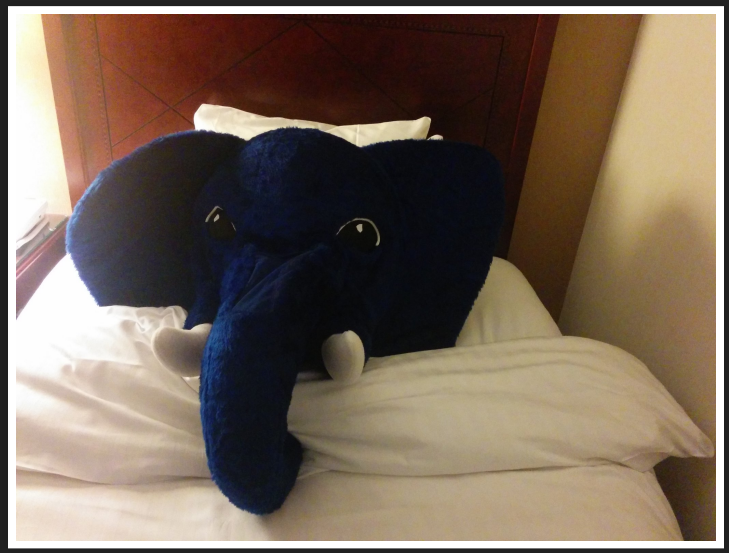
A look at the Elephants Trunk

PostgreSQL 11

PostgresOpen SV 2018
San Francisco, USA

Magnus Hagander
magnus@hagander.net



Magnus Hagander

- Redpill Linpro
  - Principal database consultant
- PostgreSQL
  - Core Team member
  - Committer
  - PostgreSQL Europe

PostgreSQL 11

PostgreSQL 11

- Not done yet
  - Almost!
- Some things exist already
  - But may be removed

Development schedule

- August 2017 - branch 10
- September 2017 - CF1
- November 2017 - CF2
- January 2018 - CF3
- March 2018 - CF4
- August 2018 - Beta3
- *Target:* Oct 2018 - release

New features

- DBA and administration
- SQL and developer
- Backup and replication
- Performance

WAL segment size configurable

- Change from 16MB without recompile
- Useful in some high-WAL environments
- Or very constrained ones
- ```
  $ initdb -D /pgdata --wal-segsize=32
  ```
  ```

pg_stat_statements

- queryid is now 64-bit
- *Much* less risk of collission
- (25% risk after 3bn instead of 50k)
- Possible breaking change!

Expression index stats

- SET STATISTICS can be done for expression index
- Defined on columns by ordinal

```
CREATE INDEX coord_idx ON measured (x, y, (z + t));
ALTER INDEX coord_idx ALTER COLUMN 3 SET STATISTICS 1000;
```

INCLUDE indexes

- Add extra columns to index
- Not in key
- Only used for index only scans

```
CREATE UNIQUE INDEX myidx ON mytable
  USING btree (id) INCLUDE (secondfield);
```

Automatic prewarm

- pg_prewarm
  - Already exists
- Automatically dump list
  - Regular intervals
  - Default: 5 minutes
- Automatically load on start

More default roles

- pg_read_server_files
- pg_write_server_files
- pg_execute_server_program

ALTER TABLE ADD COLUMN

- *With* NOT NULL DEFAULT values
- Now fast!
- Avoids rewrite
- New rows gets materialized value
- Must be non-volatile

New features

- DBA and administration
- SQL and developer
- Backup and replication
- Performance

websearch_to_tsquery

- Like phraseto_tsquery()
- But less picky
- More like typical search engines
- Quotes, AND/OR, and negation

Domain enhancements

- ARRAYs over domains
- Domains over composite types

Window frame clauses

- Now full SQL:2011 support
- RANGE BETWEEN
  - Previously, just ROWS
  - Now handles values
- Exclusion clauses
  - Exclude current row
  - Exclude ties

Window frame clauses

```
postgres=# SELECT i,
           SUM(i) OVER (ORDER BY i ROWS
                    BETWEEN 2 PRECEDING AND 2 FOLLOWING),
           SUM(i) OVER (ORDER BY i RANGE
                    BETWEEN 2 PRECEDING AND 2 FOLLOWING) FROM numb
 i  | sum | sum
----+-----+-----
  1 |   9 |   4
  3 |  16 |   9
  5 |  25 |  15
  7 |  35 |  21
```

Window frame clauses

