

Terminal Tools

pg_top, pg_systat, pg_proctab

PostgresOpen 2019



Overview

- Terminal based tools
 - Basic live views of the system
 - Intended to be simpler to use than `psql`
 - Complement other tools
- Present capabilities of these tools



About me ...

- Employed by 2ndQuadrant
- PostgreSQL Contributor since 2005
- Director at United States
PostgreSQL Association since 2011
- Portland PostgreSQL Users Group



Open source projects

- **pg_top** - Display PostgreSQL processes
https://pg_top.gitlab.io/
- **pg_systat** - Display PostgreSQL statistics
https://pg_systat.gitlab.io/
- **pg_proctab** - PostgreSQL extension to query operating system process table
https://pg_proctab.gitlab.io/



pg_top

Display top PostgreSQL processes by:

- Memory
- Processor utilization
- Transaction or query run time



pg_top Default View

```
last pid: 900; load avg: 8.89, 5.05, 3.62; up 0+00:08:19 10:30:26
11 processes: 6 active, 5 idle txn
CPU states: 16.6% user, 25.2% nice, 53.9% system, 2.1% idle, 2.3% iowait
Memory: 4063M used, 11G free, 3906M cached
Swap: 16G free
```

PID	USERNAME	SIZE	RES	STATE	XTIME	QTIME	%CPU	LOCKS	COMMAND
727	postgres	232M	138M	idltxn	0:00	0:00	8.5	8	UPDATE pgbench_tellers SET tbalance = tbalanc
729	postgres	232M	138M	idltxn	0:00	0:00	7.6	4	UPDATE pgbench_accounts SET abalance = abalan
726	postgres	232M	138M	idltxn	0:00	0:00	7.6	11	UPDATE pgbench_branches SET bbalance = bbalan
730	postgres	232M	138M	active	0:00	0:00	7.8	11	END;
723	postgres	232M	138M	idltxn	0:00	0:00	7.4	8	UPDATE pgbench_tellers SET tbalance = tbalanc
731	postgres	232M	138M	active	0:00	0:00	7.6	11	END;
724	postgres	232M	137M	active	0:00	0:00	9.1	8	UPDATE pgbench_tellers SET tbalance = tbalanc
901	postgres	232M	14M	active	0:00	0:00	0.0	9	WITH lock_activity AS(?) SELECT pid, coun
728	postgres	232M	138M	active	0:00	0:00	7.4	11	END;
722	postgres	232M	138M	idltxn	0:00	0:00	8.0	8	UPDATE pgbench_tellers SET tbalance = tbalanc
725	postgres	232M	137M	active	0:00	0:00	8.7	11	END;



pg_top Backend States

```
last pid: 917, load avg: 8.68,  
11 processes: 7 active, 4 idle txn  
CPU states: 22.6% user, 16.6% nice,  
Memory: 4248M used, 11G free, 4085M  
Swap: 16G free
```

PID	USERNAME	SIZE	RES	STATE	X
727	postgres	232M	139M	active	
729	postgres	232M	139M	active	
726	postgres	232M	139M	idle txn	



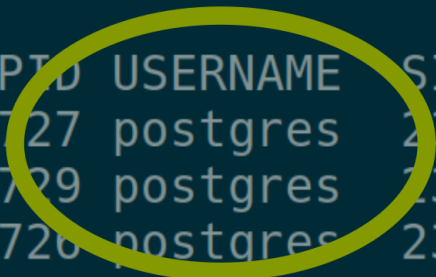
pg_top State

SIZE	RES	STATE	XTIME
232M	139M	active	0:00
232M	139M	active	0:00
232M	139M	idltxn	0:00
232M	139M	idltxn	0:00
232M	139M	active	0:00



