pbench Documentation

Pbench

Aug 31, 2023

PBENCH AGENT

Pbench is a Benchmarking and Performance Analysis Framework.

Pbench Agent

The Agent is responsible for providing commands for running benchmarks across one or more systems, while properly collecting the configuration of those systems, their logs, and specified telemetry from various tools (sar, vmstat, perf, etc).

Pbench Server

The second sub-system included here is the Server, which is responsible for archiving results and indexing them to allow the dashboard to prepare visualizations of the results.

Dashboard

Lastly, the Dashboard is used to display visualizations in graphical and other forms of the results that were collected by the Agent and indexed by the Server.

CHAPTER

ONE

INSTALLATION

Choose any one of the following approaches to setup *Pbench Agent*

1.1 Pbench Agent Container

Pbench Agent is available as container images on Quay.io. This makes Pbench Agent a distro-independent solution and it could also be used in any containerized ecosystem.

Want to build container images from sources?
Follow README

Running Pbench Agent container is as simple as

```
podman run quay.io/pbench/pbench-agent-all-centos-8
```

Depending on the use cases one has to run these containers with privileged mode, host network, pid, ipc, mount required volumes, etc.

Example:

```
podman run --name pbench --rm -ti --privileged --ipc=host --net=host --pid=host -e HOST=/
↪host -e NAME=pbench -e IMAGE=quay.io/pbench/pbench-agent-all-centos-8 -v /run:/run -v /
↪var/log:/var/log -v /etc/machine-id:/etc/machine-id -v /etc/localtime:/etc/localtime -
↪v /:/host quay.io/pbench/pbench-agent-all-centos-8
```

Note: The volumes and config shown in the command snippet above may vary depending on users needs.

Possibilities are endless, please give it a try https://quay.io/organization/pbench.

1.2 RPM based installation

The Pbench Agent requires the installation of some generic bits, but it also requires some localization. It needs to know where to send the results for storage and analysis, and it needs to be able to authenticate to the results server.

The generic bits are packaged as an RPM, available from COPR. Pbench Agent is built for all major releases of Fedora, RHEL, CentOS and openSUSE.

In the following, we describe how to install Pbench Agent using an RPM.

1.2.1 Setup

1. Enable required repos.

```
dnf copr enable ndokos/pbench-0.72
dnf copr enable ndokos/pbench
```

Note:

- We release Pbench Agent RPMs under the `ndokos` COPR account with repos following the pattern `pbench-<release>`.
- There are some RPMs that are shared between versions (e.g. pbench-sysstat). We maintain those in ndokos/pbench repo.
- On a RHEL-based system enable the subscription manager and enable the `EPEL` repo.

2. Install Pbench Agent package

```
dnf install pbench-agent
```

3. Restart terminal/shell session so that all environment varibales and PATH variables are updated

   or

```
source /etc/profile.d/pbench-agent.sh
```

1.3 Ansible based installation

In the following: we describe how to install Pbench Agent using an ANSIBLE playbook.

Note: The same Pbench Agent version must be installed on all the test systems that participate in a benchmark run, there is no support for mixed installations.

1.3.1 Setup

1. Make sure that you have the ANSIBLE package installed.
2. Install the `pbench.agent` ANSIBLE collection from Ansible Galaxy.

```
ansible-galaxy collection install pbench.agent
```

3. Tell ansible where to find these roles.

```
export ANSIBLE_ROLES_PATH=$HOME/.ansible/collections/ansible_collections/pbench/agent/
↪roles:$ANSIBLE_ROLES_PATH
```

4. Create an inventory file (`~/.config/Inventory/myhosts.inv`) naming the hosts on which you wish to install Pbench Agent and the location of the config file. Example inventory file.

Note: if you're planning to push performance data to a 0.69 Pbench Server, you need to specify the server's private RSA key. Example inventory file.

5. Use the example playbook or reference it to customize your own.
6. Run the playbook.

```
ansible-playbook -i ~/.config/Inventory/myhosts.inv pbench_agent_install.yml
```

CHAPTER

TWO

USER GUIDE

2.1 Getting Started

The following is an introduction on how to use the pbench agent.

Pbench can be used to either automate tool execution and postprocessing for you, or also run any of its built-in benchmark scripts. This first test will run the fio benchmark.

2.1.1 Installation

If you have not done so, install `pbench-agent` (via RPM or other Linux distribution supported method, documented in `INSTALL` file).

After `pbench-agent` is installed, verify that your path includes:

```
/opt/pbench-agent:/opt/pbench-agent/util-scripts:/opt/pbench-agent/bench-scripts
```

If you do not have this, you may need to source your `.bashrc`, re-log in, or just run, `. /opt/pbench-agent/profile` to have the path updated.

2.1.2 Tool Registration

After you are certain the path is updated, register the default set of tools:

```
register-tool-set
```

This command will register the default tool set, which consists of `sar`, `mpstat`, `iostat`, `pidstat`, `proc-vmstat`, `proc-interrupts`, and `perf`.

When registering these tools, `pbench-agent` checks if they are installed and may install some of them if they are not present. Some of these tools are built from source, so you may see output from fetching the source and compiling. Following any installation, you should have this output:

```
sar tool is now registered in group default
[debug]tool_opts: default --interval="3"
[debug]checking to see if tool is installed...
iostat is installed
iostat tool is now registered in group default
[debug]tool_opts: default --interval="3"
[debug]checking to see if tool is installed...
mpstat is installed
```

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```
mpstat tool is now registered in group default
[debug]tool_opts: default --interval="3"
[debug]checking to see if tool is installed...
pidstat is installed
pidstat tool is now registered in group default
[debug]tool_opts: default --interval="3"
[debug]checking to see if tool is installed...
proc-vmstat tool is now registered in group default
[debug]tool_opts: default --interval="3"
[debug]checking to see if tool is installed...
proc-interrupts tool is now registered in group default
[debug]tool_opts: default --record-opts="record -a --freq=100"
[debug]checking to see if tool is installed...
perf tool is now registered in group default
```

If at any time you are unsure which tools are registered, you can run:

```
# list-tools
default: perf,proc-interrupts,proc-vmstat,pidstat,mpstat,iostat,sar
```

The output above shows which tools are in the "default" tool group. And by specifying the `--with-options` switch, you get the options used for these tools:

```
# list-tools --with-options
default: perf --record-opts="record -a --freq=100",proc-interrupts --interval="3",
proc-vmstat --interval="3",pidstat --interval="3",mpstat --interval="3",iostat --
↪interval="3",sar --interval="3"
```

In the above example, the `--interval` option is set for all tools but `perf`. Optioonally, you can change these individually with the register-tool command:

```
# register-tool --name=pidstat -- --interval=10
[debug]tool_opts: --interval="10"
[debug]checking to see if tool is installed...
pidstat is installed
pidstat tool is now registered in group default
```

Then run `list-tools --with-options` again to confirm:

```
# list-tools --with-options
default: pidstat --interval="10",perf --record-opts="record -a --freq=100",
proc-interrupts --interval="3",proc-vmstat --interval="3",mpstat --interval="3",iostat --
↪interval="3",sar --interval="3"
```

And the interval for `pidstat` is now `10`.

2.1.3 Running a Benchmark

OK, now that the tools are registered, it's time the run the benchmark. We'll use the `fio` benchmark for this exmaple. To run, simply type 'pbench_fio', the wrapper script `pbench-agent` provides for the `fio` benchmark.

If this is the first time running `fio` via the `pbench-agent`, `pbench-agent` will attempt to download and compile `fio`. You may see quite a bit of output from this. Once `fio` is installed, `pbench-agent` will run several tests by default. Output for each will look something like this:

