Automate Performance Testing At Every Step (Presented at StarCanada, August 2017)

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  - **Wellpoint**
  - **United Healthcare**
  - **Drone captain (present day)**

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The Big Concepts

- **Adapting traditional performance testing to DevOps**
- **The secret sauce - Automating the performance test: Performance report on demand; Fast bottleneck detection**
- **Shift Left –**
  Provide pushbutton performance report to developer
- **Shift Right –**
  Provide on demand performance report in Production
- **Performance assurance comes from automated performance feedback at every step of the application pipeline.**

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Presentation Outline

- **The Business Challenge**
- **Automating the performance report**
- **A real world example / experience**
- **Takeaways – To do it for yourself**

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The Business Challenge

- Why do we performance test
  - Assure good performance in production

- The business challenge
  - *50 API's within a year of a new claims processing system*
  - *Waterfall → Agile*
  - *Continuous integration process*
- How do we get from here to there..

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Automating The Performance Test Report

- Before we automate the performance test process and its report, What is performance test process?
- The waterfall (pre-release) performance test process
    1. *Model production behavior*
    2. *Generate synthetic load*
    3. *Generate a report on universal performance metrics for each biz transaction(trx)*
        - Trx Rate
        - Response times
        - Error rates

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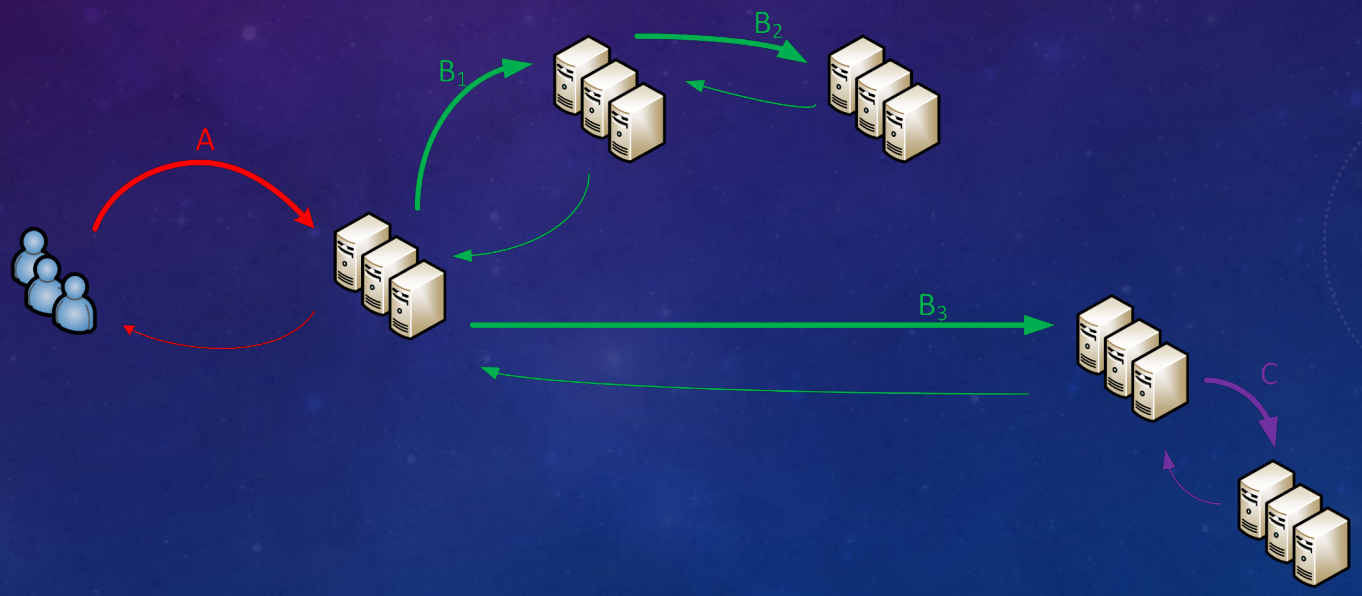
The Waterfall Performance Test Process [Continued…]

4. *Biz trx SLA violations are surfaced*
5. *Within the offending biz trx, DEV triage team hunts down the offending service.*
   - Very painful, 80% of effort



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The Waterfall Performance Test Process [Cont…]

80% of effort is figuring out which service is bottlenecking.

- So important, worth repeating…

6. *Developer of the offending service is commissioned to make the performance fix.*
7. *Test and Tune cycle repeats.*

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The Waterfall Performance Test Process - Review

1. *Model production behavior*
2. *Generate synthetic load*
3. *Generate a report on universal performance metrics for each biz trx*
4. *Biz trx SLA violations are surfaced*
5. *Within the offending biz trx, DEV triage team hunts down the offending service. - 80% of effort*
6. *Developer of the offending service is commissioned to make the performance fix.*
7. *Test and Tune cycle repeats.*

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Automating The Performance Test Report

- *If this process were automated, what would it look like?*
  - *A report that answers two critical questions*
    - Does my application perform within SLA?
    - If not, what part of my application needs to be fixed? (is bottlenecking)

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Automating The Performance Test Report

- ***The report to answer these two questions would include a***
  - **Client side report**
    - **Biz transaction performance metrics along with SLA's**
      - *Immediately tell me if my application is meeting biz expectations*
  - **Server side report**
    - **Server side performance metrics of each service used to respond to a biz transaction**
      - *Would tell me what part of the application needs to be fixed*

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How would I create an automated performance test report?

- ***Client Side Report***
  - **Performance engineer creates a pushbutton test that fires synthetic load at the system-under-test and captures the performance metrics.**
  - **Performance metrics are presented for each transaction along with SLA compliance.**
  - **SLA compliance violations are automatically shown.**
  - **This is the typical load test report.**
  - **[Show slide of biz trx performance report]**

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Client Side Report

ASSERTIONS

Assertion	Status
Global: percentage of successful requests is 100	KO
Global: 50th percentile of response time is less than 4000	KO
Global: 75th percentile of response time is less than 4000	KO
Global: 95th percentile of response time is less than 4000	KO
Global: 99th percentile of response time is less than 10000	OK

SLA compliance

STATISTICS

Expand all groups | Collapse all groups

Requests	Executions					Response Time (ms)							
	Total	OK	KO	% KO	Req/s	Min	50th pct	75th pct	95th pct	99th pct	Max	Mean	Std Dev
Global Information	15000	13865	1135	8%	2.236	724	4489	4804	5430	6376	60006	4391	1249
MGINSTALL_ADD	15000	13865	1135	8%	2.236	724	4489	4805	5430	6376	60006	4391	1249

