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**sqlc**

***Release 1.15.0***

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# OVERVIEW

<b>1</b>	<b>Installing sqlc</b>	<b>3</b>
1.1	macOS . . . . .	3
1.2	Ubuntu . . . . .	3
1.3	go install . . . . .	3
1.4	Docker . . . . .	3
1.5	Downloads . . . . .	4
<b>2</b>	<b>Getting started with MySQL</b>	<b>5</b>
<b>3</b>	<b>Getting started with PostgreSQL</b>	<b>9</b>
<b>4</b>	<b>Retrieving rows</b>	<b>13</b>
4.1	Selecting columns . . . . .	15
4.2	Passing a slice as a parameter to a query . . . . .	16
<b>5</b>	<b>Counting rows</b>	<b>19</b>
<b>6</b>	<b>Inserting rows</b>	<b>21</b>
6.1	Returning columns from inserted rows . . . . .	22
6.2	Using CopyFrom . . . . .	23
<b>7</b>	<b>Updating rows</b>	<b>25</b>
7.1	Single parameter . . . . .	25
7.2	Multiple parameters . . . . .	26
<b>8</b>	<b>Deleting rows</b>	<b>27</b>
<b>9</b>	<b>Preparing queries</b>	<b>29</b>
<b>10</b>	<b>Using transactions</b>	<b>31</b>
<b>11</b>	<b>Naming parameters</b>	<b>33</b>
11.1	Nullable parameters . . . . .	34
<b>12</b>	<b>Modifying the database schema</b>	<b>35</b>
12.1	Handling SQL migrations . . . . .	35
<b>13</b>	<b>Configuring generated structs</b>	<b>39</b>
13.1	Naming scheme . . . . .	39
13.2	JSON tags . . . . .	39
13.3	More control . . . . .	40

<b>14</b>	<b>Uploading projects</b>	<b>41</b>
14.1	Add configuration . . . . .	41
14.2	Dry run . . . . .	41
14.3	Upload . . . . .	42
<b>15</b>	<b>CLI</b>	<b>43</b>
<b>16</b>	<b>Configuration</b>	<b>45</b>
16.1	Version 2 . . . . .	45
16.2	Version 1 . . . . .	51
<b>17</b>	<b>Datatypes</b>	<b>55</b>
17.1	Arrays . . . . .	55
17.2	Dates and Time . . . . .	55
17.3	Enums . . . . .	56
17.4	Null . . . . .	56
17.5	UUIDs . . . . .	57
<b>18</b>	<b>Query annotations</b>	<b>59</b>
18.1	:exec . . . . .	59
18.2	:execresult . . . . .	59
18.3	:execrows . . . . .	60
18.4	:execlastid . . . . .	60
18.5	:many . . . . .	60
18.6	:one . . . . .	60
18.7	:batchexec . . . . .	61
18.8	:batchmany . . . . .	61
18.9	:batchone . . . . .	62
<b>19</b>	<b>Database and language support</b>	<b>65</b>
19.1	Future Language Support . . . . .	65
<b>20</b>	<b>Environment variables</b>	<b>67</b>
20.1	SQLCDEBUG . . . . .	67
<b>21</b>	<b>Changelog</b>	<b>71</b>
21.1	1.15.0 . . . . .	71
21.2	1.14.0 . . . . .	72
21.3	1.13.0 . . . . .	74
21.4	1.12.0 . . . . .	75
21.5	1.11.0 . . . . .	76
21.6	1.10.0 . . . . .	78
21.7	1.9.0 . . . . .	79
21.8	1.8.0 . . . . .	79
21.9	1.7.0 . . . . .	81
21.10	1.6.0 . . . . .	83
21.11	1.5.0 . . . . .	86
21.12	1.4.0 . . . . .	89
21.13	1.3.0 . . . . .	91
21.14	1.2.0 . . . . .	92
21.15	1.1.0 . . . . .	93
21.16	1.0.0 . . . . .	95
21.17	0.1.0 . . . . .	98
<b>22</b>	<b>Developing sqlc</b>	<b>101</b>

22.1	Building	101
22.2	Running Tests	101
22.3	Regenerate expected test output	102
<b>23</b>	<b>Authoring plugins</b>	<b>103</b>
23.1	WASM plugins	103
23.2	Process plugins	104
<b>24</b>	<b>Privacy and data collection</b>	<b>105</b>
24.1	Our Privacy Pledge	105
24.2	Hosted Services	105



**And lo, the Great One looked down upon the people and proclaimed:** “SQL is actually pretty great”

sqlc generates **fully type-safe idiomatic Go code** from SQL. Here’s how it works:

1. You write SQL queries
2. You run sqlc to generate Go code that presents type-safe interfaces to those queries
3. You write application code that calls the methods sqlc generated

Seriously, it’s that easy. You don’t have to write any boilerplate SQL querying code ever again.





## INSTALLING SQLC

sqlc is distributed as a single binary with zero dependencies.

### 1.1 macOS

```
brew install sqlc
```

### 1.2 Ubuntu

```
sudo snap install sqlc
```

### 1.3 go install

#### 1.3.1 Go >= 1.17:

```
go install github.com/kyleconroy/sqlc/cmd/sqlc@latest
```

#### 1.3.2 Go < 1.17:

```
go get github.com/kyleconroy/sqlc/cmd/sqlc
```

### 1.4 Docker

```
docker pull kjconroy/sqlc
```

Run sqlc using docker run:

```
docker run --rm -v $(pwd):/src -w /src kjconroy/sqlc generate
```

Run sqlc using docker run in the Command Prompt on Windows (cmd):

```
docker run --rm -v "%cd%:/src" -w /src kjconroy/sqlc generate
```

## 1.5 Downloads

Get pre-built binaries for *v1.15.0*:

- Linux
- macOS
- Windows (MySQL only)

See [downloads.sqlc.dev](https://downloads.sqlc.dev) for older versions.

## GETTING STARTED WITH MYSQL

This tutorial assumes that the latest version of sqlc is [installed](#) and ready to use.

Create a new directory called `sqlc-tutorial` and open it up.

Initialize a new Go module named `tutorial.sql.dev/app`

```
go mod init tutorial.sqlc.dev/app
```

sqlc looks for either a `sqlc.yaml` or `sqlc.json` file in the current directory. In our new directory, create a file named `sqlc.yaml` with the following contents:

```
version: 1
packages:
- path: "tutorial"
  name: "tutorial"
  engine: "mysql"
  schema: "schema.sql"
  queries: "query.sql"
```

sqlc needs to know your database schema and queries. In the same directory, create a file named `schema.sql` with the following contents:

```
CREATE TABLE authors (
  id BIGINT NOT NULL AUTO_INCREMENT PRIMARY KEY,
  name text NOT NULL,
  bio text
);
```

Next, create a `query.sql` file with the following four queries:

```
-- name: GetAuthor :one
SELECT * FROM authors
WHERE id = ? LIMIT 1;

-- name: ListAuthors :many
SELECT * FROM authors
ORDER BY name;

-- name: CreateAuthor :execresult
INSERT INTO authors (
  name, bio
) VALUES (
```

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```
?, ?  
);  
  
-- name: DeleteAuthor :exec  
DELETE FROM authors  
WHERE id = ?;
```

You are now ready to generate code. Run the `generate` command. You shouldn't see any errors or output.

```
sqlc generate
```

You should now have a `tutorial` package containing three files.

```
├── go.mod  
├── query.sql  
├── schema.sql  
├── sqlc.yaml  
├── tutorial  
│   ├── db.go  
│   ├── models.go  
│   └── query.sql.go
```

You can use your newly generated queries in `app.go`.

```
package main  
  
import (  
    "context"  
    "database/sql"  
    "log"  
    "reflect"  
  
    "tutorial.sqlc.dev/app/tutorial"  
  
    _ "github.com/go-sql-driver/mysql"  
)  
  
func run() error {  
    ctx := context.Background()  
  
    db, err := sql.Open("mysql", "user:password@/dbname")  
    if err != nil {  
        return err  
    }  
  
    queries := tutorial.New(db)  
  
    // list all authors  
    authors, err := queries.ListAuthors(ctx)  
    if err != nil {  
        return err  
    }  
    log.Println(authors)
```

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```
// create an author
result, err := queries.CreateAuthor(ctx, tutorial.CreateAuthorParams{
    Name: "Brian Kernighan",
    Bio:  sql.NullString{String: "Co-author of The C Programming Language,
↳and The Go Programming Language", Valid: true},
})
if err != nil {
    return err
}

insertedAuthorID, err := result.LastInsertId()
if err != nil {
    return err
}
log.Println(insertedAuthorID)

// get the author we just inserted
fetchedAuthor, err := queries.GetAuthor(ctx, insertedAuthorID)
if err != nil {
    return err
}

// prints true
log.Println(reflect.DeepEqual(insertedAuthorID, fetchedAuthor.ID))
return nil
}

func main() {
    if err := run(); err != nil {
        log.Fatal(err)
    }
}
```

Before the code will compile, you'll need to add the Go MySQL driver.

```
go get github.com/go-sql-driver/mysql
go build ./...
```

To make that possible, sqlc generates readable, **idiomatic** Go code that you otherwise would have had to write yourself. Take a look in `tutorial/query.sql.go`.



## GETTING STARTED WITH POSTGRESQL

This tutorial assumes that the latest version of sqlc is [installed](#) and ready to use.

Create a new directory called `sqlc-tutorial` and open it up.

Initialize a new Go module named `tutorial.sql.dev/app`

```
go mod init tutorial.sqlc.dev/app
```

sqlc looks for either a `sqlc.yaml` or `sqlc.json` file in the current directory. In our new directory, create a file named `sqlc.yaml` with the following contents:

```
version: 1
packages:
- path: "tutorial"
  name: "tutorial"
  engine: "postgresql"
  schema: "schema.sql"
  queries: "query.sql"
```

sqlc needs to know your database schema and queries. In the same directory, create a file named `schema.sql` with the following contents:

```
CREATE TABLE authors (
  id BIGSERIAL PRIMARY KEY,
  name text NOT NULL,
  bio text
);
```

Next, create a `query.sql` file with the following four queries:

```
-- name: GetAuthor :one
SELECT * FROM authors
WHERE id = $1 LIMIT 1;

-- name: ListAuthors :many
SELECT * FROM authors
ORDER BY name;

-- name: CreateAuthor :one
INSERT INTO authors (
  name, bio
) VALUES (
```

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```
    $1, $2
)
RETURNING *;

-- name: DeleteAuthor :exec
DELETE FROM authors
WHERE id = $1;
```

For SQL UPDATE if you do not want to return the updated record to the user, add this to the `query.sql` file:

```
-- name: UpdateAuthor :exec
UPDATE authors
set name = $2,
bio = $3
WHERE id = $1;
```

Otherwise, to return the updated record back to the user, add this to the `query.sql` file:

```
-- name: UpdateAuthor :one
UPDATE authors
set name = $2,
bio = $3
WHERE id = $1
RETURNING *;
```

You are now ready to generate code. Run the `generate` command. You shouldn't see any errors or output.

```
sqlc generate
```

You should now have a `tutorial` package containing three files.

```
├── go.mod
├── query.sql
├── schema.sql
├── sqlc.yaml
└── tutorial
    ├── db.go
    ├── models.go
    └── query.sql.go
```

You can use your newly generated queries in `app.go`.

```
package main

import (
    "context"
    "database/sql"
    "log"
    "reflect"

    "tutorial.sqlc.dev/app/tutorial"

    _ "github.com/lib/pq"
)
```

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```
)  
  
func run() error {  
    ctx := context.Background()  
  
    db, err := sql.Open("postgres", "user=pqgotest dbname=pqgotest sslmode=verify-  
↪full")  
    if err != nil {  
        return err  
    }  
  
    queries := tutorial.New(db)  
  
    // list all authors  
    authors, err := queries.ListAuthors(ctx)  
    if err != nil {  
        return err  
    }  
    log.Println(authors)  
  
    // create an author  
    insertedAuthor, err := queries.CreateAuthor(ctx, tutorial.CreateAuthorParams{  
        Name: "Brian Kernighan",  
        Bio:  sql.NullString{String: "Co-author of The C Programming Language,  
↪and The Go Programming Language", Valid: true},  
    })  
    if err != nil {  
        return err  
    }  
    log.Println(insertedAuthor)  
  
    // get the author we just inserted  
    fetchedAuthor, err := queries.GetAuthor(ctx, insertedAuthor.ID)  
    if err != nil {  
        return err  
    }  
  
    // prints true  
    log.Println(reflect.DeepEqual(insertedAuthor, fetchedAuthor))  
    return nil  
}  
  
func main() {  
    if err := run(); err != nil {  
        log.Fatal(err)  
    }  
}
```

Before the code will compile, you'll need to add the Go PostgreSQL driver.

```
go get github.com/lib/pq  
go build ./...
```

To make that possible, sqlc generates readable, **idiomatic** Go code that you otherwise would have had to write yourself. Take a look in `tutorial/query.sql.go`.