```
about to run fio read with 4 block size on /tmp/fio
--------fio will use this job file:--------
[global]
bs=4k
ioengine=libaio
iodepth=32
direct=1
time_based=1
runtime=30
[job1]
rw=read
filename=/tmp/fio
size=896M
-----------------------------------------
```

Right before the `pbench_fio` script starts a `fio` job, it will call `start-tools`, which will produce output like this:

```
[debug][start-tools]/opt/pbench-agent/tool-scripts/sar --start --iteration=1-read-4KiB --
↪group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-default␣
↪default --interval="3"
[debug][start-tools]/opt/pbench-agent/tool-scripts/iostat --start --iteration=1-read-
↪4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug][start-tools]/opt/pbench-agent/tool-scripts/mpstat --start --iteration=1-read-
↪4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug][start-tools]/opt/pbench-agent/tool-scripts/pidstat --start --iteration=1-read-
↪4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug][start-tools]/opt/pbench-agent/tool-scripts/proc-vmstat --start --iteration=1-
↪read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/
↪tools-default default --interval="3"
[debug][start-tools]/opt/pbench-agent/tool-scripts/proc-interrupts --start --iteration=1-
↪read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/
↪tools-default default --interval="3"
[debug][start-tools]/opt/pbench-agent/tool-scripts/perf --start --iteration=1-read-4KiB -
↪-group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --record-opts="record -a --freq=100"
```

That is output from `start-tools` starting all of the tools that were registered.

Next is the output from the actual `fio` job:

```
fio: Going to run [/usr/local/bin/fio /var/lib/pbench/fio__2014-09-11_12:54:42/1-read-
↪4KiB/fio.job]
job1: (g=0): rw=read, bs=4K-4K/4K-4K/4K-4K, ioengine=libaio, iodepth=32
```

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```
fio-2.1.7
Starting 1 process
job1: Laying out IO file(s) (1 file(s) / 896MB)

job1: (groupid=0, jobs=1): err= 0: pid=12961: Thu Sep 11 12:55:47 2014
  read : io=1967.4MB, bw=67147KB/s, iops=16786, runt= 30003msec
    slat (usec): min=3, max=77, avg= 7.95, stdev= 2.45
    clat (msec): min=1, max=192, avg= 1.90, stdev= 1.48
     lat (msec): min=1, max=192, avg= 1.90, stdev= 1.48
    clat percentiles (usec):
     |  1.00th=[ 1736],  5.00th=[ 1736], 10.00th=[ 1752], 20.00th=[ 1752],
     | 30.00th=[ 1768], 40.00th=[ 1768], 50.00th=[ 1768], 60.00th=[ 1912],
     | 70.00th=[ 1912], 80.00th=[ 2064], 90.00th=[ 2096], 95.00th=[ 2224],
     | 99.00th=[ 2256], 99.50th=[ 2256], 99.90th=[10304], 99.95th=[10816],
     | 99.99th=[44800]
    bw (KB  /s): min=34373, max=70176, per=100.00%, avg=67211.32, stdev=5212.44
    lat (msec) : 2=78.09%, 4=21.73%, 10=0.05%, 20=0.10%, 50=0.01%
    lat (msec) : 100=0.01%, 250=0.01%
  cpu          : usr=5.97%, sys=22.23%, ctx=501089, majf=0, minf=332
  IO depths    : 1=0.1%, 2=0.1%, 4=0.1%, 8=0.1%, 16=0.1%, 32=100.0%, >=64=0.0%
     submit    : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.0%, 64=0.0%, >=64=0.0%
     complete  : 0=0.0%, 4=100.0%, 8=0.0%, 16=0.0%, 32=0.1%, 64=0.0%, >=64=0.0%
     issued    : total=r=503651/w=0/d=0, short=r=0/w=0/d=0
     latency   : target=0, window=0, percentile=100.00%, depth=32

Run status group 0 (all jobs):
   READ: io=1967.4MB, aggrb=67146KB/s, minb=67146KB/s, maxb=67146KB/s, mint=30003msec,␣
↪maxt=30003msec

Disk stats (read/write):
    dm-1: ios=501328/154, merge=0/0, ticks=947625/12780, in_queue=960429, util=99.53%,␣
↪aggrios=503626/101, aggrmerge=25/55, aggrticks=949096/9541, aggrin_queue=958491,␣
↪aggrutil=99.49%
  sda: ios=503626/101, merge=25/55, ticks=949096/9541, in_queue=958491, util=99.49%
```

Now that this `fio` job is complete, the `pbench_fio` script calls `stop-tools`:

```
[debug][stop-tools]/opt/pbench-agent/tool-scripts/sar --stop --iteration=1-read-4KiB --
↪group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-default␣
↪default --interval="3"
[debug][stop-tools]/opt/pbench-agent/tool-scripts/iostat --stop --iteration=1-read-4KiB -
↪-group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug]stopping sar
[debug][stop-tools]/opt/pbench-agent/tool-scripts/mpstat --stop --iteration=1-read-4KiB -
↪-group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug]stopping iostat
[debug][stop-tools]/opt/pbench-agent/tool-scripts/pidstat --stop --iteration=1-read-4KiB␣
↪--group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug]stopping mpstat
```

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```
[debug][stop-tools]/opt/pbench-agent/tool-scripts/proc-vmstat --stop --iteration=1-read-
↪4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-
↪default default --interval="3"
[debug]stopping pidstat
[debug][stop-tools]/opt/pbench-agent/tool-scripts/proc-interrupts --stop --iteration=1-
↪read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/
↪tools-default default --interval="3"
[debug]stopping proc-vmstat
[debug][stop-tools]/opt/pbench-agent/tool-scripts/perf --stop --iteration=1-read-4KiB --
↪group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/tools-default␣
↪default --record-opts="record -a --freq=100"
[debug]stopping proc-interrupts
waiting for PID 12934 (perf) to finish
```

Next, `pbench_fio` calls `postprocess-tools`. This is what generates the `.csv` files and renders the `.html` file containing the NVD3 graphs for the tool data.

```
collecting /proc
collecting /sys
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/sar --postprocess --iteration=1-
↪read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-read-4KiB/
↪tools-default default --interval="3"
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/iostat --postprocess --
↪iteration=1-read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-
↪read-4KiB/tools-default default --interval="3"
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/mpstat --postprocess --
↪iteration=1-read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-
↪read-4KiB/tools-default default --interval="3"
[debug]postprocessing iostat
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/pidstat --postprocess --
↪iteration=1-read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-
↪read-4KiB/tools-default default --interval="3"
[debug]postprocessing mpstat
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/proc-vmstat --postprocess --
↪iteration=1-read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-
↪read-4KiB/tools-default default --interval="3"
[debug]postprocessing pidstat
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/proc-interrupts --postprocess --
↪iteration=1-read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-
↪read-4KiB/tools-default default --interval="3"
[debug]postprocessing proc-vmstat
[debug][postprocess-tools]/opt/pbench-agent/tool-scripts/perf --postprocess --
↪iteration=1-read-4KiB --group=default --dir=/var/lib/pbench/fio__2014-09-11_12:54:42/1-
↪read-4KiB/tools-default default --record-opts="record -a --freq=100"
[debug]postprocessing proc-interrupts
```

This will repeat for a total of 6 different `fio` jobs, then the `fio` benchmark will be complete. Now that the job is complete, we want to move the results to the archive host. The results are currently in /var/lib/pbench/fio-. To move these results, simply run:

```
# move-results
```

Once that command completes, the data should be moved to the configured archive host. To view your results, use

a link like this in your browser (replacing the "resultshost.example.com" with your pbench deployed web server, and replacing the "your-HOSTNAME" with the $(hostname -s) of the machine where you issued the "move-results" above):

http://resultshost.example.com/results//?C=M;O=D

Towards the top of the list, there should be a directory like "`fio__2014-09-11_12:54:42`". That is your pbench `fio` job. Click on that directory to see the results.

There should be a file, `fio-summary.txt`, which will contain the results for all of the `fio` jobs that were run.

In this same directory, there should be more sub-directories, one for each `fio` job. They should have a format like "`N-[read|write]-MKiB`". In pbench-speak, these are called an "iteration" and usually start with "1-". Under each of these you will find the details of that job/iteration:

- `fio.cmd`: the actual `fio` command used
- `fio.job`: the job file `pbench_fio` created
- `result.txt`: the output from the `fio` job
- `tool-default`: all of the collected tool data
- `sysinfo`: data `pbench_fio` collected from `/sys` & `/proc`

Under the `tools-default` directory, there should be text output for each tool as well as `.html` files, and a `csv` sub-directory containing all of the raw tool data.

2.2 User Guide

Contents

2.2.1 What is Pbench?

Pbench is a harness that allows data collection from a variety of tools while running a benchmark. Pbench has some built-in scripts that run some common benchmarks, but the data collection can be run separately as well with a benchmark that is not built-in to Pbench, or a Pbench script can be written for the benchmark. Such contributions are more than welcome!

2.2.2 TL;DR - How to set up Pbench and run a benchmark

Prerequisite: Somebody has already done the server setup.

The following steps assume that only a single node participates in the benchmark run. If you want a multi-node setup, you have to read up on the –remote options of various commands (in particular, pbench-register-tool-set):

- Install the agent
- Customize the agent for your server environment. This will vary from installation to installation, but it fundamentally involves copying two files that should be made available to you somehow by an admin type: an ssh private key file to allow the client(s) to send results to the server and a configuration file that should be installed in `/opt/pbench-agent/config/pbench-agent.cfg` . There is an example configuration file in that location, but you need the "real" one for your environment. Among other things, the config file specifies the IP or hostname of the server.
- Run your benchmark with a default set of tools:

```
. /etc/profile.d/pbench-agent.sh         # or log out and log back in
pbench-register-tool-set
pbench-user-benchmark -C test1 -- ./your_cmd.sh
pbench-move-results
```

- Visit the Results URL in your browser to see the results: the URL depends on the server hostname or IP"; assuming that the server is "pbench.example.com" and assuming you ran the above on a host named "myhost", the results will be found at (**N.B.:** this is a fake link serving as an example only - talk to your local administrator to find out what server to use to get to Pbench results): http://pbench.example.com/results/myhost/pbench-user-benchmark_test1_yyyy-mm-dd_HH:MM:SS.

For explanations and details, see subsequent sections.

2.2.3 How to install

See the install section for details.

2.2.4 Defaults

The benchmark scripts source the base script (/opt/pbench-agent/base) which sets a bunch of defaults:

```
pbench_run=/var/lib/pbench-agent
pbench_log=/var/lib/pbench-agent/pbench.log
date=`date "+%F_%H:%M:%S"`
hostname=`hostname -s`
results_repo=pbench@pbench.example.com
results_repo_dir=/pbench/public_html/incoming
ssh_opts='-o StrictHostKeyChecking=no'
```

These are now specified in the config file `/opt/pbench-agent/config/pbench-agent.cfg`.

2.2.5 Available tools

The configured default set of tools (what you would get by running pbench-register-tool-set) is:

- sar, iostat, mpstat, pidstat, proc-vmstat, proc-interrupts, perf

In addition, there are tools that can be added to the default set with pbench-register-tool:

- blktrace, cpuacct, dm-cache, docker, kvmstat, kvmtrace, lockstat, numastat, perf, porc-sched_debug, proc-vmstat, qemu-migrate, rabbit, strace, sysfs, systemtap, tcpdump, turbostat, virsh-migrate, vmstat

There is a default group of tools (that's what pbench-register-tool-set uses), but tools can be registered in other groups using the –group option of pbench-register-tool. The group can then be started and stopped using pbench-start-tools and pbench-stop-tools using their –group option.

Additional tools can be registered:

```
pbench-register-tool --name blktrace
```

or unregistered (e.g. some people prefer to run without perf):

```
pbench-unregister-tool --name perf
```

Note that perf is run in a "low overhead" mode with options "record -a –freq=100", but if you want to run it differently, you can always unregister it and register it again with different options:

