22. Health check

One of the key tasks for any PostgreSQL DBA is conducting daily health checks to ensure the database remains healthy. Performing these checks is critical as it helps identify potential issues and resolve them before they impact production. PostgreSQL provides several views to monitor various metrics such as wait states, CPU usage, I/O, and more.

However, today we'll focus on a tool called **pgmetrics**.
pgmetrics is an open-source, zero-dependency, single-binary tool that can collect over **350 metrics** from a running PostgreSQL server. It presents the data in an **easy-to-read text format** or allows you to **export it as JSON or CSV** for further analysis. This tool will help us monitor various aspects, including replication, slow queries, buffer usage, WAL status, and CPU & RAM usage.

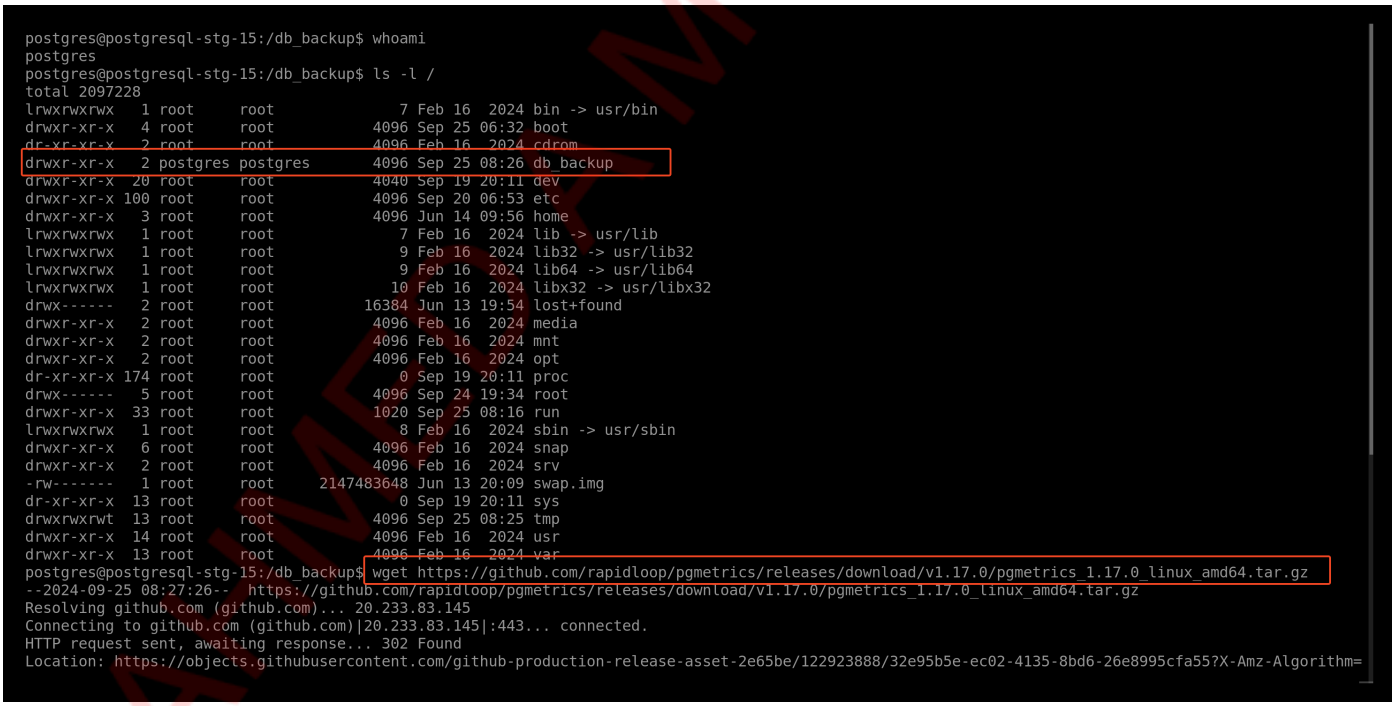
Installing pgmetrics

Installing pgmetrics is quite simple and involves just downloading the binary.

