QA PRO; TEST, MONITOR AND VISUALISE MYSQL PERFORMANCE IN JENKINS

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Agenda

- Jenkins : a continuous integration framework
- Percona Server in Jenkins
- Performance monitoring in Jenkins
  - Sysbench
  - mysql test run
  - Performance graph

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- **Jenkins : a continuous integration framework**
- Percona Server in Jenkins
- Performance monitoring in Jenkins
  - Sysbench
  - Mysql test run
  - Performance graph

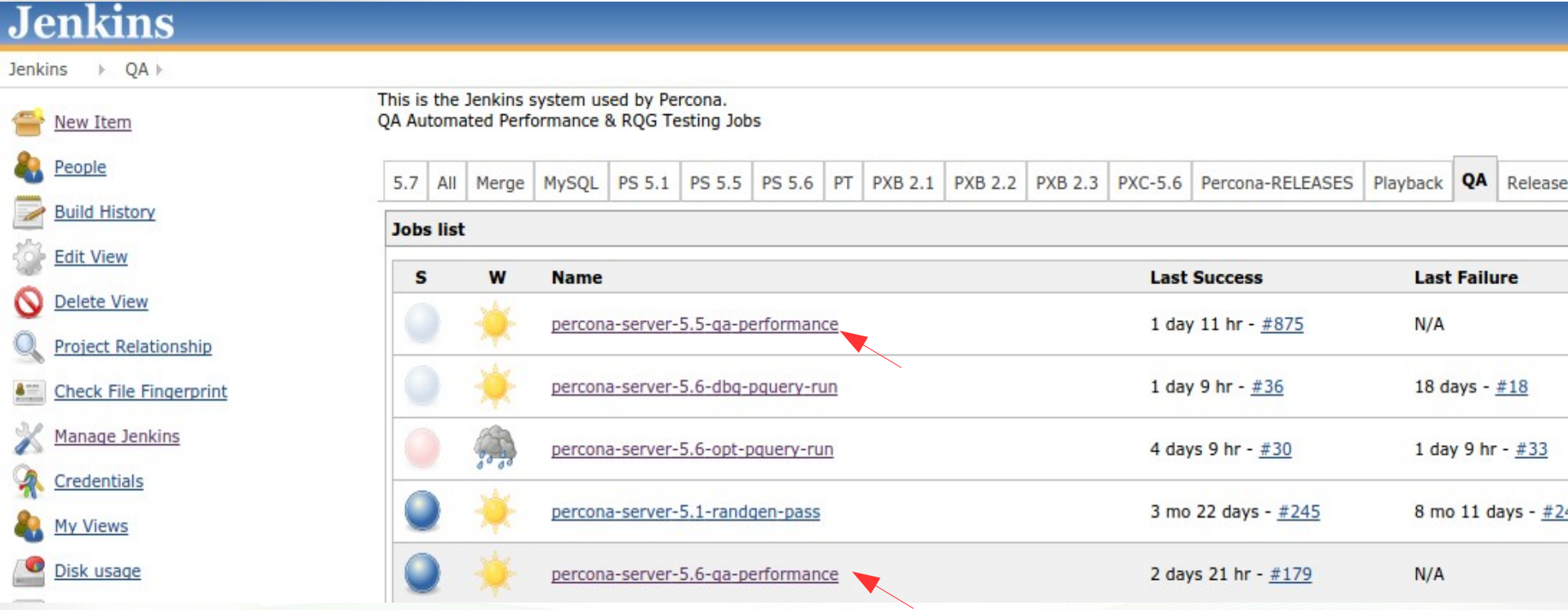
Jenkins : a continuous integration framework

- What is Jenkins?
  - It is an open source tool to perform continuous integration
  - Building/testing software projects continuously
  - Monitoring executions of externally-run jobs, such as building a software project or jobs run by cron
- For more info :
  - https://wiki.jenkins-ci.org/display/JENKINS/Meet+Jenkins

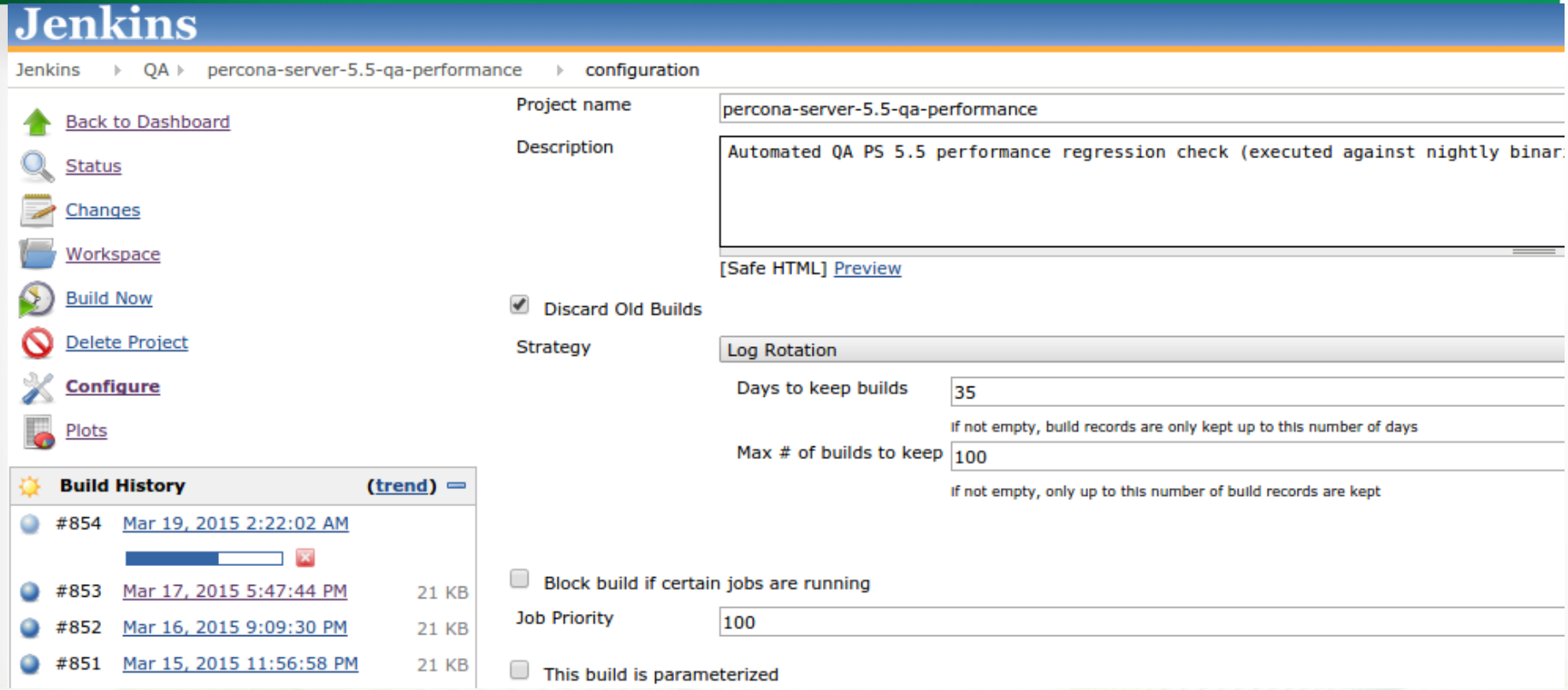
QA Jenkins job intro

- Automated performance testing will enable us to check the overall Percona Server performance for each commit/release. There is a chance of a large performance drawback or improvement when making a small code change in the server. To identify such bottlenecks we have created an automated process to test the server using sysbench with various server system configurations

Jenkins by example : Dashboard



Jenkins by example : New project



Jenkins by example : Matrix & NodeLabel plugins

https://wiki.jenkins-ci.org/display/JENKINS/Matrix+Project+Plugin

Matrix Project Plugin

Added by Jesse Glick, last edited by Daniel Beck on Mar 19, 2015 (view change)

Message from a Patron of Jenkins

Jenkins
- Home
- Mailing lists
- Source code
- Bugtracker
- Security Advisories
- Events
- Donation
- Commercial Support
- Wiki Site Map

Documents
- Meet Jenkins
- Use Jenkins
- Extend Jenkins
- Plugins
- Servlet Container Notes

Multi-configuration (matrix) project type.

