

PostgreSQL Replication in 2018

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Magnus Hagander

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Replication

"PostgreSQL doesn't have replication"

*"PostgreSQL doesn't have
replication"*

"So we have to use MySQL"

Replication

- Wasn't true back then
- Even less true now!
- Now there are too many choices?
 - But you have to pick one
 - And can be hard to use

Replication

- Can be done at different layers
- From hardware
 - (ish)
- To application

Replication layers

- ↓ Application
- ↓ App-in-database
- ↓ Database logical
- ↓ Database physical
- ↓ Operating system
- ↓ Hardware

Start from the bottom

SAN replication

- Hardware takes care of replication
- Block level
- Transparent to OS
 - And to PostgreSQL
- Common enterprise solution
 - Especially with VMs

SAN replication

- From single rack
- To multi-site
- Synchronous
- Guaranteed to never fail
 - Riiiiight...

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DRBD

- Similar in style to SAN
- Implementation in OS driver
- Performance?

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Database physical

- **WAL based** replication
- File based from 8.3
- Streaming since 9.0
- Synchronous since 9.1
 - Transaction level mixing
- Quorum commit since 10
- (etc)

wal_level = 'replica'

Synchronous mode

- off
- local
- remote_write
- on
- remote_apply

Synchronous mode

- Single (9.1)

```
synchronous_standby_names = s1, s2, s3
```

- First (9.6)

```
synchronous_standby_names = 2(s1, s2, s3)
```

- Quorum (10)

```
synchronous_standby_names = ANY 2(s1, s2, s3)
```

Streaming replication

- Primary choice today
- Easy to set up
- Hard to get wrong
- Efficient
- Built-in

Streaming replication

```
$ pg_basebackup -D /var/lib/pgsql \  
-h primary -U replica \  
-R -S replica1 -P  
$ sudo service postgresql-9.6 start
```

- for pre-10, add `-X stream`

Streaming replication

- Architecture/compile flag dependent
- Whole cluster only
- Standby completely read-only
- Primary → standby only
- Excellent for **availability**

Streaming replication

- No built-in cluster management
 - Manual *or* automatic
 - Provides infrastructure
- No fail-back
 - (no easy one)
- Easy to get started, harder to maintain

Cluster management

Patroni

- Designed for automatic management
- Including automatic failover
- Uses etcd, zookeeper, or consul
- Integrates with haproxy

Cluster management

repmgr

- Fewer pre-requisites
- Easier for manual management
 - Comes with *repmgrd* that does automatic
- Does not handle connection management
 - Use e.g. rebouncer
 - Or haproxy

Cluster management

PAF

- Integrates with pacemaker/corosync
- Management of other services
- Manages virtual IP

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Database logical

- Logical decoding since 9.4
- Logical replication since 10
 - Built-in, that is
- Piggy-backs on WAL
- Very low overhead

```
wal_level = 'logical'
```

Logical replication

- Reconstructs changes by row
- Replicates row content
 - *not* SQL statements
- Fully transactional

Logical replication

- Table-level partial replication
- Table-level bi-directional replication

Logical replication

```
CREATE TABLE testtable (a int PRIMARY KEY, b text);
```

```
CREATE PUBLICATION testpub FOR TABLE testtable;
```

Logical replication

```
CREATE TABLE testtable (a int PRIMARY KEY, b text);  
  
CREATE SUBSCRIPTION testsub  
  CONNECTION 'host=/tmp port=5500 dbname=postgres user=mha'  
  PUBLICATION testpub;
```


Logical replication

- Data replication only
 - No schema
 - No sequences
- Suitable for data distribution
- But not for HA
- Lacks failover slots!

pglogical

- External version of logical replication
- Merged piece by piece
- More capabilities!
- Not as deeply integrated

pglogical

- Sequence replication
- Row based filtering
- Column based filtering
- Merging and conflict resolution
- ...

pglogical

- Supports PostgreSQL 9.4
- Zero (or close to zero) downtime upgrades!

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App-in-database

- Trigger based systems
 - Slony
 - Bucardo
 - Londiste
 - ...

Trigger based

- For a long time the only choice
- Now *mostly* superseded
- Much higher overhead than logical
- Complex scenarios

Multimaster?

I need it!

- Do you really need it?
- Do you really know what it means?
- No transparent options
 - Because...

Multimaster?

Options

- BDR
 - Fork!
- Bucardo
- Or just don't?

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Application

- Replication done entirely in application
- Very difficult for transactional
- Useful in limited cases

Summary

High Availability

- Use streaming replication
- Mix of sync and async
- Consider patroni or repmgr

Read query offloading

- Use streaming replication
- (see previous slide)

Data distribution

- Logical replication in 10
- pglogical in 9.4+
 - Or in 10 if built-in is not enough
- Upgrade away from your Slony...

Need both?

- Use both!

Thank you!

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