1. download binary
   Make sure to download the binary using the `postgres` user and save it in a directory owned by PostgreSQL. For my lab setup, I've already created a directory for backups, which I will use to download pgmetrics.

```
sudo su - postgres
```

```
wget https://github.com/rapidloop/pgmetrics/releases/download/v1.17.0/pgmetrics_1.17.0_linux_amd64.tar.gz
```



2. extract the binary.

```
tar xvf pgmetrics_1.17.0_linux_amd64.tar.gz
```

```
postgres@postgresql-stg-15:/db_backup$ tar xvf pgmetrics_1.17.0_linux_amd64.tar.gz
pgmetrics_1.17.0_linux_amd64/LICENSE
pgmetrics_1.17.0_linux_amd64/README.md
pgmetrics_1.17.0_linux_amd64/pgmetrics
postgres@postgresql-stg-15:/db_backup$
```

3. change directory to extracted binary and start check various option option using `--help`

```
cd pgmetrics_1.17.0_linux_amd64/
./pgmetrics --help
```

```
postgres@postgresql-stg-15:/db_backup/pgmetrics_1.17.0_linux_amd64$ ./pgmetrics  --help
pgmetrics collects PostgreSQL information and metrics.

Usage:
  pgmetrics [OPTION]... [DBNAME]

General options:
  -t, --timeout=SECS           individual query timeout in seconds (default: 5)
      --lock-timeout=MILLIS    lock timeout in milliseconds (default: 50)
  -i, --input=FILE             don't connect to db, instead read and display
                                   this previously saved JSON file
  -V, --version                output version information, then exit
  -?, --help[=options]         show this help, then exit
      --help=variables         list environment variables, then exit

Collection options:
  -S, --no-sizes               don't collect tablespace and relation sizes
  -c, --schema=REGEXP          collect only from schema(s) matching POSIX regexp
  -C, --exclude-schema=REGEXP  do NOT collect from schema(s) matching POSIX regexp
  -a, --table=REGEXP           collect only from table(s) matching POSIX regexp
  -A, --exclude-table=REGEXP   do NOT collect from table(s) matching POSIX regexp
      --omit=WHAT              do NOT collect the items specified as a comma-separated
                                   list of: "tables", "indexes", "sequences",
                                   "functions", "extensions", "triggers",
                                   "statements", "log", "citus", "indexdefs",
                                   "bloat"
      --sql-length=LIMIT       collect only first LIMIT characters of all SQL
                                   queries (default: 500)
      --statements-limit=LIMIT collect only utmost LIMIT number of row from
                                   pg_stat_statements (default: 100)
      --only-listed            collect info only from the databases listed as
                                   command-line args (use with Heroku)
      --all-dbs                collect info from all user databases
      --log-file               location of PostgreSQL log file
      --log-dir                read all the PostgreSQL log files in this directory
      --log-span=MINS          examine the last MINS minutes of logs (default: 5)
      --aws-rds-dbid           AWS RDS/Aurora database instance identifier
      --az-resource            Azure resource ID
      --pgpool                 collect only Pgpool metrics
```

Using pgmetrics

to view the report i will use `--all-dbs` which will show status of all database

```
./pgmetrics --all-dbs
```

here are the metric you will get when executing the command

- **Server**: version, system identifier, timeline, transaction id wraparound, checkpoint lag
- **Replication:** primary-side, standby-side, physical and logical replication slots
- **WAL Archiving**: archive rate, wal and ready file counts, last success and fail time
- **BG Writer**: checkpoint rate, total checkpoints (sched+req), buffers

