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ACHIEVING MEANINGFUL METRICS FROM YOUR TEST AUTOMATION TOOLS

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Jack R. Frank is a managing consultant with Mosaic, Inc., a Chicago-based consulting company specializing in software risk management services. Over the last twelve years, Mr. Frank has worked on numerous large-scale, mission critical projects within Fortune 500 companies. As head of Mosaic's Automation Practice, he specializes in development, implementation and long-term maintenance of automated test tool strategies. Mr. Frank also is experienced with software risk assessments, test strategy planning, test environment construction and has managed the complete manual and automated testing process for dozens of projects. He also has expertise in the design and implementation of performance, stress and disaster recovery testing.

Prior to joining Mosaic, Mr. Frank spent 13 years with a leading manufacturer of personal computers in the role of Director, Application Software. During these early days of the PC industry, he worked on the development and testing of hundreds of applications, operating systems, as well as system and application firmware. These projects included joint testing with Microsoft of MS-DOS 1.0 through 6.22, Windows 1.0 through 3.11, Windows for Workgroups, Word, Multiplan, Excel and Access—the database and telecommunication program.

Mr. Frank has a BS in Mathematics and Computer Science from the University of Illinois at Chicago.

Achieving Meaningful Metrics From Your Test Automation Tools

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Who is Mosaic?

- Incorporated in 1988
- Headquartered in Chicago, Illinois
- Specialize in software risk management
- Focus on software testing, quality, user support and measurement
- Clients are major organizations with large complex software systems



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The Problem - Numbers! Metrics!

- Everyone wants to know your status
- Testing activities generate lots of raw numbers
 - Test cases executed - manually and/or via tools
 - Test cases passed or failed
 - Test case progress vs plan
- Performance and Stress Tests generate even more
 - Transactions per interval is just the beginning
 - Middle queue per interval
 - CPU, memory paging, disk I/O
 - Database parsing, paging, reads, writes
- Reporting can take more time than testing



The Solution (or Solutions)

- Have a process!
- Have a process that produces metrics
 - Define key management metrics before testing
 - Not just raw numbers, but metrics
 - Have metrics naturally flow out of the activities
- Share the responsibility for gathering
- Use your tools



Testing Process - MSTAR®

- Browser-based repository of testing expertise
- Industry best practices
- Includes:
 - Complete instructions and guidelines
 - Samples, templates and forms
 - Company/Project repositories

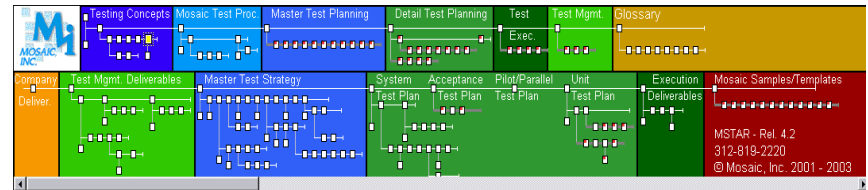


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The screenshot shows the MSTAR website interface. At the top, there is a navigation menu with items like 'Testing Concepts', 'Mosaic Test Proc.', 'Master Test Planning', 'Detail Test Planning', 'Test', 'Test Mgmt.', and 'Glossary'. Below this is a breadcrumb trail: 'Company > Test Mgmt. > Deliverables > Master Test Strategy > System > Acceptance > Pilot/Parallel > Unit > Execution > Mosaic Samples/Templates'. The main content area is titled 'Mosaic's Structured Testing and Assessment Repository (MSTAR®)' and features a sidebar on the left with links like 'Organization and Structure of MSTAR®', 'Paths within MSTAR®', 'Introduction to Mosaic Overview Path', 'Introduction to Mosaic Deliverable Reference', and 'How to View MSTAR®'. The main content area is titled 'Risk Management Through Quality Testing' and contains text about risk management in system projects, a bulleted list of risk factors, and a paragraph about a prime risk management technique. A sidebar on the right contains a note: 'For your improved viewing: Use full screen display if available in your browser.' At the bottom of the main content area, there are links for 'Indx TOC off', 'Indx TOC Home', 'Top of Page', and 'Glossary'.

