

# Final Report IPRO 338, Fall 2004

Implementing a Knowledge Management  
*Sponsor: Topiary Communications*



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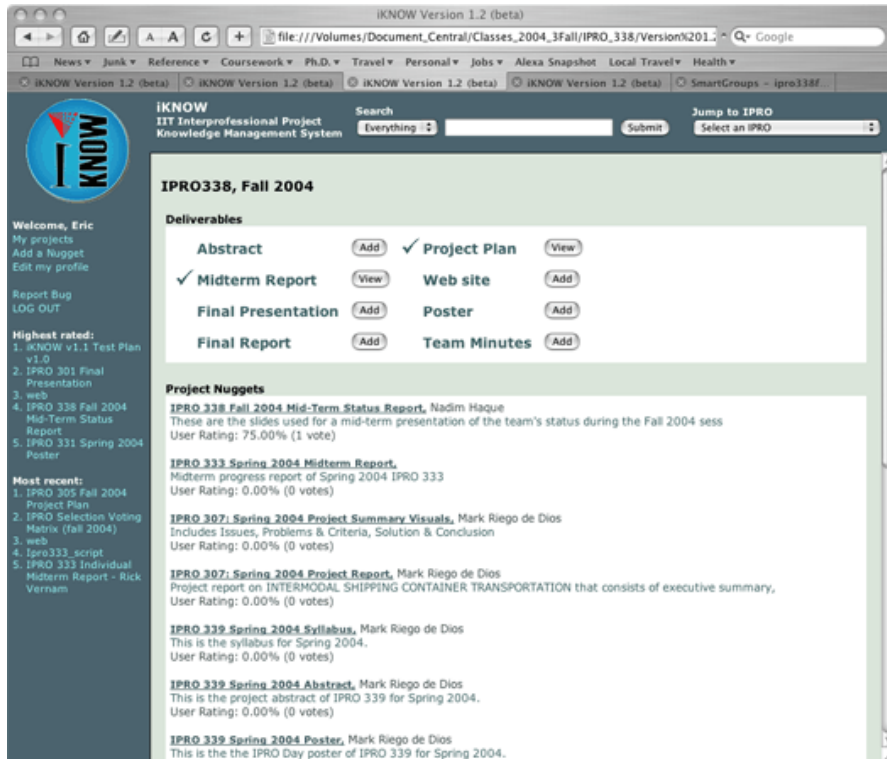
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## Abstract :: IPRO 338 :: Building a Knowledge Management System.

## Background and history:

Imagine a workplace where 80% of the employees leave every 17 weeks, and are replaced by people who have no idea what the project is, have no access to old documents from the project, and are just starting to learn how to do their job. This is the plight of the continuing IPRO.

iPRO 338's iKNOW Knowledge Management System solves these problems by:



- Allowing students to store and retrieve key documents from all previous semesters;
- Providing self-training applications for key IPRO skills such as project management and presentations;
- Recording the experts used for each project and enabling students to locate them by their expertise.

Started in Fall, 2003, IPRO 338's set out to create an IPRO KMS (Knowledge Management System) to resolve these issues.

The resulting KMS, iKNOW, includes document storage and management capabilities, extensive searching capabilities (including searching within documents in common file formats), and cross-semester and cross-project document access.

To provide self-training applications, and to extend the capabilities of knowledge management within iKNOW, IPRO 338 has been working extensively with its outside sponsor, Topiary Communications, LLC. Topiary has created the Personal Pro

knowledge capture tool, which enables subject matter experts to create web-based applications to transfer their knowledge.

Beyond initial iKNOW rollout, Topiary and IPRO 338 are exploring a fully integrated combination of Personal Pro and

iKNOW as a platform for knowledge management within corporations and large-scale organizations.

**Fall 2004 Goal:** To develop the first release version of the iKNOW KMS software, and prepare for a Spring 2005 release.

## Subteam Organization/Tasks:

Completing iKNOW team: Stabilize existing beta version of software through fixing of bugs and addition of necessary functionality

Expanding iKNOW team: Determine functionality for future versions of the iKNOW system. Developing roadmap for integration with Topiary product

iKNOW Roll-out team: Determine roll-out process; load existing content to ensure release version is already populated.

iKNOW Testing team: Run functional, performance and user tests and interpret results

## Problems faced this semester:

Technical:

- Several existing bugs needed repair; more functionality missing than anticipated. > 20 bugs identified and corrected.
- Hardware on which to run beta system had repeated memory failures, compounding testing of search functionality;
- Performance testing software difficult to obtain affordably;
- Integration of differing architectures between iKNOW and PersonalPro.

Non-technical:

- Difficult to gather information to describe individual documents clearly in roll-out database

## Results/Accomplishments:

The iKNOW KMS is ready for release to the IPRO teams. Documents have been added from continuing IPRO projects from Fall 2003 and Spring and Summer 2004. All major bugs identified at the beginning of Fall 2004 have been addressed. New functionality has been added, including: Searching within common document types (Microsoft Word, Excel, Powerpoint and PDFs), searching by data types and integration with PersonalPro applications. Ten hours of direct user tests have been completed, leading to significant interface revisions and refinements.

## Future:

Rollout of iKNOW will begin in Spring 2005, with a pilot release targeting continuing IPROs. A full release will begin in Fall Semester of 2005. The fall 2005 release will include a significant visual revision, including such features as browsing functionality, boolean searches, and a web services interface for external software system.

**Sponsors:** Topiary Communications Inc., CEO Dan Schramm; IIT Collaboratory for Professional Studies

**Advisors:** Professor Daniel Ferguson, Professor David Grossman

**Team Members:**

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Testing Atif Khan 4 <sup>th</sup> year CPE \ PersonalPro \ Testing	Eric Swanson Ph.D. Design \ User Experience \ Testing
Mark Riego de Dios 3 <sup>rd</sup> year CPE \ Roll-out	Ryan Hochstetler 4 <sup>th</sup> year CPE \ Project technical consultant
Adam Jenkins 4 <sup>th</sup> year CS \ Coding \ Testing Lead	Vance Thornton 4 <sup>th</sup> year CS \ Extending iKNOW \ Ppro

## The iKNOW Project

**Objectives.** IPRO 338 attempted to continue, in Fall 2004, the work done by three previous incarnations. Specifically, this meant completing the design of iKNOW, which existed in largely inoperable form at the beginning of the Fall 2004 semester. The team completed iKNOW functional requirements and extended the functionality by way of implementing a full-text search and upload capability of PersonalPro self-help websites. Additionally, the team made an effort to guarantee a smooth and effective roll-out of the software by preparing an initial set of data to reside in iKNOW’s database and producing training and marketing materials and produced a teamwork self-help website.

**Project Methods.** The IPRO 338 team based its development efforts for iKNOW on the functional requirements set down during Spring and Summer 2004 and created new functional requirements for iKNOW v1.2. For testing, several plans for functional, performance and usability testing were created. The team also created a roll-out plan to assign and coordinate work towards advertising and training for the system and collaborated with IPRO 339 to assemble a body of knowledge for teamwork.

**Project Timeline.** The initial project timeline—which is almost accurate even today—is shown in Figure 1.

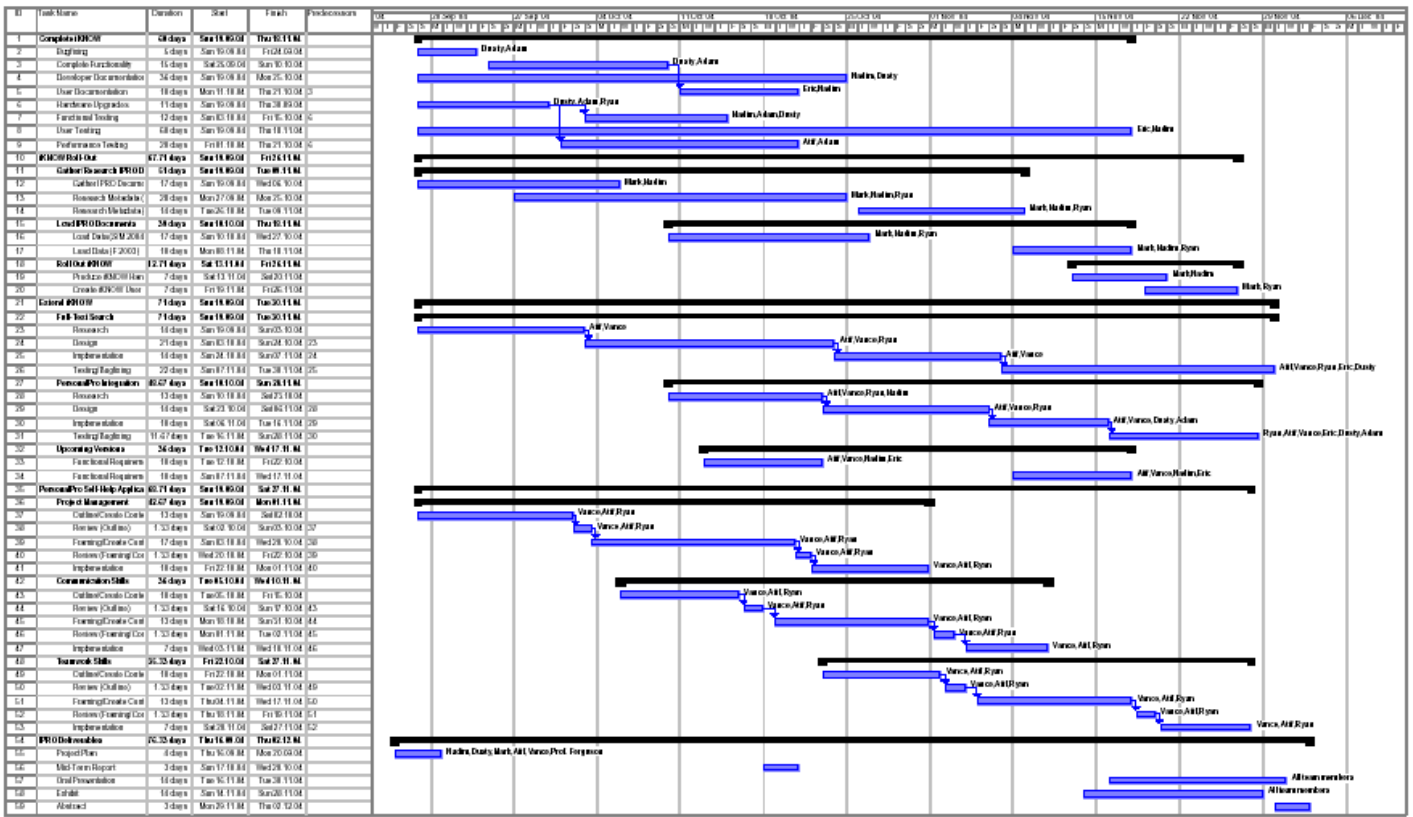


Figure 1. Project Timeline for IPRO 338 Fall 2004.

**Budget.** IPRO 338 spent approximately \$650 to assemble a new server for iKNOW operations.

**Conclusion.** IPRO 338 accomplished all of its intended tasks except for implementing project planning and communications self-help websites.

## Completing iKnow

IPRO 338 Fall 2004

By Dusty Hendrickson

## Objectives

The goals of the completion team were to finalize a stable version of iKNOW (version 1.0). Eventually, the completion continued on to the development of version 1.1 and 1.2. On top of this, testing was planned for each release. There were several tasks to be completed. First, bugs and missing functionality had to be implemented. From there, 3 forms of testing were completed. The first was functional testing. This involved testing the overall functional requirements of the system to make sure it functioned properly and complied with the iKNOW specifications. The second test was performance testing. This involved testing with 20 simultaneous users to make sure the iKNOW server could handle the work load. The final testing that was completed was usability testing. Five people volunteered to test and use iKNOW and from this the team was able to determine usability information about the system from a users point of view.

