational institutions have redesigned their programs to simulate team software development in a controlled environment. This evolution in the pedagogy of Software Engineering, however, presents new challenges to instructors regarding student evaluation. It is therefore of paramount importance to provide instructors with the proper tools to assess team and individual progress, and to assess individual student participation within those teams in these new virtual classroom environments.

In light of these challenges, Infinity Metrics will provide cutting-edge and unique tools to instructors who choose the java.net development platform as part of a Software Engineering class curriculum. Infinity Metrics will allow instructors to monitor the participation of individual students in globally and/or locally distributed java.net group projects as well as the progress of the team as a whole. Infinity Metrics will be an efficient, automated, and user-friendly web application that collects and reports on student participation metrics for such class settings. The application allows an instructor or set of instructors in different locations (i.e. concurrent Software Engineering courses taking place in different universities) to automatically collect participation data for a set of java.net projects and report on its members' contribution to the project at all stages of development. Because Infinity Metrics understands the need for intuitive, easy-to-use software in academia, the initial set-up will automatically generate the metrics categories available for the given projects, whilst allowing instructors to retain full control to modify these settings at any point throughout the semester.

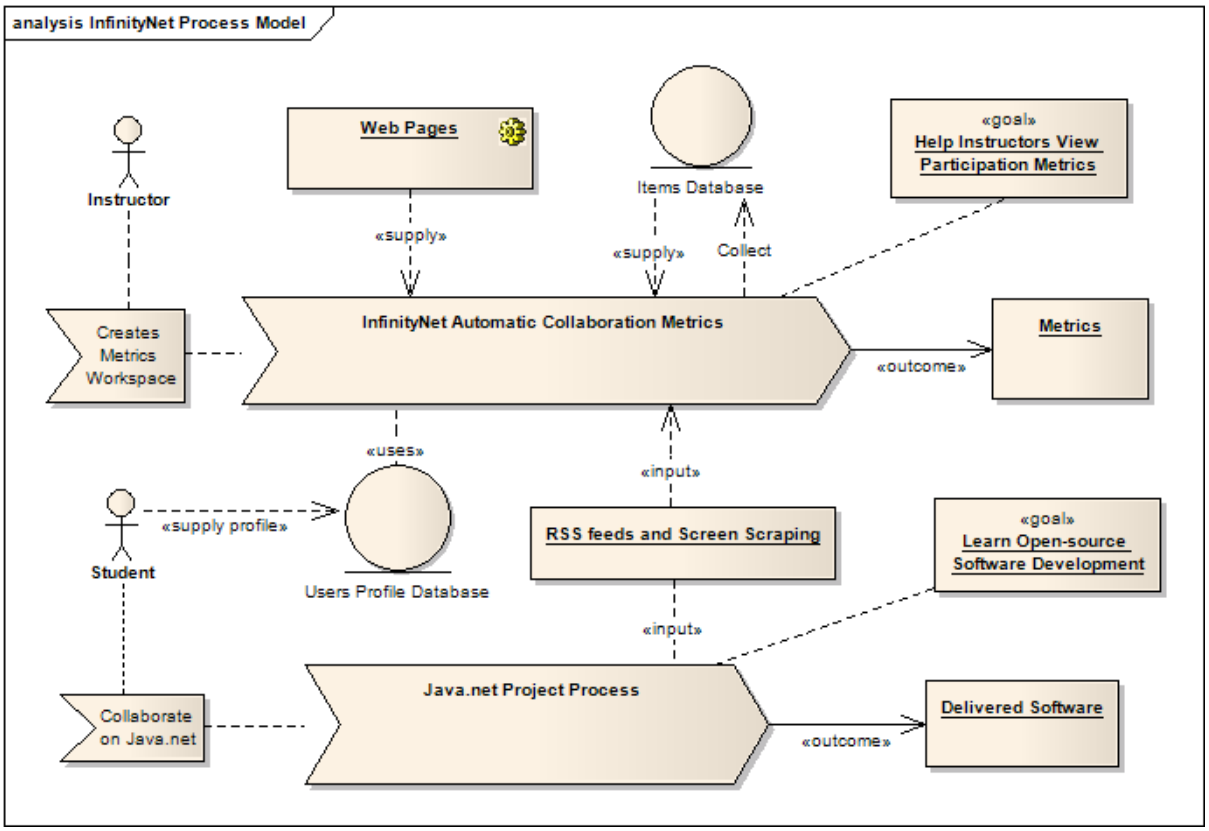
We believe that information is power. That's why our system will provide instructors with the ability to collect and view a wide ranging variety of metrics from java.net projects. It will also provide instructors with insightful information about trends and common difficulties that may arise in the development and learning processes. Our tool's seamless integration with the java.net platform, the valuable data it can extract and present (from granular to global), and its minimal maintenance overhead will allow instructors to focus their efforts in the most important aspect of their task: teaching. Infinity Metrics will thus enable and improve the quality of learning for students by providing instructors with the tools needed to be heavily involved in the progress of the class and its individuals.

