



Software Test Documentation

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For

PlasmaGraph

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Revision History

Name	Date	Reason For Changes	Version
Daniel E. Quintini	2014/05/15	Document still lacks important information like test cases, test cases reports and conclusions.	1-2014-04-24
Daniel E. Quintini	2014/06/02	Removed all remaining TBD	3-2014-06-02

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1. Test plan identifier

STD-2-2014-05-15

2. Introduction

2.1 Objectives

A system test plan for PlasmaGraph should support the following objectives:

- (1) Detail the activities required to prepare for and conduct the system test.
- (2) Communicate to all responsible parties the tasks that they must perform, and the schedule to be followed in performing those tasks.
- (3) Define the sources of information used to prepare the plan.
- (4) Define the tools and environment needed to conduct the system test.

2.2 Background

Dr. Angel Gonzalez-Lizardo, director of the plasma laboratory at the Polytechnic University of Puerto Rico requested on August 2013 that two software developers started working on a software tool with the capability to make graph charts based on the information produced by the laboratory equipment. The information is stored in a file with MATLAB's LEVEL 5 MAT-File format.

Gerardo A. Navas and Daniel E. Quintini developed the tool requested by Dr. Angel Gonzalez-Lizardo. Specific requirements are stated in the software requirements specification document (SRS-3-2014-05-14).

2.3 Scope

This test plan covers a partial system test for PlasmaGraph. This means that testing will focus only on the functional requirements specified in section 2.2.1 of the requirements document (SRS-3-2014-05-14). The test plan will only include the core packages of the system which relay on the

packages that will not be tested directly. The plan also includes all user procedures specified by the PlasmaGraph User Manual (UM-2-2014-05-28).

3. Test items

All items to be tested belong to PlasmaGraph's Alpha version. Package testing will be accomplished using Java's JUnit testing framework and the resulting test suit will be included in PlasmaGraph as a test package. Results produced by this test package will be documented by Gerardo A. Navas from the Plasma Visualization Team. User procedure testing on the other hand will be done by Daniel E. Quintini from the Plasma Visualization Team and at least one student and one professor from PUPR's plasma laboratory.

The following documents will provide the basis for defining correct operation:

- Software Requirements Specification (SRS-3-2014-05-14)
- Software Design Description (SDD r2)
- Software Project Management Plan (SPMP r1)
- PlasmaGraph User Manual (UM-2-2014-05-28)
- IEE Standard for Software Test Documentation (IEEE Std 829-1998)

3.1 System Packages

Type	Package	Member name
Source Code	org.pvg.plasmagraph.tests.DataSetTest	testDataSet () testAdd () testRemove () testFind () testContains () testGet () testIsDouble () testIsDoubleInt() testIsString() testIsStringInt () testSize () testToXYGraphDataset () testToBarGraphDataset () testGetColumnLength () testAppendDataSet ()
Source Code	org.pvg.plasmagraph.tests.GraphTest	testXYGraphs() testBarGraph()

Type	Package	Member name
Source Code	org.pvg.plasmagraph.test.HeaderDataTest	testAdd() testRemove() testFind() testContains() testGet() testIsDouble() testIsString() testIsDateTime() testSize() testPopulateData() testPopulateGroupedData() testMultipleFilePopulateData()
Source Code	org.pvg.plasmagraph.test.InterpolatorTest	testInterpolateLinear() testInterpolateQuadratic() testInterpolateCubic() testInterpolateSpline()
Source Code	org.pvg.plasmagraph.test.MATTest	testToDataSet() testToStringFile() testEquals() testPrint() testMapFileSize()
Source Code	org.pvg.plasmagraph.test.OutlierSearchTest	testClusterScanning() testMahalanobisDistance()
Source Code	org.pvg.plasmagraph.test.TemplateTest	testSaveAndOpenTemplate()
Executable Code	org.pvg.plasmagraph.test	FeatureTestSuite.java

3.2 User Procedures

The procedures detailed by the PlasmaGraph User Manual (UM-2-2014-05-28) will be tested by Daniel E. Quintini and at least two students, mentors, or professors from PUPR's plasma laboratory. These user procedures correspond specifically to features described in section 4 and identified as TDS-01-01, TDS-02-01, TDS-02-02, TDS-02-03, TDS-02-04, TDS-02-05, TDS-02-06, TDS-01-02, TDS-01-03, and TDS-02-07.

