

# Scaling the Wall of Text

Best Practices for Logging in PostgreSQL  
SCaLE 18x | March 5, 2020 | Richard Yen

# About Me

- Support Engineer at EnterpriseDB
- Previously a DBA and Web Developer
- Been using PostgreSQL since v. 7.4

# Setting Up a New Postgres Instance

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- `listen_addresses`

# Setting Up a New Postgres Instance

- `listen_addresses`
- `port`

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- listen\_addresses
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- listen\_addresses
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# Setting Up a New Postgres Instance

- listen\_addresses
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- random\_page\_cost

**HALT!** 

What about logging?

**What are the consequences?**

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- Slows down diagnosis and recovery when there's an outage or performance problem
- Reflects poorly when your boss asks you what happened last night when the database went down
- Prevents you from planning for the future

# What the log can tell you

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# What the log can tell you

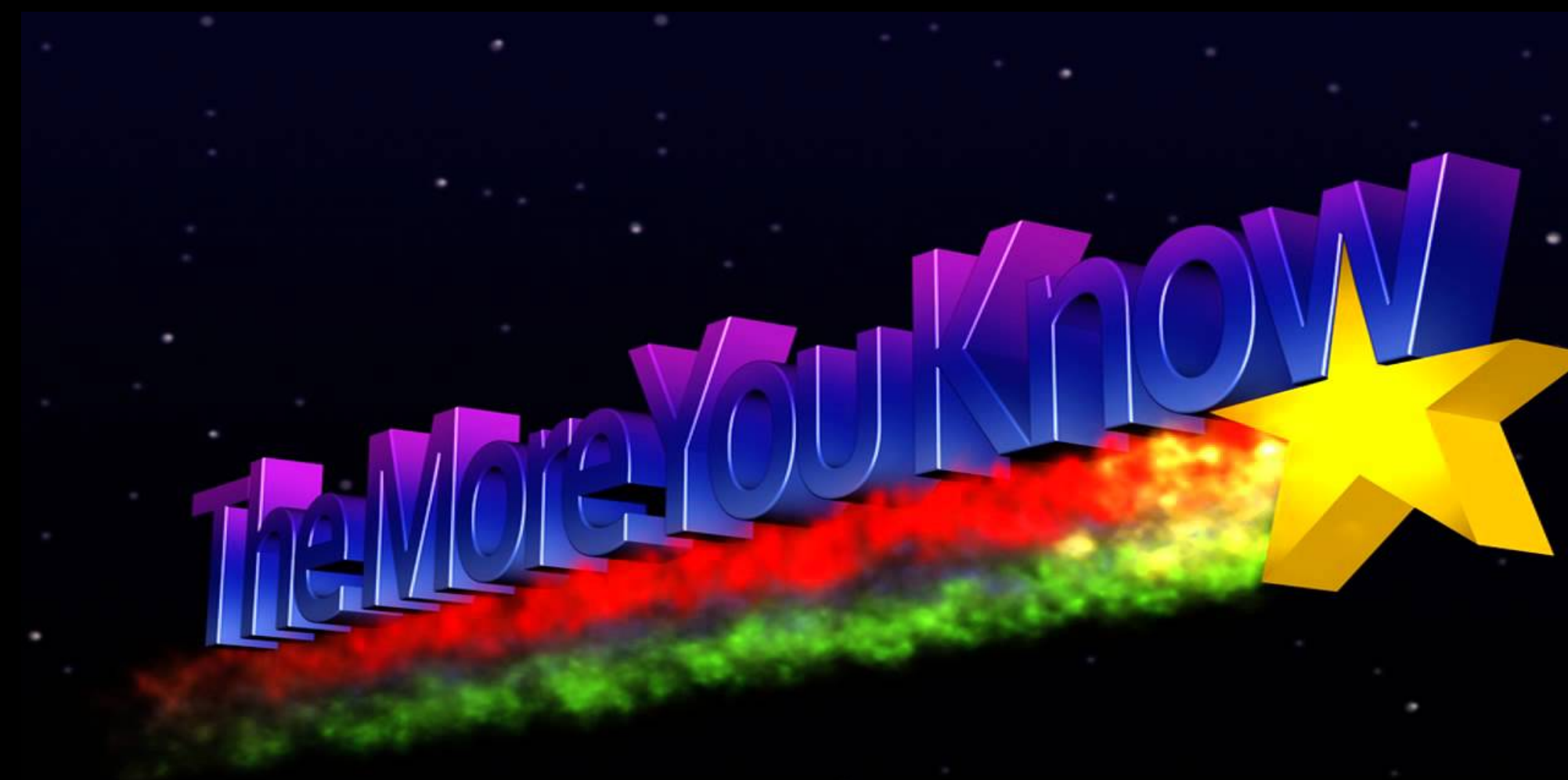
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- Statistics about queries and maintenance activity
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- Who connected to the database
- Where the connection came from
- What queries ran before a transaction was rolled back
- And more!