pg_top Username

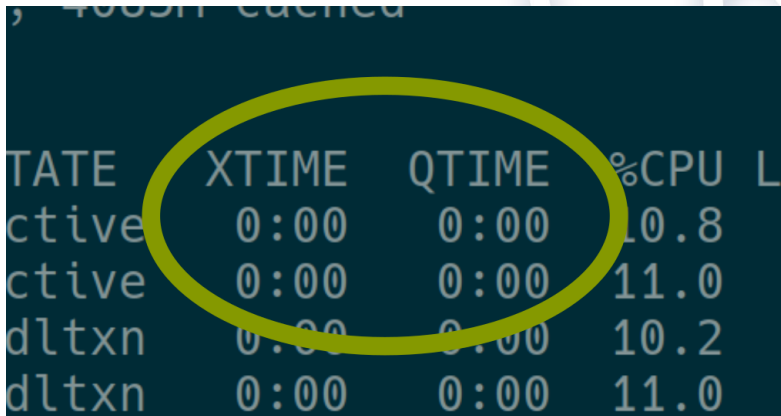
Swap: 16G free



PID	USERNAME	SIZE	RES
727	postgres	232M	139M
729	postgres	232M	139M
728	postgres	232M	139M
730	postgres	232M	139M
732	postgres	232M	139M



pg_top Transaction & Query Time



STATE	XTIME	QTIME	%CPU	L
active	0:00	0:00	10.8	
active	0:00	0:00	11.0	
dltxn	0:00	0:00	10.2	
dltxn	0:00	0:00	11.0	



pg_top I/O Statistics

```
last pid: 4903; load avg: 11.0, 10.0, 9.12; up 0+05:57:17 16:19:24
11 processes: 11 active
CPU states: 19.2% user, 0.0% nice, 46.8% system, 8.0% idle, 26.0% lowait
Memory: 7325M used, 8480M free, 7066M cached
Swap: 16G free
```

PID	RCHAR	WCHAR	SYSCR	SYSCW	READS	WRITES	CWRITES	COMMAND
4904	129K	0B	38	0	0B	0B	0B	postgres: postgres pgbench [local] idle
4605	2184K	2344K	273	34	1816K	2344K	0B	postgres: postgres pgbench [local] COMMIT
4613	2160K	2056K	270	34	1648K	2056K	0B	postgres: postgres pgbench [local] idle in transaction
4612	2152K	2432K	269	43	1896K	2432K	0B	postgres: postgres pgbench [local] COMMIT
4611	2144K	18B	268	2084	1664K	18B	0B	postgres: postgres pgbench [local] COMMIT
4606	2160K	2104K	270	33	1880K	2104K	0B	postgres: postgres pgbench [local] COMMIT
4608	2160K	2368K	270	34	1816K	2368K	0B	postgres: postgres pgbench [local] UPDATE
4607	2224K	2240K	278	33	1840K	2240K	0B	postgres: postgres pgbench [local] COMMIT
4610	2176K	2704K	272	39	1800K	2704K	0B	postgres: postgres pgbench [local] COMMIT
4609	2256K	2440K	282	41	1864K	2440K	0B	postgres: postgres pgbench [local] UPDATE
4614	2112K	2576K	264	34	1856K	2576K	0B	postgres: postgres pgbench [local] idle



pg_top Replication

```
last pid: 2703; load avg: 14.1, 6.91, 3.29; up 0+05:08:40 15:30:47
3 processes:
CPU states: 25.1% user, 0.0% nice, 58.1% system, 2.7% idle, 14.1% iowait
Memory: 3662M used, 12G free, 3501M cached
Swap: 16G free
```

PID	USERNAME	APPLICATION	CLIENT	STATE	PRIMARY	SENT	WRITE	FLUSH	REPLAY	SLAG	WLAG	FLAG	RLAG
2663	repmgr	pg3	10.1.1.103	catchup	3/58C344A8	1/16C80000	1/16BC0000	1/16BC0000	1/16ABF7E8	9248B	9248B	9248B	9249B
2664	repmgr	pg2	10.1.1.102	catchup	3/58C344A8	1/16C80000	1/16C00000	1/16B60000	1/16AEB378	9248B	9248B	9249B	9249B
2666	repmgr	pg4	10.1.1.104	catchup	3/58C344A8	1/16C40000	1/16C00000	1/16B40000	1/16A91F30	9248B	9248B	9249B	9250B



pg_top Display Query

```
Current query for procpid 1063:
```

```
UPDATE pgbench_accounts SET abalance = abalance + -150 WHERE aid = 297967;
```

```
Hit any key to continue:
```



