Using PostgreSQL as a Web Server and Content Management System

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About Me

Tim Colles
Deputy Head of Computing
Head of Research and Teaching Computing Unit
School of Informatics
University of Edinburgh

https://blogs.ed.ac.uk/timc
https://blogs.ed.ac.uk/timc/category/postgresql

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The Problem to Solve

in a nutshell
multiple systems and multiple sources of information

but also GDPR ...

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Our Solution

“personalised information portal”

important that data was “mastered” in satellite systems
but authorisation was centralised in one system

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Demo ...

but this talk is not really about this specific service …
… instead its about the implementation

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Just Use PostgreSQL

Build the service entirely within PostgreSQL using no other technologies or frameworks (well almost) …

Why?
(and why not)

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Just Use PostgreSQL

Why

Containment
Change Management
Common Paths
Performance Isolation
Features

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Just Use PostgreSQL

Why

Containment
Change Management
Common Paths
Performance Isolation
Features

Why Not

Complex
Time
Options
Versioning

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Just Use PostgreSQL

Features
(for free)

Authorisation Management
PL/PGSQL Procedural Language
Other Languages
Transactional (atomicity)
Foreign Data Wrappers
Performance Control

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Do a Demo ...

WIP

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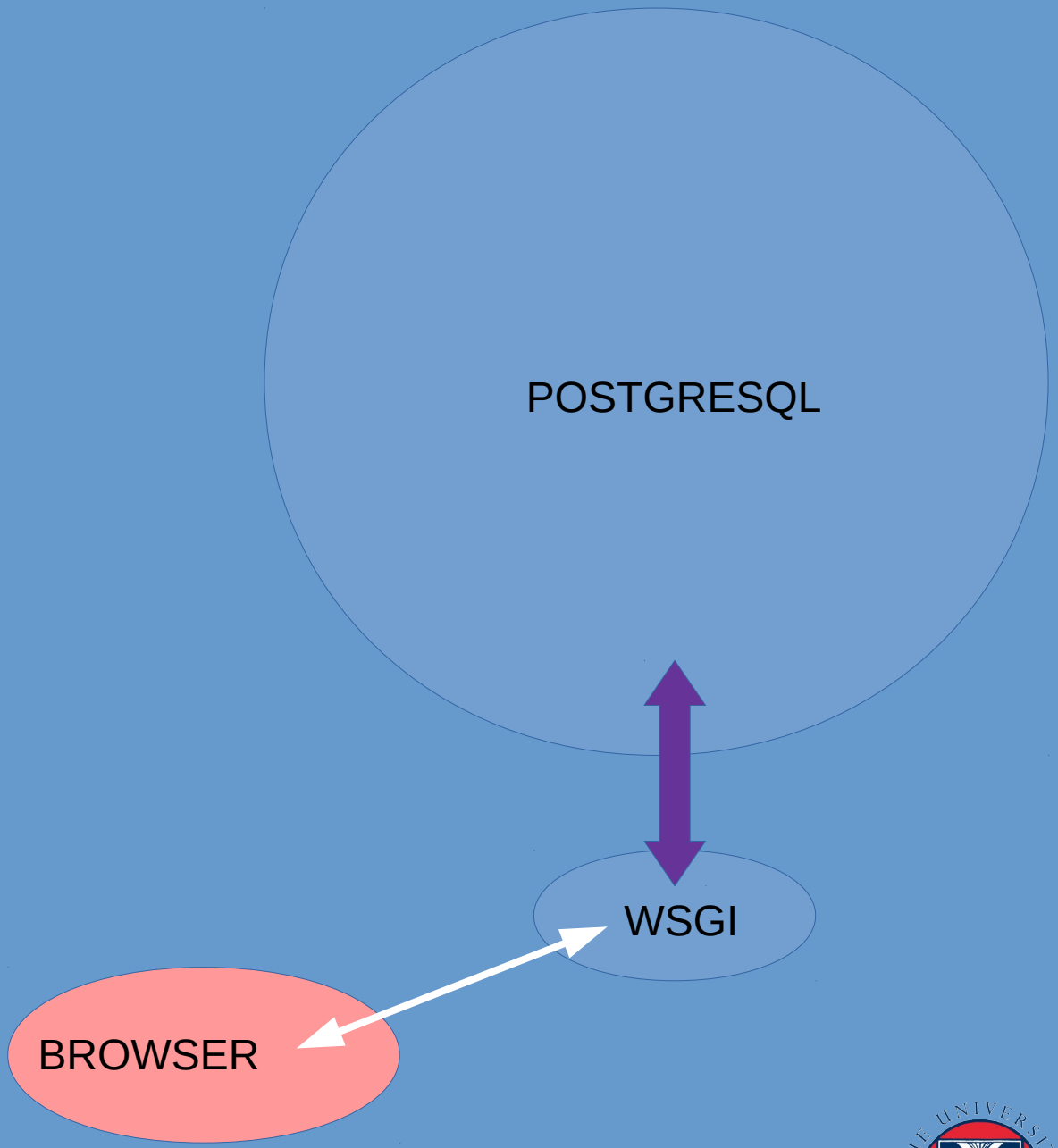

```
def root(path):
    if request.method == 'POST':
        qs = request.query_string
        with Database.cursor(commit=True) as cur:
            sql = cur.mogrify("SELECT path, page FROM pip_page_return(%s,
%s)", (path, qs))
            try:
                cur.execute(sql)
                rows = cur.fetchall()
            except:
                abort(404)
        return('', 302, {'location': rows[0]['path']})
    else:
        qs = request.query_string
        with Database.cursor() as cur:
            sql = cur.mogrify("SELECT page FROM pip_page(%s,%s)", (path, qs))
            try:
                cur.execute(sql)
                rows = cur.fetchall()
            except:
                abort(404)
        resp = make_response(rows[0]['page'])
        return resp
```

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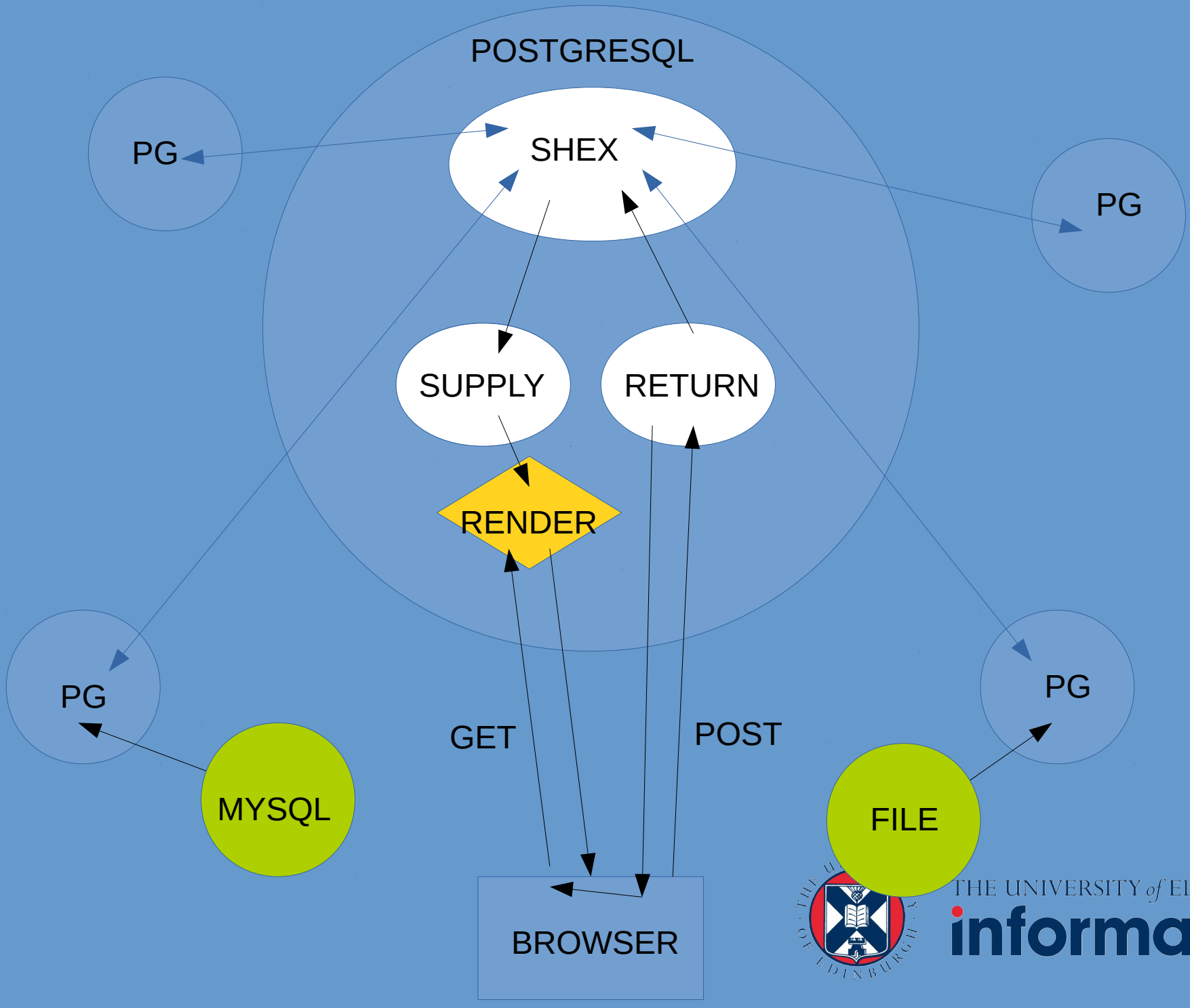

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Gurgle

Yet Another Template Processor
GNU Report Generator
PostgreSQL Extension

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FILE:/tmp/test.grg

```
@database “pg_c.sql”
SELECT *
FROM pg_catalog.pg_class
```

```
createdb gtest
psql gtest
> create extension gurgle;
> select gurgle('/tmp/test.grg');
```

FILE:/tmp/test.tex

sql_languages 13086 13228 0 10 0 13227 0 1 4 1 13229 f f p r 7 0 f f f f f f t d f 0
561 1 {timcolles=arwdDxt/timcolles,=r/timcolles}
pg_toast_13232 99 13235 0 10 0 13234 0 0 0 0 0 t f p t 3 0 f f f f f f t n f 0 561 1
pg_toast_13232_index 99 0 0 10 403 13236 0 1 0 0 0 f f p i 2 0 f f f f f f t n f 0 0 0
sql_packages 13086 13233 0 10 0 13232 0 1 10 1 13234 f f p r 5 0 f f f f f f t d f 0
561 1 {timcolles=arwdDxt/timcolles,=r/timcolles}
pg_toast_13237 99 13240 0 10 0 13239 0 0 0 0 0 t f p t 3 0 f f f f f f t n f 0 561 1
pg_toast_13237_index 99 0 0 10 403 13241 0 1 0 0 0 f f p i 2 0 f f f f f f t n f 0 0 0
sql_parts 13086 13238 0 10 0 13237 0 1 9 1 13239 f f p r 5 0 f f f f f f t d f 0 561 1
pg_toast_13242 99 13245 0 10 0 13244 0 0 0 0 0 t f p t 3 0 f f f f f f t n f 0 561 1
pg_toast_13242_index 99 0 0 10 403 13246 0 1 0 0 0 f f p i 2 0 f f f f f f t n f 0 0 0
...

