Project and Portfolio Management Center

Software Version 9.50

PPM Benchmark Document

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Table of Contents

1 Introduction

1.1 Purpose and Scope

This document provides a benchmark that characterizes the performance of Project and Portfolio Management Center version 9.50. It provides contextual data concerning the data environment within which a specific functional workload is applied representing the benchmark workload. Test results for a benchmark run within PPM Performance Labs are provided for reference purposes. LoadRunner version 12.53 was used to simulate the workload for the benchmark test run. Additionally the document provides instructions with respect to setup and execution the benchmark for the customized performance lab test environment.

1.2 Terms and Definitions

Term	Definition
Vuser	Simulation of real user performing the actions on the product through LR scripts
Injector Host/Load Generator (LG)	The client machine from which the Vusers will run from and activate the different scripts and scenarios.
LoadRunner Controller (LC)	The LoadRunner controller is used to create and run scenarios. When running a scenario, the controller coordinates all the Vusers in terms of scheduling and pacing and captures correlated resource utilization for subsequent analysis
Transaction	A measurement of one or more user actions that has a tangible business value to the end-user.
Transaction Throughput	Number of successful Transaction instances running through the product within a specified period of time
Transaction Response Time	The time measured by LoadRunner generator as the response time of the transaction. This is defined by LoadRunner as the time taken for all web requests belonging to the transaction, to return the responses. This is also termed as “Transaction Latency”
Think-Time	Delay provided between HTTP requests while simulating users (Vusers) through LoadRunner scripts, in order to simulate real world delays between various user actions while using the product
Connected users	Uses that logged into the system, but not necessary execute any business process at this time
Active users	Connected users that execute activity at this moment, can be concurrent (but not necessarily so)

1.3 Test Scenario Overview

The benchmark has been designed to simulate real user profiles as close as possible. Since the tested areas are comprised of different user profiles, they have been split into fifteen workflows, each corresponding to a specific user profile. Each LoadRunner script represents a workflow (of the same name) and the Benchmark scenario is designed to execute all workflows for a fixed number of Vusers simultaneously.

Script Name	Product Area	Vusers	Start Time After Scenario begins	Ramp up	Pacing	Duration
WF1	PM - My Task Portlet	50	+00:00:00	72s	3600s	4 hours
WF2	TM - Time Sheet Creation	240	+03:00:00	20s	0s	Until completion
WF3	PFM – Financial Management	60	+00:00:00	60s	600s	4 hours
WF4	TM -Time Sheet Approval	30	+04:20:00	80s	600s	Until completion
WF5	PM - Workplan and Tasks	50	+00:00:30	72s	600s	4 hours
WF6	RM - Manage Staffing Profile	20	+00:00:40	180s	0s	4 hours
WF7	RM - Manage Resource Pool	20	+00:00:50	180s	720s	4 hours
WF8	RM - Find a Resource	20	+00:00:60	180s	3600s	4 hours
WF9	RM - View Resource Usage	20	+00:01:10	180s	720s	4 hours
WF10	FM - View Project Plan	50	+00:01:20	72s	600s	4 hours
WF11	PFM - Portfolio Management	5	+00:00:00	720s	600s	4 Hours
WF12	PGM - Program Management	5	+00:00:00	720s	0s	4 Hours
WF13*	PGM - Open Program	6	+00:00:00	3600s	0s	Until completion
WF14	TM - Import Time Sheet	240	+01:00:00	30s	0s	Until completion
WF15	User Management	10	+01:30:00	180s	1800s	3 hours
WF16	PGM – Top Down Budget	200	+01:00:00	30s	600s	Until completion

* This is a TruClient script, which will measure both web service response and UI rendering time. This one is for Chrome browser.

Note:

PM: Project Management
TM: Time Management
PFM: Portfolio Management
PFM: Program Management
RM: Resource Management
FM: Financial Management
SS: Start-to-start
ES: End-to-start

1.4 Results Summary

In the benchmark test, 16 workflows and 193 transactions were executed in a clustered environment (see Appendix A). 95% of them have a response time of 4 seconds or less.

2 Functional Workflows

This section provides a description of each of the workflows and their contribution to the overall Benchmark scenario. Please note that Vusers for most workflows are structured to ramp-up within the first hour of execution. The Benchmark run results described further in the document ignore this 1 hour duration for the purpose of consistent run result reporting.

The workflow design structure takes into account the possibility that the target PPM deployment may require a modified workload distribution in the form of number of users executing each workflow and/or modified Vusers ramp-up distribution for each workflow. These can be modified from the default available in the Benchmark LoadRunner scenario design to reflect the target workload for the PPM deployment. This is further facilitated due to lack of any dependency between workflow scripts (on each other) with the exception of WF4 (Time Sheet Approval) script which has a producer-consumer relationship to WF2 (Time Sheet Creation) script. The data generated by WF2 script is subsequently used by WF4 script for its successful execution.

2.1 WF1: Project Management - My Task Portlet

Description:
This work flow simulates a PPM user editing a task loaded from its "My Tasks" Portlet. This portlet is designed to be available by default on every user's dashboard. The sequence of steps for this workflow is the following:

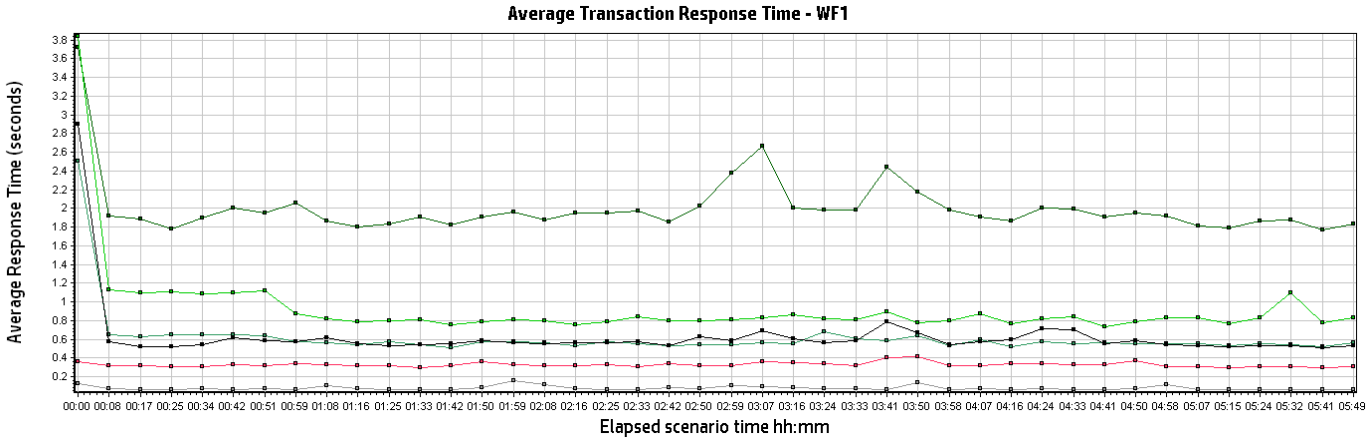
	Transaction Name	Description
1.	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using res_<user_number>, where user_number is every 6th number starting from 1
2.	WF1_T01_LoadMyTasksPortlet	Click on "Front Page" link on the left navigation pane in order to reload the "My Tasks" Portlet.
3.	WF1_T02_LoadTaskFromPortlet	Clicks on one of tasks to open it.
4.	WF1_T03_ClickDoneOnPortletTask	Click "Done" to close the opened task
5.	WF1_T04_UpdatePortletTaskPercent	Change the "Percent Complete" attribute of a task in the portlet.
6.	WF1_T05_UpdatePortletTaskActualEffort	Change the "Actual Effort" attribute of a task in the portlet.
7.	WF1_T06_SaveMyTaskPortlet	Click "Save" to save all changes on "My Tasks" Portlet
8.	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	50
Scenario Start Time	When scenario begins
Ramp-up	1 per 72 seconds
Pacing	start-to-start 3600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 50 users who execute this workflow, of which the first action (LoadMyTasksPortlet) is being executed 50 times per hour. The other actions are executed 150 times per hour.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF1_T01_LoadMyTasksPortlet	1.565	2.001	9.112	0.590
	1	WF1_T02_LoadTaskFromPortlet	0.440	0.619	11.717	0.655
	1	WF1_T03_ClickDoneOnPortletTask	0.256	0.330	1.003	0.062
	1	WF1_T04_UpdatePortletTaskPercent	0.053	0.080	0.786	0.066
	1	WF1_T05_UpdatePortletTaskActualEffort	0.609	0.930	10.084	0.736
	1	WF1_T06_SaveMyTaskPortlet	0.457	0.636	7.672	0.602

2.2 WF2: Time Management - Time Sheet Creation

Description:
This work flow simulates a PPM user creating time sheets. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1.	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using res_<*user_number*>, where user_number is: 45001,45002,45031,45032 .....45872.
2.	WF2_T01_Click_Create_A_Time_Sheet	Click on "Create a time sheet" link on the left navigation pane
3	WF2_T02_ChoosePeriod	Select the next time period (starting with the first one) from the "Time Period" drop down list.
4.	WF2_T03_ClickCreateNewTS	Click on "Create" button.

5.	WF2_T04_AddItem_Addtask	Click on "Add Item" button and select "Add Task"
6	WF2_T05_ClickFindTask	Click on the search button of the "Find Projects / Tasks to add to Time Sheet" text field
7.	WF2_T06_ClickAddTasks	Select the first 5 tasks, Click "Ok" button to choose them and click "Add" to add the tasks to the time sheet.
8	WF2_T07_ChangeTimeSheetHours	For every chosen task, change the task's hours to "5.00" for each day
9	WF2_T08_ClickSaveNewTS	Click "Save" button to save the time sheet
10	WF2_T09_ClickSubmitNewTS	Click "Submit" button to submit the time sheet
11	WF2_T10_CopyTS_ChoosePeriod	Select the next time period from the "Time Period" drop down list.
12	WF2_T11_ClickCreateTSCopy	Check the "Include Items from My Last Time Sheet" checkbox and Click "Create" to create a copy of the previously created time sheet.
13	WF2_T12_ClickSaveTSCopy	Click "Save" button to save the time sheet
14	WF2_T13_ClickSubmitTSCopy	Click "Submit" button to submit the time sheet
15	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	240
Scenario Start Time	3 hour after scenario begins
Ramp-up	1 per 20 seconds
Pacing	start-to-start 0 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 240 users who execute this workflow for a single iteration starting 3 hours after scenario begins with a pacing of 0 second. The workflow execution is limited to 1.5 hours window between 3 and 4.5 hours into the scenario run.

Think times between all transactions are 10 seconds

Setup:

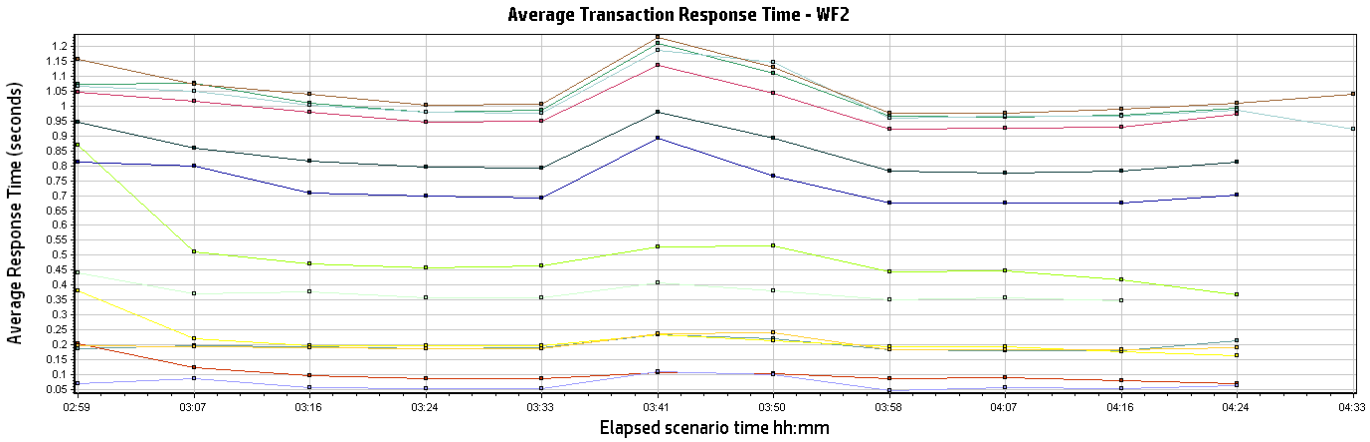
The necessary portlets for this workflow are defined in the database provided with the benchmark kit. However, the default properties for the portlets need to be updated to maintain appropriate references to time periods which are in effect during the actual dates of benchmark execution. The below process indicates the steps that must be taken to configure the default portlet properties for successfully WF2 script execution:

Make changes in table KNTA_SERVER_PARAM_DEFAULT's parameter TMG_PAST_PERIODS_TO_ALLOW with the value depending on total past time periods from August 2008. E.g. if current date is 5th July, 2009 then the default value of TMG_PAST_PERIODS_TO_ALLOW will be 22 considering 2 time periods each month.
Make changes in table KNTA_SERVER_PARAM_ DEFAULT's parameter TM_MAX_PREVIOUS_TIME_PERIODS with any value greater than or equal to TMG_PAST_PERIODS_TO_ALLOW's default value.

Note: After 6 iteration of the workflow, the Vusers exit the system.

Transaction Response Time:

Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF2_T01_Click_Create_A_Time_Sheet	0.317	0.376	1.228	0.092
	1	WF2_T02_ChoosePeriod	0.149	0.196	1.320	0.073
	1	WF2_T03_ClickCreateNewTS	0.306	0.485	4.947	0.291
	1	WF2_T04_AddItem_Addtask	0.055	0.098	3.311	0.129
	1	WF2_T05_ClickFindTask	0.089	0.206	1.524	0.131
	1	WF2_T06_ClickAddTasks	0.631	0.834	3.684	0.207
	1	WF2_T07_ChangeTimeSheetHours	0.030	0.067	3.352	0.155
	1	WF2_T08_ClickSaveNewTS	0.801	1.030	4.340	0.241
	1	WF2_T09_ClickSubmitNewTS	0.757	0.984	4.045	0.204
	1	WF2_T10_CopyTS_ChoosePeriod	0.148	0.198	1.320	0.075
	1	WF2_T11_ClickCreateTSCopy	0.527	0.731	4.287	0.241
	1	WF2_T12_ClickSaveTSCopy	0.773	1.025	3.951	0.215
	1	WF2_T13_ClickSubmitTSCopy	0.754	1.048	4.642	0.238

2.3 WF3: Portfolio Management – Financial Summary

Description:

This work flow simulates a various functional flows of a Project Manager user working with financial summary by adding/deleting forecast and actual lines, benefit lines and snapshot. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1.	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a unique number between 4501 and 4560.
2.	WF3_T01_ClickSearchProjects	Click "Search Project" from drop down Menu
3	WF3_T02_ SearchProjectByName	Enter an existing project name and click 'Search' button. Workfloe uses Project_4501 to Project_6000 projects.
4.	WF3_T03_ OpenProjectOverview	Click on the first project name from the result list
5.	WF3_T04_ ProjectDetailsTab	Go to Project Detail tab
6	WF3_T05_ FinancialSummary	Open Financial Summary associated with this project
7.	WF3_T06_ ViewBudgetDetails	Click on "View Budget Details"
8	WF3_T07_ ViewBudgetDetails_Done	Click "Done"
9	WF3_T08_ AddForecastLines	Click on "Add/Edit Forecast and Actuals"
10	WF3_T09_ AddForecastLines_Add10Lines	Add 10 forecast lines
11	WF3_T10_ AddForecast_Done	Click "Done " to save 10 forecast lines and to go back to financial summary page
12	WF3_T11_ AddBenefitLines	Click on "Add/Edit Benefits"
13	WF3_T12_ AddBenefitLines_Add10Lines	Add 10 benefit lines
14	WF3_T13_ AddBenefitLines_Done	Click "Done " to save 10 benefit lines and to go back to financial summary page
15	WF3_T14_ Tab_Detail_Lines	Click on "Detail Lines" tab in forecast and actual
16	WF3_T15_ Tab_Total_Only	Click on "Total Only" to go back to default
17	WF3_T16_ Tab_Planned_and_Actuals	Click on "Planned and Actuals" tab in forecast and actual
18	WF3_T17_ Tab_Planned_Only	Click on "Planned Only" to go back to default
19	WF3_T18_ Tab_Quarters	Click on "Quarters" in forecast and actual
20	WF3_T19_ Tab_Months	Click on "Months" to go back to default
21	WF3_T20_ DeleteForecastActuals	Click on "Edit Forecast and Actuals" to delete 5 forecast lines
22	WF3_T21_ DeleteForecastActuals_Delete5Lines	Delete first 5 forecast lines