pg_top Query Execution Plan

```
Current query plan for procpid 2215:
```

```
Statement:
```

```
UPDATE pgbench_accounts SET abalance = abalance + -1239 WHERE aid = 9276780;
```

```
Query Plan:
```

```
Update on pgbench_accounts (cost=0.43..8.46 rows=1 width=103)  
-> Index Scan using pgbench_accounts_pkey on pgbench_accounts (cost=0.43..8.46 rows=1 width=103)  
    Index Cond: (aid = 9276780)
```

```
Hit any key to continue:
```



pg_top Display Locks Held

Locks held by procpid 550:

	database	table	type	granted
1	pgbench	pgbench_accounts	RowExclusiveLock	t
2	pgbench	pgbench_accounts_pkey	RowExclusiveLock	t
3	pgbench		ExclusiveLock	t
4	pgbench		ExclusiveLock	t

Hit any key to continue:



pg_top Additional Features

- Batch-mode operation can be used to capture output to file:
`pg_top -b -d 1 -x 10 > pg_top.out`
- Can be used to display PostgreSQL processes on remote systems if the remote database has the **pg_proctab** extension loaded



pg_statstat

Display PostgreSQL statistics tables:

- `pg_stat_database`
- `pg_stat_database_conflicts`
- `pg_stat_all_tables`
- `pg_stat_all_indexes`
- `pg_statio_all_tables`
- `pg_statio_all_indexes`
- `pg_stat_process_vacuum`



pg_systat database transactions

17:17:28 PostgreSQL 9.4.23 postgres@:5432/pgbench

DATABASE	CONNECTIONS	COMMITTS	COMMITTS/s	ROLLBACKS	ROLLBACKS/s	DEADLOCKS
pgbench	11	338	67	0	0	0
postgres	0	0	0	0	0	0
repmgr	0	0	0	0	0	0
template0	0	0	0	0	0	0
template1	0	0	0	0	0	0



pg_systat database blocks

```
17:18:25 PostgreSQL 9.4.23 postgres@:5432/pgbench
```

DATABASE	READ	READ/s	HIT	HIT%	R_TIME	W_TIME	TMP_FILES	TMP_BYTES
pgbench	711	142	8553	92	0	0	0	0
postgres	0	0	0	0	0	0	0	0
repmgr	0	0	0	0	0	0	0	0
template0	0	0	0	0	0	0	0	0
template1	0	0	0	0	0	0	0	0



pg_stat database tuples

```
17:20:34 PostgreSQL 9.4.23 postgres@:5432/pgbench
```

DATABASE	R/s	W/s	RETURNED	FETCHED	INSERTED	UPDATED	DELETED
pgbench	293	230	1465	1241	288	864	0
postgres	0	0	0	0	0	0	0
repmgr	0	0	0	0	0	0	0
template0	0	0	0	0	0	0	0
template1	0	0	0	0	0	0	0



pg_systat database file system usage

```
17:19:55 PostgreSQL 9.4.23 postgres@:5432/pgbench
```

TABLESPACE	PATH	USED	AVAILABLE	%USED
pg_default	/var/lib/pgsql/9.4/data	784G	111G	85
pg_global	/var/lib/pgsql/9.4/data	784G	111G	85



pg_systat database conflicts (replicas only)

```
17:19:12 PostgreSQL 9.4.23 postgres@:5432/pgbench
```

DATABASE	CONFLICTS	TABLESPACE	LOCK	SNAPSHOT	BUFFERPIN	DEADLOCK
pgbench	0	0	0	0	0	0
postgres	0	0	0	0	0	0
repmgr	0	0	0	0	0	0
template0	0	0	0	0	0	0
template1	0	0	0	0	0	0



