WileyPLUS E5

Load/Stress Test Plan

Version 1.1

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WileyPLUS E5 Load/Stress Test Plan

John Wiley and Sons, Inc.

Audit Trail:

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1. Reference Documents

• E5 Performance Scalability Goals.xls

2. Objectives and Scope

The purpose of this document is to outline the environment and performance test plan for benchmarking Sakai 2.5.0 core tools for use in WileyPLUS E5. In general the purposes of this testing are:

- Validate the core Sakai framework and certain tools meet the minimum performance standards established for this project. The following tools will be measured for performance:
 - O Announcements
 - O Schedule
 - O Resources
 - O Gradebook
 - O Forums
 - O Site Info
- Establish a baseline for performance that can be used to measure any changes made to the core Sakai framework and tools going forward.

The performance testing effort outlined in this document will not cover the following:

- Performance testing any new Sakai tools that are developed
- Performance testing any changes to Sakai Tools that are planned for WileyPLUS E5
- Performance testing any BackOffice applications or integrations

3. Exclusions

This test plan will not cover any functional or accuracy testing of the software being tested. This test plan will not cover any browser or software compatibility testing.

4. Approach and Execution Strategy

Sakai will be tested using an existing Wiley performance test process. This test plan will serve as the basis for Testware to create Silk Performer Test Scripts. These scripts will be run by Leo Begelman using the Silk Performer software. Unicon, Inc. will watch and measure the CPU utilization of the web and database servers used during testing. Unicon, Inc. will analyze and present the performance test results to Wiley at the conclusion of the performance test cycle.

5. Load/Stress Test Types and Schedules

The following tests will be run:

- **Capacity Test** Determines the maximum number of concurrent users that the application server can support under a given configuration while maintaining an acceptable response time and error rate as defined in section 7.
- **Consistent Load Test** Long-running stress test that drives a continuous load on the application server for an extended period of time (at least 6 hours). The main purpose of this type of test is to ensure the application can sustain acceptable levels of performance over an extended period of time without exhibiting degradation, such as might be caused by a memory leak.
- Single Function Stress Test A test where 100 users perform the same function with no wait times and no ramp up time. This test will help determine how the application reacts to periods of extreme test in a very narrow area of the code. The areas that will be tested in this fashion are outlined in Appendix 3.
- **Baseline Test** At the conclusion of the **Capacity Test** and **Consistent Load Test** a third test will be established with the goal to be a repeatable test that can be performed when any portion of the system is changed. This test will not have the secondary goals

the other two tests have, and will simply exist to be a known quantity rather then the *breaking point* values the other tests are interested in.

Several test cycles may be required to obtain the results desired. The following test cycles are intended to serve as a guideline to the different test executions that may be necessary.

- 1. Obtain a baseline benchmark for 120 users logging into the system over the course of 15 minutes and performing the scenarios outlined in Appendices 1 and 2. (Note: there should be 118 students and 2 instructors).
- 2. Use the results from the first execution to make a guess as to how many users the system might support. One possibility might be to run 1000 different users through the system for one hour, with approximately 240 concurrent users at a time.
- 3. If the second execution continues to meet the performance goals outlined in section 7, continue to run new tests with increasing quantities of concurrent users until the performance goals are no longer met. It is desired that one server will support up to 500 concurrent users.
- 4. Assuming the maximum capacity is determined, a consistent load test will be run. The consistent load test will use a number of concurrent users equal to 50% of the maximum capacity. This test will run for 6 hours.
- 5. After both the maximum capacity and consistent load tests have been run, create a baseline test that stresses the system without running the maximum system load. The baseline test is recommended to be run at 75% of the maximum capacity for a period of two hours.
- 6. Run each single function test listed in Appendix 3. If any test exceeds the maximum number of server errors goal (see section 7) then try to determine if any configuration changes can be made to the system under test environment (see section 14) and run the test again.

6. Test Measurements, Metrics, and Baseline

The following metrics will be collected

Database Server:

- CPU Utilization Max., Avg., and 95th percentile. This data will be collected using the sar system utility.
- **SQL query execution time**: The time required to execute the top ten SQL queries involved in a performance test run. This data will be collected using Oracle Stats Pack.