Plugin Information

Plugin ID	matrix-project	Changes	In Latest Release Since Latest Release
Latest Release Latest Release Date Required Core Dependencies	1.4 (archives) Oct 14, 2014 1.561	Source Code Issue Tracking Maintainer(s)	GitHub Open Issues n/a (id: nenashev)
Usage		Installations	2014-Apr 2976 2014-May 23961 2014-Jun 33306 2014-Jul 42548 2014-Aug 49927 2014-Sep 57769 2014-Oct 64447 2014-Nov 58675 2014-Dec 70587 2015-Jan 76483 2015-Feb 79235 2015-Mar 88575

See Building a matrix project for user information.

Extensions

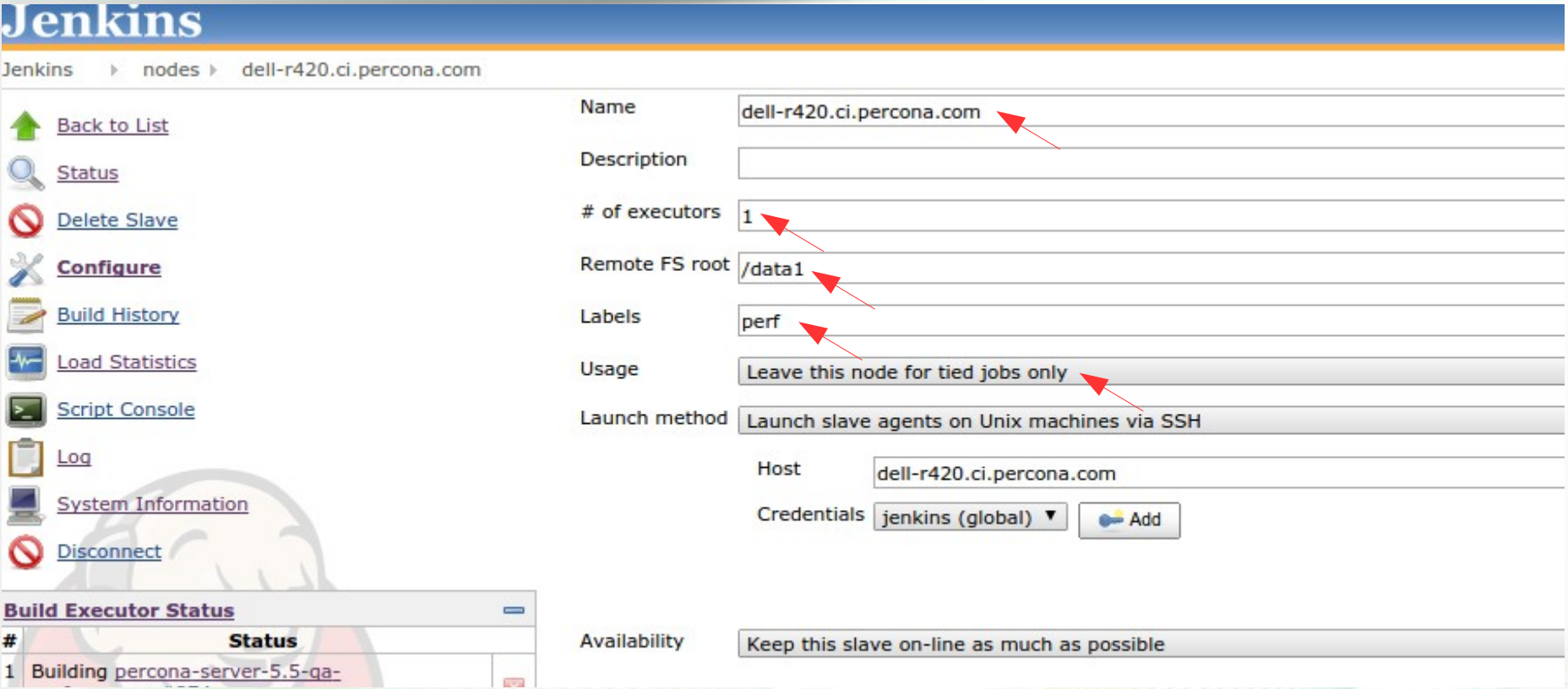
See all extension points here: Matrix Project Extension Points

Matrix Axis Extension

NodeLabel Parameter Plugin — This plugin adds two new parameter types to job configuration - node and label, this allows to dynamically select the node where a job/project should be executed.

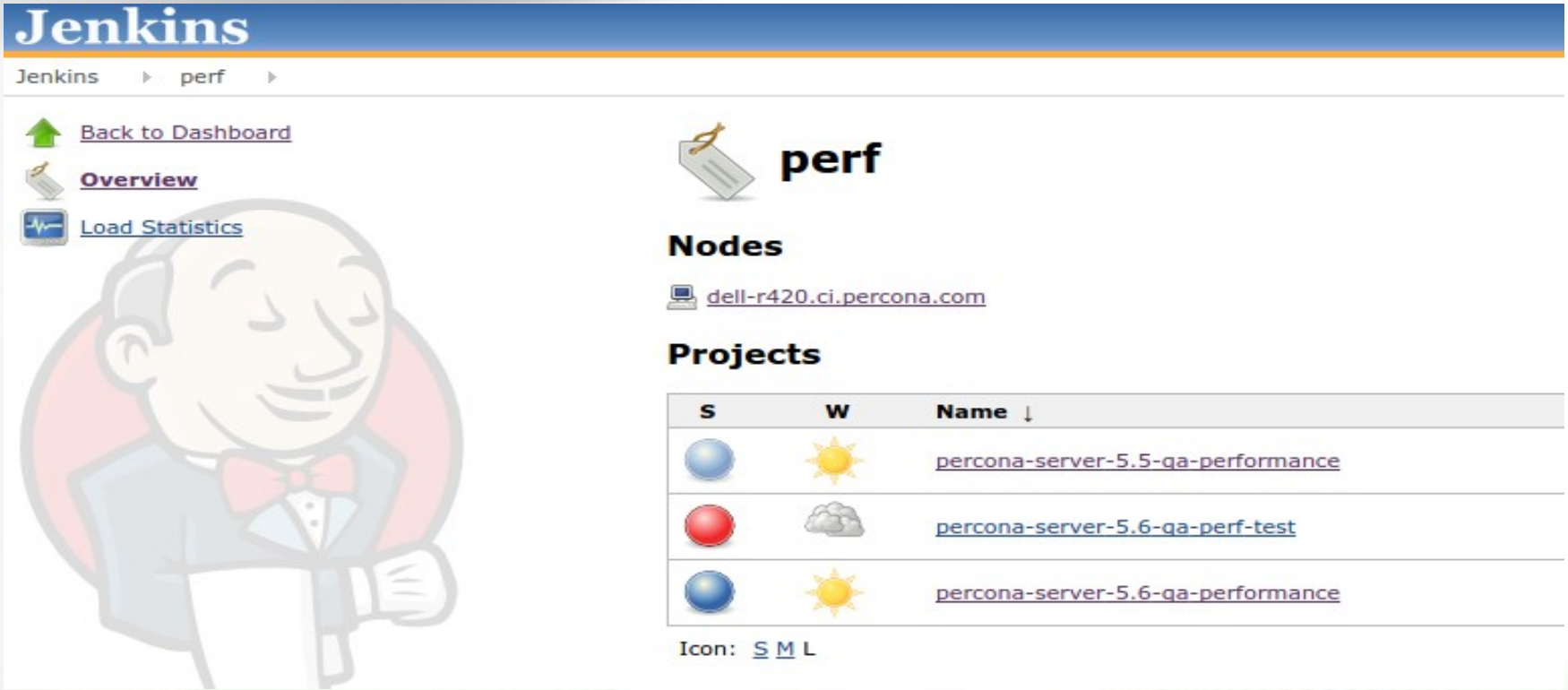
Dynamic Axis Plugin — This plugin allows you to define a matrix build axis that is dynamically populated from an environment variable:

Jenkins by example : Node/Slave configuration

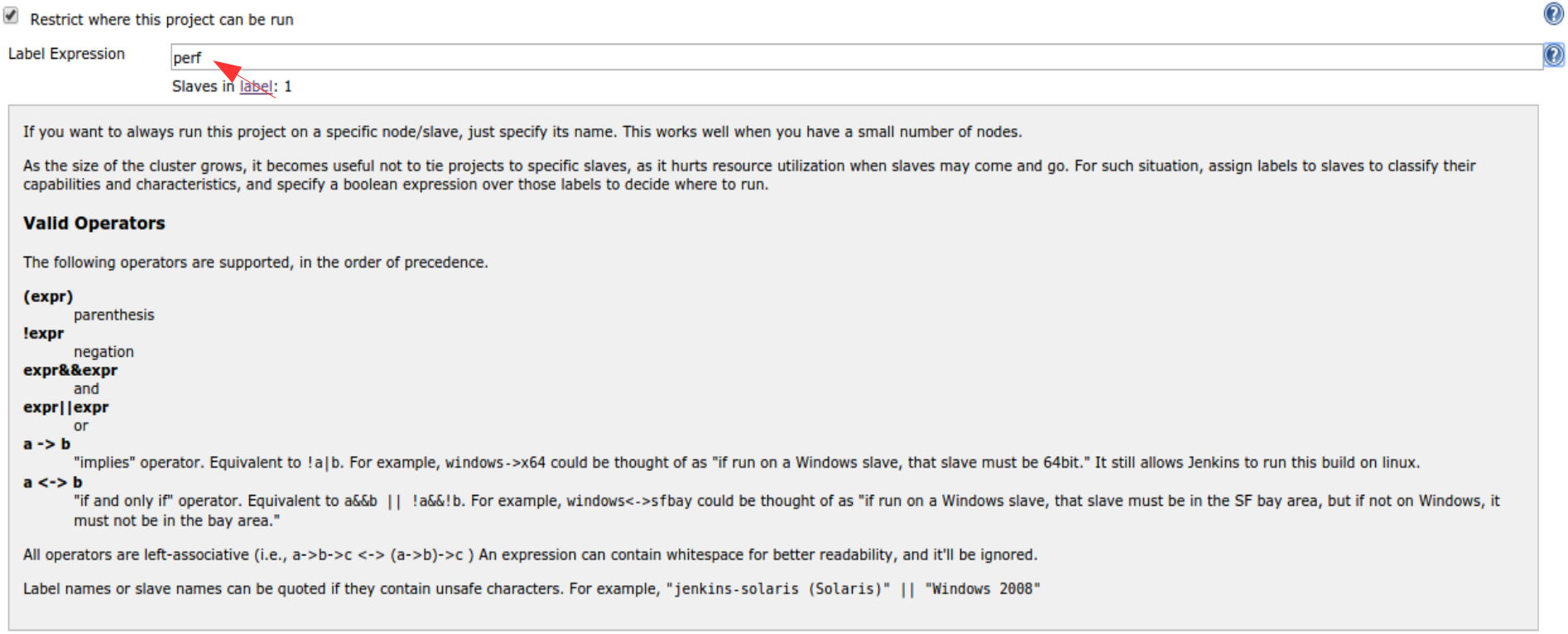


Jenkins by example : Node/Slave configuration

Jenkins by example : Node/Slave configuration

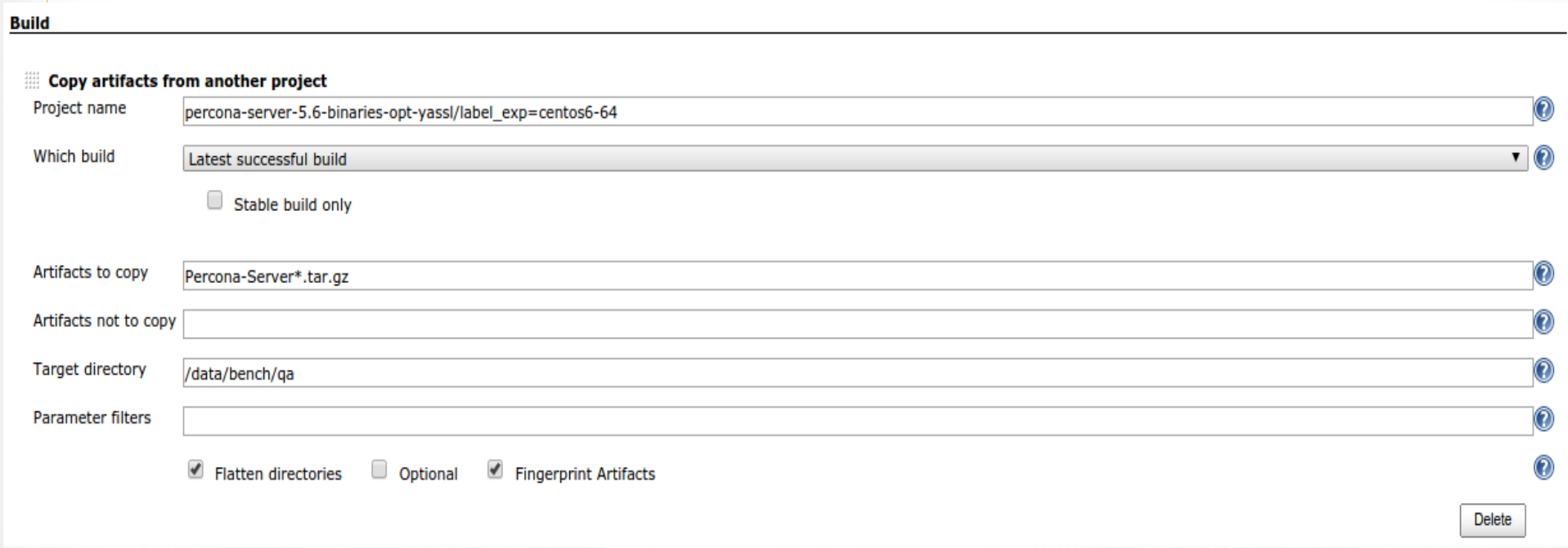


Jenkins by example : Slave/Node info

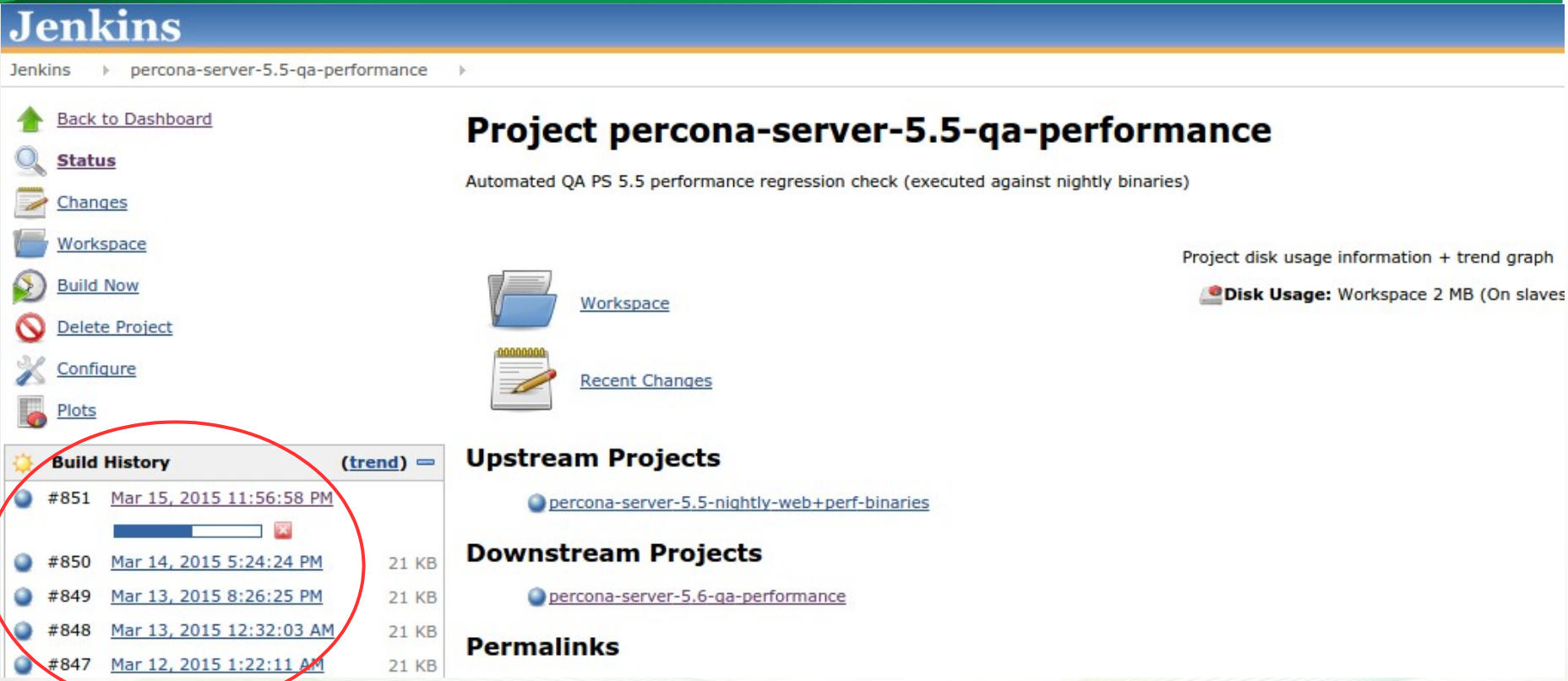


Jenkins by example : New project

Copy artifacts from another Jenkins job



Jenkins by example : build history



Jenkins by example : Job output

Jenkins

Jenkins ▸ percona-server-5.5-qa-performance ▸ #851

- Back to Project
- Status
- Changes
- **Console Output**
- View as plain text
- Edit Build Information
- Environment Variables
- See Fingerprints
- Previous Build

Timestamps

- (•) System clock time
- ( ) Elapsed time
- ( ) None

Console Output

```
23:56:58 Started by upstream project "percona-server-5.5-nightly-web+perf-binaries" build number 873
23:56:58 originally caused by:
23:56:58  Started by upstream project "percona-server-5.5-nigthly-web+perf-binaries-master" build number 314
23:56:58  originally caused by:
23:56:58   Started by timer
23:56:58 [EnvInject] - Loading node environment variables.
23:56:58 Building remotely on dell-r420.ci.percona.com (perf) in workspace /data1/workspace/percona-server-5.5-qa-performance
23:57:02 Copied 1 artifact from "percona-server-5.5-nightly-web+perf-binaries ? centos6-64" build number 873
23:57:02 [percona-server-5.5-qa-performance] $ /bin/bash -xe /tmp/hudson299859962264383220.sh
23:57:02 + ROOT_FS=/data/bench/qa
23:57:02 + cd /data/bench/qa
23:57:02 + grep -v .tar
23:57:02 + xargs rm -Rf
23:57:02 + ls -1d Percona-Server-5.5.42-rel37.1-Linux.x86_64.tar.gz Percona-Server-5.6.23-rel72.1-Linux.x86_64
23:57:02 ++ head -n1
23:57:02 ++ ls -1ct Percona-Server-5.5.42-rel37.1-Linux.x86_64.tar.gz
23:57:02 + TAR=Percona-Server-5.5.42-rel37.1-Linux.x86_64.tar.gz
23:57:02 + tar -xf Percona-Server-5.5.42-rel37.1-Linux.x86_64.tar.gz
23:57:04 + mv Percona-Server-5.5.42-rel37.1-Linux.x86_64.tar.gz build_851.tar.gz
23:57:04 ++ grep -v .tar
23:57:04 ++ head -n1
23:57:04 ++ ls -1d Percona-Server-5.5.42-rel37.1-Linux.x86_64
23:57:04 + BASE=Percona-Server-5.5.42-rel37.1-Linux.x86_64
23:57:04 + BUILD_WIPE=811
23:57:04 + '[' -w build_811.tar.gz ']'
23:57:04 + rm -Rf build_811.tar.gz
```

Jenkins by example : Background processes


```
[ramesh@dell-r420 qa]$ ps -ef | grep 853 | grep -v grep
jenkins   6628  6606  0 Mar17 ?        00:00:00 /bin/bash ./performance.sh 853 Percona-Server-5.5.42-rel37.1-Linux.x86_64