1. Business Process

The business process defines the information about the overall project, gathering necessary information about the understanding of the problem to be solved with our system. The business process is described as a high-level understanding of the system requested by Gary Thompson, and the domain vocabulary is described as the team captured both the high-level requirements and in-class information about the system.

As a matter of understanding the idea of the product, the business process model captures the main business activities, focusing on the inputs, outputs, goals and key events that drive the process. The goal of Infinity Metrics is to help instructors view participation metrics while students are learning software development on java.net.

We can describe Infinity Metrics as having two processes: one started by an instructor, and the other by students. Instructors create a configuration Workspace with the list of projects from java.net and participating members, while students provide their initial profile. As students start collaborating on java.net and, as a result, generating RSS feeds and additional information, these metrics are collected and stored by Infinity Metrics. At this point, Infinity Metrics uses web pages to display these metrics in rich and meaningful ways to the instructor.



2. REQUIREMENTS SPECIFICATIONS

This section describes the requirements gathered from the high-level specification documentation provided by Gary Thompson. Additionally, the wiki page for the PPM project was explored. The *Formal Requirements* catalogues the categorized specification for each component to be developed. On the other hand, the *Non-Functional Requirements* section lists generalized specifications. Finally, the *Use Case Model* groups these requirements and associates them the functionalities they fulfill.

As the reader will notice, the functional and non-functional requirements are specified by means of *User Stories*, following the formal conventions and best practices of the Agile Development community, where the stories remind us of a conversation with the client.

2.1. FORMAL REQUIREMENTS

Metrics Workspace	
ID	**Description**
US014	Instructors shall be able to manually add customized group interaction Events (disputes).
US015	Instructors shall be able to set up a Project Metrics Configuration Workspace.
US017	Instructors shall be able to share a Configuration with peer instructors.
US018	Instructors shall be able to filter the students their institution on a given Configuration.
US019	Instructors shall be able to list the java.net username of each group member on a given Configuration.
US022	Instructors shall be able to see each student's profile, with their Real Name, Student ID, Group Number, if he/she is a team leader, etc.
US023	Instructors shall be able to send emails to a given Project alerting about students who haven't completed their profile information.
US024	Instructors shall be able to add, remove and modify a Configuration throughout the configuration life-cycle.
US043	Instructors shall be able browse for projects in a given Configuration.
US044	Instructors shall be able to browse for Event categories in a given Configuration.
US045	Instructors shall be able to search for projects in a Configuration.
US046	Instructors shall be able to search for categories in a Configuration.
US050	Instructors shall be able to add the list of team members to each of the projects on a Configuration.
US051	Instructors shall be able to import the list of team members from a delimited file into a Configuration.
US053	Instructors shall be able to see the top 5 Projects based on participation by the sum on categories or each of them.
US058	Instructors shall be able to pause or make inactive the Metrics Workspace.

Metrics Report	
ID	**Description**
US002	Instructors shall be able to track the Event of Code Repository.
US003	Instructors shall be able to track the Event of Tracking System.
US004	Instructors shall be able to track the Event of Emails sent to the available Mailing Lists.
US005	Instructors shall be able to track the Event of Posts sent to Discussion Forums.
US006	Instructors shall be able to track the Event of Documentation.

US007	Instructors shall be able to track the Event of Disputes or others by the teams.
US010	Instructors shall be able to monitor events.
US011	Instructors shall be able to view the Events by groups.
US012	Instructors shall be able to analyze Events from the groups by their event category.
US016	Instructors shall be able to create a Report for a Metrics Configuration.
US025	Instructors shall be able to view Reports in a tabular format.
US026	Instructors shall be able to view Reports in a graphical format.
US027	Instructors shall be able to export Reports to flat text files in delimited format.
US031	Instructors shall be able to read a Report comparing all the projects in a Configuration in a tabular way.
US032	Instructors shall be able to read a Report for a single project in a tabular format for all the event categories.
US033	Instructors shall be able to read the Report for a single Event category for a given Configuration Workspace.
US034	Instructors shall be able to read the Report comparing all the projects in a Configuration in a graphical format.
US035	Instructors shall be able to read the Report for a single project in a graphical format.
US036	Instructors shall be able to read the Report on a single event category in graphs for the groups on a Configuration.