4. Features to be tested

Test Design Specification Number (TDS)	Description
TDS-01-01	Read a MATLAB LEVEL 5 MAT-File and display its contents on screen.
TDS-01-02	Import data from a MATLAB LEVEL 5 MAT-File of at least 60,000KB and plot a set of X values against a set of Y values in 5 minutes or less.
TDS-01-03	Change the chart graph's title, X axis label, and Y axis label.
TDS-01-04	Portability. Test features TDS-01-01 to TDS-01-03 and TDS-02-01 to TDS-02-07 in the following Operating Systems: Windows 7, Ubuntu Linux 14, and Mac OS X 10
TDS-02-01	Plot a set of X values against a set of Y values.
TDS-02-02	Plot a set of X values against a set of Y values and draw the line that results from the linear interpolation of the plotted points. Then, determine the confidence level of the graph.
TDS-02-03	Plot a set of X values against a set of Y values and draw the line that results from the quadratic interpolation of the plotted points. Then, determine the confidence level of the graph.
TDS-02-04	Plot a set of X values against a set of Y values and draw the line that results from the spline interpolation of the plotted points. Then, determine the confidence level of the graph.

Test Design Specification Number (TDS)	Description
TDS-02-05	Plot a set of X values against a set of Y values and identify the outliers.
TDS-02-06	Plot a set of X values against a set of Y values grouped by a third set of values and draw the line that results from the linear interpolation of the plotted points for each set of X,Y points plotted as part of each group. Then, determine the confidence level of the graph.
TDS-02-07	Plot a set of X values against a set of Y values and save the produced graph as an image in PNG format.
TDS-03-01	Perform automated testing for packages described in section 3.1.

5. Features not to be tested

Reading files formatted as comma separated values (CSV) will not be tested because its existence doesn't affect any functional requirement of PlasmaGraph at the time of delivery. For the same reason, features related to template files will not be tested by the end user.

6. Approach

Daniel E. Quintini and Gerardo A. Navas will use the system documentation to prepare all test design, cases, and procedure specifications. By taking this approach, the accuracy and comprehensiveness of PlasmaGraph's documentation will also be tested.

6.1 Conversion testing

PlasmaGraph can read a MATLAB LEVEL 5 MAT-File and convert it into an object usable by the system. This object is called a "DataSet" and to make sure that it represents the same data as the original file, it will be submitted to a verification process where the following criteria is to be met:

1. DataSet has the same amount of columns as variables in the original MATLAB LEVEL 5 MAT-File.
2. Each column in the DataSet object has a corresponding variable in the original MATLAB LEVEL 5 MAT-File and the values contained in each variable are also contained in the corresponding column of the DataSet object.

6.2 Job streaming testing

A comprehensive set of values produced by the Mirror and Cusp Plasma Machine at the Polytechnic University of Puerto Rico and formatted as a MATLAB LEVEL 5 MAT-File should be used to test features specified by test design specification numbers TDS-01-01, TDS-02-01, TDS-02-02, TDS-02-03, TDS-02-04, TDS-02-05, TDS-02-06, TDS-01-02, TDS-01-03, and TDS-02-07.

Each one of the features mentioned above should be tested using at least two different MATLAB LEVEL 5 MAT-Files.

6.3 Interface testing

Interface testing will cover features specified in section 4 as TDS-01-01, TDS-02-01, TDS-02-02, TDS-02-03, TDS-02-04, TDS-02-05, TDS-02-06, TDS-01-02, TDS-01-03, and TDS-02-07. The following items should be used in order to test the interface between PlasmaGraph and its end user which can be any student, mentor, or professors working at the PUPR plasma laboratory:

- a. User Manual: Because the end user won't be familiar with the product at the time of delivery, the Plasma Visualization Team created the PlasmaGraph User Manual (UM-2-2014-05-28) which can be used by any student, mentor, or professor at PUPR's plasma laboratory to perform any of the tests covered in this section.
- b. MTLAB LEVEL 5 MAT-Files: A team of students at PUPR's plasma laboratory created two files using the output produced by the Mirror and Cusp Plasma Machine. These files are formatted as readable data files which are described in section 3.1.1.2 of the requirements documentation (SRS-3-2014-05-14).

6.4 Performance testing

Performance testing will be evaluated against the requirements specified in section 3.3 of document (SRS-1-2014-01-23). This can be accomplished by importing data from a 60,000KB MATLAB LEVEL 5 MAT-File into PlasmaGraph and plotting a set of X values against a set of Y values as described in feature test TDS-01-02.