MSTAR[®] - Metrics

- Test Creation Status
- Test Execution
- Test Coverage
- Defect Arrival
- Defect Density
- Metrics for QA
- Metrics for PM
- Metrics for Mgmt
- Etc...



Measurement

[Return to Testing Concepts - What is Testing?](#)

- [Testable Requirements](#)
- [Economics of Testing](#)
- [Requirement/Risk Driven Testing](#)
- [Incremental Testing](#)
- [Defect Management](#)
- [Measurement](#)

- Effort measured in person days or hours,
- Cost measured in dollars and
- Defect data measured in defect counts, defect counts by categories or dollars in defect removal costs.

Metrics

A metric is a calculated or composite relationship between two or more measures that results in a meaningful and predictive value that is useful in defining a characteristic or standard. Several significant metrics can and should be measured from the testing effort. Most of these are dependent on a size measurement against which other measures can be calibrated. For testing, testable requirements is the recommended size measurement.

- **Defect Density (Defects/Testable Requirements)** - This measure gives a measurement of the number of defects in a system. Defect density should be measured by system components. A high defect density in one or more areas of a system provides useful information on areas requiring more attention and possibly worthy of redevelopment. A high defect density in areas may also point to opportunities for process improvement. Defect density is also a good predictor of testing effectiveness and system readiness for production.
- **Defect Arrival Rate (New Defects/Period Measured)** - This measure tracks the rate at which new defects are being discovered. This is useful to monitor the stability of the system and it is an important measure to evaluate readiness for implementation. This measure is most valuable to track stability when there are a large number of test cases and a fairly high retest rate. With continued testing, the Defect Arrival Rate should be leveling off towards zero as a system stabilizes. Defect density and the amount of testing must also be considered since a leveling off of the defect arrival rate may also signal a stoppage or end to testing rather than system stability.
- **Defect Removal Efficiency (Defects Removed During Development/Total Defects)** - This measure can generally only be calculated after implementation but it is a fundamental measure of the effectiveness of testing and other defect removal techniques. Defect removal efficiency is also an indicator of development effectiveness.
- **Defect Distribution (Defects by category/total defects)** - This is a useful measure to evaluate the current state of the system and testing. Various categorizations of the identified defects can assist management with monitoring defect resolution, evaluating the quality of the system, identifying areas for improvement, etc.
- **Test Coverage (Testable Requirements tested by executed Scenarios/Total Testable Requirements)** - This is a valuable measure to plan the use of the available testing time, monitor the progress of testing and evaluate risk based on completed testing.

Automation Tools - Numbers

- Tools generate lots of numbers
- QARun default log
 - Too much information
 - Wrong focus
 - Format hard to manipulate

RUN_NUMBER	TEST_RUN	SCRIPT_NAME	DATE	TIME	COMMAND
63	Default	MCP	06/23/2004	11:34:24	Start
63	Default	MCP	06/23/2004	11:34:24	testdata
63	Default	MCP	06/23/2004	11:34:24	print
63	Default	MCP	06/23/2004	11:34:24	testdatarecordcount
63	Default	MCP	06/23/2004	11:34:25	print
63	Default	MCP	06/23/2004	11:34:25	print
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	print
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	testdatafield
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	testdatafield
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	testdatafield
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	testdatafield
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	testdatafield
63	Default	MCP	06/23/2004	11:34:25	testdatafieldcount
63	Default	MCP	06/23/2004	11:34:25	print
63	Default	MCP	06/23/2004	11:34:25	testdatarecordcount
63	Default	MCP	06/23/2004	11:34:25	testdatafield



Automation Tools - Details

- QTP default log
 - Un-parse-able!
 - Too technical
 - Too much information...