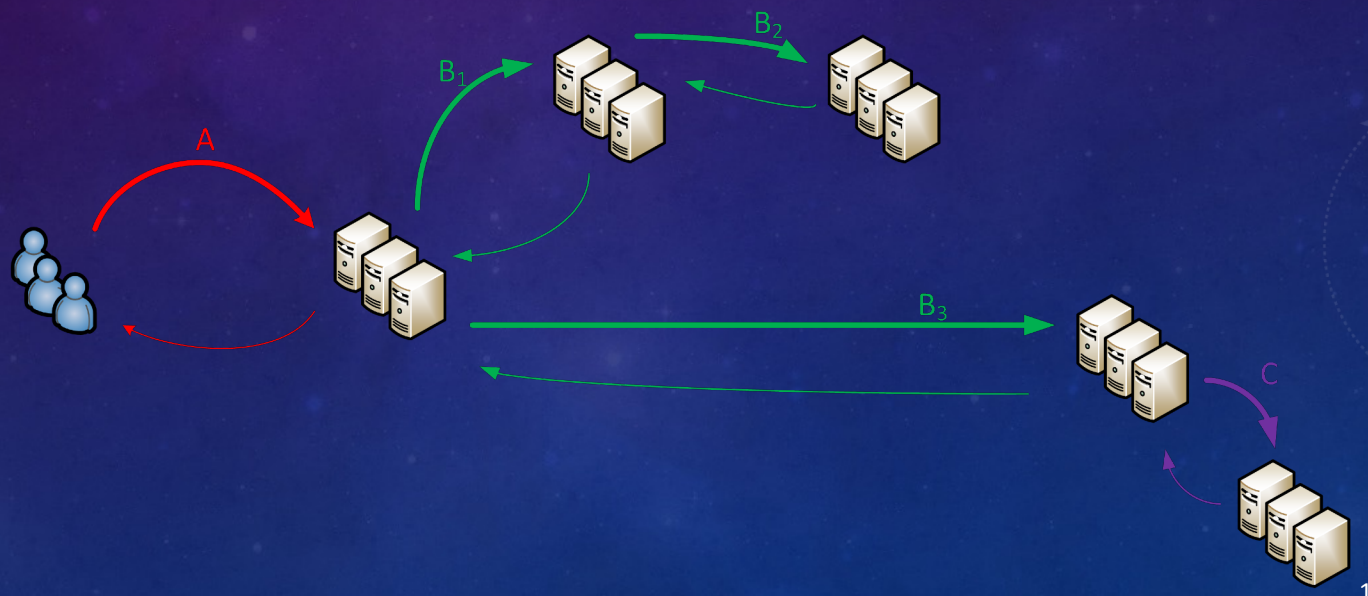
Biz transaction performance

ERRORS

Error	Count	Percentage
status.find.is(201), but actually found 207	1131	99.648 %
j.u.c.TimeoutException: Request timeout to not-connected after 60000ms	3	0.264 %
j.n.ConnectException: connection timed out: cisImembergroupinstallv1-cirrusperf.ose-elr-dmz.optum.com/10.119[redacted]:443	1	0.088 %

How would I create an automated performance test report?

- *Client Side Report*
- ***Server Side Report***
  - **Shows performance metrics of each service supporting each biz transaction**



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Server Side Report

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Server Side Report – Front Door

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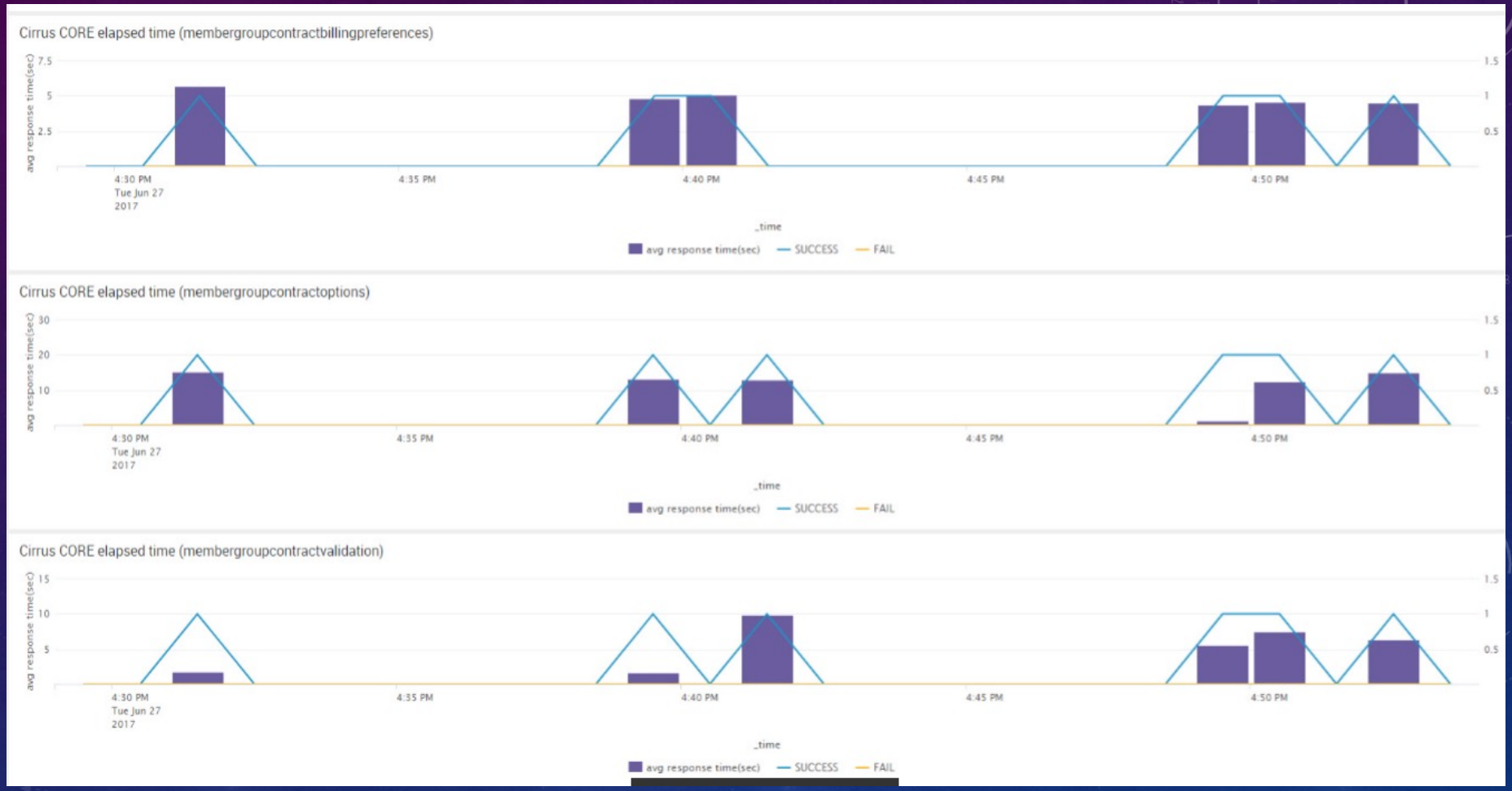
Server Side Report - Detail