jenkins  10035     1 31 03:10 ?        00:32:55 /data1/qa/Percona-Server-5.5.42-rel37.1-Linux.x86_64/bin/mysqld --no-defaults --basedir=/data1/qa/Percona-S
erver-5.5.42-rel37.1-Linux.x86_64 --character-sets-dir=/data1/qa/Percona-Server-5.5.42-rel37.1-Linux.x86_64/share/charsets --secure-file-priv=/data/bench/q
a/853/tuned_run --log-bin-trust-function-creators --character-set-server=latin1 --lc-messages-dir=/data1/qa/Percona-Server-5.5.42-rel37.1-Linux.x86_64/shar
e --tmpdir=/data/bench/qa/853/tuned_run/tmp --connect-timeout=60 --pid-file=/data/bench/qa/853/tuned_run/run/master.pid --port=26639 --socket=/data/bench/q
a/853/tuned_run/tmp/master.sock --datadir=/data/bench/qa/853/tuned_run/master-data --log-output=table,file --log=/data/bench/qa/853/tuned_run/log/master.lo
g --log-slow-queries=/data/bench/qa/853/tuned_run/log/master-slow.log --server-id=1 --loose-innodb_data_file_path=ibdata1:10M:autoextend --local-infile --l
oose-skip-ndbcluster --key_buffer_size=1M --sort_buffer_size=256K --max_heap_table_size=1M --ssl-ca=/data1/qa/Percona-Server-5.5.42-rel37.1-Linux.x86_64/my
sql-test/std_data/cacert.pem --ssl-cert=/data1/qa/Percona-Server-5.5.42-rel37.1-Linux.x86_64/mysql-test/std_data/server-cert.pem --ssl-key=/data1/qa/Percon
a-Server-5.5.42-rel37.1-Linux.x86_64/mysql-test/std_data/server-key.pem --core-file --loose-new --sql-mode=no_engine_substitution --relay-log=slave-relay-b
in --loose-innodb --secure-file-priv= --max-allowed-packet=16Mb --loose-innodb-status-file=1 --master-retry-count=65535 --skip-name-resolve --socket=/data/
bench/qa/853/socket.sock --log-output=none --loose-userstat --loose-innodb_lazy_drop_table=1 --innodb-old-blocks_time=0 --innodb-buffer-pool-size=4G --inno
db-log-file-size=1G --innodb-io-capacity=2000 --innodb-flush-log-at-trx-commit=1 --innodb-flush-method=O_DIRECT --innodb-buffer-pool-instances=8 --max-conn
ections=900 --innodb-file-per-table=true --skip-log-bin --core-file --open-files-limit=1024
jenkins  10056  6628 35 03:10 ?        00:37:39 /usr/bin/sysbench --test /usr/share/doc/sysbench/tests/db/parallel_prepare.lua --num-threads 40 --oltp-tabl
es-count 40 --oltp-table-size 1000000 --mysql-db test --mysql-user root --db-driver mysql --mysql-socket /data/bench/qa/853/socket.sock run
[ramesh@dell-r420 qa]$
```

Agenda

- Jenkins : a continuous integration framework
- **Percona Server in Jenkins**
- Performance monitoring in Jenkins
  - Sysbench
  - mysql test run
  - Performance graph

Percona Server in Jenkins

- As part of QA, we have configured different PS builds in Jenkins. This will help us to test PS quality at various levels

