Troubleshooting PostgreSQL with pgCenter

Alexey Lesovsky

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01 Introduction

- What is pgCenter.
- Goals and quick overview.

02 Troubleshooting cases

- Health checks and load spikes.
- Hidden problems.
- Client's activity.
- Streaming replication.

01

Introduction

- PgCenter overview.

- How to use pgCenter.

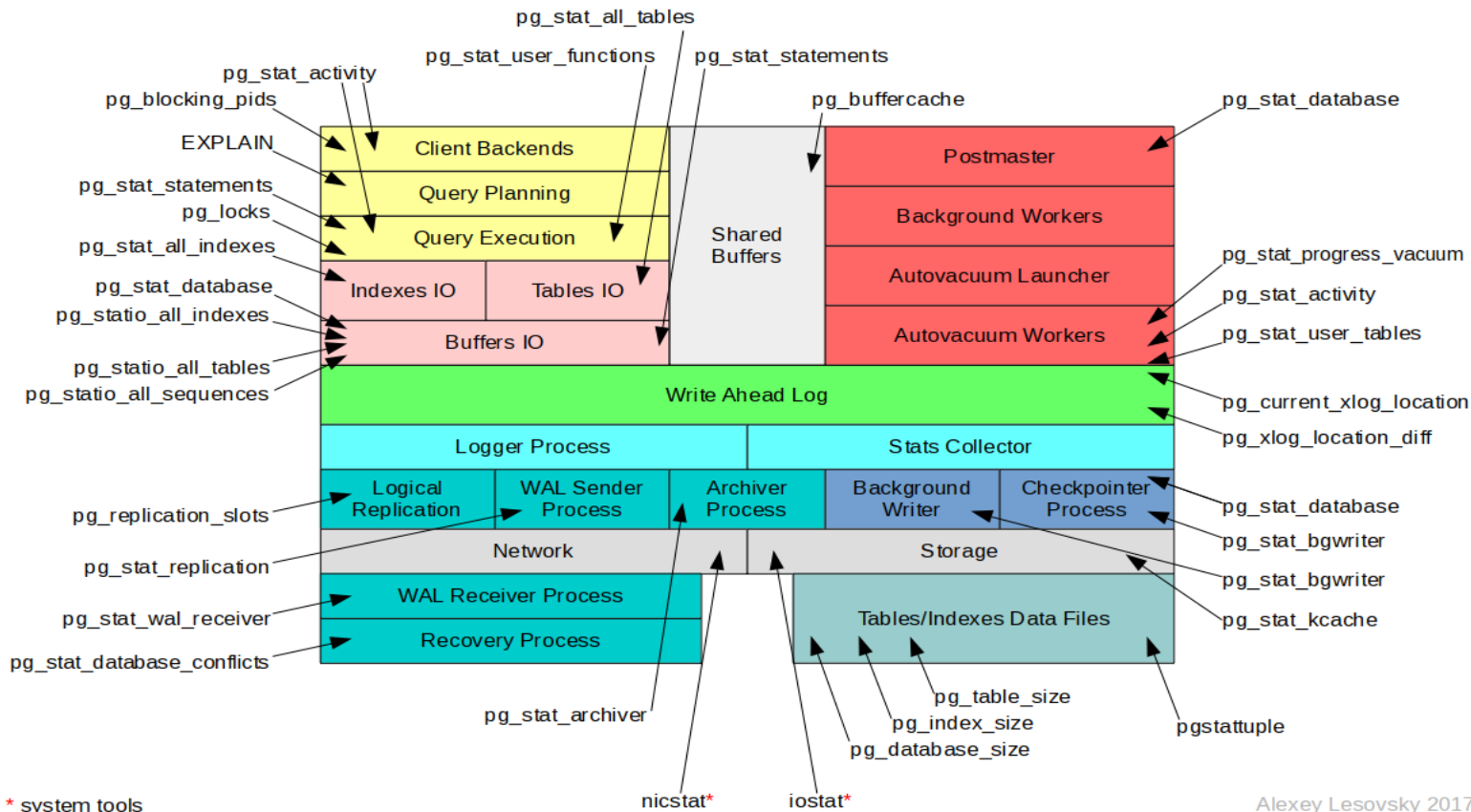- How to troubleshoot PostgreSQL with pgCenter.

01   What is pgCenter

- Top-like admin tool for Postgres stats.