Test MCP started at 9/28/2004 - 7:21:30 ended at 9/28/2004 - 7:21:49 :Status Passed				
Itr#	Status	Name	Time	Details
0	Passed	Test MCP Summary	07:21:30	
Action MCP Launcher started at 07:21:32 :Status Passed				
Itr#	Status	Name	Time	Details
Action wis_StartApp started at 07:21:33 :Status Done				
Itr#	Status	Name	Time	Details
0	Done	frmIntro-Update Description	07:21:33	Test object's previous description: vbname = frmIntro Native Class = ThunderRT6FormDC Test object's new description: vbname = frmIntro regexpwndtitle = Welcome Native Class = ThunderRT6FormDC
0	Done	Checkpoint "frmIntro"	07:21:33	
Action wis_nav_start_warehouse started at 07:21:34 :Status Done				



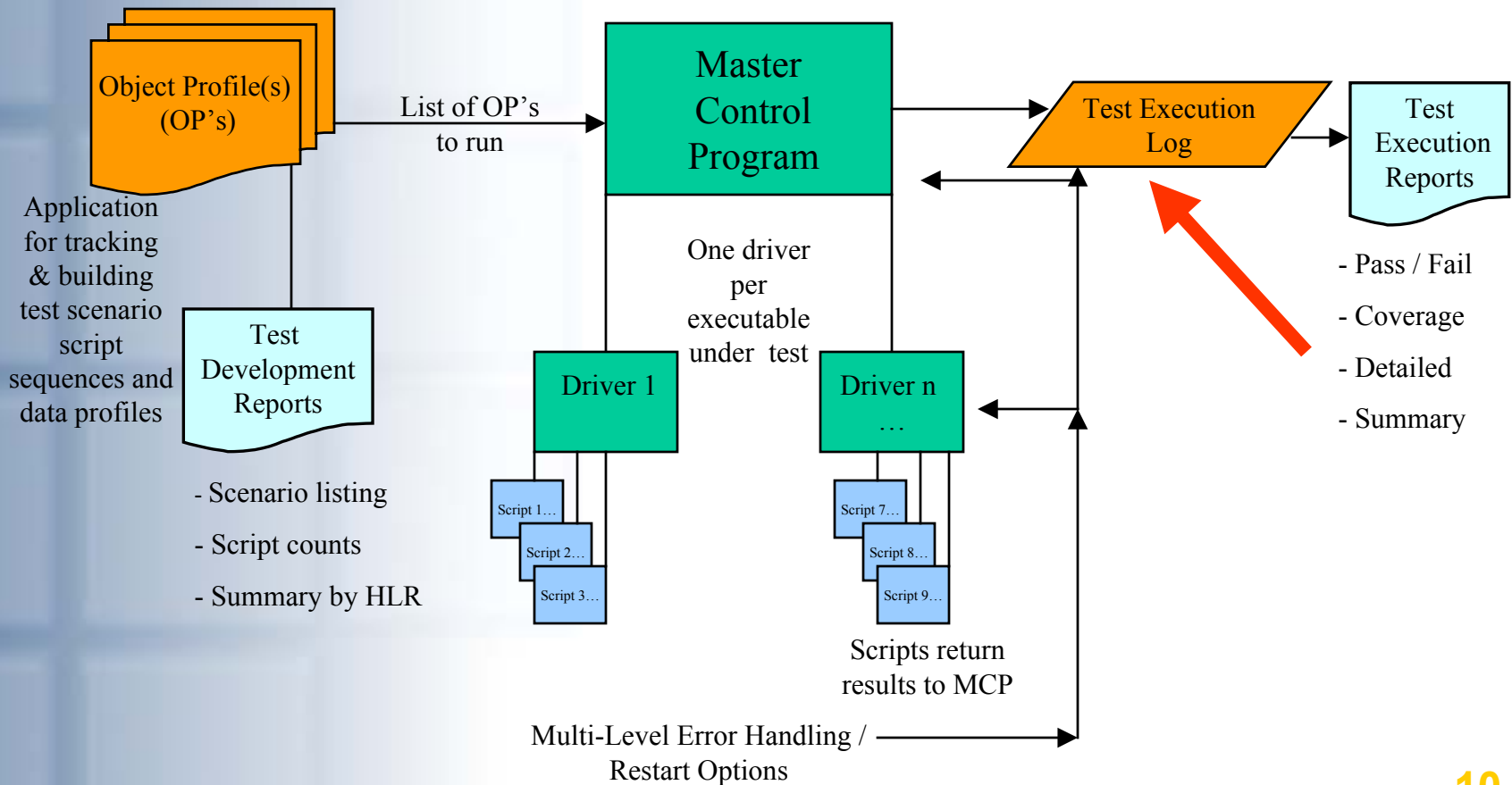
Programming the Tools

- Turn off the default log
- Tools are development environments
- Remember your defined metric set
- Structure your automation to generate your metrics



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Mosaic's Automation Architecture