## Methods

### Corrected the following bugs:

1. Fix rating system to 0% - 100% scale.
2. Highlight primary author of a nugget.
3. Fix edit nugget function save data is saved.
4. "Edit Nugget" button does not exist in Nugget View page.
5. Counter in Search Results page show "1-25 out of xxx results" even if less than 25 results were returned.
6. Search Results page prepends "Person can indeed view nugget..." to page contents.
7. In user dashboard, when attempting at add Midterm Report, the nugget creation page does not display Midterm Report
8. Store databases with a secure hash instead of plain text.
9. When an abstract is added to a project, the user dashboard still displays "Add" instead of "View"
10. When editing a nugget, and then choosing to add a new nugget, the fields are prepopulated with the edited nuggets information.
11. Search for "338", goto second page of results and prints "Viewing results 26-50 out of 33"
12. Not logged in, at page <http://iknow.iit.edu/~henddus/iKNOW/projectView.php?iProjectID=12&iSemesterID=13>, tried to select semester but query failed.

### Completed the following functional Requirements

1. View Expert Page
  - a. Contains information about an expert.
2. Improve "Add Expert" feature in Nugget Creation Process page 2.
  - a. Allow selection of an already existing expert from drop-down box or enter new expert name in text box.
  - b. Implement auto-completion of location and interests fields once an expert has been selected.
3. Browse by category page
  - a. Get to this page from a View Nugget page by clicking on a category name.
4. Change Member Password page.
5. Top 5-rate nuggets box
  - a. Direct links to actual nuggets.
6. Edit Profile page
7. Advanced Search page functionality.
8. Admin Functions
  - a. Add new project
    - I. Enter project name, IPRO number, and select semester.
    - II. Associate with users, categories, and access groups.
  - b. Add new users
    - I. Enter username and password.
  - c. View/Edit project
    - I. List project name, IPRO number, and semester.
    - II. Show access group.
    - III. List members
    - IV. List categories
    - V. List nuggets
    - VI. With each of the above items, include an "Edit" button that leads to a Change This And That page
    - VII. (i.e. associate users with project, associate category with project, etc.)
  - d. View/Edit Nuggets
    - I. Add or edit existing nuggets as an administrator.

9. AIRE Search Engine Integration
  - a. Full Text search of Word, Excel, PowerPoint, PDF, HTML, and text files.

### **Constructed New Server:**

- Athalon XP 2200
- Biostar/Ampttron M7NCD Motherboard
- nVidia TNT2 AGP Video Card
- LG 48x CDROM
- Highpoint RocketRaid 454 RAID Controller
- 3 80 GB Seagate Hard Drives
- Black ATX Case with 450 Watt Power Supply
- Software
  - Redhat Linux 9.0
  - MySQL 3.23
  - PHP 4.3.9
  - Apache 1.3
  - X Windows
  - Java 1.4 SDK
  - Jarkarta Tomcat 5.0
    - AIRE Search Servlet

### **Testing**

1. Functional Testing
  - a. Overall testing of the system requirements and functionality.
2. Performance Testing
  - a. Tested with 20 simultaneous users to assure the iKNOW server could handle the work load.
3. Usability Testing
  - a. Users were exposed to the system and provided feedback on the interface and general usability of the system.

### **Timeline**

Originally, version 1.0 was to be completed by fall break, and version 1.1 would be implemented afterwards. However, version 1.0 and version 1.1 development occurred concurrently and thus both were finished prior to fall break. Partial testing was originally planned to take place before fall break as well. However, with the dual development of version 1.0 and 1.1, the team decided it would be more feasible to test a finalized version 1.1 after fall break. The first week of November was spent doing functional and performance testing, while the next 2-3 weeks were spent doing usability testing. While testing was in progress, work began on a new version, 1.2. This version would ultimately add more functionality to 1.1 as well as included interface modifications deemed necessary after the completion of usability testing.

### **Conclusion**

#### **Completed the following versions of iKNOW:**

1. Version 1.0
  - a. Completed from v0.9 beta, which was produced in the summer. This version of iKNOW satisfies the basic requirements laid out in previous semesters. All functionality in the framework is completed, including expert and category browsing, nugget editing, top 5 nuggets and newest 5 nuggets, and an administrative system to allow management of

users, projects, nuggets, and experts. Testing of v1.0 was done at the same time as v1.1. (CVS tag: v1-0-beta)

2. Version 1.1

- a. Completed from v1.0. This version added only one feature to iKNOW, a full text search. This allowed the system to search through several different file formats, including Word, Excel, PowerPoint, PDF, HTML, and text. Full text search was achieved by integrating the IIT Information Retrieval Lab's AIRE (Advanced Information Retrieval Engine) Search Engine with iKNOW. This was done by running AIRE as a Java Servlet on the Tomcat Application Server. Extensive functional testing was performed on this version. Also, a series of usability tests were also performed for user feedback. (CVS tags: v1-1 and v1-1-beta).

3. Version 1.2 Beta

- a. Completed from v1.1. This version was finished at the end of the semester. It included a number of enhancements including a new interface, event logging, enhanced 'AND' and phrase searching, improved expert selection, and a help page. Testing was done in the last week of the semester and may carry over into break. This will be the version used for IPRO testing next spring. (CVS tag: v1-2-beta)

**Obstacles:**

1. It took some time for the coding team to completely understand the organization of the system and the database schema.
2. Few members on the team had experience with PHP and database programming.
3. It was hard to find a time to meet when group work could be done.
4. Hardware was insufficient to adequately support the AIRE search engine, and required a server upgrade.

**Tasks to be completed in the spring:**

1. Advanced search page.
  - a. Allow the user to choose how and what to search through and advanced search interface.
2. Improved Administrative System
  - a. Correct Project Management page to properly associate descriptions with semesters.
  - b. Add statistics reporting page.
  - c. Add bulk user import.
  - d. Correct nugget system so that administrator can pretend to be any user.
3. Improve user interface
  - a. Make functionality more easily accessible, without having to jump from page to page.
  - b. Add more graphics to make site visual appealing.
4. Correct expert database structure
  - a. Decompose the expertise and nuggets database table so that experts can be associated with expertise's without having to be associated with a nugget.

## Extending iKNOW

**Objective:**

The purpose of the extending iKNOW sub-team was to add additional features to the existing version of iKNOW. The following tasks needed to be accomplished



- Add full text search to iKNOW
- Allow PersonalPro self-help applications to be viewable within iKNOW
- Logging of system events
- Enhance the search by allowing searching on specific meta-data fields
- Allow selection of experts from the expert database
- Jump to IPRO dropdown box
- Modifications to the user interface
- Utility to import data from PRS into iKNOW

### **Methods:**

In order to add full text search to iKNOW, the AIRE search engine from the IIT Information Retrieval Laboratory was used. Parsers for the following document formats were added

- Text
- HTML
- PDF
- Microsoft Word
- Microsoft PowerPoint
- Microsoft Excel

In addition to this a parser for iKNOW nugget information files was created. An interface was created to allow iKNOW nuggets to be indexed by AIRE and to allow queries made from iKNOW to be processed by AIRE and the results sent back to iKNOW to be displayed to the user. This interface was implemented using Java servlets.

In order to allow PersonalPro self-help applications to be viewable within iKNOW a Java servlet was created which allows a website compressed into a ZIP file to be viewed. This required that the links within the files which comprise the website be modified to link through the servlet. PHP code was written which pulls the information from the website and displays it within iKNOW. The nugget viewing code was modified to display these websites.

In order to allow system events to be logged, a table was added to the database and code which creates records in that table were added in the appropriate sections of code. The following events are currently logged

- Search Query
- Nugget View
- File Download
- User Login

In order to enhance the full text search so that searches could be performed on specific metadata fields the iKNOW nugget parser was modified to tag the terms from metadata fields as they are added to the index.

A drop down box was added main user interface which allows the user to view the project page for a specific IPRO quickly and easily by selecting that IPRO from a drop down list.

Numerous modifications were made to the iKNOW user interface. The primary change was removing the right side bar and placing the information which was contained in it in a single left side bar. The quick search was removed from the left side bar and placed in a new top bar which also contains the Jump to IPRO dropdown list. Additional changes include a modified color scheme, and a star based rating system for nuggets.

In order to import data from PRS into iKNOW a utility will be created which reads project, user, and document information from the PRS Access database and creates the appropriate information in iKNOW's database. This utility must allow the information to be fully updateable.

## **Time Line:**

In our project timeline iKNOW version 1.1 was scheduled to be completed by October 25, 2004. We were able to meet this deadline and version 1.1 was completed on schedule. iKNOW version 1.2 was scheduled to be completed by the end of the semester, December 17, 2004. We were able to meet this deadline and version 1.2 was completed December 13, 2004.

## **Conclusion:**

- The extending iKNOW team worked to add functionality to iKNOW to make it a more effective tool. The team worked to add a full text search to iKNOW, allow PersonalPro self-help applications to be viewable within iKNOW, to log system events, to enhance the search to allow meta-data fields to be searchable, to allow experts to be selected from the expert database, and to modify the user interface to make it easier to use.

## **Roll-Out**

- 1. Purpose and tasks to be accomplished**
- 2. What we did**
- 3. Planned timeline, actual timeline**
- 4. Wrap up**

The purpose of the iKNOW Roll-Out team is to insert documents and provide training materials that would aid continuing IPRO teams in their work. The tasks include gathering, researching (determining additional critical information that can be added with documents such as abstracts, creation narratives, experts, etc.- especially when that information is rarely provided), and uploading continuing IPRO teams' documents submitted from previous semesters into the system as well as producing documentation to train students in making efficient use of iKNOW.

Throughout the first six weeks of the semester, the team compiled a list of the nineteen IPROs continuing through the current semester, obtained CD copies and electronic access of the Fall 2003, Spring 2004, and Summer 2004 IPRO document submissions, and categorized the accumulated data by continuing IPRO. In the seventh week, the team was referred to the IIT Faculty Senior Staff Expertise database, containing over two hundred experts. Documents from the team's own IPRO were first inserted into the system by the fourth week while the actual deadline was the third week. The Roll-Out team added two more members and delegated the remaining data of the other eighteen continuing IPROs, which was researched and uploaded into the system by the eighth week, as planned. The training materials were intended to be completed by the twelfth to fourteenth weeks, but were postponed until the fifteenth week as the first draft was composed and the Spring 2005 IPRO projects were created (name, number, description, and category assignments).

The Roll-Out team has currently been assigned to loading the Fall 2004 data of all IPRO teams into iKNOW for the next semester as well as completing the training materials to provide the other IPRO teams with by and on the week before the Spring 2005 semester begins.

## **Testing iKnow**

### **Objective**

We put iKnow through three different types of testing to make sure the system functioned and operated correctly. Functional, Performance, and User tested are described below.