User Management	
ID	**Description**
US020	Users shall be able to identify themselves into the system by using their java.net username and password.
US021	Instructors shall be able to see the students' real name on the reports.
US039	Instructors shall be able to login into the system with my username and password created in the registration.
US052	Instructors shall be able to view their account detail.
US054	Instructors shall be able to have the student to associate his username from java.net with his Real Name, Student ID, School he/she belong to, the group he/she belong to, so that I will know who he/she is.
US055	Users shall be able to retrieve their lost/forgotten password by email or web browser.
US059	Users shall be able to change their profile information, but not their username.
US060	Users shall be able to receive an email after registering on the website.
US063	Students, who are team leaders, shall be able to identify their team members by giving their java.net usernames.
US064	The system shall send an email to the team's dev mailing list with instructions (URL)

Personal Agent	
ID	**Description**
US047	Instructors shall be able to have their Personal Agent to use their java.net username and password to parse and extract the RSS feeds from each project mailing list.
US048	Instructors shall be able to see the students' login activities such as number of visits to java.net and the last time he logged in.
US049	Instructors shall be able to have their personal agent to go to the parent project and load the project names for a new configuration.
US057	Instructors shall be able to have their personal agent to verify the summary of the RSS posts on a given project has been changed.
US062	Users shall not be able to use a different username and password from java.net.

2.2. Non-Functional Requirements

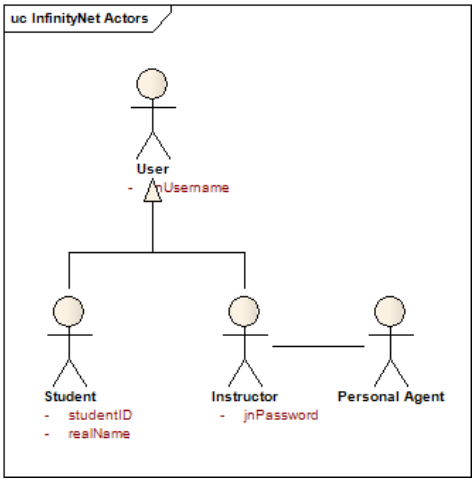
General Application	
ID	**Description**
US001	Instructors shall be able to access to the system using a web browser.
US008	The system shall be able to collect events' data automatically from java.net.
US009	The system shall be able to store **relevant parts** of the RSS feeds collected on a database.
US013	The system shall be targeted to java.net collaborative platform.
US028	Instructors shall be able to use the system without any additional training.
US029	The system shall not require users to have knowledge of web application development or database systems.
US030	The system shall be able to be accessed efficiently on high-speed Internet connections.
US038	The system shall be able to encrypt the user's username and password.
US040	The system shall offer users online help.
US041	The system shall respond to queries in less than 3 seconds.
US042	The system shall offer users a secure connection through SSL.
US061	The system shall verify the students' identity through java.net.

2.3. Use Case Diagrams

This section describes the use case diagrams for Infinity Metrics. It represents the fulfillment of each of the User Stories into the components as a given functionality. First, each actor is described and shown in the *Actors* UML diagram, and the following sections describe the use cases for each component listed in the *Requirements* section: Users Management is responsible for the management of users and their profiles; Metrics Workspace is the area used by the instructors to create the metrics configuration, and finally, the Personal Agent API is the set of functions that the instructor's Personal Agent will perform on his/her behalf.

2.3.1. Actors

User	This is the regular user of the website. It can make login using username and password.
Instructor	Instructors are the java.net users who create the metrics. They will be providing java.net username and password to be able to navigate through the private projects.
Student	Students will just fill out forms about their personal information, institution and group.
Personal Agent	The instructor's personal agent is in the form of a web crawler that represents the instructor and virtually navigates java.net to collect information.