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FILE:/tmp/test.grg

```
@database “pg_c.sql”
SELECT *
FROM pg_catalog.pg_class
@define NAMCOL
@record
%RELNAME %RELNAMESPACE %RELTYPE
```

```
> select gurgle('/tmp/test.grg');
```

FILE:/tmp/test.tex

pg_statistic 11 11319
pg_toast_2604 99 11583
pg_toast_2604_index 99 0
pg_toast_2606 99 11584
pg_toast_2606_index 99 0
pg_toast_2609 99 11585
pg_toast_2609_index 99 0
...

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FILE:/tmp/test.grg

```
@database “pg_c.sql”
SELECT *
FROM pg_catalog.pg_class
@define NAMCOL
@define TEXEXT .html
@header
<table>
<tr>
<th>Name</th>
<th>Namespace</th>
<th>Type</th>
<tr>
@record
<tr>
<td>%RELNAME</td>
<td>%RELNAMESPACE</td>
<td>%RELTYPE</td>
</tr>
@footer
</table>
```

```
> select gurgle('/tmp/test.grg');
```

FILE:/tmp/test.html

```
<table>
<tr>
<th>Name</th>
<th>Namespace</th>
<th>Type</th>
<tr>
<tr>
<td>pg_statistic</td>
<td>11</td>
<td>11319</td>
</tr>
...
```

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FILE:/tmp/test.grg

```
@database “pg_c.sql”
SELECT *
FROM pg_catalog.pg_class
@define NAMCOL
@define TEXEXT .html
@header
<table>
<tr>
<th>Name</th>
<th>Namespace</th>
<th>Type</th>
<tr>
@record
<tr>
<td>%RELNAME</td>
<td>%RELNAMESPACE</td>
<td>%RELTYPE</td>
</tr>
@footer
</table>
@define PGCAPTURE
@define PGVIRTUAL
```

```
> select * from gurgle('/tmp/test.grg');
     path      |                          data
---------------+-------------------------------------------------------
 /tmp/test.html | <table>                                              +
                | <tr>                                                 +
                | <th>Name</th>                                        +
                | <th>Namespace</th>                                   +
                | <th>Type</th>                                        +
                | <tr>                                                 +
                | <tr>                                                 +
                | <td>pg_statistic</td>                                +
                | <td>11</td>                                          +
                | <td>11319</td>                                       +
                | </tr>                                                +
...
```

```
cat /tmp/test.html
```

No such file or directory

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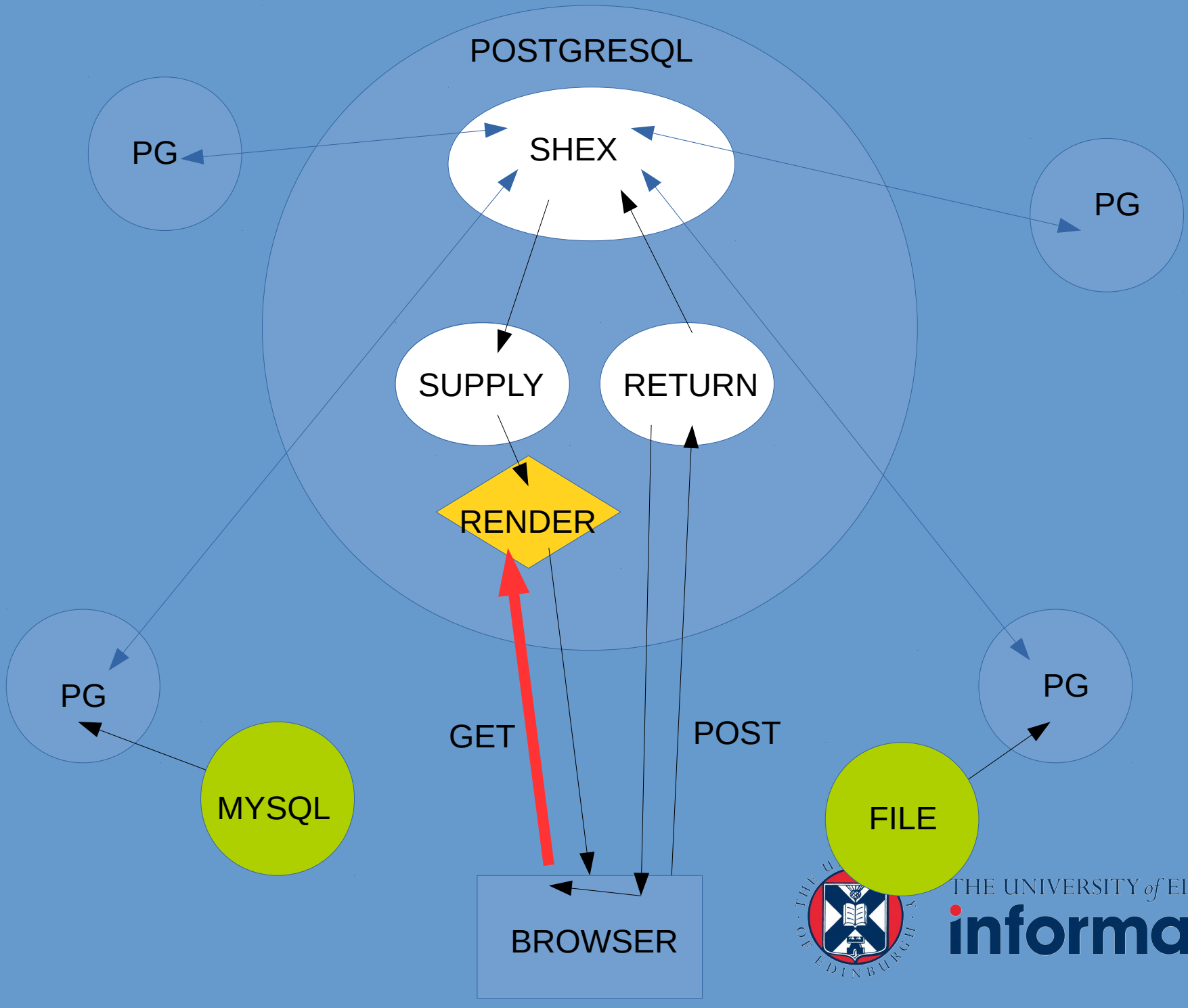

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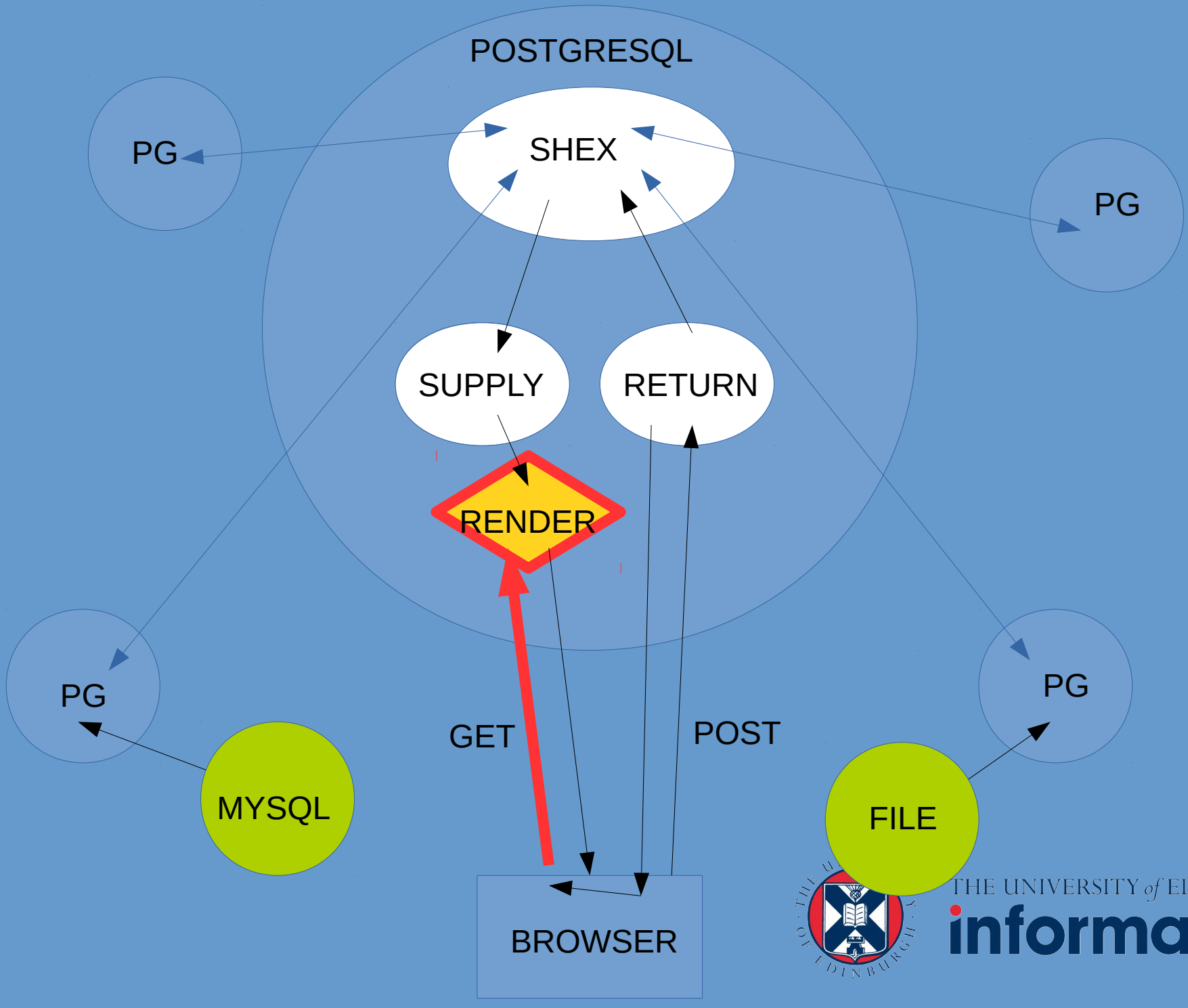