### **Functional Testing**

Below are the test cases we used to test the iKnow system for version 1.0. These test cases were taken from the Functional Requirements. Each team member was assigned a colored section of the tests to run on the system. In the end 20 bugs were found and fixed.

iKNOW Functional Test Plan v1.0		
	<b>Tester:</b>	<b>Test Run #:</b>
#	Action	Expected Result
1	Go to <a href="http://iknow.iit.edu/iKNOW_fall2004">http://iknow.iit.edu/iKNOW_fall2004</a>	iKNOW Welcome screen is displayed
2	Attempt login with bogus username and bogus password	Login is denied
3	Attempt login with your user-level account data	Login is successful, but no "Administrator" link exists in menu; Welcome screen is displayed
4	Click on "User Dashboard" link in menu	User Dashboard page appears
5	<i>Remember the project number and title shown at the top of the page</i>	
6	Click on "Create New Nugget" in menu	Nugget Creation page 1 appears for the project you are associated with
7	<i>Select a non-IPRO deliverable that you produced for the following steps</i>	
8	Click on "Save and Continue" without entering any information into the form fields	Error message appears, prompting to enter a document title
9	Enter the title of your document and a good abstract, and choose the authors of and categories for your document, then click on "Save and Continue"	Nugget Creation page 2 appears
10	Type in a good creation narrative and enter data for one or more experts who helped you with the creation of the document. If necessary, enter a few comments as well. Click on "Save and Continue"	Nugget Creation page 3 appears
11	Select one or more files using the "Browse" buttons and click on "Save and Continue"	User Dashboard page appears
12	Look up "Newest 5 Nuggets" box on right side of screen	Nugget you entered is at top of list
13	Locate the nugget you just entered in the "My Nuggets" section at the bottom of the page and click on its title	Nugget page for the previously entered nugget appears, containing ALL information you typed in during the nugget creation process
14	Click on one of the files you uploaded	Download File dialog appears
15	Save the file to your hard drive and open it	File opens without problems
16	Click on "Edit Nugget" in the menu	Nugget Edit page 1 appears
17	Edit title, abstract and authors, and click on "Save and Continue"	Nugget Edit page 2 appears
18	Edit creation narrative and some expert data and click on "Save and Continue"	Nugget Edit page 3 appears
19	Select another file to upload using the "Browse" button and click on "Save and Continue"	User Dashboard page appears
20	Locate the nugget you just edited in the "My Nuggets" section at the bottom of the page and click on its title	Nugget page for the recently edited nugget appears, containing ALL NEWLY CHANGED information
21	Click on the file you just uploaded	Download File dialog appears
22	Save the file to your hard drive and open it	File opens without problems
23	At the bottom of the nugget view page, select a rating of "Good" for your nugget and click on "Vote"	Nugget view page reappears

24	Click on "User Dashboard" link in menu	User Dashboard page appears	
25	Locate your nugget in the "My Nuggets" section and check for the rating	Nugget has one vote and a score of 75%	
26	Click on the nugget title	Nugget view page appears	
27	Click on an author's name	Author view page appears (at least one nugget--the one you just visited--appears in the "User's Nuggets" section)	
28	Click on one of the projects the user is associated with	Project view page for this project and semester appears	
29	Select a different semester using the dropdown box at the top of the project view page	Project view page for this project and the chosen semester appears	
30	Select a nugget associated with this project and click on its title	Nugget view page appears	
31	Click on the name of an expert (if the nugget has no experts associated with it, choose another nugget from the "Newest 5 Nuggets" or "Top 5 Nuggets" boxes at the right side of the screen and click on an expert name in that nugget)	Expert view page appears, containing name, institution and department and nuggets associated with this expert	
32	Locate a nugget that does not belong to your own project	"Edit Nugget" does not appear in the left-hand menu	
33	Click on "User Dashboard" link in menu	User Dashboard page appears	
34	Click on "Add" button in the "Deliverables" section of the project view page	Nugget Creation page 1 appears	
35	<i>Carry out a regular nugget insertion of the IPRO deliverable you selected to add</i>	After you clicked "Save and Continue" on nugget creation page 3, User Dashboard page appears	
36	Check "Deliverables" box for the deliverable you just added	Button next to the deliverable changed from "Add" to "View"	
37	Click on "View" button for this deliverable	Nugget view page for this deliverable appears	
38	Enter one or more words in "Quick Search" box in the menu and click on "Submit" (if less than 25 search results appear, repeat the search with easy and short words--"and" is recommended--until more than 25 results are returned)	Search results 1-25 appear	
39	Click on "Next Page" button	Search results 25+ appear	
40	Click on "Previous Page" button	Search results 1-25 appear	
41	Click on "Edit Profile" link in menu	Edit profile page appears with your user information already filled into the form	
42	Alter all of your information EXCEPT your password and click on "Change" (MAKE SURE YOU REMEMBER THE NEW E-MAIL ADDRESS YOU CHOSE)	Edit profile page appears with your NEW user information already filled into the form	
43	Click on "Log Out" in menu	Welcome screen appears with login boxes (username and password)	
44	Log in with the new e-mail address you chose and the same password as previously	Welcome screen appears with your greeting and User Dashboard and Create New Nugget links in menu	
45	Click on "Edit Profile" link in menu	Edit profile page appears	
46	Choose a new password for your account, enter it twice (in "Password" and "Confirm Password" boxes) and click on "Change"	Edit profile page appears with your user information already filled into the form	
47	Click on "Log Out" in menu	Welcome screen appears with login boxes (username and password)	
48	Log in with the new e-mail address and password you chose	Welcome screen appears with your greeting and User Dashboard and Create New Nugget links in menu	

49	Click on "Edit Profile" link in menu	Edit profile page appears with your user information already filled into the form
50	Enter an e-mail address you currently have access to	Edit profile page appears with your NEW user information already filled into the form
51	Click on "Log Out" in menu	Welcome screen appears with login boxes (username and password)
52	Click on "Forgot your password?"	Password reset page appears
53	Enter the e-mail address you chose three steps ago and click on "Reset Password"	Confirmation screen appears, and an e-mail is sent to your mailbox containing a new password
54	Retrieve your new password and log in with the last e-mail address and the new password	Welcome screen appears with your greeting and User Dashboard and Create New Nugget links in menu
55	Log out using the "Log Out" link in menu	Welcome screen appears with login boxes (username and password)
56	Attempt login with your administrator-level account data	Login is successful, and "Administrator" link exists in menu; administrator function overview page is shown
57	Click on "Manage Users" link in main section of screen	Manage users screen appears
58	Search for your user-level account by entering that account's e-mail address and clicking on "Find User"	Manage users screen appears with that user's data filled into the form fields
59	Alter all information for this user EXCEPT the password and click on "Save"	Manage users screen appears with that user's NEW data filled into the form fields
60	Click on "Manage Users" link in main section of screen	Manage users screen appears
61	Check the "Add New User" box and fill in all relevant user data including IIT e-mail address and password, then click on "Save and Add More"	Manage users screen appears
62	Search for the new account by entering that account's e-mail address and clicking on "Find User"	Manage users screen appears with the NEW user's data filled into the form fields
63	Click on "Manage Projects" link in main section of screen	Manage projects screen appears
64	Enter information for a new project and click on "Add Project"	Manage projects screen appears with NEW project added to the projects listing
65	Locate the NEW project you just created in the listing and click on "Edit" button next to it	Edit project screen appears with projects's data filled into form fields
66	Make changes to the project's title and IPRO number and click on "Save Changes"	Manage projects screen appears with NEW project and EDITED information in the projects listing
67	Locate the NEW project you just created in the listing and click on "Delete" button next to it	Manage projects screen appears with NEW project no longer in projects listing
68	Click on "Manage Experts" link in main section of screen	Manage experts screen appears
69	Enter information for a new expert and click on "Add Expert"	Manage experts screen appears with NEW expert added to the experts listing
70	Locate the NEW expert you just created in the listing and click on "Edit" button next to it	Edit expert screen appears with expert's data filled into form fields
71	Make changes to the expert's name, institution and department and click on "Save Changes"	Manage experts screen appears with NEW expert and EDITED information in the experts listing
72	Locate the NEW expert in the listing and click on "Delete" button next to it	Manage experts screen appears with NEW expert no longer in experts listing

## **Performance Testing**

We needed to ensure that the system would not die under a heavy use load. So, we used Mercury LoadRunner to test the system against 40 simultaneous users. Below is the LoadRunner report from one test.

# **LoadRunner Report**

Conducted By: Khan, Atif

Date: 10/28/2004

<b>1 Executive Summary .....</b>	<b>17</b>
1.1 Objectives.....	17
1.2 Scenario Summary .....	17
1.3 Top Time-Consuming Transactions.....	17
1.4 Conclusions.....	17
<b>2 Scenario Configuration.....</b>	<b>18</b>
2.1 Files.....	18
2.2 Scheduler Information.....	18
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# 1 Executive Summary

## 1.1 Objectives

To crash the server by running 10 virtual users at a time performing different tasks

## 1.2 Scenario Summary

**Total Duration (including Ramp Up/Down):** 2 hours, 4 minutes and 5 seconds.  
**Maximum Running Vusers:** 10  
**Total Throughput (bytes):** 590,894,273  
**Total Hits:** 76,285

## 1.3 Top Time-Consuming Transactions

Transaction Name	Ave	90%
Action_Transaction	18.457	20.711
vuser_end_Transaction	1.614	1.85
vuser_init_Transaction	0.001	0

## 1.4 Conclusions

## 2 Scenario Configuration

### 2.1 Files

**Name:** Scenario3  
**Results in Session:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Session Name:** C:\Documents and Settings\Atif Khan\Desktop\analysis\analysis.lra

### 2.2 Scheduler Information

**Started On:** 28/10/2004 00:14:15  
**Ended On:** 28/10/2004 02:18:21  
**Duration:** Until Completion  
**Load Behavior:** Load all Vusers simultaneously

### 2.3 Scripts

Script	Type	File
iknowfirsta	QTWeb	C:\Program Files\Mercury Interactive\Mercury LoadRunner\scripts\iknowfirsta\iknowfirsta.usr

### 2.4 Run Time Settings

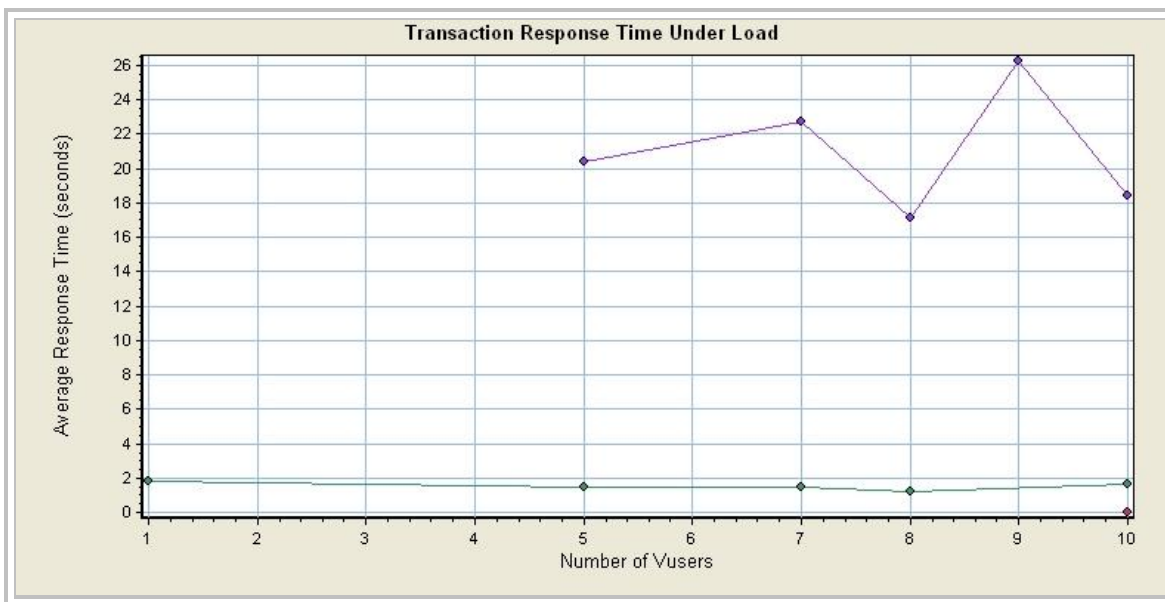
#### QTWeb

Group	Script	Pacing	Think Time	Network Speed	Browser cache
iknowfirsta	iknowfirsta	As soon as possible	As recorded	Maximum bandwidth	Yes

## 3 Users' Influence

Displays average transaction response times relative to the number of Vusers running at any given point during the load test. This graph helps you view the general impact of Vuser load on performance time and is most useful when analyzing a load test which is run with a gradual load.