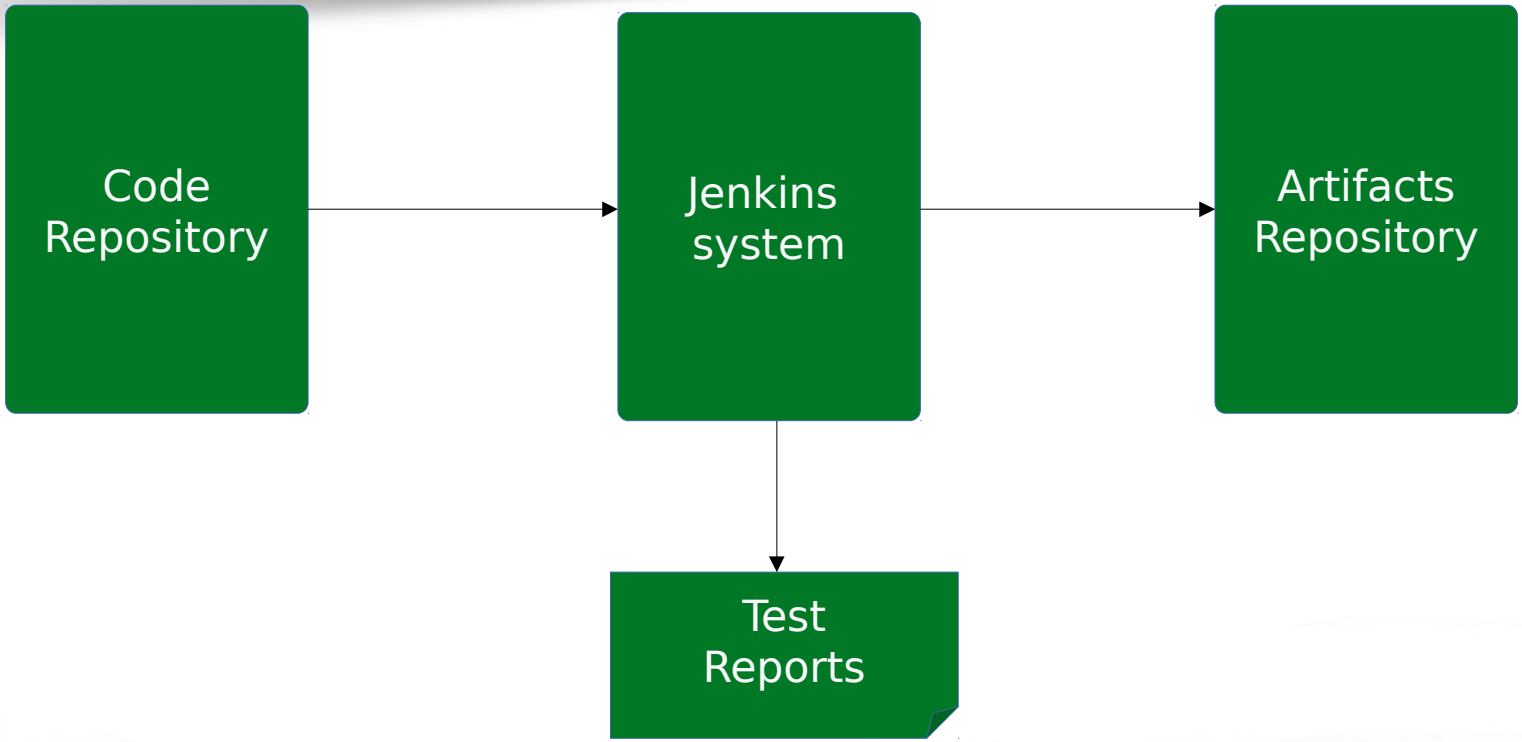
  - http://jenkins.percona.com/view/QA/job/percona-server-5.6-binaries-valgrind-yassl/
  - http://jenkins.percona.com/view/QA/job/percona-server-5.6-binaries-opt-yassl/
  - http://jenkins.percona.com/view/QA/job/percona-server-5.6-binaries-debug-yassl/

Percona Server in Jenkins

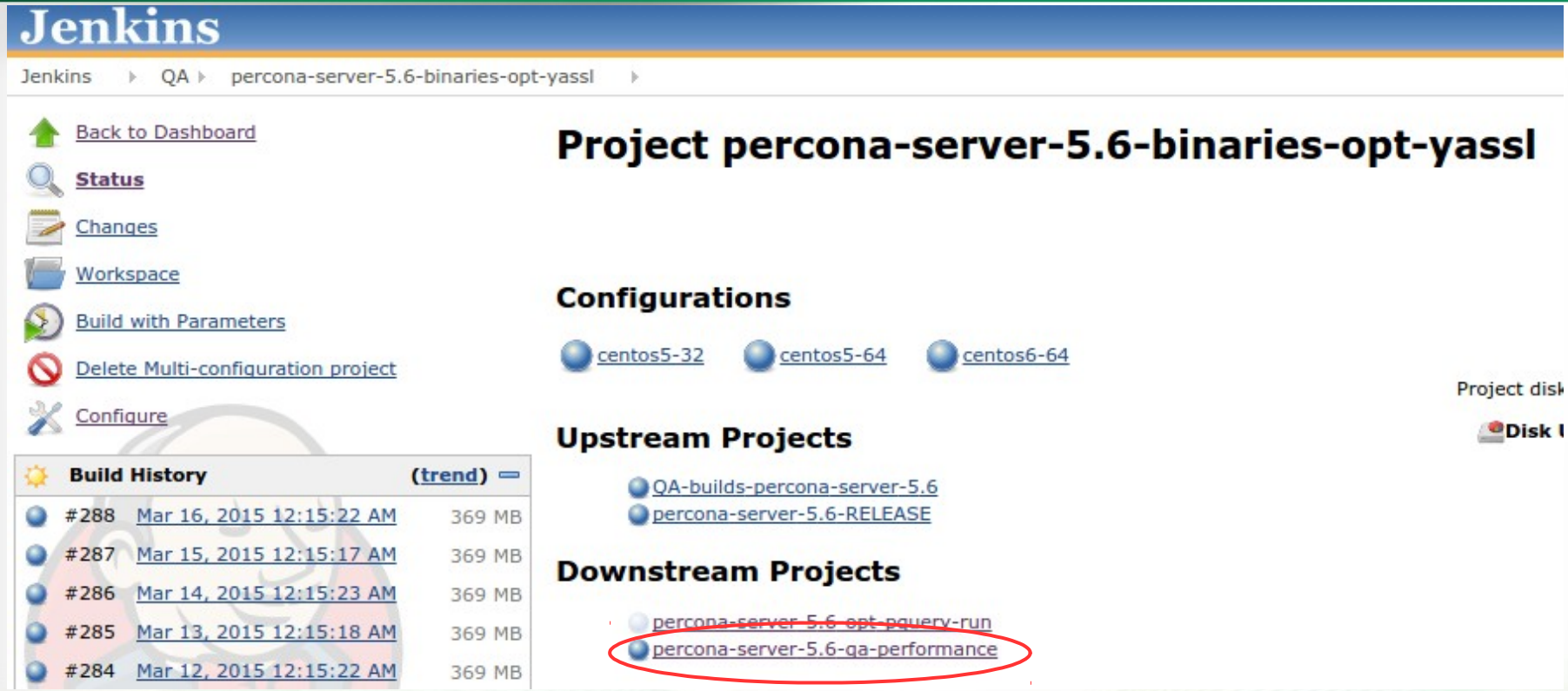
- Automated performance testing script will run against Percona Server binaries (from Jenkins project)

- We use lp:percona-qa/performance.sh script for QA performance tests (available on Launchpad!)
  - https://launchpad.net/percona-qa
  - $ bzr branch lp:percona-qa