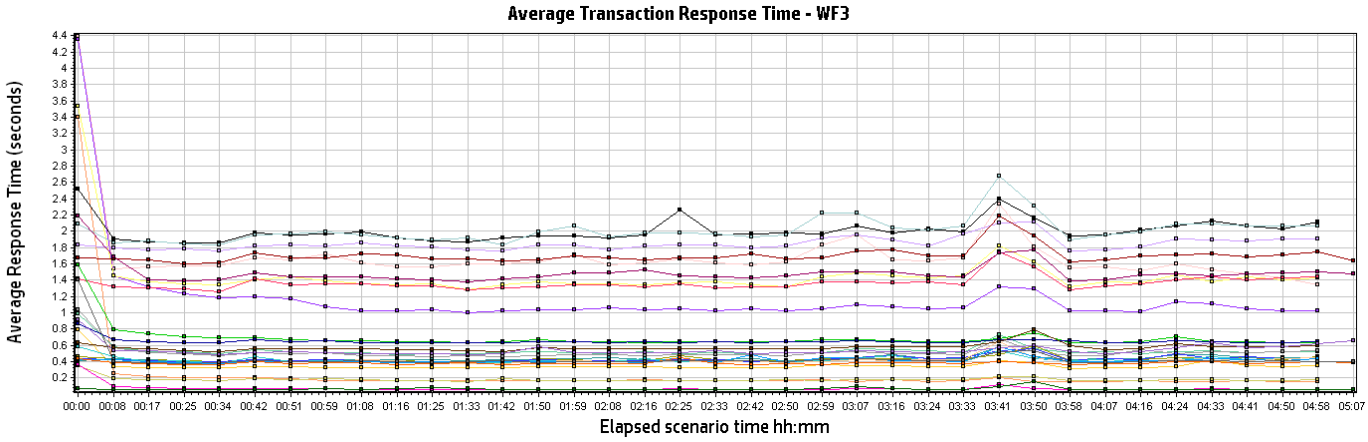
23	WF3_T22_ DeleteForecastActuals_Done	Click “Done” after deleting 5 forecast lines and go back to financial summary page
24	WF3_T23_ DeleteBenefit	Click on “Edit Benefits” to delete 5 benefit lines
25	WF3_T24_ DeleteBenefit_Delete5Lines	Delete first 5 benefit lines
26	WF3_T25_ DeleteBenefit_Done	Click “Done” after deleting 5 benefit lines and go back to financial summary page
27	WF3_T26_ CreateSnapshot	Click on “Create Snapshot”. It creates a snapshot and come back to financial summary
28	WF3_T27_ViewSnapshot	Click on “View Snapshot”
29	WF3_T28_ViewSnapshot_Done	Click “Done”
30	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	60
Scenario Start Time	When scenario begins
Ramp-up	1 per 60 seconds
Pacing	600 seconds
Think Time	10 seconds

In the LoadRunner simulation, there are 60 users who execute this workflow for a single iteration includes going to financial summary page from project details tab, adding 10 forecast and actual lines and 10 benefit lines, going to all the tabs of forecast and actual from financial summary page, deleting 5 forecast and actual line and 5 benefit lines. If forecast and actual lines and benefit lines are 100 or above then it deletes 100 lines instead of 5 lines. It creates snapshot at the end and views it.

Transaction Response Time:
Granularity: **512 Seconds**



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF3_T01_ClickSearchProjects	0.121	0.188	18.439	0.506
	1	WF3_T02_SearchProjectByName	0.132	0.177	1.161	0.052
	1	WF3_T03_OpenProjectOverview	1.156	1.654	14.900	0.555
	1	WF3_T04_ProjectDetailsTab	0.852	1.099	13.184	0.417
	1	WF3_T05_FinancialSummary	1.068	1.416	13.435	0.379
	1	WF3_T06_ViewBudgetDetails	0.392	0.526	1.922	0.106
	1	WF3_T07_ViewBudgetDetails_Done	1.057	1.367	4.166	0.191
	1	WF3_T08_AddForecastLines	0.372	0.501	2.032	0.112
	1	WF3_T09_AddForecastLines_Add10Lines	0.597	0.662	4.120	0.122
	1	WF3_T10_AddForecast_Done	0.590	2.004	4.378	0.249
	1	WF3_T11_AddBenefitLines	0.257	0.344	1.625	0.082
	1	WF3_T12_AddBenefitLines_Add10Lines	0.597	0.644	1.372	0.048
	1	WF3_T13_AddBenefit_Done	0.584	2.021	6.747	0.373
	1	WF3_T14_Tab_Detail_Lines	0.311	0.430	1.724	0.098
	1	WF3_T15_Tab_Total_Only	0.312	0.439	1.351	0.080
	1	WF3_T16_Tab_Planned_and_Actuals	0.318	0.432	1.675	0.104
	1	WF3_T17_Tab_Planned_Only	0.305	0.421	1.481	0.090
	1	WF3_T18_Tab_Quarters	0.294	0.415	2.889	0.115
	1	WF3_T19_Tab_Months	0.293	0.417	2.103	0.121
	1	WF3_T20_DeleteForecastActuals	0.444	0.575	1.880	0.106
	1	WF3_T21_DeleteForecastActuals_Delete5Lines	0.044	0.065	0.916	0.042
	1	WF3_T22_DeleteForecastActuals_Done	1.454	1.854	4.066	0.212
	1	WF3_T23_DeleteBenefit	0.290	0.381	1.861	0.073
	1	WF3_T24_DeleteBenefit_Delete5Lines	0.044	0.067	1.039	0.054
	1	WF3_T25_DeleteBenefit_Done	1.377	1.708	3.942	0.209
	1	WF3_T26_CreateSnapshot	0.406	0.530	2.064	0.100
	1	WF3_T27_ViewSnapshot	0.310	0.415	3.391	0.112

	1	WF3_T28_ViewSnapshot_Done	1.160	1.474	3.772	0.194

2.4 WF4: Time Management - Time Sheet Approval

Description:
This workflow simulates a various functional flows of a Project Manager user approving time sheets created by resources (Users who are Project contributors). The sequence of steps for this workflow is the following:

	Transaction Name	Description
1.	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a unique number between 1001 and 1030.
2.	WF4_T01_GoToApprovalPage	Click on "Front Page" link on the left navigation pane.
3	WF4_T02_ApproveTimeSheets_FromPortlet	Select all time sheets from the "Approve time sheets" portlet and click "Approve" button.
4.	WF4_T03_ApproveOne_ClickApproveTime	Click on "Approve Time" link on the left navigation pane.
5.	WF4_T04_ApproveOne_Click_Search	Click "search" button to search for all time sheets to approve.
6	WF4_T05_ApproveOne_ClickOnTimeSheetName	Click on the first time sheet from the list.
7.	WF4_T06_ApproveOne_ClickApproveFromTimeSheet	Approve all the tasks within this time sheet.
8	WF4_T07_ApproveOne_ClickDone	Click "Done" button.
9	WF4_T08_ApproveAll_ClickApproveTime	Click on "Approve Time" link on the left navigation pane.
10	WF4_T09_ApproveAll_Click_Search	Click "search" button to search for all time sheets to approve.
11	WF4_T10_ApproveAll_ClickApprove_All	Select all the time sheets from the list and click "Approve" button.
12	Logout	Logout transaction is shared by all workflows.

Workflow Properties:

Number of Users	30
Scenario Start Time	4 hours 20 minutes after scenario begins
Ramp-up	80 seconds
Pacing	600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 30 users who execute this workflow for a single iteration, approving 5 time sheets in the "TMG – Time Sheet Approvals" portlet and 26 time sheets in the approvals from the "Approve Time" page.

Setup:

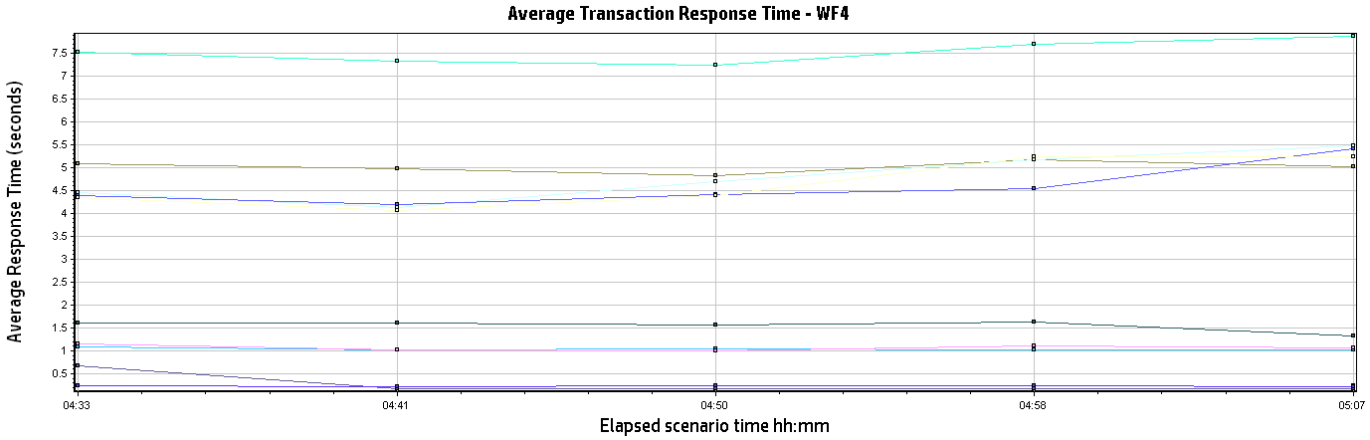
The necessary portlets for this workflow are defined in the database provided with the benchmark kit. However, the default properties for the portlets need to be updated to maintain appropriate references to time periods which are in effect during the actual dates of benchmark execution. The below process indicates the steps that must be taken to configure the default portlet properties for successfully WF4 script execution:

- Modify **validate-tm.xml** file from <PPM_HOME>\server\<SERVER_NAME>\deploy\itg.war\WEB-INF with the value same as table KNTA_SERVER_PARAM_DEF_NLS's parameter TM_MAX_PREVIOUS_TIME_PERIODS's default_value.
- Change WF4's **PreviouseTimePeriods** parameter from parameter list with value same as table KNTA_SERVER_PARAM_DEF_NLS's parameter TM_MAX_PREVIOUS_TIME_PERIODS's default_value.
- Add **Approve Time Sheets** portlet from Standard ITG Dashboard module. Change **Previous Time Period to Show** with the value same as table KNTA_SERVER_PARAM_DEF_NLS's parameter TM_MAX_PREVIOUS_TIME_PERIODS's default_value.
- Verify/Edit the "**My Task"** portlet properties from the dashboard page to have the following settings:
    - Task starting within **14** days from now.
    - **Check** Only show Tasks ready for my action.
    - Sort by Task Name.
    - Maximum Results Displayed: **5**
    - Maximum Results Displayed(Maximized Portlet): **10**

Note: The 30 Vusers simulating Timesheet approvers are injected into PPM system at the rate of 1 every 2 minutes. Each injected vuser approves the required set of timesheets and exits the system causing the total running Vusers at any given point of time to never exceed 1.

Transaction Response Time:

Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF4_T01_GoToApprovalPage	0.517	5.015	6.696	1.087
	1	WF4_T02_ApproveTimeSheets_FromPortlet	0.563	1.561	1.839	0.219
	1	WF4_T03_ApproveOne_ClickApproveTime	0.168	0.288	1.742	0.371

	1	WF4_T04_ApproveOne_Click_Search	3.596	4.741	6.004	0.615
	1	WF4_T05_ApproveOne_ClickOnTimeSheetName	0.254	0.254	0.254	0.000
	1	WF4_T06_ApproveOne_ClickApproveFromTimeSheet	0.992	1.043	1.181	0.047
	1	WF4_T07_ApproveOne_ClickDone	0.901	1.071	1.389	0.109
	1	WF4_T08_ApproveAll_ClickApproveTime	3.622	4.565	6.145	0.645
	1	WF4_T09_ApproveAll_Click_Search	0.200	0.239	0.386	0.036
	1	WF4_T10_ApproveAll_ClickApprove_All	3.505	4.668	6.079	0.773

2.5 WF5: Project Management – Workplan and Tasks

Description:
This workflow simulates a Project Manager user editing a project's workplan. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1.	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using res_<user_number>, where user_number is a unique number between 6600 and 6650.
2.	WF5_T01_SearchProjectWithBlankParameters	Click "Search Project" link on the left navigation pane. Click "Search" button while having an empty "Project Name" field
3	WF5_T02_ClickSearchProjects	Click "Search Project" link on the left navigation pane
4.	WF5_T03_SearchProjectByName	Enter an existent random project name and click "Search" button
5.	WF5_T04_OpenProjectOverview	Click on the first project name from the result list
6	WF5_T05_ClickEditWorkPlan	Click "Edit Work Plan" button.
7.	WF5_T06_Click_Next_In_WorkPlanOverview	Click "Next" button
8	WF5_T07_Click_Prev_In_WorkPlanOverview	Click "Prev" button
9	WF5_T08_Select_Gantt_View	Click on "Change View" and select "gantt view"
10	WF5_T09_Select_Print_View	Click on "Change View" and select "Print view"
11	WF5_T10_CollapseSummaryTree	Click the '-' sign of a summary task to collapse it.
12	WF5_T11_ExpandSummaryTree	Click the '+' sign of a summary task to expand it.
13	WF5_T12_LoadTaskFromWP	Double click a random task from the workplan

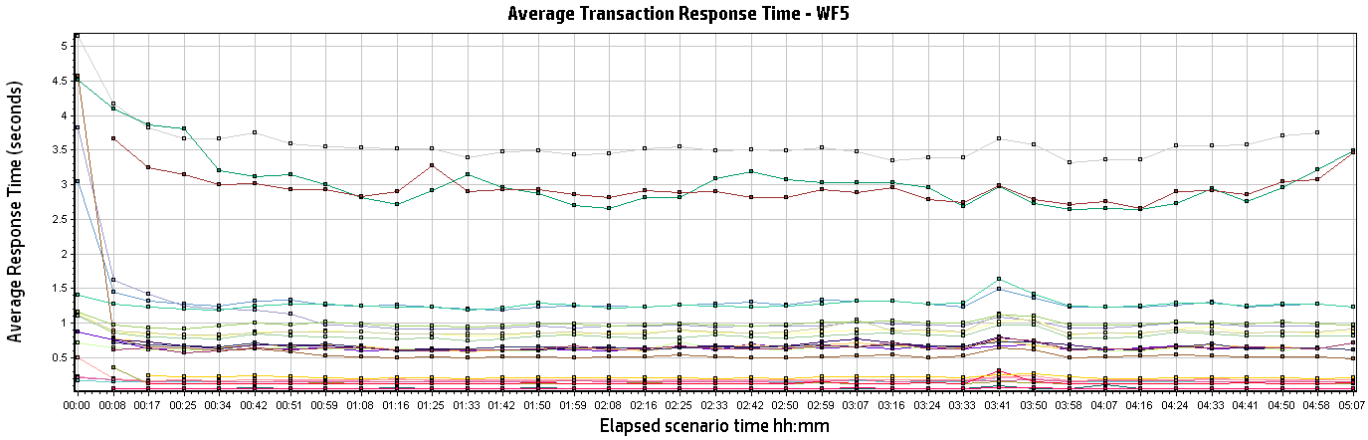
14	WF5_T13_ClickAddResource	Click the "Resources" Tab and click the "Add Resource" button
15	WF5_T14_ChooseResource	Select a resource an click "Ok" button
16	WF5_T15_AddResource_ClickDone	Click "Save" button to save the task page
17	WF5_T16_ClickDoneOnEditTaskPage	Click "Done" button in the task page
18	WF5_T17_FilterByTaskOverDue	Choose "Tasks Overdue" from the "Filter for" drop down list.
19	WF5_T18_PressNextWithFilteOverDue	Click "Next" button
20	WF5_T19_PressPrevWithFilterOverDue	Click "Prev" button
21	WF5_T20_ShowAllTasks	Choose "All Tasks" from the "Filter for" drop down list.
22	WF5_T21_EditTaskMultipleFields_changeActualEffort	Change the "Actual Effort" field
23	WF5_T22_EditTaskMultipleFields_ChangeSchedule	Click the "Schedule" Tab and change the "scheduled" duration
24	WF5_T23_EditTaskMultipleFields_ChangeSchedule	Click the "Schedule" Tab and change the "scheduled" duration
25	WF5_T24_EditTaskMultipleFields_SaveTask	Click "Save" button.
26	WF5_T25_ChangeOnlySchedule	Click the "Schedule" Tab and change the "scheduled" duration (doubles the frequency of changing the schedule)
27	WF5_T26_ChangeOnlySchedule_SaveTask	Click "Save" button.
28	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	50
Scenario Start Time	30 seconds after scenario begins
Ramp-up	72 seconds
Pacing	600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 50 users who execute this workflow multiple iterations, with a pacing of 10 minutes between iterations, loading and editing a task only in 50% of the iterations as mentioned above.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF5_T01_SearchProjectWithBlankParameters	2.871	3.534	10.154	0.376
	1	WF5_T02_ClickSearchProjects	0.120	0.152	1.386	0.047
	1	WF5_T03_SearchProjectByName	0.131	0.171	1.213	0.045
	1	WF5_T04_OpenProjectOverview	0.973	1.280	6.692	0.231
	1	WF5_T05_ClickEditWorkPlan	0.742	1.006	8.363	0.340
	1	WF5_T06_Click_Next_In_WorkPlanOverview	0.479	0.635	1.906	0.101
	1	WF5_T07_Click_Prev_In_WorkPlanOverview	0.474	0.635	2.980	0.122
	1	WF5_T08_Select_Gantt_View	0.631	0.872	2.905	0.139
	1	WF5_T09_Select_Print_View	0.658	0.882	4.810	0.199
	1	WF5_T10_CollapseSummaryTree	0.590	0.815	2.174	0.132
	1	WF5_T11_ExpandSummaryTree	0.961	1.268	3.361	0.175
	1	WF5_T12_LoadTaskFromWP	0.372	0.544	11.537	0.386
	1	WF5_T13_ClickAddResource	0.153	0.182	1.661	0.077
	1	WF5_T14_ChooseResource	0.113	0.154	0.390	0.030
	1	WF5_T15_AddResource_ClickSave	0.366	2.977	5.673	0.505
	1	WF5_T16_ClickDoneOnEditTaskPage	0.774	0.988	2.401	0.118
	1	WF5_T17_FilterByTaskOverDue	0.462	0.650	1.744	0.105
	1	WF5_T18_PressNextWithFilteOverDue	0.482	0.661	1.888	0.120

