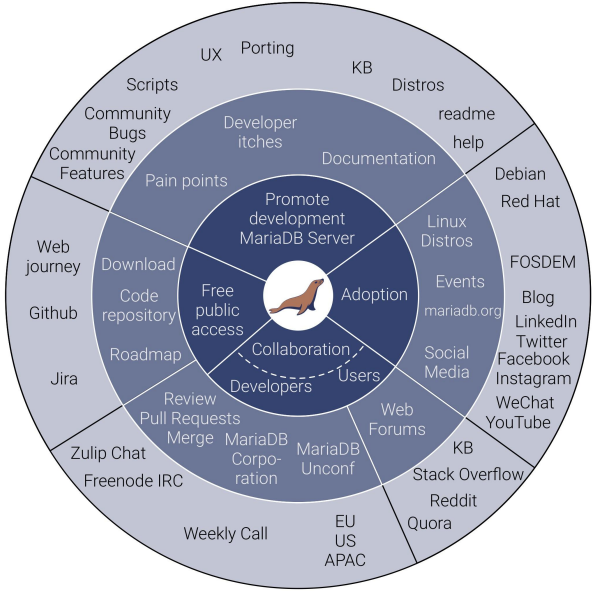


Let's compare MariaDB and MySQL Roles

Vicențiu Ciorbaru
Software Developer Team Lead
@ MariaDB Foundation

MariaDB Day
2020 Feb 2 Brussels

whoami

- Vicențiu Ciorbaru
- MariaDB Foundation,
  Software Developer Team Lead
- MariaDB developer since 2013-...
- Implemented Roles, Window Functions and others

A brief history on roles

- In the open source database world:
  - PostGres added roles in 8.1 (2005)
  - MariaDB added roles in 10.0 (2013)
  - MySQL added roles in 8.0 (2016)

- Most features correspond to SQL Standard.

What are roles?

- Roles are almost like users, with some special powers.
- Roles can own (have access) to objects in the database.
  - Read / Write tables
  - Create / Drop databases
  - Create / Drop / Alter users
  - …
- Roles can not be used to login. *

- Roles can inherit rights from other roles.
- Roles can be granted to users and subsequently activated.

Benefit of roles

- Roles simplify privilege granting / revoking.
  - Easier maintenance and auditing.
- Allow easy implementation of least-privilege principle.
- No practical performance impact. More details later.
- Can be integrated with legacy applications with the help of the default role.

Basic use case

- A simplified data warehouse.

```
CREATE DATABASE data_warehouse;
CREATE DATABASE staging;
CREATE TABLE data_warehouse.transactions (
    date datetime,
    type varchar(20),
    amount double,
    customer varchar(100));
```

```
CREATE USER rachel;
CREATE USER import_robot;
CREATE USER dave;
CREATE USER alex;
```

```
CREATE ROLE report;
CREATE ROLE import;
CREATE ROLE dev;
CREATE ROLE admin;
```