6.5 Regression

Before a new version of PlasmaGraph is approved for delivery to the client, it needs to pass every test passed by the previous version. Test results from both versions also need to be compared so the developers can detect any unexpected impact resulting from program modifications.

6.6 Comprehensiveness

Each of the features specified in the PlasmaGraph User Manual (UM-2-2014-05-28) has exactly one associated test design specification. The system's core packages are also tested using Java's JUnit

testing framework and a resulting test suit package is included in PlasmaGraph's source code so package testing can be repeated or adjusted at any time.

6.7 Constraints

A final implementation date of May 20, 2014 has been planned for PlasmaGraph. It is necessary to meet this date because the current trimester at PUPR ends on May 26, 2014 and the students working at the plasma laboratory have to produce reports from graph charts generated by PlasmaGraph before the trimester ends.

7. Item pass/fail criteria

Every item in the packages tested using Java's JUnit testing framework should pass its corresponding unit test as defined in the test package source code. Likewise, every user procedure needs to pass the test designed for it and performed by the end user with the help of the User's Guide for Testing PlasmaGraph (TDB). A user procedure test is considered to be passed if and only if the person performing the test comes up with exactly the same results as those specified by the section of the User's Guide for Testing PlasmaGraph (TDB) that corresponds to the user procedure being tested.

8. Suspension criteria and resumption requirements

8.1 Suspension criteria

Inability to translate a MATLAB LEVEL 5 MAT-File into a DataSet object will result in suspension on all testing activities. Testing activities can also result in total suspension if a version of PlasmaGraph fails a regression test as defined in section 6.5.

8.2 Resumption requirements

When the suspended version is re-introduced for testing, a regression test as described in section 6.5 is to be done.

9. Test deliverables

The following documents will be generated by the Plasma Visualization Team and/or the students and professors from the Plasma Laboratory Team selected for testing PlasmaGraph.

Test documentation:

- System Test Design Specification
- System Test Case Specification
- System Test Procedure Specification
- System Test Summary Report

These documents must be delivered to Daniel E. Quintini from the Plasma Visualization team as soon as the test is completed.

Test data:

- (1) All data entered, inquired, and used by PlasmaGraph during testing must be copied and attached to its corresponding test case documentation. The tester must also specify in which operating system the test was executed.
- (2) Copies of both input and output files resulting from testing must to be delivered to Daniel E. Quintini from the Plasma Visualization team along with the test's corresponding documentation.

10. Testing tasks

Task	Predecessor tasks	Special skills	Responsibility	Effort	Finish date
(1) Prepare test plan.	Complete Software Design Description (SDD r2) and PlasmaGraph User Manual (UM-2-2014-05-28)	Knowledge of IEE documentation standards. Proficient in any word processing tool capable of producing documentation formatted as portable document file (PDF).	Plasma Visualization Team	7	2014-05-01
(2) Prepare test design specifications.	Task 1	Knowledge of PlasmaGraph's capabilities and components. Proficient in any word processing tool capable of producing documentation formatted as portable document file (PDF).	Plasma Visualization Team	9	2014-05-08

Task	Predecessor tasks	Special skills	Responsibility	Effort	Finish date
(3) Prepare test case specifications.	Complete corresponding test designs (Task 2)	Knowledge of PlasmaGraph's capabilities and components. Proficient in any word processing tool capable of producing documentation formatted as portable document file (PDF).	Plasma Visualization Team	7	2014-05-08
(4) Prepare test procedure specifications	Complete corresponding test case specifications (Task 3)	Proficient in any word processing tool capable of producing documentation formatted as portable document file (PDF).	Plasma Visualization Team	7	2014-05-08
(5) Generate the MATLAB LEVEL 5 MAT-Files used for testing.	Software Design Description (SDD r2)	Experience programming in MATLAB		6	2014-05-01

Task	Predecessor tasks	Special skills	Responsibility	Effort	Finish date
(6) Generate a Java executable file from PlasmaGraph's source code	Implement PlasmaGraph as defined by Software Design Description (SDD r2) and using Oracle's Java programming language.	Experience programming in Java.	Plasma Visualization Team	3	2014-05-08
(7) Deliver test items to everyone responsible for testing	Task 4 Task 5 Task 6.	-	Plasma Visualization Team	-	2014-05-12
(8) Execute package testing	Task 7	Experience using Java's JUnit testing framework.	Plasma Visualization Team	4	2014-05-16
(9) Execute user procedure testing	Task 7	-	Plasma Laboratory Team: Student 1 Professor 1	3	2014-05-16
(10) Review test results	Task 8 Task 9	-	Plasma Visualization Team	5	2014-05-19
(11) Resolve test incidents reports	Task 10	Experience programming in Java.	Plasma Visualization Team	3	2014-05-19

