Progress reporting in Postgres

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Progress Reporting

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- Reporting of what?
- How does it look?
- How to use it?
- What commands are supported?
- How can I implement more?

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DDL progress reporting

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- Many DDL commands take very long time to execute
  - VACUUM, CREATE INDEX, etc
- It's useful to have insight as to:
  - How much total work there is
  - How much work we have already done
- Allows to extrapolate

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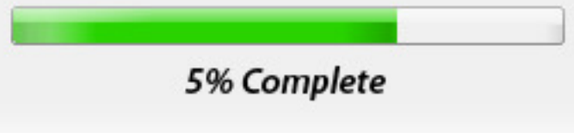
- It's useful to have insight as to:
  - How much total work there is
  - How much work we have already done
- Allows to extrapolate
- ... with caveats



Feature design principles

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- We want to present hard facts
- Not fiction
  - No guessing
  - No busted percentages
    - 0% – 95% in one minute ... *then a slow crawl to 99%*
    - *... 245% done*
    - *progress bars going backwards*

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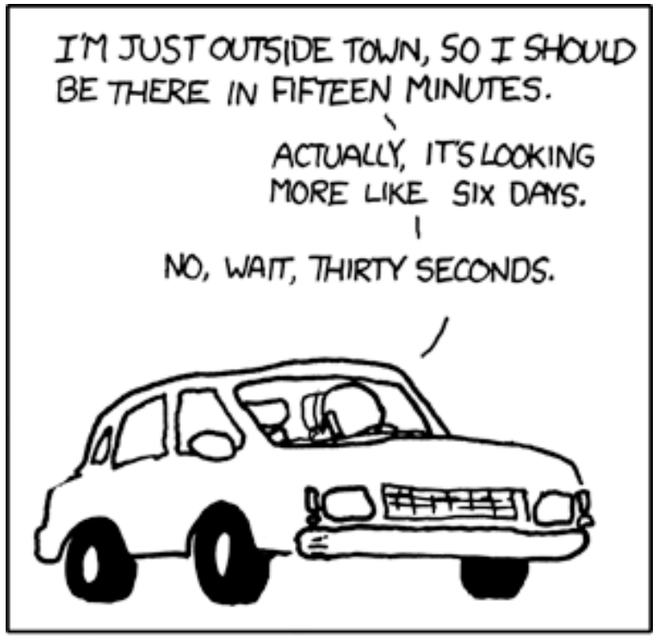
    - *... 245% done*
    - *progress bars going backwards*
- ... Preferrably, detailed and useful facts



Reporting VACUUM progress

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- PostgreSQL 10
- Add a generic command progress reporting facility.
  - `http://git.postgresql.org/pg/commitdiff/b6fb6471f6af`
  - Vinayak Pokale, Rahila Syed, Amit Langote, Robert Haas.
- Add simple VACUUM progress reporting.
  - `http://git.postgresql.org/pg/commitdiff/c16dc1aca5e0`
  - Amit Langote, Robert Haas, Vinayak Pokale, Rahila Syed.

Reporting vacuum progress (2)

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```
alvherre=# SELECT * FROM pg_stat_progress_vacuum;
```

Record 1

pid	4204
datid	12386
datname	alvherre
relid	234754
phase	scanning heap
heap_blks_total	89759
heap_blks_scanned	61181
heap_blks_vacuumed	0
index_vacuum_count	0
max_dead_tuples	291
num_dead_tuples	0

Reporting vacuum progress (3)

2ndQuadrant® PostgreSQL

```
alvherre=# SELECT now(), pid, relid::regclass as table, phase,
           heap_blks_total, heap_blks_scanned, heap_blks_vacuumed,
           index_vacuum_count, max_dead_tuples, num_dead_tuples
           FROM pg_stat_progress_vacuum WHERE datname = current_database();
```

Record 1

now	2019-08-01 11:32:15.300526-04
pid	4204
table	esquema.tabela
phase	scanning heap
heap_blks_total	134007
heap_blks_scanned	105442
heap_blks_vacuumed	0
index_vacuum_count	0
max_dead_tuples	291
num_dead_tuples	0

Reporting vacuum progress (4)

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```
alvherre=# \t
alvherre=# \pset tuples_only on
alvherre=# SELECT .. FROM pg_stat_progress_vacuum \watch 0,1
```

VACUUM: operation phases

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1. initializing
2. scanning heap
3. vacuuming indexes
4. vacuuming heap
5. cleaning up indexes
6. truncating heap
7. performing final cleanup