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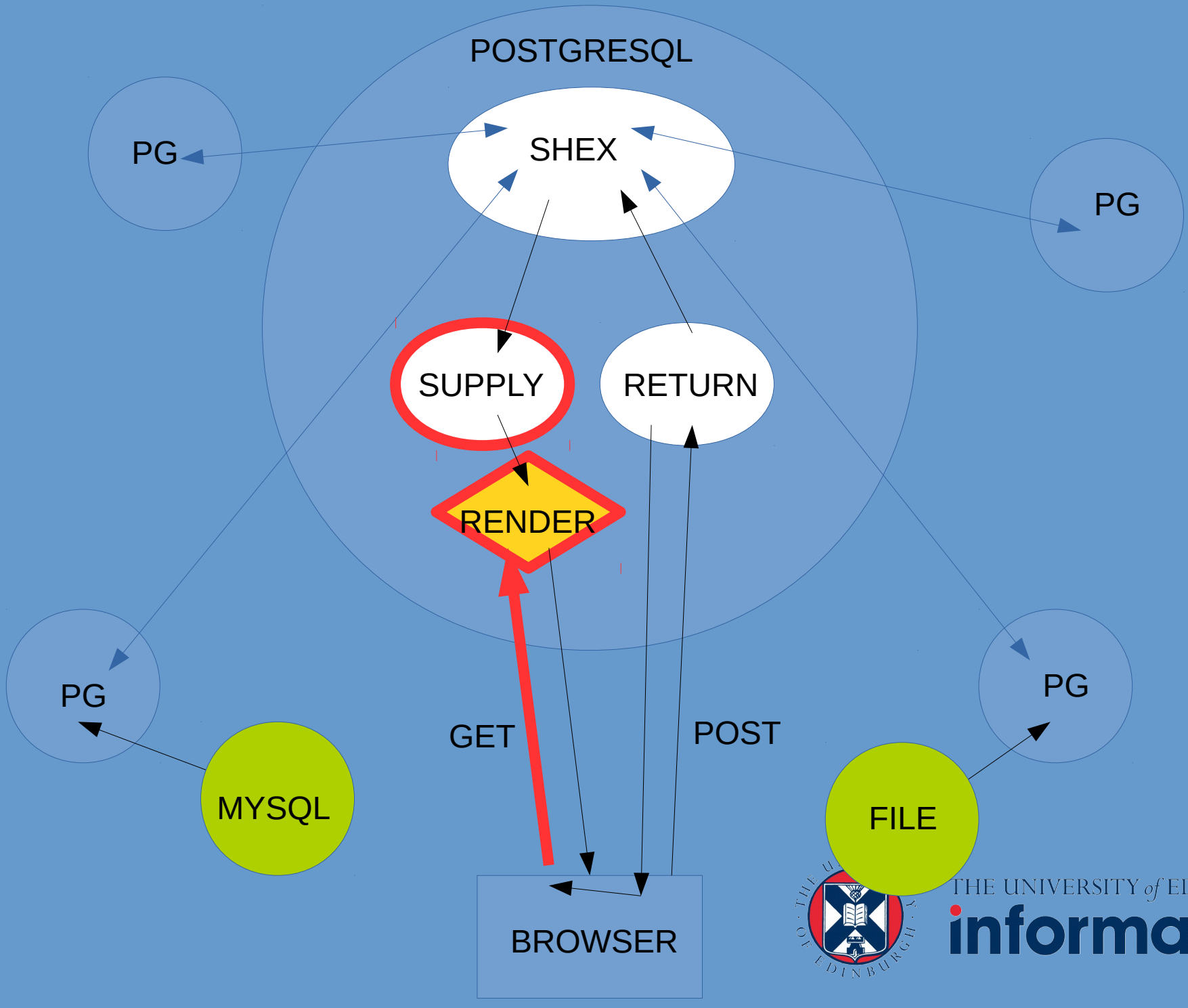

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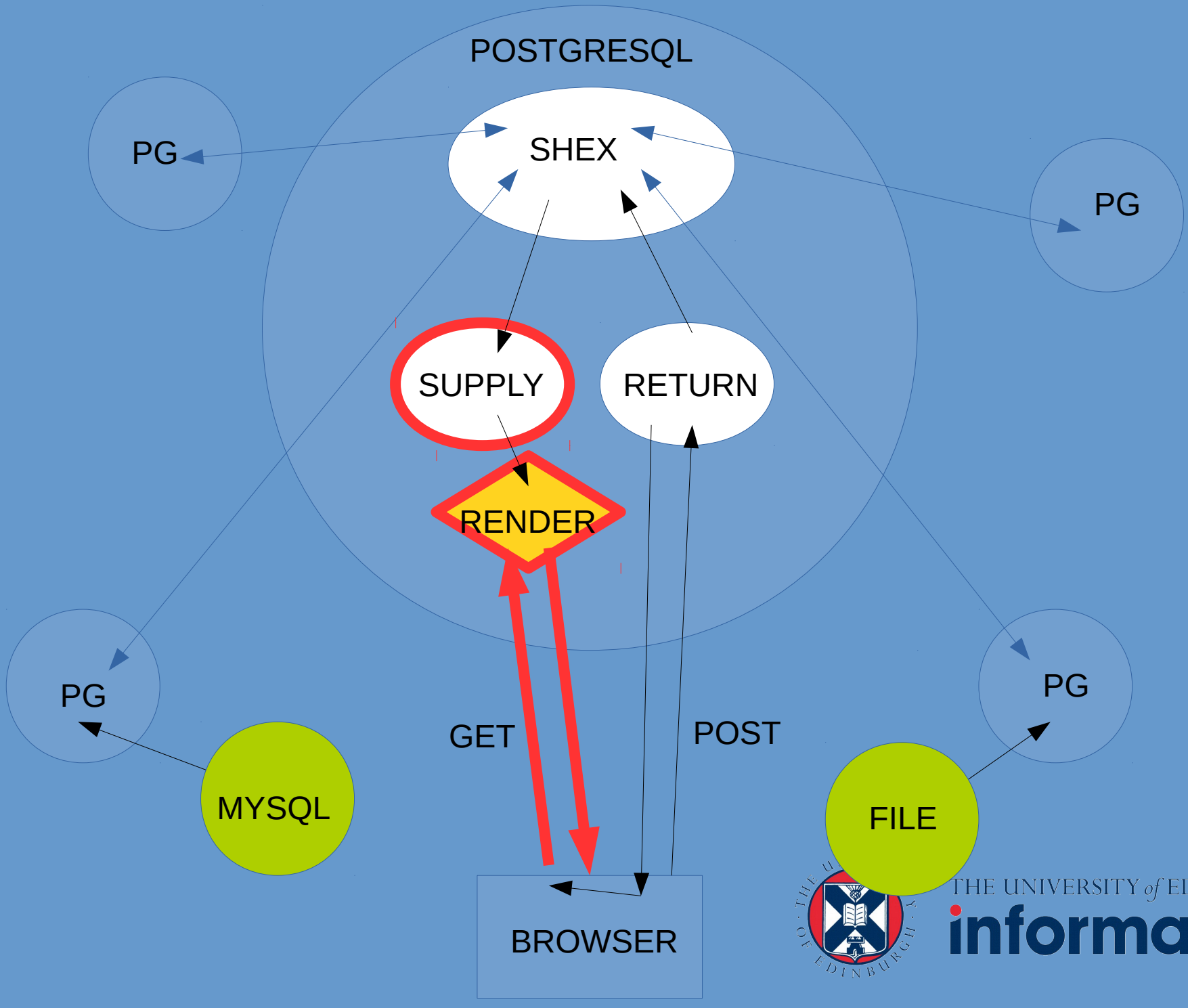

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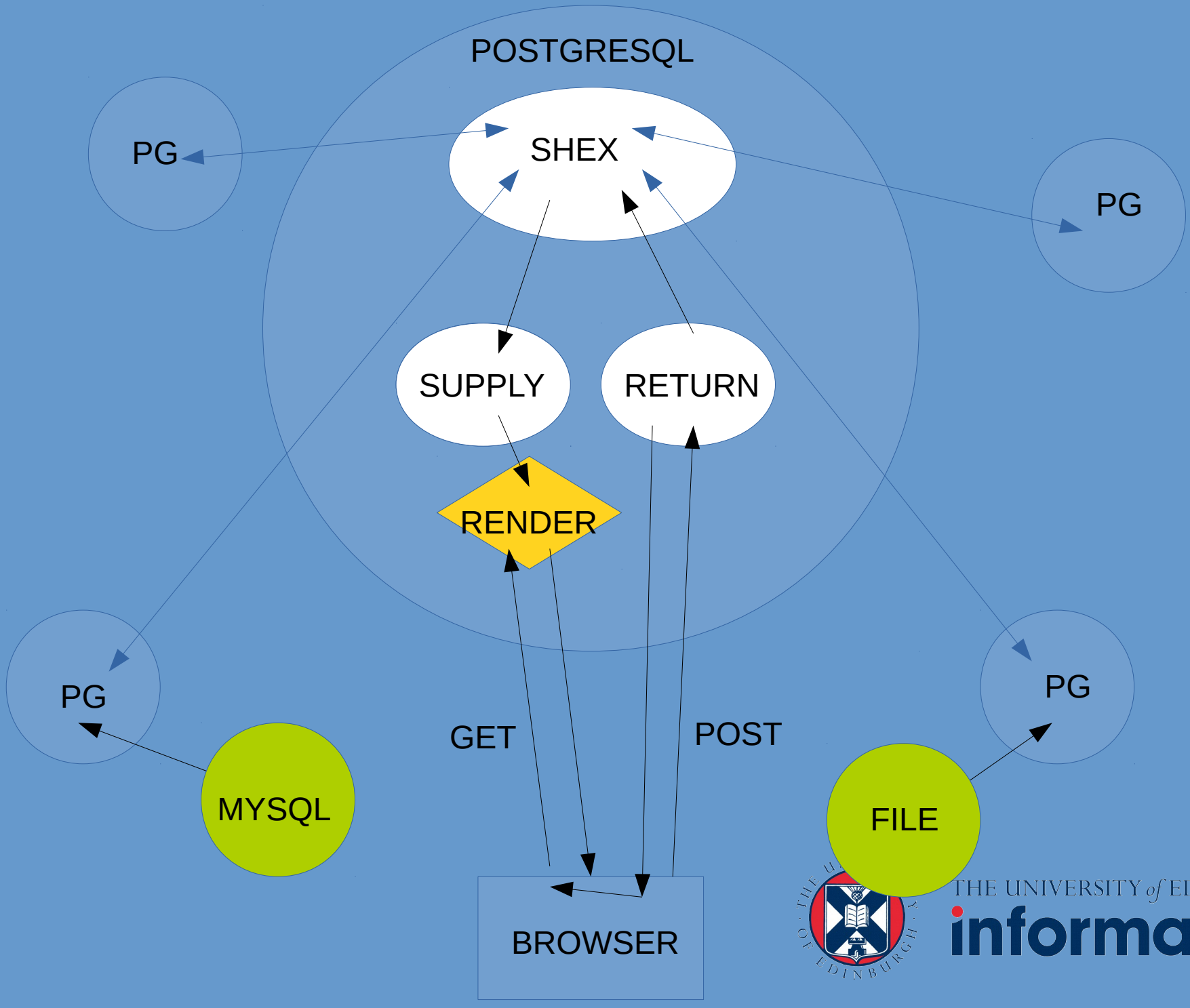