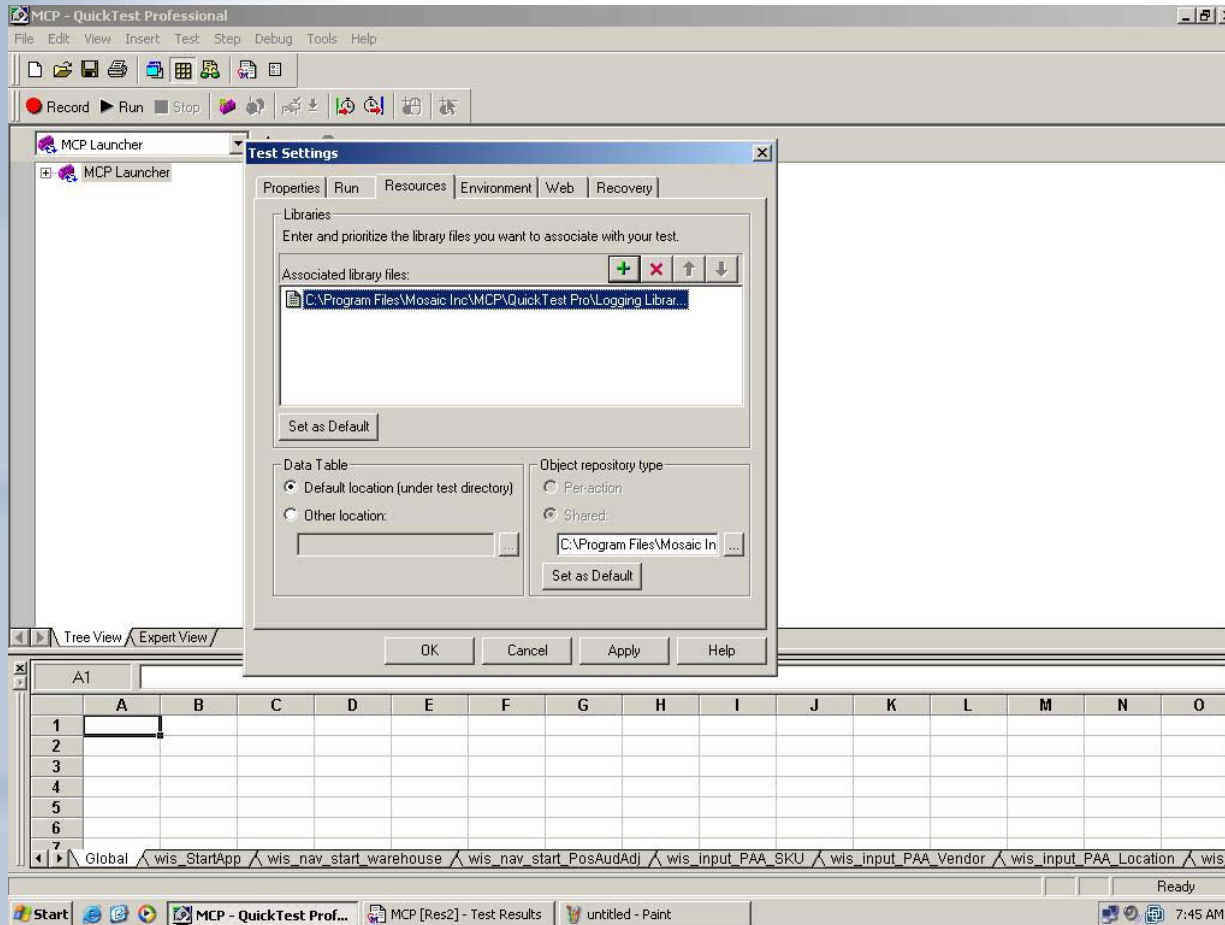


Programmed Logging - Common Library

- `Public sub LogScript(scr_name, scr_desc, scr_value)`
- `Dim intTemp, strTemp`
- `If scr_value = "" Then`
- `scr_value = "----"`
- `End If`
- `logfile.WriteLine("<table border=1 width=""100%""><tr>")`
- `logfile.WriteLine("<td width=""30%""><p>" & scr_name & "</p></td>")`
- `logfile.WriteLine("<td width=""40%""><p>" & scr_desc & "</p></td>")`
- `logfile.WriteLine("<td width=""20%""><p align=center>" & scr_value & "</p></td>")`
- `logfile.WriteLine("<td width=""10%""><p align=center>" & Time & "</p></td>")`
- `logfile.WriteLine("</tr></table>")`
- `end sub ' LogScript`
- `Public sub LogClose()`
- `dim intTemp, strTemp`
- `LogBlankLine(2)`
- `logfile.WriteLine("</table>

<p>Logfile Closed by MCP for QuickTest Pro at: "`
- `logfile.WriteLine(Time & " on: " & Date & "</p></body></html>")`
- `logfile.close`
- `End sub 'LogClose`

Common Script Library - QTP



Programmed Logging - In Use

- `//RETRY Script (Error Handling Function)`
- `// - Function to handle the "Retry" On_Error Condition`
- `//-----`
- `Function On_Error_Retry`
- `If RetryFlag = 0 Then //Check for Retry Loop`
- `ErrorState = 0 //Initialize the Errorstate to "0"`
- `before running script - cb`
- `RetryFlag = 1 //Set Retry Flag to prevent loop - cb`
- `LogScript(mcpArray[ScrNum , SCRIPT_NAME], mcpArray[ScrNum`
- `, SCRIPT_DESC], mcpArray[ScrNum , SCRIPT_VALUE])`
- `run mcpArray[ScrNum , SCRIPT_NAME] //Launch Script`
- `Else`
- `LogDetail("Info", "Ending Test to prevent Retry Loop")`
- `ExitMCP`
- `Endif`
- `End Function // On_Error_Retry`
- `//=====`

Our Run Log - QTP

- Scripted by automator
- Common log function
- Just the facts
 - Script Name
 - Scenario Run
 - Data Used
 - Pass/Fail
 - Etc.



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Output Log Opened on: 5/28/2004 1:25:13 PM by MCP for QuickTest Pro