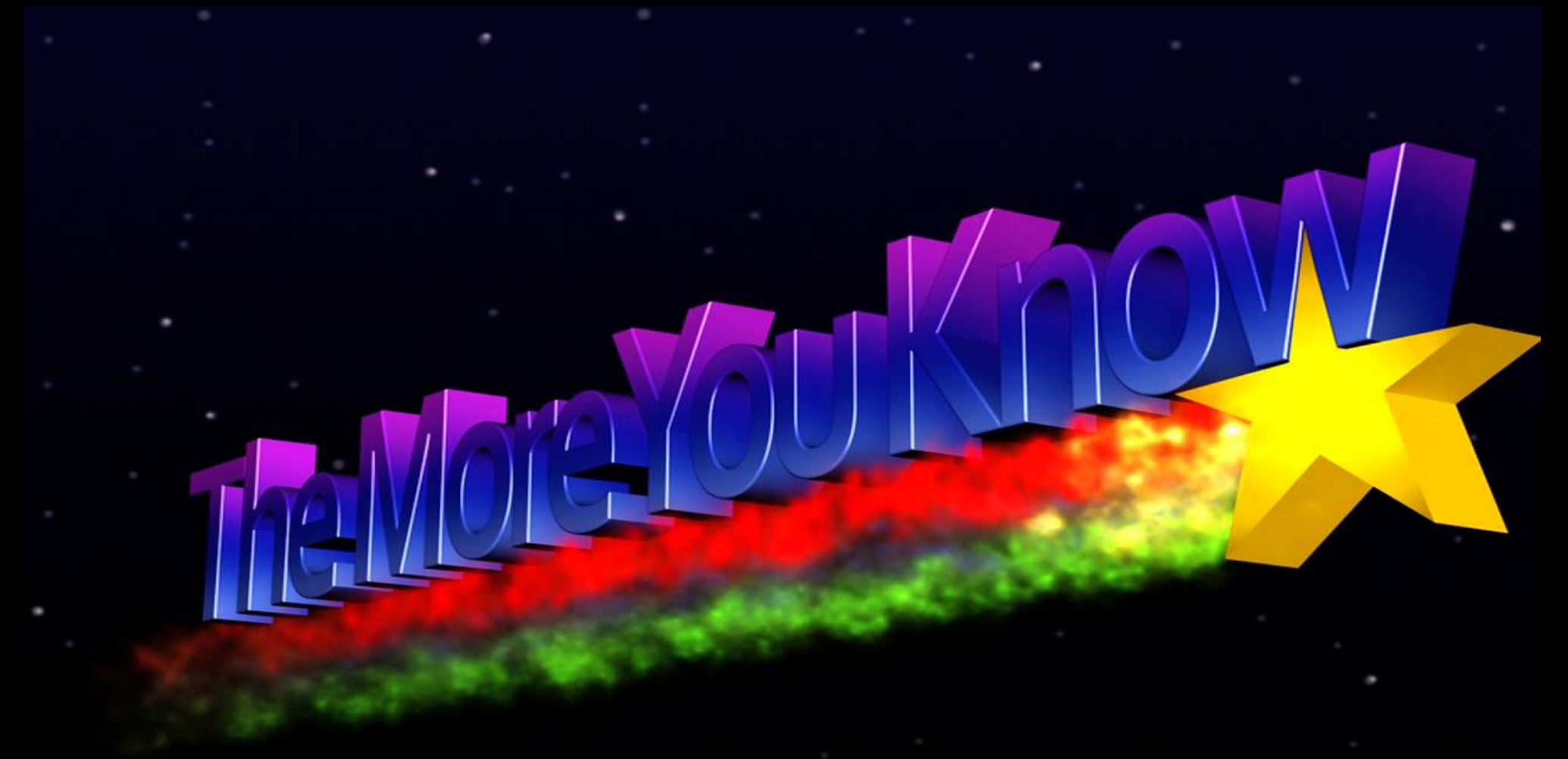


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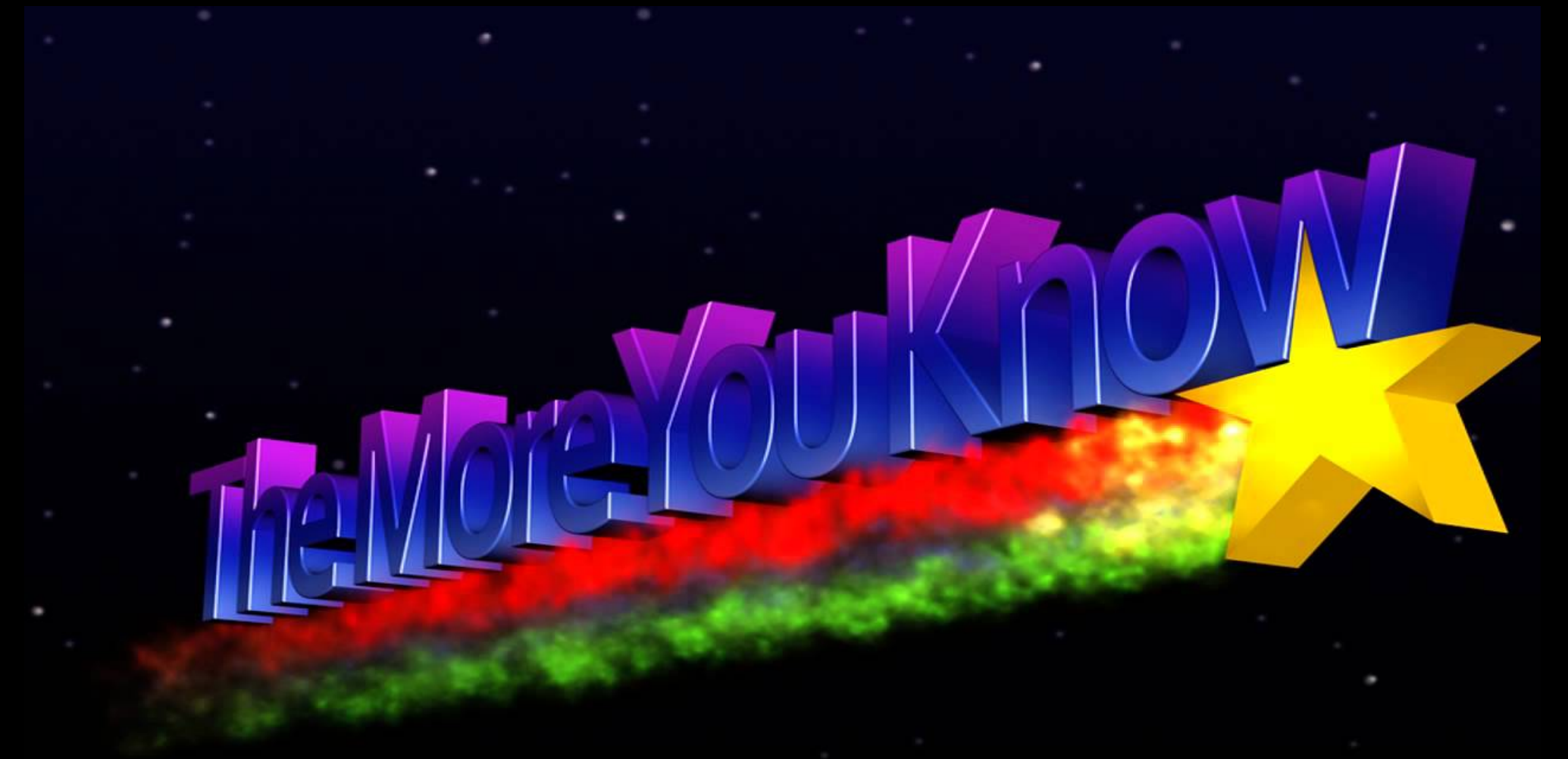
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- Faster diagnosis



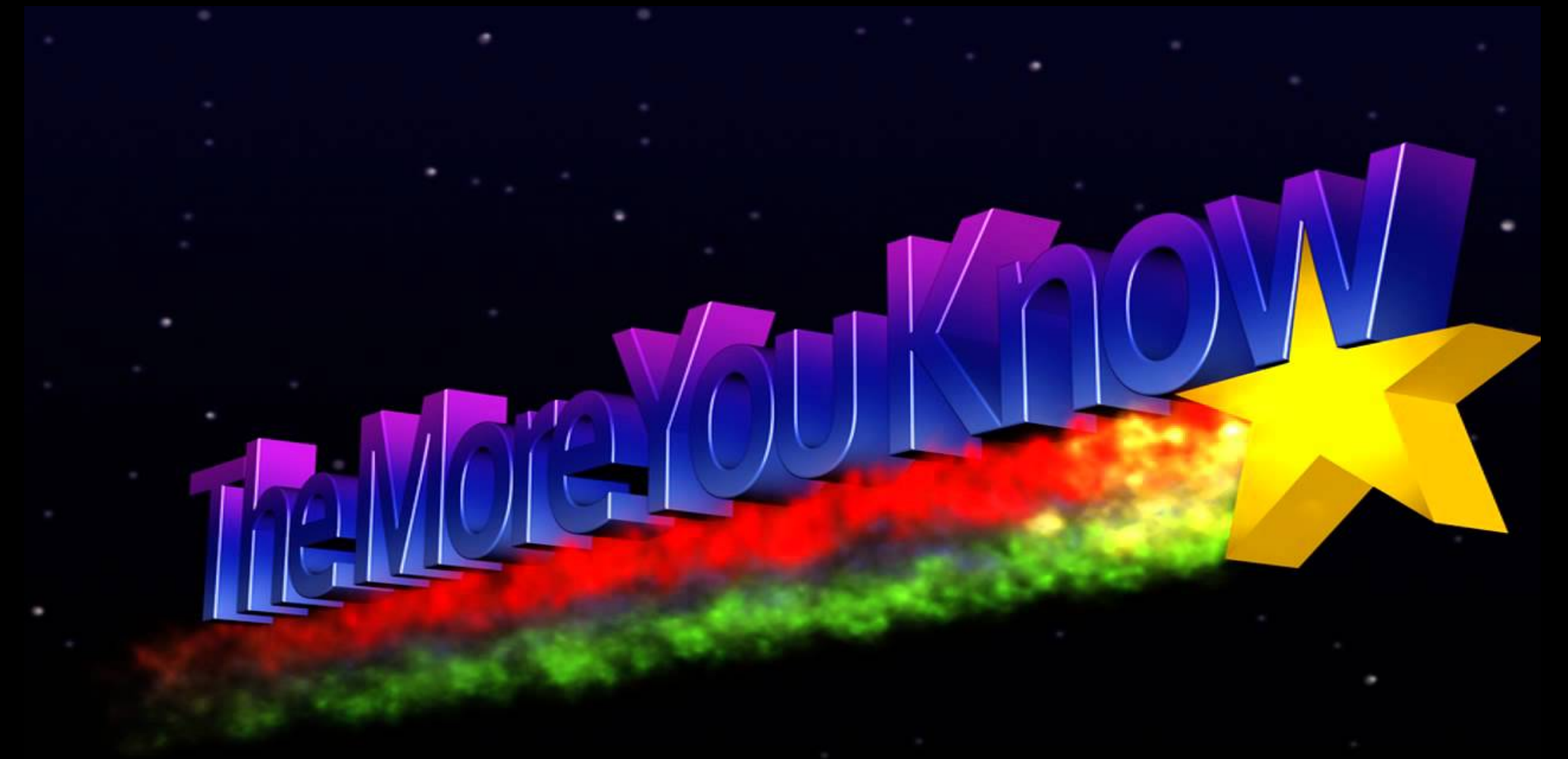
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- Faster diagnosis
- Faster time to recovery



