Mandatory Access Control in PostgreSQL - giving users ownership of their data

Leon du Toit

2019-01-15

Outline

- why take data ownership seriously?
- why Mandatory Access Control?
- a brief introduction to the `pg-need-to-know` module
- a use case to demostrate features:
  - For users: ownership, insight and consent-based usage
  - For administrators: fine-grained access control, audit information
  - For developers: a rich REST API, with a built-in authorization model

Why take data ownership seriously?

- Regulations of the GDPR
  - increased focus on data privacy and protection
  - right to access
  - right to be forgotten
  - data portability
  - consent-based data usage
  - increased demand for audit information
- To counter surveilance capitalism
  - you (and your data) are the product
  - building applications to fight this trend

What Mandatory Access Control?

- *enforcible* policies, in constrast to Discretionary Access Control
- enables consent-based data access
- supports granular access needs

pg-need-to-know

- PostgresQL “module” - really just a set of tables, views, and functions
- implements Mandatory Access Control
- more limited approach than SEPostgreSQL
- source: https://github.com/leondutoit/pg-need-to-know
- written in PL/pgSQL
  - procedural language, extending SQL with control structures
  - used to create functions
  - ~1000 sloc, another ~1500 for tests
- designed to be used via a REST API

Use case

Key terms:

- data owner: provides data about themselves
- data user: analyses data about others
- admin: creates and implements access control policies

Use case

Assume the following setup:

```
data owners: A, B, C, D, E, F
tables: spending_habits, personal_details, containing data
data users: X, Y, Z
```

Use case

Now suppose we need to set up the following access control rules in our DB:

- data users X, and Y should only have access to data in tables spending_habits and only data from owners A, B, C, D
- data user Z should have access to all data - i.e. tables spending_habits, personal_details

Use case

Using pg-need-to-know, we implement this with the following groups, and table grants:

```
group1
    - members: ((X, Y), (A, B, C, D))
    - select table access grant: (spending_habits)
group2
    - members: ((Z), (A, B, C, D, E, F))
    - select table access grants: (spending_habits, persona
```

Use case

A hypothetical sequence of events:

1. admin creates tables
2. data owners and data users register themselves, data is collected
3. admin creates groups, adds members, adds table grants
4. dats is analysed
5. users manage their own data
6. admins get audit insights
7. developers create applications using composing these features

Table creation

User registration

- can require consent before user registration
- data collection not possible without registration

Group setup

- can link consent(s) to groups

Group management

Data analysis

Data management by owners

- right to access
- right to be forgotten
- data portability

Audit

Application development

```
client -> webapp -> REST -> (pg-need-to-know, PostgresQL)
```