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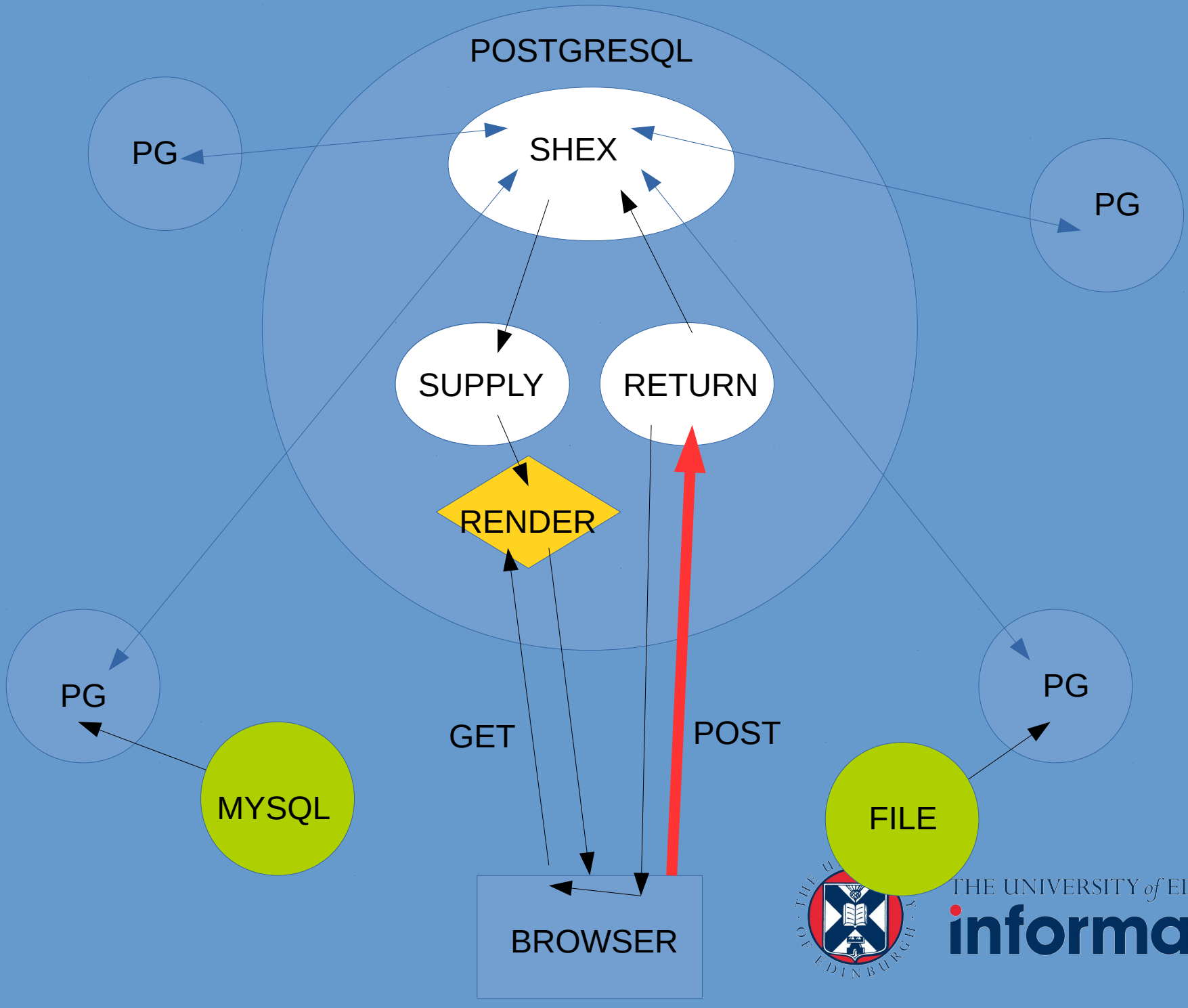

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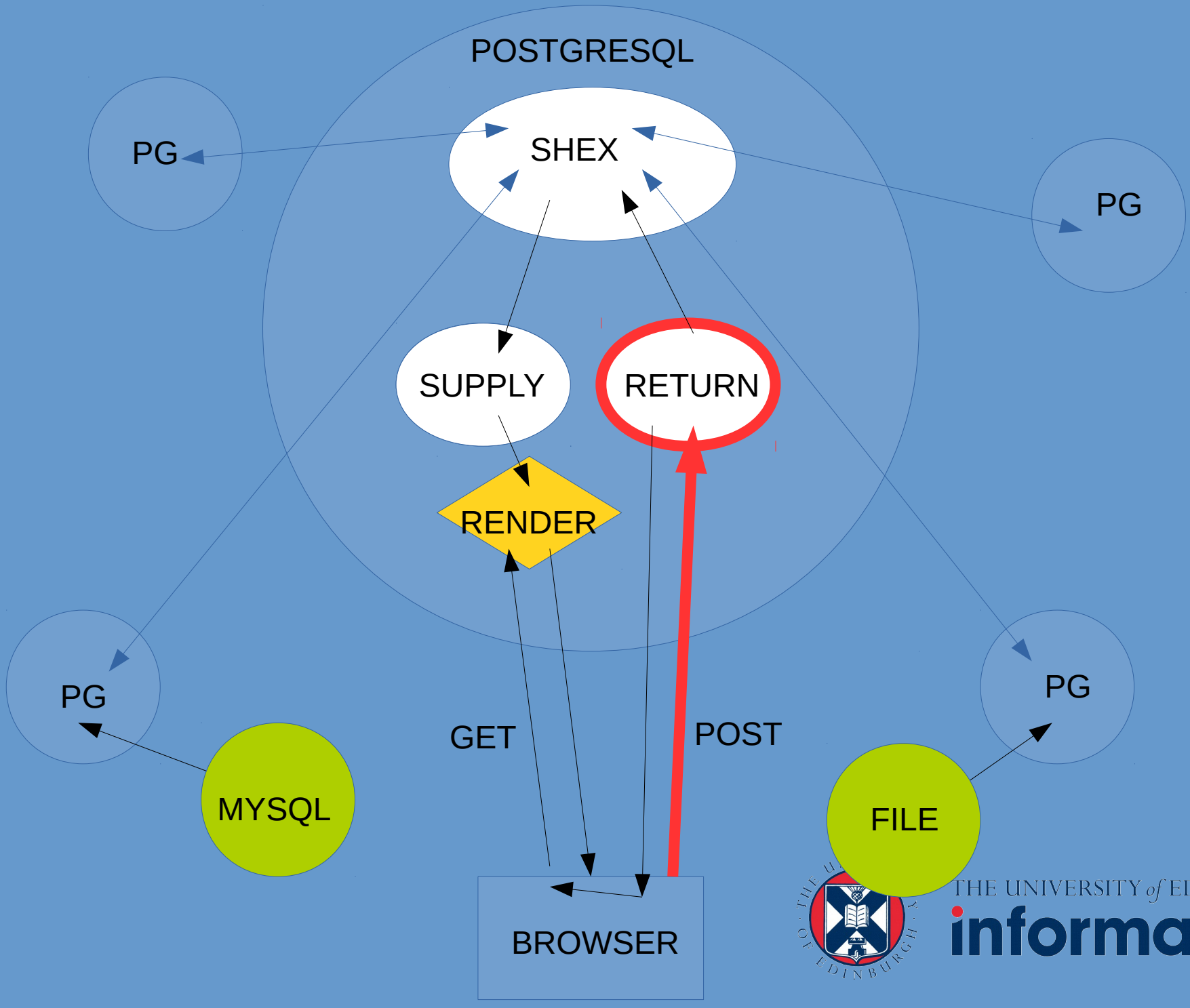