## RETRIEVING ROWS

To generate a database access method, annotate a query with a specific comment.

```
CREATE TABLE authors (  
  id          SERIAL PRIMARY KEY,  
  bio         text    NOT NULL,  
  birth_year int    NOT NULL  
);  
  
-- name: GetAuthor :one  
SELECT * FROM authors  
WHERE id = $1;  
  
-- name: ListAuthors :many  
SELECT * FROM authors  
ORDER BY id;
```

A few new pieces of code are generated beyond the `Author` struct. An interface for the underlying database is generated. The `*sql.DB` and `*sql.Tx` types satisfy this interface.

The database access methods are added to a `Queries` struct, which is created using the `New` method.

Note that the `*` in our query has been replaced with explicit column names. This change ensures that the query will never return unexpected data.

Our query was annotated with `:one`, meaning that it should only return a single row. We scan the data from that one into a `Author` struct.

Since the get query has a single parameter, the `GetAuthor` method takes a single `int` as an argument.

Since the list query has no parameters, the `ListAuthors` method accepts no arguments.

```
package db  
  
import (  
    "context"  
    "database/sql"  
)  
  
type Author struct {  
    ID          int  
    Bio         string  
    BirthYear  int
```

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```

}

type DBTX interface {
    QueryContext(context.Context, string, ...interface{}) (*sql.Rows, error)
    QueryRowContext(context.Context, string, ...interface{}) *sql.Row
}

func New(db DBTX) *Queries {
    return &Queries{db: db}
}

type Queries struct {
    db DBTX
}

const getAuthor = `-- name: GetAuthor :one
SELECT id, bio, birth_year FROM authors
WHERE id = $1
`

func (q *Queries) GetAuthor(ctx context.Context, id int) (Author, error) {
    row := q.db.QueryRowContext(ctx, getAuthor, id)
    var i Author
    err := row.Scan(&i.ID, &i.Bio, &i.BirthYear)
    return i, err
}

const listAuthors = `-- name: ListAuthors :many
SELECT id, bio, birth_year FROM authors
ORDER BY id
`

func (q *Queries) ListAuthors(ctx context.Context) ([]Author, error) {
    rows, err := q.db.QueryContext(ctx, listAuthors)
    if err != nil {
        return nil, err
    }
    defer rows.Close()
    var items []Author
    for rows.Next() {
        var i Author
        if err := rows.Scan(&i.ID, &i.Bio, &i.BirthYear); err != nil {
            return nil, err
        }
        items = append(items, i)
    }
    if err := rows.Close(); err != nil {
        return nil, err
    }
    if err := rows.Err(); err != nil {
        return nil, err
    }
}

```

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```

    return items, nil
}

```

## 4.1 Selecting columns

```

CREATE TABLE authors (
  id          SERIAL PRIMARY KEY,
  bio         text    NOT NULL,
  birth_year int    NOT NULL
);

-- name: GetBioForAuthor :one
SELECT bio FROM authors
WHERE id = $1;

-- name: GetInfoForAuthor :one
SELECT bio, birth_year FROM authors
WHERE id = $1;

```

When selecting a single column, only that value that returned. The `GetBioForAuthor` method takes a single `int` as an argument and returns a `string` and an `error`.

When selecting multiple columns, a row record (method-specific struct) is returned. In this case, `GetInfoForAuthor` returns a struct with two fields: `Bio` and `BirthYear`.

```

package db

import (
    "context"
    "database/sql"
)

type DBTX interface {
    QueryRowContext(context.Context, string, ...interface{}) *sql.Row
}

func New(db DBTX) *Queries {
    return &Queries{db: db}
}

type Queries struct {
    db DBTX
}

const getBioForAuthor = `-- name: GetBioForAuthor :one
SELECT bio FROM authors
WHERE id = $1
`

func (q *Queries) GetBioForAuthor(ctx context.Context, id int) (string, error) {

```

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```

    row := q.db.QueryRowContext(ctx, getBioForAuthor, id)
    var i string
    err := row.Scan(&i)
    return i, err
}

const getBioForAuthor = `-- name: GetBioForAuthor :one
SELECT bio, birth_year FROM authors
WHERE id = $1
`

type GetBioForAuthorRow struct {
    Bio      string
    BirthYear int
}

func (q *Queries) GetBioForAuthor(ctx context.Context, id int) (GetBioForAuthorRow, error) {
    row := q.db.QueryRowContext(ctx, getBioForAuthor, id)
    var i GetBioForAuthorRow
    err := row.Scan(&i.Bio, &i.BirthYear)
    return i, err
}

```

## 4.2 Passing a slice as a parameter to a query

In PostgreSQL, `ANY` allows you to check if a value exists in an array expression. Queries using `ANY` with a single parameter will generate method signatures with slices as arguments. Use the postgres data types, eg: `int`, `varchar`, etc.

```

CREATE TABLE authors (
    id          SERIAL PRIMARY KEY,
    bio         text    NOT NULL,
    birth_year int    NOT NULL
);

-- name: ListAuthorsByIDs :many
SELECT * FROM authors
WHERE id = ANY($1::int[]);

```

The above SQL will generate the following code:

```

package db

import (
    "context"
    "database/sql"

    "github.com/lib/pq"
)

```

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```

type Author struct {
    ID          int
    Bio         string
    BirthYear  int
}

type DBTX interface {
    QueryContext(context.Context, string, ...interface{}) (*sql.Rows, error)
    QueryRowContext(context.Context, string, ...interface{}) *sql.Row
}

func New(db DBTX) *Queries {
    return &Queries{db: db}
}

type Queries struct {
    db DBTX
}

const listAuthors = `-- name: ListAuthorsByIDs :many
SELECT id, bio, birth_year FROM authors
WHERE id = ANY($1::int[])
`

func (q *Queries) ListAuthorsByIDs(ctx context.Context, ids []int) ([]Author, error) {
    rows, err := q.db.QueryContext(ctx, listAuthors, pq.Array(ids))
    if err != nil {
        return nil, err
    }
    defer rows.Close()
    var items []Author
    for rows.Next() {
        var i Author
        if err := rows.Scan(&i.ID, &i.Bio, &i.BirthYear); err != nil {
            return nil, err
        }
        items = append(items, i)
    }
    if err := rows.Close(); err != nil {
        return nil, err
    }
    if err := rows.Err(); err != nil {
        return nil, err
    }
    return items, nil
}

```





## COUNTING ROWS

```
CREATE TABLE authors (  
  id      SERIAL PRIMARY KEY,  
  hometown text NOT NULL  
);  
  
-- name: CountAuthors :one  
SELECT count(*) FROM authors;  
  
-- name: CountAuthorsByTown :many  
SELECT hometown, count(*) FROM authors  
GROUP BY 1  
ORDER BY 1;
```

```
package db  
  
import (  
  "context"  
  "database/sql"  
)  
  
type DBTX interface {  
  QueryContext(context.Context, string, ...interface{}) (*sql.Rows, error)  
  QueryRowContext(context.Context, string, ...interface{}) *sql.Row  
}  
  
func New(db DBTX) *Queries {  
  return &Queries{db: db}  
}  
  
type Queries struct {  
  db DBTX  
}  
  
const countAuthors = `-- name: CountAuthors :one  
SELECT count(*) FROM authors  
`  
  
func (q *Queries) CountAuthors(ctx context.Context) (int, error) {  
  row := q.db.QueryRowContext(ctx, countAuthors)  
  var i int
```

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```
    err := row.Scan(&i)
    return i, err
}

const countAuthorsByTown = `-- name: CountAuthorsByTown :many
SELECT hometown, count(*) FROM authors
GROUP BY 1
ORDER BY 1
`

type CountAuthorsByTownRow struct {
    Hometown string
    Count    int
}

func (q *Queries) CountAuthorsByTown(ctx context.Context) ([]CountAuthorsByTownRow, error) {
    rows, err := q.db.QueryContext(ctx, countAuthorsByTown)
    if err != nil {
        return nil, err
    }
    defer rows.Close()
    items := []CountAuthorsByTownRow{}
    for rows.Next() {
        var i CountAuthorsByTownRow
        if err := rows.Scan(&i.Hometown, &i.Count); err != nil {
            return nil, err
        }
        items = append(items, i)
    }
    if err := rows.Close(); err != nil {
        return nil, err
    }
    if err := rows.Err(); err != nil {
        return nil, err
    }
    return items, nil
}
```

## INSERTING ROWS

```
CREATE TABLE authors (  
  id          SERIAL PRIMARY KEY,  
  bio         text    NOT NULL  
);  
  
-- name: CreateAuthor :exec  
INSERT INTO authors (bio) VALUES ($1);
```

```
package db  
  
import (  
    "context"  
    "database/sql"  
)  
  
type DBTX interface {  
    ExecContext(context.Context, string, ...interface{}) error  
}  
  
func New(db DBTX) *Queries {  
    return &Queries{db: db}  
}  
  
type Queries struct {  
    db DBTX  
}  
  
const createAuthor = `-- name: CreateAuthor :exec  
INSERT INTO authors (bio) VALUES ($1)  
`  
  
func (q *Queries) CreateAuthor(ctx context.Context, bio string) error {  
    _, err := q.db.ExecContext(ctx, createAuthor, bio)  
    return err  
}
```

## 6.1 Returning columns from inserted rows

sqlc has full support for the RETURNING statement.

```
CREATE TABLE authors (
  id          SERIAL PRIMARY KEY,
  bio         text    NOT NULL
);

-- name: Delete :exec
DELETE FROM authors WHERE id = $1;

-- name: DeleteAffected :execrows
DELETE FROM authors WHERE id = $1;

-- name: DeleteID :one
DELETE FROM authors WHERE id = $1
RETURNING id;

-- name: DeleteAuthor :one
DELETE FROM authors WHERE id = $1
RETURNING *;
```

```
package db

import (
    "context"
    "database/sql"
)

type Author struct {
    ID int
    Bio string
}

type DBTX interface {
    ExecContext(context.Context, string, ...interface{}) error
    QueryRowContext(context.Context, string, ...interface{}) error
}

func New(db DBTX) *Queries {
    return &Queries{db: db}
}

type Queries struct {
    db DBTX
}

const delete = `-- name: Delete :exec
DELETE FROM authors WHERE id = $1
`
```

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```

func (q *Queries) Delete(ctx context.Context, id int) error {
    _, err := q.db.ExecContext(ctx, delete, id)
    return err
}

const deleteAffected = `-- name: DeleteAffected :execrows
DELETE FROM authors WHERE id = $1
`

func (q *Queries) DeleteAffected(ctx context.Context, id int) (int64, error) {
    result, err := q.db.ExecContext(ctx, deleteAffected, id)
    if err != nil {
        return 0, err
    }
    return result.RowsAffected()
}

const deleteID = `-- name: DeleteID :one
DELETE FROM authors WHERE id = $1
RETURNING id
`

func (q *Queries) DeleteID(ctx context.Context, id int) (int, error) {
    row := q.db.QueryRowContext(ctx, deleteID, id)
    var i int
    err := row.Scan(&i)
    return i, err
}

const deleteAuthor = `-- name: DeleteAuthor :one
DELETE FROM authors WHERE id = $1
RETURNING id, bio
`

func (q *Queries) DeleteAuthor(ctx context.Context, id int) (Author, error) {
    row := q.db.QueryRowContext(ctx, deleteAuthor, id)
    var i Author
    err := row.Scan(&i.ID, &i.Bio)
    return i, err
}

```

## 6.2 Using CopyFrom

PostgreSQL supports the Copy Protocol that can insert rows a lot faster than sequential inserts. You can use this easily with sqlc:

```

CREATE TABLE authors (
    id          SERIAL PRIMARY KEY,
    name        text    NOT NULL,
    bio         text    NOT NULL

```

(continues on next page)

(continued from previous page)

```
);  
  
-- name: CreateAuthors :copyfrom  
INSERT INTO authors (name, bio) VALUES ($1, $2);
```

```
type CreateAuthorsParams struct {  
    Name string  
    Bio  string  
}  
  
func (q *Queries) CreateAuthors(ctx context.Context, arg []CreateAuthorsParams) (int64,   
↳error) {  
    return q.db.CopyFrom(ctx, []string{"authors"}, []string{"name", "bio"}, &  
↳iteratorForCreateAuthors{rows: arg})  
}
```