2.3.2. User Management

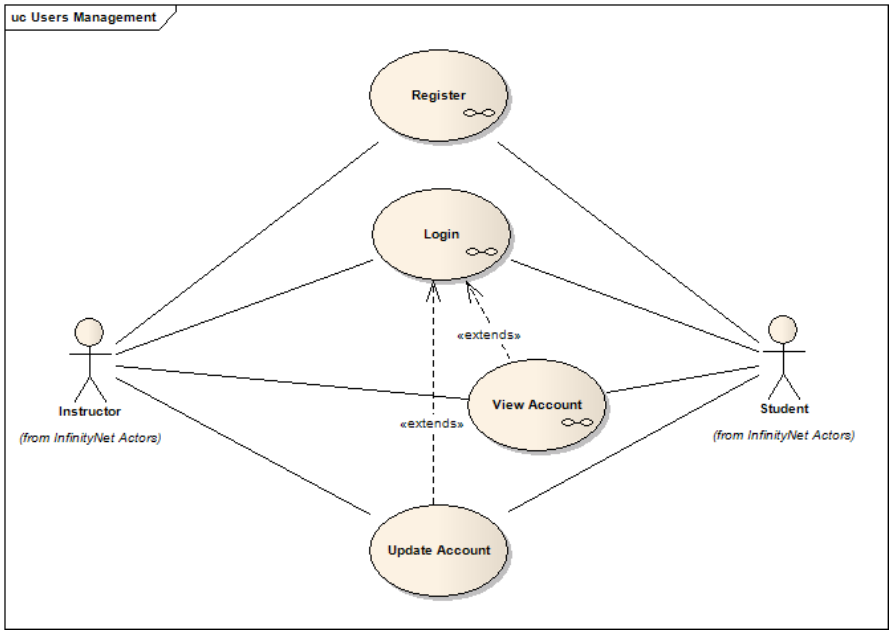
The User Management component expresses to how the main actors of Infinity Metrics will use the system to create an account, register into the system and modify their information. This component is the first section of Infinity Metrics available to the customers.

UC001	Register
Description	An Instructor or Student registers into the system.
Requirement Traceability	US020, US037, US038, US054, US001, US028, US038

UC002	Login
Description	An Instructor or Student logs in into the system.
Requirement Traceability	US020, US039, US001, US060, US001, US028

UC003	View Account
Description	An Instructor or Student views his/her user information.
Dependency	UC002
Requirement Traceability	US052, US001, US028

UC004	Update Account
Description	An Instructor or Student updates his/her account information.
Dependency	UC002
Requirement Traceability	US021, US058, US001, US028



2.3.3. METRICS WORKSPACE

Metrics Workspace component is responsible for the metrics management by the instructors. It includes regular activities such as create new Metrics Workspace, view metrics for a given Workspace, view metrics for a given project in a Workspace, and export the metrics Workspace.

UC005	Create Metrics Workspace
Description	The instructor creates a new metrics workspace for a given set of projects already registered on java.net, identifying it by a name (term name).
Dependency	UC002
Requirement Traceability	US015

UC006	View Workspace Metrics
Description	The instructor views the metrics for the set of projects of a given workspace by choosing the name of a configuration.
Dependency	UC002
Requirement Traceability	US002, US003, US004, US005, US006, US007, US010, US011, US012, US025, US026, US031, US032, US033, US034, US035, US036, US008, US009, US013, US047, US057

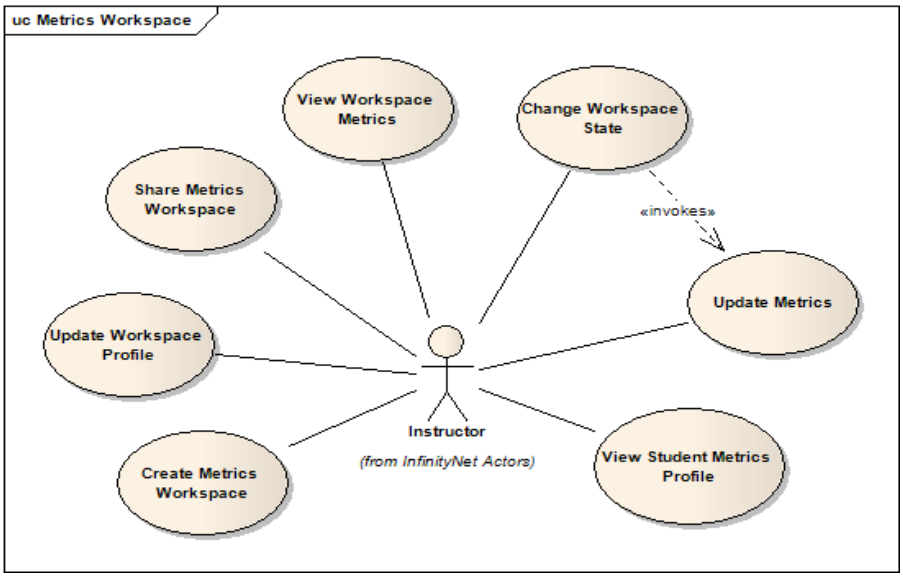
UC007	Update Workspace Profile
Description	The instructor updates any information on a given workspace such as adding or removing projects on the workspace, renaming the workspace, etc.
Dependency	UC006
Requirement Traceability	US014**,** US024