**Title:** Transaction Response Time Under Load  
**Graph Type:** Correlate  
**Base Graph:** Running Vusers  
**Additional:** Average Transaction Response Time  
**Granularity:** 1 Second

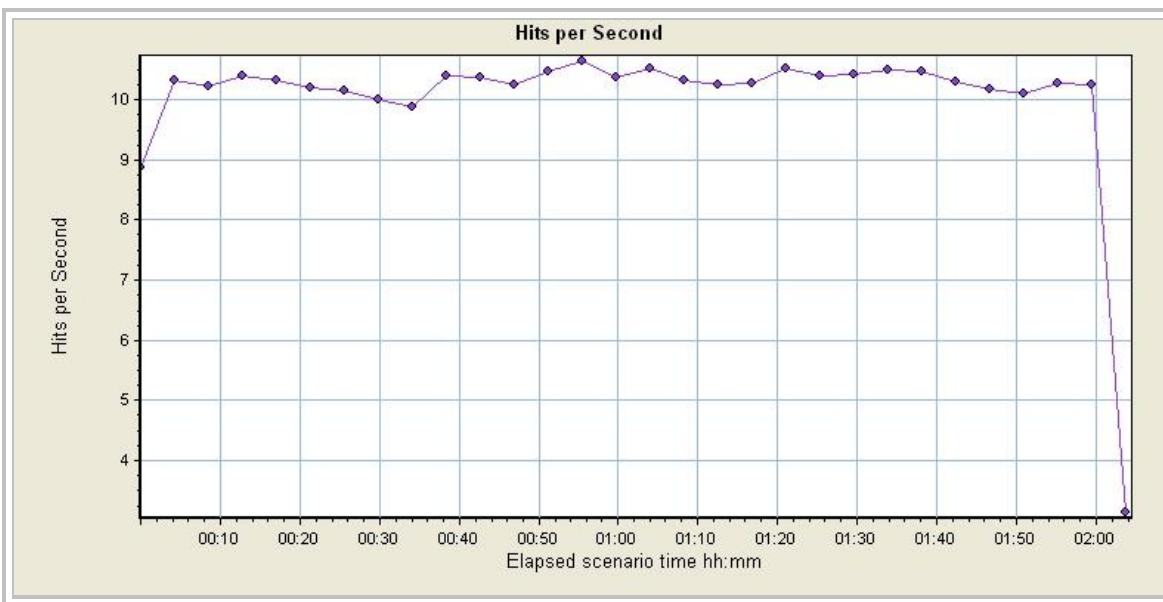


Color	Scale	Measurement	Min.	Ave.	Max.	SD
■	1	Action_Transaction	12.61	18.457	43.546	1.94
■	1	vuser_end_Transaction	1.219	1.614	2.281	0.29
■	1	vuser_init_Transaction	0.0	0.001	0.007	0.002

# 4 Hits Per Second

Displays the number of hits made on the Web server by Vusers during each second of the load test. This graph helps you evaluate the amount of load Vusers generate, in terms of the number of hits.

**Title:** Hits per Second  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**  
**Granularity:** 256 Seconds

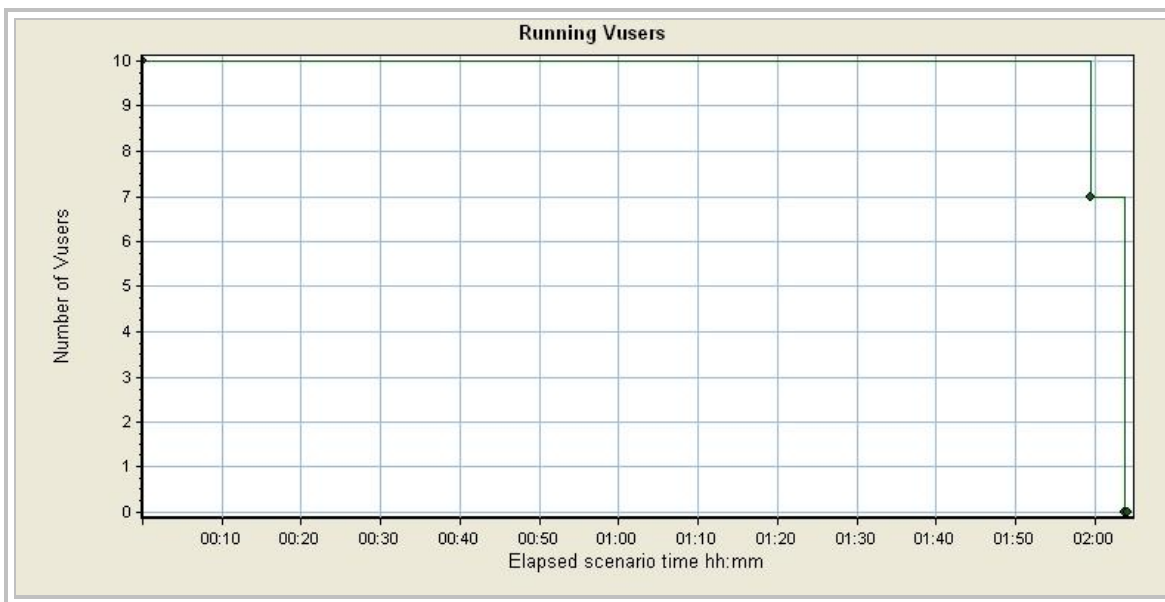


Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Hits	3.136	10.245	10.645	10.313	1.315

# 5 Vuser Load Scheme

Displays the number of Vusers that executed Vuser scripts, and their status, during each second of a load test. This graph is useful for determining the Vuser load on your server at any given moment.

**Title:** Running Vusers  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** Vuser Status = (Run)  
**Group By:**  
**Granularity:** 256 Seconds

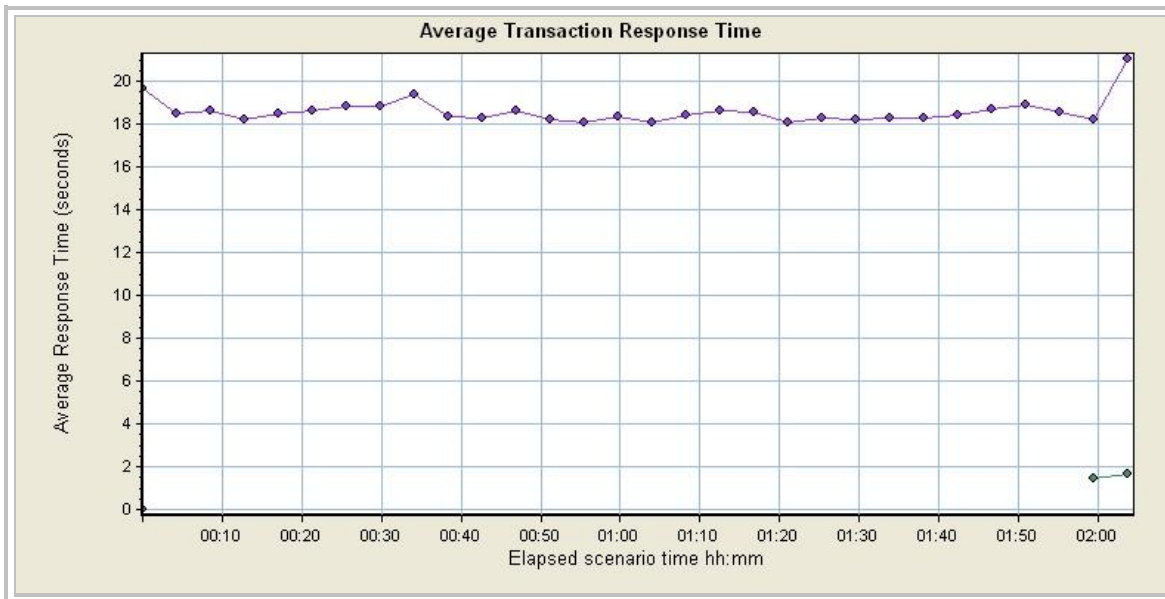


Color	Scale	Measurement	Graph Min.	Graph Ave.	Graph Max.	Graph Median	Graph SD
■	1	Run	0.0	4.25	10	7	4.38

# 6 Transaction Response Times

Displays the average time taken to perform transactions during each second of the load test. This graph helps you determine whether the performance of the server is within acceptable minimum and maximum transaction performance time ranges defined for your system.

**Title:** Average Transaction Response Time  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings\Temp\resa0\resa0.lrr  
**Filters:** Transaction End Status = (Pass), (Include Think Time)  
**Group By:**  
**Granularity:** 256 Seconds

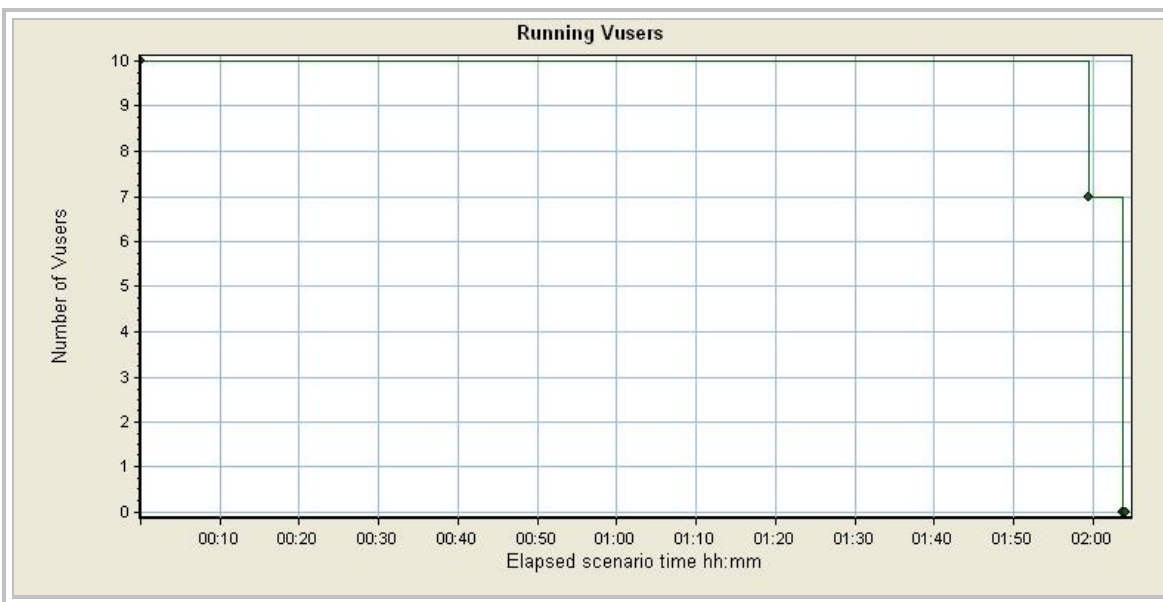


Color	Scale	Measurement	Min.	Ave.	Max.	SD
Blue	1	Action_Transaction	12.61	18.457	43.546	1.94
Green	1	vuser_end_Transaction	1.219	1.614	2.281	0.29
Red	1	vuser_init_Transaction	0.0	0.001	0.007	0.002

# 7 Running Vusers

Displays the number of Vusers that executed Vuser scripts, and their status, during each second of a load test. This graph is useful for determining the Vuser load on your server at any given moment.