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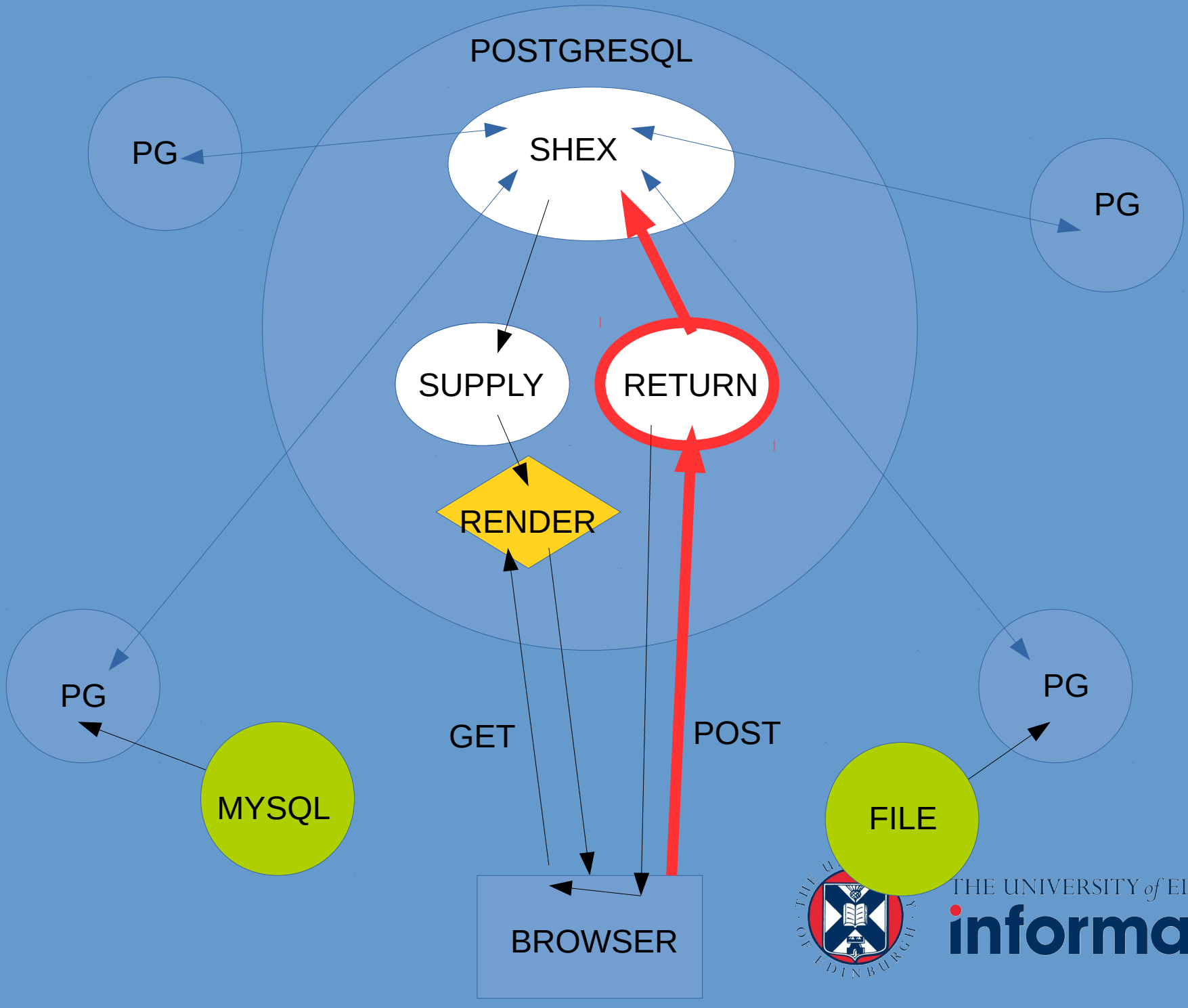

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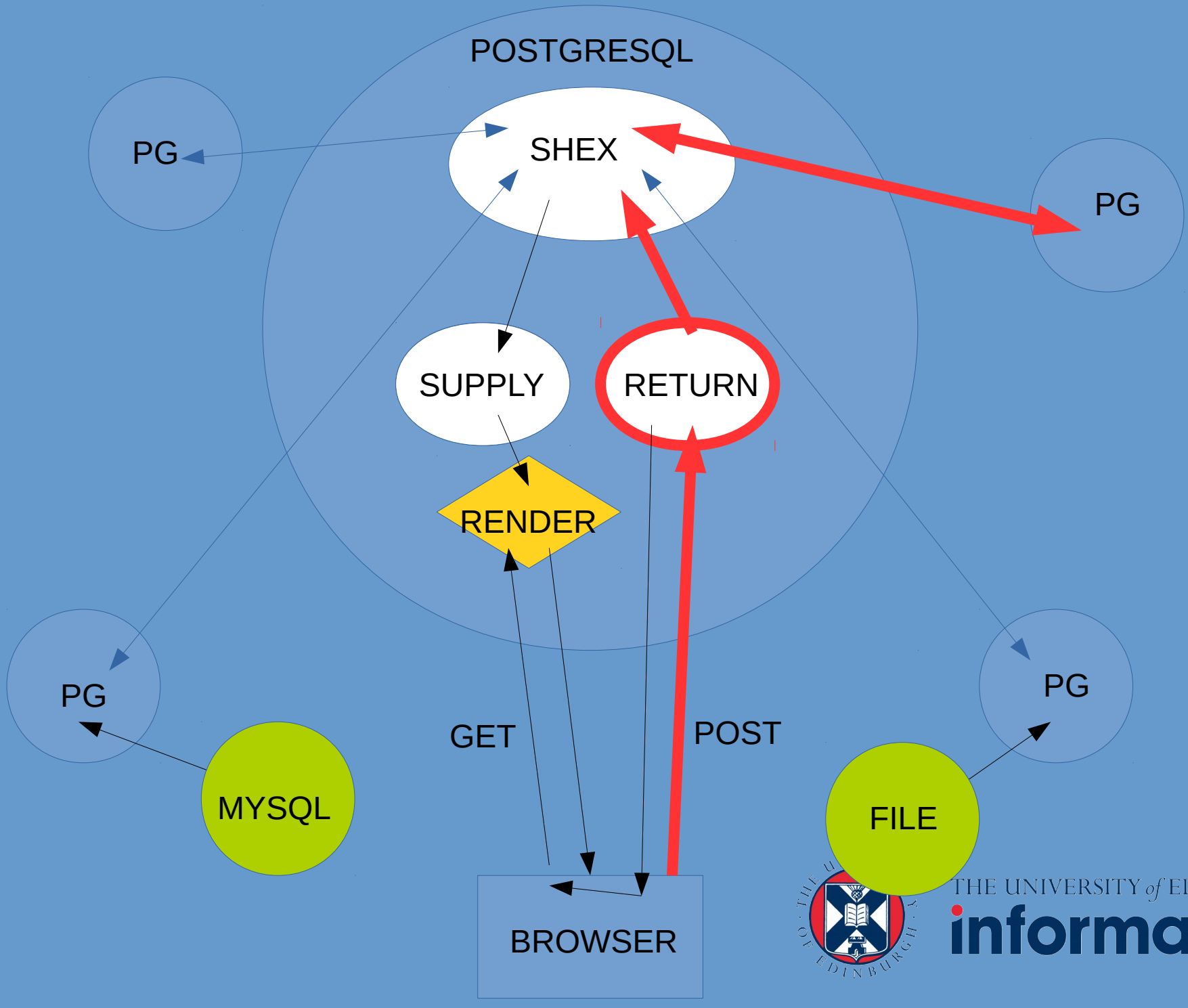

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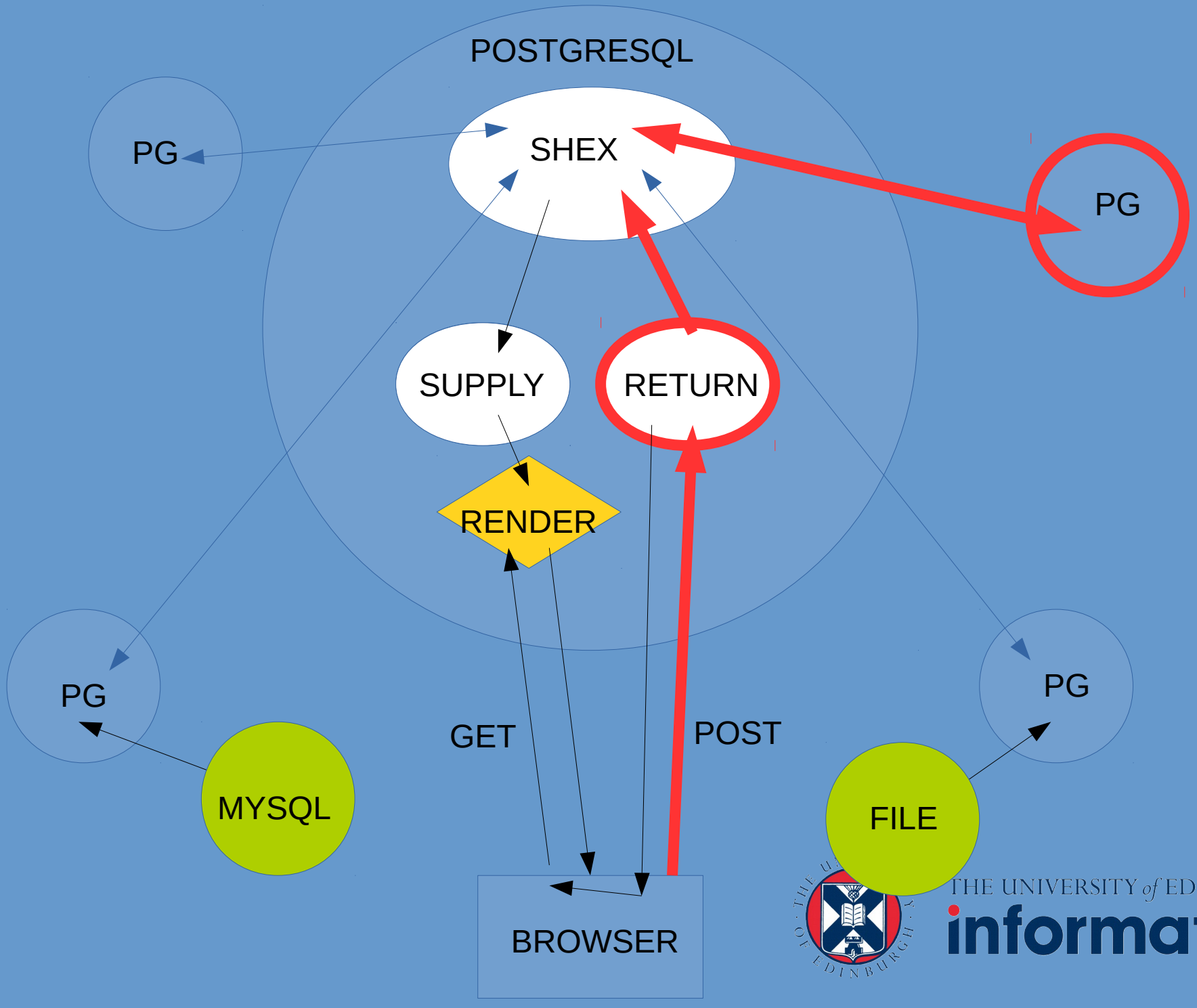