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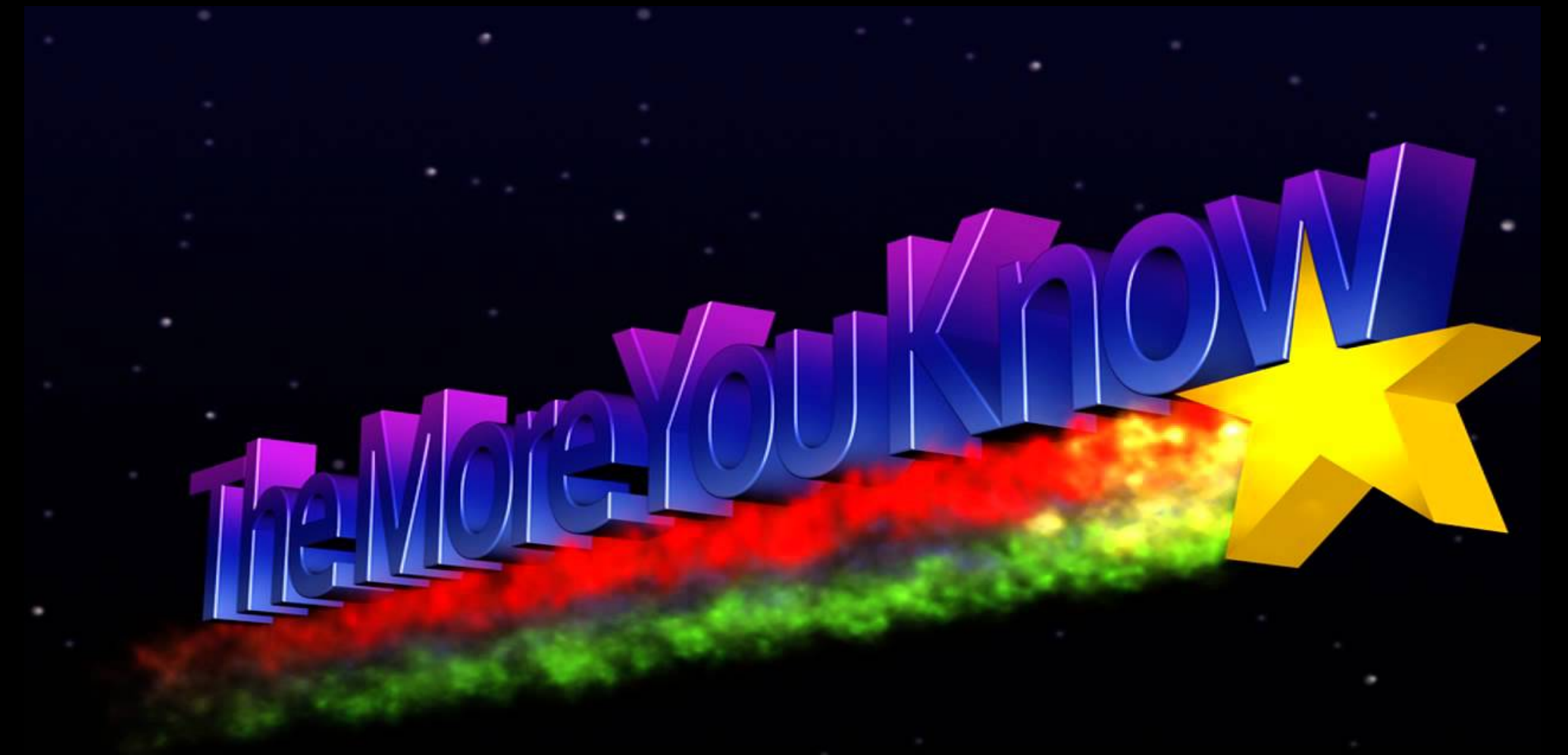
- Faster diagnosis
- Faster time to recovery
- More happy users





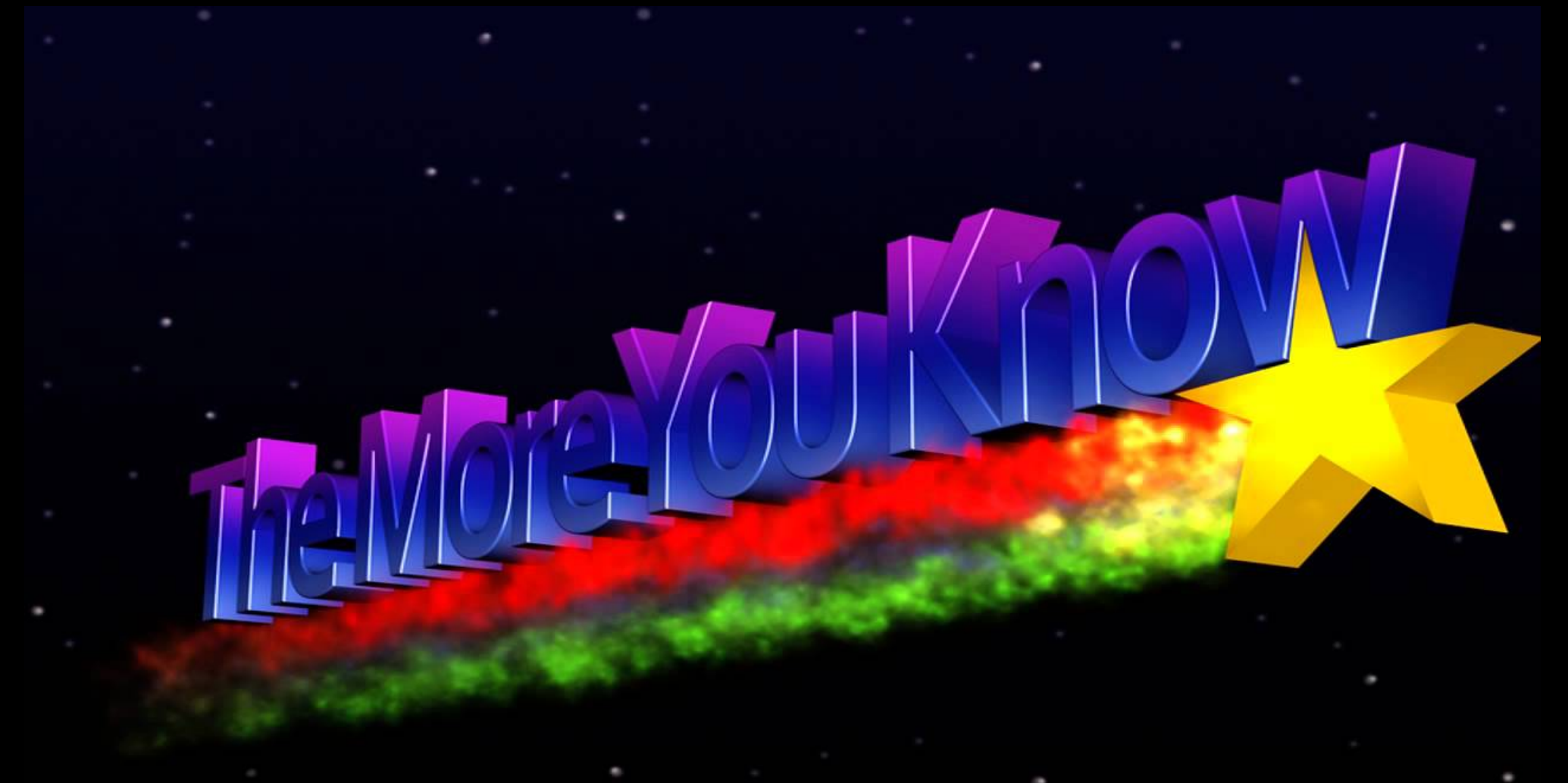
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- Faster time to recovery
- More happy users
- More sleep for DBAs