wis_StartApp		Start WIS Application	---	1:25:13 PM
PASS	Wis App Loaded Successfully			1:25:14 PM
PASS	Script Completed With no Errors			1:25:14 PM
wis_nav_start_warehouse		Go to Warehouse Adjustment Screen	---	1:25:14 PM
PASS	Warehouse Window Loaded Successfully			1:25:15 PM
PASS	Script Completed With no Errors			1:25:15 PM
wis_nav_start_PosAudAdj		Go to Positive Adjustment Screen	---	1:25:15 PM
PASS	Warehouse Window Loaded Successfully			1:25:15 PM
PASS	Script Completed With no Errors			1:25:15 PM
wis_input_PAA_SKU		Enter an SKU	123122	1:25:15 PM
PASS	SKU Data Input Successfully			1:25:16 PM
PASS	Script Completed With no Errors			1:25:16 PM
wis_input_PAA_Vendor		Enter a Vendor	ABC, Inc.	1:25:16 PM
PASS	Vendor Data Input Successfully			1:25:16 PM
PASS	Script Completed With no Errors			1:25:16 PM
wis_input_PAA_Location		Enter a Location (warehouse)	2nd Floor	1:25:16 PM
PASS	Location Data Input Successfully			1:25:17 PM
PASS	Script Completed With no Errors			1:25:17 PM
wis_input_PAA_Inc		Positive Adjustment Entry	5	1:25:17 PM

Our Run Log - QARun

- Pretty familiar...
- Based on Mosaic's standard logging requirements
- Scripted by automator
- Common log function
- Just the facts
 - Script Name
 - Scenario Run
 - Data Used
 - Pass/Fail
 - Etc.



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Output Log Opened by MCP for QARun on: 05-28-2004 at: 11:19:30

wis_StartApp	Start WIS Application	---	11:19:30
PASS	Window Check on C:\Program Files\Mosaic Inc\WIS\WIS.exe Passed		11:19:31
PASS	Script Completed With no Errors		11:19:31
wis_nav_start_warehouse	Go to Warehouse Adjustment Screen	---	11:19:31
PASS	Window Check on Warehouse Menu Passed		11:19:32
PASS	Script Completed With no Errors		11:19:32
wis_nav_start_PosAudAdj	Go to Positive Adjustment Screen	---	11:19:32
PASS	Window Check on Passed		11:19:33
PASS	Script Completed With no Errors		11:19:33
wis_input_PAA_SKU	Enter an SKU	123122	11:19:33
PASS	Script Completed With no Errors		11:19:34
wis_input_PAA_Vendor	Enter a Vendor	ABC, Inc.	11:19:34
PASS	Script Completed With no Errors		11:19:36
wis_input_PAA_Location	Enter a Location (warehouse)	2nd Floor	11:19:36
PASS	Script Completed With no Errors		11:19:37
wis_input_PAA_Inc	Positive Adjustment Entry	5	11:19:37
PASS	Value Entered Successfully		11:19:38
PASS	Script Completed With no Errors		11:19:38
wis_input_PAA_Record_and_Check	Record and Check Inventory Positive Adjustment	---	11:19:38
Info	Captured Original Value: 6963		11:19:38
Info	Received Proper Confirmation Window.		11:19:39

My Bosses' Boss Status Report

Super Scenario Summary Report					
Super Scenario File	Data Profile	Number of Times Run	First Run	Last Run	Pass/Fail
Super_scenario2.csv					
	Data Profile #1	2	05-16-2002 8:54:24	05-17-2002 12:12:06	Pass
	Data Profile #4	1	05-20-2002 14:38:42	05-20-2002 14:38:42	Fail
Super_scenario3.csv					
	Data Profile #2	2	09-15-2002 12:13:32	09-17-2002 12:13:32	Fail
	Data Profile #3	2	09-16-2002 7:28:21	09-20-2002 13:57:51	Pass

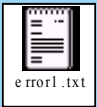
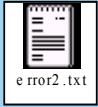


Latest Results



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Client Report - Excel w/ Txt Links

SUPER SCENARIO REPORT							
SUPER SCENARIO UNIQUE DATE STAMP	SUPER SCENARIO FILE NAME	DESCRIPTION	DATA PROFILES USED	TOTAL EXECUTION TIME IN SECONDS	# OF SCENARIOS PASSED	# OF SCENARIOS FAILED	IF FAIL, WHAT SCENARIOS FAILED
BEGIN: 05-16-2002 08:54:24	scenario2.csv	This Super Scenario runs some basic I/O	Data Profile #1	23	1	1	 error1.txt
BEGIN: 05-17-2002 12:12:06	scenario2.csv	This Super Scenario runs some basic I/O	Data Profile #1	82	2	0	
BEGIN: 05-17-2002 12:13:32	scenario3.csv	This SS runs the report application	Data Profile #2	42	2	1	 error2.txt
BEGIN: 05-20-2002 13:57:51	scenario3.csv	This Super Scenario runs some basic I/O	Data Profile #3	80	2	0	