- Quick Postgres administration.

- Available on RHEL/CentOS/Fedora/ALT Linux/Ubuntu...

- Hosted on GitHub.

- Work in progress.

- PostgreSQL 9.x support.

- Support of the most stats views.

- Support of the system stats.

- PostgreSQL admin tasks: configs, logs, reload, cancel/kill backends.

01 Interface overview

```
pgcenter: 2017-04-05 17:40:28, load average: 1.59, 0.74, 0.42          conn1 [ok]: /run/postgresql:5433 postgres@postg (ver: 10devel, up 2 days 20:29:27)
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 MiB mem:   7836 total,   1582 free,   3910 used,    2344 buff/cached             autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
MiB swap:   5119 total,   5088 free,     31 used,    26/0 dirty/writeback         statements: 7050 stmt/s, 0.123 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime

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   sda1:           0.00    0.00    0.00     0.00    0.00     0.00     0.00     0.00    0.00     0.00     0.00    0.00
   sda2:           0.00    0.00    0.00     0.00    0.00     0.00     0.00     0.00    0.00     0.00     0.00    0.00
   sdb:            0.00    6.86    0.00   288.24    0.00     2.69    19.13     0.82    2.82     0.00     2.82   82.06
   sdb1:           0.00    0.00    0.00     0.00    0.00     0.00     0.00     0.00    0.00     0.00     0.00    0.00
   sdb2:           0.00    6.86    0.00   284.31    0.00     2.69    19.39     0.11    0.39     0.00     0.39   10.98
   dm-0:           0.00    0.00    0.00     0.00    0.00     0.00     0.00     0.00    0.00     0.00     0.00    0.00
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pg_stat_database.

pg_stat_replication.

pg_stat_user_tables, pg_statio_user_tables.

pg_stat_user_indexes, pg_statio_user_indexes.

pg_stat_user_functions.

pg_stat_activity, pg_stat_progress_vacuum.

pg_stat_statement.

01 Additional stats

- Iostat – storage devices stats.

- Nicstat – network interfaces stats.

- Log tail – latest lines from postgres logs.

02

Troubleshooting cases

- **Health checks and load spikes.**

- Hidden problems.

- Clients' activity.

- Streaming replication.

Check whether is everything OK?

or

When something really goes wrong.

Run pgCenter.

Check system resources (cpu, memory/swap, storage, network).

Check postgres activity (conn's states, xact age).

Check iostat/nicstat if required.

```
pgcenter: 2017-04-07 21:50:36, load average: 4.14, 0.98, 0.46                    conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day 04:02:57)
   %cpu:  2.9 us,  0.7 sy,  0.0 ni, 11.4 id, 85.0 wa,  0.0 hi,  0.0 si,  0.0 st    activity: 13/100 conns,  0/0 prepared,  0 idle,  0 idle_xact, 13 active,  0 waiting,  0 others
 MiB mem:  32124 total,   6228 free,  25464 used,      432 buff/cached          autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
MiB swap:  15257 total,  15257 free,      0 used,      1/0 dirty/writeback       statements: 3519 stmt/s, 0.263 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime

datname        commit  rollback  reads  hits  returned  fetched  inserts  updates  deletes  conflicts  deadlocks  tmp_files  tmp_bytes  read_t  write_t
pgbench_64gb   0       0         0      0     0         0        0        0        0        0          0          0          0          0       0
pgbench_6gb    2       0         0      69    999       11       0        0        0        0          0          0          0          0       0
postgres       6       0         0      0     0         0        0        0        0        0          0          0          0          0       0
template0      0       0         0      0     0         0        0        0        0        0          0          0          0          0       0

Device:         rrqm/s  wrqm/s      r/s     w/s    rMB/s     wMB/s avgrq-sz avgqu-sz    await  r_await  w_await    %util
   sda:           0.00    3.92   841.18   20.59     6.57      3.75    24.52    11.63    13.44    13.77     0.19    99.22
  sda1:           0.00    0.00     0.00    0.00     0.00      0.00     0.00     0.00     0.00     0.00     0.00     0.00
  sda2:           0.00    3.92   841.18   20.59     6.57      3.75    24.52    11.59    13.44    13.77     0.19    99.22
   sdb:           0.00    0.00     0.00    0.00     0.00      0.00     0.00     0.00     0.00     0.00     0.00     0.00
  sdb1:           0.00    0.00     0.00    0.00     0.00      0.00     0.00     0.00     0.00     0.00     0.00     0.00
```