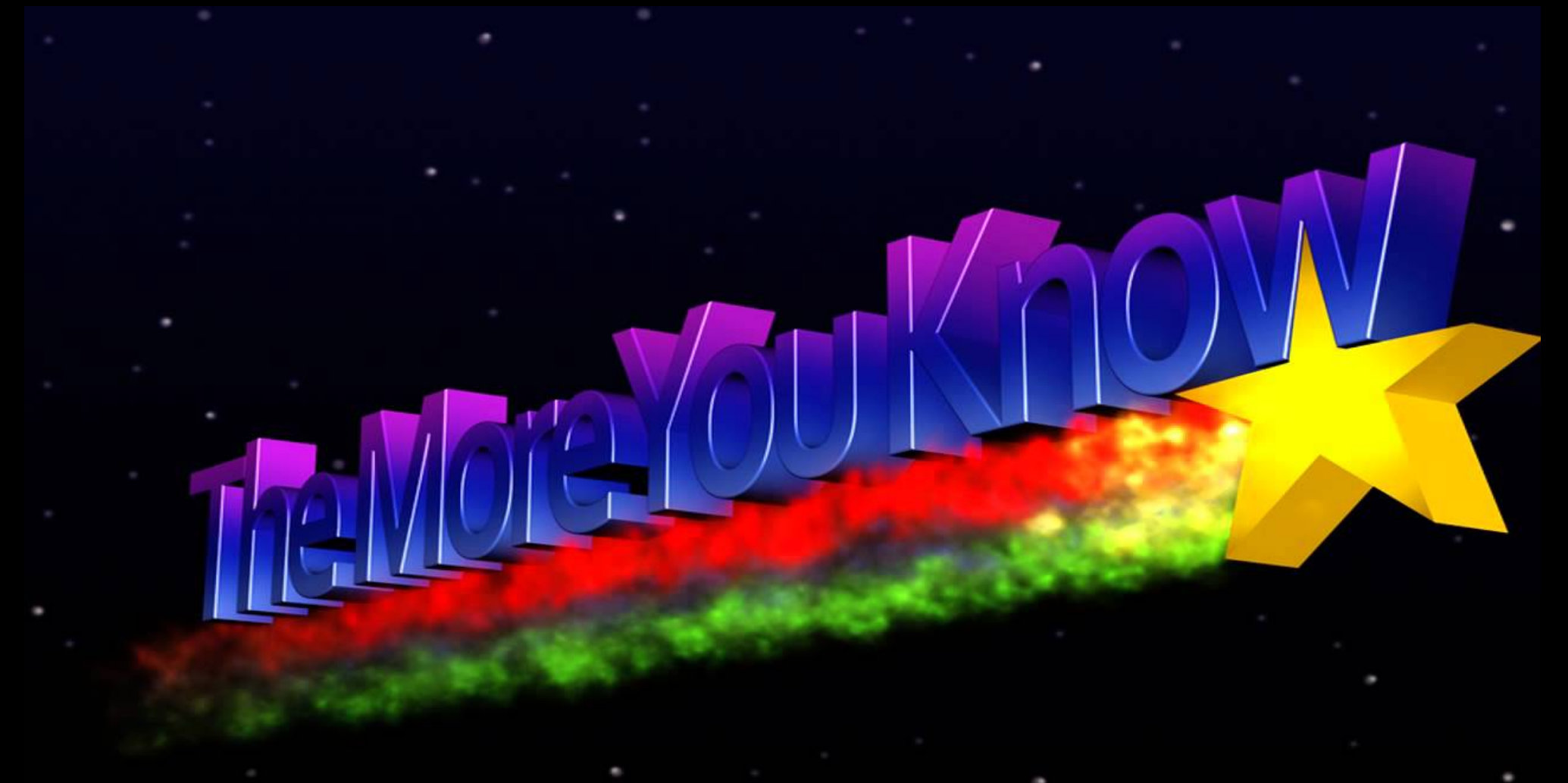
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# More log means...

- Faster diagnosis
- Faster time to recovery
- More happy users
- More sleep for DBAs
- Better auditing
- Better capacity planning



Log =





# PostgreSQL Logging Parameters

- `log_destination`
- `log_directory`
- `log_filename`
- `log_file_mode`
- `log_line_prefix`
- `log_min_duration_statement`
- `log_statement`
- `log_connections`
- `log_disconnections`
- `log_rotation_age`
- `log_rotation_size`
- `log_autovacuum_min_duration`
- `log_checkpoints`
- `log_temp_files`
- `log_truncate_on_rotation`
- `log_min_messages`
- `log_min_error_statement`
- `log_error_verbosity`
- `log_hostname`
- `log_lock_waits`
- `log_replication_commands`
- `log_timezone`
- `log_parser_stats`
- `log_planner_stats`
- `log_executor_stats`
- `log_statement_stats`

log\_line\_prefix

your starting point

# log\_line\_prefix

- printf-style string at the beginning of each log line
- As of v.10, defaults to `%m [%p]` (timestamp + backend PID)
- Before v.10, default is blank
- The more you log, the more chances you can catch a culprit

# log\_line\_prefix

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| Escape          | Effect  |
|-----------------|---|
| <code>%a</code> | Application name  |
| <code>%u</code> | User name   |
| <code>%d</code> | Database name   |
| <code>%r</code> | Remote host name or IP address, and remote port   |
| <code>%h</code> | Remote host name or IP address  |
| <code>%p</code> | Process ID  |
| <code>%t</code> | Time stamp without milliseconds   |
| <code>%m</code> | Time stamp with milliseconds  |
| <code>%n</code> | Time stamp with milliseconds (as a Unix epoch)  |
| <code>%i</code> | Command tag: type of session's current command  |
| <code>%e</code> | SQLSTATE error code   |
| <code>%c</code> | Session ID: see below   |
| <code>%l</code> | Number of the log line for each session or process, starting at 1   |
| <code>%s</code> | Process start time stamp  |
| <code>%v</code> | Virtual transaction ID (backendID/localXID)   |
| <code>%x</code> | Transaction ID (0 if none is assigned)  |
| <code>%q</code> | Produces no output, but tells non-session processes to stop at this point in the string; ignored by session processes |
| <code>%%</code> | Literal %   |

# In a sample of 130 confs

- 5% of users don't change `log_line_prefix`
- 38% only log timestamps (and nothing else)
- Why?

# The Wall of Text 🤯

```
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -4410 WHERE aid = 19334;
LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 19334;
LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -4410 WHERE tid = 8;
LOG: statement: BEGIN;
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -4410 WHERE bid = 1;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -1442 WHERE aid = 57806;
LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (8, 1, 19334, -4410, CURRENT_TIMESTAMP);
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4310 WHERE aid = 57894;
LOG: statement: BEGIN;
LOG: statement: END;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 2644 WHERE aid = 75471;
LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 57806;
LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -1442 WHERE tid = 8;
LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -1442 WHERE bid = 1;
LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 75471;
LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (8, 1, 57806, -1442, CURRENT_TIMESTAMP);
LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 57894;
LOG: statement: END;
LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 2644 WHERE tid = 9;
LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 2644 WHERE bid = 1;
LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 4310 WHERE tid = 8;
LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (9, 1, 75471, 2644, CURRENT_TIMESTAMP);
LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 4310 WHERE bid = 1;
LOG: statement: END;
LOG: statement: drop table pgbench_accounts ;
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 524 WHERE aid = 23231;
LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (8, 1, 57894, 4310, CURRENT_TIMESTAMP);
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4798 WHERE aid = 30074;
LOG: statement: END;
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -4793 WHERE aid = 23424;
ERROR: relation "pgbench_accounts" does not exist at character 8
STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + 524 WHERE aid = 23231;
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STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -4793 WHERE aid = 23424;
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -118 WHERE aid = 37745;
ERROR: relation "pgbench_accounts" does not exist at character 8
STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -118 WHERE aid = 37745;
LOG: automatic vacuum of table "postgres.public.pgbench_branches": index scans: 0
LOG: automatic analyze of table "postgres.public.pgbench_branches" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.02 s
LOG: automatic analyze of table "postgres.public.pgbench_history" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
LOG: automatic analyze of table "postgres.public.pgbench_tellers" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
```



