PostgreSQL extension's development

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What is a "Extension"?

Definitions

PostgreSQL extensibility is remarkable but incomplete.

Example (Basic SQL query)

```
SELECT col
  FROM table
 WHERE stamped > date 'today' - interval '1 day'
```

Some extensions example

46 Contribs, Community extensions, Private ones...

- cube
- ltree
- citext
- hstore
- intagg
- adminpack
- pgq
- pg_trgm
- wildspeed
- dblink
- PostGIS
- ip4r
- temporal
- prefix
- pgfincore
- pgcrypto
- pg_stattuple
- pg_freespacemap
- pg_stat_statements
- pg_standby

PostgreSQL extensibility is remarkable but incomplete.

It lacks dump and restore support.

Before 9.1 and CREATE EXTENSION

Installing an extension

Example (Installing an extension before 9.1)

```
apt-get install postgresql-contrib-9.0
apt-get install postgresql-9.0-ip4r
psql -f /usr/share/postgresql/9.0/contrib/hstore.sql
```

- so, what did it install? ok, reading the *script*
- Oh, nice, it's all in the `public` schema
- Oh, very nice, no `ALTER OPERATOR SET SCHEMA`

Wait, it gets better!

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backup and restores

```
pg_dump -h remote mydb | psql fresh
```

- extensions objects are an entire part of your database
- but they are maintained elsewhere, that's just a dependency
- `pg_dump` makes no difference
- what about upgrading systems (system, database, extension)

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The extension specs & scope

What problems are we solving?

It's all about clearing up the mess. No feature is accepted in PostgreSQL without complete support for dump and restore nowadays. And that's good news.

Example (the goal: have pg_dump output this)

```
CREATE EXTENSION IF NOT EXISTS hstore WITH SCHEMA public;
```

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```

Specs

How are we solving our problems?

Lots of little things need to happen:

- Rely on the OS to install the *script* and *module*
- Register the extension in the catalogs, to get an *OID*
- Track dependencies at `CREATE EXTENSION` time
- Adapt `pg_dump`
- Offer a `WITH SCHEMA` facility
- Offer `ALTER EXTENSION SET SCHEMA`
- Don't forget `DROP EXTENSION RESTRICT|CASCADE`
- Manage upgrading `ALTER EXTENSION UPDATE`

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Extensions and user data

What if an extension gets modified after install?

- pg_dump support is all about *excluding* things from dumps
- some extensions install default data
- and allow users to edit them
- now you want the data in your dumps, right?

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Implementation

The effort in figures

```
git diff -stat master..extension | tail -1
260 files changed, 4202 insertions(+), 2073
deletions(-)
git -no-pager diff -stat extension..upgrade | tail -1
125 files changed, 1976 insertions(+), 81 deletions(-)
```

- 5 patches, 7 branches, its own *Commit Fest* section
- about 18 months to get an agreement on what to develop *first*
- 2 *Developer Meeting* interventions, in Ottawa, *PgCon*
- 4 weeks full time, countless evenings, 3 months of refining

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What's to know, now

Some new commands and catalogs:

- `CREATE EXTENSION hstore SCHEMA utils;`
- `CREATE EXTENSION hstore VERSION 1.1;`
- `\dx`
- `ALTER EXTENSION hstore SET SCHEMA addons;`
- `DROP EXTENSION hstore CASCADE;`
- `ALTER EXTENSION hstore UPDATE TO version;`
- `CREATE EXTENSION hstore FROM unpackaged;`

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PGXS and the control file

Using PGXS

Simpler way to have your files installed at the right place, using `make install`. But `Makefiles` are hard, right?

Example (citext/Makefile)

```
MODULES = citext
EXTENSION = citext
DATA = citext--1.0.sql citext--unpackaged--1.0.sql
REGRESS = citext
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The control file

It's a very complex file containing the *meta data* that PostgreSQL needs to know about to be able to register your *extension* in its *system catalogs*. It looks like this:

Example (citext.control)

```
# citext extension
comment = 'data type for case-insensitive character strings
default_version = '1.0'
module_pathname = '$libdir/citext'
relocatable = true
```

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```

relocatable

A `relocatable` extension installs all its object into the first schema of the `search_path`.
It's then possible to `ALTER EXTENSION SET SCHEMA`.

not relocatable

An extension that needs to know where some of its objects are installed is not `relocatable`. The extension installation script is then required to use the `@extschema@` *placeholer* as the schema to work with.

Example (tsearch2/tsearch2–unpackaged–1.0.sql)

```
ALTER EXTENSION tsearch2 ADD type @extschema@.tsvector;
ALTER EXTENSION tsearch2 ADD type @extschema@.tsquery;
```

Extension Configuration Tables

Example (Flag your pg_dump worthy objects)

```
CREATE TABLE my_config (key text, value text);
SELECT pg_catalog.pg_extension_config_dump('my_config', '')

CREATE TABLE my_config (key text, value text, standard_entry
SELECT pg_catalog.pg_extension_config_dump('my_config',
       'WHERE NOT standard_entry');
```

Extension Upgrades

ALTER EXTENSION ... UPDATE;

- Versions "numbers" are just strings
- Provide scripts `extension--old--new.sql`
- Updates only refer to changes in the SQL script
- Secondary control files `extension--new.control`

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ALTER EXTENSION ... UPDATE [TO VERSION];

- system view `pg_available_extensions`
- system view `pg_available_extension_versions`
- `CREATE EXTENSION ... FORM old_versions`

Example (hstore–unpackaged–1.0.sql)

```
ALTER EXTENSION hstore ADD type hstore;
ALTER EXTENSION hstore ADD function hstore_in(cstring);
ALTER EXTENSION hstore ADD function hstore_out(hstore);
...
```

Upgrade Scripts

Extension author has to provide scripts for all supported upgrades

- PostgreSQL handles upgrade paths
- `1.0-1.1` then `1.1-1.2`
- system view `pg_available_extension_versions`
- Be careful about downgrade paths!

Extension and packaging

debian and pg_buildext

Contributed and available in *debian squeeze*,
`postgresql-server-dev-all`

Example (debian/pgversions)

```
8.4
9.0
```

debian and pg_buildext

Contributed and available in *debian squeeze*,
`postgresql-server-dev-all`

Example (debian/rules)

```
include /usr/share/postgresql-common/pgxs_debian_control.mk

install: build
# build all supported version
pg_buildext build $(SRCDIR) $(TARGET) "$(CFLAGS)"

# then install each of them
for v in `pg_buildext supported-versions $(SRCDIR)`; do \
dh_install -ppostgresql-$$v-pgfincore ;\
done
```

Conclusion

Money

4 week full time at home, thanks to 2ndQuadrant, and to our affiliation with European Research

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Any question?

Now is a pretty good time to ask!