Basic use case

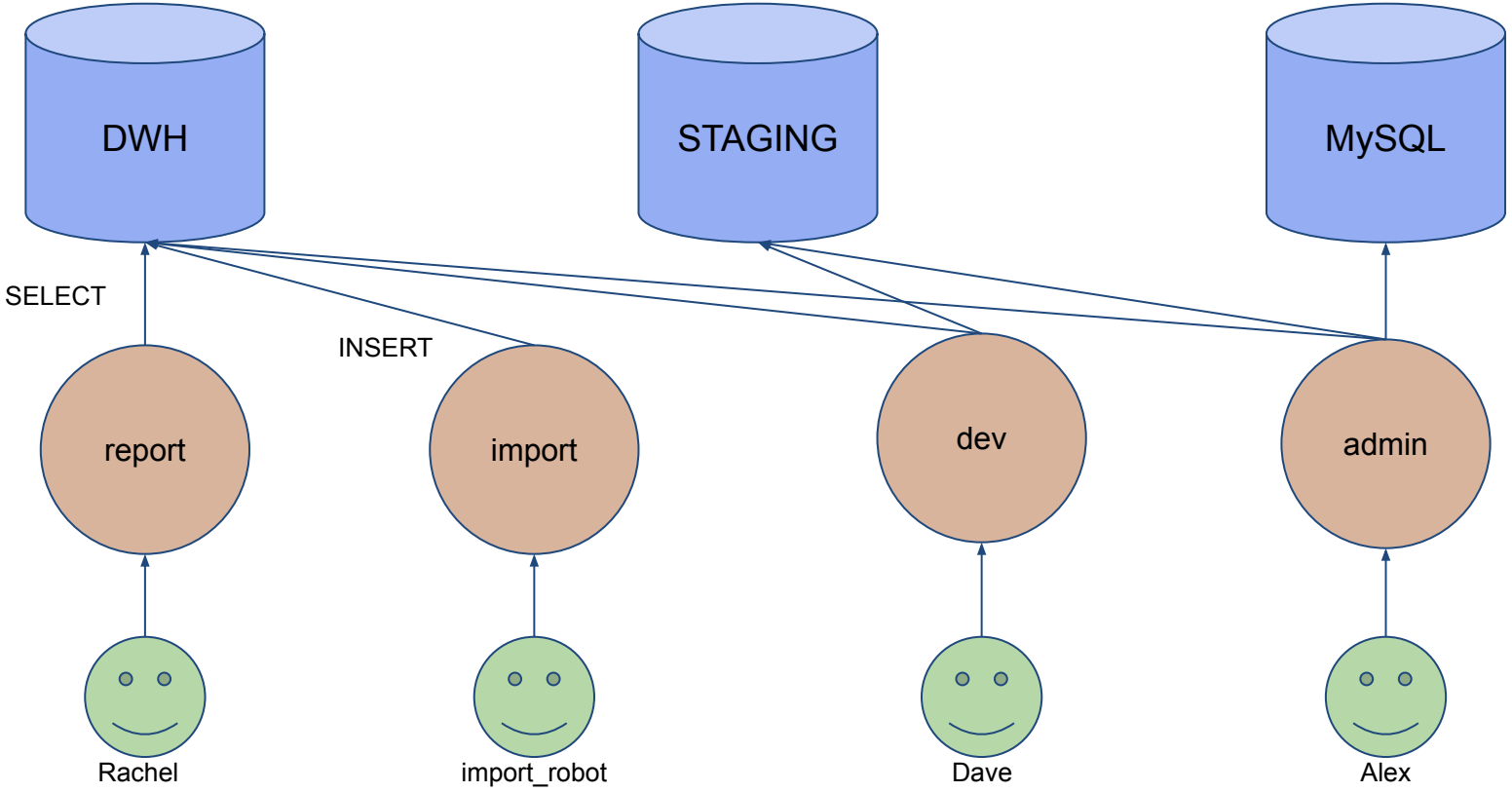
```
CREATE USER rachel;                    CREATE ROLE report;
CREATE USER import_robot;              CREATE ROLE import;
CREATE USER dave;                      CREATE ROLE dev;
CREATE USER alex;                      CREATE ROLE admin;

GRANT SELECT ON data_warehouse.* TO report;
GRANT INSERT ON data_warehouse.* TO import;
GRANT ALL    ON data_warehouse.* TO dev;
GRANT ALL    ON staging.*        TO dev;

GRANT ALL    ON data_warehouse.* TO admin;
GRANT ALL    ON staging.*        TO admin;
GRANT CREATE USER ON *.*         TO admin WITH GRANT OPTION;

GRANT report TO rachel;
GRANT import TO import_robot;
GRANT dev    TO dave;
GRANT admin  TO alex;
```