Work flow


Code Repository
Jenkins system
Artifacts Repository
Test Reports

Percona Server in Jenkins



Agenda

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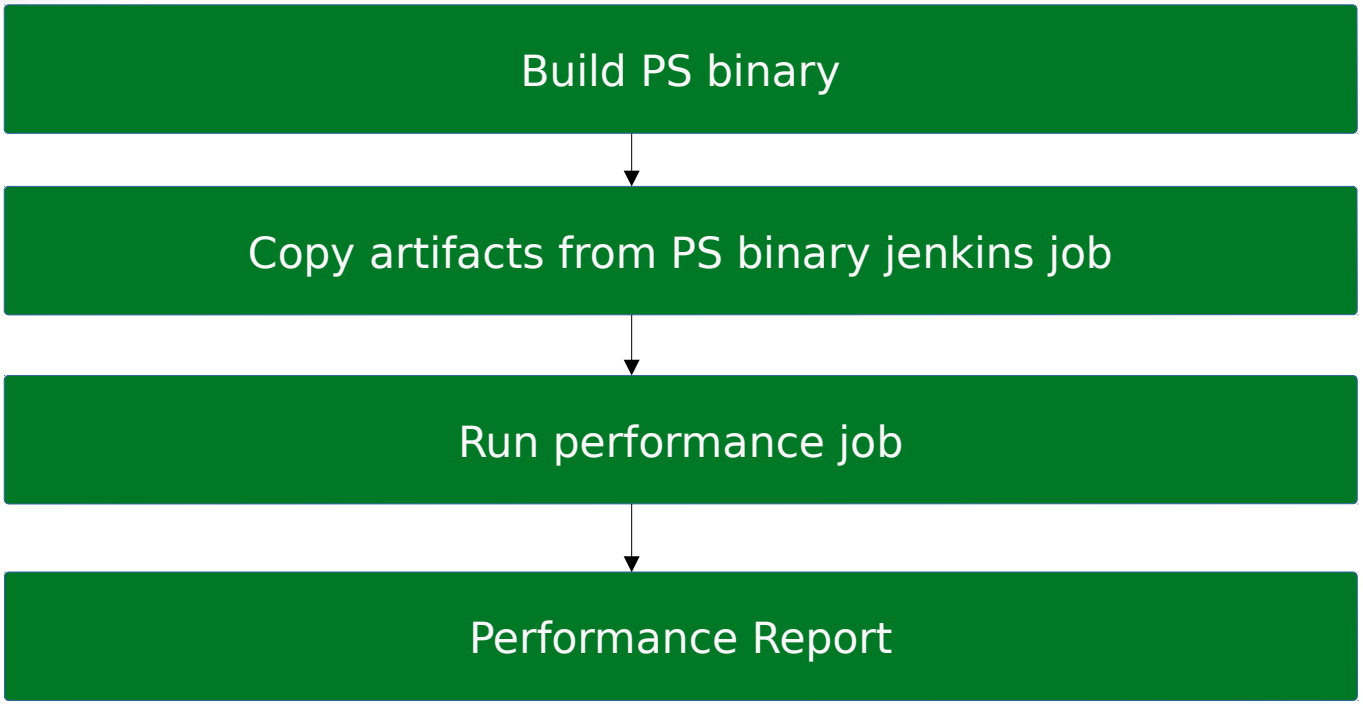
  - Sysbench
  - mysql test run
  - Performance graph

Performance monitoring in Jenkins

- Hardware used for performance testing
  - Model : Dell R420
  - CPU - Intel(R) Xeon(R) CPU E5-2450 0 @ 2.10GHz (32 Threads)
  - Storage - SSD 240GB + HDD 1TB
  - RAM – 50G

Performance job work flow



Performance job work log


```
17:47:44 Started by upstream project "percona-server-5.5-nightly-web+perf-binaries" build number 875
[..]
17:47:44 Building remotely on dell-r420.ci.percona.com (perf) in workspace /data1/workspace/percona-server-5.5-qa-performance
17:47:46 Copied 1 artifact from "percona-server-5.5-nightly-web+perf-binaries ? centos6-64" build number 875
17:47:46 [percona-server-5.5-qa-performance] $ /bin/bash -xe /tmp/hudson8983591239000179055.sh
[..]
17:47:55 + ./performance.sh 853 Percona-Server-5.5.42-rel37.1-Linux.x86_64
17:47:55 Workdir: /data/bench/qa/853
[..]
07:09:39 Logging: lib/v1/mysql-test-run.pl --start-and-exit --skip-ndb --vardir=/data/bench/qa/853/tuned_run --master_port=26639 --mysqld=--core-file --mysqld=--loose-new --mysqld=--sql-mode=no_engine_substitution --mysqld=--relay-log=slave-relay-bin --mysqld=--loose-innodb --mysqld=--secure-file-priv= --mysqld=--max-allowed-packet=16Mb --mysqld=--loose-innodb-status-file=1 --mysqld=--master-retry-count=65535 --mysqld=--skip-name-resolve --mysqld=--socket=/data/bench/qa/853/socket.sock --mysqld=--log-output=none --mysqld=--loose-userstat --mysqld=--loose-innodb_lazy_drop_table=1 --mysqld=--innodb-old-blocks_time=0 --mysqld=--innodb-buffer-pool-size=4G --mysqld=--innodb-log-file-size=1G --mysqld=--innodb-io-capacity=2000 --mysqld=--innodb-flush-log-at-trx-commit=1 --mysqld=--innodb-flush-method=O_DIRECT --mysqld=--innodb-buffer-pool-instances=8 --mysqld=--max-connections=900 --mysqld=--innodb-file-per-table=true 1st
[..]
10:32:36 Sysbench Run: OLTP RW testing with default server settings + single threaded + cpubound
11:32:36 Sysbench Run: OLTP RW testing with default server settings + multiple threaded (700) + cpubound
12:17:37 Sysbench Run: OLTP RW testing with tuned server settings + single threaded + iobound
13:17:37 Sysbench Run: OLTP RW Run with tuned server settings + multiple threaded (700) + iobound
[..]
14:17:28 Recording plot data
[..]
14:17:28 Finished: SUCCESS
```

sysbench

- Sysbench is a benchmark suite to quickly get an impression about system performance without setting up complex database benchmarks.
- Current features allow to test the following system parameters:
  - file I/O performance
  - scheduler performance
  - memory allocation and transfer speed
  - POSIX threads implementation performance
  - database server performance (OLTP benchmark)

sysbench

- You can download sysbench from below link
  - https://github.com/akopytov/sysbench
- Documentation
  - http://imysql.com/wp-content/uploads/2014/10/sysbench-manual.pdf
- Useful links
  - http://www.percona.com/blog/2014/09/02/using-sysbench-0-5-benchmark-mysql-whats-changed-latest-release/
  - https://blog.mariadb.org/using-lua-enabled-sysbench/
  - http://www.lefred.be/node/154

sysbench

- sysbench runs a specified number of threads and which then all execute requests in parallel
- The actual workload produced by requests depends on the specified test mode
- You can limit either the total number of requests or the total time for the benchmark, or both

sysbench

The general syntax for sysbench is as follows:

sysbench [common-options] --test=name [test-options] command

Below is a brief description of available commands and their purpose:

prepare
Performs preparative actions for those tests which need them, e.g. creating the necessary files on disk for the fileio test, or filling thetest database for the OLTP test.

run
Runs the actual test specified with the --test=name option.

cleanup
Removes temporary data after the test run in those tests which create one.

help
Displays usage information for a test specified with the --test=name option

Sysbench configuration

- We use read/write sysbench combinations to test the server performance with different options, which include threads, buffer, data etc.