```
pbench-unregister-tool --name=perf
pbench-register-tool --name=perf -- --record-opts="record -a --freq=200"
```

Tools can be also be registered, started and stopped on remote hosts (see the –remote option described in What does –remote do? in FAQ section.

2.2.6 Available benchmark scripts

Pbench provides a set of pre-packaged scripts to run some common benchmarks using the collection tools and other facilities that pbench provides. These are found in the bench-scripts directory of the Pbench installation (`/opt/pbench-agent/bench-scripts` by default). The current set includes:

- pbench fio
- pbench-linpack
- pbench-specjbb2005
- pbench-uperf
- pbench-user-benchmark (see *Running Pbench collection tools with an arbitrary benchmark* below for more on this)

You can run any of these with the –help option to get basic information about how to run the script. Most of these scripts accept a standard set of generic options, some semi-generic ones that are common to a bunch of benchmarks, as well as some benchmark specific options that vary from benchmark to benchmark.

The generic options are:

–help	show the set of options that the benchmark accepts.
–config	the name of the testing configuration (user specified).
–tool-group	the name of the tool group specifying the tools to run during execution of the benchmark.
–install	just install the benchmark (and any other needed packages) - do not run the benchmark.

The semi-generic ones are:

–test-types	the test types for the given benchmark - the values are benchmark-specific and can be obtained using –help.
–runtime	maximum runtime in seconds.
–clients	list of hostnames (or IPs) of systems that run the client (drive the test).
–samples	the number of samples per iteration.
–max-stddev	the percent maximum standard deviation allowed in order to consider the iteration to pass.
–max-failures	the maximum number of failures to achieve the allowed standard deviation.
–postprocess-only	
–run-dir	
–start-iteration-num	
–tool-label-pattern	

Benchmark-specific options are called out in the following sections for each benchmark.

Note that in some of these scripts the default tool group is hard-wired: if you want them to run a different tool group, you need to edit the script.

2.2.6.1 pbench-fio

Iterations are the cartesian product targets X test-types X block-sizes. More information on many of the following can be obtained from the fio man page.

–direct	O_DIRECT enabled or not (1/0) - default is 1.
–sync	O_SYNC enabled or not (1/0) - default is 0.
–rate-iops	IOP rate not to be exceeded (per job, per client)
–ramptime	seconds - time to warm up test before measurement.
–block-sizes	list of block sizes - default is 4, 64, 1024.
–file-size	fio will create files of this size during the job run.
–targets	file locations (list of directory/block device).
–job-mode	serial/concurrent - default is concurrent.
–ioengine	any IO engine that fio supports (see the fio man page) - default is psync.
–iodepth	number of I/O units to keep in flight against the file.
–client-file	file containing list of clients, one per line.
–numjobs	number of clones (processes/threads performing the same workload) of this job - default is 1.
–job-file	if you need to go beyond the recognized options, you can use a fio job file.
–unique-ports	use different ports for each client (needed if e.g. multiple clients on one system)

2.2.6.2 pbench-linpack

Note: TBD

2.2.6.3 pbench-specjbb2005

Note: TBD

2.2.6.4 pbench-uperf

–kvm-host
–message-sizes
–protocols
–instances
–servers
–server-nodes
–client-nodes
–log-response-times

2.2.6.5 pbench-user-benchmark

Note: TBD

2.2.7 Utility Scripts

This section is needed as preparation for the *Second Steps* section below.

Pbench uses a bunch of utility scripts to do common operations. There is a common set of options for some of these: –name to specify a tool, –group to specify a tool group, –with-options to list or pass options to a tool, –remote to operate on a remote host (see entries in the FAQ section for more details on these options).

The first set is for registering and unregistering tools and getting some information about them:

Command	Description
pbench-list-tools	list the tools in the default group or in the specified group; with the –name option, list the groups that the named tool is in. TBD: how do you list all available tools whether in a group or not?
pbench-register-tool-set	call pbench-register-tool on each tool in the default list.
pbench-register-tool	add a tool to a tool group (possibly remotely).
pbench-unregister-tool (Obsolete)	remove a tool from a tool group (possibly remotely).
pbench-clear-tools	remove a tool or all tools from a specified tool group (including remotely). Used with a –name option, it replaces pbench -unregistered-tool.

The second set is for controlling the running of tools – pbench-start-tools and pbench-stop-tools, as well as pbench-postprocess- tools below, take –group, –dir and –iteration options: which group of tools to start/stop/postprocess, which directory to use to stash results and a label to apply to this set of results. pbench-kill-tools is used to make sure that all running tools are stopped: having a bunch of tools from earlier runs still running has been known to happen and is the cause of many problems (slowdowns in particular):

Command	Description
pbench-start-tools	start a group of tools, stashing the results in the directory specified by –dir.
pbench-stop-tools	stop a group of tools
pbench-kill-tools	make sure that no tools are running to pollute the environment.

The third set is for handling the results and doing cleanup:

Command	Description
pbench-postprocess-tools	run all the relevant postprocessing scripts on the tool output - this step also gathers up tool output from remote hosts to the local host in preparation for copying it to the results repository.
pbench-clear-results	start with a clean slate.
pbench-copy-results	copy results to the results repo.
pbench-move-results	move the results to the results repo and delete them from the local host.
pbench-edit-prefix	change the directory structure of the results (see the *Accessing results on the web* section below for details).
pbench-cleanup	clean up the pbench run directory - after this step, you will need to register any tools again.

pbench-register-tool-set, pbench-register-tool and pbench-unregister-tool can also take a –remote option (see What does –remote do?) in FAQ section in order to allow the starting/stopping of tools and the postprocessing of results on multiple remote hosts.

There is a set of miscellaneous tools for doing various and sundry things - although the name of the script indicates its purpose, if you want more information on these, you will have to read the code:

- pbench-log-timestamp

These are used by various pieces of Pbench. There is also a contrib directory that contains completely unsupported tools that various people have found useful.

2.2.8 Second Steps

Warning: It is highly recommended that you use one of the pbench-< benchmark> scripts for running your benchmark. If one does not exist already, you might be able to use the pbench-user-benchmark script to run your own script. The advantage is that these scripts already embody some conventions that Pbench and associated tools depend on, e.g. using a timestamp in the name of the results directory to make the name unique. If you cannot use pbench-user-benchmark and a pbench-< benchmark> script does not exist already, consider writing one or helping us write one. The more we can encapsulate all these details into generally useful tools, the easier it will be for everybody: people running it will not need to worry about all these details and people maintaining the system will not have to fix stuff because the script broke some assumptions. The easiest way to do so is to crib an existing pbench- script, e.g pbench-fio.

Once collection tools have been registered, the work flow of a benchmark script is as follows:

- Process options (see *Benchmark scripts options*).
- Check that the necessary prerequisites are installed and if not, install them.
- Iterate over some set of benchmark characteristics (e.g. pbench-fio iterates over a couple test types: read, randread and a bunch of block sizes), with each iteration doing the following:
  - create a benchmark_results directory
  - start the collection tools
  - run the benchmark
  - stop the collection tools
  - postprocess the collection tools data

The tools are started with an invocation of pbench-start-tools like this:

```
pbench-start-tools --group=$group --iteration=$iteration --dir=$benchmark_tools_dir
```

where the group is usually "default" but can be changed to taste as described above, iteration is a benchmark-specific tag that disambiguates the separate iterations in a run (e.g. for pbench-fio it is a combination of a count, the test type, the block size and a device name), and the benchmark_tools_dir specifies where the collection results are going to end up (see the section for much more detail on this).

The stop invocation is parallel, as is the postprocessing invocation:

```
pbench-stop-tools --group=$group --iteration=$iteration --dir=$benchmark_tools_dir
pbench-postprocess-tools --group=$group --iteration=$iteration --dir=$benchmark_tools_dir
```

2.2.8.1 Benchmark scripts options

Generally speaking, benchmark scripts do not take any pbench-specific options except –config (see What does –config do? in FAQ section). Other options tend to be benchmark-specific.

2.2.8.2 Collection tools options

–help can be used to trigger the usage message on all of the tools (even though it's an invalid option for many of them). Here is a list of gotcha's:

- blktrace: you need to pass –devices=/dev/sda,/dev/sdb when you register the tool:

```
pbench-register-tool --name=blktrace [--remote=foo] -- --devices=/dev/sda,/dev/sdb
```

There is no default and leaving it empty causes errors in postprocessing (this should be flagged).

2.2.8.3 Utility script options

Note that pbench-move-results, pbench-copy-results and pbench-clear-results always assume that the run directory is the default `/var/lib/pbench-agent`.

pbench-move-results and pbench-copy-results now (starting with Pbench version 0.31-108gf016ed6) take a –prefix option. This is explained in the *Accessing results on the web* section below.

Note also that pbench-start/stop/postprocess-tools must be called with exactly the same arguments. The built-in benchmark scripts do that already, but if you go your own way, make sure to follow this dictum.

–dir

specify the run directory for all the collections tools. This argument **must** be used by `pbench-start/stop/postprocess-tools`, so that all the results files are in known places:

```
pbench-start-tools --dir=/var/lib/pbench-agent/foo
pbench-stop-tools --dir=/var/lib/pbench-agent/foo
pbench-postprocess-tools --dir=/var/lib/pbench-agent/foo
```

–remote

specify a remote host on which a collection tool (or set of collection tools) is to be registered:

```
pbench-register-tool --name=< tool> --remote=< host>
```

2.2.9 Running Pbench collection tools with an arbitrary benchmark

If you want to take advantage of Pbench's data collection and other goodies, but your benchmark is not part of the set above (see *Available benchmark scripts*), or you want to run it differently so that the pre-packaged script does not work for you, that's no problem (but, if possible, heed the WARNING above). The various Pbench phases can be run separately and you can fit your benchmark into the appropriate slot:

```
group=default
benchmark_tools_dir=TBD

pbench-register-tool-set --group=$group
pbench-start-tools --group=$group --iteration=$iteration --dir=$benchmark_tools_dir
```

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```
< run your benchmark>
pbench-stop-tools --group=$group --iteration=$iteration --dir=$benchmark_tools_dir
pbench-postprocess-tools --group=$group --iteration=$iteration --dir=$benchmark_tools_dir
pbench-copy-results
```

Often, multiple experiments (or "iterations") are run as part of a single run. The modified flow then looks like this:

```
group=default
experiments="exp1 exp2 exp3"
benchmark_tools_dir=TBD

pbench-register-tool-set --group=$group
for exp in $experiments ;do
     pbench-start-tools --group=$group --iteration=$exp
     < run the experiment>
     pbench-stop-tools --group=$group --iteration=$exp
     pbench-postprocess-tools --group=$group --iteration=$exp
done
pbench-copy-results
```

Alternatively, you may be able to use the pbench-user-benchmark script as follows:

```
pbench-user-benchmark --config="specjbb2005-4-JVMs" -- my_benchmark.sh
```

which is going to run my_benchmark.sh in the < run your benchmark> slot above. Iterations and such are your responsibility.

pbench-user-benchmark can also be used for a somewhat more specialized scenario: sometimes you just want to run the collection tools for a short time while your benchmark is running to get an idea of how the system looks. The idea here is to use pbench- user-benchmark to run a sleep of the appropriate duration in parallel with your benchmark:

```
pbench-user-benchmark --config="specjbb2005-4-JVMs" -- sleep 10
```

will start data collection, sleep for 10 seconds, then stop data collection and gather up the results. The config argument is a tag to distinguish this data collection from any other: you will probably want to make sure it's unique.