	1	WF5_T19_PressPrevWithFilterOverDue	0.456	0.654	1.272	0.084
	1	WF5_T20_ShowAllTasks	0.474	0.639	1.835	0.114
	1	WF5_T21_EditTaskMultipleFields_changePercent	0.046	0.053	0.830	0.045
	1	WF5_T22_EditTaskMultipleFields_changeActualEffort	0.045	0.050	0.311	0.014
	1	WF5_T23_EditTaskMultipleFields_ChangeSchedule	0.111	0.125	0.517	0.031
	1	WF5_T24_EditTaskMultipleFields_SaveTask	0.218	2.913	4.798	0.350
	1	WF5_T25_ChangeOnlySchedule	0.111	0.129	1.767	0.090
	1	WF5_T26_ChangeOnlySchedule_SaveTask	0.155	0.209	0.851	0.050

2.6 WF6: Resource Management – Manage Staffing Profile

Description:
This workflow simulates a Staffing Manager user managing a staffing profile. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1.	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 1 and 50
2.	WF6_T01_SearchStaffingProfileLink	Click on “Search Staffing Profile” link on the left navigation pane
3*	WF6_T02_SearchButton	Enter <user_number> into “Profile Name contains” textbox and click on the search button
4.	WF6_T03_SelectStaffingProfile	Click on the staffing profile Staffp_<user_number> from the search results
5.	WF6_T04_AnalyzeStaffingByRole	Click on “Compare to Work Plan” button
6	WF6_T05_AnalyzeStaffingByResource	Click on “Resource” link on the top of the page
7	WF6_T06_AddPosition_AddButton	Click on “Add” button
8	WF6_T07_ViewAssignmentLoadPortlet	Click on the “Analyze_Assignmen_Load” load on the left navigation link to view Assignment Load Portlet

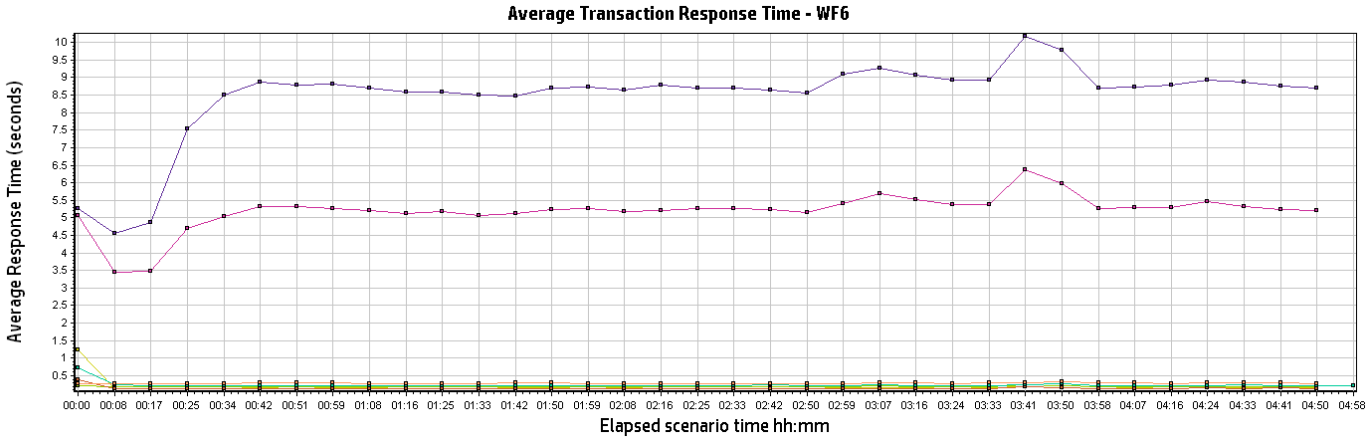
19	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	20
Scenario Start Time	40 seconds after scenario begins
Ramp-up	1 per 180 seconds
Pacing	0 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 20 users who execute this workflow multiple iterations, with a pacing of 0 second between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF6_T01_SearchStaffingProfileLink	0.116	0.151	10.281	0.178
	1	WF6_T02_SearchButton	0.145	0.189	1.676	0.051
	1	WF6_T03_SelectStaffingProfile	0.119	0.140	1.589	0.054
	1	WF6_T04_AnalyzeStaffingByRole	2.540	5.284	11.924	0.642
	1	WF6_T05_AnalyzeStaffingByResource	3.978	8.729	18.274	0.980
	1	WF6_T06_AddPosition	0.161	0.221	3.108	0.089
	1	WF6_T07_ViewAssignmentLoadPortlet	0.228	0.289	1.161	0.057

2.7 WF7: Resource Management – Manage Resource Pool

Description:
This workflow simulates a Staffing Manager user managing resource pools. The sequence of steps for this workflow is the following:

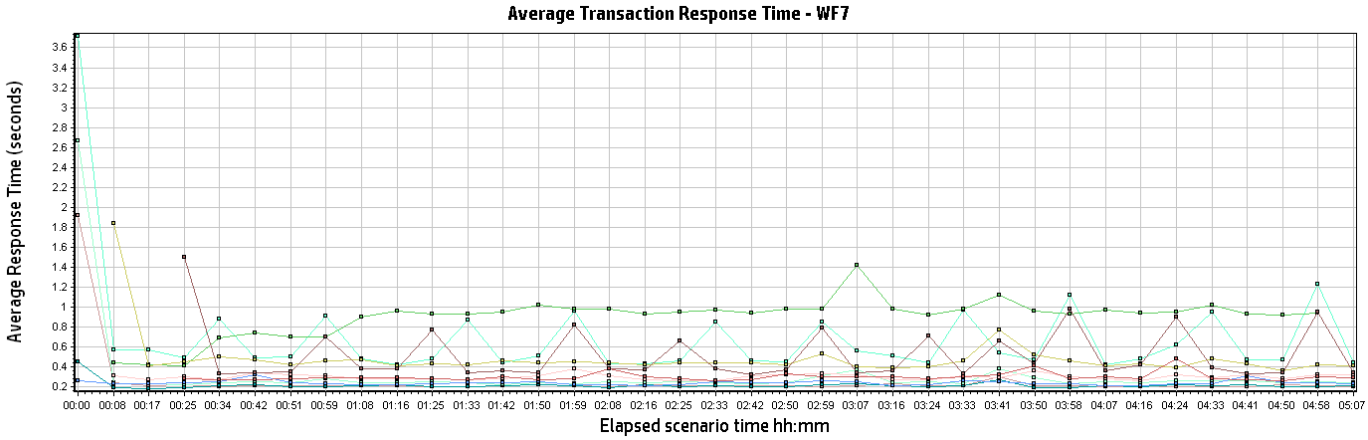
	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 1 and 150
2	WF7_T01_ClickSearchResourcePool	Click on “Manage Resource Pools” link on the left navigation pane
3	WF7_T02_SearchAResourcePool	Click “Search” button
3	WF7_T03_ClickAResourcePool	Select ResPool_<user_number> from the list of resource pools
4	WF7_T04_ClickViewForeCastedDemand	Click on “View Forecasted Demand” button on top
5	WF7_T05_DoneForeCastedDemand	Click on “Done” button
6	WF7_T06_ViewTwoRmPortlets	
7	WF7_T07_ClickViewResourceLoad	Click on “View Resource Load” button
8	WF7_T08_DoneViewResourceLoad	Click on Done” button
9	WF7_T09_ClickManagementPoolCapacity	Click on “Manage Pool Capacity” button
10	WF7_T10_DoneManagementPoolCapacity	Click on “Done” button
11	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	20
Scenario Start Time	50 seconds after scenario begins
Ramp-up	180 seconds
Pacing	720 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 20 users who execute this workflow multiple iterations, with a pacing of 12 minutes between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF7_T01_ClickSearchResourcePools	0.164	0.227	4.365	0.199
	1	WF7_T02_SearchAResourcePool	0.158	0.215	0.942	0.055
	1	WF7_T03_ClickAResourcePool	0.183	0.273	4.460	0.257
	1	WF7_T04_ClickViewForeCastedDemand	0.348	0.707	7.197	0.804
	1	WF7_T05_DoneForeCastedDemand	0.181	0.244	0.371	0.032
	1	WF7_T06_ViewTwoRmPortlets	0.409	0.926	3.728	0.271
	1	WF7_T07_ClickViewResourceLoad	0.323	0.482	2.088	0.230
	1	WF7_T08_DoneViewResourceLoad	0.246	0.302	0.505	0.042
	1	WF7_T09_ClickManagementPoolCapacity	0.274	0.525	3.023	0.456
	1	WF7_T10_DoneManagementPoolCapacity	0.244	0.303	0.764	0.069

2.8 WF8: Resource Management – Find a Resource

Description:

This workflow simulates a Resource Manager finding an available resource. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 1 and 50
2	WF8_T01_SearchResourceAvailabilityLink	Click on “Search resource Availability” link on the left navigation pane

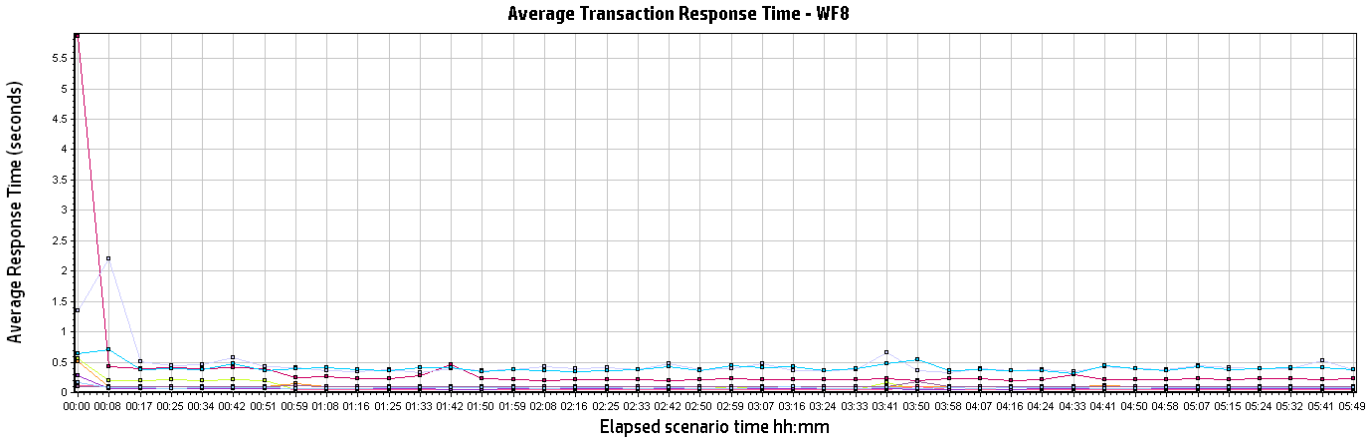
3	WF8_T02_FromDatePopup	Click on “Availability within dates” popup
4	WF8_T03_SelectFromDate	Enter today’s date
5	WF8_T04_ToDatePopup	Click on to date popup
6	WF8_T05_SelectToDate	Enter a work date 60 days from today
7	WF8_T06_SpecifySkill	Click on “View Resource Load” button
8	WF8_T07_SpecifyResourcePool	Enter skill_<random_skill_number> where random_skill_number is a random number between 1 and 50
9	WF8_T08_SearchButton	Click on “Search” button
10	WF8_T09_SortByName	Click on “Resource Name” column heading to sort by name
11	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	20
Scenario Start Time	60 seconds after scenario begins
Ramp-up	180 seconds
Pacing	3600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 20 users who execute this workflow multiple iterations, with a pacing of 1 hour between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation

	1	WF8_T01_SearchResourceAvailabilityLink	0.174	0.399	13.005	1.218
	1	WF8_T02_FromDatePopup	0.048	0.091	0.747	0.106
	1	WF8_T03_SelectFromDate	0.093	0.108	0.930	0.085
	1	WF8_T04_ToDatePopup	0.048	0.061	0.188	0.022
	1	WF8_T05_SelectToDate	0.091	0.100	0.345	0.023
	1	WF8_T06_SpecifySkill	0.055	0.065	0.714	0.060
	1	WF8_T07_SpecifyResourcePool	0.066	0.078	0.226	0.018
	1	WF8_T08_SearchButton	0.264	0.463	3.926	0.396
	1	WF8_T09_SortByName	0.287	0.404	1.357	0.123

2.9 WF9: Resource Management – View Resource Usage

Description:
This workflow simulates a Project Manager viewing resource usage of the project. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 1 and 50
2	WF9_T01_ClickSearchProjects	Click on “Search Projects” link on the left navigation pane
3	WF9_T02_SearchProjectByName	Enter <user_number> into “Project Name contains” textbox and click on the search button
4	WF9_T03_OpenProjectOverview	Select Project<user_number> from the results list
5	WF9_T04_ClickEditWorkPlan	Click on “Edit Work Plan” button
6	WF9_T05_ViewResourceUsage	Click on “Actions-Resource Usage”
7	WF9_T06_DoneResourceUsage	Click on “Done” button
8	Logout	Logout transaction is shared by all workflows

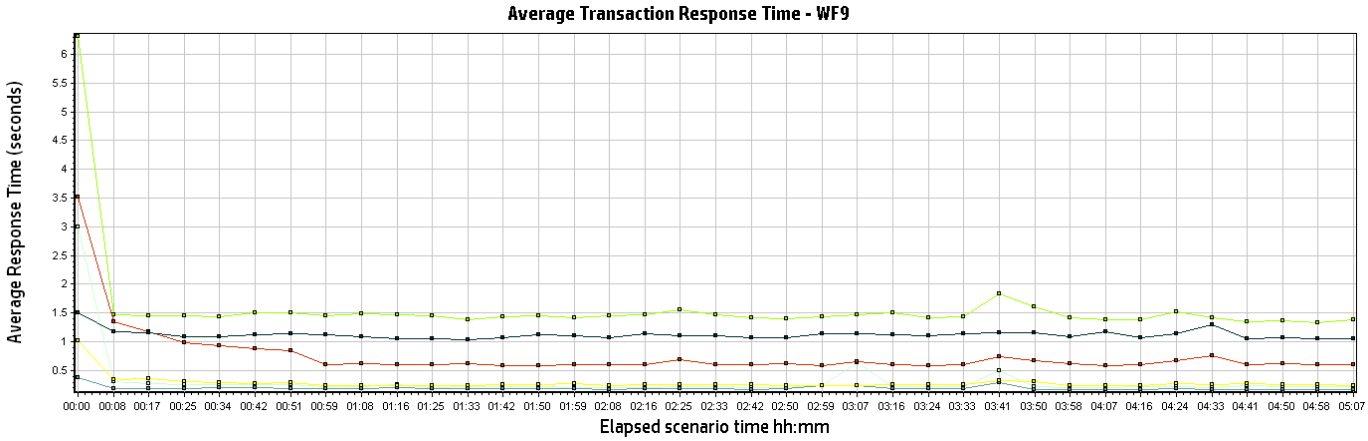
Workflow Properties:

Number of Users	20
Scenario Start Time	70 seconds after scenario begins
Ramp-up	180 seconds
Pacing	720 seconds

Think Time	10 seconds

In the LoadRunner simulation there are 20 users who execute this workflow multiple iterations, with a pacing of 12 minutes between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF9_T01_ClickSearchProjects	0.174	0.258	8.210	0.420
	1	WF9_T02_SearchProjectByName	0.144	0.189	0.821	0.059
	1	WF9_T03_OpenProjectOverview	1.110	1.488	14.802	0.650
	1	WF9_T04_ClickEditWorkPlan	0.508	0.682	6.928	0.383
	1	WF9_T05_ViewResourceUsage	0.208	0.264	1.313	0.091
	1	WF9_T06_DoneResourceUsage	0.885	1.111	2.194	0.128

2.10 WF10: Financial Management – FM Portlets and Views

Description:
This workflow simulates a Project Manager seeing financial portlets and different views of the work plan. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 1 and 150
2	WF10_T01_ViewFMPortlets	Click on FM link , under Dashboard to view the following 3 FM portlets : Budget To Budget Comparison Portlet

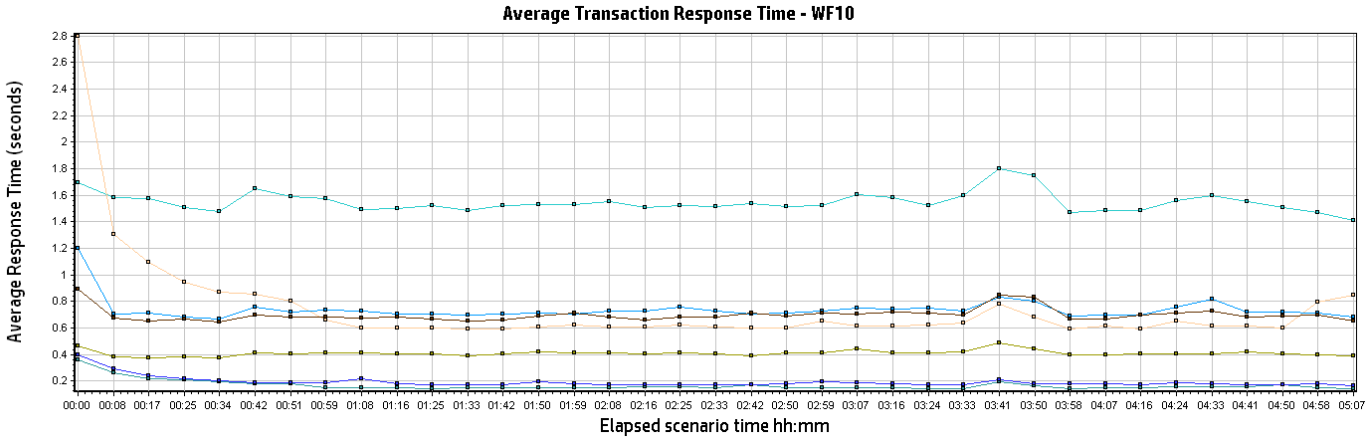
		Current Cost Metrics Portlet Project Cost Summary Portlet
3	WF10_T02_ClickSearchProjects	Click on “Search Projects” link on the left navigation pane
4	WF10_T03_SearchProjectByName	Enter <user_number> into “Project Name contains” textbox and click on the search button
5	WF10_T04_OpenProjectOverview	Select Project<user_number> from the results list
6	WF10_T05_ClickEditWorkPlan	Click on “Edit Work Plan” button
7	WF10_T06_Costing_View	Click on “Change Views-Costing View”
8	WF10_T07_Earned_Value_View	Click on “Change Views-Earned Value View” button
9	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	50
Scenario Start Time	80 seconds after scenario begins
Ramp-up	72 seconds
Pacing	600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 50 users who execute this workflow multiple iterations, with a pacing of 10 minutes between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF10_T01_ViewFMPortlets	0.328	0.411	1.160	0.061
	1	WF10_T02_ClickSearchProjects	0.119	0.161	1.252	0.058

	1	WF10_T03_SearchProjectByName	0.130	0.185	1.201	0.072
	1	WF10_T04_OpenProjectOverview	1.111	1.548	4.483	0.220
	1	WF10_T05_ClickEditWorkPlan	0.511	0.672	7.606	0.322
	1	WF10_T06_Costing_View	0.538	0.731	2.999	0.140
	1	WF10_T07_Earned_Value_View	0.478	0.699	2.409	0.126

2.11 WF11: Portfolio Management – Portfolio creation

Description:
This workflow simulates a Portfolio Manager creating, editing and removing a portfolio. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1	Login	Login to PPM application
2	WF11_T01_PortfolioLanding	Using the menu bar, navigate to Open->Portfolio Management
3	WF11_T02_ViewPortfolioHierarchy	In the portfolio landing page, click the View Portfolio Hierarchy icon.
4	WF11_T03_SearchForAPortfolio	In the search box, enter a portfolio name to search for it.
5	WF11_T04_OpenPortfolioOverview	Select the first returned portfolio name from the search result, this opens the portfolio overview page
6	WF11_T05_ClickCreatePortfolio	In the portfolio landing page, click the Create Portfolio icon.
7	WF11_T06_OpenACL	Open the AutoComplete for Portfolio Managers
8	WF11_T07_CreatePortfolio	Select the default (logged in user) and click Create
9	WF11_T08_AutoComplete_Portfolio	Under Subportfolios tab, to add sub-portfolios, open the portfolio AutoComplete
10	WF11_T09_AutoComplete_SearchByPortfolio	Enter the keyword- Portfolio_xy, to return a list of portfolios
11	WF11_T10_AddSubPortfolios	Select all the returned portfolios and add them
12	WF11_T11_RemoveSubPortfolios	Highlight all the sub portfolios and Use the remove option to remove them
13	WF11_T12_OpenProgramSearch	Under Program tab, to add sub-programs, click 'Add Programs' this will bring up the Program Search Dialog

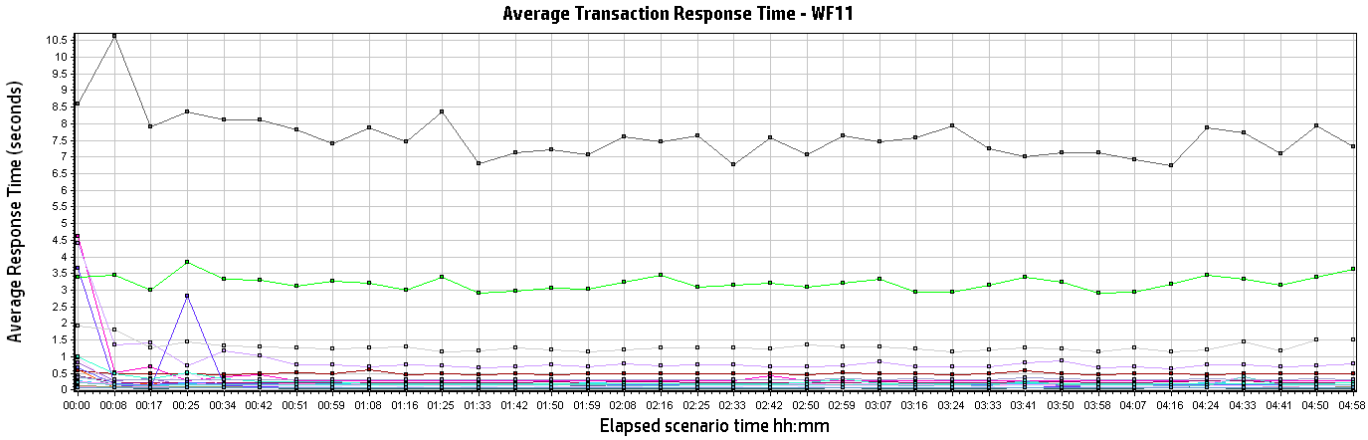
14	WF11_T13_AutoComplete_SearchByProgram	Enter the keyword- Program_xy, to return a list of programs
15	WF11_T14_AddPrograms	Select all the returned programs and add them
16	WF11_T15_RemovePrograms	Highlight all the programs and Use the remove option to remove them
17	WF11_T16_OpenContentSearch	Under Projects/Proposals/Assets tab, to add content, click 'Add Projects' this will bring up the Project Search Dialog
18	WF11_T17_AutoComplete_Projects	Click on the Project AutoComplete
19	WF11_T18_AutoComplete_SearchByProject	Enter the keyword- Project_xy, to return a list of projects
20	WF11_T19_AddProjects	Select all the returned projects and add them
21	WF11_T20_RemoveProjects	Highlight all the projects and Use the remove option to remove them
22	WF11_T21_AddEpics	In the Portfolio Epics tab, click Add Epic to add epics.
23	WF11_T22_RemoveEpics	Select an epic and click Remove.
24	WF11_T23_DeletePortfolio	Click on Delete Portfolio, this opens a warning dialog
25	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	5
Scenario Start Time	When scenario begins
Ramp-up	720 seconds
Pacing	600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 5 users who execute this workflow multiple iterations, with a pacing of 10 minutes between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF11_T01_PortfolioLanding	0.235	0.329	4.620	0.385
	1	WF11_T02_ViewPortfolioHierarchy	0.593	0.799	4.401	0.398
	1	WF11_T03_SearchForAPortfolio	0.051	0.063	0.609	0.060
	1	WF11_T04_OpenPortfolioOverview	0.358	0.491	1.527	0.114
	1	WF11_T05_ClickCreatePortfolio	0.117	0.155	0.822	0.081
	1	WF11_T06_OpenACL	6.234	7.528	11.267	0.742
	1	WF11_T07_CreatePortfolio	0.201	0.229	0.430	0.033
	1	WF11_T08_AutoComplete_Portfolio	0.059	0.071	0.162	0.017
	1	WF11_T09_AutoComplete_SearchByPortfolio	0.033	0.047	0.252	0.024
	1	WF11_T10_AddSubPortfolios	0.120	0.141	0.519	0.043
	1	WF11_T11_RemoveSubPortfolios	0.119	0.140	0.487	0.044
	1	WF11_T12_OpenProgramSearch	0.090	0.131	0.972	0.107
	1	WF11_T13_AutoComplete_SearchByProgram	0.148	0.178	0.326	0.028
	1	WF11_T14_AddPrograms	0.146	0.177	1.179	0.086
	1	WF11_T15_RemovePrograms	0.137	0.164	0.655	0.057
	1	WF11_T16_OpenContentSearch	0.059	0.118	3.663	0.378
	1	WF11_T17_AutoComplete_Projects	2.676	3.185	4.047	0.310
	1	WF11_T18_AutoComplete_SearchByProject	0.156	0.219	1.002	0.105
	1	WF11_T19_AddProjects	1.054	1.270	1.920	0.171

	1	WF11_T20_RemoveProjects	0.133	0.157	1.174	0.095
	1	WF11_T21_AddEpics	0.060	0.069	0.224	0.015
	1	WF11_T22_RemoveEpics	0.050	0.054	0.082	0.004
	1	WF11_T23_DeletePortfolio	0.287	0.317	0.492	0.022

2.12 WF12: Program Management – Program creation

Description:
This workflow simulates a Program Manager creating, editing and removing a program. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 101 and 110
2	WF12_T01_CreateProgramfromMenu	Click on “Create Program” from menu
3	WF12_T02_CreateProgram	Click on “Create” for creating a program
4	WF12_T03_ProgramSettings	Go to “Program Settings”
5	WF12_T04_ProgramSettingsDone	Enable financial management and click on “Done”
6	WF12_T05_AddContent_ProgramOverviewPage	Click on “Add Content”
7	WF12_T06_AddContent_OpenPopUp	Click on auto-comp for project which will open a pop-up
8	WF12_T07_AddContent_SearchProjects	Search for projects
9	WF12_T08_AddContent_AddButtonfromPopUp	Click “OK” to add 50 projects
10	WF12_T09_IncludeClosed	Click on the check box “Include Closed” to include closed content
11	WF12_T10_UnselectClosed	Click on the check box “Include Closed” to unselect closed content
12	WF12_T11_OpenProgramCostView	Click Cost tab in Program Overview page
13	WF12_T12_FinancialSummary	Click on financial summary of this program
14	WF12_T13_ViewApproveBudgetDetails	Click “View Approved Budget Details”
15	WF12_T14_AddOneForecastLine	Click on “Add Forecast and Actuals”

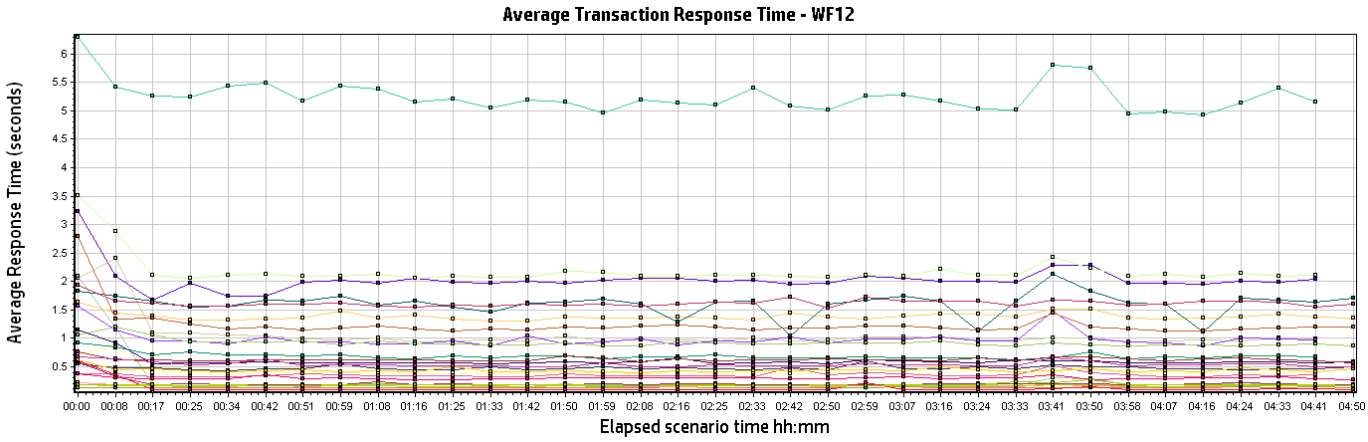
16	WF12_T15_AddOneForecastLine_AddLine	Add one forecast line
17	WF12_T16_AddForecastDone	Click “Done”
18	WF12_T17_AddOneBenefitLine	Click on “Add Benefits”
19	WF12_T18_AddOneBenefitLine_AddLine	Add one benefit line
20	WF12_T19_AddBenefitDone	Click “Done”
21	WF12_T20_FinancialSummaryDone	Click “Done” on financial summary page to go back to Program Overview page
22	WF12_T21_DeleteProgram	Click “Delete”
23	WF12_T22_DeleteProgram_ConfirmationPopUp	Click “Yes” for confirmation
24	WF12_T23_SearchProgram_fromMenu	Click “Search” and “Program” to search a program from menu
25	WF12_T24_SearchProgram	Search Program
26	WF12_T25_OpenProgram	Open one program
27	WF12_T26_OpenProgramDone	Click “Done”
28	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	5
Scenario Start Time	When scenario begins
Ramp-up	720 seconds
Pacing	0 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 5 users who execute this workflow multiple iterations, with a pacing of 0 second between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF12_T01_CreateProgramfromMenu	0.305	2.013	4.135	0.301
	1	WF12_T02_CreateProgram	1.951	2.140	4.694	0.249
	1	WF12_T03_ProgramSettings	0.343	0.401	1.276	0.097
	1	WF12_T04_ProgramSettingsDone	0.834	1.010	3.702	0.224
	1	WF12_T05_AddContent_ProgramOverviewPage	0.097	0.214	5.927	0.366
	1	WF12_T06_AddContent_OpenPopUp	4.274	5.220	8.436	0.523
	1	WF12_T07_AddContent_SearchProjects	0.092	0.165	0.859	0.053
	1	WF12_T08_AddContent_AddButtonfromPopUp	0.634	0.975	5.721	0.312
	1	WF12_T09_IncludeClosed	0.269	0.360	1.561	0.120
	1	WF12_T10_UnselectClosed	0.540	0.681	1.075	0.077
	1	WF12_T11_OpenProgramCostView	0.745	0.910	1.519	0.089
	1	WF12_T12_FinancialSummary	1.176	1.383	1.941	0.103
	1	WF12_T13_ViewApproveBudgetDetails	0.506	0.589	1.656	0.098
	1	WF12_T14_AddOneForecastLine	0.382	0.477	1.669	0.102
	1	WF12_T15_AddOneForecastLine_AddLine	0.175	0.201	0.586	0.045
	1	WF12_T16_AddForecastDone	0.242	1.596	3.883	0.358
	1	WF12_T17_AddOneBenefitLine	0.237	0.303	0.666	0.041
	1	WF12_T18_AddOneBenefitLine_AddLine	0.121	0.136	0.230	0.012
	1	WF12_T19_AddBenefitDone	1.286	1.616	2.436	0.123
	1	WF12_T20_FinancialSummaryDone	0.518	0.628	0.982	0.064
	1	WF12_T21_DeleteProgram	0.095	0.112	0.888	0.071
	1	WF12_T22_DeleteProgram_ConfirmationPopUp	0.345	0.436	1.041	0.067
	1	WF12_T23_SearchProgram_fromMenu	0.133	0.165	0.322	0.024
	1	WF12_T24_SearchProgram	0.145	0.191	0.786	0.064

	1	WF12_T25_OpenProgram	1.019	1.199	2.797	0.167
	1	WF12_T26_OpenProgramDone	0.392	0.540	1.318	0.094

2.13 WF13: Program Management – Open Program

Description:
This workflow simulates a Program Manager opening Program Overview page and program Timeline tab with different amounts of projects included in the program. Unlike other scripts with Web HTTP/HTML protocol which emulates communication between a browser and Web server on an HTTP or HTML level, this is a TruClient-Web script, which is for modern JavaScript-based applications emulating user activity within a Web browser. Scripts are developed interactively from within a Web browser. This one is for Chrome browser.

