

The GUCS: A Three-Hour Tour



What are GUCS?

“Grand Unified Configuration Settings”

A large set of global and session database settings which live in:

`src/backend/utils/misc/guc.c`

Your main way of configuring and tuning the database.

in addition to compile options, system configuration and schema tuning!

Pronounced “gucks”

194 Switches and Levers



194 Settings?!?



Don't worry!



Setting GUCS

8

6

5

Eight types of GUCS

Boolean

Integer

Float

Memory / Disk

Time

Strings

ENUMs

Lists

Eight types of GUCS

Boolean

take TRUE | FALSE or ON | OFF

enable_seqscan = on

Integer

take whole numbers only

max_connections = 700

Eight types of GUCS

Float

take decimal values

```
random_page_cost = 3.75
```

Memory / Disk Size

can take integers

but can also take “computer units”: kB, MB, GB

```
work_mem = 512MB  
shared_buffers = 4096
```

Eight Types of GUCS

Time

take time values (units vary)

units are often omitted

```
authentication_timeout = 30s
```

Strings

take unchecked strings

often refers to file locations or program names

```
log_directory = 'pg_log'
```

Eight Types of GUCS

ENUMs

take a string value from a prescribed list

```
log_destination = 'csvlog'
```

Lists

take a list of values, either freeform or ENUM

```
search_path = 'main, archive, "$user"'
```

Six GUCS Contexts

user

superuser

sighup

postmaster

backend

internal

Six GUCS Contexts

user

can be set on per-session basis at runtime

superuser

can be set at runtime for the whole server, but only by the superuser

sighup

requires a soft restart of the postmaster to change

postmaster

can only be changed with a hard restart

Six GUCS Contexts

backend

developer settings which have to be set before session start

internal

compile-time settings provided for reference.
Unalterable.

5 Places of set GUCs

1. postgresql.conf file

2. SET

3. pg_settings

4. ALTER objects

5. command-line switches & PGOPTIONS

postgresql.conf

\$PGDATA/postgresql.conf

can be relocated or symlinked

Primary way to change GUCS

for performance

for logging

for defaults

postgresql.conf

just a big list of settings

defaults are “# commented” out

if a setting appears multiple times, the last one takes effect

SET & SHOW

Access GUCS in a SQL session

SET changes

only applies to user and superuser contexts

best way to change things for only one session

can be embedded in stored procedures

```
SET enable_mergejoin = false;
```

SHOW displays

SHOW ALL lets you see all GUCS

```
SHOW shared_buffers;
```

pg_settings

Tabular representation of GUCS

a “system view”

can be queried

can be updated, which runs a SET on the relevant parameter

needs some clean-up (I'm working on it)

```
SELECT * FROM pg_settings  
WHERE name = 'work_mem';
```

```
UPDATE pg_settings SET setting = '12MB'  
WHERE name = 'work_mem';
```

ALTER objects

You can ALTER some objects to change their configuration settings

ROLES (users)

DATABASEs

FUNCTIONs

Changes configuration setting when that object is used (unless overridden by a SET)

```
ALTER ROLE "data entry" SET  
search_path = 'entry, public';
```

ALTER objects

Good way to discriminate between applications & users

set search_path

sometimes for security

primitive resource management

change work_mem, etc. for specific ROLES, applications or reports

localization

if different users have different desired displays

```
ALTER DATABASE sao_paulo SET timezone =  
'America/SaoPaulo';
```

ALTER objects

```
CREATE FUNCTION check_password(uname TEXT,  
pass TEXT)  
RETURNS BOOLEAN AS $$  
DECLARE passed BOOLEAN;  
BEGIN  
    SELECT (pwd = $2) INTO passed  
    FROM pwds  
    WHERE username = $1;  
  
    RETURN passed;  
END;  
$$ LANGUAGE plpgsql  
SECURITY DEFINER  
-- Set a secure search_path: trusted  
-- schema(s), then 'pg_temp'.  
SET search_path = admin, pg_temp;
```