This works well for one-off scenarios, but for repeated usage on well defined phase changes you might want to investigate *Triggers*.

2.2.10 Remote hosts

2.2.10.1 Multihost benchmarks

Usually, a multihost benchmark is run using a host that acts as the "controller" of the run. There is a set of hosts on which data collection is to be performed while the benchmark is running. The controller may or may not be itself part of that set. In what follows, we assume that the controller has password-less ssh access to the relevant hosts.

The recommended way to run your workload is to use the generic pbench-user-benchmark script. The workflow in that case is:

- Register the collection tools on each host in the set:

```
for host in $hosts ;do
    pbench-register-tool-set --remote=$host
done
```

- Invoke pbench-user-benchmark with your workload generator as argument: that will start the collection tools on all the hosts and then run your workload generator; when that finishes, it will stop the collection tools on all the hosts and then run the postprocessing phase which will gather the data from all the remote hosts and run the postprocessing tools on everything.
- Run pbench-copy-results or pbench-move-results to upload the data to the results server.

If you cannot use the pbench-user-benchmark script, then the process becomes more manual. The workflow is:

- Register the collection tools on **each** host as above.
- Invoke pbench-start-tools on the controller: that will start data collection on all of the remote hosts.
- Run the workload generator.
- Invoke pbench-stop-tools on the controller: that will stop data collection on all of the remote hosts.
- Invoke pbench-postprocess-tools on the controller: that will gather all the data from the remotes and run the postprocessing tools on all the data.
- Run pbench-copy-results or pbench-move-results to upload the data to the results server.

2.2.11 Customizing

Some characteristics of Pbench are specified in config files and can be customized by adding your own config file to override the default settings. TBD

2.2.12 Results handling

2.2.12.1 Accessing results on the web

This section describes how to get to your results using a web browser. It describes how pbench-move-results moves the results from your local controller to a centralized location and what happens there. It also describes the –prefix option to pbench-move -results (and pbench-copy-results) and a utility script, pbench-edit-prefix, that allows you to change how the results are viewed.

2.2.12.2 Where to go to see results

Where pbench-move/copy-results copies the results is site-dependent. Check with the admin who set up the Pbench server and provided you with the configuration file for the pbench-agent installation.

2.2.13 Advanced topics

2.2.13.1 Triggers

Triggers are groups of tools that are started and stopped on specific events. They are registered with pbench-register-tool-trigger using the –start-trigger and –stop-trigger options. The output of the benchmark is piped into the pbench-tool-trigger tool which detects the conditions for starting and stopping the specified group of tools.

There are some commands specifically for triggers:

Command	Description
pbench-register-tool-trigger	register start and stop triggers for a tool group.
pbench-list-triggers	list triggers and their start/stop criteria.
pbench-tool-trigger	this is a Perl script that looks for the start-trigger and end-trigger markers in the benchmark's output, starting and stopping the appropriate group of tools when it finds the corresponding marker.

2.3 Man pages

2.3.1 Commands by functional group

2.3.1.1 Performance tool management commands

- *pbench-clear-results*
- *pbench-clear-tools*
- *pbench-list-tools*
- *pbench-list-triggers*
- *pbench-register-tool*
- *pbench-register-tool-set*
- *pbench-register-tool-trigger*

2.3.1.2 Benchmark commands

- *pbench-user-benchmark*

2.3.1.3 Upload to Pbench Server

Pbench Server 0.69

The 0.69 variant of Pbench Server relies on a private `id_rsa` key for the Pbench Server's `pbench` user in order to upload data to the server using `ssh` protocols. Results on the server have no ownership, and are visible to everyone. Results cannot be deleted except by administrators.

- *pbench-move-results*
- *pbench-copy-results*

Pbench Server 1.0

The 1.0 variant of Pbench Server relies on OIDC2 authentication to identify specific users. Data is uploaded to the server through HTTPS APIs, so that all results are owned and managed by the individual user. Results can be published to make them accessible to other users.

- *pbench-results-move*

2.3.2 Commands

2.3.2.1 pbench-clear-results

NAME

`pbench-clear-results` - clears the result directory

SYNOPSIS

`pbench-clear-results [OPTIONS]`

DESCRIPTION

This command clears the results directories from `/var/lib/pbench-agent` directory.

OPTIONS

[`-C`, `--config`] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the `_PBENCH_AGENT_CONFIG` environment variable.

`--help`
Show this message and exit.

2.3.2.2 pbench-clear-tools

NAME

`pbench-clear-tools` - clear registered tools by name or group

SYNOPSIS

`pbench-clear-tools [OPTIONS]`

DESCRIPTION

Clear all tools which are registered and can filter by name of the group.

OPTIONS

[`-C`, `--config`] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the `_PBENCH_AGENT_CONFIG` environment variable.

[`-n`, `--name`, `--names`] <name>
Clear only the <name> tool.

[`-g`, `--group`, `--groups`] <group>
Clear the tools in the <group>. If no group is specified, the `default` group is assumed.

[`-r`, `--remote`, `--remotes`] <host>[,<host>]...
Clear the tool(s) only on the specified remote(s). Multiple remotes may be specified as a comma-separated list. If no remote is specified, all remotes are cleared.

`--help`
Show this message and exit.

2.3.2.3 pbench-copy-results

NAME

`pbench-copy-results` - copy result tarball to a Pbench Server

SYNOPSIS

`pbench-copy-results --user=<user> [OPTIONS]`

DESCRIPTION

Push all accumulated benchmark results to a Pbench Server without removing them from the local host.

OPTIONS

`--user <user>`
This option value is required if not provided by the `PBENCH_USER` environment variable; otherwise, a value provided on the command line will override any value provided by the environment.

`--controller <controller>`
This option may be used to override the value provided by the `PBENCH_CONTROLLER` environment variable; if neither value is available, the result of `hostname -f` is used. (If no value is available, the command will exit with an error.)

`--prefix <prefix>`
This option allows the user to specify an optional directory-path hierarchy to be used when displaying the result files on the Pbench Server.

`--show-server`
This will not move any results but will resolve and then display the pbench server destination for results.

`--xz-single-threaded`
This will force the use of a single thread for locally compressing the result files.

`--help`
Show this message and exit.

2.3.2.4 pbench-list-tools

NAME

`pbench-list-tools` - list all the registered tools optionally filtered by name or group

SYNOPSIS

`pbench-list-tools [OPTIONS]`

DESCRIPTION

List tool registrations, optionally filtered by tool name or tool group.

OPTIONS

[`-C`, `--config`] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the `_PBENCH_AGENT_CONFIG` environment variable.