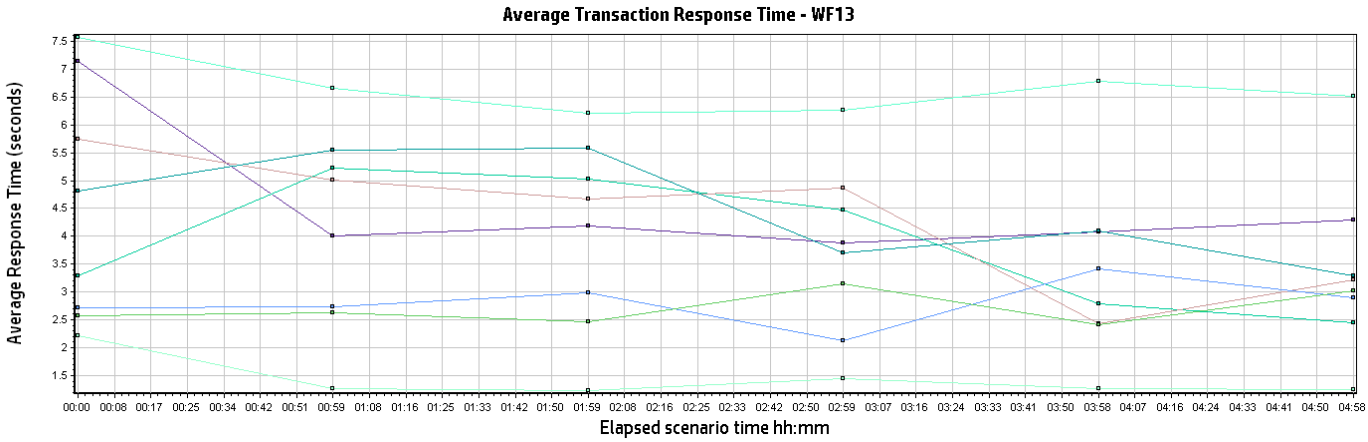
	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 101 and 110
2	WF13_OpenProgramOverview_10Projects	Open one program with 10 projects, 60 issues, 60 risks, 16 scope changes and 3 business objects
3	WF13_OpenProgramOverview_200Projects	Open one program with 200 projects, 1200 issues, 1200 risks, 330 scope changes and 8 business objects
4	WF13_OpenProgramOverview_40Projects	Open one program with 40 projects, 240 issues, 240 risks, 64 scope changes and 5 business objects
5	WF13_OpenProgramOverview_60Projects	Open one program with 60 projects, 360 issues, 60 risks, 96 scope changes and 8 business objects
6	WF13_OpenProgramTimeline_10Projects	Open one program and click Timeline tab, with 10 projects, 20 milestones per project, 18 months program duration
7	WF13_OpenProgramTimeline_200Projects	Open one program and click Timeline tab, with 200 projects, 1200 issues, 1200 risks, 330 scope changes and 8 business objects
8	WF13_OpenProgramTimeline_40Projects	Open one program and click Timeline tab, with 40 projects, 36 milestones per project, 48 months program duration
9	WF13_OpenProgramTimeline_60Projects	Open one program and click Timeline tab, with 60 projects, 36 milestones per project, 96 months program duration
10	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	6
Scenario Start Time	When scenario begins
Ramp-up	3600 seconds
Pacing	0 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 6 users who execute this workflow multiple iterations, with a pacing of 0 second between iterations.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF13_OpenProgramOverview_10Projects	3.824	4.366	7.143	0.898
	1	WF13_OpenProgramOverview_200Projects	2.276	3.931	5.929	1.181
	1	WF13_OpenProgramOverview_40Projects	2.360	4.190	5.750	1.286
	1	WF13_OpenProgramOverview_60Projects	2.335	4.477	6.033	1.169
	1	WF13_OpenProgramTimeline_10Projects	1.108	1.372	2.212	0.288
	1	WF13_OpenProgramTimeline_200Projects	5.960	6.584	7.574	0.526
	1	WF13_OpenProgramTimeline_40Projects	2.111	2.819	3.621	0.571
	1	WF13_OpenProgramTimeline_60Projects	2.330	2.720	3.954	0.521

2.14 WF14: TM – Import Time Sheet

Description:
This workflow simulates a PPM user importing external data to a PPM time sheet. The sequence of steps for this workflow is the following:

	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 101 and 110
2	WF14_T01_Click_Create_A_Time_Sheet	Click on “Create a time sheet” link
3	WF14_T02_ChoosePeriod	Select a time period from Time Period drop-down list
4	WF14_T03_Click_CreateTimeSheetBtn	Click on “Create” button
5	WF14_T04_Choose_AddExternalData	Click on “Add Items” button and select “Add External Data”
6	WF14_T05_UserConfiguration	Select instance from in "Import External Data" window, then go to next "User Configuration" step, input AGM Username/password to pass AGM authentication
7	WF14_T06_Submit_ExternalData	Click on “Submit” button on Confirmation step of “Import External Data” window
8	WF14_T07_Save&Submit_TimeSheet	Click on “Save & Submit” button to submit time sheet
9	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	240
Scenario Start Time	1 hour after scenario begins
Ramp-up	1 per 30 seconds
Pacing	0 seconds
Think Time	10 seconds

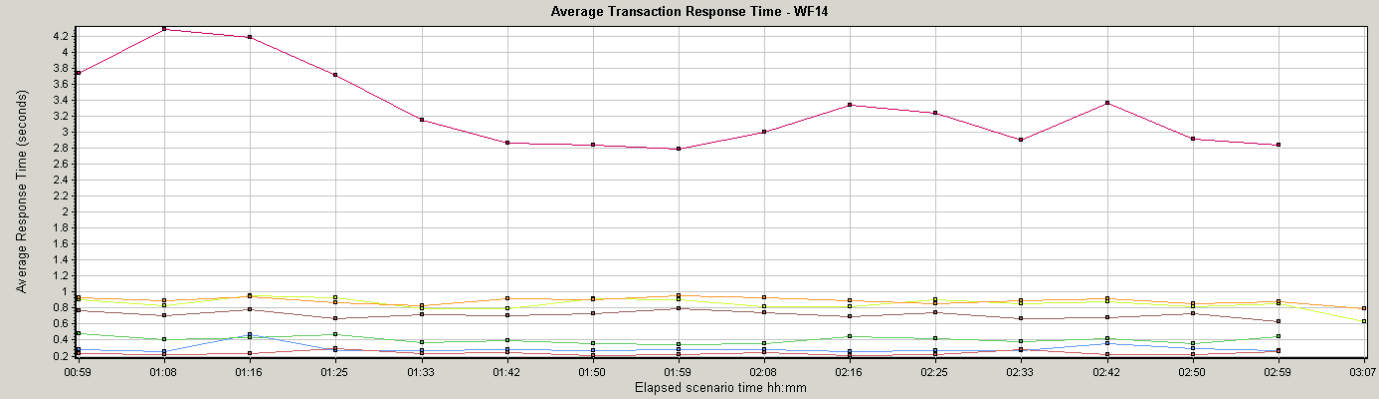
In the LoadRunner simulation there are 240 users who execute this workflow for 6 iterations starting 1 hour after scenario begins, with pacing of 0 second. The workflow execution is limited to 1 hour window between 1 and 2 hours into the scenario run. Think time between all transactions is 10 seconds.

Set up:

- Prepare data in AGM for PPM integration:
  1. Create a workspace.
  2. Create a user under this workspace.
  3. Generate integration client ID and client secret associated to his workflow.
  4. Create a release.
  5. Create a time with the above user and assign the team to the above release.
  6. Create a sprint backlog for this release, and add a task under it, with the above user assigned.
- Configuration in PPM:
  1. Add External Data in Work Items tab for global time sheet policy in PPM Workbench.

2. Add integration from PPM web.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF14_T01_Click_Create_A_Time_Sheet	0.170	0.294	3.445	0.219
	1	WF14_T02_ChoosePeriod	0.151	0.399	2.603	0.279
	1	WF14_T03_Click_CreateTimeSheetBtn	0.475	0.720	3.929	0.321
	1	WF14_T04_Choose_AddExternalData	0.114	0.235	2.605	0.234
	1	WF14_T05_UserConfiguration	2.324	3.269	13.526	0.857
	1	WF14_T06_Submit_ExternalData	0.509	0.863	3.552	0.379
	1	WF14_T07_Save&Submit_TimeSheet	0.590	0.897	3.511	0.303

2.15 WF15: User Management

Description
This workflow simulates a PPM administrative user opening User Management Console to view, edit, and create users. The sequence of steps for this workflow is the following:

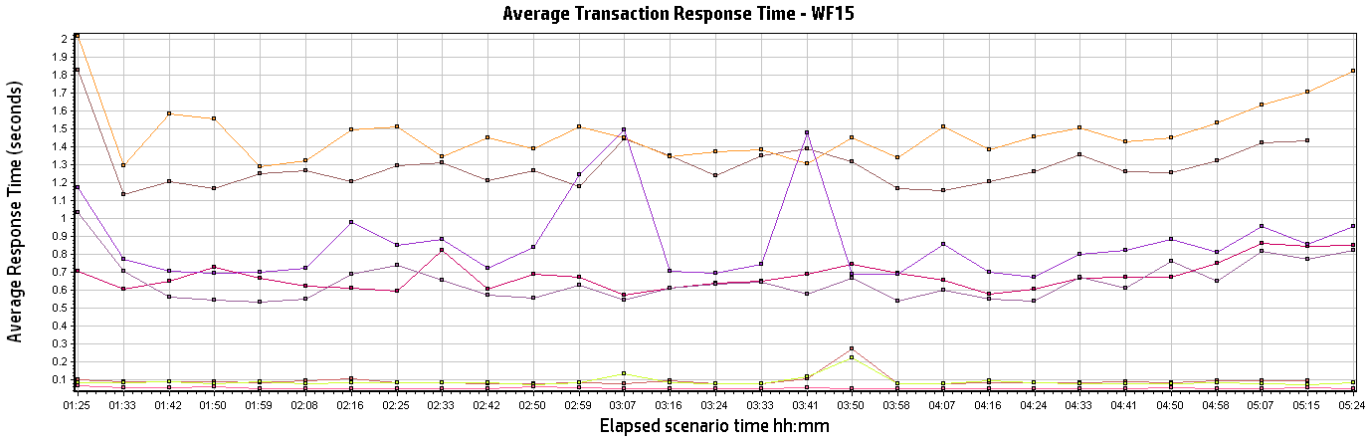
	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 101 and 110
2	WF15_T01_Open_UserMngConsole	Click Open > Administration > Open User Management Console from PPM menu
3	WF15_T02_FilterByUsername	Click Filter icon, enter username, and click Search
4	WF15_T03_OpenUser	Click a user
5	WF15_T04_EditUser	Click Edit icon to edit user
6	WF15_T05_EditUser_Save	Click Save to save edits
7	WF15_T06_CreateUser	Click Add user icon to create a user
8	WF15_T07_CreateUser_Save	Enter user information and click Add to save the user
9	WF15_T08_CopyUser	Click Copy user icon to copy a user
10	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	10
Scenario Start Time	1.5 hours after scenario begins
Ramp-up	1 per 180 seconds
Pacing	1800 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 10 users who execute this workflow for a single iteration starting 1.5 hours after scenario begins with a pacing of 30 minutes.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF15_T01_Open_UserMngConsole	1.070	1.289	1.896	0.156
	1	WF15_T02_FilterByUsername	0.072	0.093	0.663	0.066
	1	WF15_T03_OpenUser	0.530	0.673	0.902	0.099
	1	WF15_T04_EditUser	0.069	0.088	0.500	0.052
	1	WF15_T05_EditUser_Save	1.147	1.464	2.329	0.185
	1	WF15_T06_CreateUser	0.047	0.051	0.081	0.005
	1	WF15_T07_CreateUser_Save	0.491	0.634	1.033	0.111
	1	WF15_T08_CopyUser	0.647	0.846	2.646	0.323

2.16 WF16: PGM – Top Down Budget

Description

This workflow simulates a PPM administrative user opening User Management Console to view, edit, and create users. The sequence of steps for this workflow is the following:

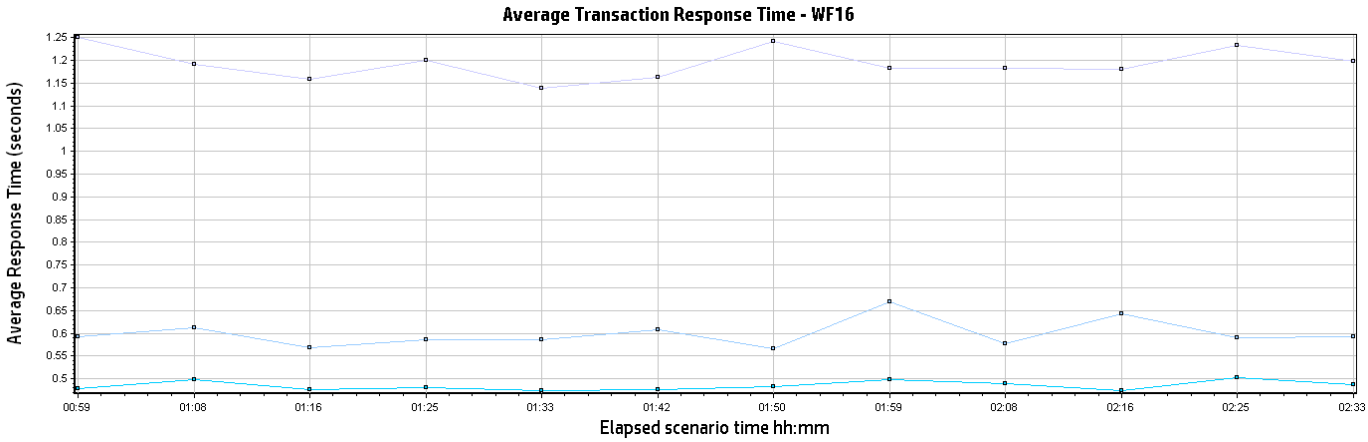
	Transaction Name	Description
1	Login	Login transaction is shared by all workflow scripts. In this script, the user logs in using mng_<user_number>, where user_number is a random number between 101 and 110
2	WF16_T01_OpenTopDownProgram	Open a program that uses the top-down budgeting strategy.
3	WF16_T02_OpenTopDownProgramFS	Open the program financial summary.
4	WF16_T03_OpenTopDownProgramBudget	Click the View Approved Budget Details link.
5	Logout	Logout transaction is shared by all workflows

Workflow Properties:

Number of Users	200
Scenario Start Time	1 hour after scenario begins
Ramp-up	1 per 300 seconds
Pacing	600 seconds
Think Time	10 seconds

In the LoadRunner simulation there are 200 users who execute this workflow for a single iteration starting 1 hour after scenario begins with a pacing of 10 minutes.