```
pgcenter: 2017-04-07 21:50:36, load average: 4.14, 0.98, 0.46                conn1
    %cpu:  2.9 us,  0.7 sy,  0.0 ni, 11.4 id, 85.0 wa,  0.0 hi,  0.0 si,  0.0 st     act
 MiB mem:  32124 total,   6228 free,   25464 used,      432 buff/cached          autov
MiB swap:  15257 total,  15257 free,       0 used,      1/0 dirty/writeback       state

datname        commit   rollback   reads   hits   returned   fetched   inserts   updates   delete
pgbench_64gb   0        0          0       0      0          0         0         0         0
pgbench_6gb    2        0          0       69     999        11        0         0         0
postgres       6        0          0       0      0          0         0         0         0
template0      0        0          0       0      0          0         0         0         0
```

```
conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day 04:02:57)
  activity: 13/100 conns,  0/0 prepared,  0 idle,  0 idle_xact, 13 active,  0 waiting,  0 others
autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
statements: 3519 stmt/s, 0.263 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime
```

s	deletes	conflicts	deadlocks	tmp_files	tmp_bytes	read_t	write_t
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Device:	rrqm/s	wrqm/s	r/s	w/s	rMB/s	wMB/s	avgrq-sz	avgqu-sz	await	r_await	w_await	%util
sda:	0.00	3.92	841.18	20.59	**6.57**	**3.75**	24.52	11.63	13.44	13.77	0.19	**99.22**
sda1:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sda2:	0.00	3.92	841.18	20.59	**6.57**	**3.75**	24.52	11.59	13.44	13.77	0.19	**99.22**
sdb:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sdb1:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Which queries cause the load?

pg_stat_statements is a contrib module.

GUCs:

shared_preload_libraries = 'pg_stat_statements'

track_io_timing = on

Available stats in pgCenter:

timings - how long queries have run;

general - number of calls and rows;

IO - buffers, temp, local IO.

02 Health checks and load spikes

```
pgcenter: 2017-04-07 21:50:36, load average: 4.14, 0.98, 0.46                    conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day 04:02:57)
    %cpu:  2.9 us,  0.7 sy,  0.0 ni, 11.4 id, 85.0 wa,  0.0 hi,  0.0 si,  0.0 st   activity: 13/100 conns,  0/0 prepared,  0 idle,  0 idle_xact, 13 active,  0 waiting,  0 others
 MiB mem:  32124 total,   6228 free,  25464 used,      432 buff/cached          autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
MiB swap:  15257 total,  15257 free,       0 used,      1/0 dirty/writeback       statements: 3519 stmt/s, 0.263 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime

user     database      t_all_t   t_read_t  t_write_t  t_cpu_t   all_t  read_t  write_t  cpu_t  calls  queryid     query
postgres pgbench_64gb  47:38:04  47:33:07  00:00:00   00:04:57  7868   7855    0        12     405    94ffafcb30  UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid =
postgres pgbench_64gb  23:51:51  23:48:08  00:00:00   00:03:42  5      0       0        6      405    111df3ad65  SELECT abalance FROM pgbench_accounts WHERE aid = ?;
postgres pgbench_6gb   02:14:23  00:02:45  00:00:00   02:11:38  0      0       0        0      0      e8e1cdb2da  SELECT abalance FROM pgbench_accounts WHERE aid = 7287471;
postgres pgbench_64gb  00:01:31  00:00:18  00:00:00   00:01:13  6      0       0        6      405    45b6b13d62  UPDATE pgbench_tellers SET tbalance = tbalance + ? WHERE tid = ?
postgres pgbench_6gb   01:07:36  00:00:16  00:00:00   01:07:19  0      0       0        0      0      192353e099  UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid =
postgres pgbench_64gb  00:01:22  00:00:08  00:00:00   00:01:13  6      0       0        6      405    e192b43faf  UPDATE pgbench_branches SET bbalance = bbalance + ? WHERE bid =
okagent  pgbench_6gb   00:00:00  00:00:00  00:00:00   00:00:00  0      0       0        0      0      f67e66660a  select * from pg_stat_user_tables s limit ?
postgres pgbench_6gb   00:00:00  00:00:00  00:00:00   00:00:00  0      0       0        0      0      f6241e76ed  vacuum pgbench_branches
postgres pgbench_64gb  00:00:00  00:00:00  00:00:00   00:00:00  0      0       0        0      0      eaf8d3d459  truncate pgbench_history
postgres pgbench_64gb  00:00:42  00:00:00  00:00:00   00:00:42  4      0       0        3      405    e7cc060768  INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES
postgres pgbench_6gb   00:30:17  00:00:00  00:00:00   00:30:17  0      0       0        0      0      e7766dd7c6  UPDATE pgbench_branches SET bbalance = bbalance + ? WHERE bid =
okagent  pgbench_64gb  00:00:00  00:00:00  00:00:00   00:00:02  0      0       0        0      0      de77700d35   SELECT schemaname, relname, indexrelname, coalesce(pg_relation_
okagent  pgbench_64gb  00:00:02  00:00:00  00:00:00   00:00:02  0      0       0        0      0      d1bcc9180b   SELECT schemaname, relname, coalesce(heap_blks_read,?) as heap_
postgres pgbench_64gb  00:00:00  00:00:00  00:00:00   00:00:00  0      0       0        0      0      d101ae1052  vacuum pgbench_branches
```