pg_systat table scans

17:21:26 (1-28 of 79) PostgreSQL 9.4.23 postgres@:5432/pgbench

SCHEMA	NAME	SEQ_SCAN	SEQ_TUP_READ	IDX_SCAN	IDX_TUP_FETCH
public	pgbench_accounts	0	0	698	698
public	pgbench_branches	0	0	349	349
public	pgbench_history	0	0	0	0
public	pgbench_tellers	0	0	349	349
pg_toast	pg_toast_1255	0	0	0	0
pg_toast	pg_toast_12632	0	0	0	0
pg_toast	pg_toast_12637	0	0	0	0
pg_toast	pg_toast_12642	0	0	0	0
pg_toast	pg_toast_12647	0	0	0	0
pg_toast	pg_toast_12652	0	0	0	0
pg_toast	pg_toast_12657	0	0	0	0
pg_toast	pg_toast_12662	0	0	0	0
pg_toast	pg_toast_2396	0	0	0	0
pg_toast	pg_toast_2604	0	0	0	0
pg_toast	pg_toast_2606	0	0	0	0
pg_toast	pg_toast_2609	0	0	0	0
pg_toast	pg_toast_2618	0	0	1	3
pg_toast	pg_toast_2619	0	0	0	0
pg_toast	pg_toast_2620	0	0	0	0
pg_toast	pg_toast_2964	0	0	0	0
pg_toast	pg_toast_3596	0	0	0	0
pg_catalog	pg_aggregate	0	0	1	1
pg_catalog	pg_am	2	2	0	0
pg_catalog	pg_amop	0	0	9	11
pg_catalog	pg_amproc	0	0	5	8
pg_catalog	pg_attrdef	0	0	0	0
pg_catalog	pg_attribute	0	0	67	98
pg_catalog	pg_auth_members	0	0	0	0



pg_systat table tuples

17:23:01 (1-32 of 79) PostgreSQL 9.4.23 postgres@5432/pgbench

SCHEMA	NAME	INS	UPD	DEL	HOT_UPD	LIVE	DEAD
public	pgbench_accounts	0	0	264	0	71879	10000045
public	pgbench_branches	0	0	264	0	507541	1000
public	pgbench_history	264	264	0	0	0	147163
public	pgbench_tellers	0	0	264	0	508380	10000
pg_toast	pg_toast_1255	0	0	0	0	0	0
pg_toast	pg_toast_12632	0	0	0	0	0	0
pg_toast	pg_toast_12637	0	0	0	0	0	0
pg_toast	pg_toast_12642	0	0	0	0	0	0
pg_toast	pg_toast_12647	0	0	0	0	0	0
pg_toast	pg_toast_12652	0	0	0	0	0	0
pg_toast	pg_toast_12657	0	0	0	0	0	0
pg_toast	pg_toast_12662	0	0	0	0	0	0
pg_toast	pg_toast_2396	0	0	0	0	0	0
pg_toast	pg_toast_2604	0	0	0	0	0	0
pg_toast	pg_toast_2606	0	0	0	0	0	0
pg_toast	pg_toast_2609	0	0	0	0	0	0
pg_toast	pg_toast_2618	0	0	0	0	0	0
pg_toast	pg_toast_2619	0	0	0	0	0	0
pg_toast	pg_toast_2620	0	0	0	0	0	0
pg_toast	pg_toast_2964	0	0	0	0	0	0
pg_toast	pg_toast_3596	0	0	0	0	0	0
pg_catalog	pg_aggregate	0	0	0	0	0	0
pg_catalog	pg_am	0	0	0	0	0	0
pg_catalog	pg_amop	0	0	0	0	0	0
pg_catalog	pg_amproc	0	0	0	0	0	0
pg_catalog	pg_attrdef	0	0	0	0	0	0
pg_catalog	pg_attribute	0	0	0	0	0	44
pg_catalog	pg_auth_members	0	0	0	0	1	6
pg_catalog	pg_authid	0	0	0	0	1	6
pg_catalog	pg_cast	0	0	0	0	0	7
pg_catalog	pg_class	0	0	0	0	0	0
pg_catalog	pg_collation	0	0	0	0	0	0