Transaction Response Time:
Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	WF16_T01_OpenTopDownProgram	0.516	0.600	0.993	0.073
	1	WF16_T02_OpenTopDownProgramFS	1.002	1.193	1.659	0.091

	1	WF16_T03_OpenTopDownProgramBudget	0.423	0.485	0.630	0.034

3 Benchmark Scenario Run

The following section provides results from a benchmark in PPM Performance Labs. Please note that while all workflows scripts were run simultaneously, the average transaction response times are broken down by individual workflows in the interest of readability.

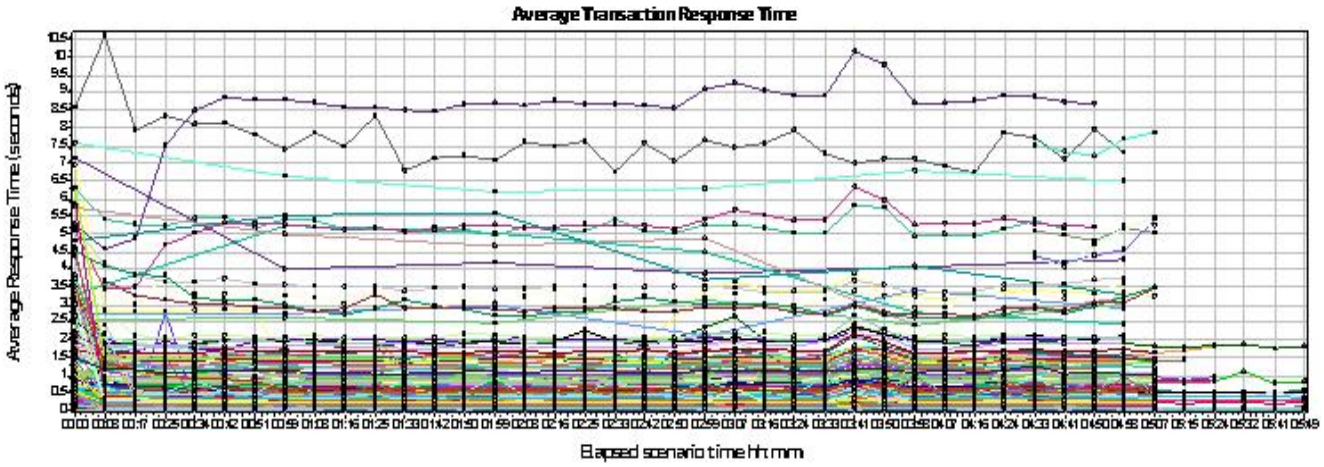
3.1 Graph Information

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.
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 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.

3.2 Average Transaction Response Time

Display the average time taken to perform transactions during each second of the load test. This graph helps us determine whether the performance of the system is within acceptable minimum and maximum transaction performance time ranges.

Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	Login	0.611	2.811	32.822	2.444
	1	Logout	0.015	0.065	0.747	0.051
	1	WF1_T01_LoadMyTasksPortlet	1.565	2.001	9.112	0.590
	1	WF1_T02_LoadTaskFromPortlet	0.440	0.619	11.717	0.655
	1	WF1_T03_ClickDoneOnPortletTask	0.256	0.330	1.003	0.062
	1	WF1_T04_UpdatePortletTaskPercent	0.053	0.080	0.786	0.066
	1	WF1_T05_UpdatePortletTaskActualEffort	0.609	0.930	10.084	0.736
	1	WF1_T06_SaveMyTaskPortlet	0.457	0.636	7.672	0.602
	1	WF10_T01_ViewFMPortlets	0.328	0.411	1.160	0.061
	1	WF10_T02_ClickSearchProjects	0.119	0.161	1.252	0.058
	1	WF10_T03_SearchProjectByName	0.130	0.185	1.201	0.072
	1	WF10_T04_OpenProjectOverview	1.111	1.548	4.483	0.220
	1	WF10_T05_ClickEditWorkPlan	0.511	0.672	7.606	0.322
	1	WF10_T06_Costing_View	0.538	0.731	2.999	0.140
	1	WF10_T07_Earned_Value_View	0.478	0.699	2.409	0.126
	1	WF11_T01_PortfolioLanding	0.235	0.329	4.620	0.385
	1	WF11_T02_ViewPortfolioHierarchy	0.593	0.799	4.401	0.398
	1	WF11_T03_SearchForAPortfolio	0.051	0.063	0.609	0.060
	1	WF11_T04_OpenPortfolioOverview	0.358	0.491	1.527	0.114
	1	WF11_T05_ClickCreatePortfolio	0.117	0.155	0.822	0.081
	1	WF11_T06_OpenACL	6.234	7.528	11.267	0.742
	1	WF11_T07_CreatePortfolio	0.201	0.229	0.430	0.033
	1	WF11_T08_AutoComplete_Portfolio	0.059	0.071	0.162	0.017
	1	WF11_T09_AutoComplete_SearchByPortfolio	0.033	0.047	0.252	0.024
	1	WF11_T10_AddSubPortfolios	0.120	0.141	0.519	0.043
	1	WF11_T11_RemoveSubPortfolios	0.119	0.140	0.487	0.044
	1	WF11_T12_OpenProgramSearch	0.090	0.131	0.972	0.107
	1	WF11_T13_AutoComplete_SearchByProgram	0.148	0.178	0.326	0.028
	1	WF11_T14_AddPrograms	0.146	0.177	1.179	0.086

	1	WF11_T15_RemovePrograms	0.137	0.164	0.655	0.057
	1	WF11_T16_OpenContentSearch	0.059	0.118	3.663	0.378
	1	WF11_T17_AutoComplete_Projects	2.676	3.185	4.047	0.310
	1	WF11_T18_AutoComplete_SearchByProject	0.156	0.219	1.002	0.105
	1	WF11_T19_AddProjects	1.054	1.270	1.920	0.171
	1	WF11_T20_RemoveProjects	0.133	0.157	1.174	0.095
	1	WF11_T21_AddEpics	0.060	0.069	0.224	0.015
	1	WF11_T22_RemoveEpics	0.050	0.054	0.082	0.004
	1	WF11_T23_DeletePortfolio	0.287	0.317	0.492	0.022
	1	WF12_T01_CreateProgramfromMenu	0.305	2.013	4.135	0.301
	1	WF12_T02_CreateProgram	1.951	2.140	4.694	0.249
	1	WF12_T03_ProgramSettings	0.343	0.401	1.276	0.097
	1	WF12_T04_ProgramSettingsDone	0.834	1.010	3.702	0.224
	1	WF12_T05_AddContent_ProgramOverviewPage	0.097	0.214	5.927	0.366
	1	WF12_T06_AddContent_OpenPopUp	4.274	5.220	8.436	0.523
	1	WF12_T07_AddContent_SearchProjects	0.092	0.165	0.859	0.053
	1	WF12_T08_AddContent_AddButtonfromPopUp	0.634	0.975	5.721	0.312
	1	WF12_T09_IncludeClosed	0.269	0.360	1.561	0.120
	1	WF12_T10_UnselectClosed	0.540	0.681	1.075	0.077
	1	WF12_T11_OpenProgramCostView	0.745	0.910	1.519	0.089
	1	WF12_T12_FinancialSummary	1.176	1.383	1.941	0.103
	1	WF12_T13_ViewApproveBudgetDetails	0.506	0.589	1.656	0.098
	1	WF12_T14_AddOneForecastLine	0.382	0.477	1.669	0.102
	1	WF12_T15_AddOneForecastLine_AddLine	0.175	0.201	0.586	0.045
	1	WF12_T16_AddForecastDone	0.242	1.596	3.883	0.358
	1	WF12_T17_AddOneBenefitLine	0.237	0.303	0.666	0.041
	1	WF12_T18_AddOneBenefitLine_AddLine	0.121	0.136	0.230	0.012
	1	WF12_T19_AddBenefitDone	1.286	1.616	2.436	0.123
	1	WF12_T20_FinancialSummaryDone	0.518	0.628	0.982	0.064
	1	WF12_T21_DeleteProgram	0.095	0.112	0.888	0.071
	1	WF12_T22_DeleteProgram_ConfirmationPopUp	0.345	0.436	1.041	0.067
	1	WF12_T23_SearchProgram_fromMenu	0.133	0.165	0.322	0.024
	1	WF12_T24_SearchProgram	0.145	0.191	0.786	0.064
	1	WF12_T25_OpenProgram	1.019	1.199	2.797	0.167
	1	WF12_T26_OpenProgramDone	0.392	0.540	1.318	0.094
	1	WF13_OpenProgramOverview_10Projects	3.824	4.366	7.143	0.898
	1	WF13_OpenProgramOverview_200Projects	2.276	3.931	5.929	1.181
	1	WF13_OpenProgramOverview_40Projects	2.360	4.190	5.750	1.286
	1	WF13_OpenProgramOverview_60Projects	2.335	4.477	6.033	1.169
	1	WF13_OpenProgramTimeline_10Projects	1.108	1.372	2.212	0.288
	1	WF13_OpenProgramTimeline_200Projects	5.960	6.584	7.574	0.526
	1	WF13_OpenProgramTimeline_40Projects	2.111	2.819	3.621	0.571
	1	WF13_OpenProgramTimeline_60Projects	2.33	2.720	3.954	0.521
	1	WF15_T01_Open_UserMngConsole	1.070	1.289	1.896	0.156

	1	WF15_T02_FilterByUsername	0.072	0.093	0.663	0.066
	1	WF15_T03_OpenUser	0.530	0.673	0.902	0.099
	1	WF15_T04_EditUser	0.069	0.088	0.500	0.052
	1	WF15_T05_EditUser_Save	1.147	1.464	2.329	0.185
	1	WF15_T06_CreateUser	0.047	0.051	0.081	0.005
	1	WF15_T07_CreateUser_Save	0.491	0.634	1.033	0.111
	1	WF15_T08_CopyUser	0.647	0.846	2.646	0.323
	1	WF16_T01_OpenTopDownProgram	0.516	0.600	0.993	0.073
	1	WF16_T02_OpenTopDownProgramFS	1.002	1.193	1.659	0.091
	1	WF16_T03_OpenTopDownProgramBudget	0.423	0.485	0.630	0.034
	1	WF2_T01_Click_Create_A_Time_Sheet	0.317	0.376	1.228	0.092
	1	WF2_T02_ChoosePeriod	0.149	0.196	1.320	0.073
	1	WF2_T03_ClickCreateNewTS	0.306	0.485	4.947	0.291
	1	WF2_T04_AddItem_Addtask	0.055	0.098	3.311	0.129
	1	WF2_T05_ClickFindTask	0.089	0.206	1.524	0.131
	1	WF2_T06_ClickAddTasks	0.631	0.834	3.684	0.207
	1	WF2_T07_ChangeTimeSheetHours	0.030	0.067	3.352	0.155
	1	WF2_T08_ClickSaveNewTS	0.801	1.030	4.340	0.241
	1	WF2_T09_ClickSubmitNewTS	0.757	0.984	4.045	0.204
	1	WF2_T10_CopyTS_ChoosePeriod	0.148	0.198	1.320	0.075
	1	WF2_T11_ClickCreateTSCopy	0.527	0.731	4.287	0.241
	1	WF2_T12_ClickSaveTSCopy	0.773	1.025	3.951	0.215
	1	WF2_T13_ClickSubmitTSCopy	0.754	1.048	4.642	0.238
	1	WF3_T01_ClickSearchProjects	0.121	0.188	18.439	0.506
	1	WF3_T02_SearchProjectByName	0.132	0.177	1.161	0.052
	1	WF3_T03_OpenProjectOverview	1.156	1.654	14.900	0.555
	1	WF3_T04_ProjectDetailsTab	0.852	1.099	13.184	0.417
	1	WF3_T05_FinancialSummary	1.068	1.416	13.435	0.379
	1	WF3_T06_ViewBudgetDetails	0.392	0.526	1.922	0.106
	1	WF3_T07_ViewBudgetDetails_Done	1.057	1.367	4.166	0.191
	1	WF3_T08_AddForecastLines	0.372	0.501	2.032	0.112
	1	WF3_T09_AddForecastLines_Add10Lines	0.597	0.662	4.120	0.122
	1	WF3_T10_AddForecast_Done	0.590	2.004	4.378	0.249
	1	WF3_T11_AddBenefitLines	0.257	0.344	1.625	0.082
	1	WF3_T12_AddBenefitLines_Add10Lines	0.597	0.644	1.372	0.048
	1	WF3_T13_AddBenefit_Done	0.584	2.021	6.747	0.373
	1	WF3_T14_Tab_Detail_Lines	0.311	0.430	1.724	0.098
	1	WF3_T15_Tab_Total_Only	0.312	0.439	1.351	0.080
	1	WF3_T16_Tab_Planned_and_Actuals	0.318	0.432	1.675	0.104
	1	WF3_T17_Tab_Planned_Only	0.305	0.421	1.481	0.090
	1	WF3_T18_Tab_Quarters	0.294	0.415	2.889	0.115
	1	WF3_T19_Tab_Months	0.293	0.417	2.103	0.121
	1	WF3_T20_DeleteForecastActuals	0.444	0.575	1.880	0.106
	1	WF3_T21_DeleteForecastActuals_Delete5Lines	0.044	0.065	0.916	0.042