**Title:** Running Vusers  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** Vuser Status = (Run)  
**Group By:**  
**Granularity:** 256 Seconds

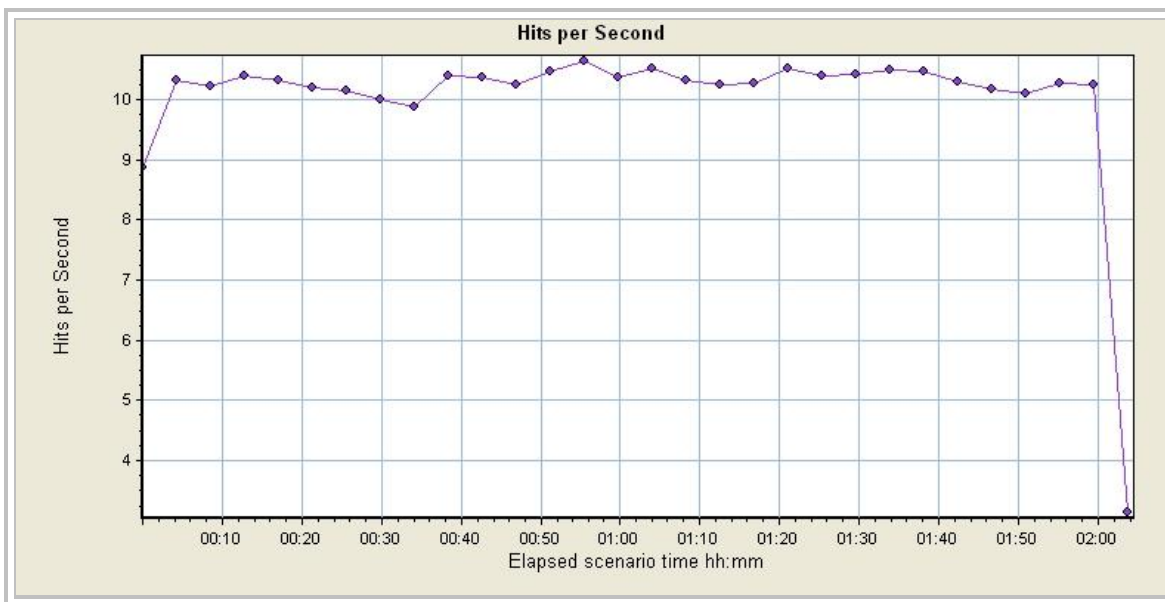


Color	Scale	Measurement	Graph Min.	Graph Ave.	Graph Max.	Graph Median	Graph SD
■	1	Run	0.0	4.25	10	7	4.38

# 8 Hits per Second

Displays the number of hits made on the Web server by Vusers during each second of the load test. This graph helps you evaluate the amount of load Vusers generate, in terms of the number of hits.

**Title:** Hits per Second  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**  
**Granularity:** 256 Seconds



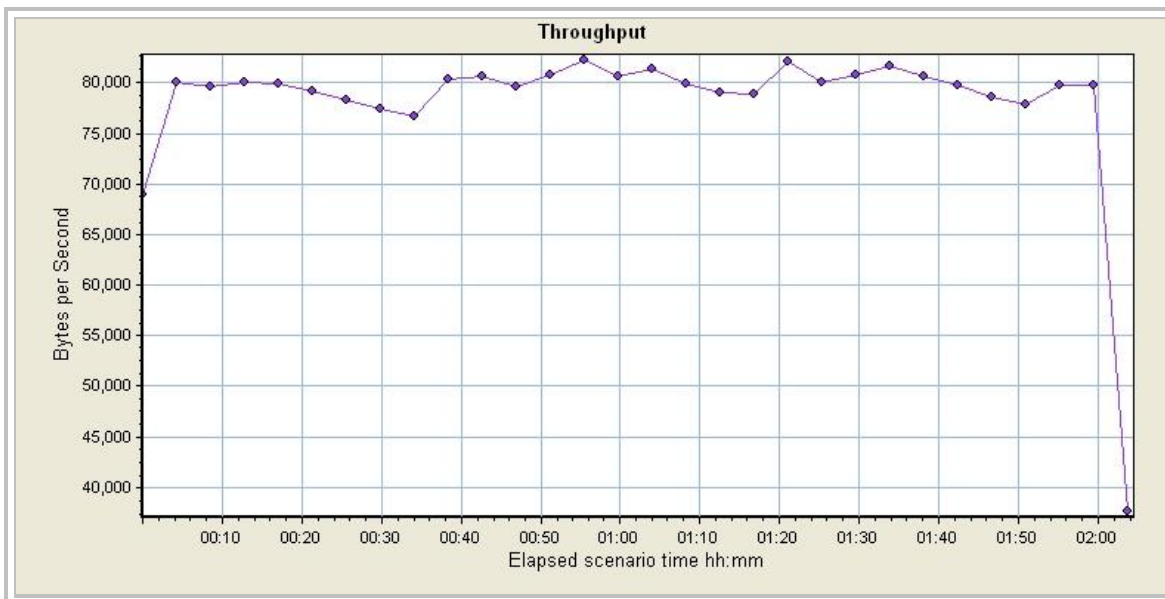
Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Hits	3.136	10.245	10.645	10.313	1.315



# 9 Throughput

Displays the amount of throughput (in bytes) on the Web server during the load test. Throughput represents the amount of data that the Users received from the server at any given second. This graph helps you to evaluate the amount of load Users generate, in terms of server throughput.

**Title:** Throughput  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**  
**Granularity:** 256 Seconds

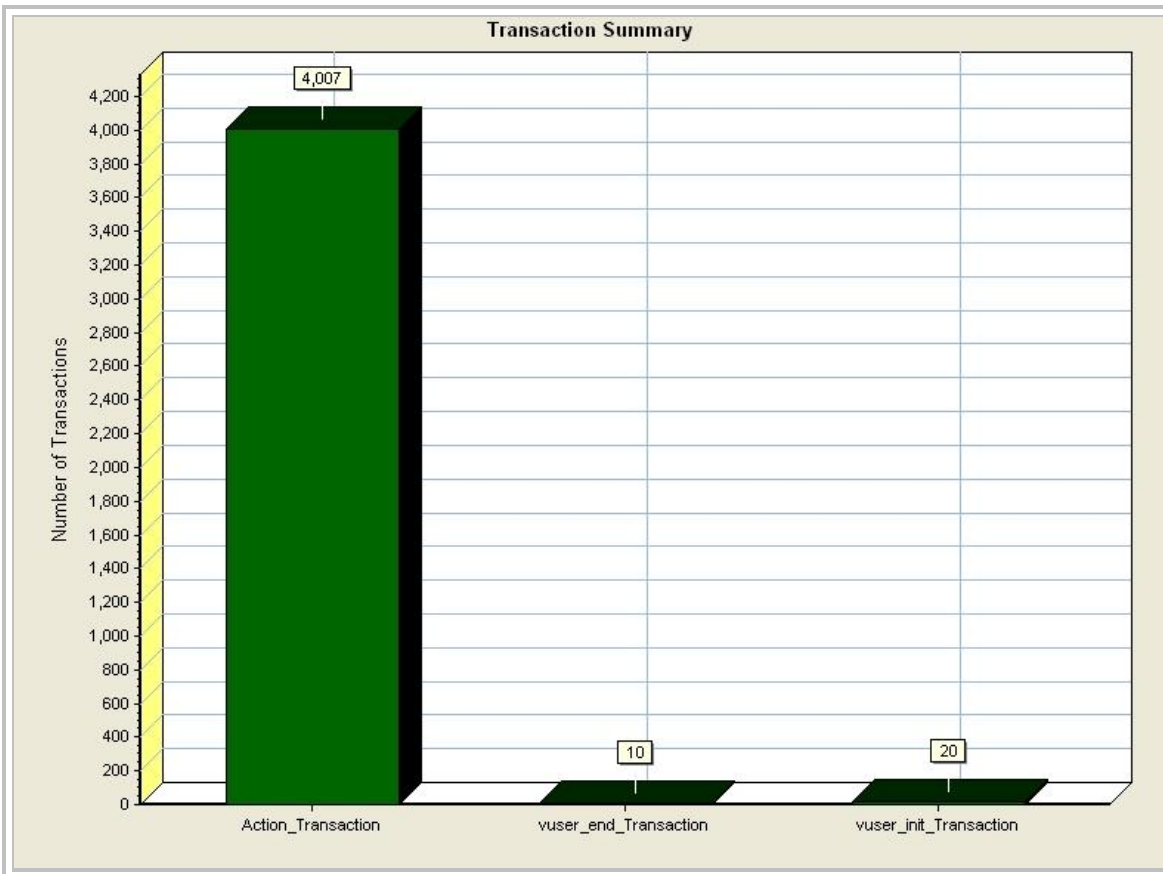


Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Throughput	37634.227	79357.275	82266.535	79862.234	7864.006

# 10 Transaction Summary

Displays the number of transactions that passed, failed, stopped, or ended with errors.

**Title:** Transaction Summary  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** (Include Think Time)  
**Group By:**

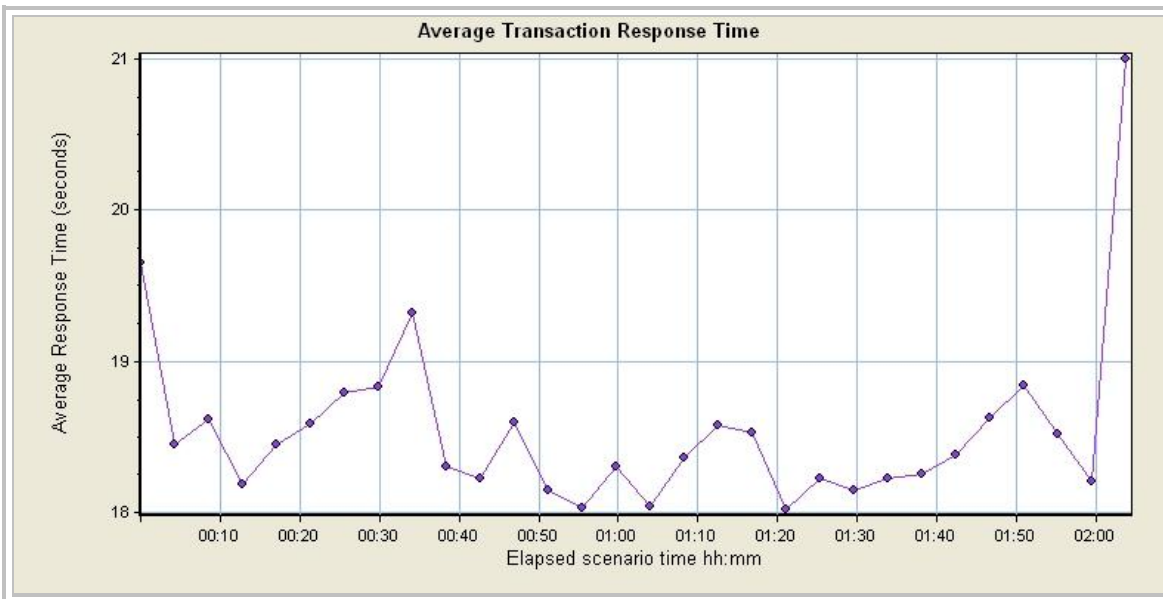


Color	Scale	Measurement
■	1	Pass

# 11 Average Transaction Response Time

Displays the average time taken to perform transactions during each second of the load test. This graph helps you determine whether the performance of the server is within acceptable minimum and maximum transaction performance time ranges defined for your system.