Application Server:

- **Application Server CPU** Max., Avg., and 95th percentile. This data will be collected using the **sar** system utility.
- *Memory footprint:* The memory footprint is the peak memory consumed by the application while running. This data will be collected using the Java Virtual Machine (JVM) verbose garbage collection logging.
- **Bytes over the wire (BoW):** The bytes-over-the-wire is a count of the number of bytes that are passed between the server and the client. There are two major ways to measure this value: *initial action* and *cached* scenarios:
 - The *initial action* means that the user has no cached images, script, or pages on their machine because the request is a fresh request to the server. Therefore; that request is expected to be more expensive.
 - The *cached* mode means that images and pages are cached on the client with only the dynamic information needing to be transmitted for these subsequent actions.
 - It is recommended a mix of *initial Action* and *Cached* scenarios be included in the performance test runs.
 - This data will be collected using Silk Performer

Client:

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• *Time to last byte (TTLB)*: This is what will currently be measured in the stress tests, as opposed to user-perceived response time. Time to last byte measures the time between the request leaving the client machine and the last byte of the response being sent down from the server. This time does not take in to account the scripting engine that must run in the browser, the rendering, and other functions that can cause a user to experience poor performance. If the client-side script is very complex this number and the user perceived response time can be wildly different. A user will not care how fast the response reaches their machine (about the user perceived response time) if they cannot interact with the page for an extended amount of time. This data will be collected using Silk Performer.

Network:

• **Network Traffic**: Network traffic analysis is one of the most important functions in performance testing. It can help identify unnecessary transmissions, transmissions which are larger than expected, and those that can be improved. We need to watch network traffic to identify the bytes over the wire being transmitted, the response times, and the concurrent connections that are allowed. This data will be collected using the **sar** system utility.

7. Performance/Capability Goals (Expected Results) and Pass/Fail Criteria

The following are performance requirements (success criteria) for the performance tests:

- 1. The average response time (measured by the *Time to last byte* metric) is less then 2.5 seconds
- 2. The worst response time (measured by the *Time to last byte* metric) is less then 30 seconds
- 3. The average CPU utilization of the database server is less then 75%
- 4. The average CPU utilization of the application server is less then 75%
- 5. Each blade server must be capable of handing 500 concurrent users
- 6. The maximum number of acceptable server errors, non HTTP-200 status codes on client requests, will be less then 2% of all client requests.

8. Software and Tools Used

Component	Software Version
Sakai	Sakai 2.5.0 GA
Servlet Container	Tomcat 5.5.25
Java Virtual Machine	Sun Java Development Kit 1.5.0.14
Database	Oracle 10g (version 10.?.?.)
Load Test Tool	Silk Performer

9. Load Descriptions

Each test outlined in section 5 will run with a ratio of 59 students to 1 instructor. There is no expected difference between users logging in for the first time or subsequent logins given how the data (outlined in section 10) will be created. The data set these tests will start with, will appear to be in mid-course for all users.

There will be no ramp up time for any of the **Single Function Stress Tests**. The ramp up time for all other tests, should be set to 1 user every 3 seconds. 120 users should therefore be

running within 6 minutes. The wait time between requests is contained in the test scenarios in Appendix 1 and Appendix 2.

In order to place as much stress on the system as possible with a small number of users, all users should come from different worksites.

10. Content and User Data Preparation

The Sakai system will need to be preloaded with data before the performance testing will begin. This data will be created using the Sakai Shell and Sakai Web Services. Once the data is created it will be extracted from the database with a database dump. The following table identifies several types of data that will need to be preloaded into the Sakai environment.