# The Wall of Text (with '%m [%p]')

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2020-02-29 00:11:15.330 UTC [2411] LOG: statement: BEGIN;
2020-02-29 00:11:15.331 UTC [2411] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -4410 WHERE aid = 19334;
2020-02-29 00:11:15.331 UTC [2411] LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 19334;
2020-02-29 00:11:15.331 UTC [2411] LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -4410 WHERE tid = 8;
2020-02-29 00:11:15.332 UTC [2412] LOG: statement: BEGIN;
2020-02-29 00:11:15.332 UTC [2413] LOG: statement: BEGIN;
2020-02-29 00:11:15.332 UTC [2411] LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -4410 WHERE bid = 1;
2020-02-29 00:11:15.332 UTC [2412] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -1442 WHERE aid = 57806;
2020-02-29 00:11:15.332 UTC [2411] LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (8, 1, 19334, -4410, CURRENT_TIMESTAMP);
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2020-02-29 00:11:15.332 UTC [2414] LOG: statement: BEGIN;
2020-02-29 00:11:15.332 UTC [2411] LOG: statement: END;
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2020-02-29 00:11:15.334 UTC [2414] LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 2644 WHERE tid = 9;
2020-02-29 00:11:15.335 UTC [2414] LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 2644 WHERE bid = 1;
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2020-02-29 00:11:15.337 UTC [658] LOG: statement: drop table pgbench_accounts ;
2020-02-29 00:11:15.339 UTC [2416] LOG: statement: BEGIN;
2020-02-29 00:11:15.340 UTC [2416] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 524 WHERE aid = 23231;
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2020-02-29 00:11:21.566 UTC [2419] LOG: automatic vacuum of table "postgres.public.pgbench_branches": index scans: 0
2020-02-29 00:11:21.589 UTC [2419] LOG: automatic analyze of table "postgres.public.pgbench_branches" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.02 s
2020-02-29 00:11:21.603 UTC [2419] LOG: automatic analyze of table "postgres.public.pgbench_history" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
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2020-02-29 00:11:15.331 UTC [2411] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -4410 WHERE aid = 19334;
2020-02-29 00:11:15.332 UTC [2411] LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -4410 WHERE bid = 1;
2020-02-29 00:11:15.331 UTC [2411] LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -4410 WHERE tid = 8;
2020-02-29 00:11:15.332 UTC [2412] LOG: statement: BEGIN;
2020-02-29 00:11:15.334 UTC [2412] LOG: statement: END;
2020-02-29 00:11:15.334 UTC [2412] LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (8, 1, 57806, -1442, CURRENT_TIMESTAMP);
2020-02-29 00:11:15.333 UTC [2412] LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 57806;
2020-02-29 00:11:15.332 UTC [2412] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -1442 WHERE aid = 57806;
2020-02-29 00:11:15.333 UTC [2412] LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -1442 WHERE bid = 1;
2020-02-29 00:11:15.333 UTC [2412] LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -1442 WHERE tid = 8;
2020-02-29 00:11:15.332 UTC [2413] LOG: statement: BEGIN;
2020-02-29 00:11:15.342 UTC [2413] LOG: statement: END;
2020-02-29 00:11:15.340 UTC [2413] LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (8, 1, 57894, 4310, CURRENT_TIMESTAMP);
2020-02-29 00:11:15.334 UTC [2413] LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 57894;
2020-02-29 00:11:15.332 UTC [2413] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4310 WHERE aid = 57894;
2020-02-29 00:11:15.336 UTC [2413] LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 4310 WHERE bid = 1;
2020-02-29 00:11:15.335 UTC [2413] LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 4310 WHERE tid = 8;
2020-02-29 00:11:15.332 UTC [2414] LOG: statement: BEGIN;
2020-02-29 00:11:15.337 UTC [2414] LOG: statement: END;
2020-02-29 00:11:15.336 UTC [2414] LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (9, 1, 75471, 2644, CURRENT_TIMESTAMP);
2020-02-29 00:11:15.334 UTC [2414] LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 75471;
2020-02-29 00:11:15.333 UTC [2414] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 2644 WHERE aid = 75471;
2020-02-29 00:11:15.335 UTC [2414] LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 2644 WHERE bid = 1;
2020-02-29 00:11:15.334 UTC [2414] LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 2644 WHERE tid = 9;
2020-02-29 00:11:15.345 UTC [2415] ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:11:15.340 UTC [2415] LOG: statement: BEGIN;
2020-02-29 00:11:15.341 UTC [2415] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4798 WHERE aid = 30074;
2020-02-29 00:11:15.345 UTC [2415] STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + 4798 WHERE aid = 30074;
2020-02-29 00:11:15.345 UTC [2416] ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:11:15.339 UTC [2416] LOG: statement: BEGIN;
2020-02-29 00:11:15.340 UTC [2416] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 524 WHERE aid = 23231;
2020-02-29 00:11:15.345 UTC [2416] STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + 524 WHERE aid = 23231;
2020-02-29 00:11:15.345 UTC [2417] ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:11:15.342 UTC [2417] LOG: statement: BEGIN;
2020-02-29 00:11:15.342 UTC [2417] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -4793 WHERE aid = 23424;
2020-02-29 00:11:15.345 UTC [2417] STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -4793 WHERE aid = 23424;
2020-02-29 00:11:15.352 UTC [2418] ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:11:15.351 UTC [2418] LOG: statement: BEGIN;
2020-02-29 00:11:15.352 UTC [2418] LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -118 WHERE aid = 37745;
2020-02-29 00:11:15.352 UTC [2418] STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -118 WHERE aid = 37745;
2020-02-29 00:11:21.589 UTC [2419] LOG: automatic analyze of table "postgres.public.pgbench_branches" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.02 s
2020-02-29 00:11:21.603 UTC [2419] LOG: automatic analyze of table "postgres.public.pgbench_history" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
2020-02-29 00:11:21.616 UTC [2419] LOG: automatic analyze of table "postgres.public.pgbench_tellers" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
2020-02-29 00:11:21.566 UTC [2419] LOG: automatic vacuum of table "postgres.public.pgbench_branches": index scans: 0
2020-02-29 00:11:15.337 UTC [658] LOG: statement: drop table pgbench_accounts ;
```



# My Personal Favorites

# My Personal Favorites

- `%a` - Application Name - Allows quick reference and filtering

# My Personal Favorites

- **%a** - Application Name - Allows quick reference and filtering
- **%u** - User Name - Allows filter by user name

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- **%u** - User Name - Allows filter by user name
- **%d** - Database Name - Allows filter by database name

# My Personal Favorites

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- **%u** - User Name - Allows filter by user name
- **%d** - Database Name - Allows filter by database name
- **%r** - Remote Host IP/Name (w/ port) - Helps identify suspicious activity from a host

# My Personal Favorites

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# My Personal Favorites

- **%a** - Application Name - Allows quick reference and filtering
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- **%l** - Session/Process Log Line - Helps identify what a session has done



# My Personal Favorites

- **%a** - Application Name - Allows quick reference and filtering
- **%u** - User Name - Allows filter by user name
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- **%r** - Remote Host IP/Name (w/ port) - Helps identify suspicious activity from a host
- **%p** - Process ID - Helps identify specific problematic sessions
- **%l** - Session/Process Log Line - Helps identify what a session has done
- **%v/%x** - Transaction IDs - Helps identify what queries a transaction ran

# Other Useful Parameters

- `log_min_duration_statement` -- helpful in identifying slow queries
- `log_statement` -- good for auditing purposes
- `log_[dis]connections` -- good for auditing purposes
- `log_rotation_age/log_rotation_size` -- good for organization
- `log_autovacuum_min_duration` -- gives insight into autovacuum behavior
- `log_checkpoints` -- know what queries happened between checkpoints
- `log_temp_files` -- helps identify work\_mem shortages, I/O spikes

# The Wall of Text (with `Log_connections`)