UC008	Share Metrics Workspace
Description	The instructor shares the metrics workspace with another instructor by sending him/her an invitation.
Dependency	UC006
Requirement Traceability	US017

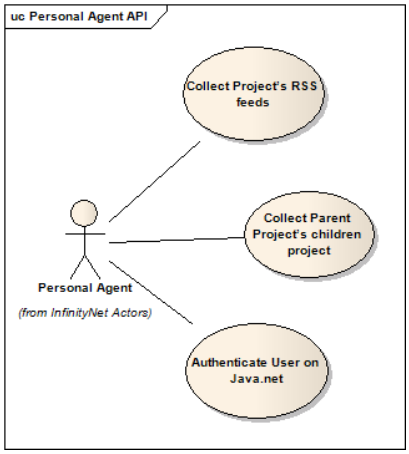
UC009	View Student Metrics Profile
Description	The instructor views the metrics from a given student in a given workspace. This includes his real name and the number of participation on all the event categories.
Dependency	UC006
Requirement Traceability	US022, US21, US054

UC010	Update Metrics
Description	The instructor updates information on a given workspace.
Dependency	UC006
Requirement Traceability	US007, US014, US050, US051

UC011	Change Workspace State
Description	The instructor changes the workspace state.
Dependency	UC006
Requirement Traceability	US058



2.3.4. Personal Agent API



The personal agent API will be responsible for the collection of data from java.net. The personal agent will represent the Instructor on the web, and will be navigating java.net him/her, using his/her personal username and password.

For most of the functionalities that depends on java.net, personal agents can be used to ensure that the data is valid. For example, if different students can hack the system by registering their username as someone else. In order to prevent such malicious activities, the personal agent will always verify the java.net related information.

UC012	Collect Project's RSS feeds
Description	The instructor's personal agent logs into a given project and collects RSS data feeds from all the available events such as mailing lists and forums.
Requirement Traceability	US002, US003, US004, US005, US006, US007, US008, US010, US047, US057

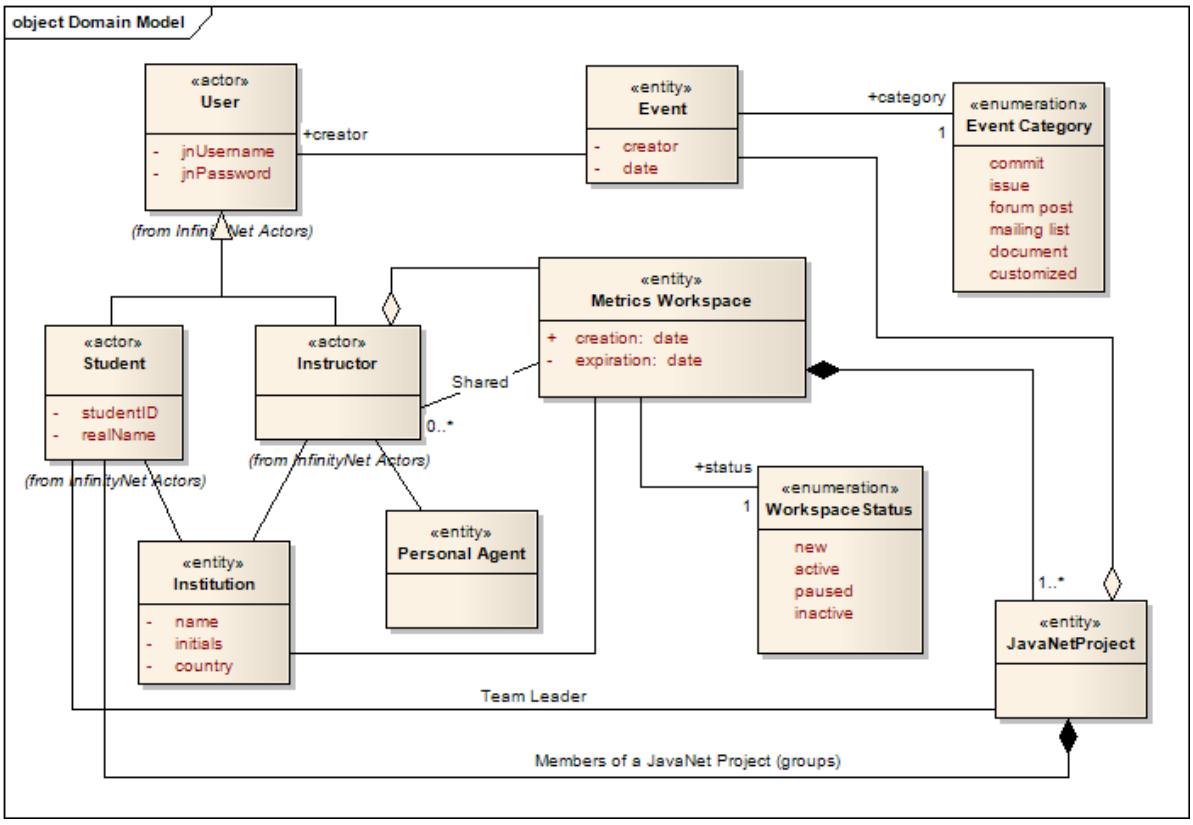
UC013	Collect Parent Project's children project
Description	While creating a new Workspace Profile, the instructor's personal agent logs into the given java.net parent project and collects the names of all children projects.
Requirement Traceability	US015, US049