**Title:** Average Transaction Response Time  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings\Temp\resa0\resa0.lrr  
**Filters:** Transaction End Status = (Pass), (Include Think Time)  
**Group By:**  
**Granularity:** 256 Seconds

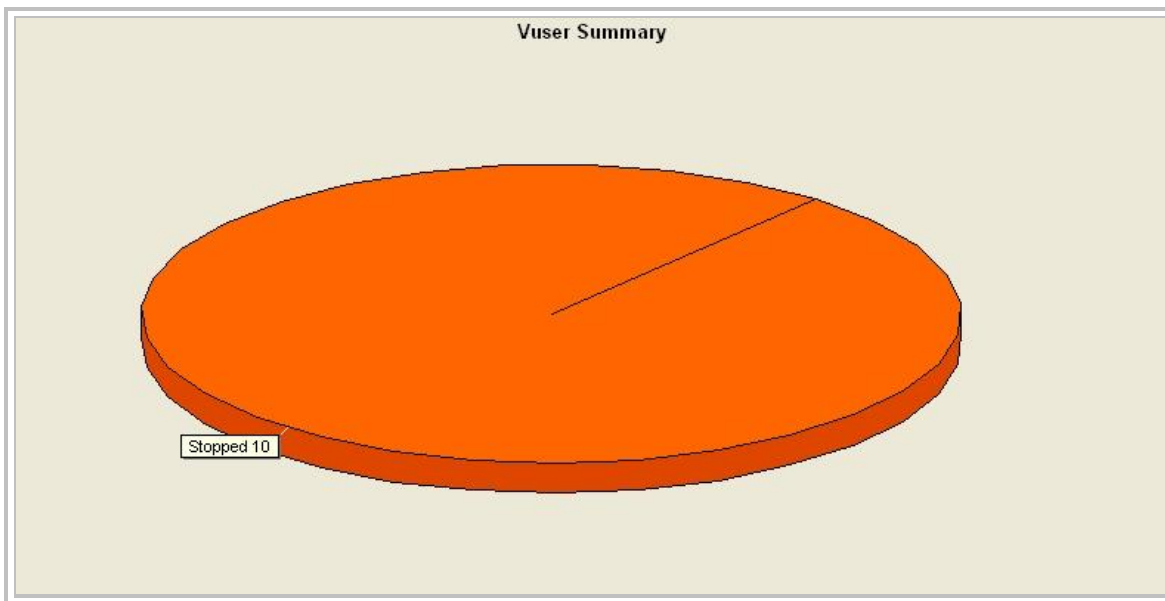


Color	Scale	Measurement	Graph's Min.	Graph's Ave.	Graph's Max.	Graph's Median	Graph's SD
■	1	Action_Transaction	18.019	18.547	21	18.446	0.579

## 12 Vuser Summary

Displays the number of Vusers that completed their run successfully, stopped their run, or ended with errors.

**Title:** Vuser Summary  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**

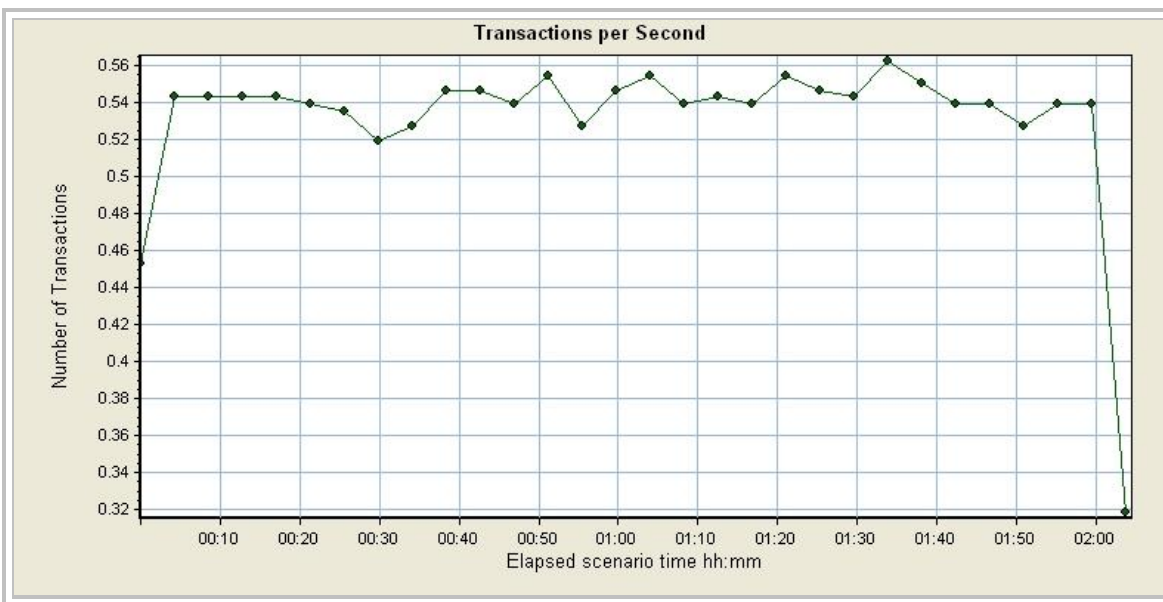


Color	Scale	Measurement	Graph Ave.
Orange	1	Stopped	10

# 13 Transactions per Second

Displays the number of completed transactions (both successful and unsuccessful) performed during each second of a load test. This graph helps you determine the actual transaction load on your system at any given moment.

**Title:** Transactions per Second  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
 \Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:** Transaction End Status  
**Granularity:** 256 Seconds

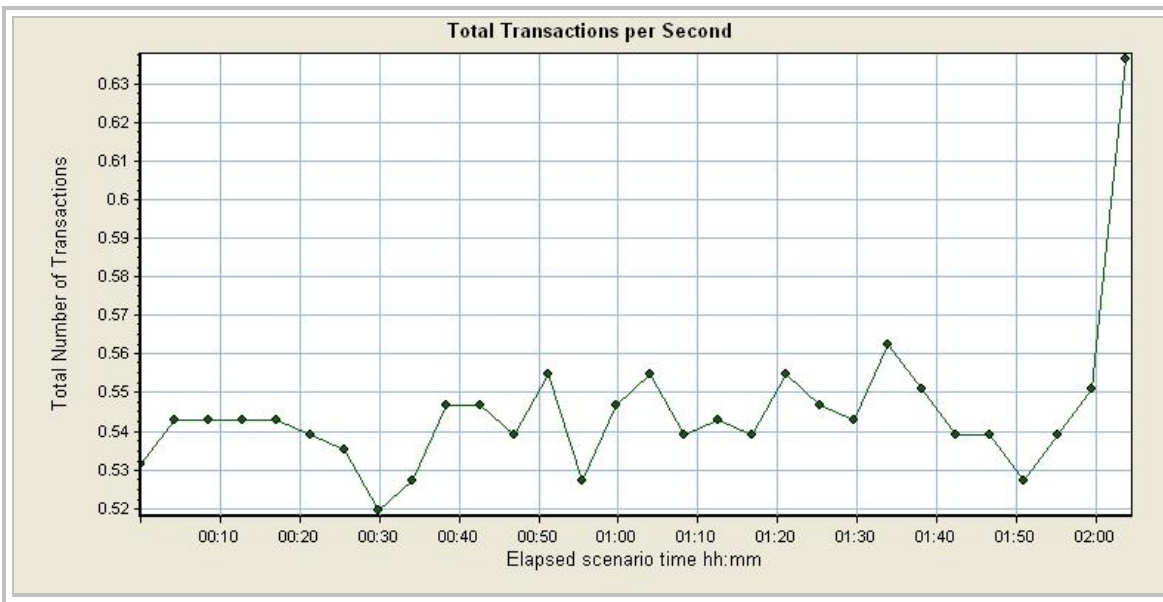


Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Action_Transaction:Pass	0.318	0.538	0.563	0.543	0.044

# 14 Total Transactions per Second

Displays the total number of completed transactions (both successful and unsuccessful) performed during each second of a load test. This graph helps you determine the actual transaction load on your system at any given moment.

**Title:** Total Transactions per Second  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**  
**Granularity:** 256 Seconds

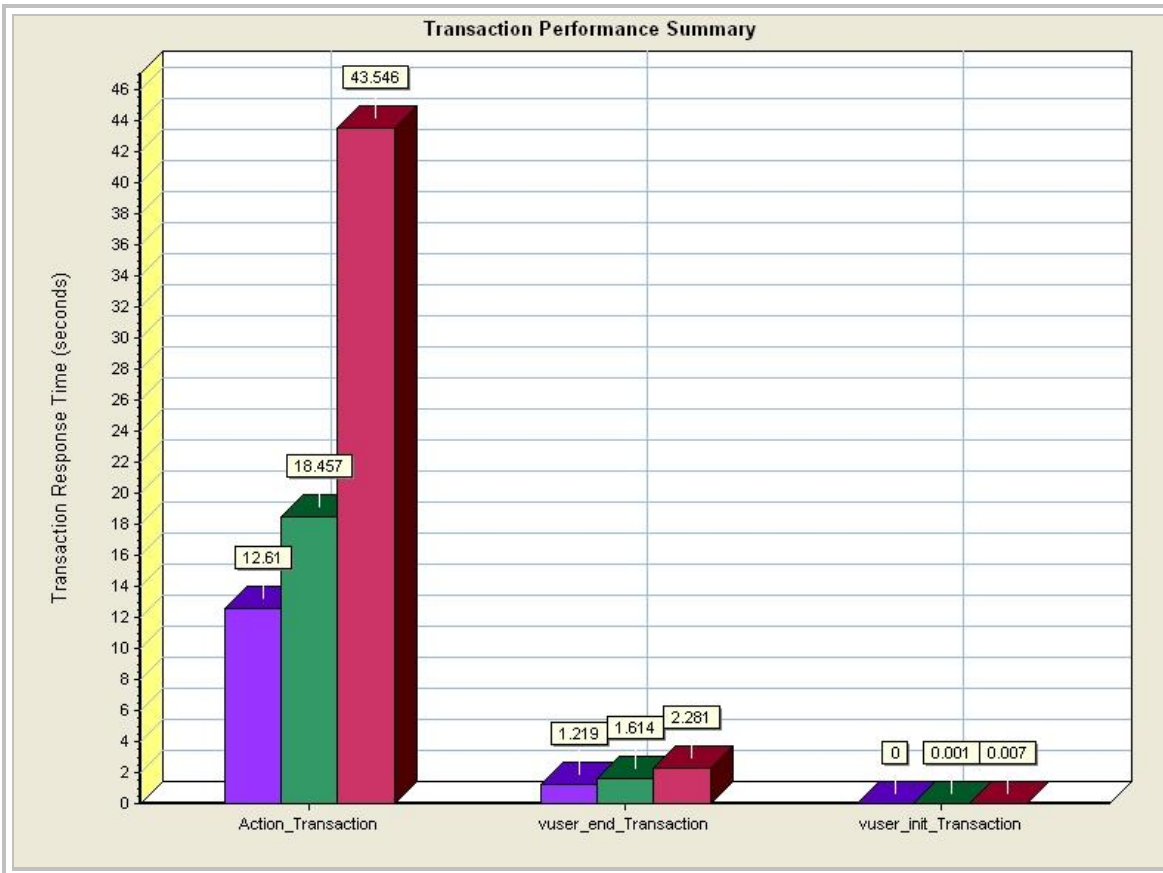


Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	Pass	0.52	0.542	0.636	0.543	0.019

# 15 Transaction Performance Summary

Displays the minimum, average, and maximum response time for all the transactions in the load test.