Type of Data	Amount of Data
Users	93567
Students	92000
Instructors	1557
Administrators	10
Very Large Worksites	2
Large Worksites	5
Medium Worksites	50
Small Worksites	1500
Students to Instructors Ratio	59 to 1
Students per Very Large Worksite	1000
Students per Large Worksite	500
Students per Medium Worksite	250
Students per Small Worksite	50
Announcements per Worksite	13
Forum Topics per Worksite	1/3 of all forum posts in a worksite
Forum Posts per Worksite	(spread across topics) ¼ students in worksite * 6.5
Columns (Assignments) in Gradebook	13
Instructor Resource per Worksite	20

11. Load Script Recording

Testware will create new Silk Performer Test Scripts based on the two scenarios outlined in Appendices 1 and 2. Appendix 1 represents the Student scenario, while Appendix 2 represents the Instructor scenario. The Test Suite should be set up to accommodate a ratio of 59 students to 1 instructor. Wait time should be included between each page request, so that the total time for an activity is equal to the number of page requests * 2.5 seconds + the total wait time.

12. Load Testing Process

This section details the load testing process that will be followed for all performance tests conducted as described in this test plan.

- 1. Start data collection scripts
- 2. Stop the application
- 3. Remove any temporary files
- 4. Reset the database and file system to known starting points
- 5. Start the application and run a quick sanity test to make sure each application server can successfully return login screen markup can successfully process a login request.
- 6. Request the Silk Performer scripts be started
- 7. Once the Silk Performer scripts have completed, stop the data collection scripts
- 8. Acquire any database specific data being collected
- 9. Collate the data for all the metrics specified in section 6, into one report.
- 10. Make the report available in the Wiley Portal

13. Training Needs

Testware will need to be trained on the use of the Sakai environment. The scenarios outlined in Appendix 1 and Appendix 2 give some idea about which parts of Sakai will be used, however, more training will probably be required by the Test Script writers.

14. System-Under-Test (SUT) Environment

Specifying mixes of system hardware, software, memory, network protocol, bandwidth, etc.

- Network access variables: For example, 56K modem, 128K Cable modem, T1, etc.
- ISP infrastructure variables: For example, first tier, second tier, etc.
- Client baseline configurations
 - Computer variables
 - Browser variables
- Server baseline configurations
 - Computer variables
 - System architecture variables and diagrams

Other questions to consider asking:

- What is the definition of "system"?
- How many other users are using the same resources on the system under test (SUT)?
- Are you testing the SUT in its complete, real-world environment (with load balances, replicated database, etc.)?
- Is the SUT inside or outside the firewall?
- Is the load coming from the inside or outside of the firewall?

15. Test Deliverables

The following test deliverables are expected as part of this performance testing effort.

- **Test Plan** This Document
- **Test Scripts** Silk Performer Test Scripts to implement the scenarios outlined in Appendix 1 and Appendix 2
- Test Results Data The data resulting from the performance tests run
- **Test Results Final Report** The final report that documents and analyzes the results of the performance tests that were conducted according to this test plan

16. Team Members and Responsibilities

The following table defines the different team member responsibilities.

Responsibility	Team Member
Test Plan Creation	Cris Holdorph (Unicon)
Silk Performer Test Script Creation	TestWare
Validation of Test Script Execution	Leo Begelman and Cris Holdorph (Unicon)
Sakai Test Fixture/Data Generation	Cris Holdorph (Unicon)
Silk Performer Test Script Execution	Leo Begelman
CPU Monitoring and Test Orchestration	Unicon
Database Loading and Analysis	Alex Bragg (Unicon)

17. Risk Assessment and Mitigation

Business

Risk: Unsatisfactory Performance of Sakai

Mitigation: Conduct performance testing of core Sakai at the beginning of the project. If Sakai does not meet the goals established above, project management will have the most time possible to adjust project plans.

IT

Risk: Limit on the number of virtual users available with Silk Performer **Mitigation**: Test only one blade server per 500 virtual users available with Silk Performer

Risk: All Sakai tools needed for testing at this stage may not be available **Mitigation**: Tests will be conducted against the core tools that are in the Sakai 2.5.0 release. Where a tool that is needed is not yet available, and place holder tool has been specified in the test scenarios in Appendix 1 and 2. (e.g., Calendar will be used in place of Student Gateway for this testing)

18. List of Appendices

- Appendix 1 Student test scenario
- Appendix 2 Instructor test scenario
- Appendix 2 Single function stress test scenarios

19. Test Plan Approval

Business Approval

Tom Speyer, Director, Enabling Technologies	Date
IT Approval	
Brian Librandi,	Date
Testing Approval	
Leo Begelman, Software QA Manager, Higer Education	Date