[`-n`, `--name`] <name>
List the tool groups in which tool <name> is registered.

[`-g`, `--group`] <group>
List all the tools registered in the <group>.

`-o`, `--with-option`
List the options with each tool.

`--help`
Show this message and exit.

2.3.2.5 pbench-list-triggers

NAME

`pbench-list-triggers` - list the registered triggers by group

SYNOPSIS

`pbench-list-triggers [OPTIONS]`

DESCRIPTION

This command will list all the registered triggers by `group-name`.

OPTIONS

[`-C`, `--config`] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the `_PBENCH_AGENT_CONFIG` environment variable.

[`-g`, `--group`, `--groups`] <group>
List all the triggers registered in the <group>.

`--help`
Show this message and exit.

2.3.2.6 pbench-move-results

NAME

`pbench-move-results` - move all results to a Pbench Server

SYNOPSIS

`pbench-move-results [OPTIONS]`

DESCRIPTION

Push all accumulated benchmark results to a Pbench Server. On successful completion, this command removes the results from the local host.

OPTIONS

`--user <user>`
This option value is required if not provided by the `PBENCH_USER` environment variable; otherwise, a value provided on the command line will override any value provided by the environment.

`--controller <controller>`
This option may be used to override the value provided by the `PBENCH_CONTROLLER` environment variable; if neither value is available, the result of `hostname -f` is used. (If no value is available, the command will exit with an error.)

`--prefix <prefix>`
This option allows the user to specify an optional directory-path hierarchy to be used when displaying the result tar balls on the pbench server.

`--show-server`
This will not move any results but will resolve and then display the pbench server destination for results.

`--xz-single-threaded`
This will force the use of a single thread for locally compressing the result files.

`--help`
Show this message and exit.

2.3.2.7 pbench-register-tool

NAME

`pbench-register-tool` - registers the specified tool

SYNOPSIS

`pbench-register-tool --name=<tool-name> [OPTIONS] [-- <tool-specific-options>]`

DESCRIPTION

Register the specified tool. List of available tools:

Transient

- blktrace
- bpftrace
- cpuacct
- disk
- dm-cache
- docker
- docker-info
- external-data-source
- haproxy-ocp
- iostat
- jmap
- jstack
- kvm-spinlock
- kvmstat
- kvmtrace
- lockstat
- mpstat
- numastat
- oc
- openvswitch
- pcp-transient
- perf
- pidstat
- pprof
- proc-interrupts
- proc-sched_debug
- proc-vmstat

- prometheus-metrics
- qemu-migrate
- rabbit
- sar
- strace
- sysfs
- systemtap
- tcpdump
- turbostat
- user-tool
- virsh-migrate
- vmstat

Persistent

- node-exporter
- dcgm
- pcp

For a list of tool-specific options, run:

```
/opt/pbench-agent/tool-scripts/<tool-name> --help
```

OPTIONS

`--name <tool-name>`
`<tool-name>` specifies the name of the tool to be registered.

[`-g`, `--group`, `--groups`] `<group>`
Register the tool in `<group>`. If no group is specified, the `default` group is assumed.

`[--persistent | --transient]`
For tools which can be run as either "transient" (where they are started and stopped on each iteration) or as "persistent" (where they are started before the first iteration and run continuously over all iterations), these options determine how the tool will be run.

Most tools can be run only in one mode, so these options are necessary only when a tool (such as `pcp`) can be run in either mode. Specifying a mode the tool does not support will produce an error.

`--no-install`
[To be supplied]

`--labels=<label>[,<label>]...`
Where the list of labels must match the list of remotes.

`--remotes <host>[,<host>]... | @<file>`
A single remote host, a list of remote hosts (comma-separated, no spaces) or an "at" sign (`@`) followed by a filename. In this last case, the file should contain a list of hosts and their (optional) labels. Each line of the file should contain a hostname, optionally followed by a label separated by a comma (`,`); empty lines are ignored, and comments are denoted by a leading hash (`#`), character.

`--help`
Show this message and exit.

2.3.2.8 pbench-register-tool-set

NAME

`pbench-register-tool-set` - register the specified toolset

SYNOPSIS

`pbench-register-tool-set [OPTIONS] <tool-set>`

DESCRIPTION

Register all the tools in the specified toolset.

Available <`tool-set`> from /opt/pbench-agent/config/pbench-agent.cfg:

- heavy
- legacy
- light
- medium

OPTIONS

`--remotes <host>[,<host>]... | @<file>`
Single remote host, a list of remote hosts (comma-separated, no spaces) or an "at" sign (`@`) followed by a filename. In this last case, the file should contain a list of hosts and their (optional) labels. Each line of the file should contain a hostname, optionally followed by a label separated by a comma (`,`); empty lines are ignored, and comments are denoted by a leading hash (`#`), character.

[`-g`, `--group`] <`group`>
Register the toolset in <`group`>. If no group is specified, the `default` group is assumed.

`--labels=<label>[,<label>]...`
Where the list of labels must match the list of remotes. If a remotes file is specified with `--remotes @<file>` then labels are read from the file instead.

`--interval=<interval>`
Define a default interval for tools.

`--no-install`
Don't check whether the expected tools are installed when registering. This can lead to unexpected errors later, but may also allow running with nonstandard tool versions if there are no binary incompatibilities.

`--help`
Show this message and exit.

2.3.2.9 pbench-register-tool-trigger

NAME

`pbench-register-tool-trigger` - register the tool trigger

SYNOPSIS

`pbench-register-tool-trigger [OPTIONS]`

DESCRIPTION

Register triggers which start and stop data collection for the given tool group.

OPTIONS

[-C, --config] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the _PBENCH_AGENT_CONFIG environment variable.

[-g, --group, --groups] <group>
Registers the trigger in the <group>. If no group is specified, the default group is assumed.

--start-trigger <string>
[To be supplied]

--stop-trigger <string>
[To be supplied]

--help
Show this message and exit.

2.3.2.10 pbench-results-move

NAME

pbench-results-move - move results directories to a Pbench Server

SYNOPSIS

pbench-results-move [OPTIONS]

DESCRIPTION

This command uploads all accumulated results to a Pbench Server.

Two modes are supported:

1. The results are pushed directly to a Pbench Server using the API Key authentication token specified by --token and will be owned by that user. The Pbench Server URI can be specified with --server, or will be defaulted from the active configuration file.
2. The results are pushed to a Relay server rather than directly to a Pbench Server, and the command will report the URI of a Relay manifest. The Pbench Server can later be used to pull the results by supplying the full Relay manifest URI. The Relay server may be located on any network host accessible to both the Pbench Agent and the Pbench Server to allow uploading results through a firewall.

On successful completion, the result directories are removed from the local system unless --no-delete is specified.

OPTIONS

[-C, --config] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the _PBENCH_AGENT_CONFIG environment variable.

--relay <relay>
Instead of pushing results directly to a Pbench Server, push them to a Relay server at the specified address. For example, https://myrelay.example.com.

--server <server>
Override the default server address in the Pbench Agent configuration file and push results to the specified Pbench Server address. For example, https://pbench.example.com. This often allows a Pbench Agent to push results without creating a customized Pbench Agent configuration file.

--controller <controller>
Override the default controller name.

--token <token>
Pbench Server API key [required unless --relay is specified].

--delete | --no-delete
Remove local data after successful copy [default: delete]

--xz-single-threaded
Use single-threaded compression with xz.

--help
Show this message and exit.