**Title:** Transaction Performance Summary  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** Transaction End Status = (Pass), (Include Think Time)  
**Group By:**

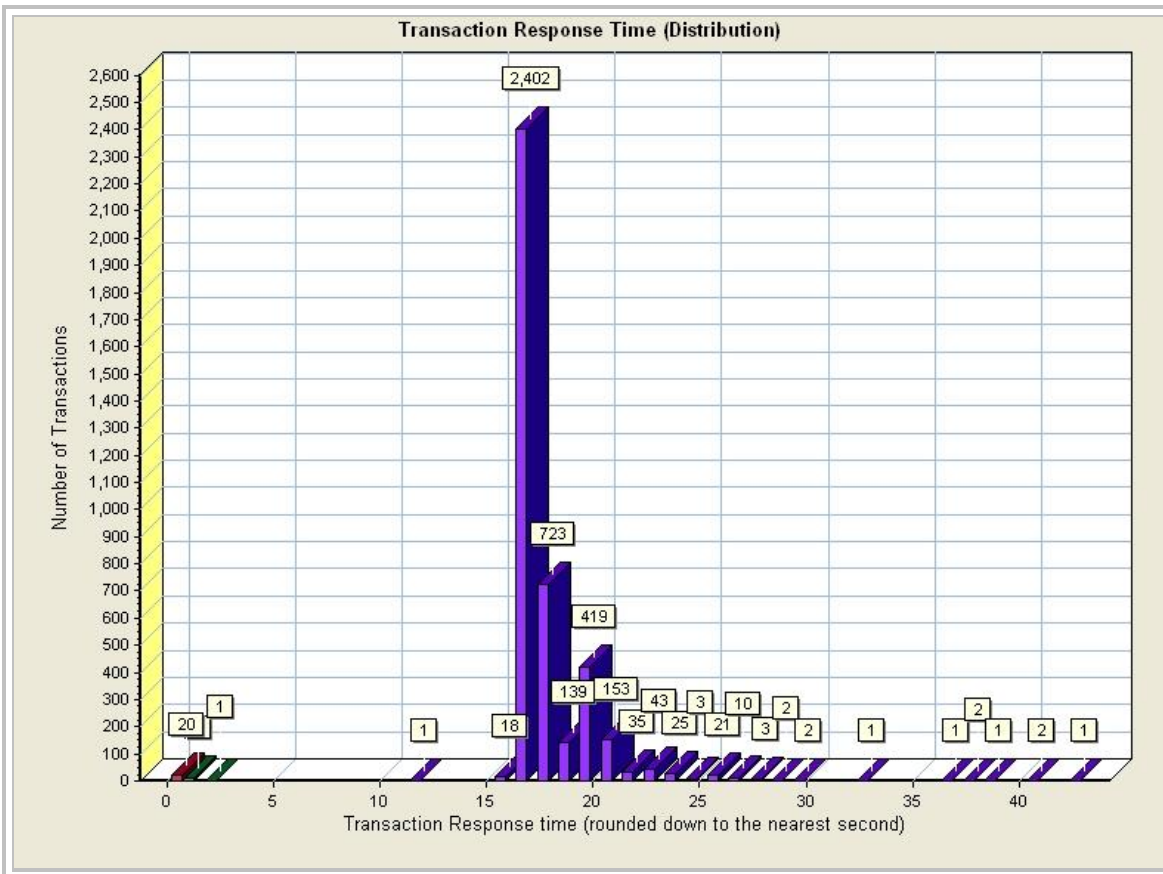


Color	Scale	Measurement
Blue	1	Minimum
Green	1	Average
Red	1	Maximum

# 16 Transaction Response Time (Distribution)

Displays the number of times a transaction was completed over a distribution of time ranges.

**Title:** Transaction Response Time (Distribution)  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
 \Temp\resa0\resa0.lrr  
**Filters:** Transaction End Status = (Pass)  
**Group By:**



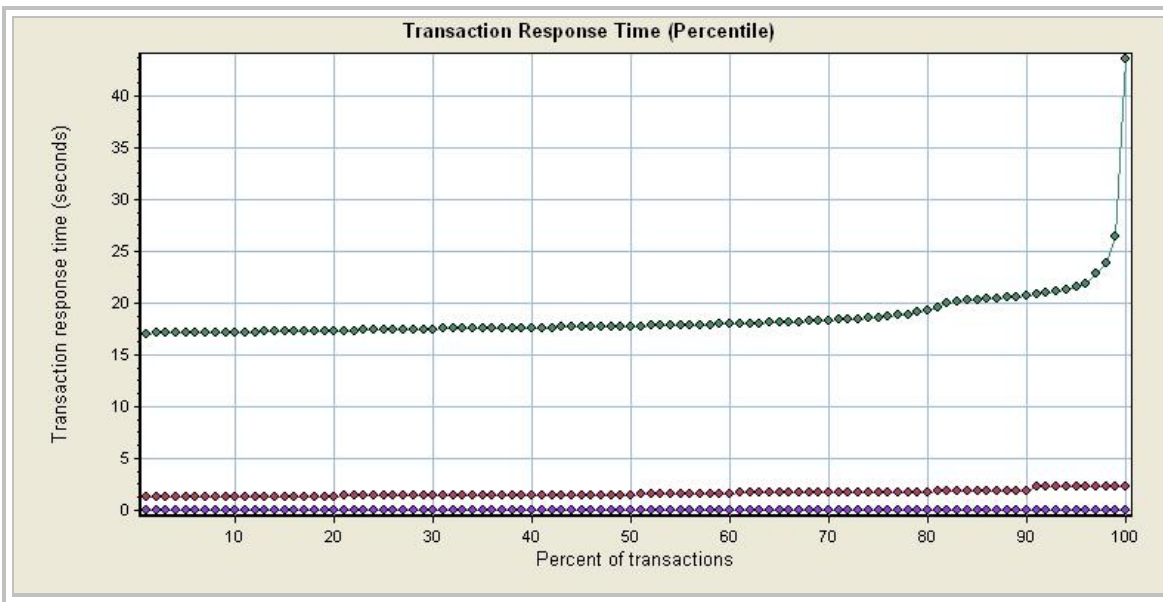
Color	Scale	Measurement
Blue	1	Action_Transaction
Green	1	vuser_end_Transaction
Red	1	vuser_init_Transaction



# 17 Transaction Response Time (Percentile)

Displays the percentage of transactions that were performed within a given time range. This graph helps you determine the percentage of transactions that meet the performance criteria defined for your system.

**Title:** Transaction Response Time (Percentile)  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
 \Temp\resa0\resa0.lrr  
**Filters:** Transaction End Status = (Pass), (Include Think Ti  
 me)  
**Group By:**

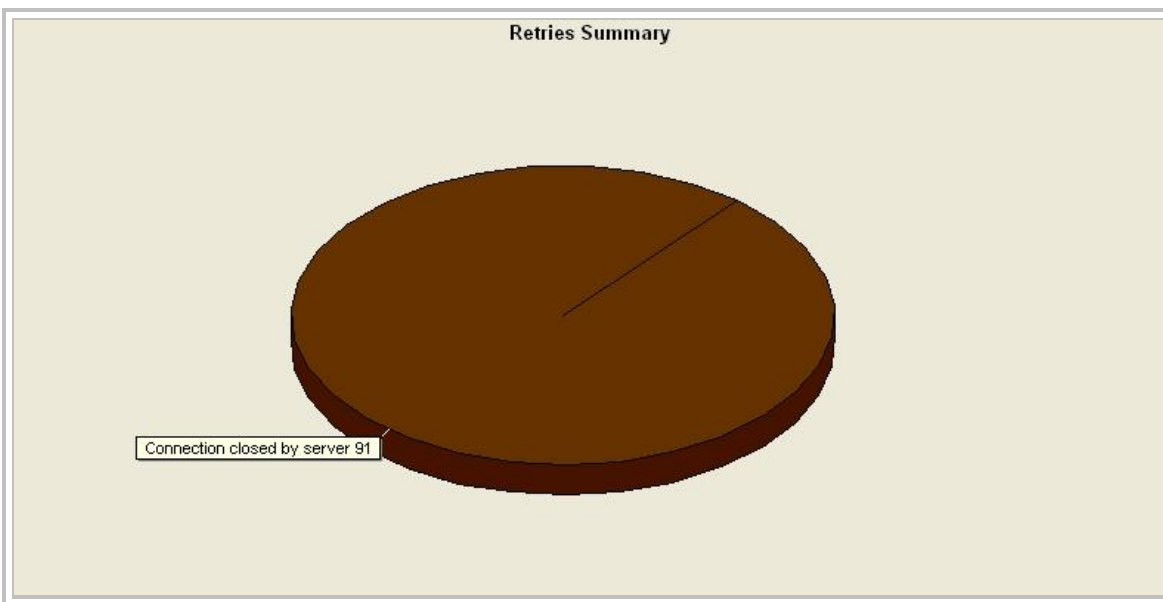


Color	Scale	Measurement	Graph Min.	Graph Ave.	Graph Max.	Graph Median	Graph SD
<span style="color: purple;">■</span>	1	vuser_init_Transaction	0.0	0.0	0.0	0.0	0.0
<span style="color: green;">■</span>	1	Action_Transaction	17.01	18.642	43.545	17.773	2.974
<span style="color: red;">■</span>	1	vuser_end_Transaction	1.217	1.61	2.275	1.633	0.29

# 18 Retries Summary

Shows the number of attempted server connections during the scenario run, grouped by the cause of the retry. Use this graph together with the Retries per Second Graph to determine at what point during the scenario the server retries were attempted.