```
LOG: connection received: host=127.0.0.1 port=45214
LOG: connection authorized: user=postgres database=postgres
LOG: statement: END;
LOG: connection authorized: user=postgres database=postgres
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4305 WHERE aid = 47364;
LOG: statement: BEGIN;
LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 47364;
LOG: connection authorized: user=postgres database=postgres
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -2684 WHERE aid = 53855;
LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 4305 WHERE tid = 10;
LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 4305 WHERE bid = 1;
LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (10, 1, 47364, 4305, CURRENT_TIMESTAMP);
LOG: statement: END;
LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 53855;
LOG: connection received: host=127.0.0.1 port=45216
LOG: statement: drop table pgbench_accounts
LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -2684 WHERE tid = 10;
LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -2684 WHERE bid = 1;
LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (10, 1, 53855, -2684, CURRENT_TIMESTAMP);
LOG: statement: END;
LOG: connection authorized: user=postgres database=postgres
LOG: connection received: host=127.0.0.1 port=45218
LOG: connection authorized: user=postgres database=postgres
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -3198 WHERE aid = 51840;
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4395 WHERE aid = 62616;
ERROR: relation "pgbench_accounts" does not exist at character 8
STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + 4395 WHERE aid = 62616;
ERROR: relation "pgbench_accounts" does not exist at character 8
STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -3198 WHERE aid = 51840;
LOG: connection received: host=127.0.0.1 port=45220
LOG: connection received: host=127.0.0.1 port=45222
LOG: connection authorized: user=postgres database=postgres
LOG: connection authorized: user=postgres database=postgres
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -148 WHERE aid = 98357;
ERROR: relation "pgbench_accounts" does not exist at character 8
STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -148 WHERE aid = 98357;
LOG: statement: BEGIN;
LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -3241 WHERE aid = 26657;
ERROR: relation "pgbench_accounts" does not exist at character 8
STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -3241 WHERE aid = 26657;
LOG: automatic vacuum of table "postgres.public.pgbench_branches": index scans: 0
LOG: automatic analyze of table "postgres.public.pgbench_branches" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.02 s
LOG: automatic analyze of table "postgres.public.pgbench_history" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
LOG: automatic vacuum of table "postgres.public.pgbench_tellers": index scans: 0
LOG: automatic analyze of table "postgres.public.pgbench_tellers" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
```



# The Wall of Text (with `'%m [%p]: [%l] [txid=%x] user=%u,db=%d,app%a,client=%r '`)

```
2020-02-29 00:37:42.791 UTC [5194]: [1] [txid=0] user=[unknown],db=[unknown],app[unknown],client=127.0.0.1(45214) LOG: connection received: host=127.0.0.1 port=45214
2020-02-29 00:37:42.791 UTC [5192]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45210) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.792 UTC [5191]: [9] [txid=100155] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45208) LOG: statement: END;
2020-02-29 00:37:42.792 UTC [5194]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45214) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.794 UTC [5194]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: BEGIN;
2020-02-29 00:37:42.795 UTC [5194]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4305 WHERE aid = 47364;
2020-02-29 00:37:42.796 UTC [5192]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: BEGIN;
2020-02-29 00:37:42.796 UTC [5194]: [5] [txid=100157] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 47364;
2020-02-29 00:37:42.796 UTC [5193]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=172.17.0.3(44698) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.796 UTC [5192]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -2684 WHERE aid = 53855;
2020-02-29 00:37:42.796 UTC [5194]: [6] [txid=100157] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + 4305 WHERE tid = 10;
2020-02-29 00:37:42.796 UTC [5194]: [7] [txid=100157] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + 4305 WHERE bid = 1;
2020-02-29 00:37:42.796 UTC [5194]: [8] [txid=100157] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (10, 1, 47364,
2020-02-29 00:37:42.797 UTC [5194]: [9] [txid=100157] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: END;
2020-02-29 00:37:42.797 UTC [5192]: [5] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 53855;
2020-02-29 00:37:42.797 UTC [5195]: [1] [txid=0] user=[unknown],db=[unknown],app[unknown],client=127.0.0.1(45216) LOG: connection received: host=127.0.0.1 port=45216
2020-02-29 00:37:42.797 UTC [5193]: [3] [txid=0] user=postgres,db=postgres,appsql,client=172.17.0.3(44698) LOG: statement: drop table pgbench_accounts
2020-02-29 00:37:42.797 UTC [5192]: [6] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -2684 WHERE tid = 10;
2020-02-29 00:37:42.798 UTC [5192]: [7] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -2684 WHERE bid = 1;
2020-02-29 00:37:42.798 UTC [5192]: [8] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (10, 1, 53855,
2020-02-29 00:37:42.798 UTC [5192]: [9] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: END;
2020-02-29 00:37:42.799 UTC [5195]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45216) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.799 UTC [5196]: [1] [txid=0] user=[unknown],db=[unknown],app[unknown],client=127.0.0.1(45218) LOG: connection received: host=127.0.0.1 port=45218
2020-02-29 00:37:42.800 UTC [5196]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45218) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.800 UTC [5195]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45216) LOG: statement: BEGIN;
2020-02-29 00:37:42.800 UTC [5195]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45216) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -3198 WHERE aid = 51840;
2020-02-29 00:37:42.801 UTC [5196]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45218) LOG: statement: BEGIN;
2020-02-29 00:37:42.801 UTC [5196]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45218) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4395 WHERE aid = 62616;
2020-02-29 00:37:42.801 UTC [5196]: [5] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45218) ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:37:42.801 UTC [5196]: [6] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45218) STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + 4395 WHERE aid = 62616;
2020-02-29 00:37:42.802 UTC [5195]: [5] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45216) ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:37:42.802 UTC [5195]: [6] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45216) STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -3198 WHERE aid = 51840;
2020-02-29 00:37:42.804 UTC [5197]: [1] [txid=0] user=[unknown],db=[unknown],app[unknown],client=127.0.0.1(45220) LOG: connection received: host=127.0.0.1 port=45220
2020-02-29 00:37:42.804 UTC [5198]: [1] [txid=0] user=[unknown],db=[unknown],app[unknown],client=127.0.0.1(45222) LOG: connection received: host=127.0.0.1 port=45222
2020-02-29 00:37:42.805 UTC [5197]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45220) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.807 UTC [5198]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45222) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.807 UTC [5197]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45220) LOG: statement: BEGIN;
2020-02-29 00:37:42.808 UTC [5197]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45220) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -148 WHERE aid = 98357;
2020-02-29 00:37:42.808 UTC [5197]: [5] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45220) ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:37:42.808 UTC [5197]: [6] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45220) STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -148 WHERE aid = 98357;
2020-02-29 00:37:42.808 UTC [5198]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45222) LOG: statement: BEGIN;
2020-02-29 00:37:42.809 UTC [5198]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45222) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -3241 WHERE aid = 26657;
2020-02-29 00:37:42.809 UTC [5198]: [5] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45222) ERROR: relation "pgbench_accounts" does not exist at character 8
2020-02-29 00:37:42.809 UTC [5198]: [6] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45222) STATEMENT: UPDATE pgbench_accounts SET abalance = abalance + -3241 WHERE aid = 26657;
2020-02-29 00:37:47.480 UTC [5199]: [1] [txid=0] user=,db=,app,client= LOG: automatic vacuum of table "postgres.public.pgbench_branches": index scans: 0
2020-02-29 00:37:47.501 UTC [5199]: [2] [txid=100160] user=,db=,app,client= LOG: automatic analyze of table "postgres.public.pgbench_branches" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.02 s
2020-02-29 00:37:47.515 UTC [5199]: [3] [txid=100161] user=,db=,app,client= LOG: automatic analyze of table "postgres.public.pgbench_history" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
2020-02-29 00:37:47.527 UTC [5199]: [4] [txid=0] user=,db=,app,client= LOG: automatic vacuum of table "postgres.public.pgbench_tellers": index scans: 0
2020-02-29 00:37:47.527 UTC [5199]: [5] [txid=100162] user=,db=,app,client= LOG: automatic analyze of table "postgres.public.pgbench_tellers" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
```

# The Wall of Text (sorted)