```
oad average: 4.14, 0.98, 0.46                    conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day 04:02:57)
 ni, 11.4 id, 85.0 wa,  0.0 hi,  0.0 si,  0.0 st    activity: 13/100 conns,  0/0 prepared,  0 idle,  0 idle_xact, 13 active,  0 waiting,  0 others
ree,  25464 used,    432 buff/cached             autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
ree,      0 used,     1/0 dirty/writeback        statements: 3519 stmt/s, 0.263 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime
```

t_read_t	t_write_t	t_cpu_t	all_t	read_t	write_t	cpu_t	calls	queryid	query
47:33:07	00:00:00	00:04:57	7868	7855	0	12	405	94ffafcb30	UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid =
23:48:08	00:00:00	00:03:42	5	0	0	6	405	111df3ad65	SELECT abalance FROM pgbench_accounts WHERE aid = ?;
00:02:45	00:00:00	02:11:38	0	0	0	0	0	e8e1cdb2da	SELECT abalance FROM pgbench_accounts WHERE aid = 7287471;
00:00:18	00:00:00	00:01:13	6	0	0	6	405	45b6b13d62	UPDATE pgbench_tellers SET tbalance = tbalance + ? WHERE tid = ?
00:00:16	00:00:00	01:07:19	0	0	0	0	0	192353e099	UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid =
00:00:08	00:00:00	00:01:13	6	0	0	6	405	e192b43faf	UPDATE pgbench_branches SET bbalance = bbalance + ? WHERE bid =
00:00:00	00:00:00	00:00:00	0	0	0	0	0	f67e66660a	select * from pg_stat_user_tables s limit ?
00:00:00	00:00:00	00:00:00	0	0	0	0	0	f6241e76ed	vacuum pgbench_branches
00:00:00	00:00:00	00:00:00	0	0	0	0	0	eaf8d3d459	truncate pgbench_history
00:00:00	00:00:00	00:00:42	4	0	0	3	405	e7cc060768	INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES
00:00:00	00:00:00	00:30:17	0	0	0	0	0	e7766dd7c6	UPDATE pgbench_branches SET bbalance = bbalance + ? WHERE bid =
00:00:00	00:00:00	00:00:02	0	0	0	0	0	de77700d35	SELECT schemaname, relname, indexrelname, coalesce(pg_relation_
00:00:00	00:00:00	00:00:02	0	0	0	0	0	d1bcc9180b	SELECT schemaname, relname, coalesce(heap_blks_read,?) as heap_
00:00:00	00:00:00	00:00:00	0	0	0	0	0	d101ae1052	vacuum pgbench_branches

Another example.