- **Checkpointer**: checkpoints and restartpoints performed, buffers written, time taken
- **Vacuum-related**: ongoing auto/manual vacuum progress, last analyze/vacuum, settings
- **Tablespaces**: location, size, disk and inode usage of filesystem
- **Database**: size, bloat, disabled triggers, installed extensions, temp files, transaction id wraparound, deadlocks, conflicts
- **Roles**: users, groups, membership
- **Active backends**: transaction running too long, idling in transaction, waiting for locks
- **Tables**: vacuum, analyze, row estimates, idx and seq scans, cache hit ratio, HOT update ratio, size, bloat
- **Indexes**: cache hit ratio, scans, rows read/scan, rows fetched/scan
- **Sequences**: cache hit ratio
- **System metrics**: cores, load average, memory and disk usage
- **Settings**: current values, and default ones where different
- **Slow queries**: from pg_stat_statements, if available
- **Locks**: granted and waiting locks, from pg_locks
- **Job Progress**: progress of analyze, backup, cluster, copy, create index and vacuum jobs
- **Blocked queries**: blocked queries, along with the queries that they are waiting for

```
PostgreSQL Cluster:
    Name:               15/main
    Server Version:     15.7 (Ubuntu 15.7-1.pgdg22.04+1)
    Server Started:     24 Sep 2024 6:43:32 PM (13 hours ago)
    System Identifier:  7380300028322386333
    Timeline:           1
    Last Checkpoint:    24 Sep 2024 6:58:03 PM (13 hours ago)
    REDO LSN:           0/8E404BD8
    Checkpoint LSN:     0/9E3D1F28 (256 MiB since REDO)
    Transaction IDs:    oldest = 716, next = 782, range = 66
    Notification Queue: 0.0% used
    Active Backends:    1 (max 100)
    Recovery Mode?      no

System Information:
    Hostname:           postgresql-stg-15
    CPU Cores:          2 x Common KVM processor
    Load Average:       0.02
    Memory:             used=144 MiB, free=541 MiB, buff=35 MiB, cache=1.1 GiB
    Swap:               used=16 MiB, free=2.0 GiB
    +--------------------------------+-----------------+
    |                        Setting |           Value |
    +--------------------------------+-----------------+
    |                 shared_buffers | 16384 (128 MiB) |
    |                       work_mem |  4096 (4.0 MiB) |
    |           maintenance_work_mem |  65536 (64 MiB) |
    |                   temp_buffers |  1024 (8.0 MiB) |
    |            autovacuum_work_mem |              -1 |
    |               temp_file_limit |              -1 |
    |          max_worker_processes |               8 |
    |       autovacuum_max_workers |               3 |
    | max_parallel_workers_per_gather |               2 |
    |       effective_io_concurrency |               1 |
    +--------------------------------+-----------------+
```

pg_stat_statements

`pg_stat_statements` is an extension for PostgreSQL that tracks and records statistics about SQL queries executed in the database. It provides a way to monitor query performance, helping DBAs identify slow or expensive queries, optimize resource usage, and improve overall performance.

when using `pgmetrics` it advisable to enable `pg_stat_statements` extension to get report of slow query which is very useful when performing health check or even try to identify slow running query

Enable pg_stat_statements

`pg_stat_statements` should be already installed with postgresql but only change that you have to update the parameter `shared_preload_libraries` and include .

```
sudo nano /etc/postgresql/15/mainpostgresql.conf
```

```
shared_preload_libraries = 'pg_stat_statements'
```

```
#local_preload_libraries = ''
#session_preload_libraries = ''
shared_preload_libraries = 'pgaudit,pg_stat_statements' # (change requires restart)
#jit_provider = 'llvmjit'              # JIT library to use

# - Other Defaults -

#dynamic_library_path = '$libdir'
#extension_destdir = ''                # prepend path when loading extensions
                                       # and shared objects (added by Debian)

#gin_fuzzy_search_limit = 0
```