```
postgres=# SELECT i,
           SUM(i) OVER (ORDER BY i ROWS BETWEEN 2 PRECEDING AND 2
             EXCLUDE CURRENT ROW),
           SUM(i) OVER (ORDER BY i RANGE BETWEEN 2 PRECEDING AND 2
             EXCLUDE CURRENT ROW) FROM numbers;
 i  | sum | sum
----+-----+-----
  1 |   8 |   3
  3 |  13 |   6
  5 |  20 |  10
  7 |  28 |  14
```

Stored procedures

- Not just void-returning functions
- SQL standard syntax
  - Uses CALL
- Transaction control
  - Not just savepoints

Stored procedures

```
postgres=# CREATE PROCEDURE myproc() LANGUAGE plpgsql AS $$
BEGIN
  INSERT INTO mytable VALUES (1);
  COMMIT;
  INSERT INTO mytable VALUES (2);
  ROLLBACK;
END;
$$
```

Stored procedures

```
postgres=# CALL myproc();
CALL
postgres=# SELECT * FROM mytable;
 a
---
 1
(1 row)
```

New features

- DBA and administration
- SQL and developer
- Backup and replication
- Performance

Advance replication slots

- Without consuming
- Keep slots in sync across nodes
- Mainly for cluster management

```
SELECT * FROM
pg_replication_slot_advance('test_slot', '0/1678BC8')
```

Logical replication of TRUNCATE

- Separately enabled in publication
- Published by default

Exclude unlogged tables

- Unlogged tables excluded from base backups
- Deleted on restore anyway...
- (temp tables also excluded)

Validate checksums

- Base backups validate checksums by default
- Cheap since I/O is already paid

New features

- DBA and administration
- SQL and developer
- Backup and replication
- Performance

Parallelism

- 9.6 added parallelism
- 10 made it useful
- 11 makes it even better!

Parallelism

- General enhancements
- Parallel append plan nodes
- Parallel aware hash joins

Parallell CREATE INDEX

- btree indexes only
- Often CPU bound
  - Much faster now!
- max_parallel_maintenance_workers=2

Partitioning

- Declarative partitioning in 10
- Syntax and basic functionality
- 11 makeas it much more powerful!

Default partitions

- Where to put rows that match no other partition

```
postgres=# CREATE TABLE p_def PARTITION OF p DEFAULT;
CREATE TABLE
```

Allow UPDATE to move rows

- Change the value in partition key
- Previously only within partition
- Including in and out of default
- Some concurrency issues

Local partitioned indexes

- Indexes can be created on master table
- Automatically added to partitions
- Both existing and new
- Can still do individual indexes too

Cross partition UNIQUE

- UNIQUE indexes on parent
  - PRIMARY KEY
- Must include *all* partition keys
- (foreign keys only one way)

INSERT ON CONFLICT

- Now on partitioned tables

Better partition pruning

- Done in executor
- Once at start
  - For parameters
- Once at runtime
  - For subqueries etc

Hash partitioning

- Partition by automatic hash value

```
postgres=# CREATE TABLE p2(i int, t text)
postgres-# PARTITION BY HASH (i);
CREATE TABLE
postgres=# CREATE table p2_1 PARTITION OF p2
postgres-# FOR VALUES WITH (MODULUS 4, REMAINDER 0);
CREATE TABLE
```

Partition wise join

- Join of tables on partition key
- *Identical* partition key
- Joining on complete partition key
- Default: off

Partition wise aggregates

- Partition key part of GROUP BY
- Run aggregates per partition
- Summarize at the end

Other performance

JIT compilation

- LLVM based JIT compilation
  - Availability depends on packaging
- Optimized expresison processing
  - Big speedup for some analytical
  - E.g. large computational aggregatese
- Automatically enabled for expensive queries

That's a lot!

There's always more

- Lots of smaller fixes
- Performance improvements
- etc, etc
- Can't mention them all!

Please help!

Please help!

- Download and test!
  - apt packages available
  - rpm/yum packagesavailable

Thank you!

Magnus Hagander
magnus@hagander.net
@magnushagander
https://www.hagander.net/talks/