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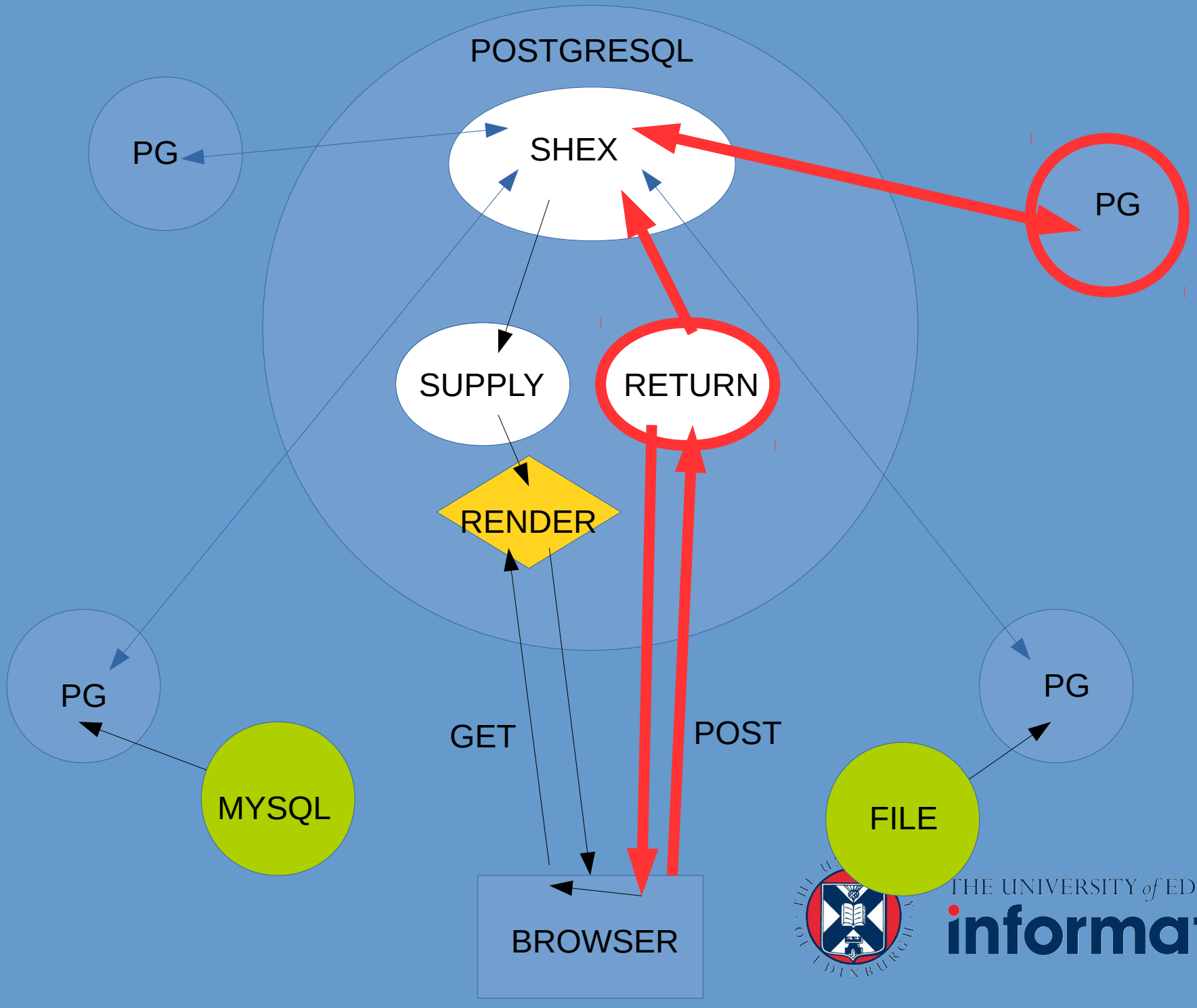

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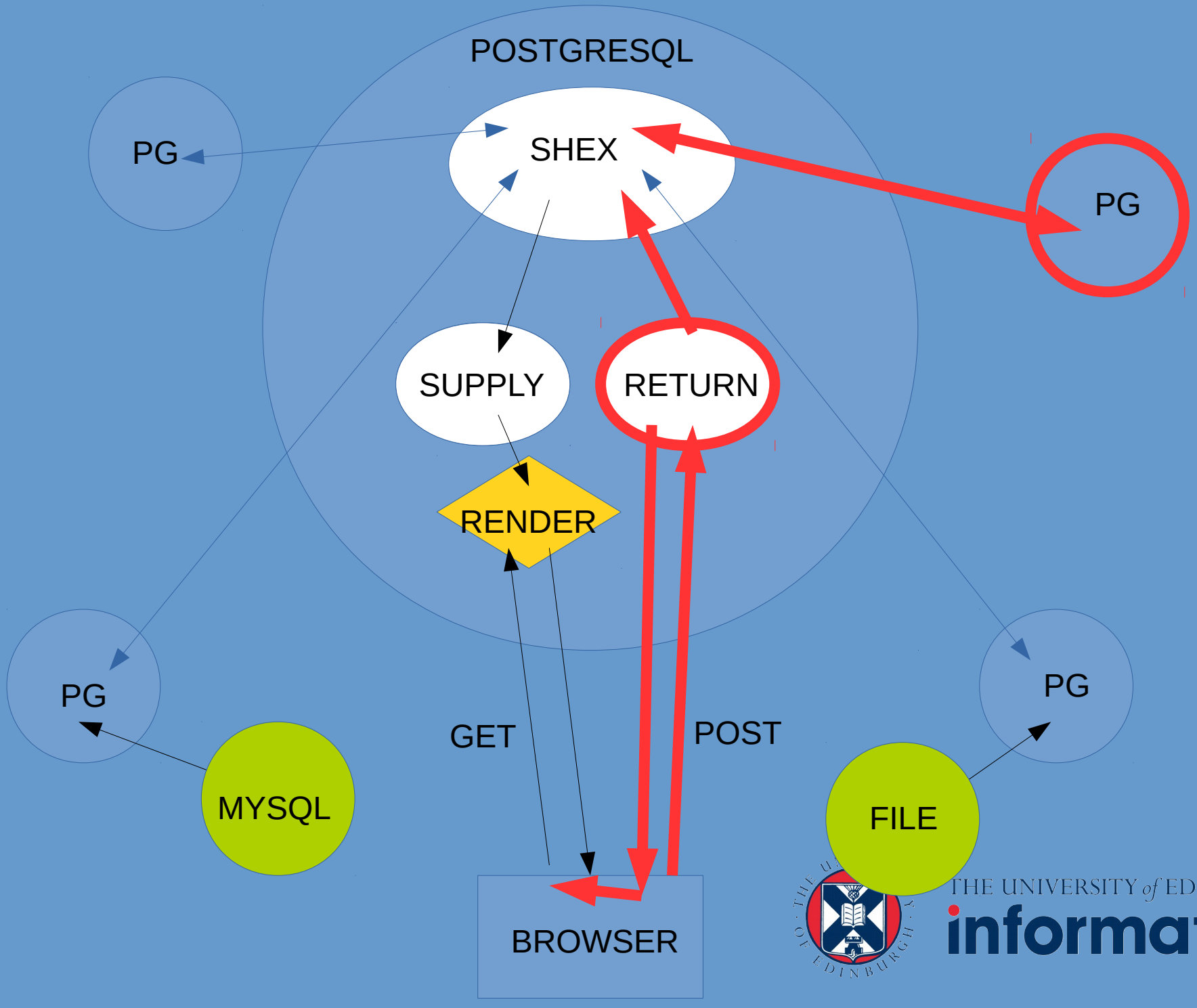