VACUUM: operation phases

2ndQuadrant® PostgreSQL

1. initializing
2. scanning heap
   → `dead_tuples[0 ... maintenance_work_mem]`
3. vacuuming indexes
4. vacuuming heap
5. cleaning up indexes
6. truncating heap
7. performing final cleanup

Record 1

now	...
pid	...
table	...
phase	...
heap_blks_total	134007
heap_blks_scanned	105442
heap_blks_vacuumed	0
index_vacuum_count	0
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VACUUM: operation phases

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1. initializing
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   → FSM update

VACUUM: operation phases

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1. initializing
2. scanning heap
3. vacuuming indexes
4. vacuuming heap
5. cleaning up indexes
6. truncating heap
   → requires access exclusive lock
   → step not done if unavailable
7. performing final cleanup
   → FSM update

Reporting CREATE INDEX / REINDEX progress

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- PostgreSQL 12
- Report progress of CREATE INDEX operations
  - `http://git.postgresql.org/pg/commitdiff/ab0dfc961b6a`
  - Álvaro Herrera
- Report progress of REINDEX operations
  - `http://git.postgresql.org/pg/commitdiff/03f9e5cba0ee`
  - Peter Eisentraut

Report of CREATE INDEX

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```
SELECT ... FROM pg_stat_progress_create_index ... \watch 1
```

pid	1209
relid	esquema.tabela
index_relid	35684
command	CREATE INDEX CONCURRENTLY
phase	building index: scanning table
lockers_total	0
lockers_done	0
current_locker_pid	0
blocks_total	44248
blocks_done	17627
tuples_total	0
tuples_done	0
partitions_total	0
partitions_done	0

Operation phases of CREATE INDEX / REINDEX

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1. initializing
2. waiting for writers before build
3. building index
4. waiting for writers before validation
5. index validation: scanning index
6. index validation: sorting tuples
7. index validation: scanning table
8. waiting for old snapshots
9. waiting for readers before marking dead
10. waiting for readers before dropping

Operation phases of CREATE INDEX / REINDEX

2ndQuadrant® PostgreSQL

1. initializing
2. waiting for writers before build
3. building index
4. waiting for writers before validation
5. index validation: scanning index
6. index validation: sorting tuples
7. index validation: scanning table
8. waiting for old snapshots
9. waiting for readers before marking dead
10. waiting for readers before dropping

phase	....
lockers_total	0
lockers_done	0
current_locker_pid	0
blocks_total	44248
blocks_done	17627
tuples_total	0
tuples_done	0
partitions_total	0
partitions_done	0

Build phases for B-Tree indexes

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1. initializing
2. scanning table
3. sorting live tuples
4. sorting dead tuples
5. loading tuples in tree

Reporting CLUSTER / VACUUM FULL progress

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- PostgreSQL 12
- Add progress reporting for CLUSTER and VACUUM FULL.
  - `http://git.postgresql.org/pg/commitdiff/6f97457e0ddd`
  - Tatsuro Yamada

Reporting cluster progress

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```
alvherre=# SELECT * FROM pg_stat_progress_cluster \watch 1
```

pid	1209
table	esquema.tabela
command	VACUUM FULL
phase	seq scanning heap
cluster_index_relid	0
heap_tuples_scanned	8064358
heap_tuples_written	8064358
heap_blks_total	44248
heap_blks_scanned	35684
index_rebuild_count	0

CLUSTER: operation phases

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1. initializing
2. seq scanning heap
3. index scanning heap
4. sorting tuples
5. writing new heap
6. swapping relation files
7. rebuilding index
8. performing final cleanup

Reporting ANALYZE progress

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- Patch submitted for PostgreSQL 13
- `https://postgr.es/m/20190621185207.GA27929@alvherre.pgsql`

Questions?

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Thanks for listening!

Appendix: Implementation

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- Set-returning function `pg_stat_get_progress_info(text)`
- Returns raw metrics
- View definitions (`pg_stat_progress_vacuum` etc) transform metrics into user-readable parameters
- PostgreSQL C code injects metrics into `pgstat` system

```
pgstat_progress_start_command(command type);
pgstat_progress_update_param(4, 158);
pgstat_progress_update_param(PROGRESS_ANALYZE_PHASE,
                             PROGRESS_ANALYZE_PHASE_SCAN_TABLE);
pgstat_progress_end_command();
```