Basic use case

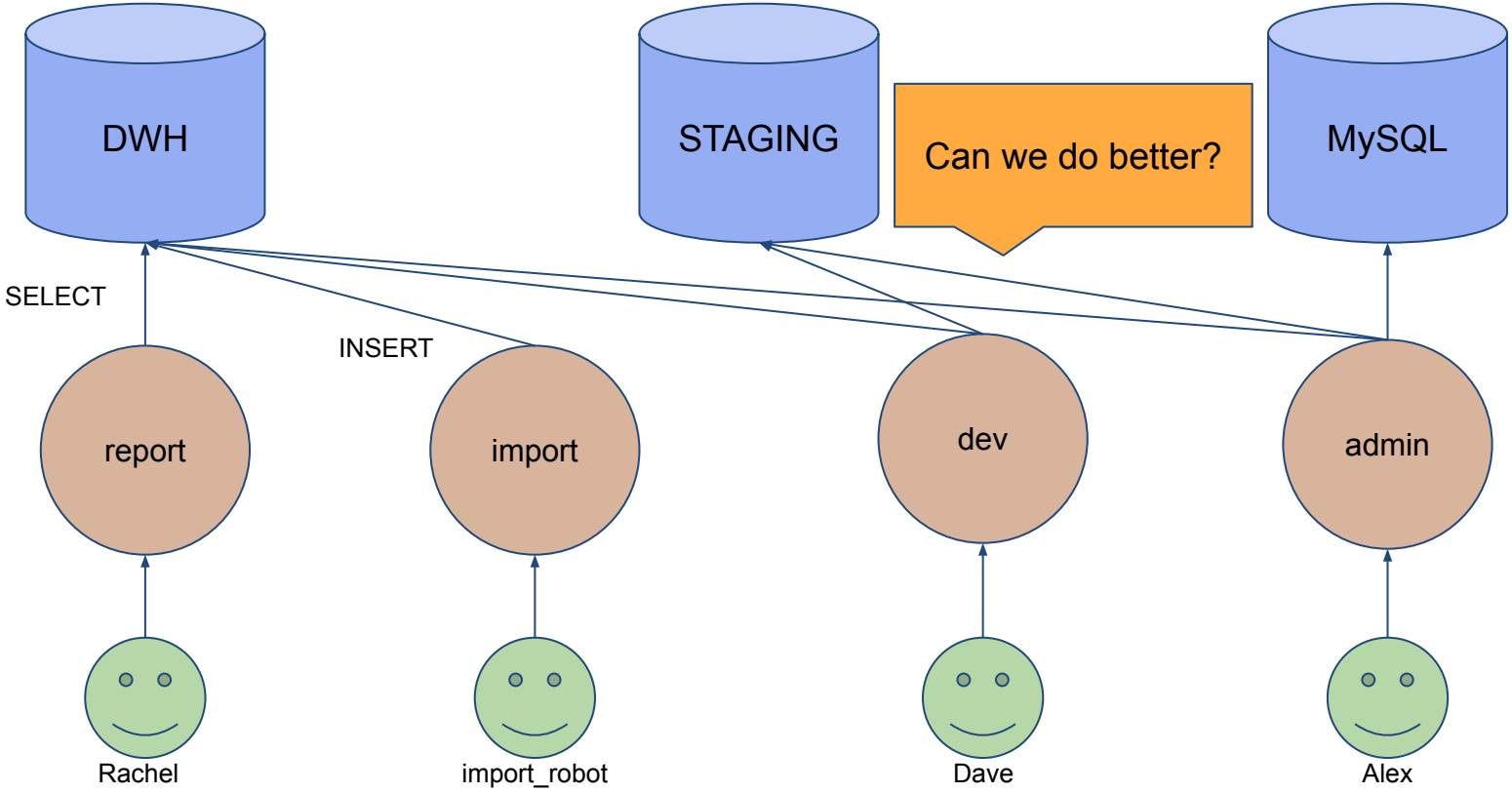
```
CREATE USER rachel;
CREATE USER import_robot;
CREATE USER dave;
CREATE USER alex;

CREATE ROLE report;
CREATE ROLE import;
CREATE ROLE dev;
CREATE ROLE admin;

GRANT SELECT ON data_warehouse.* TO report;
GRANT INSERT ON data_warehouse.* TO import;
GRANT ALL    ON data_warehouse.* TO dev;
GRANT ALL    ON staging.*        TO dev;

GRANT ALL    ON data_warehouse.* TO admin;
GRANT ALL    ON staging.*        TO admin;
GRANT CREATE USER ON *.*         TO admin WITH GRANT OPTION;

GRANT report TO rachel;
GRANT import TO import_robot;
GRANT dev    TO dave;
GRANT admin  TO alex;
```