## UPDATING ROWS

```
CREATE TABLE authors (  
  id          SERIAL PRIMARY KEY,  
  bio        text   NOT NULL  
);
```

### 7.1 Single parameter

If your query has a single parameter, your Go method will also have a single parameter.

```
-- name: UpdateAuthorBios :exec  
UPDATE authors SET bio = $1;
```

```
package db  
  
import (  
    "context"  
    "database/sql"  
)  
  
type DBTX interface {  
    ExecContext(context.Context, string, ...interface{}) error  
}  
  
func New(db DBTX) *Queries {  
    return &Queries{db: db}  
}  
  
type Queries struct {  
    db DBTX  
}  
  
const updateAuthorBios = `-- name: UpdateAuthorBios :exec  
UPDATE authors SET bio = $1  
`  
  
func (q *Queries) UpdateAuthorBios(ctx context.Context, bio string) error {  
    _, err := q.db.ExecContext(ctx, updateAuthorBios, bio)
```

(continues on next page)

```
    return err
}
```

## 7.2 Multiple parameters

If your query has more than one parameter, your Go method will accept a Params struct.

```
package db

import (
    "context"
    "database/sql"
)

type DBTX interface {
    ExecContext(context.Context, string, ...interface{}) error
}

func New(db DBTX) *Queries {
    return &Queries{db: db}
}

type Queries struct {
    db DBTX
}

const updateAuthor = `-- name: UpdateAuthor :exec
UPDATE authors SET bio = $2
WHERE id = $1
`

type UpdateAuthorParams struct {
    ID int32
    Bio string
}

func (q *Queries) UpdateAuthor(ctx context.Context, arg UpdateAuthorParams) error {
    _, err := q.db.ExecContext(ctx, updateAuthor, arg.ID, arg.Bio)
    return err
}
```



## DELETING ROWS

```
CREATE TABLE authors (  
  id          SERIAL PRIMARY KEY,  
  bio        text   NOT NULL  
);  
  
-- name: DeleteAuthor :exec  
DELETE FROM authors WHERE id = $1;
```

```
package db  
  
import (  
    "context"  
    "database/sql"  
)  
  
type DBTX interface {  
    ExecContext(context.Context, string, ...interface{}) error  
}  
  
func New(db DBTX) *Queries {  
    return &Queries{db: db}  
}  
  
type Queries struct {  
    db DBTX  
}  
  
const deleteAuthor = `-- name: DeleteAuthor :exec  
DELETE FROM authors WHERE id = $1  
`  
  
func (q *Queries) DeleteAuthor(ctx context.Context, id int) error {  
    _, err := q.db.ExecContext(ctx, deleteAuthor, id)  
    return err  
}
```



## PREPARING QUERIES

```
CREATE TABLE records (  
  id SERIAL PRIMARY KEY  
);  
  
-- name: GetRecord :one  
SELECT * FROM records  
WHERE id = $1;
```

sqlc has an option to use prepared queries. These prepared queries also work with transactions.

```
package db  
  
import (  
  "context"  
  "database/sql"  
)  
  
type Record struct {  
  ID int  
}  
  
type DBTX interface {  
  PrepareContext(context.Context, string) (*sql.Stmt, error)  
  QueryRowContext(context.Context, string, ...interface{}) *sql.Row  
}  
  
func New(db DBTX) *Queries {  
  return &Queries{db: db}  
}  
  
func Prepare(ctx context.Context, db DBTX) (*Queries, error) {  
  q := Queries{db: db}  
  var err error  
  if q.getRecordStmt, err = db.PrepareContext(ctx, getRecord); err != nil {  
    return nil, err  
  }  
  return &q, nil  
}  
  
func (q *Queries) queryRow(ctx context.Context, stmt *sql.Stmt, query string, args ...  
interface{}) *sql.Row {
```

(continues on next page)

```
switch {
case stmt != nil && q.tx != nil:
    return q.tx.StmtContext(ctx, stmt).QueryRowContext(ctx, args...)
case stmt != nil:
    return stmt.QueryRowContext(ctx, args...)
default:
    return q.db.QueryRowContext(ctx, query, args...)
}
}

type Queries struct {
    db          DBTX
    tx          *sql.Tx
    getRecordStmt *sql.Stmt
}

func (q *Queries) WithTx(tx *sql.Tx) *Queries {
    return &Queries{
        db:          tx,
        tx:          tx,
        getRecordStmt: q.getRecordStmt,
    }
}

const getRecord = `-- name: GetRecord :one
SELECT id FROM records
WHERE id = $1
`

func (q *Queries) GetRecord(ctx context.Context, id int) (Record, error) {
    row := q.queryRow(ctx, q.getRecordStmt, getRecord, id)
    var i Record
    err := row.Scan(&i.ID)
    return i, err
}
```

## USING TRANSACTIONS

In the code generated by sqlc, the `WithTx` method allows a `Queries` instance to be associated with a transaction.

For example, with the following SQL structure:

`schema.sql`:

```
CREATE TABLE records (  
  id SERIAL PRIMARY KEY,  
  counter INT NOT NULL  
);
```

`query.sql`

```
-- name: GetRecord :one  
SELECT * FROM records  
WHERE id = $1;  
  
-- name: UpdateRecord :exec  
UPDATE records SET counter = $2  
WHERE id = $1;
```

And the generated code from sqlc in `db.go`:

```
package tutorial  
  
import (  
  "context"  
  "database/sql"  
)  
  
type DBTX interface {  
  ExecContext(context.Context, string, ...interface{}) (sql.Result, error)  
  PrepareContext(context.Context, string) (*sql.Stmt, error)  
  QueryContext(context.Context, string, ...interface{}) (*sql.Rows, error)  
  QueryRowContext(context.Context, string, ...interface{}) *sql.Row  
}  
  
func New(db DBTX) *Queries {  
  return &Queries{db: db}  
}  
  
type Queries struct {
```

(continues on next page)

```
    db DBTX
}

func (q *Queries) WithTx(tx *sql.Tx) *Queries {
    return &Queries{
        db: tx,
    }
}
```

You'd use it like this:

```
func bumpCounter(ctx context.Context, db *sql.DB, queries *tutorial.Queries, id int32) error {
    tx, err := db.Begin()
    if err != nil {
        return err
    }
    defer tx.Rollback()
    qtx := queries.WithTx(tx)
    r, err := qtx.GetRecord(ctx, id)
    if err != nil {
        return err
    }
    if err := qtx.UpdateRecord(ctx, tutorial.UpdateRecordParams{
        ID:      r.ID,
        Counter: r.Counter + 1,
    }); err != nil {
        return err
    }
    return tx.Commit()
}
```

## NAMING PARAMETERS

sqlc tried to generate good names for positional parameters, but sometimes it lacks enough context. The following SQL generates parameters with less than ideal names:

```
-- name: UpsertAuthorName :one
UPDATE author
SET
  name = CASE WHEN $1::bool
    THEN $2::text
    ELSE name
  END
RETURNING *;
```

```
type UpdateAuthorNameParams struct {
  Column1 bool `json:""`
  Column2_2 string `json:"_2"`
}
```

In these cases, named parameters give you the control over field names on the Params struct.

```
-- name: UpsertAuthorName :one
UPDATE author
SET
  name = CASE WHEN sqlc.arg(set_name)::bool
    THEN sqlc.arg(name)::text
    ELSE name
  END
RETURNING *;
```

```
type UpdateAuthorNameParams struct {
  SetName bool `json:"set_name"`
  Name string `json:"name"`
}
```

If the `sqlc.arg()` syntax is too verbose for your taste, you can use the `@` operator as a shortcut.

```
-- name: UpsertAuthorName :one
UPDATE author
SET
  name = CASE WHEN @set_name::bool
    THEN @name::text
```

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```
ELSE name
END
RETURNING *;
```

## 11.1 Nullable parameters

sqlc infers the nullability of any specified parameters, and often does exactly what you want. If you want finer control over the nullability of your parameters, you may use `sqlc.narg()` (nullable arg) to override the default behavior. Using `sqlc.narg` tells sqlc to ignore whatever nullability it has inferred and generate a nullable parameter instead. There is no nullable equivalent of the `@` syntax.

Here is an example that uses a single query to allow updating an author's name, bio or both.

```
-- name: UpdateAuthor :one
UPDATE author
SET
  name = coalesce(sqlc.narg('name'), name),
  bio = coalesce(sqlc.narg('bio'), bio)
WHERE id = sqlc.arg('id');
```

The following code is generated:

```
type UpdateAuthorParams struct {
    Name sql.NullString
    Bio  sql.NullString
    ID   int64
}
```



## MODIFYING THE DATABASE SCHEMA

sqlc understands ALTER TABLE statements when parsing SQL.

```
CREATE TABLE authors (  
  id          SERIAL PRIMARY KEY,  
  birth_year int    NOT NULL  
);  
  
ALTER TABLE authors ADD COLUMN bio text NOT NULL;  
ALTER TABLE authors DROP COLUMN birth_year;  
ALTER TABLE authors RENAME TO writers;
```

```
package db  
  
type Writer struct {  
  ID int  
  Bio string  
}
```

### 12.1 Handling SQL migrations

sqlc will ignore rollback statements when parsing migration SQL files. The following tools are current supported:

- dbmate
- golang-migrate
- goose
- sql-migrate
- tern

### 12.1.1 goose

```
-- +goose Up
CREATE TABLE post (
  id    int NOT NULL,
  title text,
  body  text,
  PRIMARY KEY(id)
);

-- +goose Down
DROP TABLE post;
```

```
package db

type Post struct {
  ID    int
  Title sql.NullString
  Body  sql.NullString
}
```

### 12.1.2 sql-migrate

```
-- +migrate Up
-- SQL in section 'Up' is executed when this migration is applied
CREATE TABLE people (id int);

-- +migrate Down
-- SQL section 'Down' is executed when this migration is rolled back
DROP TABLE people;
```

```
package db

type People struct {
  ID int32
}
```

### 12.1.3 tern

```
CREATE TABLE comment (id int NOT NULL, text text NOT NULL);
---- create above / drop below ----
DROP TABLE comment;
```

```
package db

type Comment struct {
  ID int32
}
```

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```

    Text string
}

```

## 12.1.4 golang-migrate

Warning: `golang-migrate` specifies that the version number in the migration file name is to be interpreted numerically. However, `sqlc` executes the migration files in **lexicographic** order. If you choose to simply enumerate your migration versions, make sure to prepend enough zeros to the version number to avoid any unexpected behavior.

Probably doesn't work as intended:

```

1_initial.up.sql
...
9_foo.up.sql
# this migration file will be executed BEFORE 9_foo
10_bar.up.sql

```

Works as was probably intended:

```

001_initial.up.sql
...
009_foo.up.sql
010_bar.up.sql

```

In `20060102.up.sql`:

```

CREATE TABLE post (
  id    int NOT NULL,
  title text,
  body  text,
  PRIMARY KEY(id)
);

```

In `20060102.down.sql`:

```

DROP TABLE post;

```

```

package db

type Post struct {
  ID    int
  Title sql.NullString
  Body  sql.NullString
}

```

### 12.1.5 dbmate

```
-- migrate:up
CREATE TABLE foo (bar INT NOT NULL);

-- migrate:down
DROP TABLE foo;
```

```
package db

type Foo struct {
    Bar int32
}
```

## CONFIGURING GENERATED STRUCTS

### 13.1 Naming scheme

Structs generated from tables will attempt to use the singular form of a table name if the table name is pluralized.

```
CREATE TABLE authors (  
  id SERIAL PRIMARY KEY,  
  name text NOT NULL  
);
```

```
package db  
  
// Struct names use the singular form of table names  
type Author struct {  
  ID int  
  Name string  
}
```

### 13.2 JSON tags

```
CREATE TABLE authors (  
  id SERIAL PRIMARY KEY,  
  created_at timestamp NOT NULL  
);
```

sqlc can generate structs with JSON tags. The JSON name for a field matches the column name in the database.

```
package db  
  
import (  
  "time"  
)  
  
type Author struct {  
  ID int `json:"id"`  
  CreatedAt time.Time `json:"created_at"`  
}
```

## 13.3 More control

See the Type Overrides section of the Configuration File docs for fine-grained control over struct field types and tags.

## UPLOADING PROJECTS

*This feature requires signing up for [sqlc Cloud](#), which is currently in beta.*

Uploading your project ensures that future releases of sqlc do not break your existing code. Similar to Rust's [crater](#) project, uploaded projects are tested against development releases of sqlc to verify correctness.