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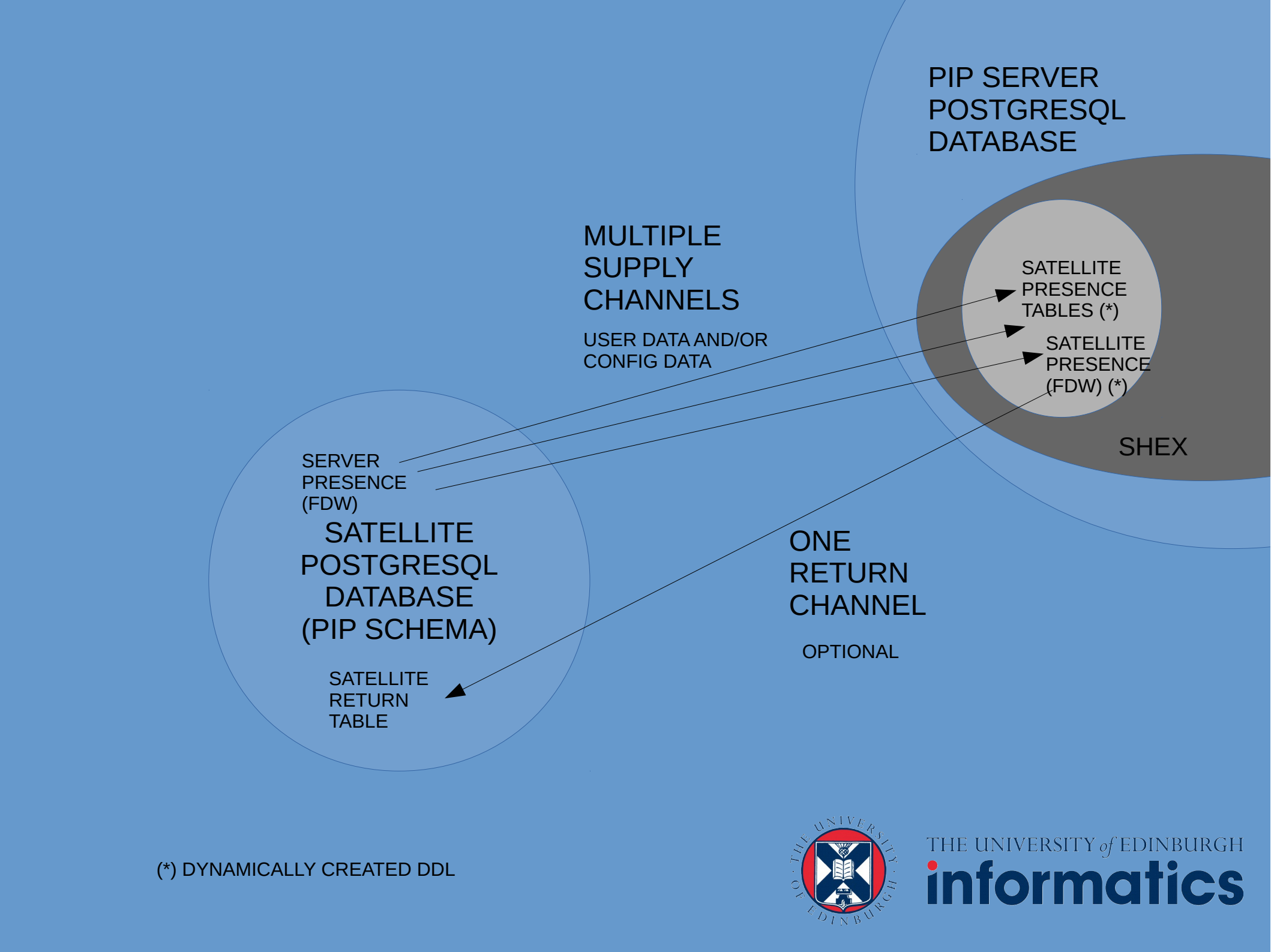
PIP SERVER
POSTGRESQL
DATABASE
SATELLITE
PRESENCE
TABLES (*)
SATELLITE
PRESENCE
(FDW) (*)
SHEX
MULTIPLE
SUPPLY
CHANNELS
USER DATA AND/OR
CONFIG DATA
SERVER
PRESENCE
(FDW)
SATELLITE
POSTGRESQL
DATABASE
(PIP SCHEMA)
SATELLITE
RETURN
TABLE
ONE
RETURN
CHANNEL
OPTIONAL
(*) DYNAMICALLY CREATED DDL
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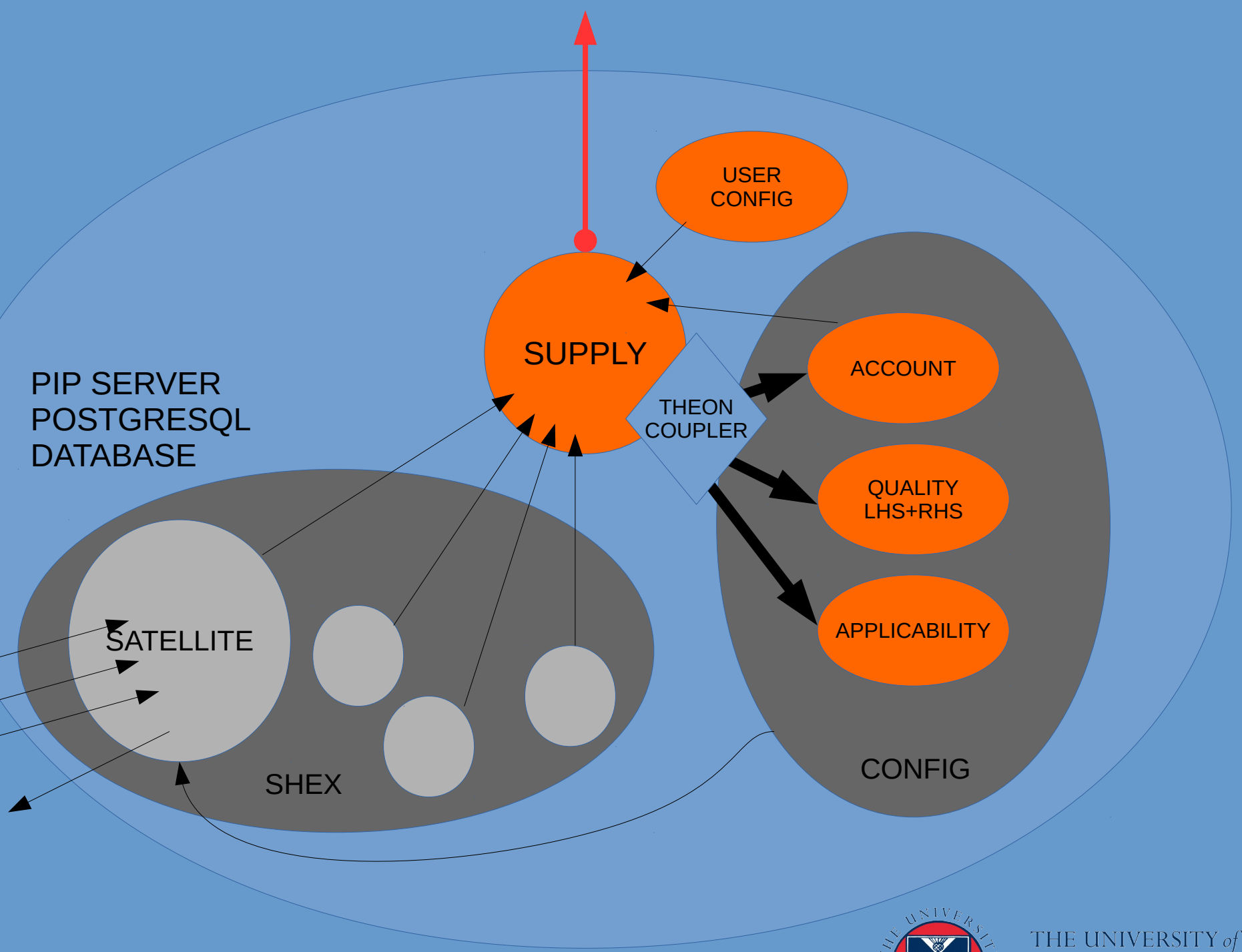

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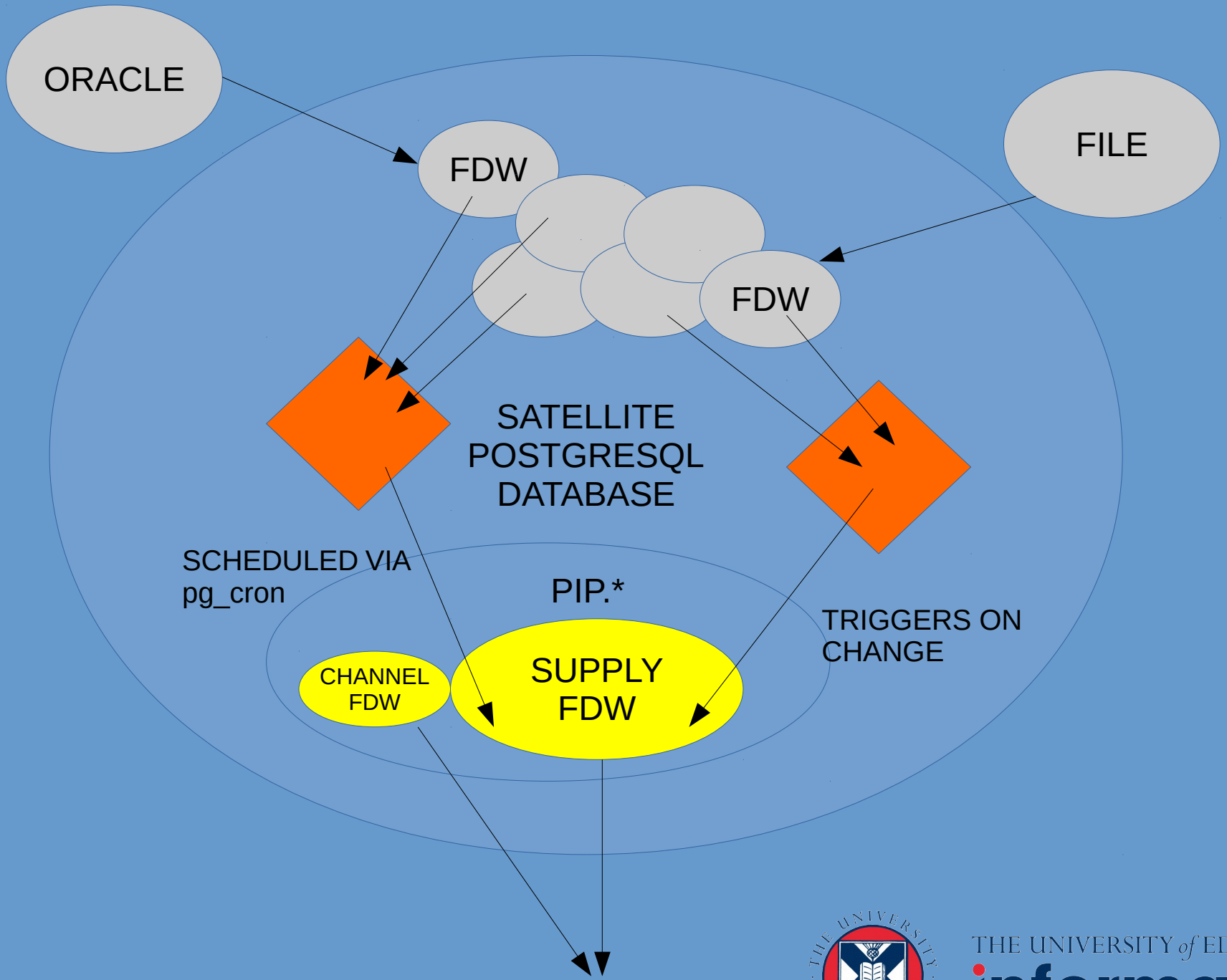