Syntax for GRANTING roles

Basic use case



Basic use case



Role hierarchies

- To eliminate duplicate grants, one can create a role hierarchy.
- Rights from the granted role propagate to the grantee role.

Role hierarchies

- To eliminate duplicate grants, one can create a role hierarchy.
- Rights from the granted role propagate to the grantee role.

```
CREATE USER rachel;                    CREATE ROLE report;
CREATE USER import_robot;              CREATE ROLE import;
CREATE USER dave;                      CREATE ROLE dev;
CREATE USER alex;                      CREATE ROLE admin;

GRANT SELECT ON data_warehouse.* TO report;
GRANT INSERT ON data_warehouse.* TO import;
GRANT ALL    ON data_warehouse.* TO dev;
GRANT ALL    ON staging.*        TO dev;

GRANT ALL    ON data_warehouse.* TO admin;
GRANT ALL    ON staging.*        TO admin;
GRANT CREATE USER ON *.*         TO admin WITH GRANT OPTION;
```

Role hierarchies

- To eliminate duplicate grants, one can create a role hierarchy.
- Rights from the granted role propagate to the grantee role.

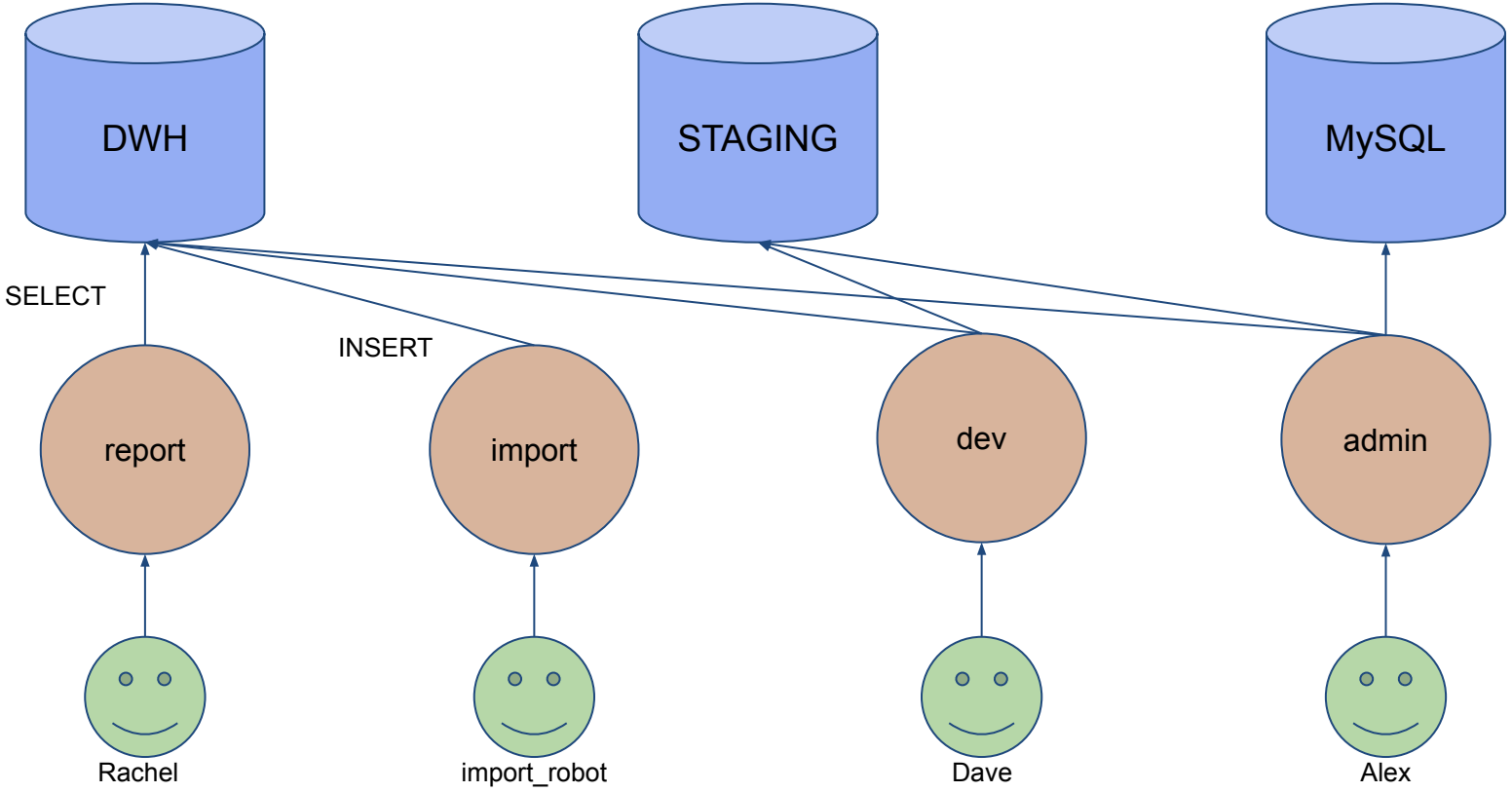
```
CREATE USER rachel;                    CREATE ROLE report;
CREATE USER import_robot;              CREATE ROLE import;
CREATE USER dave;                      CREATE ROLE dev;
CREATE USER alex;                      CREATE ROLE admin;

GRANT SELECT ON data_warehouse.* TO report;
GRANT INSERT ON data_warehouse.* TO import;
GRANT ALL    ON data_warehouse.* TO dev;
GRANT ALL    ON staging.*        TO dev;

GRANT ALL    ON data_warehouse.* TO admin;
GRANT ALL    ON staging.*        TO admin;
GRANT CREATE USER ON *.*         TO admin WITH GRANT OPTION;
```