### 14.1 Add configuration

After creating a project, add the project ID to your sqlc configuration file.

```
version: "1"
project:
  id: "<PROJECT-ID>"
packages: []
```

```
{
  "version": "1",
  "project": {
    "id": "<PROJECT-ID>"
  },
  "packages": [
  ]
}
```

You'll also need to create an API token and make it available via the `SQLC_AUTH_TOKEN` environment variable.

```
export SQLC_AUTH_TOKEN=sqlc_XXXXXXXX
```

### 14.2 Dry run

You can see what's included when uploading your project by using the `--dry-run` flag:

```
sqlc upload --dry-run
```

The output will be the exact HTTP request sent by sqlc.

## 14.3 Upload

Once you're ready to upload, remove the `--dry-run` flag.

```
sqlc upload
```

By uploading your project, you're making sqlc more stable and reliable. Thanks!



Usage:

```
sqlc [command]
```

Available Commands:

```
compile    Statically check SQL for syntax and type errors
completion Generate the autocompletion script for the specified shell
generate    Generate Go code from SQL
help        Help about any command
init        Create an empty sqlc.yaml settings file
upload      Upload the schema, queries, and configuration for this project
version     Print the sqlc version number
```

Flags:

```
-x, --experimental  enable experimental features (default: false)
-f, --file string    specify an alternate config file (default: sqlc.yaml)
-h, --help           help for sqlc
```

Use "sqlc [command] --help" **for** more information about a command.



## CONFIGURATION

The `sqlc` tool is configured via a `sqlc.yaml` or `sqlc.json` file. This file must be in the directory where the `sqlc` command is run.

### 16.1 Version 2

```
version: "2"
sql:
- schema: "postgresql/schema.sql"
  queries: "postgresql/query.sql"
  engine: "postgresql"
  gen:
    go:
      package: "authors"
      out: "postgresql"
- schema: "mysql/schema.sql"
  queries: "mysql/query.sql"
  engine: "mysql"
  gen:
    go:
      package: "authors"
      out: "mysql"
```

#### 16.1.1 sql

Each mapping in the `sql` collection has the following keys:

- `engine`:
  - Either `postgresql` or `mysql`.
- `schema`:
  - Directory of SQL migrations or path to single SQL file; or a list of paths.
- `queries`:
  - Directory of SQL queries or path to single SQL file; or a list of paths.
- `gen`:
  - A mapping to configure built-in code generators. Supports the following keys:

- `strict_function_checks`
  - If true, return an error if a called SQL function does not exist. Defaults to `false`.

## 16.1.2 gen

The `gen` mapping supports the following keys:

### `go`

- `package`:
  - The package name to use for the generated code. Defaults to `out` basename.
- `out`:
  - Output directory for generated code.
- `sql_package`:
  - Either `pgx/v4` or `database/sql`. Defaults to `database/sql`.
- `emit_db_tags`:
  - If true, add DB tags to generated structs. Defaults to `false`.
- `emit_prepared_queries`:
  - If true, include support for prepared queries. Defaults to `false`.
- `emit_interface`:
  - If true, output a `Querier` interface in the generated package. Defaults to `false`.
- `emit_exact_table_names`:
  - If true, struct names will mirror table names. Otherwise, `sqlc` attempts to singularize plural table names. Defaults to `false`.
- `emit_empty_slices`:
  - If true, slices returned by `:many` queries will be empty instead of `nil`. Defaults to `false`.
- `emit_exported_queries`:
  - If true, autogenerated SQL statement can be exported to be accessed by another package.
- `emit_json_tags`:
  - If true, add JSON tags to generated structs. Defaults to `false`.
- `emit_result_struct_pointers`:
  - If true, query results are returned as pointers to structs. Queries returning multiple results are returned as slices of pointers. Defaults to `false`.
- `emit_params_struct_pointers`:
  - If true, parameters are passed as pointers to structs. Defaults to `false`.
- `emit_methods_with_db_argument`:
  - If true, generated methods will accept a `DBTX` argument instead of storing a `DBTX` on the `*Queries` struct. Defaults to `false`.
- `emit_enum_valid_method`:

- If true, generate a Valid method on enum types, indicating whether a string is a valid enum value.
- `emit_all_enum_values`:
  - If true, emit a function per enum type that returns all valid enum values.
- `json_tags_case_style`:
  - `camel` for camelCase, `pascal` for PascalCase, `snake` for snake\_case or `none` to use the column name in the DB. Defaults to `none`.
- `output_db_file_name`:
  - Customize the name of the db file. Defaults to `db.go`.
- `output_models_file_name`:
  - Customize the name of the models file. Defaults to `models.go`.
- `output_querier_file_name`:
  - Customize the name of the querier file. Defaults to `querier.go`.
- `output_files_suffix`:
  - If specified the suffix will be added to the name of the generated files.
- `rename`:
  - Customize the name of generated struct fields. Explained in detail on the `Renaming fields` section.
- `overrides`:
  - It is a collection of definitions that dictates which types are used to map a database types. Explained in detail on the `Type overriding` section.

## Renaming fields

Struct field names are generated from column names using a simple algorithm: split the column name on underscores and capitalize the first letter of each part.

```
account    -> Account
spotify_url -> SpotifyUrl
app_id     -> AppID
```

If you're not happy with a field's generated name, use the `rename` mapping to pick a new name. The keys are column names and the values are the struct field name to use.

```
version: "2"
sql:
- schema: "postgresql/schema.sql"
  queries: "postgresql/query.sql"
  engine: "postgresql"
gen:
  go:
    package: "authors"
    out: "postgresql"
    rename:
      spotify_url: "SpotifyURL"
```

## Type overriding

The default mapping of PostgreSQL/MySQL types to Go types only uses packages outside the standard library when it must.

For example, the `uuid` PostgreSQL type is mapped to `github.com/google/uuid`. If a different Go package for UUIDs is required, specify the package in the `overrides` array. In this case, I'm going to use the `github.com/gofrs/uuid` instead.

```
version: "2"
sql:
- schema: "postgresql/schema.sql"
  queries: "postgresql/query.sql"
  engine: "postgresql"
  gen:
    go:
      package: "authors"
      out: "postgresql"
      overrides:
        - db_type: "uuid"
          go_type: "github.com/gofrs/uuid.UUID"
```

Each mapping of the `overrides` collection has the following keys:

- `db_type`:
  - The PostgreSQL or MySQL type to override. Find the full list of supported types in [postgresql\\_type.go](#) or [mysql\\_type.go](#). Note that for Postgres you must use the `pg_catalog` prefixed names where available. Can't be used if the `column` key is defined.
- `column`
  - In case the type overriding should be done on specific a column of a table instead of a type. `column` should be of the form `table.column` but you can be even more specific by specifying `schema.table.column` or `catalog.schema.table.column`. Can't be used if the `db_type` key is defined.
- `go_type`:
  - A fully qualified name to a Go type to use in the generated code.
- `go_struct_tag`:
  - A reflect-style struct tag to use in the generated code, e.g. `a:"b" x:"y,z"`. If you want general json/db tags for all fields, use `emit_db_tags` and/or `emit_json_tags` instead.
- `nullable`:
  - If true, use this type when a column is nullable. Defaults to `false`.

For more complicated import paths, the `go_type` can also be an object.

```
version: "2"
sql:
- schema: "postgresql/schema.sql"
  queries: "postgresql/query.sql"
  engine: "postgresql"
  gen:
    go:
      package: "authors"
```

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```
out: "postgresql"
overrides:
  - db_type: "uuid"
    go_type:
      import: "a/b/v2"
      package: "b"
      type: "MyType"
```

When generating code, entries using the `column` key will always have preference over entries using the `db_type` key in order to generate the struct.

## kotlin

- `package`:
  - The package name to use for the generated code.
- `out`:
  - Output directory for generated code.
- `emit_exact_table_names`:
  - If true, use the exact table name for generated models. Otherwise, guess a singular form. Defaults to `false`.

## python

- `package`:
  - The package name to use for the generated code.
- `out`:
  - Output directory for generated code.
- `emit_exact_table_names`:
  - If true, use the exact table name for generated models. Otherwise, guess a singular form. Defaults to `false`.
- `emit_sync_querier`:
  - If true, generate a class with synchronous methods. Defaults to `false`.
- `emit_async_querier`:
  - If true, generate a class with asynchronous methods. Defaults to `false`.
- `emit_pydantic_models`:
  - If true, generate classes that inherit from `pydantic.BaseModel`. Otherwise, define classes using the `dataclass` decorator. Defaults to `false`.

## json

- out:
  - Output directory for the generated JSON.
- filename:
  - Filename for the generated JSON document. Defaults to `codegen_request.json`.
- indent:
  - Indent string to use in the JSON document. Defaults to .

### 16.1.3 plugins

Each mapping in the `plugins` collection has the following keys:

- name:
  - The name of this plugin. Required
- process:
  - cmd:
    - \* The executable to call when using this plugin

### 16.1.4 global overrides

Sometimes, the same configuration must be done across various specifications of code generation. Then a global definition for type overriding and field renaming can be done using the `overrides` mapping the following manner:

```
version: "2"
overrides:
  go:
    rename:
      id: "Identifier"
    overrides:
      - db_type: "timestampz"
        nullable: true
        engine: "postgresql"
        go_type:
          import: "gopkg.in/guregu/null.v4"
          package: "null"
          type: "Time"
  sql:
    - schema: "postgresql/schema.sql"
      queries: "postgresql/query.sql"
      engine: "postgresql"
      gen:
        go:
          package: "authors"
          out: "postgresql"
    - schema: "mysql/schema.sql"
      queries: "mysql/query.sql"
      engine: "mysql"
```

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```

gen:
  go:
    package: "authors"
    out: "mysql"

```

With the previous configuration, whenever a struct field is generated from a table column that is called `id`, it will be generated as `Identifier`. Also, whenever there is a nullable `timestamp with time zone` column in a PostgreSQL table, it will be generated as `null.Time`. Note that, the mapping for global type overrides has a field called `engine` that is absent in the regular type overrides. This field is only used when there are multiple definitions using multiple engines. Otherwise, the value of the `engine` key will be defaulted to the engine that is currently being used.

Currently, type overrides and field renaming, both global and regular, are only fully supported in Go.

## 16.2 Version 1

```

version: "1"
packages:
- name: "db"
  path: "internal/db"
  queries: "./sql/query/"
  schema: "./sql/schema/"
  engine: "postgresql"
  emit_prepared_queries: true
  emit_interface: false
  emit_exact_table_names: false
  emit_empty_slices: false
  emit_exported_queries: false
  emit_json_tags: true
  emit_result_struct_pointers: false
  emit_params_struct_pointers: false
  emit_methods_with_db_argument: false
  emit_enum_valid_method: false
  emit_all_enum_values: false
  json_tags_case_style: "camel"
  output_db_file_name: "db.go"
  output_models_file_name: "models.go"
  output_querier_file_name: "querier.go"

```

### 16.2.1 packages

Each mapping in the `packages` collection has the following keys:

- `name`:
  - The package name to use for the generated code. Defaults to `path` basename.
- `path`:
  - Output directory for generated code.
- `queries`:
  - Directory of SQL queries or path to single SQL file; or a list of paths.

- **schema:**
  - Directory of SQL migrations or path to single SQL file; or a list of paths.
- **engine:**
  - Either `postgresql` or `mysql`. Defaults to `postgresql`.
- **sql\_package:**
  - Either `pgx/v4` or `database/sql`. Defaults to `database/sql`.
- **emit\_db\_tags:**
  - If true, add DB tags to generated structs. Defaults to `false`.
- **emit\_prepared\_queries:**
  - If true, include support for prepared queries. Defaults to `false`.
- **emit\_interface:**
  - If true, output a Querier interface in the generated package. Defaults to `false`.
- **emit\_exact\_table\_names:**
  - If true, struct names will mirror table names. Otherwise, sqlc attempts to singularize plural table names. Defaults to `false`.
- **emit\_empty\_slices:**
  - If true, slices returned by `:many` queries will be empty instead of `nil`. Defaults to `false`.
- **emit\_exported\_queries:**
  - If true, autogenerated SQL statement can be exported to be accessed by another package.
- **emit\_json\_tags:**
  - If true, add JSON tags to generated structs. Defaults to `false`.
- **emit\_result\_struct\_pointers:**
  - If true, query results are returned as pointers to structs. Queries returning multiple results are returned as slices of pointers. Defaults to `false`.
- **emit\_params\_struct\_pointers:**
  - If true, parameters are passed as pointers to structs. Defaults to `false`.
- **emit\_methods\_with\_db\_argument:**
  - If true, generated methods will accept a DBTX argument instead of storing a DBTX on the `*Queries` struct. Defaults to `false`.
- **emit\_enum\_valid\_method:**
  - If true, generate a `Valid` method on enum types, indicating whether a string is a valid enum value.
- **emit\_all\_enum\_values:**
  - If true, emit a function per enum type that returns all valid enum values.
- **json\_tags\_case\_style:**
  - `camel` for camelCase, `pascal` for PascalCase, `snake` for snake\_case or `none` to use the column name in the DB. Defaults to `none`.
- **output\_db\_file\_name:**

- Customize the name of the db file. Defaults to `db.go`.
- `output_models_file_name`:
  - Customize the name of the models file. Defaults to `models.go`.
- `output_querier_file_name`:
  - Customize the name of the querier file. Defaults to `querier.go`.
- `output_files_suffix`:
  - If specified the suffix will be added to the name of the generated files.