Sysbench configuration

Single Thread	Multi Thread
1) Default mysqld configurations + Cpu-bound	4) Default mysqld configurations + Cpu-bound
2) Tuned mysqld configurations + Cpu-bound	5) Tuned mysqld configurations + Cpu-bound
3) Tuned mysqld configurations + io-bound	6) Tuned mysqld configurations + io-bound

MTR (mysql-test-run)

- MTR's --start-and-exit option starts the server (after which MTR self-terminates), while leaving the server running for future use. Our performance.sh script then takes over

MTR (mysql-test-run)

Sample MTR startup command

```
perl lib/v1/mysql-test-run.pl \
   --start-and-exit \
   --skip-ndb \
   --vardir=$WORKDIR/$WORKDIRSUB/default_run \
   --master_port=$PORT \
   --mysqld=--core-file \
   --mysqld=--sql-mode=no_engine_substitution \
   --mysqld=--relay-log=slave-relay-bin \
   --mysqld=--loose-innodb \
   --mysqld=--log-output=none \
   --mysqld=--secure-file-priv= \
   --mysqld=--max-connections=900 \
   --mysqld=--socket=$WORKDIR/$WORKDIRSUB/socket.sock
```

MTR (mysql-test-run)

MTR by example

```
[ramesh@qaserver-03 mysql-test]$ perl lib/v1/mysql-test-run.pl --start-and-exit --skip-
ndb --vardir=/sda/1000/default_run 1st
Logging: lib/v1/mysql-test-run.pl --start-and-exit --skip-ndb
--vardir=/sda/1000/default_run 1st
2015-03-30 05:52:04 32093 [Warning] Buffered warning: Changed limits: max_open_files:
1024 (requested 5000)

2015-03-30 05:52:04 32093 [Warning] Buffered warning: Changed limits: table_cache: 431
(requested 2000)
[..]

Servers started, exiting
[ramesh@qaserver-03 mysql-test]$

[ramesh@qaserver-03 mysql-test]$ /sda/Percona-Server-5.6.22-rel71.0-
729.Linux.x86_64/bin/mysqladmin -S/sda/1000/default_run/tmp/master.sock -uroot ping
mysqld is alive
[ramesh@qaserver-03 mysql-test]$
```

Performance monitoring in Jenkins

- mysqld startup configuration
  - For I/O-bound and read/write CPU-bound operations, configured following mysqld options for tuned sysbench run

```
--innodb-old-blocks_time=0
--innodb-buffer-pool-size=4G
--innodb-lru-scan-depth=3000
--innodb-log-file-size=1G
--innodb-io-capacity=2000
--innodb-io-capacity-max=4000
--innodb-flush-log-at-trx-commit=1
--innodb-flush-method=O_DIRECT
--innodb-checksum-algorithm=crc32
--innodb-log-checksum-algorithm=crc32
--innodb-file-per-table=true
```

Performance monitoring in Jenkins

- To test I/O-bound and RW CPU-bound performance we used large undo logs
- To control the background flushing rate added optimal innodb_io_capacity and innodb_io_capacity_max values
- We also configured innodb_lru_scan_depth (for I/O-intensive workloads) and log checksums

Performance monitoring in Jenkins

MTR sysbench run by example

- After MTR startup we use sysbench **prepare** script to insert records into table. This prepare script will insert 1 million records in 40 tables

```
/usr/bin/sysbench --test=/usr/share/doc/sysbench/tests/db/parallel_prepare.lua
--num-threads=40 --oltp-tables-count=40 --oltp-table-size=1000000 --mysql-db=test
--mysql-user=root --db-driver=mysql --mysql-socket=$WORKDIR/$WORKDIRSUB/socket.sock run
```

- Before starting performance job, it will initiate read only sysbench run to keep the server buffer pool warm

```
/usr/bin/sysbench --test=/usr/share/doc/sysbench/tests/db/oltp.lua \
--num-threads=$MULTI_THREAD_COUNT --max-time=120 --max-requests=1870000000 \
--oltp-tables-count=30 --mysql-db=test --oltp-read-only --mysql-user=root \
--db-driver=mysql --mysql-socket=$WORKDIR/$WORKDIRSUB/socket.sock \
run
```

Performance monitoring in Jenkins

MTR sysbench run by example

- The following will start the sysbench read/write combinations one by one to analyse the performance.

```
## OLTP RW Run with Tuned server settings + multiple threaded (400) + cpubound (10
tables * 1 M Rows each : data size approx = 2.3G )

  /usr/bin/sysbench --test=/usr/share/doc/sysbench/tests/db/oltp.lua --num-
threads=$MULTI_THREAD_COUNT --max-time=$SYSBENCH_DURATION --max-requests=1870000000
--oltp-tables-count=10 --mysql-db=test –mysql-user=root --db-driver=mysql --mysql-
socket=$WORKDIR/$WORKDIRSUB/socket.sock run
```

Performance monitoring in Jenkins

- Single thread sysbench combinations

  - ## OLTP Read/Write Run with default server settings + single threaded + cpubound (10 tables * 1 M Rows each : data size approx = 2.3G)
  - ## OLTP Read/Write Run with Tuned server settings + single threaded + iobound (30 tables * 1 M Rows each : data size approx = 6.9G)
  - ## OLTP Read/Write Run with Tuned server settings + single threaded + cpubound (10 tables * 1 M Rows each : data size approx = 2.3G)

Performance monitoring in Jenkins

- Multi thread sysbench combinations

  - ## OLTP Read/Write Run with default server settings + multiple threaded (400) + cpubound (10 tables * 1 M Rows each : data size approx = 2.3G)
  - ## OLTP Read/Write Run with Tuned server settings + multiple threaded (400) + cpubound (10 tables * 1 M Rows each : data size approx = 2.3G)
  - ## OLTP Read/Write Run with Tuned server settings + multiple threaded (400) + iobound (30 tables * 1 M Rows each : data size approx = 6.9G)

Performance monitoring in Jenkins

- Currently we have configured performance testing job for PS-5.5 and PS-5.6 releases.
  - http://jenkins.percona.com/view/QA/job/percona-server-5.5-qa-performance/plot/
  - http://jenkins.percona.com/view/QA/job/percona-server-5.6-qa-performance/plot/

Performance job report


```
14:02:42 Storing Sysbench results in /data1/workspace/percona-server-5.5-qa-performance
14:02:42 ================================================================================================================
14:02:42 RW_DS_CPUBOUND Last Run: 1566300            | RW_DS_CPUBOUND This Run: 1206440
14:02:42 RW_DM_CPUBOUND Last Run: 27222738           | RW_DM_CPUBOUND This Run: 23206187
14:02:42 RW_TS_CPUBOUND Last Run: 1235580            | RW_TS_CPUBOUND This Run: 1214200
14:02:42 RW_TM_CPUBOUND Last Run: 89683651           | RW_TM_CPUBOUND This Run: 122184036
14:02:42 RW_TS_IOBOUND Last Run: 1219740             | RW_TS_IOBOUND This Run: 1032160
14:02:42 RW_TM_IOBOUND Last Run: 68965504            | RW_TM_IOBOUND This Run: 69368730
14:02:42 ================================================================================================================
14:02:42 RW_DS_CPUBOUND Factor: .77 (77%)
14:02:42 RW_DM_CPUBOUND Factor: .85 (85%)
14:02:42 RW_TS_CPUBOUND Factor: .98 (98%)
14:02:42 RW_TM_CPUBOUND Factor: 1.36 (136%)
14:02:42 RW_TS_IOBOUND Factor: .84 (84%)
14:02:42 RW_TM_IOBOUND Factor: 1.00 (100%)
14:02:42 ========================================================================
14:02:42 Warning: big decrease in OLTP RW Run with default server settings + single threaded + cpubound performance
14:02:42 Warning: big decrease in OLTP RW Run with default server settings + multi threaded + cpubound performance
14:02:42 Great: big increase in OLTP RW Run with tuned server settings + multi threaded + cpubound performance
14:02:42 Warning: big decrease in OLTP RW Run with tuned server settings + single threaded + iobound performance
14:02:43 ========================================================================
```

Jenkins graph configuration

- After completing the job we can visualize the performance status using the Jenkins Plot plugin
- This plugin provides generic plotting/graphing capabilities in Jenkins
- After each build completes the plots' data series latest values are pulled from Java properties file(s), CSV file(s), or XML file(s) via an XPath from the workspace
  - https://wiki.jenkins-ci.org/display/JENKINS/Plot+Plugin

Jenkins graph configuration


```
[ramesh@dell-r420 percona-server-5.6-qa-performance]$ cat sysbench_performance_results.xml
<?xml version="1.0" encoding="UTF-8"?>
<performance>
  <RW_DM_CPUBOUND_QUERIES type="result">59830151</RW_DM_CPUBOUND_QUERIES>
  <RW_TM_CPUBOUND_QUERIES type="result">128192015</RW_TM_CPUBOUND_QUERIES>
  <RW_TM_IOBOUND_QUERIES type="result">100774440</RW_TM_IOBOUND_QUERIES>
</performance>
[ramesh@dell-r420 percona-server-5.6-qa-performance]$ pwd
/data1/workspace/percona-server-5.6-qa-performance
[ramesh@dell-r420 percona-server-5.6-qa-performance]$
[ramesh@dell-r420 percona-server-5.6-qa-performance]$
```