Role hierarchies

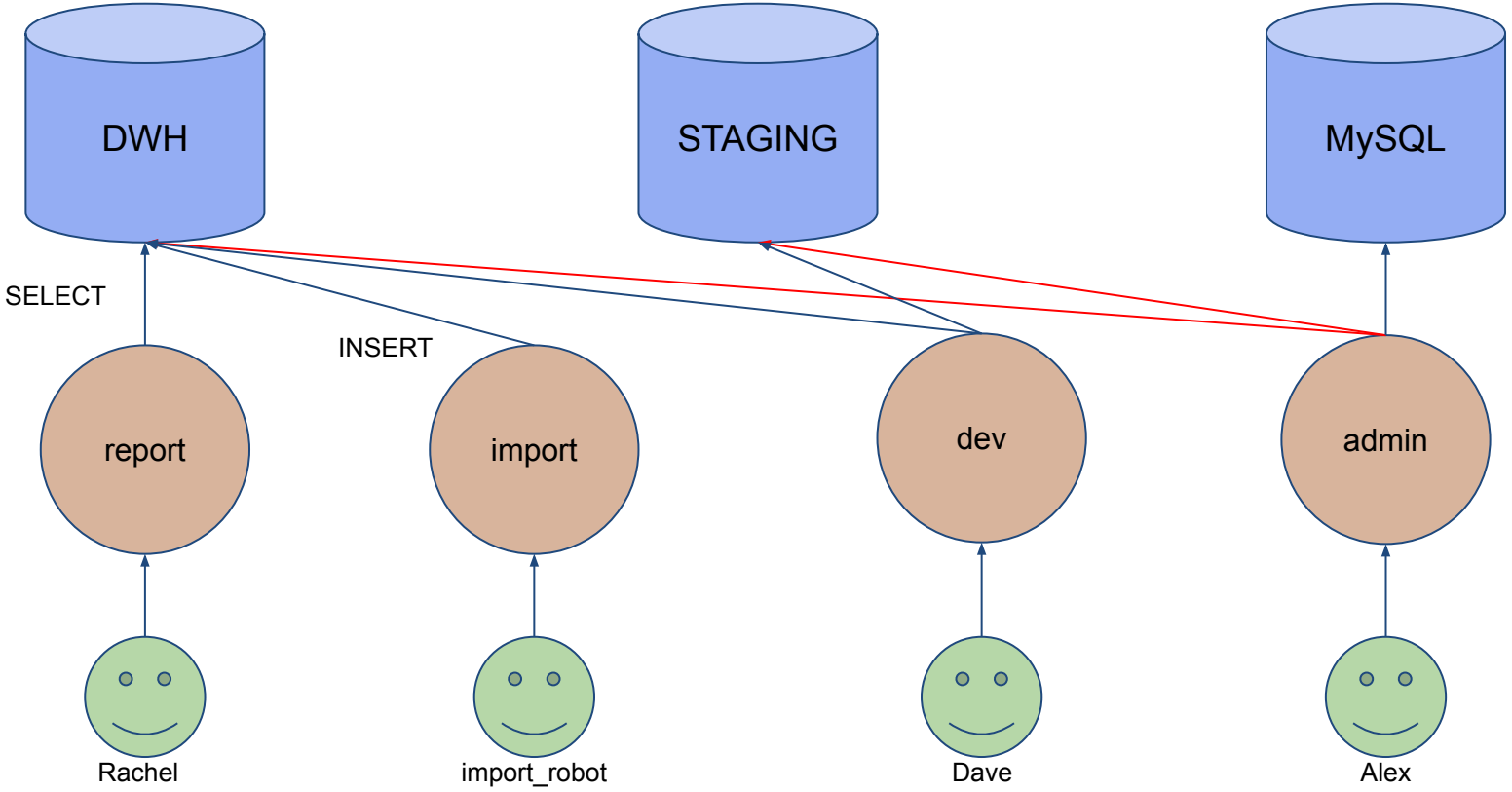
- To eliminate duplicate grants, one can create a role hierarchy.
- Rights from the granted role propagate to the grantee role.

```
CREATE USER rachel;                    CREATE ROLE report;
CREATE USER import_robot;              CREATE ROLE import;
CREATE USER dave;                      CREATE ROLE dev;
CREATE USER alex;                      CREATE ROLE admin;

GRANT SELECT ON data_warehouse.* TO report;
GRANT INSERT ON data_warehouse.* TO import;
GRANT ALL    ON data_warehouse.* TO dev;
GRANT ALL    ON staging.*        TO dev;

GRANT dev TO admin;
GRANT CREATE USER ON *.*         TO admin WITH GRANT OPTION;
```