Appendices

Appendix 1 Student Test Scenario

1. Login

Tool/Service:Access ControlTime Spent on Task:0.25 minNotes:This test plan will assume Sakai local authentication.Steps:A. Enter User Id

- B. Enter Password
- C. Click the Login button
- D. Click on a worksite tab for this student that represents a class and is not the My Workspace tab

2. Read Announcements

Tool/Service:AnnouncementsTime Spent on Task:0.5 minNotes:Steps:

- A. Click on Announcements Page
- B. Select an Announcement Title under Subject

3. Navigate to today's work

Tool/Service:ScheduleTime Spent on Task:0.5 minNotes:Schedule will mimic the Student Gateway for nowSteps:A.A.Click on Schedule Page in Worksite to View Events for Today

4. Add Event to Personal Site

Tool/Service:ScheduleTime Spent on Task:Notes:Notes:Add Schedule Event in WorkspaceSteps:A.A.Click on the Schedule Page in Personal Site

- B. Click Add
- C. Enter Title/Date/Start Time and Message
- D. Click Save Event

5. Do Readings

 Tool/Service:
 Resources

 Time Spent on Task:
 3 min

 Notes:
 3

 Steps:
 A

- A. Click on Resources Page in Worksite
- B. Select desired resource

- C. Select option to Open or Save
- D. Read selected Resource

6. Upload Resource to Personal Site

Tool/Service: Resources

Time Spent on Task: Notes: Upload Resource(s)

Steps:

- A. Click on Resources Page in Personal Site
- B. Click on the Add Drop Down Arrow next to the resource listed
- C. Select Upload File
- D. Click Browse to locate file
- E. Select file name to upload
- F. Click Upload Files Now

7. Preview Questions

Tool/Service:AssessmentTime Spent on Task:0.5 minNotes:Skip for now

8. Do Assessments

Tool/Service:AssessmentTime Spent on Task:5 minNotes:Skip for now

9. Get/Utilize Feedback

Tool/Service:ResourcesTime Spent on Task:1 minNotes:Skip for now

10. Review Results

Tool/Service:GradebookTime Spent on Task:0.5 minNotes:Steps:

- A. Click on Gradebook Page in Worksite
- B. View all grades listed

11. Communicate in Forums

Tool/Service:ForumsTime Spent on Task:1 minNotes:3Steps:4

- A. Click on Forums Page in Worksite
- B. Click on Question for Forum link
- C. Click Post New Thread
- D. Enter Title/Message info

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E. Click Post Message

12. Communicate in e-mail

Tool/Service: Mailtool Time Spent on Task: 0.75 min Notes: Skip for now

13. Join Worksite

Tool/Service: Membership Time Spent on Task: Notes: Steps:

- A. Click on Membership Page in Personal Site
- B. Click on Joinable Sites
- C. Click on Site you want to Join
- D. Verify new tab for new Worksite is displayed

14. **Populate Student Profile**

Tool/Service:	Profile
Time Spent on Task:	
Notes:	
Steps:	

- A. Click Edit my Profile
- B. Enter First Name/Last Name/Email and any optional information to include in profile
- C. Click Save

15. **Search for Information**

Tool/Service: Search Time Spent on Task: Notes: Steps:

- A. Click Search
- B. Enter word to search for
- C. View results of search

16. **Change e-mail Preference**

Tool/Service: Profile Time Spent on Task: Notes: Steps:

- A. Click on the Preferences Page
- B. Select the radio button for 'Send me one email per day summarizing all emails'
- C. Click Update Preferences

17. **Browse Help**

Tool/Service: Profile

Time Spent on Task: Notes: Steps:

- A. Click on the Help page
 B. Select topic for help information
 C. Close 2nd Browser window

Logout 18.