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Server Side Report - Automation

- ***Server Side Report***
  - **The "automation" of this step is the instrumentation of all services to report their performance metrics. Two approaches:**
    - **1) Log mining**
    - **2) Vendor solution**
  - **1) Log Mining – Roll your own solutions**
    - *Splunk / Kibana*
    - *Implement performance logging*
      - *[Show spec]*

Performance Log Abstraction	Field names
dateTimeStamp	eventStartTime
	logTime
activity	activity
	src
	destination
origination point	host
	node
	component
	environment
	splunk_host
	splunk_source
Corrolation ID's	transID
	external_tracking_id
	eventID
ErrorInfo	operationStatus
	operationDetail
duration	eventElapsedTime
	e2eElapsedTime
Log Level	level

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Server Side Report

- ***Server Side Report***
  - **The "automation" of this step is the instrumentation of all services to report their performance metrics.**
    - **1) Log Mining – Roll your own solutions**
      - *Splunk / Kibana*
    - **2) Vendor solutions (Data Center Fairy dust) – Shim the VM for automated instrumentation**
      - *DynaTrace*
        - [Show DT slide]
      - *New Relic*

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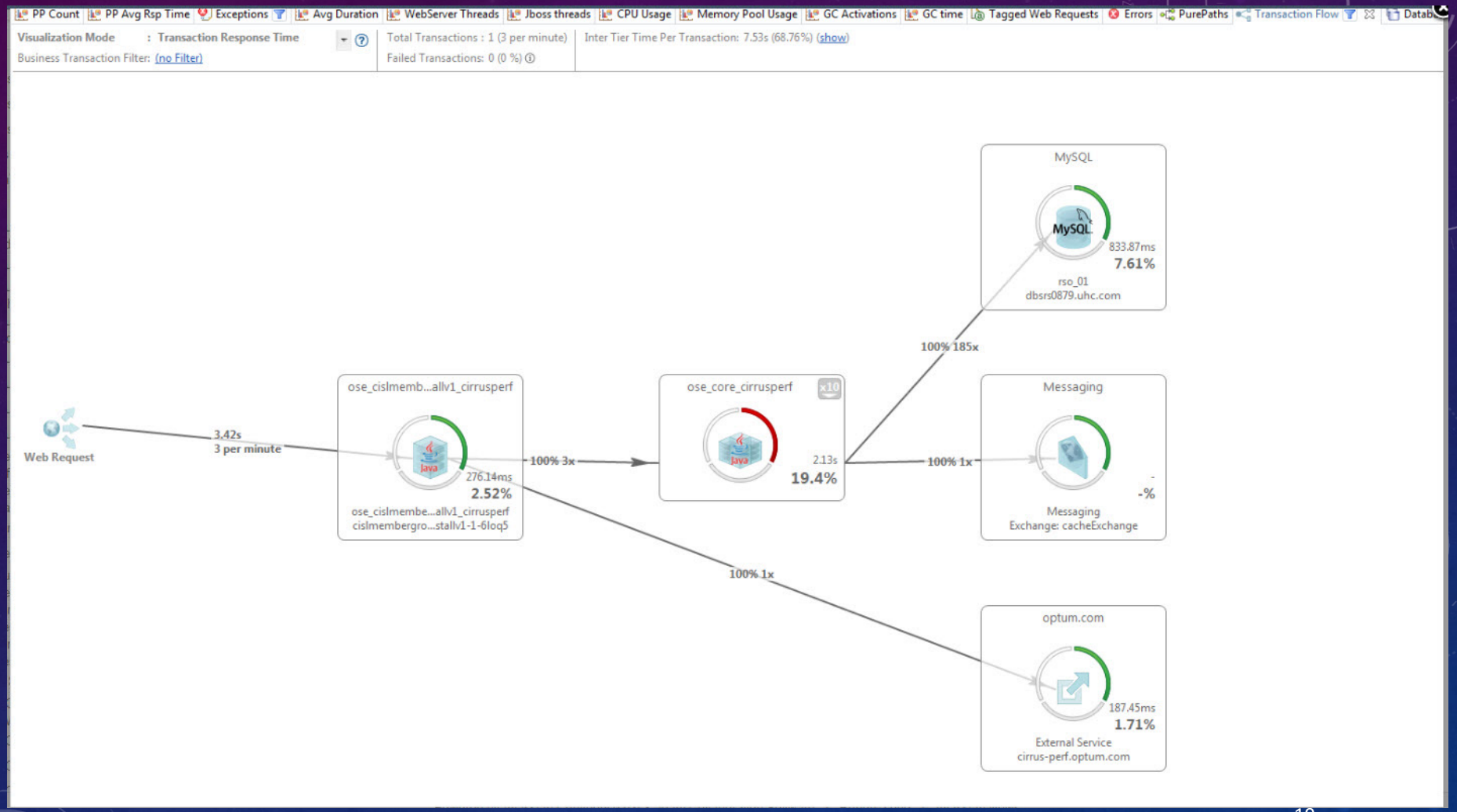
Server Side Report – Vendor Solution / Dynatrace