UC014	Verify User Identity through java.net
Description	While creating a new user on the system, the personal agent can use the java.net username and password from the user to authenticate him/her on java.net.
Requirement Traceability	US061

2.4. DOMAIN VOCABULARY

The Domain Model defines a consistent, common vocabulary across a project. After analyzing the requirements and use cases, the entities and their relationships are defined below. The domain vocabulary can be thought of as the first abstraction of the high-level class diagram.

User	Derived from the Actors, a user has the username and password from java.net. It will be used by the specialized users Instructor and Student for identity verification.
Student	Students play a secondary role on Infinity Metrics where he/she just fills out the participation form with his/her personal information. Also, he can be identified as a team leader in any java.net project and is always tied to a given institution.
Instructor	Instructors are aggregated by their Metrics Workspaces for different terms on a given institution. They also can participate on the ownership of a given Workspace.
Personal Agent	The instructor's personal agent is the internet crawler that uses the professor's username and password to navigate through java.net on his/her behalf in order to get metrics information and find out more about the projects.
Metrics Workspace	The Metrics Workspace is composed by a set of java.net projects names and it can assume different states during the metrics workspace life-cycle.
java.net Project	The java.net project space name that will be tracked. It is composed of a set of java.net usernames in the form of the student names.
Event	Each item on a java.net project RSS feed is called an Event. Each event is part an event category such as the commit message, an issue, and a topic posted in a discussion forum or an email sent to a given mailing list. Finally, it contains a reference to the creator of the item, who can be a student or a professor. It can also refer to a given entry by the instructor. This information is associated with the java.net username used in the RSS 'creator' tag.
Event Category	This is an enumeration of the types of events, or from which category the RSS item originated. It will be associated with each event and will also include the customized values of events such as disputes on the team.
Workspace Status	It is associated with the Metrics Workspace. Active is defined by default when the instructor creates the workspace environment. In that way, the instructor can tell his Personal Agent to collect metrics online.


object Domain Model
«actor»
User
- jnUsername
- jnPassword
(from InfinityNet Actors)
+creator
«entity»
Event
- creator
- date
+category
1
«enumeration»
Event Category
commit
issue
forum post
mailing list
document
customized
«entity»
Metrics Workspace
+ creation: date
- expiration: date
«actor»
Student
- studentID
- realName
(from InfinityNet Actors)
«actor»
Instructor
(from InfinityNet Actors)
Shared
0..*
+status
1
«enumeration»
Workspace Status
new
active
paused
inactive
«entity»
Institution
- name
- initials
- country
«entity»
Personal Agent
1..*
«entity»
JavaNetProject
Team Leader
Members of a JavaNet Project (groups)