Tool/Service: Access Control Time Spent on Task: Notes: Steps: A. Click the Logout link

Appendix 2 Instructor Test Scenario

1. Login

Tool/Service:Access ControlTime Spent on Task:0.25 minNotes:This test plan will assume Sakai local authentication.Steps:Image: Control of the steps of the step

- B. Enter User Id
- C. Enter Password
- D. Click the Login button
- E. Click on a worksite tab for this student that represents a class and is not the My Workspace tab

2. Post Announcements

Tool/Service:AnnouncementsTime Spent on Task:5 minNotes:5 minSteps:3

- A. Click on Worksite Tab
- B. Click on Announcements Page
- C. Click on Add
- D. Type in Announcement Title/Body/Access/Availability/Attachments
- E. Click Add Announcement

3. Upload Roster

Tool/Service:unknownTime Spent on Task:5 minNotes:Skip for now

4. Upload Resources

Tool/Service:ResourcesTime Spent on Task:15 minNotes:Many instru

Notes: Many instructors use large ppt files as resources for their presentations. In many cases, multiple presentations for a given class section get uploaded prior to the class section start within a relatively short period of time, one-by-one. This might cause a significant load increase to the system

Steps:

- A. Click on Resources Page in Worksite
- B. Click Add/Upload Files
- C. Browse to location of file to upload
- D. Click Add Another File link
- E. Browse to another file location
- F. Click Upload Files Now

5. Create Assignments

Tool/Service:AssessmentTime Spent on Task:15 minNotes:Skip for now

6. **Preview Questions**

Tool/Service:AssessmentTime Spent on Task:15 minNotes:Skip for now

7. Review Grades

Tool/Service:GradebookTime Spent on Task:5 minNotes:5 minSteps:3 min

- A. Click on Gradebook
- B. See list of posted grades
- C. Click Add Gradebook Item
- D. Enter Title/Gradebook Item Point Value/Due Date
- E. Click Add Item

8. Export Grades

Tool/Service:GradebookTime Spent on Task:5 minNotes:5Steps:4

- A. Click Course Grades
- B. Click Export Course Grades
- C. Select Open or Save option for Export

9. Import Grades

Tool/Service:GradebookTime Spent on Task:Notes:Notes:Steps:

- A. Click Import Grades from Gradebook Tool
- B. Follow directions to create Template
- C. Edit Spreadsheet
- D. Save Spreadsheet
- E. Browse to newly saved Spreadsheet
- F. Click Import Spreadsheet

10. Add Schedule Event

Tool/Service:ScheduleTime Spent on Task:Notes:Notes:Schedule

Steps:

- A. Click Schedule Page
- B. Click Add
- C. Enter Title/Date/Start Time/Message
- D. Click Save Event

11. Change Role

Tool/Service: Site Info Time Spent on Task: Notes: Steps: Official official

- A. Click on Site info in Worksite
- B. Select TA from the dropdown list for student changing roles
- C. Click Update Participants

12. Add Tools to Worksite

Tool/Service:Site InfoTime Spent on Task:Notes:Notes:Steps:

- A. Click Site Info
- B. Click Edit Tools
- C. Check box for Search
- D. Click Continue
- E. Verify Search is now listed, then click Finish

13. Edit Site Information

Tool/Service:	Site Info
Time Spent on Task:	
Notes:	
Steps:	

- A. Change Description information given for Worksite
- B. Click Continue
- C. Verify Changes are correct, then Click Finish

14. Search for Information

Tool/Service:SearchTime Spent on Task:Notes:Notes:Steps:

- A. Click Search
- B. Enter word to search for
- C. View results of search

15. Logout

 Tool/Service:
 Access Control

 Time Spent on Task:
 Notes:

 Steps:
 Other that have third

A. Click the Logout link

Appendix 3 Single Function Stress Test Scenarios

Student Tests (use steps from Appendix 1)

- 1. Login (1), Logout (18)
- 2. Login (1), View Schedule (3)
- 3. Login (1), Upload Resources (6)
- 4. Login (1), View Gradebook (10)
- 5. Login (1), Use Forums (11)
- 6. Login (1), View Joinable Sites (13)
- 7. Login (1), Use Search (15)

Instructor Tests (use steps from Appendix 2)

- 1. Login (1), Logout (15)
- 2. Login (1), Add Announcement (2)
- 3. Login (1), Upload Resources (4)
- 4. Login (1), View Gradebook (7)
- 5. Login (1), Export Grades (8)