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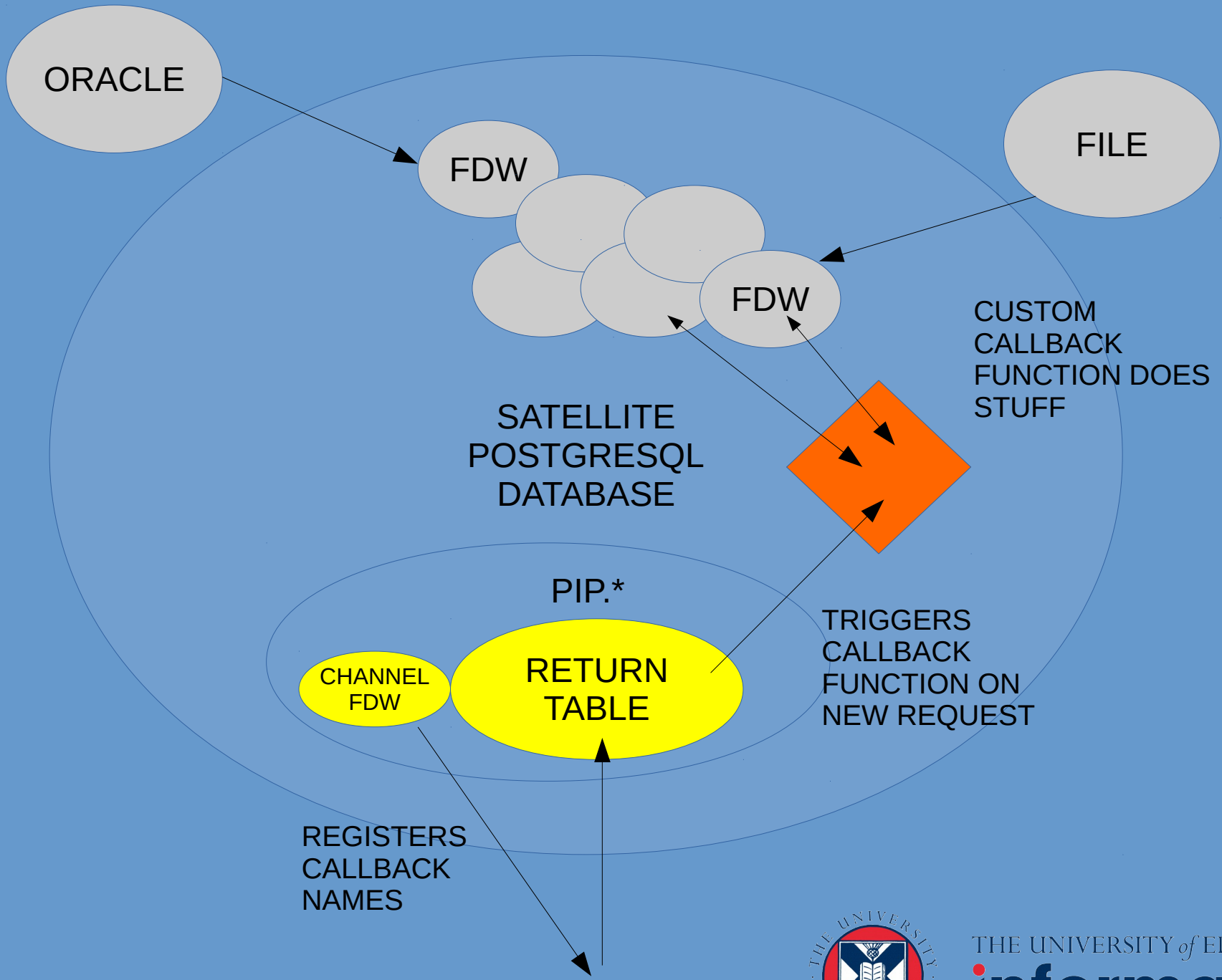

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```
pip-register \
  --name "demo" \
  --info "Just a Demo" \
  --db "demo" \
  --host "localhost"

        name = demo
          id = 143607031172249350
        info = Just a Demo
        host = localhost
          db = demo
   auth token = 100ad48d-293a-4398-ae69-
9f205adf7288
```

```
psql pip
```

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```
pip-register \
  --name "demo" \
  --info "Just a Demo" \
  --db "demo" \
  --host "localhost"

        name = demo
          id = 143607031172249350
        info = Just a Demo
        host = localhost
          db = demo
   auth token = 100ad48d-293a-4398-ae69-
9f205adf7288
```

```
psql pip

> select * from satellite where name =
'demo';
-[ RECORD 1 ]--+------------------------------------
id             | 6
name           | demo
server_host    | localhost
definition     | Just a Demo
connection_key | 100ad48d-293a-4398-ae69-9f205adf7288
disabled       | f
server_db      | demo
```

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```
createdb demo
psql demo
```

```
psql pip
```

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```
createdb demo
psql demo

> create extension pip cascade;
```

```
psql pip
```

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```
createdb demo
psql demo

> create extension pip cascade;

> \d pip.
pip.channel
pip.connection_unq
pip.server_pages
pip.server_satellite
pip.connection
pip.return
pip.server_qualities_lhs
pip.supply
pip.connection_pkey
pip.server_channels
pip.server_qualities_rhs
```

```
psql pip
```

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```
createdb demo
psql demo

> create extension pip cascade;

> \d pip.
pip.channel
pip.connection_unq
pip.server_pages
pip.server_satellite
pip.connection
pip.return
pip.server_qualities_lhs
pip.supply
pip.connection_pkey
pip.server_channels
pip.server_qualities_rhs

> select
pip.connect('demo','/tmp','pi
p','100ad48d-293a-4398-ae69-
9f205adf7288');
 connect
---------

(1 row)
```

```
psql pip
```

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```
createdb demo
psql demo

> create extension pip cascade;

> \d pip.
pip.channel
pip.connection_unq
pip.server_pages
pip.server_satellite
pip.connection
pip.return
pip.server_qualities_lhs
pip.supply
pip.connection_pkey
pip.server_channels
pip.server_qualities_rhs

> select
pip.connect('demo','/tmp','pi
p','100ad48d-293a-4398-ae69-
9f205adf7288');
 connect
---------

(1 row)
```

```
psql pip

> \d pipshex.
pipshex._th_theon
pipshex.channel_pgconfeu
pipshex.qualities_lhs
pipshex.return_pgconfeu     pipshex.supply_demo
pipshex.channel             pipshex.channel_test
pipshex.qualities_rhs       pipshex.return_test
pipshex.supply_marriot
pipshex.channel_demo        pipshex.channels
pipshex.return_demo         pipshex.satellite
pipshex.supply_pgconfeu
pipshex.channel_marriot     pipshex.pages
pipshex.return_marriot      pipshex.supply
pipshex.supply_test
```

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```
> select * from pip.server_channels;

-[ RECORD 1 ]----------------------------------
name    | applicability
info    | Internal Server Configuration Channel
blocked | t

-[ RECORD 2 ]----------------------------------
name    | page
info    | Internal Server Configuration Channel
blocked | t

-[ RECORD 3 ]----------------------------------
name    | quality-lhs
info    | Internal Server Configuration Channel
blocked | t

-[ RECORD 4 ]----------------------------------
name    | quality-rhs
info    | Internal Server Configuration Channel
blocked | t

-[ RECORD 5 ]----------------------------------
name    | account
info    | Internal Server Configuration Channel
blocked | t
```

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```
-- create a view for channel supply
> CREATE VIEW local_food AS
SELECT 'local-food'::text AS channel,
    ARRAY['person/account'::text] AS visibility,
    NULL::text AS page,
    NULL::text AS format,
    'record'::text AS type,
    ARRAY[name,address,distance,rating]::text[] AS value,
    row_number() OVER (ORDER BY name) AS place,
    data.name::text AS ident,
    NULL::text AS bunch
   FROM data
UNION ALL
 SELECT 'local-food'::text AS channel,
    ARRAY['person/account'::text] AS visibility,
    NULL::text AS page,
    NULL::text AS format,
    'header'::text AS type,
    ARRAY['Restaurant'::text, 'Address'::text, 'Distance'::text,
'Rating'::text] AS value,
    NULL::integer AS place,
    'h'::text AS ident,
    NULL::text AS bunch;
```

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```
-- create channel

> INSERT INTO pip.channel (name,
info, page, visibility,
supply_visibility, c_expose,
c_onpage, c_opened)
VALUES ('local-food',
'Local Eating Places',
'home',
ARRAY['person/account'],
ARRAY['person/account'],
TRUE,TRUE,TRUE);
```

```
psql pip
```

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```
-- create channel

> INSERT INTO pip.channel (name,
info, page, visibility,
supply_visibility, c_expose,
c_onpage, c_opened)
VALUES ('local-food',
'Local Eating Places',
'home',
ARRAY['person/account'],
ARRAY['person/account'],
TRUE,TRUE,TRUE);
```

```
psql pip
> select * from channel where name =
'local-food';
-[ RECORD 1 ]------+-------------------
id                 | 31
satellite          | demo
name               | local-food
definition         | Local Eating Places
page               | home
hidden             |
fallback           | f
onpage             | t
onmenu             |
expanded           | t
visibility         | {person/account}
content_visibility | {person/account}
included           | t
place              | 0.09375
adjust             |
csv                |
export             | f
proto              |
callbacks          |
exportable         | f
disabled           | f
updated_at         |
sortable           | f
vsplitat           | 0
csvfrom            |
```

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```
-- create channel

> INSERT INTO pip.channel (name,
info, page, visibility,
supply_visibility, c_expose,
c_onpage, c_opened)
VALUES ('local-food',
'Local Eating Places',
'home',
ARRAY['person/account'],
ARRAY['person/account'],
TRUE,TRUE,TRUE);

-- refresh supply

> SELECT
pip.refresh('local_food');
 refresh
---------

(1 row)
```

```
psql pip
> select * from channel where name =
'local-food';
-[ RECORD 1 ]------+-------------------
id                 | 31
satellite          | demo
name               | local-food
definition         | Local Eating Places
page               | home
hidden             |
fallback           | f
onpage             | t
onmenu             |
expanded           | t
visibility         | {person/account}
content_visibility | {person/account}
included           | t
place              | 0.09375
adjust             |
csv                |
export             | f
proto              |
callbacks          |
exportable         | f
disabled           | f
updated_at         |
sortable           | f
vsplitat           | 0
csvfrom            |
```

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```
-- create channel

> INSERT INTO pip.channel (name,
info, page, visibility,
supply_visibility, c_expose,
c_onpage, c_opened)
VALUES ('local-food',
'Local Eating Places',
'home',
ARRAY['person/account'],
ARRAY['person/account'],
TRUE,TRUE,TRUE);

-- refresh supply

> SELECT
pip.refresh('local_food');
 refresh
---------

(1 row)
```

```
psql pip
> select * from channel where name =
'local-food';
-[ RECORD 1 ]------+-------------------
id                 | 31
satellite          | demo
name               | local-food
definition         | Local Eating Places
page               | home
hidden             |
fallback           | f
onpage             | t
onmenu             |
expanded           | t
visibility         | {person/account}
content_visibility | {person/account}
included           | t
place              | 0.09375
adjust             |
csv                |
export             | f
proto              |
callbacks          |
exportable         | f
disabled           | f
updated_at         |
sortable           | f
vsplitat           | 0
csvfrom            |
> select count(*) from supply where
channel = 'local-food';
 count
-------
     4
(1 row)
```

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Takeaway

PostgreSQL is not just an RDBMS

https://groups.inf.ed.ac.uk/theon
https://groups.inf.ed.ac.uk/theon/download/gurgle-2.0.3.tar.gz
git://afsgit.inf.ed.ac.uk/timc/gurgle

https://2019.pgconf.eu/f

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