pg_systat table vacuum

17:23:33 (1-31 of 79) PostgreSQL 9.4.23 postgres@5432/pgbench

SCHEMA	NAME	LAST_VACUUM	LAST_AUTOVACUUM	VACUUM_COUNT	AUTOVACUUM_COUNT
public	pgbench_accounts	2019-08-03 15:54:53.293		1	0
public	pgbench_branches	2019-08-03 17:15:39.800	2019-08-03 17:23:30.668646+	4	30
public	pgbench_history	2019-08-03 15:54:58.190		1	0
public	pgbench_tellers	2019-08-03 17:15:39.806	2019-08-03 17:23:29.046989+	4	30
pg_toast	pg_toast_1255			0	0
pg_toast	pg_toast_12632			0	0
pg_toast	pg_toast_12637			0	0
pg_toast	pg_toast_12642			0	0
pg_toast	pg_toast_12647			0	0
pg_toast	pg_toast_12652			0	0
pg_toast	pg_toast_12657			0	0
pg_toast	pg_toast_12662			0	0
pg_toast	pg_toast_2396			0	0
pg_toast	pg_toast_2604			0	0
pg_toast	pg_toast_2606			0	0
pg_toast	pg_toast_2609			0	0
pg_toast	pg_toast_2618			0	0
pg_toast	pg_toast_2619			0	0
pg_toast	pg_toast_2620			0	0
pg_toast	pg_toast_2964			0	0
pg_toast	pg_toast_3596			0	0
pg_catalog	pg_aggregate			0	0
pg_catalog	pg_am			0	0
pg_catalog	pg_amop			0	0
pg_catalog	pg_amproc			0	0
pg_catalog	pg_attrdef			0	0
pg_catalog	pg_attribute			0	0
pg_catalog	pg_auth_members			0	0
pg_catalog	pg_authid			0	0
pg_catalog	pg_cast			0	0
pg_catalog	pg_class			0	0



pg_systat table analyze

18:15:18 (1-31 of 79) PostgreSQL 9.4.23 postgres@5432/pgbench

SCHEMA	NAME	N_MOD	LAST_ANALYZE	LAST_AUTOANALYZE	ANALYZE_COUNT	AUTOANALYZE_COUNT
public	pgbench_acco	565345	2019-08-03 15:54:58.		1	0
public	pgbench_bran	0	2019-08-03 15:52:55.	2019-08-03 17:26:31.0088	1	34
public	pgbench_hist	0	2019-08-03 15:54:58.	2019-08-03 17:26:30.9260	1	30
public	pgbench_tell	0	2019-08-03 15:52:55.	2019-08-03 17:26:29.2665	1	33
pg_toast	pg_toast_125	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_126	0			0	0
pg_toast	pg_toast_239	0			0	0
pg_toast	pg_toast_260	0			0	0
pg_toast	pg_toast_260	0			0	0
pg_toast	pg_toast_260	0			0	0
pg_toast	pg_toast_261	0			0	0
pg_toast	pg_toast_261	0			0	0
pg_toast	pg_toast_262	0			0	0
pg_toast	pg_toast_296	0			0	0
pg_toast	pg_toast_359	0			0	0
pg_catalog	pg_aggregate	0			0	0
pg_catalog	pg_am	0			0	0
pg_catalog	pg_amop	0			0	0
pg_catalog	pg_amproc	0			0	0
pg_catalog	pg_attrdef	0			0	0
pg_catalog	pg_attribute	44			0	0
pg_catalog	pg_auth_mem	1			0	0
pg_catalog	pg_authid	7			0	0
pg_catalog	pg_cast	0			0	0
pg_catalog	pg_class	11			0	0