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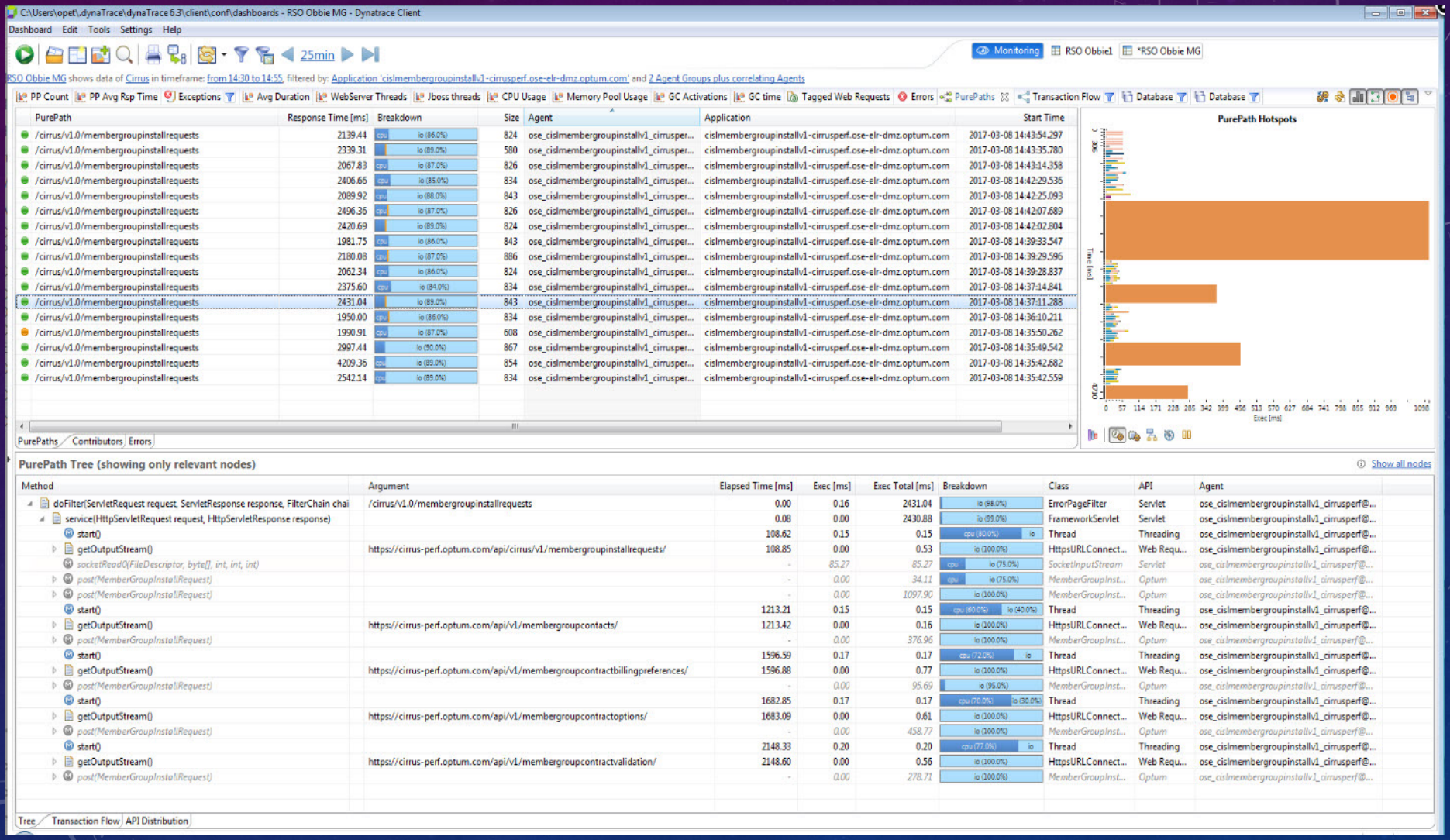
Server Side Report – Vendor Solution / Dynatrace



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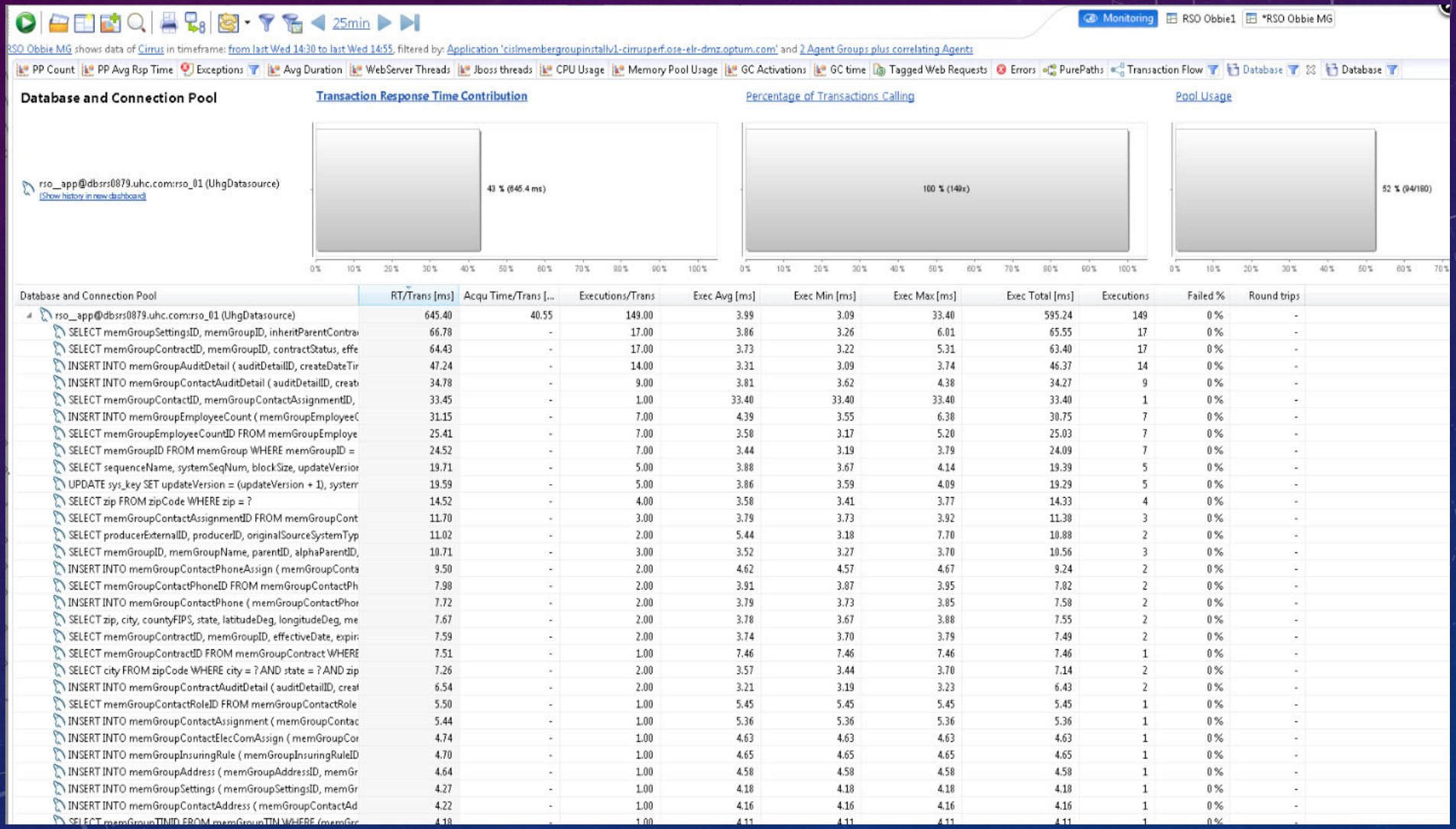
Server Side Report – Vendor Solution / Dynatrace