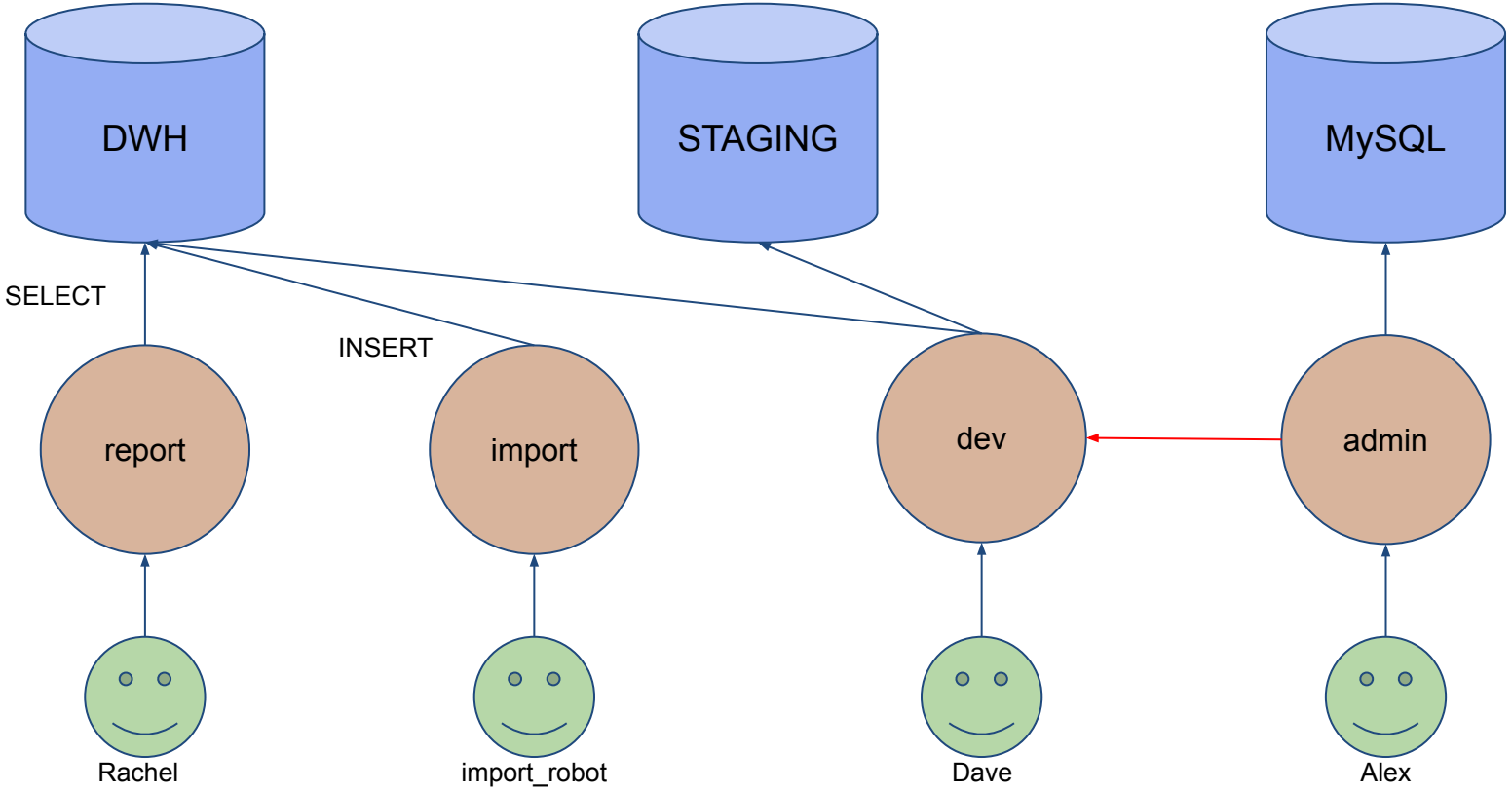
Basic use case



Basic use case



Basic use case



Role hierarchies

- To eliminate duplicate grants, one can create a role hierarchy.
- Rights from the granted role propagate to the grantee role.

- MariaDB disallows cycles.
- MySQL allows cycles.

- When a cycle is created, the whole hierarchy collapses. All roles have the same privileges (ALL from the hierarchy).

Role hierarchies

- Effective privileges for roles in a graph are cached.

- MariaDB and MySQL employ different caching strategies.
- MariaDB
  - computes the effective privileges when loading the role graph from disk.
  - Recomputes only necessary parts when grants are performed.
- MySQL
  - computes an "effective" authentication id (user + all active roles)
  - Computes effective rights for authentication id.
  - Stores effective rights in a cache for subsequent queries.

Role hierarchies

- Both databases optimise for the critical path.

- MariaDB slower GRANT operations (infrequent).
- Always fast access checks (frequent)

- MySQL no performance penalty on GRANT operations. (infrequent)
- First access check slow, then fast. (frequent)

Least privilege principle

- Dave has a tricky bug to debug. He needs a clone of some tables to investigate.