pg_systat index

00:17:15 (1-28 of 116) PostgreSQL 9.4.23 postgres@:5432/pgbench

SCHEMA	INDEXNAME	TABlename	SCAN	TUP_READ	TUP_FETCH
public	pgbench_accounts	pgbench_accounts_pkey	1130692	1612350	1130692
public	pgbench_branches	pgbench_branches_pkey	565348	623923	565346
public	pgbench_tellers	pgbench_tellers_pkey	565345	577527	565345
pg_toast	pg_toast_1255	pg_toast_1255_index	0	0	0
pg_toast	pg_toast_12632	pg_toast_12632_index	0	0	0
pg_toast	pg_toast_12637	pg_toast_12637_index	0	0	0
pg_toast	pg_toast_12642	pg_toast_12642_index	0	0	0
pg_toast	pg_toast_12647	pg_toast_12647_index	0	0	0
pg_toast	pg_toast_12652	pg_toast_12652_index	0	0	0
pg_toast	pg_toast_12657	pg_toast_12657_index	0	0	0
pg_toast	pg_toast_12662	pg_toast_12662_index	0	0	0
pg_toast	pg_toast_2396	pg_toast_2396_index	0	0	0
pg_toast	pg_toast_2604	pg_toast_2604_index	0	0	0
pg_toast	pg_toast_2606	pg_toast_2606_index	0	0	0
pg_toast	pg_toast_2609	pg_toast_2609_index	0	0	0
pg_toast	pg_toast_2618	pg_toast_2618_index	4640	13501	13501
pg_toast	pg_toast_2619	pg_toast_2619_index	0	0	0
pg_toast	pg_toast_2620	pg_toast_2620_index	0	0	0
pg_toast	pg_toast_2964	pg_toast_2964_index	0	0	0
pg_toast	pg_toast_3596	pg_toast_3596_index	0	0	0
pg_catalog	pg_aggregate	pg_aggregate_fnoid_in	4520	4520	4520
pg_catalog	pg_am	pg_am_name_index	0	0	0
pg_catalog	pg_am	pg_am_oid_index	0	0	0
pg_catalog	pg_amop	pg_amop_fam_strat_ind	25362	25362	25362
pg_catalog	pg_amop	pg_amop_oid_index	0	0	0
pg_catalog	pg_amop	pg_amop_opr_fam_index	18577	28422	28422
pg_catalog	pg_amproc	pg_amproc_fam_proc_in	24084	38855	38855
pg_catalog	pg_amproc	pg_amproc_oid_index	0	0	0



pg_systat Additional Features

- Batch-mode operation can be used to capture output to file:
`pg_systat -b > pg_systat.out`
- Almost all views can display PostgreSQL statistics from remote systems



pg_proctab

A PostgreSQL extension that provides a SQL interface to the operating system's process table through user-defined functions:

- pg_cputime
- pg_loadavg
- pg_memusage
- pg_proctab



pg_proctab Features

- Generate reports on system utilization by process; see scripts in `contrib` directory
- Allows **pg_top** to get operating system statistics from remote systems
- Currently only for PostgreSQL systems running on Linux



pg_proctab Information

- Provides low level system information
- Example scripts provided for:
 - creating tables to store snapshots of statistics data
 - collecting snapshots of statistics data
 - generating reports from the saved data



pg_system Additional Features

- Batch-mode operation can be used to capture output to file:
`pg_top -b -d 1 -x 10 > pg_top.out`
- Can be used to display PostgreSQL processes on remote systems if the remote database has the **pg_proctab** extension loaded



pg_proctab Example

Create tables

```
psql -f create-ps_procstat-tables.sql
```

Take a snapshot of data; returns snapshot ID

```
psql -f ps_procstat-snap.sql
```

Take another snapshot of data

returns snapshot ID

```
psql -f ps_procstat-snap.sql
```



pg_proctab

Processor and I/O Utilization Reports

```
% ps-processor-utilization.sh <pid> <snap1> <snap2>
```

Processor Utilization = 42.00 %

```
% ps-io-utilization.sh <pid> <snap1> <snap2>
```

Reads = 276981

Writes = 63803

Reads (Bytes) = 2164604928

Writes (Bytes) = 508166144

Cancelled (Bytes) = 36880384



pg_proctab Database Reports

```
% ps—report.pl <pid> <snapshot 1> <snapshot 2>
```

```
Database           : dbt5  
Snapshot Start    : 2010-03-26 15:24:51.516226-07  
Snapshot End      : 2010-03-26 15:25:51.57661-07
```

Database Statistics

```
Commits           : 421  
Rollbacks         : 2  
Blocks Read      : 13919368  
Blocks Hit       : 7876506
```



pg_proctab Table Stat Report

```
=====
Table Statistics
=====
```

Schema.Relation	Seq	Scan	Seq Tup	Read	Idx	Scan	Idx
public.broker		169		8067		259	
...							



pg_proctab Index Stats Report

```
=====
Index Statistics
=====
```

Schema.Relation.Index	Idx	Scan	Idx	Tup	Read	Idx	T
public.broker.pk_broker		259			259		
...							



Thank you!
Visit 2ndQuadrant in the Expo Hall!

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