```
2020-02-29 00:37:42.792 UTC [5191]: [9] [txid=100155] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45208) LOG: statement: END;
2020-02-29 00:37:42.791 UTC [5192]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45210) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.796 UTC [5192]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: BEGIN;
2020-02-29 00:37:42.796 UTC [5192]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -2684 WHERE aid = 53855;
2020-02-29 00:37:42.797 UTC [5192]: [5] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 53855;
2020-02-29 00:37:42.797 UTC [5192]: [6] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_tellers SET tbalance = tbalance + -2684 WHERE tid = 10;
2020-02-29 00:37:42.798 UTC [5192]: [7] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_branches SET bbalance = bbalance + -2684 WHERE bid = 1;
2020-02-29 00:37:42.798 UTC [5192]: [8] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: INSERT INTO pgbench_history (tid, bid, aid, delta, mtime) VALUES (10, 1, 53855,
2020-02-29 00:37:42.798 UTC [5192]: [9] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: END;
2020-02-29 00:37:42.796 UTC [5193]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=172.17.0.3(44698) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.797 UTC [5193]: [3] [txid=0] user=postgres,db=postgres,appsqll,client=172.17.0.3(44698) LOG: statement: drop table pgbench_accounts
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2020-02-29 00:37:42.795 UTC [5194]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45214) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + 4305 WHERE aid = 47364;
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2020-02-29 00:37:42.799 UTC [5195]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45216) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.800 UTC [5195]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45216) LOG: statement: BEGIN;
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2020-02-29 00:37:42.804 UTC [5198]: [1] [txid=0] user=[unknown],db=[unknown],app[unknown],client=127.0.0.1(45222) LOG: connection received: host=127.0.0.1 port=45222
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2020-02-29 00:37:47.501 UTC [5199]: [2] [txid=100160] user=,db=,app,client= LOG: automatic analyze of table "postgres.public.pgbench_branches" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.02 s
2020-02-29 00:37:47.515 UTC [5199]: [3] [txid=100161] user=,db=,app,client= LOG: automatic analyze of table "postgres.public.pgbench_history" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
2020-02-29 00:37:47.527 UTC [5199]: [4] [txid=0] user=,db=,app,client= LOG: automatic vacuum of table "postgres.public.pgbench_tellers": index scans: 0
2020-02-29 00:37:47.527 UTC [5199]: [5] [txid=100162] user=,db=,app,client= LOG: automatic analyze of table "postgres.public.pgbench_tellers" system usage: CPU: user: 0.00 s, system: 0.00 s, elapsed: 0.00 s
```



# Found the culprit!

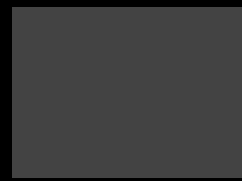
```
2020-02-29 00:37:42.792 UTC [5191]: [9] [txid=100155] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45208) LOG: statement: END;
2020-02-29 00:37:42.791 UTC [5192]: [2] [txid=0] user=postgres,db=postgres,app[unknown],client=127.0.0.1(45210) LOG: connection authorized: user=postgres database=postgres
2020-02-29 00:37:42.796 UTC [5192]: [3] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: BEGIN;
2020-02-29 00:37:42.796 UTC [5192]: [4] [txid=0] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: UPDATE pgbench_accounts SET abalance = abalance + -2684 WHERE aid = 53855;
2020-02-29 00:37:42.797 UTC [5192]: [5] [txid=100158] user=postgres,db=postgres,apppgbench,client=127.0.0.1(45210) LOG: statement: SELECT abalance FROM pgbench_accounts WHERE aid = 53855;
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```

# How much is too much?



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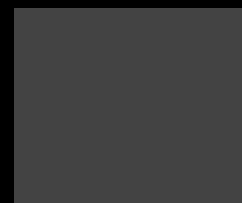
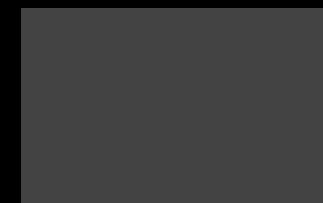
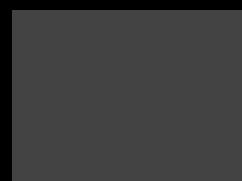
- Log as much, as long, as your system can handle





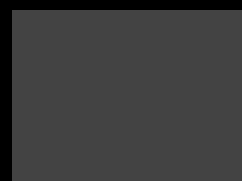
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- Most logging params can be turned on/off with a HUP/reload
- Use a separate partition
- Get familiar with `grep` and `awk` (or even `sed`)
- Compress your log files (using a cronjob)
- If you know what to look for, you can filter out the noise



# A word on verbosity

- `log_min_messages`
  - This indicates \*generally\* how much to log.
  - Valid values are :
    - DEBUG{5,4,3,2,1}
    - INFO
    - NOTICE
    - WARNING
    - ERROR
    - LOG
    - FATAL
    - PANIC
  - WARNING is the default, but you shouldn't ever have to do more than INFO

# What to look for: Logging Levels

- WARNING
  - Not necessarily urgent, but a proactive notice from PG
- ERROR
  - Failure to execute a command; often a syntax error, but can indicate worse (i.e., corruption)
- FATAL
  - Session terminated due to some error (ex., wrong password, bad auth)
- PANIC
  - Some anomaly encountered in the database engine (segfault, corruption, etc.)
  - All sessions terminated for safety



# What to look for: Common Issues

- Don't ignore DETAIL and HINT messages
- A spike in FATAL messages often correlates to misconfigured application
- A spike in ERROR messages often correlates to an application bug
- A spike in ERROR messages can indicate broken replication
- Autovacuum problems? Look for long-running idle transactions

# What to look for: hints

```
2016-03-04 10:13:51.746 CET [15340]: [80091-1] user=postgres,db=postgres,10.0.1.1(49015) WARNING: database "postgres"
must be vacuumed within 9763669 transactions
```

```
2016-03-04 10:13:51.746 CET [15340]: [80092-1] user=postgres,db=postgres,10.0.1.1(49015) HINT: To avoid a database
shutdown, execute a database-wide VACUUM in that database.
```

You might also need to commit or roll back old prepared transactions.

```
2016-03-04 10:13:51.746 CET [15337]: [79775-1] user=postgres,db=postgres,10.0.1.1(49012) WARNING: database "postgres"
must be vacuumed within 9763668 transactions
```

```
2016-03-04 10:13:51.746 CET [15337]: [79776-1] user=postgres,db=postgres,10.0.1.1(49012) HINT: To avoid a database
shutdown, execute a database-wide VACUUM in that database.
```

You might also need to commit or roll back old prepared transactions.

```
2016-03-04 10:13:51.746 CET [15332]: [80655-1] user=postgres,db=postgres,10.0.1.1(49007) WARNING: database "postgres"
must be vacuumed within 9763667 transactions
```

```
2016-03-04 10:13:51.746 CET [15332]: [80656-1] user=postgres,db=postgres,10.0.1.1(49007) HINT: To avoid a database
shutdown, execute a database-wide VACUUM in that database.
```

You might also need to commit or roll back old prepared transactions.



# What to look for: Application Bugs

```
2017-01-11 00:02:18 IST WARNING: there is no transaction in progress
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2017-01-11 00:15:07 IST WARNING: there is no transaction in progress
2017-01-11 00:16:48 IST WARNING: there is no transaction in progress
2017-01-11 00:25:11 IST WARNING: there is no transaction in progress
2017-01-11 00:45:01 IST WARNING: there is no transaction in progress
2017-01-11 00:48:33 IST WARNING: there is no transaction in progress
2017-01-11 00:56:23 IST WARNING: there is no transaction in progress
2017-01-11 01:01:04 IST LOG: unexpected EOF on client connection
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2017-01-11 01:05:14 IST WARNING: there is no transaction in progress
2017-01-11 01:15:10 IST WARNING: there is no transaction in progress
2017-01-11 01:25:29 IST WARNING: there is no transaction in progress
2017-01-11 01:45:01 IST WARNING: there is no transaction in progress
```

# What to look for: Broken Replication

```
2019-02-19 19:35:57.222 UTC > ERROR: requested WAL segment 000000010000000000000009 has already been removed
2019-02-19 19:36:02.217 UTC > ERROR: requested WAL segment 000000010000000000000009 has already been removed
2019-02-19 19:36:07.235 UTC > ERROR: requested WAL segment 000000010000000000000009 has already been removed
2019-02-19 19:36:12.232 UTC > ERROR: requested WAL segment 000000010000000000000009 has already been removed
2019-02-19 19:36:17.235 UTC > ERROR: requested WAL segment 000000010000000000000009 has already been removed
```

# What to look for: autovacuum

```
2020-02-25 00:29:29.062 UTC [66340] LOG:  automatic vacuum of table "postgres.public.pgbench_accounts": index scans: 1
pages: 0 removed, 8694 remain, 0 skipped due to pins, 0 skipped frozen
tuples: 198 removed, 125983 remain, 99944 are dead but not yet removable, oldest xmin: 95278
buffer usage: 25163 hits, 0 misses, 0 dirtied
avg read rate: 0.000 MB/s, avg write rate: 0.000 MB/s
system usage: CPU: user: 0.17 s, system: 0.01 s, elapsed: 3.00 s
```