Task	Predecessor tasks	Special skills	Responsibility	Effort	Finish date
(12) Repeat tasks (7)-(11) until every test incident report is resolved.	Task 11	-	Plasma Visualization Team	-	2014-05-19
(13) Write the system test summary report.	Task 12	Knowledge of PlasmaGraph's capabilities and components. Proficient in any word processing tool capable of producing documentation formatted as portable document file (PDF).	Plasma Visualization Team	3	2014-05-20

11. Environmental needs

11.1 Hardware

The testing will be done using 3 different computers:

Computer 1:

- a. 15'' Monitor
- b. A standard alphanumeric American (QWERTY) keyboard
- c. One 3.20GHz dual core processor
- d. 8GB of RAM
- e. Operating System: Windows 7 Professional

Computer 2:

- a. 15.4'' Monitor
- b. A standard alphanumeric American (QWERTY) keyboard
- c. One 2.53GHz dual core processor
- d. 4GB of RAM
- e. Operating System: Mac OS X 10

Computer 3:

- a. 17.3'' Monitor
- b. A standard alphanumeric American (QWERTY) keyboard
- c. One 2.40 GHz dual core processor
- d. 4GB of RAM
- e. Operating System: Linux Ubuntu 14

11.2 Software

In order to run any test, Oracle's Java SE Runtime Environment version 7 must be installed.

11.3 Operating system

Because one of the functional requirements for PlasmaGraph is to be portable, every test described by this document must be performed 3 times. That is once in each of the following operating systems:

- Microsoft's Windows 7
- Mac OS X 10
- Linux Ubuntu 14

11.4 Security

Security will be limited to existing controls defined by the operating system.

11.5 Tools

The following tools are required for generating, evaluating, and documenting the system's tests:

- (1) Mirror and Cusp Plasma Machine
- (2) MathWorks' MATLAB high-level language and interactive environment for numerical computation, visualization, and programming.
- (3) NetBeans IDE or Eclipse IDE.
- (4) Any word processor software capable of producing documentation formatted as a portable document file (PDF).

11.6 Publications

The following documents are required to support system testing:

- Software Requirements Specification (SRS-1-2014-01-23)
- PlasmaGraph User Manual (UM-02-2014-05-28)
- Software Design Description (SDD r2)
- Software Project Management Plan (SPMP r1)

12. Responsibilities

The following groups are responsible for segments of the testing:

12.1 Plasma Visualization Team

This group performs the following functions:

- Provide overall management of the testing and the technical testing expertise.
- Provide the version of PlasmaGraph to be tested along with all necessary items for performing said test.
- Respond to the PlasmaGraph's Test Incident Reports.
- Program debugging.
- Execute each test once.

12.2 Plasma Laboratory Team

This group is the end user of PlasmaGraph and performs the following functions:

- Review test design specifications.
- Generate at least two MATLAB LEVEL 5 MAT-Files from PUPR's Mirror and Cusp Plasma Machine output.
- Execute user procedure testing.

13. Staffing and training needs

13.1 Plasma Visualization Team

The team consists of two (2) computer science undergraduate students from the Polytechnic University of Puerto Rico.

13.2 Plasma Laboratory Team

The team consists of five (5) professors, two (2) mentors and ten (10) students from the Polytechnic University of Puerto Rico.

13.3 Training

Members of the plasma laboratory team that execute user procedure testing must be familiar with the PlasmaGraph User Manual (UM-2-2014-05-28).

14. Schedule

Package testing will be done on April 25 and user procedure testing will be done from May 5 to May 9. See section 10 of this document for a full list of tasks and their delivery dates.

15. Risks and contingencies

If the testing schedule is significantly impacted by system failure, the plasma visualization team will take on the task of debugging and will make this their first priority.

If the client Dr. Angel Gonzalez-Lizardo is not sufficiently available for testing he will identify another professor able to complete the testing.

16. Approvals

Dr. Angel Gonzalez-Lizardo

Date

Daniel E. Quintini

Date

Gerardo A. Navas

Date