After that restart postgresql services

```
sudo systemctl restart postgresql@15-main.service
```

now login to `psql` change to database you want to enable the extension

```
sudo -u postgres psql
```

```
\c production

CREATE EXTENSION pg_stat_statements;
```

```
postgres=# \c prodction
connection to server on socket "/var/run/postgresql/.s.PGSQL.5432" failed: FATAL:  database "prodction" does not exist
Previous connection kept
postgres=# \c production
You are now connected to database "production" as user "postgres".
production=# CREATE EXTENSION pg_stat_statements;
ERROR:  extension "pg_stat_statements" already exists
production=# \dt+
                                    List of relations
 Schema |       Name       | Type  |  Owner   | Persistence | Access method |  Size   | Description
--------+------------------+-------+----------+-------------+---------------+---------+-------------
 public | pgbench_accounts | table | postgres | permanent   | heap          | 641 MB  |
 public | pgbench_branches | table | postgres | permanent   | heap          | 40 kB   |
 public | pgbench_history  | table | postgres | permanent   | heap          | 0 bytes |
 public | pgbench_tellers  | table | postgres | permanent   | heap          | 56 kB   |
(4 rows)

production=# \dx
                                      List of installed extensions
       Name        | Version |   Schema   |                              Description
-------------------+---------+------------+---------------------------------------------------------------------
 pg_stat_statements | 1.10    | public     | track planning and execution statistics of all SQL statements executed
 plpgsql            | 1.0     | pg_catalog | PL/pgSQL procedural language
(2 rows)

production=#
```

Now, run the command `./pgmetrics --all-dbs` and scroll down until you reach the database where you enabled the extension. You should see the top most expensive queries listed there.

```
Database #2:
    Name:               production
    Owner:              postgres
    Tablespace:         pg_default
    Connections:        1 (no max limit)
    Frozen Xid Age:     72
    Transactions:       3717 (99.9%) commits, 5 (0.1%) rollbacks
    Cache Hits:         23.7%
    Rows Changed:       ins 100.0%, upd 0.0%, del 0.0%
    Total Temp:         382 MiB in 16 files
    Problems:           0 deadlocks, 0 conflicts
    Totals Since:
    Size:               755 MiB
    Installed Extensions:
      +--------------------+---------+-------------------------------------------------------------------------+
      |               Name | Version |                                                                 Comment |
      +--------------------+---------+-------------------------------------------------------------------------+
      | pg_stat_statements |    1.10 | track planning and execution statistics of all SQL statements executed |
      |             plpgsql |     1.0 |                                                  PL/pgSQL procedural language |
      +--------------------+---------+-------------------------------------------------------------------------+

    Slow Queries:
      +-------+----------+------------+-----------+-----------------------------------------------------+
      | Calls | Avg Time | Total Time | Rows/Call |                                               Query |
      +-------+----------+------------+-----------+-----------------------------------------------------+
      |     3 |  11.411s |    34.235s |   5000000 |  copy pgbench_accounts from stdin with (freeze on) |
      |     3 |   3.973s |    11.921s |         0 | alter table pgbench_accounts add primary key (aid) |
      |     3 |    673ms |     2.02s |         0 |                     vacuum analyze pgbench_accounts |
      |     1 |    730ms |    730ms |         0 |                           ANALYZE pgbench_accounts |
      |     5 |     41ms |    209ms |         7 | SELECT   current_database() AS db, schemaname, tab |
      |     6 |     31ms |    187ms |         2 | SELECT name, current_database(), COALESCE(default_ |
      |    12 |      5ms |     67ms |         1 |                     SELECT pg_tablespace_size( $1 ) |
      |     1 |     61ms |     61ms |         0 |  CREATE EXTENSION IF NOT EXISTS pg_stat_statements |
      |     3 |     14ms |     43ms |         0 | alter table pgbench_branches add primary key (bid) |
      |    12 |      2ms |     27ms |         1 |                       SELECT pg_database_size( $1 ) |
      |     5 |      4ms |     23ms |        98 | SELECT userid, dbid, queryid, LEFT(COALESCE(query, |
      |     6 |      3ms |     18ms |       368 | SELECT name, setting, COALESCE(boot_val,$1), sourc |
      |     3 |      5ms |     16ms |         0 | drop table if exists pgbench_accounts, pgbench_bra |
```