**Title:** Retries Summary  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
\Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**

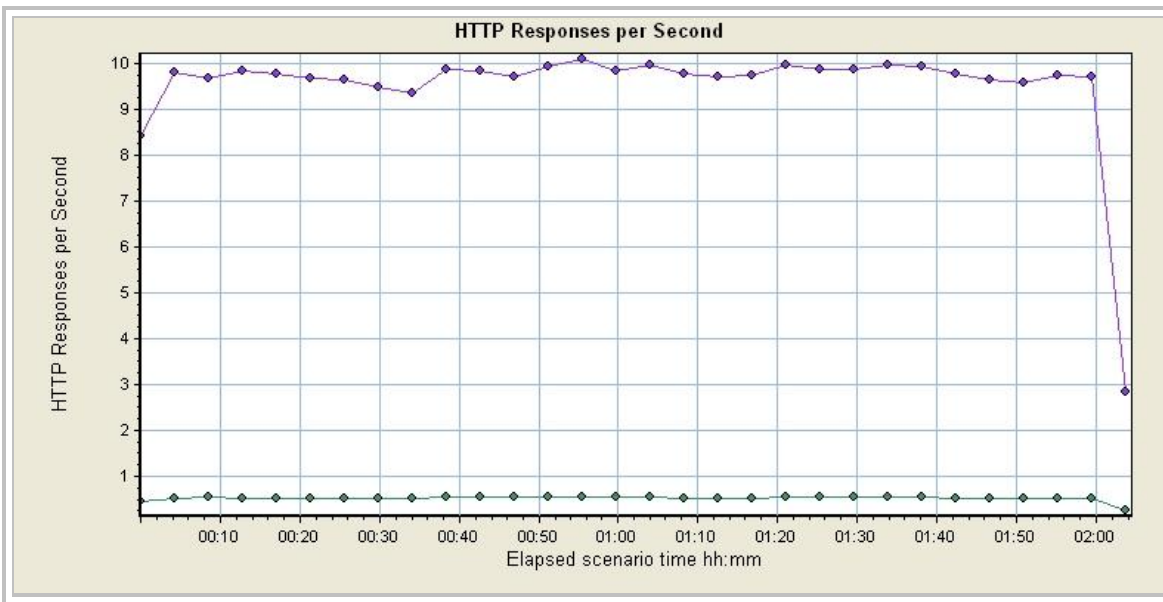


Color	Scale	Measurement	Graph Min.	Graph Ave.	Graph Max.	Graph Median	Graph SD
■	1	Connection closed by server	91	91	91	91	0.0

# 19 HTTP Responses per Second

Displays the number of the different HTTP status codes returned from the Web server during each second of the load test.

**Title:** HTTP Responses per Second  
**Current Results:** c:\Documents and Settings\Atif Khan\Local Settings  
 \Temp\resa0\resa0.lrr  
**Filters:** None  
**Group By:**  
**Granularity:** 256 Seconds



Color	Scale	Measurement	Graph Min.	Ave.	Graph Max.	Graph Median	Graph SD
■	1	HTTP_200	2.864	9.706	10.09	9.773	1.265
■	1	HTTP_302	0.273	0.539	0.559	0.543	0.051

# 20 Terminology

## 20.1 LoadRunner Objects

Term	Definition
Vuser Scripts	A Vuser script describes the actions that a Vuser performs during the scenario. Each Vuser executes a Vuser script during a scenario run. The Vuser scripts include functions that measure and record the performance of your application's components.
Load Test	Tests a system's ability to handle a heavy workload. A load test simulates multiple transactions or users interacting with the computer at the same time and provides reports on response times and system behavior.
Run-Time Settings	Run-Time settings allow you to customize the way a Vuser script is executed. You configure the run-time settings from the Controller or VuGen before running a scenario. You can view information about the Vuser groups and scripts that were run in each scenario, as well as the run-time settings for each script in a scenario, in the Scenario Run-Time Settings dialog box.
Scenario	A scenario defines the events that occur during each testing session. For example, a scenario defines and controls the number of users to emulate, the actions that they perform, and the machines on which they run their emulations.
Scheduler	The Schedule Builder allows you to set the time that the scenario will start running, the duration time of the scenario or of the Vuser groups within the scenario, and to gradually run and stop the Vusers within the scenario or within a Vuser group. It also allows you to set the load behavior of Vusers in a scenario.
Session	When you work with the Analysis utility, you work within a session. An Analysis session contains at least one set of scenario results (lrr file). The Analysis utility processes the scenario result information and generates graphs and reports. The Analysis stores the display information and layout settings for the active graphs in a file with an .lra extension. Each session has a session name, result file name, database name, directory path, and type.
Transactions	A transaction represents an action or a set of actions used to measure the performance of the server. You define transactions within your Vuser script by enclosing the appropriate sections of the script with start and end transaction statement.
Vusers	Vusers or virtual users are used by LoadRunner as a replacement for human users. When you run a scenario, Vusers emulate the actions of human users working with your application. A scenario can contain tens, hundreds, or even thousands of Vusers running concurrently on a single workstation.

## 20.2 Graph Information

Term	Definition
Average	Average value of the graph measurement's.
Hits	The number of HTTP requests made by Vusers to the Web server.
Maximum	Maximum value of the graph measurement's.
Measurement	This is the type of resource being monitored
Median	Middle value of the graph measurement's.
Minimum	Minimum value of the graph measurement's.
Network Delay	The time it takes for a packet of data sent across the network to go to the requested node and return.
Network Path	The Network Path is the route data travels between the source machine and the destination machine.
Response time	The time taken to perform a transaction.
Scale (or granularity)	In order to display all the measurements on a single graph, thus making the graphs easier to read and analyze, you can change the scale or (granularity) of the x-axis. You can either set measurement scales manually, view measurement trends for all measurements in the graph, or let Analysis scale them automatically. The Legend tab indicates the scale factor for each resource.
Standard Deviation (SD)	The square root of the arithmetic mean value of the squares of the deviations from the arithmetic mean.
Throughput	Throughput is measured in bytes and represents the amount of data that the Vusers received from the server.
Vuser Load	When you run a scenario, the Vusers generate load or stress on the server. LoadRunner monitors the effect of this load on the performance of your application.

## User Testing

The most important testing is the user tested performed to ensure that the system was usable by IIT students. We user Prof. Feinburg's Usability, Testing, and Evaluation Center. Below I have inserted the testing proposal on the user testing for iKnow.

## **General description of this usability research:**

**This research is a set of usability tests on a stable beta of the system (version 1.1). These tests are designed to probe aspects of the system that could not previously be sufficiently tested with prior prototypes, such as aspects of user behavior dependent on access to a database containing real data. The results of research will support refinements in the user interface to support the first release version (1.2), as well as to suggest directions for the next major release, version 2.0.**

For testing (and first release), we have loaded all available electronic documents for each ongoing IPRO project. These documents include both official deliverables and internal project documents, such as functional requirements or photographs of the project in use.

**The use-case scenarios are designed to mimic real-world behavior with the system. Subjects will be using materials from their own projects both for data entry and recall.**

## **Resources requested:**

**5 sessions of 90 minutes lab time (as available, pending schedule) (+ set up and tear down) over a two-week period starting 11.1.04.**

### **Equipment:**

Usability lab

Workstation with

- Windows
- Internet access w/Internet Explorer to access iKNOW
- Microsoft Word
- PowerPoint
- Excel
- Adobe Acrobat Reader

Video camera and recording device

### **Personnel:**

Equipment set-up assistance (one time)

### **Set up requested:**

Camera over-the-shoulder onto computer screen

Audio recording (of user)

## Test plan

Five subjects will be selected for five different 90-minute sessions. Each subject is a member of a current IPRO project that continues from a previous semester. Subjects will be distributed by IPRO continuation (new IPRO, continuing IPRO – second semester, continuing IPRO – third semester) and IPRO class.

### Instruction to subjects prior to arrival at testing facility

For this user test, you will need to bring along a copy of your team's midterm report, or any other document that your IPRO team has created that you consider valuable (it need not be an IPRO deliverable, but it must be in electronic form).

You have been scheduled for 90 minutes, starting at [time] on [date].

After you arrive at [location, directions], you will be using the proposed iKNOW Knowledge Management System to submit your document, as well as to find other documents that are related to your IPRO work.

After the ninety minutes is done, we'll give you a coupon worth a free pizza and bottle of soda Domino's. Enjoy!

We look forward to your help,  
Eric Swanson  
[tester 2]  
[tester 3]  
From IPRO 338

### General setup

*Three members of the team are present throughout the study. Two are present in the lab with the subject; the third (the technical observer) stays behind the mirror and monitors the recordings. The two individuals in the lab – the note taker and the test runner – are the primary contacts with the subject. The note taker is responsible for greeting the subject and explaining the whole process. (The note taker should also establish some sort of rapport with the subject; this will make it easier to debrief the subject without intimidating him or her). The test runner actually instructs the user during each of the individual tests, explaining the nature of the tasks, and how to initiate them, as well resolving any technical issues with iKNOW that might interfere with the test.*

The camera(s) will be set up to capture both the user's activity with the computer and, if possible, the user's face (depending on the nature of the lab). The camera(s) will also capture audio from the user. The tapes will be kept for later review. The individual behind the mirror will be responsible for verifying that the tests are being recorded properly, as well as for taking additional notes.

### Introduction and familiarization with the test (10 minutes)

All three team members in attendance introduce themselves to the subject. The *note taker* describes the nature of the experiment. This description includes the following points:

- This is a test of our software, not of your abilities. Any problems that you in encounter we will assume are problems with the software. Nothing that you do during this study is wrong.
- This study is a “talk-aloud” study. This means that we encourage you to talk to yourself out loud. [The *test runner* will briefly model the talk-aloud behavior using Internet Explorer]
- [Test runner name] will be here to help you get each of the tasks started, he will not be guiding you through the tasks. If you are truly stuck, you can ask him for help, and he/she will get you back on track. He/she will also take care of any technical problems that arise.
- After each task, we'll be asking you some questions based on what we saw.

- You will, of course, be getting a gift certificate worth a pizza and a bottle of soda from Domino's Pizza for your participation.

### **Uploading a nugget (20-25 min)** (35 min so far)

The *test runner* opens Internet Explorer, navigates to the iKNOW portal, and gives the subject a username and password.

Instructions:

1. Please retrieve the IPRO project document you brought from your [CD ROM/e-mail/USB drive etc].
2. Your task is to log into iKNOW and add this document to your current semester's data, entering the information in the forms based on the on-screen instructions. If you reach a point in which you cannot determine what to do next, please spend a few moments trying to figure it out. If you are still unable to continue, ask me for help. Again, please speak your thoughts as you go through this process. Remember, nothing you do here is wrong; we are testing our software, not you.

### **Nugget de-brief (5 minutes)** (40 min so far)

The *note taker* selects a few of instances where the subject appeared to struggle or behave unexpectedly, and asks what happened and if there is any way it might be improved (This is done now, rather than later, in order to get information while it is fresh on the subject's mind).

### **Locating old documents from prior semesters of their IPRO (15 min)** (55 min so far)

Instructions:

1. We would like you to search for documents from prior semesters of your IPRO that relate to some technical issue you are currently facing. What are some technical issues you are currently facing?

The *test runner* and *note taker* determine which of these issues to ask the user to search for.

2. We'd like you to find any documents from your IPRO that relate to [subject selected]. Again, please speak your thoughts out loud, as we go through the process. Nothing you do here is wrong; we are testing the software, not you.
3. Once you've found a document you believe might be helpful, download it and open it up. Does the document contain what you expected? If not, why did it not meet your expectations?

### **Locating a best-practices document (15 min)** (1:10 so far) (can be removed for time)

Instructions:

1. iKNOW is designed to allow you to research other teams work for ideas and examples. Please use iKNOW to find a good example of a Final Presentation. Were you able to find one? If so, would the presentation you found help you create your own?

### **Document Locating de-brief (5 min)** (1:15 so far)

Similar to the Nugget de-brief, only covering both of the document location tasks.

### **Final wrap up (Impressions, thank you's, coupons) (15 min)** (1:30)

The *technical observer* joins the other two team members in the lab with the subject to ask any questions he or she has noted, based on their observation.

The team asks the subject for his or her overall impressions of the iKNOW system. Questions should include:

- Was the system navigation clear? How so or how not?
- Does the system seem helpful?
- Do you think you'd use the system once it is introduced? Why or why not?
- What recommendations do you have for changes in the system?
- What would you like to see in future versions of the system?
- How would you describe the system? (From set of five point scales)

Each member of the team thanks the subject for their time and effort, and hands over the coupon for the pizza.