Database and Connection Pool	RT/Trans [ms]	Acqu Time/Trans [...	Executions/Trans	Exec Avg [ms]	Exec Min [ms]	Exec Max [ms]	Exec Total [ms]	Executions	Failed %	Round trips
rso__app@dbsrs0879.uhc.com:rso_01 (UhgDatasource)	645.40	40.55	149.00	3.99	3.09	33.40	595.24	149	0 %	-
SELECT memGroupSettingsID, memGroupID, inheritParentContra	66.78	-	17.00	3.86	3.26	6.01	65.55	17	0 %	-
SELECT memGroupContractID, memGroupID, contractStatus, effe	64.43	-	17.00	3.73	3.22	5.31	63.40	17	0 %	-
INSERT INTO memGroupAuditDetail (auditDetailID, createDateTir	47.24	-	14.00	3.31	3.09	3.74	46.37	14	0 %	-
INSERT INTO memGroupContactAuditDetail (auditDetailID, creat	34.78	-	9.00	3.81	3.62	4.38	34.27	9	0 %	-
SELECT memGroupContactID, memGroupContactAssignmentID,	33.45	-	1.00	33.40	33.40	33.40	33.40	1	0 %	-
INSERT INTO memGroupEmployeeCount (memGroupEmployeeC	31.15	-	7.00	4.39	3.55	6.38	30.75	7	0 %	-
SELECT memGroupEmployeeCountID FROM memGroupEmploye	25.41	-	7.00	3.58	3.17	5.20	25.03	7	0 %	-
SELECT memGroupID FROM memGroup WHERE memGroupID =	24.52	-	7.00	3.44	3.19	3.79	24.09	7	0 %	-
SELECT sequenceName, systemSeqNum, blockSize, updateVersior	19.71	-	5.00	3.88	3.67	4.14	19.39	5	0 %	-
UPDATE sys_key SET updateVersion = (updateVersion + 1), systerr	19.59	-	5.00	3.86	3.59	4.09	19.29	5	0 %	-
SELECT zip FROM zipCode WHERE zip = ?	14.52	-	4.00	3.58	3.41	3.77	14.33	4	0 %	-
SELECT memGroupContactAssignmentID FROM memGroupCont	11.70	-	3.00	3.79	3.73	3.92	11.38	3	0 %	-
SELECT producerExternalID, producerID, originalSourceSystemTyp	11.02	-	2.00	5.44	3.18	7.70	10.88	2	0 %	-
SELECT memGroupID, memGroupName, parentID, alphaParentID,	10.71	-	3.00	3.52	3.27	3.70	10.56	3	0 %	-
INSERT INTO memGroupContactPhoneAssign (memGroupConta	9.50	-	2.00	4.62	4.57	4.67	9.24	2	0 %	-
SELECT memGroupContactPhoneID FROM memGroupContactPh	7.98	-	2.00	3.91	3.87	3.95	7.82	2	0 %	-
INSERT INTO memGroupContactPhone (memGroupContactPhor	7.72	-	2.00	3.79	3.73	3.85	7.58	2	0 %	-
SELECT zip, city, countyFIPS, state, latitudeDeg, longitudeDeg, me	7.67	-	2.00	3.78	3.67	3.88	7.55	2	0 %	-
SELECT memGroupContractID, memGroupID, effectiveDate, expir	7.59	-	2.00	3.74	3.70	3.79	7.49	2	0 %	-
SELECT memGroupContractID FROM memGroupContract WHERE	7.51	-	1.00	7.46	7.46	7.46	7.46	1	0 %	-
SELECT city FROM zipCode WHERE city = ? AND state = ? AND zip	7.26	-	2.00	3.57	3.44	3.70	7.14	2	0 %	-
INSERT INTO memGroupContractAuditDetail (auditDetailID, creat	6.54	-	2.00	3.21	3.19	3.23	6.43	2	0 %	-
SELECT memGroupContactRoleID FROM memGroupContactRole	5.50	-	1.00	5.45	5.45	5.45	5.45	1	0 %	-
INSERT INTO memGroupContactAssignment (memGroupContac	5.44	-	1.00	5.36	5.36	5.36	5.36	1	0 %	-
INSERT INTO memGroupContactElecComAssign (memGroupCor	4.74	-	1.00	4.63	4.63	4.63	4.63	1	0 %	-
INSERT INTO memGroupInsuringRule (memGroupInsuringRuleID	4.70	-	1.00	4.65	4.65	4.65	4.65	1	0 %	-
INSERT INTO memGroupAddress (memGroupAddressID, memGr	4.64	-	1.00	4.58	4.58	4.58	4.58	1	0 %	-
INSERT INTO memGroupSettings (memGroupSettingsID, memGr	4.27	-	1.00	4.18	4.18	4.18	4.18	1	0 %	-
INSERT INTO memGroupContactAddress (memGroupContactAd	4.22	-	1.00	4.16	4.16	4.16	4.16	1	0 %	-
SELECT memGroupTINID FROM memGroupTIN WHERE (memGro	4.18	-	1.00	4.11	4.11	4.11	4.11	1	0 %	-

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Automating The Performance Test Report

- ***Summarizing the automated performance test***
  - ***A push button test which provides an integrated client and server report***
  - ***Weaving it all together… an example of an automated framework that produces a pushbutton performance test that initiates the test, produces the client and server reports AND provides summary and trend info.***

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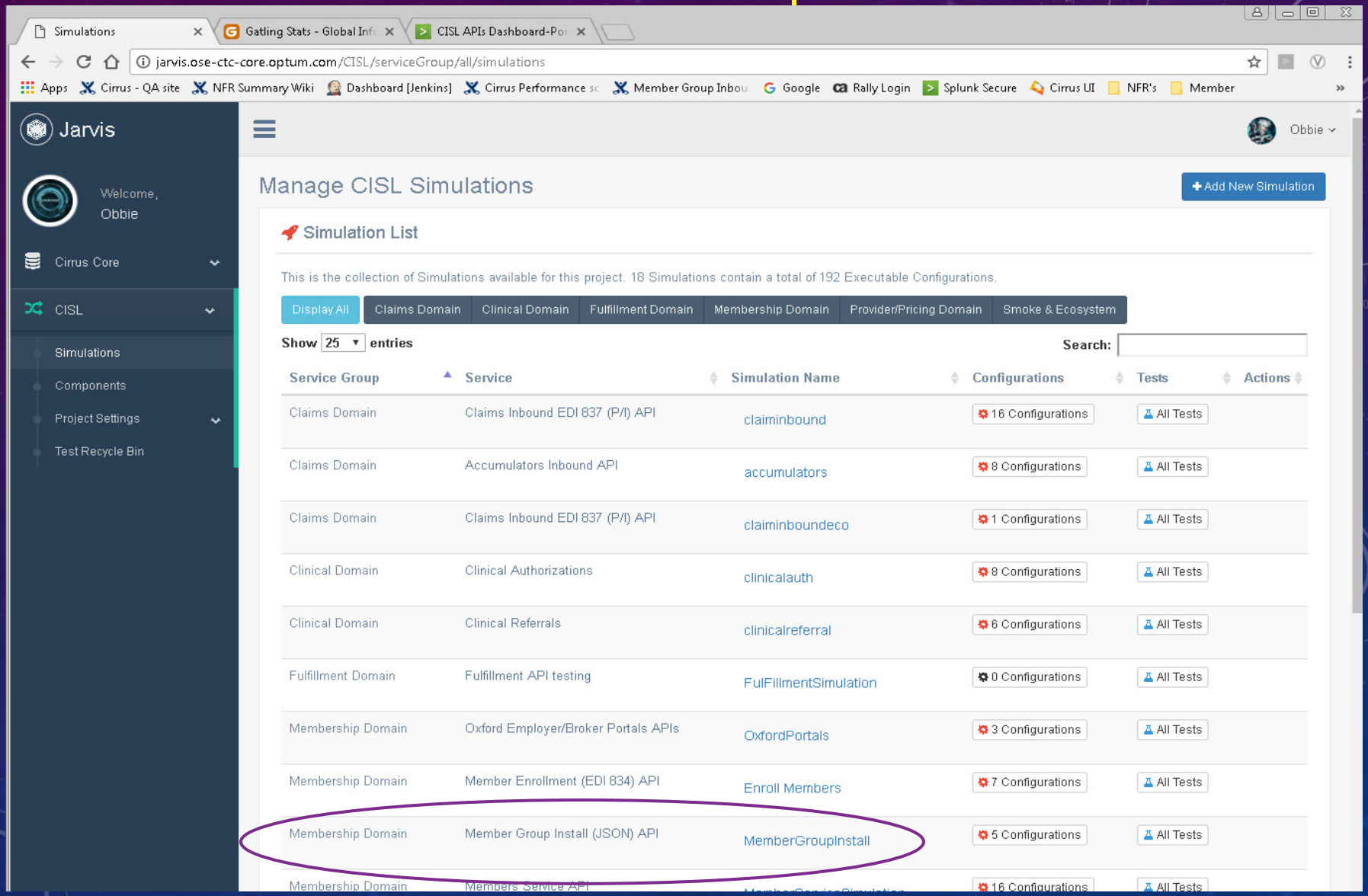
Automated test framework sample – All API's