## 16.2.2 overrides

The default mapping of PostgreSQL/MySQL types to Go types only uses packages outside the standard library when it must.

For example, the `uuid` PostgreSQL type is mapped to `github.com/google/uuid`. If a different Go package for UUIDs is required, specify the package in the `overrides` array. In this case, I'm going to use the `github.com/gofrs/uuid` instead.

```
version: "1"
packages: [...]
overrides:
- go_type: "github.com/gofrs/uuid.UUID"
  db_type: "uuid"
```

Each override document has the following keys:

- `db_type`:
  - The PostgreSQL or MySQL type to override. Find the full list of supported types in [postgresql\\_type.go](#) or [mysql\\_type.go](#). Note that for Postgres you must use the `pg_catalog` prefixed names where available.
- `go_type`:
  - A fully qualified name to a Go type to use in the generated code.
- `go_struct_tag`:
  - A reflect-style struct tag to use in the generated code, e.g. `a:"b" x:"y,z"`. If you want general json/db tags for all fields, use `emit_db_tags` and/or `emit_json_tags` instead.
- `nullable`:
  - If true, use this type when a column is nullable. Defaults to `false`.

For more complicated import paths, the `go_type` can also be an object.

```
version: "1"
packages: [...]
overrides:
- db_type: "uuid"
  go_type:
    import: "a/b/v2"
    package: "b"
    type: "MyType"
```

## Per-Column Type Overrides

Sometimes you would like to override the Go type used in model or query generation for a specific field of a table and not on a type basis as described in the previous section.

This may be configured by specifying the `column` property in the override definition. `column` should be of the form `table.column` but you can be even more specific by specifying `schema.table.column` or `catalog.schema.table.column`.

```
version: "1"
packages: [...]
overrides:
  - column: "authors.id"
    go_type: "github.com/segmentio/ksuid.KSUID"
```

## Package Level Overrides

Overrides can be configured globally, as demonstrated in the previous sections, or they can be configured on a per-package which scopes the override behavior to just a single package:

```
version: "1"
packages:
  - overrides: [...]
```

### 16.2.3 rename

Struct field names are generated from column names using a simple algorithm: split the column name on underscores and capitalize the first letter of each part.

```
account      -> Account
spotify_url  -> SpotifyUrl
app_id       -> AppID
```

If you're not happy with a field's generated name, use the `rename` mapping to pick a new name. The keys are column names and the values are the struct field name to use.

```
version: "1"
packages: [...]
rename:
  spotify_url: "SpotifyURL"
```

## 17.1 Arrays

PostgreSQL arrays are materialized as Go slices. Currently, only one-dimensional arrays are supported.

```
CREATE TABLE places (  
  name text not null,  
  tags text[]  
);
```

```
package db  
  
type Place struct {  
  Name string  
  Tags []string  
}
```

## 17.2 Dates and Time

All PostgreSQL time and date types are returned as `time.Time` structs. For null time or date values, the `NullTime` type from `database/sql` is used.

```
CREATE TABLE authors (  
  id SERIAL PRIMARY KEY,  
  created_at timestamp NOT NULL DEFAULT NOW(),  
  updated_at timestamp  
);
```

```
package db  
  
import (  
  "database/sql"  
  "time"  
)  
  
type Author struct {  
  ID int  
  CreatedAt time.Time
```

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```
    UpdatedAt sql.NullTime
}
```

## 17.3 Enums

PostgreSQL `enums` are mapped to an aliased string type.

```
CREATE TYPE status AS ENUM (
    'open',
    'closed'
);

CREATE TABLE stores (
    name text PRIMARY KEY,
    status status NOT NULL
);
```

```
package db

type Status string

const (
    StatusOpen Status = "open"
    StatusClosed Status = "closed"
)

type Store struct {
    Name string
    Status Status
}
```

## 17.4 Null

For structs, null values are represented using the appropriate type from the `database/sql` package.

```
CREATE TABLE authors (
    id SERIAL PRIMARY KEY,
    name text NOT NULL,
    bio text
);
```

```
package db

import (
    "database/sql"
)
```

(continues on next page)

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```
type Author struct {
    ID    int
    Name  string
    Bio   sql.NullString
}
```

## 17.5 UUIDs

The Go standard library does not come with a `uuid` package. For UUID support, sqlc uses the excellent [github.com/google/uuid](https://github.com/google/uuid) package.

```
CREATE TABLE records (
  id    uuid PRIMARY KEY
);
```

```
package db

import (
    "github.com/google/uuid"
)

type Author struct {
    ID uuid.UUID
}
```





## QUERY ANNOTATIONS

sqlc requires each query to have a small comment indicating the name and command. The format of this comment is as follows:

```
-- name: <name> <command>
```

### 18.1 :exec

The generated method will return the error from `ExecContext`.

```
-- name: DeleteAuthor :exec  
DELETE FROM authors  
WHERE id = $1;
```

```
func (q *Queries) DeleteAuthor(ctx context.Context, id int64) error {  
    _, err := q.db.ExecContext(ctx, deleteAuthor, id)  
    return err  
}
```

### 18.2 :execresult

The generated method will return the `sql.Result` returned by `ExecContext`.

```
-- name: DeleteAllAuthors :execresult  
DELETE FROM authors;
```

```
func (q *Queries) DeleteAllAuthors(ctx context.Context) (sql.Result, error) {  
    return q.db.ExecContext(ctx, deleteAllAuthors)  
}
```

## 18.3 :execrows

The generated method will return the number of affected rows from the `result` returned by `ExecContext`.

```
-- name: DeleteAllAuthors :execrows
DELETE FROM authors;
```

```
func (q *Queries) DeleteAllAuthors(ctx context.Context) (int64, error) {
    _, err := q.db.ExecContext(ctx, deleteAllAuthors)
    // ...
}
```

## 18.4 :execlastid

The generated method will return the number generated by the database from the `result` returned by `ExecContext`.

```
-- name: InsertAuthor :execlastid
INSERT INTO authors (name) VALUES (?);
```

```
func (q *Queries) InsertAuthor(ctx context.Context, name string) (int64, error) {
    _, err := q.db.ExecContext(ctx, insertAuthor, name)
    // ...
}
```

## 18.5 :many

The generated method will return a slice of records via `QueryContext`.

```
-- name: ListAuthors :many
SELECT * FROM authors
ORDER BY name;
```

```
func (q *Queries) ListAuthors(ctx context.Context) ([]Author, error) {
    rows, err := q.db.QueryContext(ctx, listAuthors)
    // ...
}
```

## 18.6 :one

The generated method will return a single record via `QueryRowContext`.

```
-- name: GetAuthor :one
SELECT * FROM authors
WHERE id = $1 LIMIT 1;
```

```
func (q *Queries) GetAuthor(ctx context.Context, id int64) (Author, error) {
    row := q.db.QueryRowContext(ctx, getAuthor, id)
    // ...
}
```

## 18.7 :batchexec

**NOTE: This command only works with PostgreSQL using the pgx driver and outputting Go code.**

The generated method will return a batch object. The batch object will have the following methods:

- Exec, that takes a `func(int, error)` parameter,
- Close, to close the batch operation early.

```
-- name: DeleteBook :batchexec
DELETE FROM books
WHERE book_id = $1;
```

```
type DeleteBookBatchResults struct {
    br pgx.BatchResults
    ind int
}

func (q *Queries) DeleteBook(ctx context.Context, bookID []int32) (
    ↪ *DeleteBookBatchResults {
    //...
}

func (b *DeleteBookBatchResults) Exec(f func(int, error)) {
    //...
}

func (b *DeleteBookBatchResults) Close() error {
    //...
}
```

## 18.8 :batchmany

**NOTE: This command only works with PostgreSQL using the pgx driver and outputting Go code.**

The generated method will return a batch object. The batch object will have the following methods:

- Query, that takes a `func(int, []T, error)` parameter, where T is your query's return type
- Close, to close the batch operation early.

```
-- name: BooksByTitleYear :batchmany
SELECT * FROM books
WHERE title = $1 AND year = $2;
```

```
type BooksByTitleYearBatchResults struct {
    br pgx.BatchResults
```

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```

        ind int
    }
    type BooksByTitleYearParams struct {
        Title string `json:"title"`
        Year   int32  `json:"year"`
    }

    func (q *Queries) BooksByTitleYear(ctx context.Context, arg []BooksByTitleYearParams)
    ↪ *BooksByTitleYearBatchResults {
        //...
    }
    func (b *BooksByTitleYearBatchResults) Query(f func(int, []Book, error)) {
        //...
    }
    func (b *BooksByTitleYearBatchResults) Close() error {
        //...
    }
}

```

## 18.9 :batchone

**NOTE: This command only works with PostgreSQL using the pgx driver and outputting Go code.**

The generated method will return a batch object. The batch object will have the following methods:

- QueryRow, that takes a func(int, T, error) parameter, where T is your query's return type
- Close, to close the batch operation early.

```

-- name: CreateBook :batchone
INSERT INTO books (
    author_id,
    isbn
) VALUES (
    $1,
    $2
)
RETURNING book_id, author_id, isbn

```

```

type CreateBookBatchResults struct {
    br pgx.BatchResults
    ind int
}
type CreateBookParams struct {
    AuthorID int32 `json:"author_id"`
    Isbn     string `json:"isbn"`
}

func (q *Queries) CreateBook(ctx context.Context, arg []CreateBookParams)
↪ *CreateBookBatchResults {
    //...
}

```

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```
func (b *CreateBookBatchResults) QueryRow(f func(int, Book, error)) {
    //...
}
func (b *CreateBookBatchResults) Close() error {
    //...
}
```



## DATABASE AND LANGUAGE SUPPORT

Language	MySQL	PostgreSQL	SQLite
Go	Stable	Stable	Beta
Kotlin	Beta	Beta	Not implemented
Python	Beta	Beta	Not implemented

### 19.1 Future Language Support

- C#
- TypeScript





## ENVIRONMENT VARIABLES

### 20.1 SQLCDEBUG

The SQLCDEBUG variable controls debugging variables within the runtime. It is a comma-separated list of name=val pairs settings.