command-line and pgoptions

Set options when you start PostgreSQL

as command-line switches

using the PGOPTIONS shell variable

Not generally recommended

hard to administrate or document

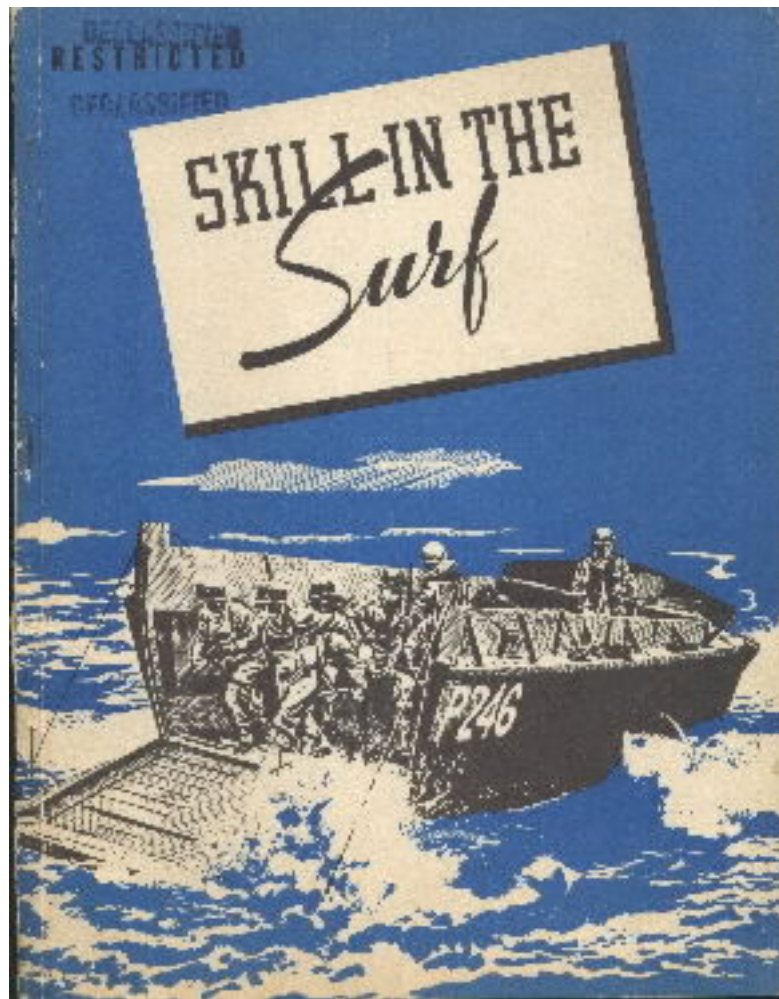
mainly for running automated tests

and for restarting with recovery options

```
postgres -c 'bgwriter_delay = 50ms'
```

```
export PGOPTIONS = '-c zero_damaged_pages = ON'
```

GUCS Reference



The 14 Settings

most users need to adjust

- (1) listen_address
- (2) max_connections
- (3) shared_buffers
- (4) work_mem
- (5) maintenance_work_mem
- (6) max_fsm_pages
- (7) synchronous_commit
- (8) checkpoint_segments
- (9) wal_buffers
- (10) autovacuum
- (11) effective_cache_size
- (12) default_statistics_target
- (13) constraint_exclusion
- (14) log_destination & log settings

Categories (new)

file locations

connection settings

memory management

maintenance

WAL & checkpoints

query tuning

logging

statistics

locks

locale & formatting

other settings & defaults

compatibility

custom GUCS

developer options

presets

GUCS: the Grand Tour



Finale

- 1) config_file
- 2) data_directory
- 3) hba_file
- 4) ident_file
- 5) external_pid_file
- 6) listen_addresses
- 7) port
- 8) max_connections
- 9) superuser_reserved_connections
- 10) unix_socket_directory
- 11) unix_socket_group
- 12) unix_socket_permissions
- 13) bonjour_name
- 14) authentication_timeout
- 15) tcp_keepalives_count
- 16) tcp_keepalives_idle
- 17) tcp_keepalives_interval
- 18) db_user_namespace
- 19) password_encryption
- 20) ssl
- 21) krb_caseins_users
- 22) krb_realm
- 23) krb_server_hostname
- 24) krb_server_keyfile
- 25) krb_srvname
- 26) shared_buffers
- 27) work_mem
- 28) temp_buffers
- 29) max_prepared_transactions
- 30) max_files_per_process
- 31) max_stack_depth
- 32) shared_preload_libraries
- 33) maintenance_work_mem
- 34) max_fsm_pages
- 35) max_fsm_relations
- 36) vacuum_cost_delay
- 37) vacuum_cost_limit
- 38) vacuum_cost_page_dirty

Contact

Josh Berkus: josh@postgresql.org

blog: blogs.ittoolbox.com/database/soup

PostgreSQL: www.postgresql.org

Sun: www.sun.com/postgresql

Upcoming Events

PGDay OSCON : July 20th, Portland

PGDay LWE : August 5, San Francisco

PGCon Brazil : September 27-28, Campinas

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