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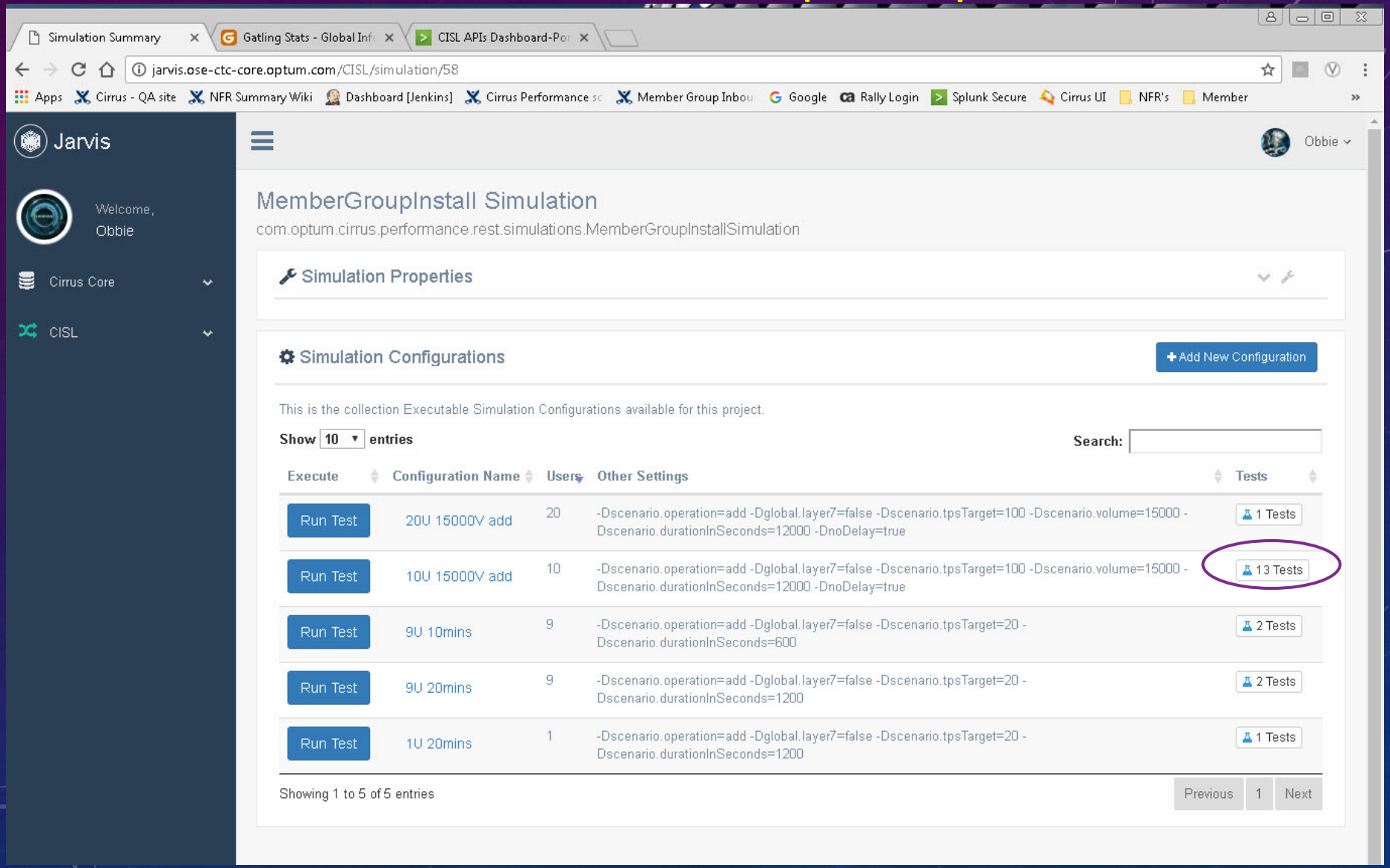
Automated test framework sample – Specific API