Client Report - Summary

Test Automation Log 3/3/2005

Summary

Total Super Scenarios Executed	14
Super Scenarios Passed	6
Super Scenarios Failed	8
Unexpected Results	8

Super Scenarios Executed

Purpose	A Spot Trade. Dealing JPY with a EUR.JPY pair.
Date and Time	3/3/2005 8:00:33 AM
Result	FAIL
Scripts Executed	80
Test Scenarios Executed	77
Tests Passed	74
Tests Failed	3
Unexpected Results	3

Purpose	A Multiple Trade. Dealing USD with a EUR.USD pair.
Date and Time	3/3/2005 8:15:14 AM
Result	PASS
Scripts Executed	105
Test Scenarios Executed	105
Tests Passed	105
Tests Failed	0
Unexpected Results	0



Client Report - Detailed

Details Test Execution Log: 3/3/2005 8:23:26 AM

Overall Result: **FAIL**

Tests Run: 14 Tests Passed: 6 Tests Failed: 8

FAILED Spot033.xls at 8:00:33 AM 3/3/2005 A Spot Trade. Dealing JPY with a EUR.JPY pair.
BUYING JPY 206390000 \Rightarrow EUR (3345598.96 \neq 1507046.37)
- Spot Tenor Rate EUR.JPY (61.6700 \neq 136.9300)/(61.6900 \neq 136.9500)

PASSED Mult014.xls at 8:15:14 AM 3/3/2005 A Multiple Trade. Dealing USD with a EUR.USD pair.
SELLING USD 100000.00 \Rightarrow EUR 77059.41 - Spot Tenor Rate EUR.USD 1.2977/1.2958
BUYING USD 200000.00 \Rightarrow EUR 152960.28 - 1Y Tenor Rate EUR.USD 1.305163/1.307529

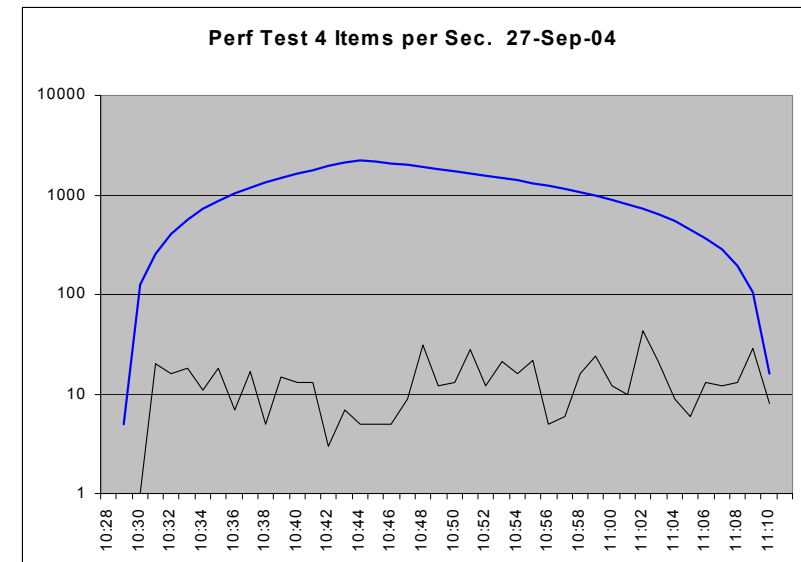


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Example - Automated Yet Manual

- Tool generated data
 - Performance data
 - Scripts do specific logging(s)
 - Output Excel format
- Manual charting
 - Tool's limits
 - Scripts' output speeds up reporting
- Everyone has Excel...