3. User Interfaces — Mock-ups

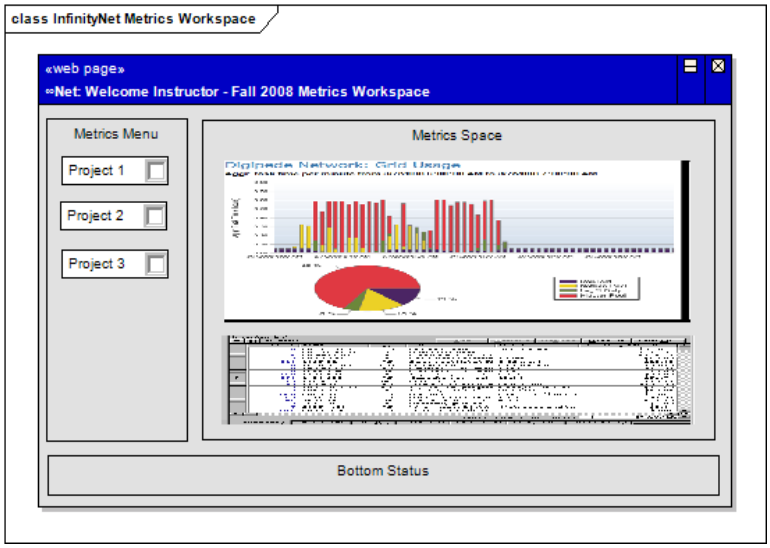
As user interfaces goes, Infinity Metrics will provide the regular registration forms and login forms as any other web application, containing their own set of required field for the type of user: instructor or students. However, the most important aspect of the application is the instructor's metrics workspace.

3.1. Metrics Workspace

The Metrics workspace consists of the top bar, a left-side navigation menu and the main area in the center of the screen.

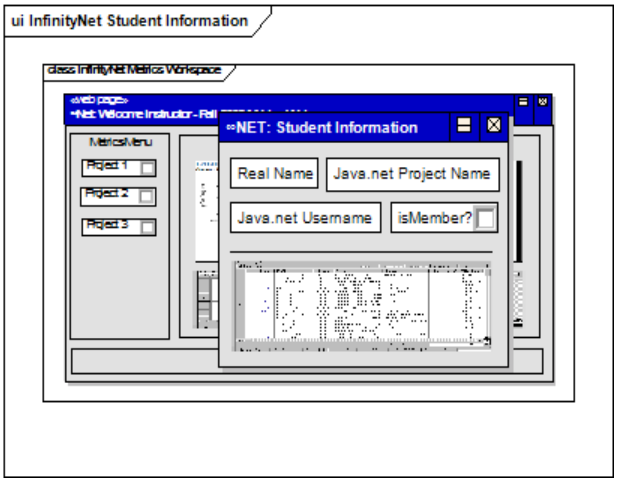
The top bar contains the instructor's name, the name of the current workspace being viewed and the name of other instructors with whom the Workspace is shared.

The left-side navigation menu lists projects contained in the current Metrics Workspace, as well as general related functional items such as edit list, download events data file, search student, etc.



Finally, the center are contains the metrics in tabular and the graphical representation, from the aggregated events data for the general set of projects. When one of the projects is clicked from the left-side navigation, the tabular data and graphical representation are changed accordingly.

3.2. Student information for Instructors



When the instructor clicks on a given student, he/she is shown the students' participation metrics in the current workspace metrics opened. Note that the information displayed shows his participation in the project only. It shows his list of team members and which one is the team leader. Also, it shows statistical information about the overall performance in the current project on the workspace for all the configured event categories such as commits to repository, participation on issues and posts on discussion forums.