#### 20.1.1 dumpast

The `dumpast` command shows the SQL AST that was generated by the parser. Note that this is the generic SQL AST, not the engine-specific SQL AST.

```
SQLCDEBUG=dumpast=1
```

```
([]interface {}) (len=1 cap=1) {
  (*catalog.Catalog)(0xc0004f48c0){
    Comment: (string) "",
    DefaultSchema: (string) (len=6) "public",
    Name: (string) "",
    Schemas: ([]*catalog.Schema) (len=3 cap=4) {
      (*catalog.Schema)(0xc0004f4930){
        Name: (string) (len=6) "public",
        Tables: ([]*catalog.Table) (len=1 cap=1) {
          (*catalog.Table)(0xc00052ff20){
            Rel: (*ast.TableName)(0xc00052fda0){
              Catalog: (string) "",
              Schema: (string) "",
              Name: (string) (len=7) "authors"
            },
          },
        },
      },
    },
  },
}
```

#### 20.1.2 dumpcatalog

The `dumpcatalog` command outputs the entire catalog. If you're using MySQL or PostgreSQL, this can be a bit overwhelming. Expect this output to change in future versions.

```
SQLCDEBUG=dumpcatalog=1
```

```
([]interface {}) (len=1 cap=1) {
  (*catalog.Catalog)(0xc00050d1f0){
    Comment: (string) "",
    DefaultSchema: (string) (len=6) "public",
    Name: (string) "",
    Schemas: ([]*catalog.Schema) (len=3 cap=4) {
      (*catalog.Schema)(0xc00050d260){
        Name: (string) (len=6) "public",
        Tables: ([]*catalog.Table) (len=1 cap=1) {
          (*catalog.Table)(0xc0000c0840){
            Rel: (*ast.TableName)(0xc0000c06c0){
              Catalog: (string) "",
              Schema: (string) "",
              Name: (string) (len=7) "authors"
            },
          },
        },
      },
    },
  },
}
```

### 20.1.3 trace

The trace command is helpful for tracking down performance issues.

```
SQLCDEBUG=trace=1
```

By default, the trace output is written to `trace.out` in the current working directory. You can configure a different path if needed.

```
SQLCDEBUG=trace=name.out
```

View the execution trace using the Go trace tool.

```
go tool trace trace.out
```

There's a ton of different views for the trace output, but here's an example log showing the execution time for each package.

```
0.000043897      .      1      task sqlc (id 1, parent 0) created
0.000144923      .  101026      1      region generate started (duration: 47.
↳619781ms)
0.001048975      .   904052      1      region package started (duration: 14.
↳588456ms)
0.001054616      .    5641      1      name=authors dir=/Users/kyle/projects/
↳sqlc/examples/python language=python
0.001071257      .   16641      1      region parse started (duration: 7.
↳966549ms)
0.009043960      .  7972703      1      region codegen started (duration: 6.
↳587086ms)
0.009171704      .   127744      1      new goroutine 35: text/template/parse.
↳lex.dwrap.1
0.010361654      .  1189950      1      new goroutine 36: text/template/parse.
↳lex.dwrap.1
0.015641815      .   5280161      1      region package started (duration: 10.
↳904938ms)
0.015644943      .    3128      1      name=booktest dir=/Users/kyle/projects/
↳sqlc/examples/python language=python
0.015647431      .    2488      1      region parse started (duration: 4.
↳207749ms)
```