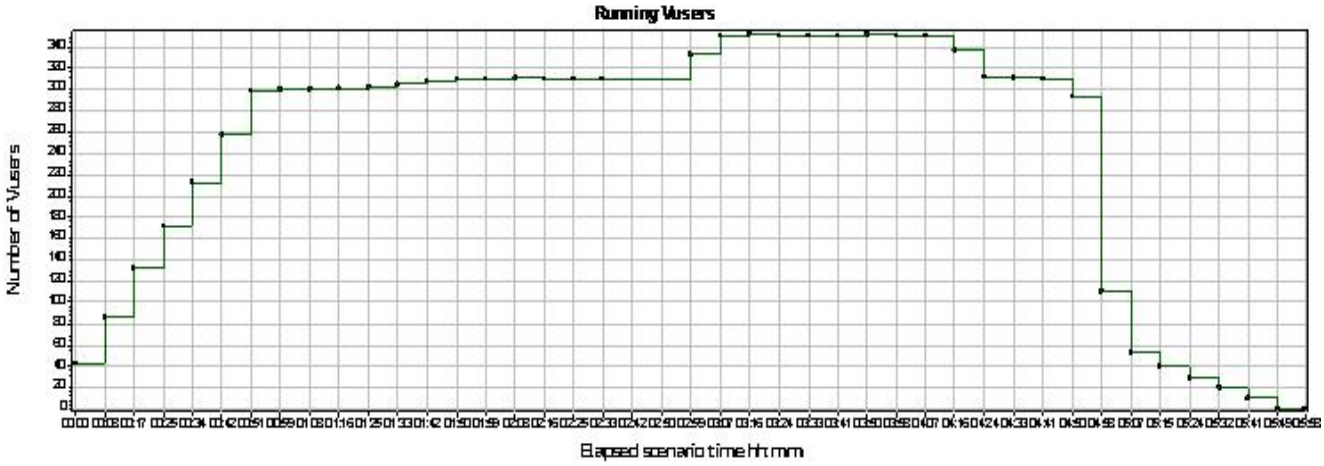
	1	WF3_T22_DeleteForecastActuals_Done	1.454	1.854	4.066	0.212
	1	WF3_T23_DeleteBenefit	0.290	0.381	1.861	0.073
	1	WF3_T24_DeleteBenefit_Delete5Lines	0.044	0.067	1.039	0.054
	1	WF3_T25_DeleteBenefit_Done	1.377	1.708	3.942	0.209
	1	WF3_T26_CreateSnapshot	0.406	0.530	2.064	0.100
	1	WF3_T27_ViewSnapshot	0.310	0.415	3.391	0.112
	1	WF3_T28_ViewSnapshot_Done	1.16	1.474	3.772	0.194
	1	WF4_T01_GoToApprovalPage	0.517	5.015	6.696	1.087
	1	WF4_T02_ApproveTimeSheets_FromPortlet	0.563	1.561	1.839	0.219
	1	WF4_T03_ApproveOne_ClickApproveTime	0.168	0.288	1.742	0.371
	1	WF4_T04_ApproveOne_Click_Search	3.596	4.741	6.004	0.615
	1	WF4_T05_ApproveAll_ClickApproveTime	0.254	0.254	0.254	0.000
	1	WF4_T05_ApproveOne_ClickOnTimeSheetName	0.992	1.043	1.181	0.047
	1	WF4_T06_ApproveOne_ClickApproveFromTimeSheet	0.901	1.071	1.389	0.109
	1	WF4_T07_ApproveOne_ClickDone	3.622	4.565	6.145	0.645
	1	WF4_T08_ApproveAll_ClickApproveTime	0.200	0.239	0.386	0.036
	1	WF4_T09_ApproveAll_Click_Search	3.505	4.668	6.079	0.773
	1	WF4_T10_ApproveAll_ClickApprove_All	6.899	7.526	8.309	0.360
	1	WF5_T01_SearchProjectWithBlankParameters	2.871	3.534	10.154	0.376
	1	WF5_T02_ClickSearchProjects	0.120	0.152	1.386	0.047
	1	WF5_T03_SearchProjectByName	0.131	0.171	1.213	0.045
	1	WF5_T04_OpenProjectOverview	0.973	1.280	6.692	0.231
	1	WF5_T05_ClickEditWorkPlan	0.742	1.006	8.363	0.340
	1	WF5_T06_Click_Next_In_WorkPlanOverview	0.479	0.635	1.906	0.101
	1	WF5_T07_Click_Prev_In_WorkPlanOverview	0.474	0.635	2.980	0.122
	1	WF5_T08_Select_Gantt_View	0.631	0.872	2.905	0.139
	1	WF5_T09_Select_Print_View	0.658	0.882	4.810	0.199
	1	WF5_T10_CollapseSummaryTree	0.590	0.815	2.174	0.132
	1	WF5_T11_ExpandSummaryTree	0.961	1.268	3.361	0.175
	1	WF5_T12_LoadTaskFromWP	0.372	0.544	11.537	0.386
	1	WF5_T13_ClickAddResource	0.153	0.182	1.661	0.077
	1	WF5_T14_ChooseResource	0.113	0.154	0.390	0.030
	1	WF5_T15_AddResource_ClickSave	0.366	2.977	5.673	0.505
	1	WF5_T16_ClickDoneOnEditTaskPage	0.774	0.988	2.401	0.118
	1	WF5_T17_FilterByTaskOverDue	0.462	0.650	1.744	0.105
	1	WF5_T18_PressNextWithFilteOverDue	0.482	0.661	1.888	0.120
	1	WF5_T19_PressPrevWithFilterOverDue	0.456	0.654	1.272	0.084
	1	WF5_T20_ShowAllTasks	0.474	0.639	1.835	0.114
	1	WF5_T21_EditTaskMultipleFields_changePercent	0.046	0.053	0.830	0.045
	1	WF5_T22_EditTaskMultipleFields_changeActualEffort	0.045	0.050	0.311	0.014
	1	WF5_T23_EditTaskMultipleFields_ChangeSchedule	0.111	0.125	0.517	0.031
	1	WF5_T24_EditTaskMultipleFields_SaveTask	0.218	2.913	4.798	0.350

	1	WF5_T25_ChangeOnlySchedule	0.111	0.129	1.767	0.090
	1	WF5_T26_ChangeOnlySchedule_SaveTask	0.155	0.209	0.851	0.050
	1	WF6_T01_SearchStaffingProfileLink	0.116	0.151	10.281	0.178
	1	WF6_T02_SearchButton	0.145	0.189	1.676	0.051
	1	WF6_T03_SelectStaffingProfile	0.119	0.140	1.589	0.054
	1	WF6_T04_AnalyzeStaffingByRole	2.540	5.284	11.924	0.642
	1	WF6_T05_AnalyzeStaffingByResource	3.978	8.729	18.274	0.980
	1	WF6_T06_AddPosition	0.161	0.221	3.108	0.089
	1	WF6_T07_ViewAssignmentLoadPortlet	0.228	0.289	1.161	0.057
	1	WF7_T01_ClickSearchResourcePools	0.164	0.227	4.365	0.199
	1	WF7_T02_SearchAResourcePool	0.158	0.215	0.942	0.055
	1	WF7_T03_ClickAResourcePool	0.183	0.273	4.460	0.257
	1	WF7_T04_ClickViewForeCastedDemand	0.348	0.707	7.197	0.804
	1	WF7_T05_DoneForeCastedDemand	0.181	0.244	0.371	0.032
	1	WF7_T06_ViewTwoRmPortlets	0.409	0.926	3.728	0.271
	1	WF7_T07_ClickViewResourceLoad	0.323	0.482	2.088	0.230
	1	WF7_T08_DoneViewResourceLoad	0.246	0.302	0.505	0.042
	1	WF7_T09_ClickManagementPoolCapacity	0.274	0.525	3.023	0.456
	1	WF7_T10_DoneManagementPoolCapacity	0.244	0.303	0.764	0.069
	1	WF8_T01_SearchResourceAvailabilityLink	0.174	0.399	13.005	1.218
	1	WF8_T02_FromDatePopup	0.048	0.091	0.747	0.106
	1	WF8_T03_SelectFromDate	0.093	0.108	0.930	0.085
	1	WF8_T04_ToDatePopup	0.048	0.061	0.188	0.022
	1	WF8_T05_SelectToDate	0.091	0.100	0.345	0.023
	1	WF8_T06_SpecifySkill	0.055	0.065	0.714	0.060
	1	WF8_T07_SpecifyResourcePool	0.066	0.078	0.226	0.018
	1	WF8_T08_SearchButton	0.264	0.463	3.926	0.396
	1	WF8_T09_SortByName	0.287	0.404	1.357	0.123
	1	WF9_T01_ClickSearchProjects	0.174	0.258	8.210	0.420
	1	WF9_T02_SearchProjectByName	0.144	0.189	0.821	0.059
	1	WF9_T03_OpenProjectOverview	1.110	1.488	14.802	0.650
	1	WF9_T04_ClickEditWorkPlan	0.508	0.682	6.928	0.383
	1	WF9_T05_ViewResourceUsage	0.208	0.264	1.313	0.091
	1	WF9_T06_DoneResourceUsage	0.885	1.111	2.194	0.128

3.3 Total Running Vusers

Display 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 the system at any given moment.

Granularity: 512 Seconds



Color	Scale	Measurement	Graph Minimum	Graph Average	Graph Maximum	Graph Median	Graph Std. Deviation
	1	Run	0.000	240.220	352.000	305.000	123.376

3.4 Total Transaction per Second

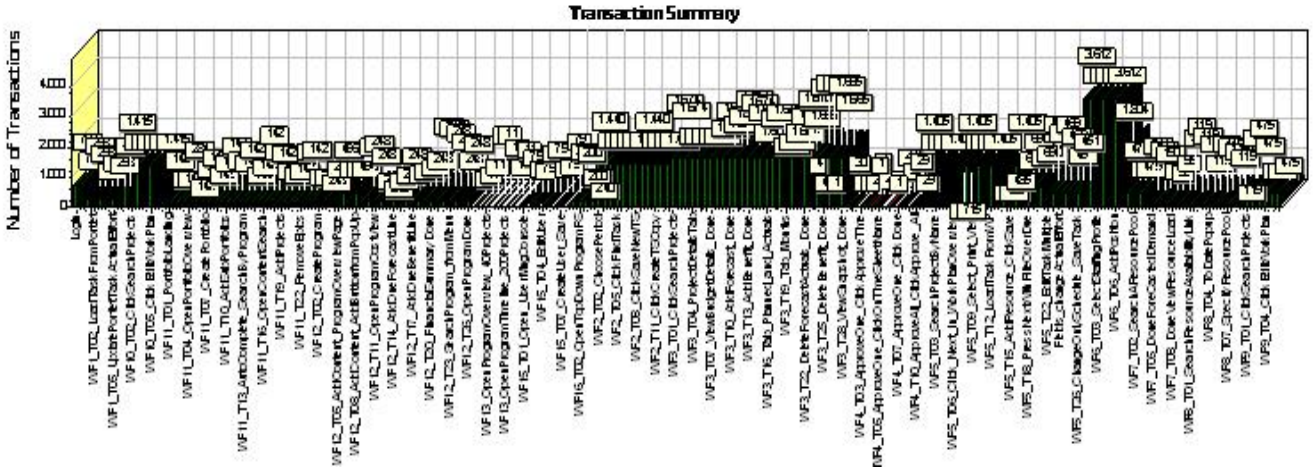
Display the total number of completed transactions (both successful and unsuccessful) performed during each second of a load test. This graph helps determine the actual transaction load on the system at any given moment.

Granularity: 512 Seconds

Color	Scale	Measurement	Graph Minimum	Average	Graph Maximum	Graph Median	Graph Std. Deviation
	1	Fail	0.000	0.001	0.010	0.000	0.002
	1	Pass	0.148	6.688	11.170	7.545	3.480

3.5 Transaction Summary

Display the number of transactions that passed.



Color	Scale	Measurement
	1	Pass
	1	Fail

3.6 Hits per Second

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

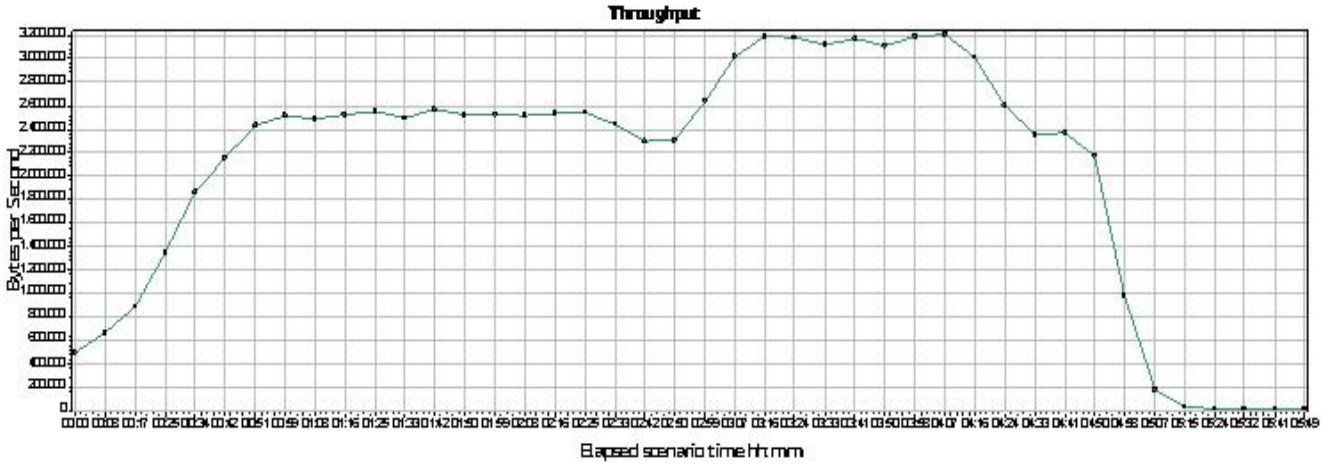
Granularity: 512 Seconds

Color	Scale	Measurement	Graph Minimum	Average	Graph Maximum	Graph Median	Graph Std. Deviation
	1	Hits	0.494	24.363	38.484	27.441	11.111

3.7 Network Throughput

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

Granularity: 512 Seconds

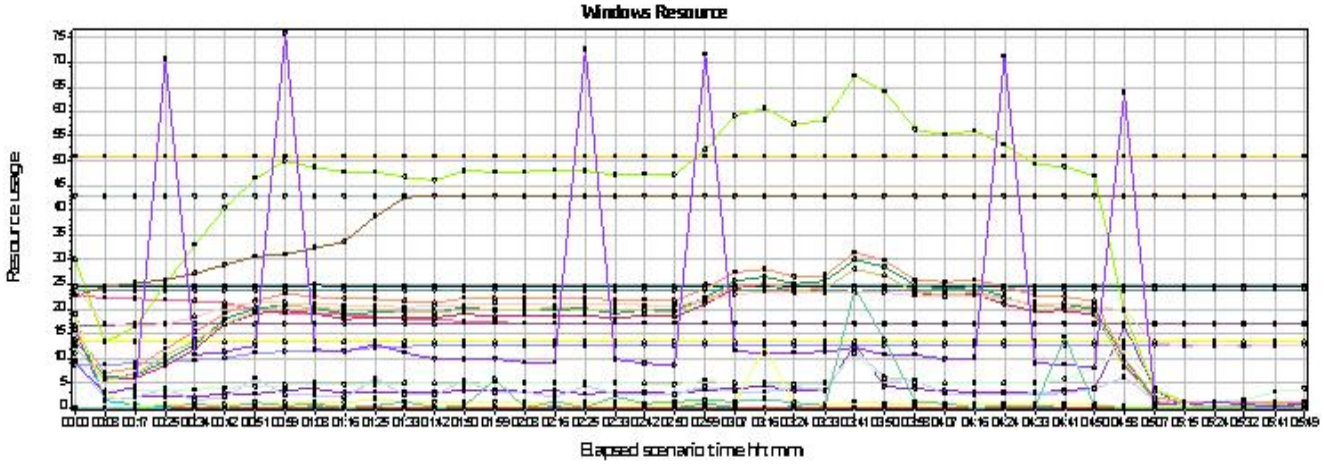


Color	Scale	Measurement	Graph Minimum	Average	Graph Maximum	Graph Median	Graph Std. Deviation
	1	Throughput	16,859.229	2,058,608.308	3,209,382.158	2,499,314.656	1,044,788.035

3.8 PPM Application Servers CPU Usage

Display a summary of the CPU System Resource usage for each Windows based host PPM Application Servers.