2.3.2.11 pbench-user-benchmark

NAME

pbench-user-benchmark - run a workload and collect performance data

SYNOPSIS

pbench-user-benchmark [OPTIONS] <command-to-run>

DESCRIPTION

Collects data from the registered tools while running a user-specified action. This can be a specific synthetic benchmark workload, a real workload, or simply a delay to measure system activity.

Invoking pbench-user-benchmark with a workload generator as an argument will perform the following steps:

- Start the collection tools on all the hosts.
- Execute the workload generator.
- Stop the collection tools on all the hosts.
- Gather the data from all the remote hosts and generate a result.txt file by running the tools' post-processing on the collected data.

<command-to-run>
A script, executable, or shell command to run while gathering tool data. Use -- to stop processing of pbench-user-benchmark options if your command includes options, like

```
pbench-user-benchmark --config string -- fio --bs 16k
```

OPTIONS

[-C, --config] <path>
Path to the Pbench Agent configuration file. This option is required if not provided by the _PBENCH_AGENT_CONFIG environment variable.

--tool-group <tool-group>
The tool group to use for data collection.

`--iteration-list <file>`
A file containing a list of iterations to run for the provided script. The file must contain one iteration per line. Empty lines are ignored, and comments are denoted by a leading hash (#) character. Each iteration line should use alpha-numeric characters before the first space to name the iteration, with the rest of the line provided as arguments to the script.

NOTE: –iteration-list is not compatible with –use-tool-triggers.

`--sysinfo <module>[,<module>]...`
Comma-separated values of system information to be collected; available: `default`, `none`, `all`, `ara`, `block`, `insights`, `kernel_config`, `libvirt`, `security_mitigations`, `sos`, `stockpile`, `topology`

`--pbench-pre <pre-script>`
Path to the script which will be executed before tools are started.

NOTE: –pbench-pre is not compatible with –use-tool-triggers.

`--pbench-post <post-script>`
Path to the script which will be executed after tools are stopped and postprocessing is complete.

NOTE: –pbench-post is not compatible with –use-tool-triggers.

`--use-tool-triggers`
Use tool triggers instead of normal start/stop sequence when starting and stopping iterations.

Tool triggers allow starting and stopping tool data collection based on data in the `<command-to-run>` output stream to allow collecting data over parts of the execution, dynamically.

NOTE: –use-tool-triggers is not compatible with –iteration-list, –pbench-pre, or –pbench-post.

[TODO: Document the register/list tool trigger commands]

`--no-stderr-capture`
Do not capture the standard error output of the script in the `result.txt` file

`--help`
Show this message and exit.

2.4 End-to-End Workflow

Each command in pbench-agent accepts the `--help` option and outputs a brief usage message

The default set of tools for data collection can be enabled with

```
$pbench-register-tool-set
```

To list all your registered tools

```
$pbench-list-tools
```

You may then perform a built-in benchmark by running it's Pbench script

```
$pbench-user-benchmark - sleep 10
```

The above command will collect data from the registered tools for the specified time period and save it in the `/var/lib/pbench-agent` directory.

To move the results, the outcomes are tarred and sent to the configured pbench-server with

```
$pbench-results-move
```

CHAPTER

THREE

FAQ

CHAPTER

FOUR

PBENCH SERVER API DOCUMENTATION

The Pbench Server API provides the interface to Pbench data for use by the UI dashboard as well as any other web clients.

The Pbench Server provides a set of HTTP endpoints to manage user authentication and curated performance information, called "dataset resources" or just "datasets".

The V1 API provides a REST-like functional interface.

The Pbench Server APIs accept parameters from a variety of sources. See the individual API documentation for details.

1. Some parameters, especially "resource ids", are embedded in the URI, such as `/api/v1/datasets/<resource_id>`;
2. Some parameters are passed as query parameters, such as `/api/v1/datasets?name:fio`;
3. For `PUT` and `POST` APIs, parameters may also be passed as a JSON (`application/json` content type) request payload, such as `{"metadata": {"dataset.name": "new name"}}`

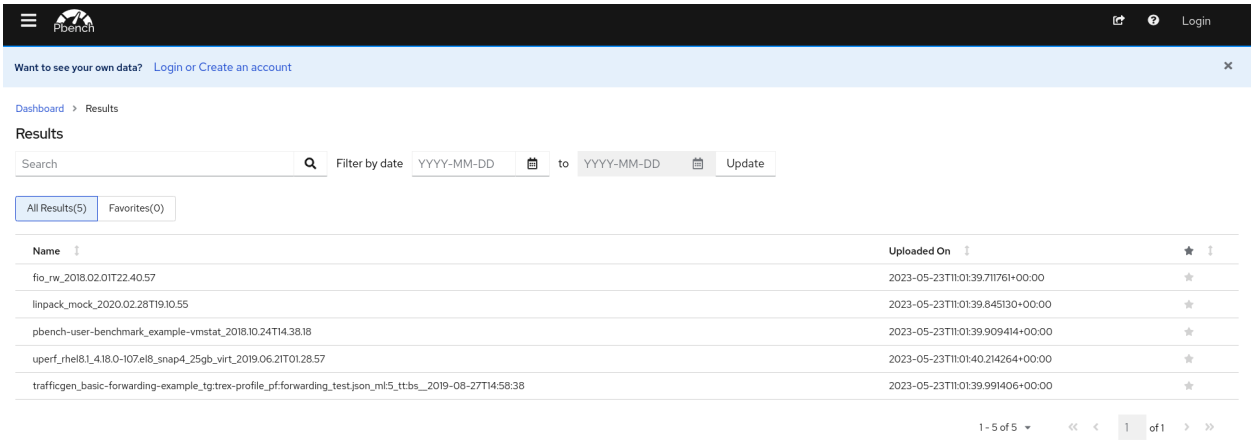
CHAPTER

FIVE

PBENCH DASHBOARD

Pbench Dashboard is the web-based platform for consuming indexed performance benchmark data. It provides data curation capabilities for the performance datasets.

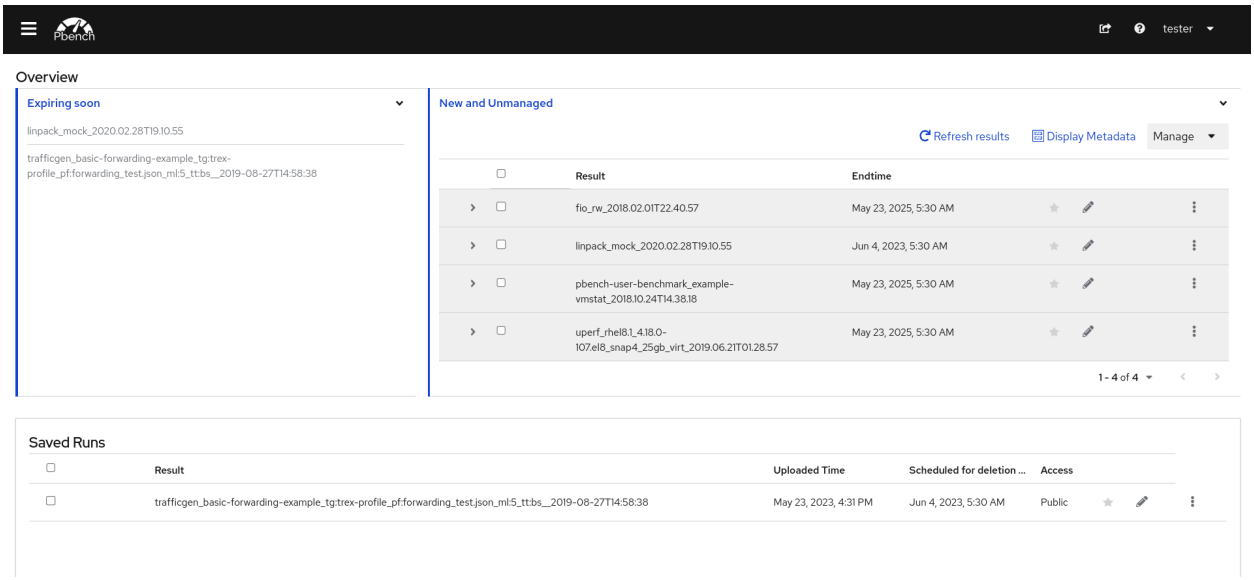
The landing page is the browsing page where the user can view the list of public datasets. Those datasets can be filtered based on name and/or uploaded time.