Jenkins graph configuration

Post-build Actions

Plot build data

Delete Plot

Plot group: Automated QA Sysbench Performance Check for PS 5.6

Plot title: 1) Sysbench OLTP RW QPR Across Builds (Multiple thread)

Number of builds to include: 35

Plot y-axis label: Queries(Duration - 45 Minutes)

Plot style: Line

Build Descriptions as labels

Data series file: sysbench_performance_results.xml

Load data from properties file

Load data from csv file

Load data from xml file using xpath

XPath Result type: **Nodeset Node String Boolean Number**

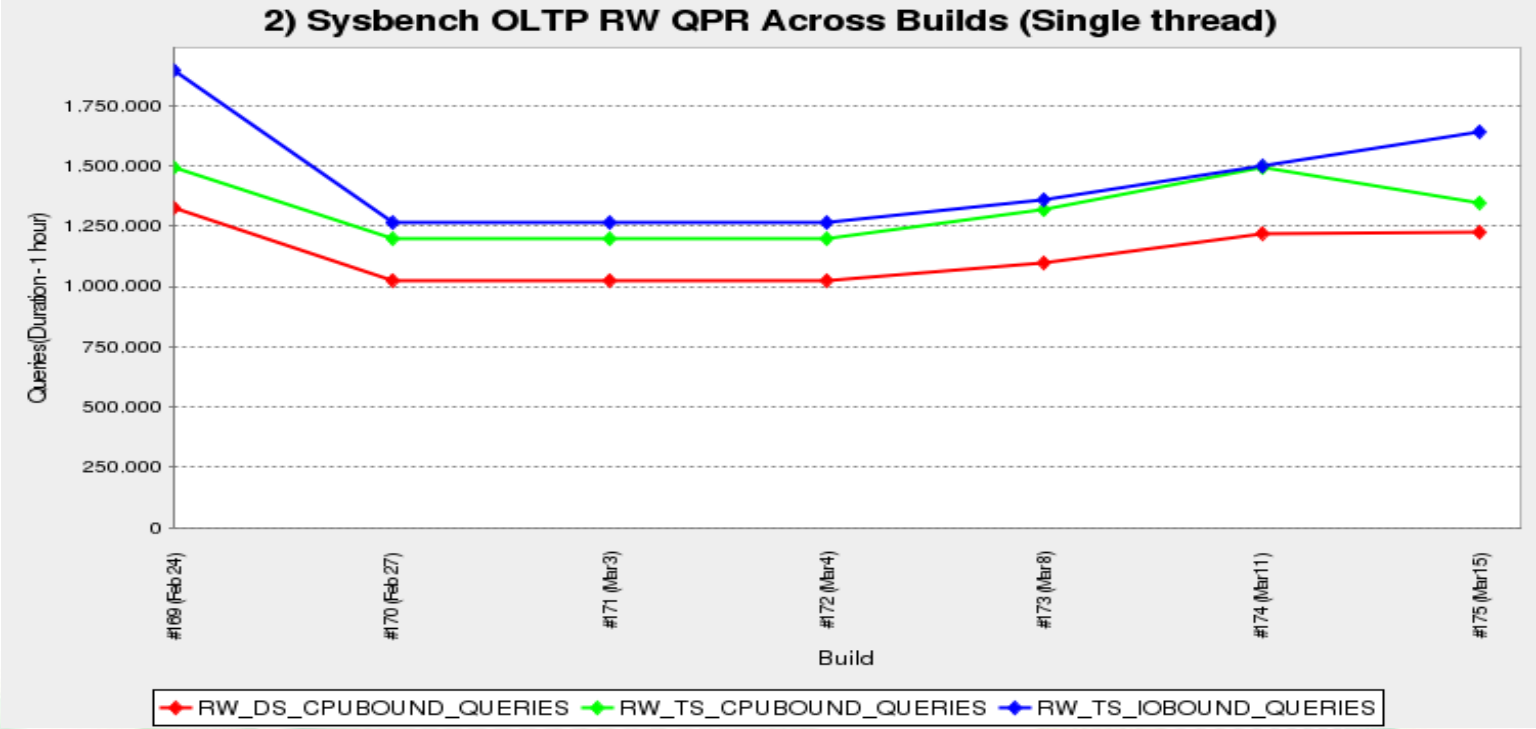
XPath Expression: /performance/*[@type='result']

URL:

Delete Data Series

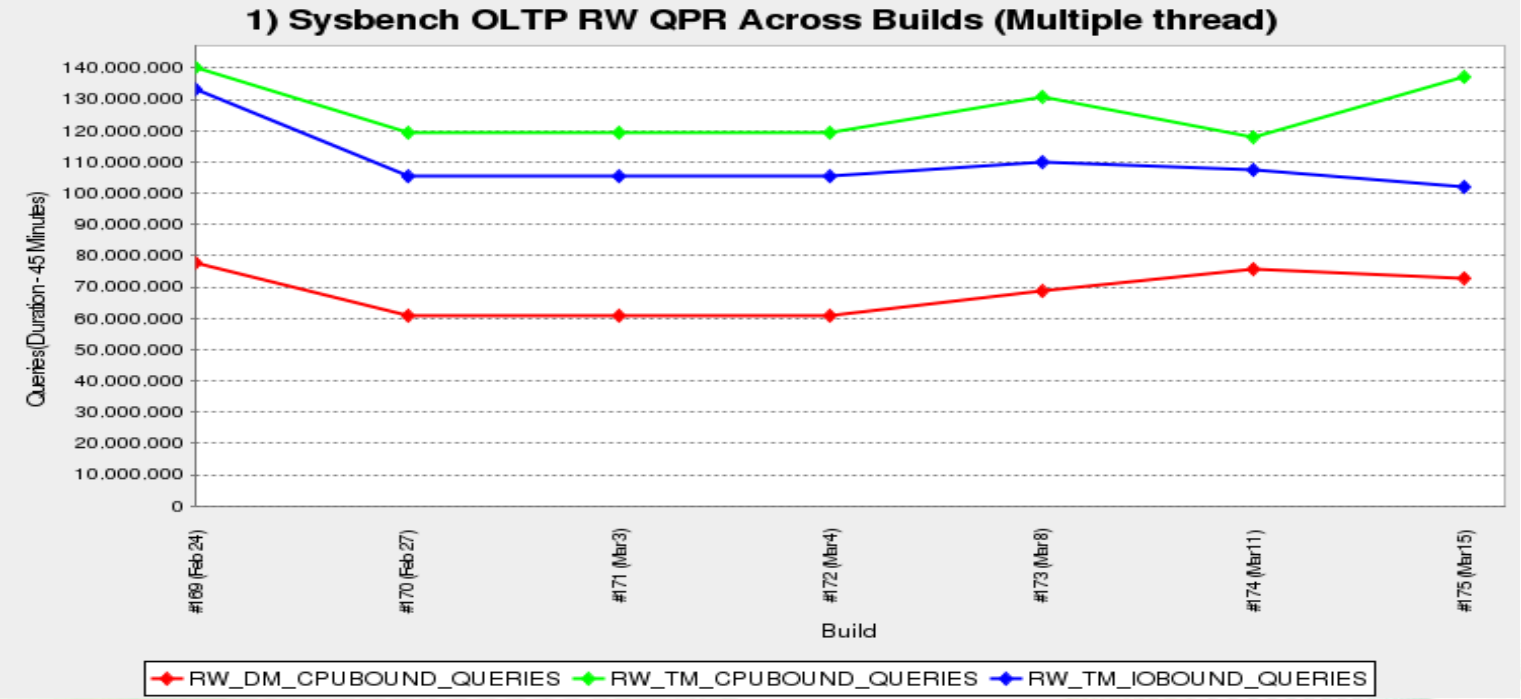
Performance monitoring in Jenkins

Sysbench OLTP read/write QPR across builds (Single thread)



Performance monitoring in Jenkins

Sysbench OLTP read/write QPR across builds (Multiple thread)



Q & A