Granularity: 512 Seconds



Color	Scale	Measurement	Minimum	Average	Maximum	Std. Deviation
	1	/PPM/Windows Resources on 16.186.75.24/countersInError:16.186.78.98	0.000	0.000	0.000	0.000

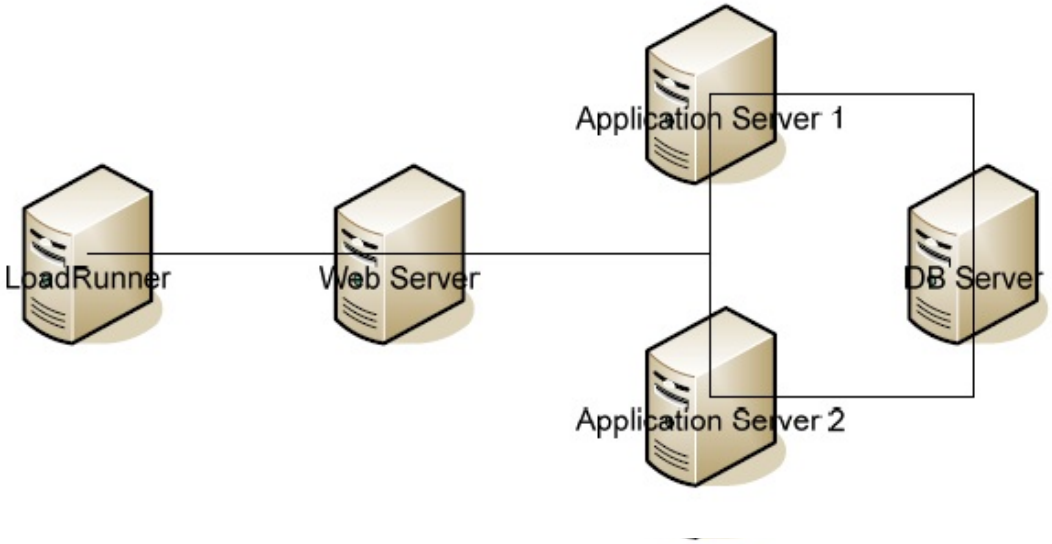
	0.001	/PPM/Windows Resources on 16.186.75.24/Memory\Available MBytes:16.186.78.98	16,880.000	18,001.785	23,799.000	1,765.682
	1E-09	/PPM/Windows Resources on 16.186.75.24/Memory\Committed Bytes:16.186.78.98	16,077,926,400.000	17,064,369,210.314	17,240,678,400.000	130,214,902.610
	10	/PPM/Windows Resources on 16.186.75.24/Memory\Pages/sec:16.186.78.98	0.000	0.377	27.386	0.950
	10	/PPM/Windows Resources on 16.186.75.24/PhysicalDisk_Total\% Disk Time:16.186.78.98	0.011	0.343	17.785	0.780
	1000	/PPM/Windows Resources on 16.186.75.24/PhysicalDisk_Total\Avg. Disk Queue Length:16.186.78.98	0.000	0.003	0.175	0.008
	100	/PPM/Windows Resources on 16.186.75.24/PhysicalDisk_Total\Disk Reads/sec:16.186.78.98	0.000	0.006	1.100	0.055
	1	/PPM/Windows Resources on 16.186.75.24/PhysicalDisk_Total\Disk Writes/sec:16.186.78.98	0.350	4.976	166.293	5.878
	0.01	/PPM/Windows Resources on 16.186.75.24/Process_Total\% Processor Time:16.186.78.98	2,259.231	2,381.173	2,423.685	9.768
	0.1	/PPM/Windows Resources on 16.186.75.24/Process_Total\% User Time:16.186.78.98	8.345	402.831	1,181.968	215.497
	1	/PPM/Windows Resources on 16.186.75.24/Process_Total\ID Process:16.186.78.98	0.000	0.000	0.000	0.000
	1E-09	/PPM/Windows Resources on 16.186.75.24/Process_Total\Private Bytes:16.186.78.98	13,205,135,358.000	13,212,547,192.932	13,237,370,878.000	5,323,071.165
	1E-09	/PPM/Windows Resources on 16.186.75.24/Process_Total\Virtual Bytes:16.186.78.98	24,511,766,524.000	24,626,929,618.730	24,921,427,964.000	133,254,541.352
	1E-09	/PPM/Windows Resources on 16.186.75.24/Process_Total\Working Set:16.186.78.98	7,382,433,792.000	11,970,793,963.375	12,591,595,518.000	1,184,422,668.907
	0.1	/PPM/Windows Resources on 16.186.75.24/Process\java#1\% Processor Time:16.186.78.98	0.390	171.337	535.427	98.587
	0.1	/PPM/Windows Resources on 16.186.75.24/Process\java#1\% User Time:16.186.78.98	0.234	160.726	497.038	93.931
	0.01	/PPM/Windows Resources on 16.186.75.24/Process\java#1\ID Process:16.186.78.98	5,112.000	5,112.000	5,112.000	0.000
	1E-08	/PPM/Windows Resources on 16.186.75.24/Process\java#1\Private Bytes:16.186.78.98	4,294,967,295.000	4,294,967,295.000	4,294,967,295.000	45.255
	1E-08	/PPM/Windows Resources on 16.186.75.24/Process\java#1\Virtual Bytes:16.186.78.98	4,294,967,295.000	4,294,967,295.000	4,294,967,295.000	45.255
	1E-08	/PPM/Windows Resources on 16.186.75.24/Process\java#1\Working Set:16.186.78.98	1,875,333,120.000	3,932,007,906.038	4,294,967,295.000	650,160,800.502
	1	/PPM/Windows Resources on 16.186.75.24/Processor_Total\% Processor Time:16.186.78.98	0.802	18.833	56.130	9.669
	1	/PPM/Windows Resources on 16.186.75.24/Processor_Total\% User Time:16.186.78.98	0.361	16.784	49.645	8.982
	0.001	/PPM/Windows Resources on 16.186.75.24/System\Context Switches/sec:16.186.78.98	11,196.767	19,984.639	31,272.550	3,546.381

	1	/PPM/Windows Resources on 16.186.75.24/System\Exception Dispatches/sec:16.186.78.98	0.000	17.347	1,528.013	115.250
	0.01	/PPM/Windows Resources on 16.186.75.24/System\File Data Operations/sec:16.186.78.98	2.849	153.611	19,361.147	794.672
	10	/PPM/Windows Resources on 16.186.75.24/System\Processor Queue Length:16.186.78.98	0.000	0.185	56.000	2.274

APPENDIX A – Benchmark Environment

Benchmark Test Environment

The environment created for the benchmarking effort is illustrated in the figure below.



- **Web Server.** Microsoft IIS server which balances the load between across the PPM nodes handling user requests on the application server hosts. The Web server communicates with the PPM application container using the AJP13 protocol. The web server host has the following characteristics:
  - Linux version 2.6.18-231.el5
  - 1 Intel(R) Xeon(R) CPU L5640 @ 2.27GHz
  - 800 MB of RAM
  - Red Hat Enterprise Linux Server release 5.6 Beta (Tikanga)
- **Application Servers.** The environment consists of 2 clustered Application Server machines with PPM nodes, designated "Application Server 1" and “Application Server 2”. Each server had a PPMC node for handling incoming user requests. One of the servers had an additional node for handling background services. The application servers have the following characteristics:
  - 8 Core 2.27 GHZ Intel Xeon(R) L5640
  - 16 GB of RAM
  - Microsoft Windows 2008 R2 Enterprise Service Pack 1
- **Database Server**. The database runs on a dedicated host machine and communicates with both PPMC application servers using the JDBC protocol. The database server has the following characteristics:
  - 40 Intel(R) Xeon(R) CPU E7-4820 v3 @ 1.90GHz
  - 256 GB of RAM
  - Linux version 3.10.0-327.10.1.el7.x86_64
  - Oracle version 12.1.0.2.0
  - Gigabit Ethernet adapter
- **Client Browser** settings were consistent with the default settings of Microsoft Internet Explorer 11.0, the simulation assumed that the browser:
  - Has caching turned on
  - Supports GZIP encoding, where the application server compresses HTTP replies and thereby reduces network bandwidth utilization.

Hardware Configuration Table

Purpose	CPU	Memory	Software	OS
Web Server / Load Balancer	1 x 2.27 Ghz	8GB	Apache 2.2	Linux Redhat 7.2
App Server #1	8 x 2.27 Ghz	16GB	PPM 9.50	Windows 2008 R2 SE
App Server #2	8 x 2.27 Ghz	16GB	PPM 9.50	Windows 2008 R2 SE
DB Server	40 x 1.90 Ghz	256GB	Oracle 12.1.0.2.0	RH Linux version 7.2 (Maipo)

Cluster Setup Information

PPM cluster can be set up in various configurations (leveraging JBoss clustering technology). For example, you can have multiple nodes (server instance) in same host (server machine) and cluster them together. Or, you can have one (or more) node(s) on one host and other node(s) on a different host and cluster them together as well.

If you have multiple nodes that are clustered together on same host, there can be port collisions if each node doesn't have distinct port definitions. Failure to configure distinct ports can result in application startup failures.

Each PPM node will have an xml file called "ppm-bindings.xml" which contains unique, node-specific port set. You can define distinct ports per node in the "server.conf" file. After updating this file, run "kUpdateHtml.sh" script which generates an appropriate "ppm-bindings.xml" file for each node in the cluster. After this update the cluster can be started using the kStart.sh script. If error messages occur during startup, verify that each of the nodes does in fact have distinct ports.

Port set definitions (currently at five)

When running in a cluster, ten ports need to be distinctly set for each node in the cluster. The below table identifies a set of sample port definitions if running with 4 nodes.

Port Name (to be used in server.conf)	Node A	Node B	Node C	Node D	Node E
APP_SERVER_NAMING_SERVICE_RMI_PORT	1198	1298	1398	1498	1598
APP_SERVER_NAMING_SERVICE_BINDING_PORT	1199	1299	1399	1499	1599
APP_SERVER_WEBSERVICE_PORT	8083	8183	8283	8383	8483
APP_SERVER_JRMP_INVOKER_RMI_PORT	4444	4544	4644	4744	4844
APP_SERVER_POOLED_INVOKER_BINDING_PORT	4445	4545	4645	4745	4845
APP_SERVER_HAJNDI_RMI_PORT	1101	1201	1301	1401	1501
APP_SERVER_HAJNDI_BINDING_PORT	1100	1200	1300	1400	1500
APP_SERVER_POOLEDHA_BINDING_PORT	4446	4546	4646	4746	4846
APP_SERVER_JMX_RMI_PORT	19001	19101	19201	19301	19401

APP_SERVER_UIL2_BINDING_PORT	8093	8193	8293	8393	8493

Let's look at how a sample server.conf will look like on a cluster with two nodes running on a single physical host (application server). Assume that under the <PPM_INSTALL_HOME>/server/ we have two nodes - 'kintana' and 'kintana_er' (name of each node directory). 'kintana' node is the default, installed node so it will have Node A port configuration. For 'kintana_er' node, we'll take Node E port configuration, referring to the port values listed in the above table.

com.kintana.core.server.KINTANA_SERVER_NAME=kintana

com.kintana.core.server.MULTICAST_CLUSTER_NAME=abc com.kintana.core.server.MULTICAST_IP=225.39.39.242
com.kintana.core.server.MULTICAST_PORT=9020 com.kintana.core.server.APP_SERVER_MULTICAST_PORT=9130

# PPM JBoss Cluster-specific ports com.kintana.core.server.APP_SERVER_NAMING_SERVICE_RMI_PORT=1198
com.kintana.core.server.APP_SERVER_NAMING_SERVICE_BINDING_PORT=1199
com.kintana.core.server.APP_SERVER_WEBSERVICE_PORT=8083
com.kintana.core.server.APP_SERVER_JRMP_INVOKER_RMI_PORT=4444
com.kintana.core.server.APP_SERVER_POOLED_INVOKER_BINDING_PORT=4445
com.kintana.core.server.APP_SERVER_HAJNDI_RMI_PORT=1101
com.kintana.core.server.APP_SERVER_HAJNDI_BINDING_PORT=1100
com.kintana.core.server.APP_SERVER_POOLEDHA_BINDING_PORT=4446
com.kintana.core.server.APP_SERVER_JMX_RMI_PORT=19001
com.kintana.core.server.APP_SERVER_UIL2_BINDING_PORT=8093

@node com.kintana.core.server.KINTANA_SERVER_NAME=kintana_er

com.kintana.core.server.RMI_URL=rmi://<SERVERNAME>:43001/KintanaServer
com.kintana.core.server.HTTP_PORT=43000

# PPM JBoss Cluster-specific ports com.kintana.core.server.APP_SERVER_NAMING_SERVICE_RMI_PORT=1598
com.kintana.core.server.APP_SERVER_NAMING_SERVICE_BINDING_PORT=1599
com.kintana.core.server.APP_SERVER_WEBSERVICE_PORT=8483
com.kintana.core.server.APP_SERVER_JRMP_INVOKER_RMI_PORT=4844
com.kintana.core.server.APP_SERVER_POOLED_INVOKER_BINDING_PORT=4845
com.kintana.core.server.APP_SERVER_HAJNDI_RMI_PORT=1501
com.kintana.core.server.APP_SERVER_HAJNDI_BINDING_PORT=1500
com.kintana.core.server.APP_SERVER_POOLEDHA_BINDING_PORT=4846
com.kintana.core.server.APP_SERVER_JMX_RMI_PORT=19401
com.kintana.core.server.APP_SERVER_UIL2_BINDING_PORT=8493

Parameters outlined above are node-specific. In addition to these, there is a cluster-specific parameters that have to be defined in server.conf. Define these parameters in the common area of server.conf. The parameters are:

1. MULTICAST_IP - used for PPM-proprietary clustering
2. MULTICAST_PORT - used for PPM-proprietary clustering
3. APP_SERVER_MULTICAST_PORT - used for JBoss clustering (must be different from MULTICAST_PORT)
4. MULTICAST_CLUSTER_NAME - used for PPM-proprietary and JBoss clustering

After adding these lines to server.conf, run kClusterDeploy.sh (setup is mentioned in next section) then run 'kUpdateHtml.sh' and start up each node. Each node should start up with no port conflicts.

NOTE: You can define all the nodes (clustering ports + node specific configuration) in one server.conf - even if the nodes are distributed across multiple physical hosts. This configuration which involves a single server.conf file distributed across all hosts in participating in the cluster simplifies administrative complexity. Additionally, this allows scripts such as kStatus.sh to gather information from all the nodes in the cluster, not just the nodes that are residing in the machine where you're invoking the script, when executed. By maintaining a single server.conf file which is propagated across the hosts in the cluster the management of port definitions for each node in the cluster is simplified as well.

Cluster Deployment

The benchmark performance data presented here was generated against a clustered PPMC instance. The assumption is that a customer running this benchmark will deploy a new PPMC instance and configure the environment as stated in the readme HTML file included with the kit. To provide equivalent performance the PPMC instance created for executing the benchmark should be a clustered instance with the configuration outlined in this document. The following table outlines the nodes included in the cluster, their roles (user-traffic or background services), and the port specifications for each.

APPENDIX B – Benchmark DB

The following table provides high-level information regarding the contents of the DB used for PPM 9.4 Benchmark runs.

Entity	Quantity & Structure
Contacts	* Total of **100,000** * Not attached to any other entity
Role	* Total of **50**
Skill	* Total of **50**

Resource	* Total of **85,000**
	  * **80,000** will be Resources assigned to Resource Pools
	  * **5,000** will be Managers
	* Each res/manager will have **1** role
	* Each res/manager will have **5** skills
	* Each resource will have a region (random of **10**)
	* Each of 30 resources will be assigned 1 manager

Resource Pool (RP)	* Total of **2000:**
	  * Grouped in 20 trees of **10** RP each.
	  * The tree has **4** nesting levels (ternary tree)
	* Each Resource Pool contains **30** resources.
	* Total of **60000** resources assigned to Resource Pools (2000*30)

Org Unit (OU)	* Total of **200**:
	  * Grouped in **1** ternary tree.
	  * The tree has **5** nesting levels
	* Each OU contains **100** resources.

Staffing Profile (Created per project)	* Total of **1500** (1 created per project)
	  * Each has a duration of **6** months (date of creation to next 6 months)
	  * Each assigned to 500 line projects contains **10** positions
	  * Each position has 2 resources
	  * Each SP has positions assigned a single RP
	  * 1 FTE per resource
	  * Each assigned to 1500 line projects contains **20** positions
	  * Each position has 3 resources
	  * Each SP has positions assigned from 2 RPs
	  * 1 FTE per resource

Budget (created per project)	* Total of **1500** (1 created per project) * Each has a duration of 6 months (date of creation to next 6 months) * **1000** budgets with cap flag turned on (1 to 100) (Each with Total 200 lines) * Each contain **100** lines of Cap Exp type * **50** labor * 20 Contract * 30 Employee * **50** non-labor * 10 Hardware * 20 Software * 20 Training * Each contain 100 lines of Operating Exp type * **50** labor * 20 Contract * 30 Employee * **50** non-labor * 10 Hardware * 20 Software * 20 Training * **500** budgets with cap flag turned off (101 to 150) (Each with Total 100 lines) * **50** labor * 20 Contract * 30 Employee * **50** non-labor * 10 Hardware * 20 Software * 20 Training

Active Project with TM "Off" (Type 2)	* Total of **1000**: * Each project has **1** manager * Each Project Has a Budget * Each project has a Staffing Profile * 50% project have **500** tasks in work plan: * Each project has 20 resources * Each has **70** summary tasks * Each summary task has **6** leaf tasks * Within each branch, each leaf task is a predecessor of the next leaf task * Each leaf task is 2 weeks long * All leaf tasks in each branch are sequentially allocated one of 20 users. * The rest **20** tasks are under the root task and has no resource assigned. * A Task has a status of 'In Planning' * Workplan contain 2 baselines. * 50% of projects have 1500 tasks in work plan: * Each project has 60 resources * Each has 210 summary tasks * Each summary task has 6 leaf tasks * Within each branch, each leaf task is a predecessor of the next leaf task * Each leaf task is 4 weeks long * All leaf tasks in each branch are sequentially allocated one of 60 users. * The rest 60 tasks are under the root task and has no resource assigned. * Tasks have status of 'In Planning' * Workplan contain 2 baselines.
Active Project with TM "On" (Type 2)	* Total of **500**: * Each project has 20 resources * Each has 70 summary tasks * Each summary task has 6 leaf tasks * Within each branch, each leaf task is a predecessor of the next leaf task * Each leaf task is 2 weeks long * All leaf tasks in each branch are sequentially allocated one of 20 users. * The rest 20 tasks are under the root task and has no resource assigned. * Tasks have status of 'In Planning' * Workplan contain 2 baselines.
Program	* Total of 5**0**: * Each program has 10 projects
Cost Rate Rules	* Total of 500: * Divided uniformly for Project, Resource, Region and Role