```
pgcenter: 2017-04-07 21:52:54, load average: 10.65, 4.65, 1.89          conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day 04:05:15)
    %cpu: 77.4 us,  9.6 sy,  0.0 ni, 12.9 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st     activity: 73/100 conns,  0/0 prepared, 12 idle,  0 idle_xact, 61 active,  0 waiting,  0 others
 MiB mem:  32124 total,    215 free,  25469 used,     6440 buff/cached          autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
MiB swap:  15257 total,  15257 free,       0 used,      0/0 dirty/writeback          statements: 76074 stmt/s, 0.263 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime
```

user	database	t_all_t	t_read_t	t_write_t	t_cpu_t	all_t	read_t	write_t	cpu_t	calls	queryid	query
postgres	pgbench_6gb	02:14:30	00:02:45	00:00:00	02:11:45	909	0	0	909	63551	e8e1cdb2da	SELECT abalance FROM pgbench_accounts WHERE aid = 7287471;
postgres	pgbench_6gb	01:07:36	00:00:16	00:00:00	01:07:19	0	0	0	0	0	192353e099	UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid =
postgres	pgbench_6gb	00:30:17	00:00:00	00:00:00	00:30:17	0	0	0	0	0	e7766dd7c6	UPDATE pgbench_branches SET bbalance = bbalance + ? WHERE bid =
postgres	pgbench_6gb	00:29:07	00:00:00	00:00:00	00:29:07	0	0	0	0	0	5372cff023	UPDATE pgbench_tellers SET tbalance = tbalance + ? WHERE tid = ?
postgres	pgbench_6gb	00:16:05	00:00:00	00:00:00	00:16:05	0	0	0	0	0	7a4d34a918	INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES
postgres	pgbench_64gb	47:40:16	47:35:18	00:00:00	00:04:57	0	0	0	0	0	94ffafcb30	UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid =
postgres	pgbench_64gb	23:51:51	23:48:08	00:00:00	00:03:42	0	0	0	0	0	111df3ad65	SELECT abalance FROM pgbench_accounts WHERE aid = ?;
postgres	pgbench_64gb	00:01:22	00:00:08	00:00:00	00:01:13	0	0	0	0	0	e192b43faf	UPDATE pgbench_branches SET bbalance = bbalance + ? WHERE bid =
postgres	pgbench_64gb	00:01:31	00:00:18	00:00:00	00:01:13	0	0	0	0	0	45b6b13d62	UPDATE pgbench_tellers SET tbalance = tbalance + ? WHERE tid = ?
postgres	pgbench_64gb	00:00:42	00:00:00	00:00:00	00:00:42	0	0	0	0	0	e7cc060768	INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES
postgres	pgbench_6gb	00:00:41	00:00:00	00:00:00	00:00:41	0	0	0	0	0	7cbfcd7045	END;
postgres	pgbench_6gb	00:00:35	00:00:00	00:00:00	00:00:35	0	0	0	0	0	250dbbb915	BEGIN;

Device:	rrqm/s	wrqm/s	r/s	w/s	rMB/s	wMB/s	avgrq-sz	avgqu-sz	await	r_await	w_await	%util
sda:	0.00	0.00	0.00	28.71	0.00	0.22	16.00	0.00	0.00	0.00	0.00	0.00
sda1:	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sda2:	0.00	0.00	0.00	28.71	0.00	0.22	16.00	0.00	0.00	0.00	0.00	0.00
sdb:	0.00	0.99	17.82	0.00	0.15	0.00	16.89	0.00	0.22	0.22	0.00	0.40
sdb1:	0.00	0.99	17.82	0.00	0.15	0.00	16.89	0.00	0.22	0.22	0.00	0.40

Reports based on pg_stat_statements.

Use queryid and "G" hotkey.

```
summary:
        total_time: 75:59:21, cpu_time: 04:50:58, io_time: 71:08:23
(ALL: 100.00%, CPU: 6.38%, IO: 93.62%),
        total queries: 1,090,573,273
query info:
        usename:                                postgres,
        datname:                                pgbench_64gb,
        calls (relative to all queries):        4,826,787 (0.44%),
        rows (relative to all queries):         4,826,787 (0.53%),
        total time (relative to all queries):   47:21:38 (ALL: 62.3%, CPU: 1.7%, IO: 66.5%),
        average time (only for this query):     35.32ms, cpu_time: 0.06ms, io_time: 35.26ms,
                                                (ALL: 100.0%, CPU: 0.2%, IO: 99.8%),

query text (id: 94ffafcb30):
UPDATE pgbench_accounts SET abalance = abalance + ? WHERE aid = ?;
```