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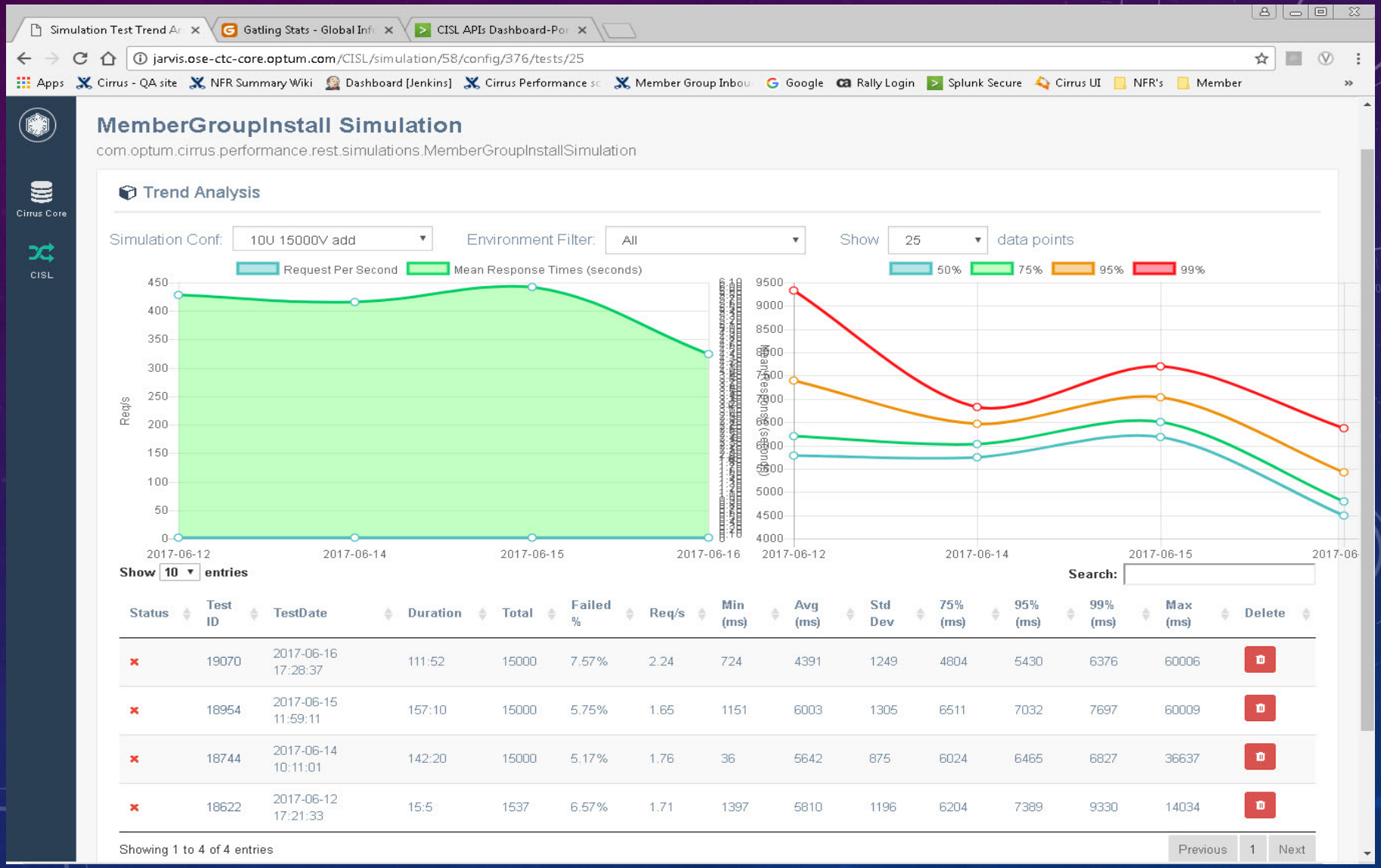
Automated test framework sample – Test case trend analysis



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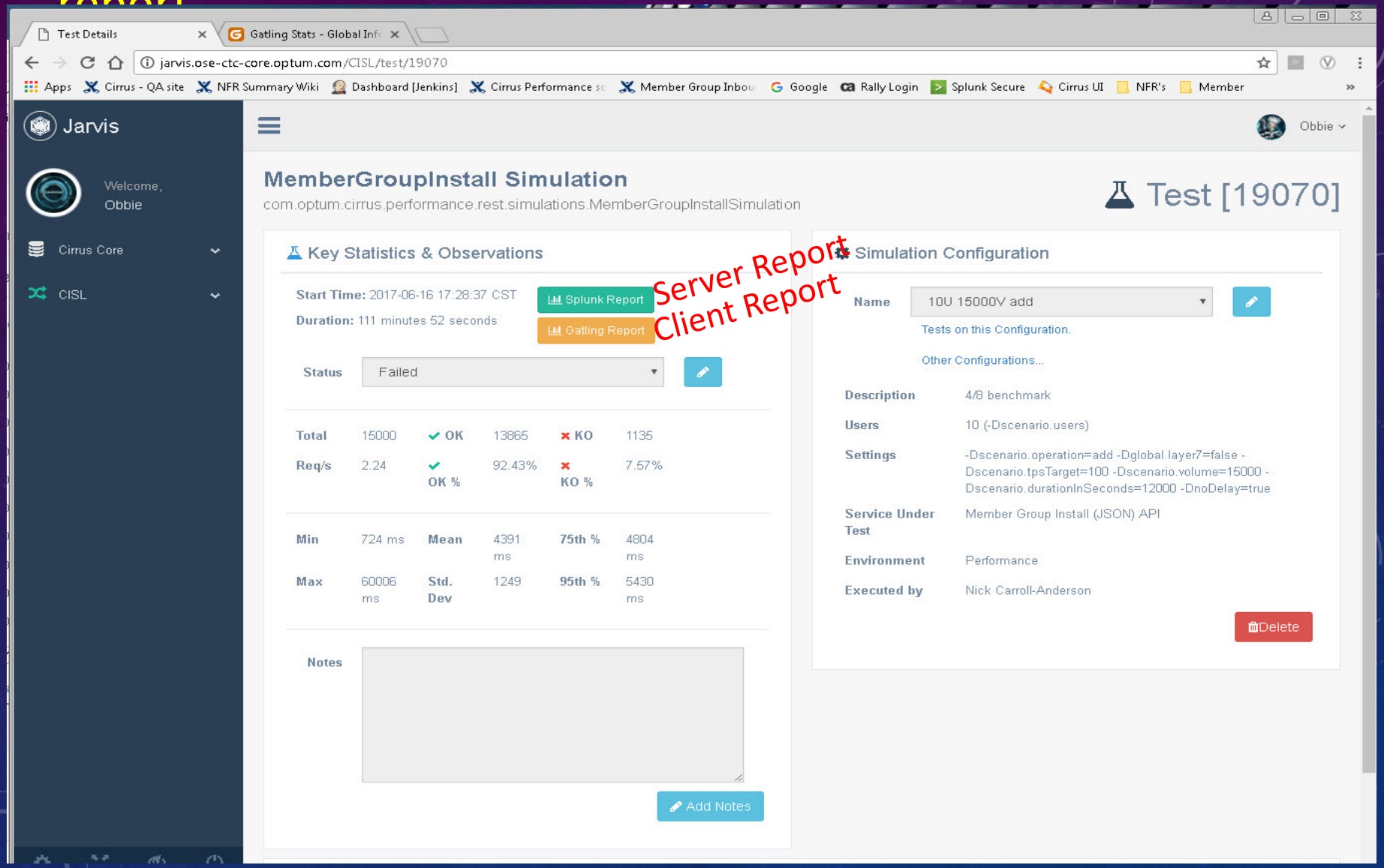
Automated test framework sample – A pushbutton test report



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Client Side Report

ASSERTIONS

Assertion	Status
Global: percentage of successful requests is 100	KO
Global: 50th percentile of response time is less than 4000	KO
Global: 75th percentile of response time is less than 4000	KO
Global: 95th percentile of response time is less than 4000	KO
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SLA compliance