Login button can be found on the right side of the Header. Clicking on it will redirect the browser to the login page.

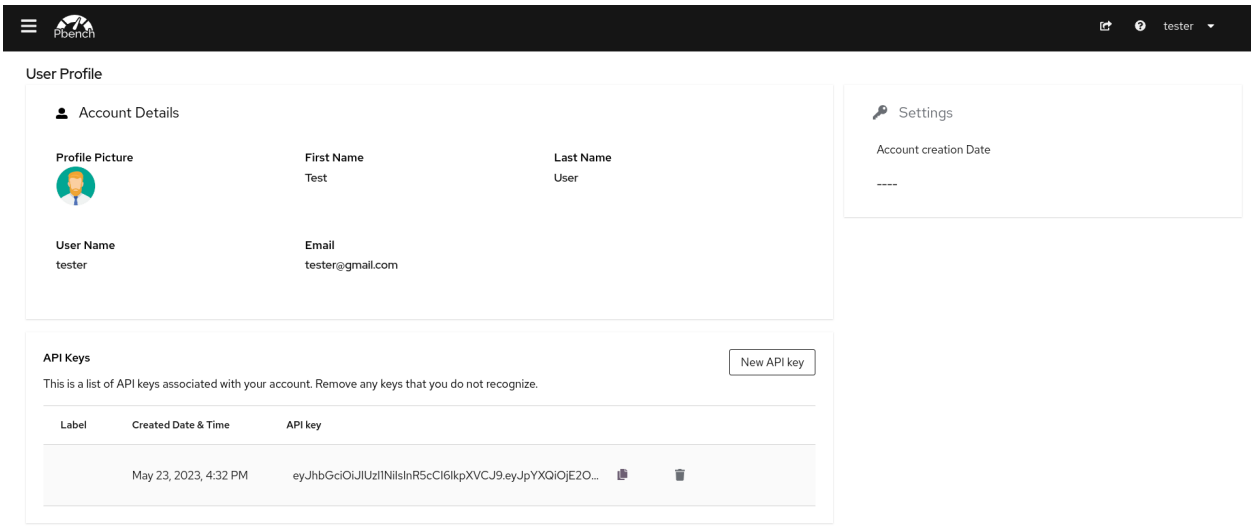
On logging in, the user can view the Overview Page which is the data curation page. It has three components.

- *New and Unmanaged Runs* shows the newly created runs which can be saved
- *Saved Runs* lists the saved runs which can be published to share with others
- *Expiring Runs* lists the saved runs which will be deleted from the server within the next 20 days



The *User Profile* page can be used to view profile information from the OIDC authentication as well as to view and manage Pbench Server API keys. This page is accessed by selecting the *My profile* option from the dropdown menu activated by clicking on the username at the right end of the header bar.

From this page, Pbench Server API keys can be created by clicking on the *New API Key* button; existing keys are listed with their labels and creation dates; and, the keys can be copied or deleted using the icon buttons.



CHAPTER

SIX

FAQ

CHAPTER

SEVEN

GUIDELINES FOR CONTRIBUTING TO PBENCH

7.1 1. Forking the repository:

Forking a repository allows you to freely experiment with changes without affecting the original project. Most commonly, forks are used to either propose changes to someone else's project or to use someone else's project as a starting point for your own idea.

7.2 2. Cloning

Cloning is used to create a local copy of the repository. It takes only one command in the terminal to clone the repository.

```
git clone https://github.com/distributed-system-analysis/pbench.git
```

7.3 3. Choosing an issue to work upon

1. Go to the issues section, to find a list of open issues.

1. Select the issues you are interested to work upon based upon the labels and descriptions.

1. It is a good practice to assign the issue to yourself to let others know you're working upon it.

7.4 Making changes to the codebase

- Follow the instructions in the README.md to setup and install pbench.
- Save your changes by creating your own local branches on git

7.5 Add, Commit and Push

- Follow these commands to push the changes to your branch.

```
git add .
git commit -m "Issue solved"
git push origin branch_name
```

7.6 Conventions on commits, PRs, and overall git best practices.

- Commit messages should have a short description (50 - 70 characters) followed by a longer format description of the changes below if needed. You'll also notice each line is formatted for a specific length in the longer format description. For example:

```
Extend auditing to incoming, results, and users

The server audit is now applied to the incoming, results, and users
directory hierarchies.  Any unpacked tar ball should now be compre-
hensively checked to see that all is in the correct place.

The test-20 unit test gold file holds an example of an audit report
covering all the possible outputs it can emit.  Each unit test runs
the report as well, and they have been updated accordingly.
```

- For more on best practices, check out this article for reference from time to time: https://www.git-tower.com/learn/git/ebook/en/command-line/appendix/best-practices

7.7 Opening a pull request

1. **If there are multiple commits, squash down the commits to one**
2. For more complicated commits it is appropriate to have more than one
3. Commit the changes
4. Click on New Pull Request
5. Write appropriate Pull Request Title stating the fix
6. Use present tense (ex. Fixes, Changes, Fixing, Changing..)
7. Reference the issue that the PR is fixing with **"Fixes #issue_number"** in the description
8. Provide a detailed description of the changes; if UI related, add screenshots
9. Make sure that the branches can be automatically merged (otherwise rebase the PR with `master`) and then click the drop down next to, `Create pull request`, and select `Create draft pull request`
10. Assign the PR to yourself and add appropriate labels
11. Add "**DO NOT MERGE**" label if the work does not need to be merged or there is no agreement on the work yet
12. Make sure to add Milestone to the PR to mention specific release
13. Request for review once the work is ready for getting reviewed

14. Select the `Ready for Review` button to move the PR out of `Draft` mode indicating it is ready for review and merging

7.8 Creating an Isssue

1. Make sure to add proper details to the Issue raised
2. Upload screenshot(if possible) in dashboard issues
3. Apply proper labels to the Issue
4. Try to actively respond to the communication in case of comments in the same issue.

7.9 Reviewing a pull request

1. Go to Files changed and check for the fixes proposed by the Pull Request
2. Check for certain general criteria:
3. The PR has no merge conflicts with the base branch
4. The commits are squashed into one
5. There is proper indentation and alignment
6. No additional lines are added unnecessarily
7. The code is clearly understandable, with comments if necessary to clarify
8. Do not merge the PR with `DO NOT MERGE` or `WIP` label.
9. In case of the requirement of running the changes in the PR on the local system, follow the mentioned process:

- To fetch a remote PR into your local repo,

```
git fetch origin pull/ID/head:BRANCHNAME
where ID is the pull request id and BRANCHNAME is the name of the new branch that you␣
↪want to create. Once you have created the branch, then simply
git checkout BRANCHNAME
```

- If modification is required, then either “Request changes” or add “General comments” for your feedback
- For more information about reviewing PR in github go through: https://help.github.com/en/articles/about-pull-request-reviews https://help.github.com/en/articles/reviewing-proposed-changes-in-a-pull-request