```
summary:
        total_time: 75:56:34, cpu_time: 04:50:04, io_time: 71:06:29
                    (ALL: 100.00%, CPU: 6.37%, IO: 93.63%),
        total queries: 1,087,323,630
query info:
        usename:                                    postgres,
        datname:                                    pgbench_6gb,
        calls (relative to all queries):            531,640,449 (48.89%),
        rows (relative to all queries):             531,640,449 (58.59%),
        total time (relative to all queries):       02:12:35 (ALL: 2.9%, CPU: 44.8%, IO: 0.1%),
        average time (only for this query):         0.01ms, cpu_time: 0.01ms, io_time: 0.00ms,
                                                    (ALL: 100.0%, CPU: 100.0%, IO: 0.0%),

query text (id: e8e1cdb2da):
SELECT abalance FROM pgbench_accounts WHERE aid = 7287471;
```

using pg_stat_statements you able to find:

- frequently called queries;

- queries that return highest number of rows;

- queries caused buffers IO;

- cpu hog queries;

- disk hog queries (read/write);

- queries with IO on temp files;

- queries with IO on temp tables;

- use sorting and filtering;

- reports.

- Health checks and load spikes.

- **Hidden problems.**

- Clients' activity.

- Streaming replication.

Sequential scans.

Database's unwanted events.

Unused indexes.

Tables' sizes.

Sequential scans:

- might increase time of query execution;

- extra IO impact on large tables.

But OK for OLAP workload.

```
pgcenter: 2017-04-08 11:10:14, load average: 3.09, 1.03, 0.37          conn1 [ok]: /var/run/postgresql:5432
    %cpu: 91.8 us,  0.2 sy,  0.0 ni,  8.0 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st     activity: 12/100 conns,  0/0 prepa
 MiB mem:  32124 total,    291 free,  25471 used,     6362 buff/cached    autovacuum:  0/3 workers/max,  0 man
MiB swap:  15257 total,  15257 free,      0 used,       0/0 dirty/writeback   statements:   0 stmt/s, 0.000 stmt_a
```

relation	seq_scan	seq_read	idx_scan	idx_fetch	inserts	updates	deletes	hot_updates	live	dead
public.ycsb_metrics	43	43000000	129	4397052	0	0	0	0	0	0
public.pgbench_tellers	0	0	0	0	0	0	0	0	0	0
public.pgbench_history	0	0	0	0	0	0	0	0	0	0
public.pgbench_branches	0	0	0	0	0	0	0	0	0	0
public.pgbench_accounts	0	0	0	0	0	0	0	0	0	0

02 Sequential scans

```
pgcenter: 2017-04-08 11:10:50, load average: 6.73, 2.17, 0.78          conn1 [ok]: /var/run/postgresql:5432
    %cpu: 91.6 us,  0.2 sy,  0.0 ni,  8.3 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st     activity: 12/100 conns,  0/0 prepa
 MiB mem:  32124 total,    290 free,  25471 used,     6363 buff/cached       autovacuum:  0/3 workers/max,  0 man
MiB swap:  15257 total,  15257 free,      0 used,      0/0 dirty/writeback   statements:   0 stmt/s, 0.000 stmt_a
```

relation	heap_read	heap_hit	idx_read	idx_hit	toast_read	toast_hit	tidx_read	tidx_hit
public.ycsb_metrics	0	7675872	0	93752	0	0	0	0
public.pgbench_tellers	0	0	0	0	0	0	0	0
public.pgbench_history	0	0	0	0	0	0	0	0
public.pgbench_branches	0	0	0	0	0	0	0	0
public.pgbench_accounts	0	0	0	0	0	0	0	0

```
pgcenter: 2017-04-08 11:13:02, load average: 10.66, 5.43, 2.18          conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day
    %cpu: 91.9 us,  0.3 sy,  0.0 ni,  7.8 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st     activity: 12/100 conns,  0/0 prepared,  0 idle,  0 idle_xact, 12 active,
 MiB mem:  32124 total,    286 free,  25475 used,    6363 buff/cached     autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00
 MiB swap:  15257 total,  15257 free,      0 used,      0/0 dirty/writeback     statements: 160 stmt/s, 0.253 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00