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```

0.019860308      . 4212877      1      region codegen started (duration: 6.
↳681624ms)
0.020028488      . 168180       1      new goroutine 37: text/template/parse.
↳lex·dwrap·1
0.021020310      . 991822       1      new goroutine 8: text/template/parse.
↳lex·dwrap·1
0.026551163      . 5530853     1      region package started (duration: 9.
↳217294ms)
0.026554368      . 3205         1      name=jets dir=/Users/kyle/projects/
↳sqlc/examples/python language=python
0.026556804      . 2436         1      region parse started (duration: 3.
↳491005ms)
0.030051911      . 3495107     1      region codegen started (duration: 5.
↳711931ms)
0.030213937      . 162026       1      new goroutine 20: text/template/parse.
↳lex·dwrap·1
0.031099938      . 886001       1      new goroutine 38: text/template/parse.
↳lex·dwrap·1
0.035772637      . 4672699     1      region package started (duration: 10.
↳267039ms)
0.035775688      . 3051         1      name=ondeck dir=/Users/kyle/projects/
↳sqlc/examples/python language=python
0.035778150      . 2462         1      region parse started (duration: 4.
↳094518ms)
0.039877181      . 4099031     1      region codegen started (duration: 6.
↳156341ms)
0.040010771      . 133590       1      new goroutine 39: text/template/parse.
↳lex·dwrap·1
0.040894567      . 883796       1      new goroutine 40: text/template/parse.
↳lex·dwrap·1
0.046042779      . 5148212     1      region writefiles started (duration: 1.
↳718259ms)
0.047767781      . 1725002     1      task end

```



## CHANGELOG

All notable changes to this project will be documented in this file.

### 21.1 1.15.0

Released 2022-08-07

#### 21.1.1 Bug Fixes

- (mysql) Typo (#1700)
- (postgresql) Add quotes for CamelCase columns (#1729)
- Cannot parse SQLite upsert statement (#1732)
- (sqlite) Regenerate test output for builtins (#1735)
- (wasm) Version modules by wasmtime version (#1734)
- Missing imports (#1637)
- Missing slice import for querier (#1773)

#### 21.1.2 Documentation

- Add process-based plugin docs (#1669)
- Add links to downloads.sqlc.dev (#1681)
- Update transactions how to example (#1775)

#### 21.1.3 Features

- More SQL Syntax Support for SQLite (#1687)
- (sqlite) Promote SQLite support to beta (#1699)
- Codegen plugins, powered by WASM (#1684)
- Set user-agent for plugin downloads (#1707)
- Null enums types (#1485)
- (sqlite) Support stdlib functions (#1712)

- (sqlite) Add support for returning (#1741)

#### 21.1.4 Miscellaneous Tasks

- Add tests for quoting columns (#1733)
- Remove catalog tests (#1762)

#### 21.1.5 Testing

- Add tests for fixing slice imports (#1736)
- Add test cases for returning (#1737)

#### 21.1.6 Build

- Upgrade to Go 1.19 (#1780)
- Upgrade to go-wasmtime 0.39.0 (#1781)

#### 21.1.7 Plugins

- (wasm) Change default cache location (#1709)
- (wasm) Change the SHA-256 config key (#1710)

### 21.2 1.14.0

Released 2022-06-09

#### 21.2.1 Bug Fixes

- (postgresql) Remove extra newline with db argument (#1417)
- (sqlite) Fix DROP TABLE (#1443)
- (compiler) Fix left join nullability with table aliases (#1491)
- Regenerate testdata for CREATE TABLE AS (#1516)
- (bundler) Only close multipart writer once (#1528)
- (endtoend) Regenerate testdata for exex\_lastid
- (pgx) Copyfrom imports (#1626)
- Validate sqlc function arguments (#1633)
- Fixed typo sql.narg in doc (#1668)

## 21.2.2 Features

- (golang) Add Enum.Valid and AllEnumValues (#1613)
- (sqlite) Start expanding support (#1410)
- (pgx) Add support for batch operations (#1437)
- (sqlite) Add support for delete statements (#1447)
- (codegen) Insert comments in interfaces (#1458)
- (sdk) Add the plugin SDK package (#1463)
- Upload projects (#1436)
- Add sqlc version to generated Kotlin code (#1512)
- Add sqlc version to generated Go code (#1513)
- Pass sqlc version in codegen request (#1514)
- (postgresql) Add materialized view support (#1509)
- (python) Graduate Python support to beta (#1520)
- Run sqlc with docker on windows cmd (#1557)
- Add JSON “codegen” output (#1565)
- Add sqlc.narg() for nullable named params (#1536)
- Process-based codegen plugins (#1578)

## 21.2.3 Miscellaneous Tasks

- Fix extra newline in comments for copyfrom (#1438)
- Generate marshal/unmarshal with vtprotobuf (#1467)

## 21.2.4 Refactor

- (codegen) Port Kotlin codegen package to use plugin types (#1416)
- (codegen) Port Go to plugin types (#1460)
- (cmd) Simplify codegen selection logic (#1466)
- (sql/catalog) Improve Readability (#1595)
- Add basic fuzzing for config / overrides (#1500)

## 21.3 1.13.0

Released 2022-03-31

### 21.3.1 Bug Fixes

- (compiler) Fix left join nullability with table aliases (#1491)
- (postgresql) Remove extra newline with db argument (#1417)
- (sqlite) Fix DROP TABLE (#1443)

### 21.3.2 Features

- (cli) Upload projects (#1436)
- (codegen) Add sqlc version to generated Go code (#1513)
- (codegen) Add sqlc version to generated Kotlin code (#1512)
- (codegen) Insert comments in interfaces (#1458)
- (codegen) Pass sqlc version in codegen request (#1514)
- (pgx) Add support for batch operations (#1437)
- (postgresql) Add materialized view support (#1509)
- (python) Graduate Python support to beta (#1520)
- (sdk) Add the plugin SDK package (#1463)
- (sqlite) Add support for delete statements (#1447)
- (sqlite) Start expanding support (#1410)

### 21.3.3 Miscellaneous Tasks

- Fix extra newline in comments for copyfrom (#1438)
- Generate marshal/unmarshal with vtprotobuf (#1467)

### 21.3.4 Refactor

- (codegen) Port Kotlin codegen package to use plugin types (#1416)
- (codegen) Port Go to plugin types (#1460)
- (cmd) Simplify codegen selection logic (#1466)



### 21.3.5 Config

- Add basic fuzzing for config / overrides (#1500)

## 21.4 1.12.0

Released 2022-02-05

### 21.4.1 Bug

- ALTER TABLE SET SCHEMA (#1409)

### 21.4.2 Bug Fixes

- Update ANTLR v4 go.mod entry (#1336)
- Check delete statements for CTEs (#1329)
- Fix validation of GROUP BY on field aliases (#1348)
- Fix imports when non-copyfrom queries needed imports that copyfrom queries didn't (#1386)
- Remove extra comment newline (#1395)
- Enable strict function checking (#1405)

### 21.4.3 Documentation

- Bump version to 1.11.0 (#1308)

### 21.4.4 Features

- Inheritance (#1339)
- Generate query code using ASTs instead of templates (#1338)
- Add support for CREATE TABLE a ( LIKE b ) (#1355)
- Add support for sql.NullInt16 (#1376)

### 21.4.5 Miscellaneous Tasks

- Add tests for :exec{result,rows} (#1344)
- Delete template-based codegen (#1345)

## 21.4.6 Build

- Bump github.com/jackc/pgx/v4 from 4.14.0 to 4.14.1 (#1316)
- Bump golang from 1.17.3 to 1.17.4 (#1331)
- Bump golang from 1.17.4 to 1.17.5 (#1337)
- Bump github.com/spf13/cobra from 1.2.1 to 1.3.0 (#1343)
- Remove devel Docker build
- Bump golang from 1.17.5 to 1.17.6 (#1369)
- Bump github.com/google/go-cmp from 0.5.6 to 0.5.7 (#1382)
- Format all Go code (#1387)

## 21.5 1.11.0

Released 2021-11-24

### 21.5.1 Bug Fixes

- Update incorrect signatures (#1180)
- Correct aggregate func sig (#1182)
- Jsonb\_build\_object (#1211)
- Case-insensitive identifiers (#1216)
- Incorrect handling of meta (#1228)
- Detect invalid INSERT expression (#1231)
- Respect alias name for coalesce (#1232)
- Mark nullable when casting NULL (#1233)
- Support nullable fields in joins for MySQL engine (#1249)
- Fix between expression handling of table references (#1268)
- Support nullable fields in joins on same table (#1270)
- Fix missing binds in ORDER BY (#1273)
- Set RV for TargetList items on updates (#1252)
- Fix MySQL parser for query without trailing semicolon (#1282)
- Validate table alias references (#1283)
- Add support for MySQL ON DUPLICATE KEY UPDATE (#1286)
- Support references to columns in joined tables in UPDATE statements (#1289)
- Add validation for GROUP BY clause column references (#1285)
- Prevent variable redeclaration in single param conflict (#1298)
- Use common params struct field for same named params (#1296)

## 21.5.2 Documentation

- Replace deprecated go get with go install (#1181)
- Fix package name referenced in tutorial (#1202)
- Add environment variables (#1264)
- Add go.17+ install instructions (#1280)
- Warn about golang-migrate file order (#1302)

## 21.5.3 Features

- Instrument compiler via runtime/trace (#1258)
- Add MySQL support for BETWEEN arguments (#1265)

## 21.5.4 Refactor

- Move from io/ioutil to io and os package (#1164)

## 21.5.5 Styling

- Apply gofmt to sample code (#1261)

## 21.5.6 Build

- Bump golang from 1.17.0 to 1.17.1 (#1173)
- Bump eskatos/gradle-command-action from 1 to 2 (#1220)
- Bump golang from 1.17.1 to 1.17.2 (#1227)
- Bump github.com/pganalyze/pg\_query\_go/v2 (#1234)
- Bump actions/checkout from 2.3.4 to 2.3.5 (#1238)
- Bump babel from 2.9.0 to 2.9.1 in /docs (#1245)
- Bump golang from 1.17.2 to 1.17.3 (#1272)
- Bump actions/checkout from 2.3.5 to 2.4.0 (#1267)
- Bump github.com/lib/pq from 1.10.3 to 1.10.4 (#1278)
- Bump github.com/jackc/pgx/v4 from 4.13.0 to 4.14.0 (#1303)

## 21.5.7 Cmd/sqlc

- Bump version to v1.11.0

## 21.6 1.10.0

Released 2021-09-07

### 21.6.1 Documentation

- Fix invalid language support table (#1161)
- Add a getting started guide for MySQL (#1163)

### 21.6.2 Build

- Bump golang from 1.16.7 to 1.17.0 (#1129)
- Bump github.com/lib/pq from 1.10.2 to 1.10.3 (#1160)

### 21.6.3 Ci

- Upgrade Go to 1.17 (#1130)

### 21.6.4 Cmd/sqlc

- Bump version to v1.10.0 (#1165)

### 21.6.5 Codegen/golang

- Consolidate import logic (#1139)
- Add pgx support for range types (#1146)
- Use pgtype for hstore when using pgx (#1156)

### 21.6.6 Codgen/golang

- Use p[gq]type for network address types (#1142)

## 21.6.7 Endtoend

- Run `go test` in CI (#1134)

## 21.6.8 Engine/mysql

- Add support for LIKE (#1162)

## 21.6.9 Golang

- Output NullUUID when necessary (#1137)

## 21.7 1.9.0

Released 2021-08-13

### 21.7.1 Documentation

- Update documentation (a bit) for v1.9.0 (#1117)

### 21.7.2 Build

- Bump go lang from 1.16.6 to 1.16.7 (#1107)

### 21.7.3 Cmd/sqlc

- Bump version to v1.9.0 (#1121)

### 21.7.4 Compiler

- Add tests for COALESCE behavior (#1112)
- Handle subqueries in SELECT statements (#1113)

## 21.8 1.8.0

Released 2021-05-03

### 21.8.1 Documentation

- Add language support Matrix (#920)

### 21.8.2 Features

- Add case style config option (#905)

### 21.8.3 Python

- Eliminate runtime package and use sqlalchemy (#939)

### 21.8.4 Build

- Bump github.com/google/go-cmp from 0.5.4 to 0.5.5 (#926)
- Bump github.com/lib/pq from 1.9.0 to 1.10.0 (#931)
- Bump golang from 1.16.0 to 1.16.1 (#935)
- Bump golang from 1.16.1 to 1.16.2 (#942)
- Bump github.com/jackc/pgx/v4 from 4.10.1 to 4.11.0 (#956)
- Bump github.com/go-sql-driver/mysql from 1.5.0 to 1.6.0 (#961)
- Bump github.com/pganalyze/pg\_query\_go/v2 (#965)
- Bump urllib3 from 1.26.3 to 1.26.4 in /docs (#968)
- Bump golang from 1.16.2 to 1.16.3 (#963)
- Bump github.com/lib/pq from 1.10.0 to 1.10.1 (#980)

### 21.8.5 Cmd

- Add the `-experimental` flag (#929)
- Fix `sqlc init` (#959)

### 21.8.6 Cmd/sqlc

- Bump version to `v1.7.1-devel` (#913)
- Bump version to `v1.8.0`

## 21.8.7 Codegen

- Generate valid enum names for symbols (#972)

## 21.8.8 Postgresql

- Support generated columns
- Add test for PRIMARY KEY INCLUDE
- Add tests for CREATE TABLE PARTITION OF
- CREATE TRIGGER EXECUTE FUNCTION
- Add support for renaming types (#971)

## 21.8.9 Sql/ast

- Resolve return values from functions (#964)

## 21.8.10 Workflows

- Only run tests once (#924)

## 21.9 1.7.0

Released 2021-02-28

### 21.9.1 Bug Fixes

- Struct tag formatting (#833)

### 21.9.2 Documentation

- Include all the existing Markdown files (#877)
- Split docs into four sections (#882)
- Reorganize and consolidate documentation
- Add link to Windows download (#888)
- Shorten the README (#889)

### 21.9.3 Features

- Adding support for pgx/v4
- Adding support for pgx/v4

### 21.9.4 README

- Add Go Report Card badge (#891)

### 21.9.5 Build

- Bump github.com/google/go-cmp from 0.5.3 to 0.5.4 (#813)
- Bump github.com/lib/pq from 1.8.0 to 1.9.0 (#820)
- Bump golang from 1.15.5 to 1.15.6 (#822)
- Bump github.com/jackc/pgx/v4 from 4.9.2 to 4.10.0 (#823)
- Bump github.com/jackc/pgx/v4 from 4.10.0 to 4.10.1 (#839)
- Bump golang from 1.15.6 to 1.15.7 (#855)
- Bump golang from 1.15.7 to 1.15.8 (#881)
- Bump github.com/spf13/cobra from 1.1.1 to 1.1.2 (#892)
- Bump golang from 1.15.8 to 1.16.0 (#897)
- Bump github.com/lfittl/pg\_query\_go from 1.0.1 to 1.0.2 (#901)
- Bump github.com/spf13/cobra from 1.1.2 to 1.1.3 (#893)

### 21.9.6 Catalog

- Improve alter column type (#818)

### 21.9.7 Ci

- Upgrade to Go 1.15 (#887)

### 21.9.8 Cmd

- Allow config file location to be specified (#863)



### 21.9.9 Cmd/sqlc

- Bump to version v1.6.1-devel (#807)
- Bump version to v1.7.0 (#912)

### 21.9.10 Codegen/golang

- Make sure to import net package (#858)

### 21.9.11 Compiler

- Support UNION query

### 21.9.12 Dolphin

- Generate bools for tinyint(1)
- Support joins in update statements (#883)
- Add support for union query

### 21.9.13 Endtoend

- Add tests for INTERSECT and EXCEPT

### 21.9.14 Go.mod

- Update to go 1.15 and run 'go mod tidy' (#808)

### 21.9.15 Mysql

- Compile tinyint(1) to bool (#873)

### 21.9.16 Sql/ast

- Add enum values for SetOperation

## 21.10 1.6.0

Released 2020-11-23

### 21.10.1 Dolphin

- Implement Rename (#651)
- Skip processing view drops (#653)

### 21.10.2 README

- Update language / database support (#698)

### 21.10.3 Astutils

- Fix Params rewrite call (#674)

### 21.10.4 Build

- Bump golang from 1.14 to 1.15.3 (#765)
- Bump docker/build-push-action from v1 to v2.1.0 (#764)
- Bump github.com/google/go-cmp from 0.4.0 to 0.5.2 (#766)
- Bump github.com/spf13/cobra from 1.0.0 to 1.1.1 (#767)
- Bump github.com/jackc/pgx/v4 from 4.6.0 to 4.9.2 (#768)
- Bump github.com/lfittl/pg\_query\_go from 1.0.0 to 1.0.1 (#773)
- Bump github.com/google/go-cmp from 0.5.2 to 0.5.3 (#783)
- Bump golang from 1.15.3 to 1.15.5 (#782)
- Bump github.com/lib/pq from 1.4.0 to 1.8.0 (#769)

### 21.10.5 Catalog

- Improve variadic argument support (#804)

### 21.10.6 Cmd/sqlc

- Bump to version v1.6.0 (#806)

### 21.10.7 Codegen

- Fix errant database/sql imports (#789)

## 21.10.8 Compiler

- Use engine-specific reserved keywords (#677)

## 21.10.9 Dolphi

- Add list of builtin functions (#795)

## 21.10.10 Dolphin

- Update to the latest MySQL parser (#665)
- Add ENUM() support (#676)
- Add test for table aliasing (#684)
- Add MySQL ddl\_create\_table test (#685)
- Implement TRUNCATE table (#697)
- Represent tinyint as int32 (#797)
- Add support for coalesce (#802)
- Add function signatures (#796)

## 21.10.11 Endtoend

- Add MySQL json test (#692)
- Add MySQL update set multiple test (#696)

## 21.10.12 Examples

- Use generated enum constants in db\_test (#678)
- Port ondeck to MySQL (#680)
- Add MySQL authors example (#682)

## 21.10.13 Internal/cmd

- Print correct config file on parse failure (#749)

## 21.10.14 Kotlin

- Remove runtime dependency (#774)

### 21.10.15 Metadata

- Support multiple comment prefixes (#683)

### 21.10.16 Postgresql

- Support string concat operator (#701)

### 21.10.17 Sql/catalog

- Add support for variadic functions (#798)

## 21.11 1.5.0

Released 2020-08-05

### 21.11.1 Documentation

- Build sqlc using Go 1.14 (#549)

### 21.11.2 Cmd

- Add debugging support (#573)

### 21.11.3 Cmd/sqlc

- Bump version to v1.4.1-devel (#548)
- Bump version to v1.5.0

### 21.11.4 Compiler

- Support calling functions with defaults (#635)
- Skip func args without a paramRef (#636)
- Return a single column from coalesce (#639)

### 21.11.5 Config

- Add emit\_empty\_slices to version one (#552)

### 21.11.6 Contrib

- Add generated code for contrib

### 21.11.7 Dinosql

- Remove deprecated package (#554)

### 21.11.8 Dolphin

- Add support for column aliasing (#566)
- Implement star expansion for subqueries (#619)
- Implement expansion with reserved words (#620)
- Implement parameter refs (#621)
- Implement limit and offset (#622)
- Implement inserts (#623)
- Implement delete (#624)
- Implement simple update statements (#625)
- Implement INSERT ... SELECT (#626)
- Use test driver instead of TiDB driver (#629)
- Implement named parameters via sqlc.arg() (#632)

### 21.11.9 Endtoend

- Add MySQL test for SELECT \* JOIN (#565)
- Add MySQL test for inflection (#567)

### 21.11.10 Engine

- Create engine package (#556)

### 21.11.11 Equinox

- Use the new equinox-io/setup action (#586)

### 21.11.12 Examples

- Run tests for MySQL booktest (#627)

### 21.11.13 Golang

- Add support for the money type (#561)
- Generate correct types for int2 and int8 (#579)

### 21.11.14 Internal

- Rm catalog, pg, postgres packages (#555)

### 21.11.15 Mod

- Downgrade TiDB package to fix build (#603)

### 21.11.16 Mysql

- Upgrade to the latest vitess commit (#562)
- Support to infer type of a duplicated arg (#615)
- Allow some builtin functions to be nullable (#616)

### 21.11.17 Postgresql

- Generate all functions in pg\_catalog (#550)
- Remove pg\_catalog schema from tests (#638)
- Move contrib code to a package

### 21.11.18 Sql/catalog

- Fix comparison of pg\_catalog types (#637)

### 21.11.19 Tools

- Generate functions for all of contrib

### 21.11.20 Workflow

- Migrate to equinox-io/setup-release-tool (#614)

## 21.12 1.4.0

Released 2020-06-17

### 21.12.1 Dockerfile

- Add version build argument (#487)

### 21.12.2 MySQL

- Prevent Panic when WHERE clause contains parenthesis. (#531)

### 21.12.3 README

- Document emit\_exact\_table\_names (#486)

### 21.12.4 All

- Remove the exp build tag (#507)

### 21.12.5 Catalog

- Support functions with table parameters (#541)

### 21.12.6 Cmd

- Bump to version 1.3.1-devel (#485)

### 21.12.7 Cmd/sqlc

- Bump version to v1.4.0 (#547)

### 21.12.8 Codegen

- Add the new codegen packages (#513)
- Add the :execresult query annotation (#542)

### 21.12.9 Compiler

- Validate function calls (#505)
- Port bottom of parseQuery (#510)
- Don't mutate table name (#517)
- Enable experimental parser by default (#518)
- Apply rename rules to enum constants (#523)
- Temp fix for typecast function parameters (#530)

### 21.12.10 Endtoend

- Standardize JSON formatting (#490)
- Add per-test configuration files (#521)
- Read expected stderr failures from disk (#527)

### 21.12.11 Internal/dinosql

- Check parameter style before ref (#488)
- Remove unneeded column suffix (#492)
- Support named function arguments (#494)

### 21.12.12 Internal/postgresql

- Fix NamedArgExpr rewrite (#491)

### 21.12.13 Multierr

- Move dinosql.ParserErr to a new package (#496)

### 21.12.14 Named

- Port parameter style validation to SQL (#504)

### 21.12.15 Parser

- Support columns from subselect statements (#489)



### 21.12.16 Rewrite

- Move parameter rewrite to package (#499)

### 21.12.17 Sqlite

- Use convert functions instead of the listener (#519)

### 21.12.18 Sqlpath

- Move ReadSQLFiles into a separate package (#495)

### 21.12.19 Validation

- Move query validation to separate package (#498)

## 21.13 1.3.0

Released 2020-05-12

### 21.13.1 Makefile

- Update target (#449)

### 21.13.2 README

- Add Myles as a sponsor (#469)

### 21.13.3 Testing

- Make sure all Go examples build (#480)

### 21.13.4 Cmd

- Bump version to v1.3.0 (#484)

### 21.13.5 Cmd/sqlc

- Bump version to v1.2.1-devel (#442)

### 21.13.6 Dinosql

- Inline addFile (#446)
- Add PostgreSQL support for TRUNCATE (#448)

### 21.13.7 Gen

- Emit json.RawMessage for JSON columns (#461)

### 21.13.8 Go.mod

- Use latest lib/pq (#471)

### 21.13.9 Parser

- Use same function to load SQL files (#483)

### 21.13.10 Postgresql

- Fix panic walking CreateTableAsStmt (#475)

## 21.14 1.2.0

Released 2020-04-07

### 21.14.1 Documentation

- Publish to Docker Hub (#422)

### 21.14.2 README

- Docker installation docs (#424)

### 21.14.3 Cmd/sqlc

- Bump version to v1.1.1-devel (#407)
- Bump version to v1.2.0 (#441)

### 21.14.4 Gen

- Add special case for “campus” (#435)
- Properly quote reserved keywords on expansion (#436)

### 21.14.5 Migrations

- Move migration parsing to new package (#427)

### 21.14.6 Parser

- Generate correct types for SELECT EXISTS (#411)

## 21.15 1.1.0

Released 2020-03-17

### 21.15.1 README

- Add installation instructions (#350)
- Add section on running tests (#357)
- Fix typo (#371)

### 21.15.2 Ast

- Add AST for ALTER TABLE ADD / DROP COLUMN (#376)
- Add support for CREATE TYPE as ENUM (#388)
- Add support for CREATE / DROP SCHEMA (#389)

### 21.15.3 Astutils

- Apply changes to the ValuesList slice (#372)

### 21.15.4 Cmd

- Return v1.0.0 (#348)
- Return next bug fix version (#349)

### 21.15.5 Cmd/sqlc

- Bump version to v1.1.0 (#406)

### 21.15.6 Compiler

- Wire up the experimental parsers

### 21.15.7 Config

- Remove “emit\_single\_file” option (#367)

### 21.15.8 Dolphin

- Add experimental parser for MySQL

### 21.15.9 Gen

- Add option to emit single file for Go (#366)
- Add support for the ltree extension (#385)

### 21.15.10 Go.mod

- Add packages for MySQL and SQLite parsers

### 21.15.11 Internal/dinosql

- Support Postgres macaddr type in Go (#358)

### 21.15.12 Internal/endtoend

- Remove %ow (#354)

### 21.15.13 Kotlin

- Add Query class to support timeout and cancellation (#368)

### 21.15.14 Postgresql

- Add experimental parser for MySQL

### 21.15.15 Sql

- Add generic SQL AST

### 21.15.16 Sql/ast

- Port support for COMMENT ON (#391)
- Implement DROP TYPE (#397)
- Implement ALTER TABLE RENAME (#398)
- Implement ALTER TABLE RENAME column (#399)
- Implement ALTER TABLE SET SCHEMA (#400)

### 21.15.17 Sql/catalog

- Port tests over from catalog pkg (#402)

### 21.15.18 Sql/errors

- Add a new errors package (#390)

### 21.15.19 Sqlite

- Add experimental parser for SQLite

## 21.16 1.0.0

Released 2020-02-18

### 21.16.1 Documentation

- Add documentation for query commands (#270)
- Add named parameter documentation (#332)

### 21.16.2 README

- Add sponsors section (#333)

### 21.16.3 Cmd

- Remove parse subcommand (#322)

### 21.16.4 Config

- Parse V2 config format
- Add support for YAML (#336)

### 21.16.5 Examples

- Add the jets and booktest examples (#237)
- Move sqlc.json into examples folder (#238)
- Add the authors example (#241)
- Add build tag to authors tests (#319)

### 21.16.6 Internal

- Allow CTE to be used with UPDATE (#268)
- Remove the PackageMap from settings (#295)

### 21.16.7 Internal/config

- Create new config package (#313)

### 21.16.8 Internal/dinosql

- Emit Querier interface (#240)
- Strip leading “go-“ or trailing “-go” from import (#262)
- Overrides can now be basic types (#271)
- Import needed types for Querier (#285)
- Handle schema-scoped enums (#310)
- Ignore golang-migrate rollbacks (#320)

### 21.16.9 Internal/endoend

- Move more tests to the record/replay framework
- Add update test for named params (#329)

### 21.16.10 Internal/mysql

- Fix flaky test (#242)
- Port tests to endtoend package (#315)

### 21.16.11 Internal/parser

- Resolve nested CTEs (#324)
- Error if last query is missing (#325)
- Support joins with aliases (#326)
- Remove print statement (#327)

### 21.16.12 Internal/sqlc

- Add support for composite types (#311)

### 21.16.13 Kotlin

- Support primitives
- Arrays, enums, and dates
- Generate examples
- README for examples
- Factor out db setup extension
- Fix enums, use List instead of Array
- Port Go tests for examples
- Rewrite numbered params to positional params
- Always use use, fix indents
- Unbox query params

### 21.16.14 Parser

- Attach range vars to insert params
- Attach range vars to insert params (#342)
- Remove dead code (#343)

## 21.17 0.1.0

Released 2020-01-07

### 21.17.1 Documentation

- Replace remaining references to DinoSQL with sqlc (#149)

### 21.17.2 README

- Fix download links (#66)
- Add LIMIT 1 to query that should return one (#99)

### 21.17.3 Catalog

- Support “ALTER TABLE ... DROP CONSTRAINT ...” (#34)
- Differentiate functions with different argument types (#51)

### 21.17.4 Ci

- Enable tests on pull requests

### 21.17.5 Cmd

- Include filenames in error messages (#69)
- Do not output any changes on error (#72)

### 21.17.6 Dinosql/internal

- Add lower and upper functions (#215)
- Ignore alter sequence commands (#219)



### 21.17.7 Gen

- Add DO NOT EDIT comments to generated code (#50)
- Include all schemas when generating models (#90)
- Prefix structs with schema name (#91)
- Generate single import for uuid package (#98)
- Use same import logic for all Go files
- Pick correct struct to return for queries (#107)
- Create consistent JSON tags (#110)
- Add Close method to Queries struct (#127)
- Ignore empty override settings (#128)
- Turn SQL comments into Go comments (#136)

### 21.17.8 Internal/catalog

- Parse unnamed function arguments (#166)

### 21.17.9 Internal/dinosql

- Prepare() with no GoQueries still valid (#95)
- Fix multiline comment rendering (#142)
- Dereference alias nodes on walk (#158)
- Ignore sql-migrate rollbacks (#160)
- Sort imported packages (#165)
- Add support for timestampz (#169)
- Error on missing queries (#180)
- Use more database/sql null types (#182)
- Support the pg\_temp schema (#183)
- Override columns with array type (#184)
- Implement robust expansion
- Implement robust expansion (#186)
- Add COMMENT ON support (#191)
- Add DATE support
- Add DATE support (#196)
- Filter out invalid characters (#198)
- Quote reserved keywords (#205)
- Return parser errors first (#207)
- Implement advisory locks (#212)

- Error on duplicate query names (#221)
- Fix incorrect enum names (#223)
- Add support for numeric types
- Add support for numeric types (#228)

### 21.17.10 Internal/dinosql/testdata/ondeck

- Add Makefile (#156)

### 21.17.11 Ondeck

- Move all tests to GitHub CI (#58)

### 21.17.12 ParseQuery

- Return either a query or an error (#178)

### 21.17.13 Parser

- Use schema when resolving catalog refs (#82)
- Support function calls in expressions (#104)
- Correctly handle single files (#119)
- Return error if missing RETURNING (#131)
- Add support for mathematical operators (#132)
- Add support for simple case expressions (#134)
- Error on mismatched INSERT input (#135)
- Set IsArray on joined columns (#139)

### 21.17.14 Pg

- Store functions in the catalog (#41)
- Add location to errors (#73)

## DEVELOPING SQLC

### 22.1 Building

For local development, install sqlc under an alias. We suggest sqlc-dev.