STATISTICS

Expand all groups | Collapse all groups

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Biz transaction performance

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Error	Count	Percentage
status.find.is(201), but actually found 207	1131	99.648 %
j.u.c.TimeoutException: Request timeout to not-connected after 60000ms	3	0.264 %
j.n.ConnectException: connection timed out: cisImembergroupinstallv1-cirrusperf.ose-elr-dmz.optum.com/10.119[redacted]:443	1	0.088 %

Server Side Report

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Automating The Performance Test Report

- ***Summarizing the automated performance test.***

  - ***We have automated away 80% of the effort in waterfall performance testing with an automated report that can quickly answer two critical questions***
    - **Does my application perform within SLA?**
    - **If not, what part of my application needs to be fixed?**

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Performance Testing at Every Step

- **What if these reports weren't limited to the "Waterfall" prelease test window?!!**
- **What if we could get such reports at every step of the software lifecycle? Performance issue could be caught early in the lifecycle and after they slip into PROD.**

- **That sounds like DevOps?**

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Performance Testing at Every Step – SHIFT LEFT

- ***How do we validate functional testing in CD***
  - **Junit like tools support 1000's of unit tests automatically.**
  - **Triggered with every build.**
- ***With pushbutton performance tests which assert SLA compliance, performance tests could also be automated or easily kicked off.***
- ***Gatling (http://Gatling.io) is an open source performance test tool that integrates with Jenkins and produce a client side performance report.***
- ***Gatling like tests can do for performance what Junit does for unit testing.***
- ***The Performance reports***
  - ***Client side reports come from Gatling***
  - ***Server side reports come from splunk or DT***

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Performance Testing at Every Step – SHIFT LEFT

- ***Challenges to automated performance testing in Development***
  - **Can the test environment handle load?**
  - **Is there dependencies on other services?**

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Performance Testing at Every Step – SHIFT RIGHT

- ***Lets generalize the automated test and reporting process and see how it can be implemented in production***
- ***Three pieces are needed in automation: Load; Client side report; Server side report.***

	Shift Left	Waterfall (Pre-Release)	Shift Right
Load		Tool e.g. Gatling (Synthetic)	
Client Side Report		Tool	
Server Side Report		Performance Monitors e.g. Splunk or DT	

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Performance Testing at Every Step – SHIFT RIGHT

- ***Same tooling is used for Shift Left***

	Shift Left	Waterfall (Pre-Release)	Shift Right
Load	Tool e.g. Gatling (Synthetic)	Tool e.g. Gatling (Synthetic)	
Client Side Report	Tool	Tool	
Server Side Report	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT	

- ***How do we create the three necessary pieces in Production?***

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Performance Testing at Every Step – SHIFT RIGHT

- ***Production Servers are monitored the same way as upstream environments***

	Shift Left	Waterfall (Pre-Release)	Shift Right
Load	Tool e.g. Gatling (Synthetic)	Tool e.g. Gatling (Synthetic)	
Client Side Report	Tool	Tool	
Server Side Report	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT

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Performance Testing at Every Step – SHIFT RIGHT

- ***Load via PROD traffic…***

	Shift Left	Waterfall (Pre-Release)	Shift Right
Load	Tool e.g. Gatling (Synthetic)	Tool e.g. Gatling (Synthetic)	PROD Traffic
Client Side Report	Tool	Tool	
Server Side Report	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT

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Performance Testing at Every Step – SHIFT RIGHT

- ***Use monitors rather than tool for client side report…***

	Shift Left	Waterfall (Pre-Release)	Shift Right
Load	Tool e.g. Gatling (Synthetic)	Tool e.g. Gatling (Synthetic)	PROD Traffic
Client Side Report	Tool	Tool	Performance Monitors e.g. Splunk
Server Side Report	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT

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Shift Right performance results – Load, Client and Server side report

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Performance Testing at Every Step – SHIFT RIGHT

- ***Performance monitors can be used as additional source for Client report***

	Shift Left	Waterfall (Pre-Release)	Shift Right
Load	Tool e.g. Gatling (Synthetic)	Tool e.g. Gatling (Synthetic)	PROD Traffic
Client Side Report	Tool / Performance Monitors e.g. Splunk	Tool / Performance Monitors e.g. Splunk	Performance Monitors e.g. Splunk
Server Side Report	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT	Performance Monitors e.g. Splunk or DT

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Performance Testing at Every Step

- ***We've laid out a plan for automated performance testing at every step…***
  - ***Shift Left***
  - ***Pre-release***
  - ***Shift Right***

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A Real World Example / Experience

- ***What does automating performance assurance look like in a real project?***
- ***Recall the challenge –***
  - ***Many API's to test in a short amount of time***
  - ***Waterfall → Agile***
  - ***Continuous Delivery***
- ***Solution: The API test factory***

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A Real World Example / Experience

- ***API Test Factory***
  - **Phase 0**
    - **Create a Gatling framework, heavily automate the common aspects of api performance testing (Client side report)**
    - **Instrument code with performance monitoring, wrap each api in our logging framework (Server side report)**
  - **Phase I**
    - **Create Gatling script for each new API**

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A Real World Example / Experience

- ***API Test Factory – Continued…***
  - **Phase II**
    - **Test/Tune new API in isolation**
  - **Phase III**
    - **Add isolation tuned API to benchmark test bucket. Daily execution of all working API's together**
  - **Phase IV**
    - **Release to production with performance monitoring in place**

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A Real World Example / Experience

- **How is this Continuous Integration?**
  - **Lots of infrastructure investment: Instrumentation, Gatling framework**
  - **Tests are run and results are packaged at the push of a button.**

- ***How is this Agile?***
  - **Each api treated as steps in a sequence, broken into 2 week sprints.**
  - **Moving product thru a factory in schedulable chunks.**

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TakeAways to do it for yourself

- ***The U Strategy***
  - **Suggested approach to start this in your shop**
  - **Get Pre-release performance testing automated, than migrate tooling left and right**
  - **Follow the U Strategy**
  - **[U Strategy slide]**

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The U Strategy

<u>E-2-E/ waterfall performance testing</u>

STAGING ENVIRONMENT

- Simulate Prod traffic via your tool (Gatling?)
- Performance report on each business transaction
  - Response times, Transaction Rates, Error rates
- Create server centric monitoring to isolate the bottleneck. (80% of performance remediation is figuring out which service is failing)
- Create client centric monitoring that produces the same kind of report as Gatling. (Splunk or DT)

<u>Shift Right</u>

PRODUCTION ENVIRONMENT

- Fast performance defect isolation that maps directly into biz transactions
- Proactive performance monitoring with same precision as performance tests
- Adapt server centric reports for PROD
- Adapt client centric reports for PROD

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Automating Performance Testing at Every Step

- ***Q & A***

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