# What to look for: temp files

```
2020-02-14 09:20:23 EST [63408]: [3-1] db=,user=,app=,client=LOG: temporary file: path "base/pgsql_tmp/pgsql_tmp63408.0", size 8216576
2020-02-14 09:20:23 EST [63410]: [3-1] db=,user=,app=,client=LOG: temporary file: path "base/pgsql_tmp/pgsql_tmp63410.0", size 11018240
2020-02-14 09:20:23 EST [63411]: [3-1] db=,user=,app=,client=LOG: temporary file: path "base/pgsql_tmp/pgsql_tmp63411.0", size 13869056
2020-02-14 09:20:23 EST [63409]: [3-1] db=,user=,app=,client=LOG: temporary file: path "base/pgsql_tmp/pgsql_tmp63409.0", size 10616832
```



# What to look for: locking & blocking

```
2020-02-14 09:20:24 EST [43118]: [64706-1] db=immcare,user=svc-mmpphmp,app=PostgreSQL JDBC
Driver,client=10.8.37.178LOG: process 43118 still waiting for AccessExclusiveLock on tuple (0,2) of relation 17305 of
database 16493 after 1000.117 ms
```

```
2020-02-14 09:20:24 EST [43118]: [64707-1] db=immcare,user=svc-mmpphmp,app=PostgreSQL JDBC
Driver,client=10.8.37.178DETAIL: Process holding the lock: 29558. Wait queue: 59904, 45056, 19684, 60331, 45055,
43385, 45544, 29400, 43383, 55077, 45197, 50943, 43549, 29401, 43548, 59877, 43550, 29076, 35322, 50944, 25466, 29078,
19683, 43119, 54837, 10518, 43118.
```

```
-----
2019-02-07 01:01:36.253 EST,"postgres","dbname",6652,"10.161.66.46:64171",5c5bc869.19fc,2,"SELECT",2019-02-07 00:55:53
EST,15/2674841,579153561,ERROR,40P01,"deadlock detected","Process 6652 waits for AccessExclusiveLock on relation
34670713 of database 9122478; blocked by process 7715.
```

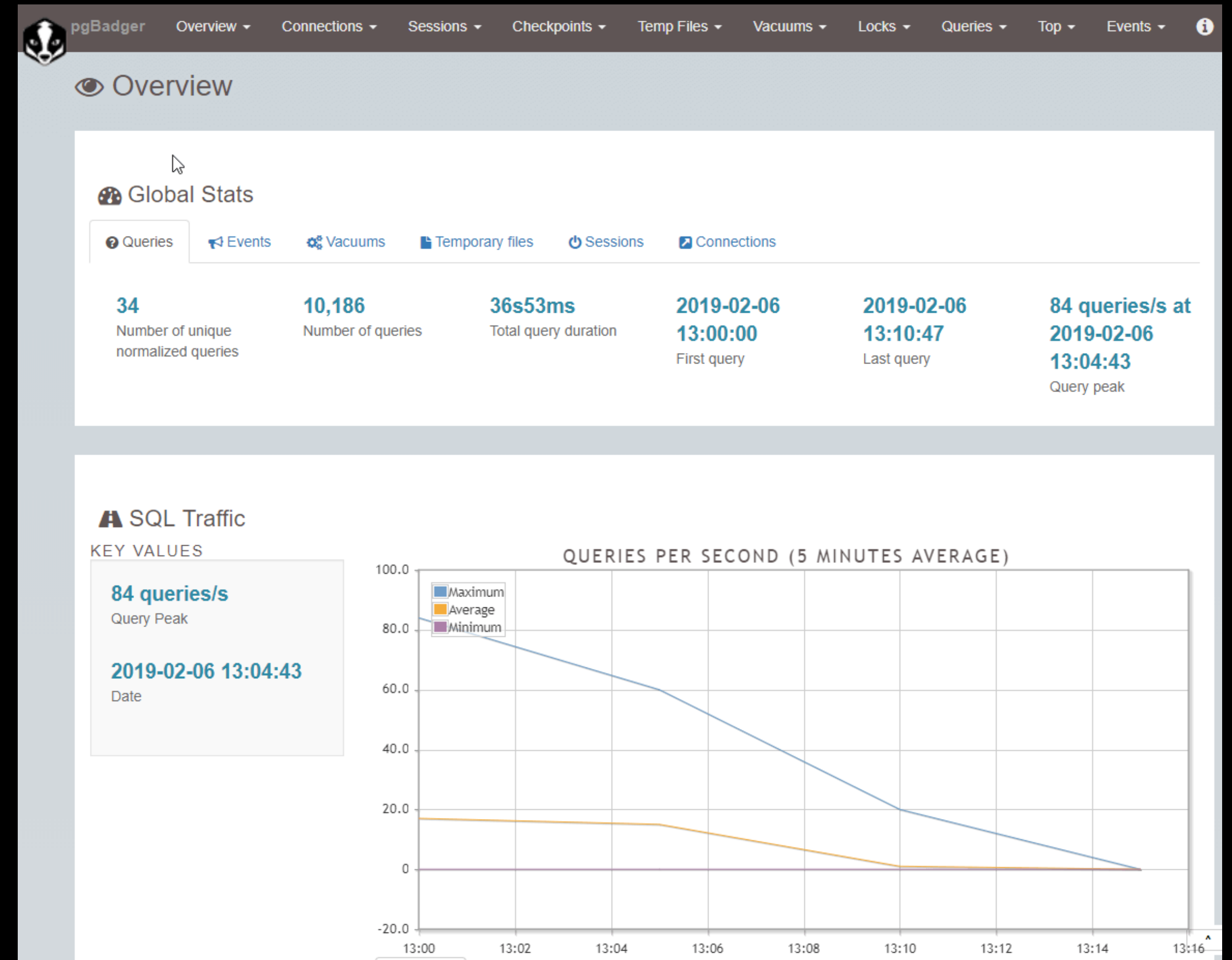
```
Process 7715 waits for AccessShareLock on relation 34670707 of database 9122478; blocked by process 6652.
```

```
Process 6652: SELECT * FROM myschema.proc_mv_refresh()
```

```
Process 7715: SELECT c.relname AS view_name, c.relkind AS view_type, c.relispopulated AS ispopulated, spc.spcname AS
tablespace_name, pg_get_userbyid(c.relowner) AS view_owner, pg_get_viewdef(c.oid, true) AS definition FROM
pg_catalog.pg_class c LEFT OUTER JOIN pg_tablespace spc on spc.oid=c.reltablespace LEFT OUTER JOIN pg_namespace n on
n.oid=c.relnamespace WHERE (c.relkind = 'v' OR c.relkind = 'm') AND c.relnamespace = n.oid AND n.nspname = $1","See
server log for query details.",,"SQL statement ""REFRESH MATERIALIZED VIEW ENTRP_SERVS.MV_8001_AU_PRSN""
```

# Digesting the log: pgbadger

- Analyzes your logs
- Generates statistics of your query traffic
- Helps identify problematic queries



# More Knowledge, More Power

- `auto_explain`
  - Adds `EXPLAIN` output to your log
  - Can show the runtimes of each plan node
  - Can show caching behavior and memory usage
- `pg_stat_statements`
  - Logs statistics on each statement executed
  - Doesn't go into your log, but in a table within Postgres
  - Can help alleviate log traffic (YMMV)

# Some gotchas

- `logging_collector`
  - needs to be turned on if you want separate log files (i.e., not using syslog)
- `log_filename`
  - needs to include the relevant escapes for notation to happen
  - otherwise, it just appends (unless `log_truncate_on_rotation` is turned on)

# Some gotchas

- `log_min_duration_statement` v `log_duration`
  - `log_duration`
    - only logs the time it took for a query to run
    - does not log the query
    - Applies to all queries
  - `log_min_duration_statement`
    - logs the time it took for a query to run
    - logs the query
    - Applies to only queries exceeding the threshold
- Why `log_duration`?
  - Allows you to gather stats on high-workload environments, without the added overhead of printing the full query

# Some gotchas

- `log_min_duration_statement` v `log_statement`
- `log_min_duration_statement`
  - logs the statement and duration AFTER the query has finished
  - does not log parameters
- `log_statement`
  - logs the statement BEFORE the query is executed
  - logs parameters

# Summary



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- Turn on `log_connections` to track down the origin of your queries
- Log as much as you can, for as long as you can
- Run your logs through pgbadger for visibility and forecasting
- Monitor for spikes in FATAL/ERROR/WARNING messages

**Questions?**