```
go build -o ~/go/bin/sqlc-dev ./cmd/sqlc
```

### 22.2 Running Tests

```
go test ./...
```

To run the tests in the examples folder, use the `examples` tag.

```
go test --tags=examples ./...
```

These tests require locally-running database instances. Run these databases using [Docker Compose](#).

```
docker-compose up -d
```

The tests use the following environment variables to connect to the database

#### 22.2.1 For PostgreSQL

Variable	Default Value
PG_HOST	127.0.0.1
PG_PORT	5432
PG_USER	postgres
PG_PASSWORD	mysecretpassword
PG_DATABASE	dinotest

## 22.2.2 For MySQL

Variable	Default Value
MYSQL_HOST	127.0.0.1
MYSQL_PORT	3306
MYSQL_USER	root
MYSQL_ROOT_PASSWORD	mysecretpassword
MYSQL_DATABASE	dinotest

## 22.3 Regenerate expected test output

If you need to update a large number of expected test output in the `internal/endtoend/testdata` directory, run the `regenerate` script.

```
go build -o ~/go/bin/sqlc-dev ./cmd/sqlc
go run scripts/regenerate/main.go
```

Note that this uses the `sqlc-dev` binary, not `sqlc` so make sure you have an up to date `sqlc-dev` binary.

## AUTHORING PLUGINS

To use plugins, you must be using [Version 2](#) of the configuration file. The top-level `plugins` array defines the available plugins.

### 23.1 WASM plugins

WASM plugins are fully sandboxed. Plugins do not have access to the network, filesystem, or environment variables.

In the codegen section, the `out` field dictates what directory will contain the new files. The `plugin` key must reference a plugin defined in the top-level `plugins` map. The options are serialized to a string and passed on to the plugin itself.

```
{
  "version": "2",
  "plugins": [
    {
      "name": "greeter",
      "wasm": {
        "url": "https://github.com/kyleconroy/sqlc-gen-greeter/releases/download/v0.1.0/
↪sqlc-gen-greeter.wasm",
        "sha256": "afc486dac2068d741d7a4110146559d12a013fd0286f42a2fc7dcd802424ad07"
      }
    }
  ],
  "sql": [
    {
      "schema": "schema.sql",
      "queries": "query.sql",
      "engine": "postgresql",
      "codegen": [
        {
          "out": "gen",
          "plugin": "greeter"
        }
      ]
    }
  ]
}
```

For a complete working example see the following files:

- `sqlc-gen-greeter`
  - A WASM plugin (written in Rust) that outputs a friendly message
- `wasm_plugin_sqlc_gen_greeter`
  - An example project showing how to use a WASM plugin

## 23.2 Process plugins

Process-based plugins offer minimal security. Only use plugins that you trust. Better yet, only use plugins that you've written yourself.

In the codegen section, the `out` field dictates what directory will contain the new files. The `plugin` key must reference a plugin defined in the top-level `plugins` map. The `options` are serialized to a string and passed on to the plugin itself.

```
{
  "version": "2",
  "plugins": [
    {
      "name": "jsonb",
      "process": {
        "cmd": "sqlc-gen-json"
      }
    }
  ],
  "sql": [
    {
      "schema": "schema.sql",
      "queries": "query.sql",
      "engine": "postgresql",
      "codegen": [
        {
          "out": "gen",
          "plugin": "jsonb",
          "options": {
            "indent": "  ",
            "filename": "codegen.json"
          }
        }
      ]
    }
  ]
}
```

For a complete working example see the following files:

- `sqlc-gen-json`
  - A process-based plugin that serializes the `CodeGenRequest` to JSON
- `process_plugin_sqlc_gen_json`
  - An example project showing how to use a process-based plugin

## PRIVACY AND DATA COLLECTION

These days, it feels like every piece of software is tracking you. From your browser, to your phone, to your terminal, programs collect as much data about you as possible and send it off to the cloud for analysis.

We believe the best way to keep data safe is to never collect it in the first place.

### 24.1 Our Privacy Pledge

The `sqlc` command line tool does not collect any information. It does not send crash reports to a third-party. It does not gather anonymous aggregate user behaviour analytics.

No analytics. No finger-printing. No tracking.

Not now and not in the future.

#### 24.1.1 Distribution Channels

We distribute `sqlc` using popular package managers such as [Homebrew](#) and [Snapcraft](#). These package managers and their associated command-line tools do collect usage metrics.

We use these services to make it easy to for users to install `sqlc`. There will always be an option to download `sqlc` from a stable URL.

### 24.2 Hosted Services

We provide a few hosted services in addition to the `sqlc` command line tool.

#### 24.2.1 `sqlc.dev`

- Hosted on [GitHub Pages](#)
- Analytics with [Plausible](#)

### 24.2.2 docs.sqlc.dev

- Hosted on [Read the Docs](#)
- Analytics with [Plausible](#)

### 24.2.3 play.sqlc.dev

- Hosted on [Heroku](#)
- Playground data stored in [Google Cloud Storage](#)
  - Automatically deleted after 30 days

### 24.2.4 app.sqlc.dev / api.sqlc.dev

- Hosted on [Heroku](#)
- Error tracking and tracing with [Sentry](#)