4. High-level System Architecture

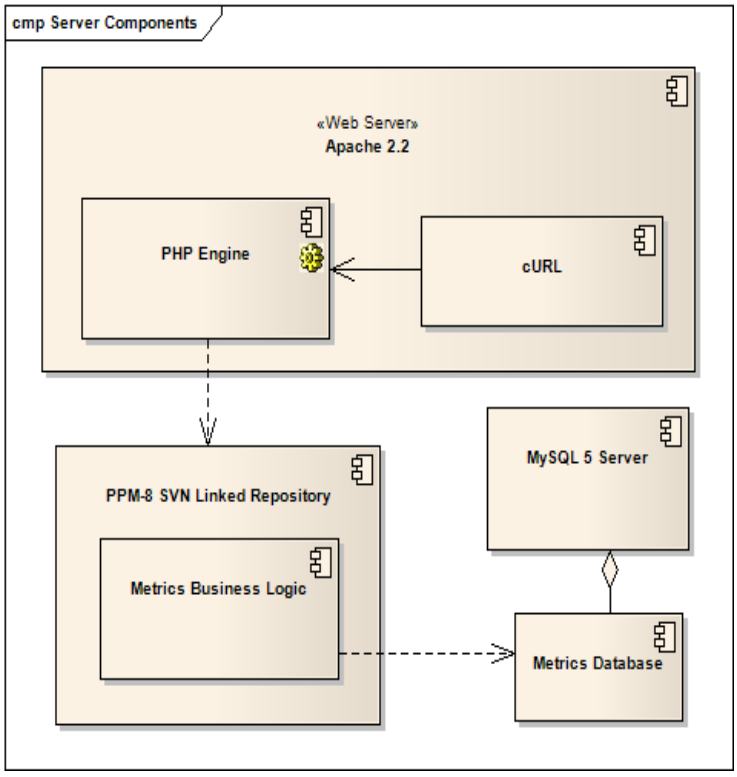
4.1. Web Server and Web technology

The font-end of the Infinity Metrics implementation consists of an extensive User Interface, constructed mainly in PHP and perhaps Ajax. Infinity Metrics will be redesigning and expanding on the core functionality of the StatsWidgets Project, and in doing so, will work to bring this functionality up-to-date with current technology by implementing a well-constructed, web-based user interface along with its back-end crawler. In order to offer most of the features planned, the server will feature an Apache Web Server, along with additional PHP modules. The most important additional module is called cURL, which can be used as an HTTP client.

As for the PHP source-code, it will be deployed to the SFSU T-2000 server using Subversion infrastructure during the development process. In this way, a given revision **must** be tested and selected to be deployed. This revision includes the core components for the Metrics Business logic, with the intent to make use of additional PHP frameworks.

4.2. Database Server

In order to overcome the short-comings of RSS feeds where older data drops as new data is acquired, the back-bone of Infinity Metrics system will contain a MySQL database for information storage. In this way, the metrics data will be categorized in a meaningful way to be later retrieved. The MySQL server consists of the version 5, and will use advanced stored procedures and triggers during implementation.



At the end of a given semester, or upon project completion, the data that was collected and stored will not be discarded. This will allow instructors not only to maintain access over the project life-cycle and eventual project completion, but into the future, where analysis and comparisons can be made between different Workspace Configurations in order to infer trends or the effects of changes in the structure of the course by student participation and progress in the projects.

5. COMPETITIVE ANALYSIS

Despite its potential wide-ranging applications, research on the automation of collecting participation metrics of java.net projects by the community at large has yielded little significant results. In fact, GlassFish, one of the largest and most widely used projects on java.net[1] has no automated participation metrics system[2]. While StatsWidgets provides the limited functionality of outputting delimited text files of a given RSS feed (or a set of them) from public and/or private projects, this implementation provides little usability for the intended audience of our system because it would require instructors to set up, configure and maintain a database to handle the output files generated by StatsWidgets. Since the requirements explicitly state that users should have no such prior knowledge of database systems, StatsWidgets proves inadequate in this regard. In addition, not all metrics generated by a project are traceable using RSS, and so the need for a tool that will collect metrics on these non-RSS participation metrics is essential. We aim to automate not only the retrieval of the RSS feeds, but the storage in a database that will enable presentation in rich and meaningful ways to the instructor.

Notwithstanding StatsWidgets' differing intended audience, the similarity of its core functionality makes it a competitor to our system. Following is a side-by-side architectural and functional comparison of the two systems.

Competitive Analysis – Financial and Technical					
Product	**Open-Source**	**Cost**	**Platform**	**Persistence**	**Modules**
∞Metrics	Yes	Free	PHP 5.2	MySQL	PHP, cURL
StatsWidgets	Yes	Free	JDK 2	Text Files	Kosuke Scraper

Competitive Analysis – Functional		
Functionality	**∞Metrics**	**StatsWidgets**
Provides Metrics for Public projects	✓	✓
Provides Metrics for Private Projects	✓	✓
Store Metrics in a Database System	✓	
Provides Web Interface for Users	✓	
Provides Tabular Data to Users	✓	✓
Provides Graphical Data to Users	✓	
Export Delimited Data	✓	✓
Saves Configuration	✓	

[1] http://community.java.net/projects/top.csp

[2] http://wiki.glassfish.java.net/Wiki.jsp?page=CommunityStatistics

6. RESOURCES ALLOCATION

Since the team will be following an Agile/Scrum process, the team will be cross-functional, with all the members being developers, and the team leaders as product owner. More detail is presented in the following table, as well as the roles each of us will be playing in the team.

Team Member	Role
Marcello de Sales	Team Leader, Scrum Master, Product Owner, Cross-functional Developer
Andres Ardila	Product Owner, Cross-functional Developer
Brett Fisher	Cross-functional Developer
Gurdeep Singh	Cross-functional Developer
Marilyne Mendolla	Cross-functional Developer
Mateo Mejia	Cross-functional Developer