user       database      t_calls     t_rows     calls  rows   queryid     query
postgres   pgbench_6gb   11191       11186446   38     38292  3702386801  select id,inserted_at,severity,payload from ycsb_metrics where ycsb_sensor = ?;
postgres   pgbench_6gb   11220       1122000    38     3800   e55c44ee4a  select id,ycsb_sensor,extra1 from ycsb_metrics where severity = ? order by inserted_at
postgres   pgbench_6gb   11221       1122010    38     3800   18d47af42e  select id,inserted_at,severity,payload,extra1,extra2,extra3 from ycsb_metrics where
postgres   pgbench_6gb   54          6425       1      119    3cadff41ef  SELECT a.rolname AS user, d.datname AS database, sum(p.calls) AS t_calls, sum(p.rows)
postgres   pgbench_6gb   11224       11224      39     39     65087e0adb  select ycsb_sensor,inserted_at,severity,payload from ycsb_metrics where id = ?;
```

Rollbacks.

Deadlocks.

Temporary files.

Recovery conflicts.

```
pgcenter: 2017-04-08 11:40:07, load average: 10.56, 4.80, 2.28          conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day
    %cpu: 91.9 us,  2.6 sy,  0.0 ni,  5.5 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st    activity: 12/100 conns,  0/0 prepared,  7 idle,  0 idle_xact,  5 active,
 MiB mem:  32124 total,    267 free,  25475 used,     6382 buff/cached    autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00
MiB swap:  15257 total,  15257 free,      0 used,      0/0 dirty/writeback   statements: 3535 stmt/s, 0.255 stmt_avgtime, 00:00:00 xact_maxtime,
```

datname	commit	rollback	reads	hits	returned	fetched	inserts	updates	deletes	conflicts	deadlocks	tmp_files	tmp_bytes	read_t	write_t
pgbench_64gb	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
pgbench_6gb	154	37	0	918112	40826627	3826627	22	1	0	0	0	0	0	0	0
postgres	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
template0	2	0	0	69	978	11	0	0	0	0	0	0	0	0	0
template1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Rollbacks - check postgres logs and application.

Deadlocks - enable *log_lock_waits*, check logs.

Temp files - enable *log_temp_files*, check logs, pg_stat_statements.

Recovery conflicts - check postgres logs, standby's queries.

Unused indexes are bad:

- consume disk space;

- extra writes operations;

- slow down INSERT/UPDATE/DELETEs;

- extra work for (auto)VACUUM.

```
pgcenter: 2017-04-08 11:45:20, load average: 0.09, 2.08, 1.87          conn1 [ok]: /var/run/postgresql:5432 postgre
    %cpu:  0.2 us,  0.0 sy,  0.0 ni, 99.8 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st     activity:  1/100 conns,  0/0 prepared,  0
 MiB mem:  32124 total,    282 free,  25462 used,     6380 buff/cached    autovacuum:  0/3 workers/max,  0 manual,  0
 MiB swap:  15257 total,  15257 free,       0 used,       0/0 dirty/writeback    statements:   6 stmt/s, 0.255 stmt_avgtime,


relation                    index                    idx_scan  idx_tup_read  idx_tup_fetch  idx_read  idx_hit
public.ycsb_metrics         ycsb_metrics_ycsb_sensor_idx  0         0             0              0         0
public.ycsb_metrics         ycsb_metrics_severity_idx     0         0             0              0         0
public.ycsb_metrics         ycsb_metrics_pkey             0         0             0              0         0
public.ycsb_metrics         ycsb_metrics_inserted_at_idx  0         0             0              0         0
public.pgbench_tellers      pgbench_tellers_pkey          0         0             0              0         0
public.pgbench_branches     pgbench_branches_pkey         0         0             0              0         0
public.pgbench_accounts     pgbench_accounts_pkey         0         0             0              0         0
```

How fast do tables and their indexes grow?

- pg_relation_size();

- pg_total_relation_size();

- pg_stat_user_tables.