10:28	0	0		
10:29	240	240	1	5
10:30	240	480	1	125
10:31	240	720	20	257
10:32	240	960	16	408
10:33	240	1200	18	567
10:34	240	1440	11	727
10:35	240	1680	18	872
10:36	240	1920	7	1026
10:37	240	2160	17	1182
10:38	240	2400	5	1343
10:39	240	2640	15	1496
10:40	240	2880	13	1644
10:41	240	3120	13	1795
10:42	240	3360	3	1947
10:43	240	3600	7	2113
10:44	240	3840	5	2251
10:45	0	3840	5	2169
10:46			5	2088



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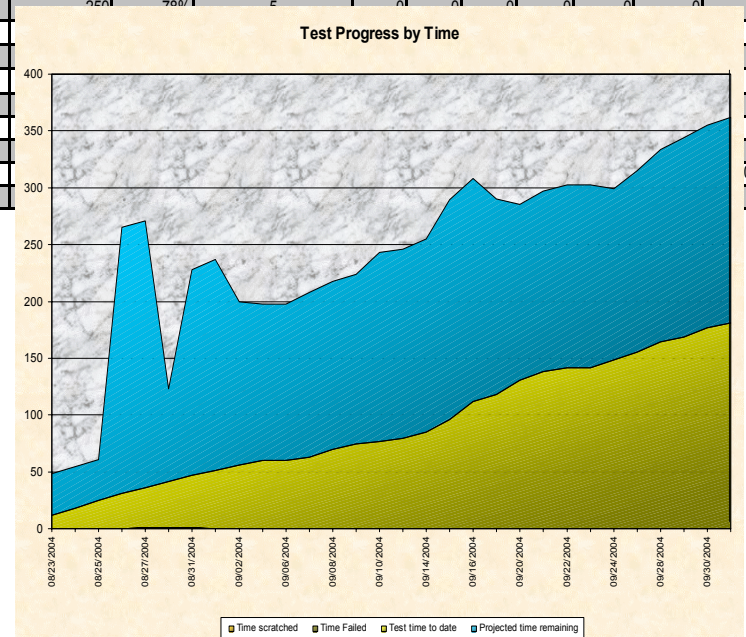
Automated Metrics - to Excel

- Manual initial setup
- Tool updates its cells
 - Defined points of entry
 - Chart impossible within the tool
 - Clients standard...
- Output - Excel



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Metric	Number	Percent	Worksheet	Cycle							
				ST_PH _II	IT_PH I	PCV98	MR	CL_EFF Sun	CL_EFF Win95	CL_EFF Win98	S_EF F
Total scripts	32		N/P/F/R/X	0	0	0	0	0	0	0	0
Scripts scratched	0	0%	6	0	0	0	0	0	0	0	0
Scripts passed	25	78%	Cycle & Stat	0	0	0	0	0	0	0	0
Scripts failed	0	0%	11	0	0	0	0	0	0	0	0
Scripts to be re-tested	4	13%	Cycle	0	0	0	0	0	0	0	0
Scripts not run yet	3	9%	1	0	0	0	0	0	0	0	0
Scripts remaining	7	22%	Total Run Time	0	0	0	0	0	0	0	0
Original est. test time	320		37	0	320	0	0	0	0	0	0
Est. test time scratched	0	0%	Est Run Time	0	0	0	0	0	0	0	0
Est. test time passed	250	78%	5	0	0	0	0	0	0	0	0
Est. test time failed											
Est time to retest											
Est time not run yet											
Est. test time remaining											
Test time to date											
Revised est. test time											
Retest factor										1.00	
Projected time remaining											



Next Steps

- Beef up your process
- Focus on key metrics
 - Work with Mgmt and Users
 - Standardize- data and presentation
- Ensure automation architecture can generate raw information
 - Summary, Detailed
 - Historical, Current
- Don't forget manual testing - get whole picture
- Program with the tool



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