Least privilege principle

- Dave has a tricky bug to debug. He needs a clone of some tables to investigate.

```
SET ROLE dwh_development;
```

- Dave gets to work on the staging database.

```
CREATE TABLE staging.transactions LIKE transactions;
```

Least privilege principle

- Dave has a tricky bug to debug. He needs a clone of some tables to investigate.

```
SET ROLE dwh_development;
```

- Dave gets to work on the staging database.

```
CREATE TABLE staging.transactions LIKE transactions;
```

- Dave does some work, investigating experimenting with different transactions.

Least privilege principle

- Dave has a tricky bug to debug. He needs a clone of some tables to investigate.

```
SET ROLE dwh_development;
```

- Dave gets to work on the staging database.

```
CREATE TABLE staging.transactions LIKE transactions;
```

- Dave does some work, investigating experimenting with different transactions.
- After a long day he finishes and wants to clean up…

Least privilege principle

- Dave has a tricky bug to debug. He needs a clone of some tables to investigate.

```
SET ROLE dwh_development;
```

- Dave gets to work on the staging database.

```
CREATE TABLE staging.transactions LIKE transactions;
```

- Dave does some work, investigating experimenting with different transactions.
- After a long day he finishes and wants to clean up…

```
DROP TABLE transactions;
```

Least privilege principle

- Dave has a tricky bug to debug. He needs a clone of some tables to investigate.

```
SET ROLE dwh_development;
```

- Dave gets to work on the staging database.

```
CREATE TABLE staging.transactions LIKE transactions;
```

- Dave does some work, investigating experimenting with different transactions.
- After a long day he finishes and wants to clean up…

```
DROP TABLE transactions; -- oops, wrong current database;
```

Least privilege principle

- All this could have been prevented.
- Split roles into *safe* and *dangerous* ones.
- Only activate dangerous ones when you need them.
- This would not be possible without roles without switching users.

Roles related features

- MySQL allows enabling multiple roles at once.
- MySQL implements "mandatory roles".
  - Roles that are always active for a user.
  - Implicitly granted

- MySQL and MariaDB implement DEFAULT ROLE
  - Role is activated on login.
  - MySQL can activate multiple roles on login.

INFORMATION_SCHEMA for Roles

- **INFORMATION_SCHEMA.ENABLED_ROLES**
  - MySQL reports just the direct list of enabled roles.
  - MariaDB reports the enabled role, plus the effective inherited roles.
- **INFORMATION_SCHEMA.APPLICABLE_ROLES**
  - Same behaviour in MySQL and MariaDB.
  - MySQL extends the table with specific columns - is_mandatory
- **Newly introduced in MySQL 8.0.19 only**
  - INFORMATION_SCHEMA.ROLE_TABLE_GRANTS
  - INFORMATION_SCHEMA.ROLE_ROUTINE_GRANTS
  - INFORMATION_SCHEMA.ROLE_COLUMN_GRANTS
  - INFORMATION_SCHEMA ADMINISTRABLE_ROLE_AUTHORIZATIONS

Overall comparison

- Both databases allow role-based access control.
  - From a functional perspective both implementations meet the core requirements.
- MariaDB never allows authentication via Roles. MySQL allows it.
- MySQL allows activating multiple roles at the same time. MariaDB can achieve the same result by creating an intermediate aggregate role.
- Since latest MySQL release, MySQL 8.0 has more complete INFORMATION_SCHEMA list.
- **If you stick to basic SQL Standard syntax, implementations are compatible.**

Sponsors of MariaDB Foundation

- This talk would not have been possible if it not for the MariaDB Foundation's sponsors.

Alibaba Cloud
Booking.com
Tencent Cloud
Microsoft
DBS
VISMA
腾讯游戏 Tencent Games
MariaDB
IBM
Acronis
TDSQL 腾讯金融级分布式数据库
PERCONA
nexedi
Tencent Game DBA
Virtuozzo
Verkkokauppa.com TODENNÄKÖISESTI AINA HALVEMPI

Thank you!

Contact details:

vicentiu@mariadb.org

About:

https://mariadb.org/vicentiu