```
pgcenter: 2017-04-08 12:03:55, load average: 3.29, 0.85, 0.81
    %cpu: 79.1 us,  8.8 sy,  0.0 ni, 12.1 id,  0.0 wa,  0.0 hi,  0.1 si,  0.0 st
 MiB mem:  32124 total,    230 free,  25471 used,     6423 buff/cached
MiB swap:  15257 total, 15257 free,      0 used,     29/0 dirty/writeback
```

relation	total_size	rel_size	idx_size	total_change	rel_change	idx_change
public.ycsb_metrics	362800	237312	125488	4208	2464	1744
public.pgbench_tellers	2984	2160	824	0	0	0
public.pgbench_history	0	0	0	0	0	0
public.pgbench_branches	1944	1624	320	0	0	0
public.pgbench_accounts	6934296	5967448	966848	0	0	0

These are not all cases.

There are many other use cases.

Troubleshooting cases

- Health checks and load spikes.

- Hidden problems.

- **Clients' activity.**

- Streaming replication.

A lot of active clients.

Idle transactions.

Waiting clients.

Age of the longest transaction.

Autovacuum.

02 Clients' activity

```
pgcenter: 2017-04-08 14:02:32, load average: 12.65, 10.19, 5.50          conn1 [ok]: /var/run/postgresql:5432 postgres@p (ver: 9.6.2, up 1 day 20:14:53)
   %cpu: 69.0 us, 10.5 sy,  0.0 ni, 20.3 id,  0.2 wa,  0.0 hi,  0.0 si,  0.0 st  activity: 11/100 conns,  0/0 prepared,  0 idle,  0 idle_xact, 11 active,  3 waiting,  0 others
 MiB mem:  32124 total,    224 free,  25466 used,     6434 buff/cached      autovacuum:  0/3 workers/max,  0 manual,  0 wraparound, 00:00:00 vac_maxtime
MiB swap:  15257 total,  15257 free,      0 used,       1/0 dirty/writeback  statements: 80598 stmt/s, 0.246 stmt_avgtime, 00:00:00 xact_maxtime, 00:00:00 prep_maxtime

pid    cl_addr  cl_port  datname      usename   state   wait_etype     wait_event     xact_age  query_age  change_age  query
21304           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 2099 WH
21303           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 1822 WH
21302           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 1989 WH
21301           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 2305 WH
21300           -1       pgbench_6gb  postgres  active   LWLockNamed    XidGenLock     00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 762 WHE
21299           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 771 WHE
21298           -1       pgbench_6gb  postgres  active   LWLockTranche  buffer_content 00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 4219 WH
21297           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + -2077 W
21296           -1       pgbench_6gb  postgres  active                                00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + -2311 W
21295           -1       pgbench_6gb  postgres  active   LWLockNamed    XidGenLock     00:00:00  00:00:00   00:00:00    UPDATE pgbench_accounts SET abalance = abalance + 4555 WH
```

Avoid:

- idle and long transactions cause bloat;

- deadlocks frustrate users.

Possible solutuions:

- cancel or terminate them;

- inspect an application.

- Health checks and load spikes.

- Hidden problems.

- Clients' activity.

- **Streaming replication.**

Replication issues:

- replication lag;

- standby's queries.

```
pgcenter: 2017-04-08 14:13:49, load average: 0.04, 3.10, 4.61          conn1 [ok]: /var/run/postgresql:5432 postgres@p
    %cpu:  0.0 us,  0.1 sy,  0.0 ni, 99.9 id,  0.0 wa,  0.0 hi,  0.0 si,  0.0 st   activity:  1/100 conns,  0/0 prepared,  0 idle,
 MiB mem:  32124 total,    232 free,  25461 used,     6431 buff/cached       autovacuum:  0/3 workers/max,  0 manual,  0 wra
MiB swap:  15257 total,  15257 free,       0 used,       0/0 dirty/writeback       statements:   6 stmt/s, 0.241 stmt_avgtime, 00:

client      user       name           state       mode    xlog   pending   write   flush   replay   total_lag   xact_age   time_age
10.6.6.9   replica   walreceiver   streaming   async   2485   0         0       0       410480   410480      524824     00:02:14
10.6.6.7   replica   walreceiver   streaming   async   2485   0         0       0       0        0                      
10.6.6.6   replica   walreceiver   streaming   async   2485   0         0       0       128      128         14         00:00:01
```

02 Troubleshooting cases

- Health checks and load spikes.

- Hidden problems.

- Clients activity.

- Streaming replication.

Postgres offers a lot of stats.

pgCenter offers handy stats' representation.

pgCenter helps to solve many types of issues.

It's still work in progress.

02 Links

pgCener – https://github.com/lesovsky/pgcenter

Slides – https://slideshare.net/alexeylesovsky/presentations

DataEgret – http://dataegret.com

DataEgret Blog – https://blog.postgresql-consulting.com

Thanks for watching!

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