The Future of Postgres

Ken Rugg, EnterpriseDB
May 30, 2019
We are the world leader Postgres-based software and services

PROVEN
• Recognized RDBMS leader by Gartner
• 2013-2018 Member of Gartner Magic Quadrant

COMMITTED
• Founded in 2004
• Largest PostgreSQL contributor—40% of core team

GLOBAL
• Customer global base > 4000
• 300+ Employees world-wide
• Offices in 16 countries
Postgres: DBMS OF THE YEAR! 2018

PostgreSQL is the DBMS of the Year 2017
by Paul Andlinger, Matthias Geibmann, 2 January 2018
Tags: DBMS of the year, Elasticsearch, MariaDB, PostgreSQL

PostgreSQL is the database management system that gained more popularity in our DB-Engines Ranking within the last year than any of the other 341 monitored systems. We thus declare PostgreSQL as the DBMS of the Year 2017.

DB-Engines Ranking
347 systems in ranking, May 2019

<table>
<thead>
<tr>
<th>Rank</th>
<th>May 2019</th>
<th>Apr 2019</th>
<th>May 2018</th>
<th>DBMS</th>
<th>Database Model</th>
<th>Score May 2019</th>
<th>Score Apr 2019</th>
<th>Score May 2018</th>
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<td>1.</td>
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<td>1.</td>
<td>Oracle</td>
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<td>Elasticsearch</td>
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<td>10.</td>
<td>11.</td>
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<td></td>
<td>Cassandra</td>
<td>Wide column</td>
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<td>+2.11</td>
<td>+7.89</td>
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</table>
HIGHLIGHTS OF POSTGRES 12

• Table Access Methods
  • Storage API

• btree Index Improvements
  • In some cases, btree indexes are up to 40% smaller than in previous releases.

• Partitioning Improvements
  • Foreign keys that reference partitioned tables
  • Faster run-time pruning
  • Partition pruning now covers a few more cases
  • ATTACH PARTITION w/ShareUpdateExclusiveLock
  • Use Append Rather than MergeAppend for scanning ordered partitions
HIGHLIGHTS OF POSTGRES 12 (MORE)

• Removal of recovery.conf
• Generated columns (stored, not virtual)
• CTE inlining (with manual control)
• REINDEX CONCURRENTLY
• Unified logging system for command-line programs, including colors.
• SQL/JSON: jsonpath
• Extended statistics: Multivariate MCV lists
• Collations with nondeterministic comparison
• GSSAPI encryption support
• SERIALIZABLE for parallel query
FUTURE TECHNOLOGY TRENDS
Three cool areas of innovation

- Storage Engine
  - Storage engine API
  - zHeap

- Data Distribution
  - Partitioning & Sharding
  - Replication

- Deployment Options
  - Cloud
  - Containers
PLUGGABLE STORAGE

To all the MySQL folks… Yeah, I know…

• Allow PostgreSQL to support pluggable storage formats

• Allows innovation – major changes to the heap are impossible because everyone relies on it. Can’t go backwards for any use case!

• Allows for user choice – if there are multiple storage formats available, pick the one that is best for your use case.
PLUGGABLE STORAGE: EXAMPLES

• **Columnar storage**
  • Most queries don’t need all columns

• **Write-once read-many (WORM)**
  • No support UPDATE, DELETE, or SELECT FOR UPDATE/SHARE

• **Index-organized storage**
  • One index is more important than all of the others

• **In-memory storage**
  • No need to spill to disk

• **zHeap…**
ZHEAP: HIGH-LEVEL BENEFITS

• Better Bloat Control
  • Perform updates “in place” to avoid creating bloat (when possible)
  • Reuse space right after COMMIT or ABORT – little or no need for VACUUM

• Fewer Writes (eliminate write amplification)
  • Eliminate hint-bits, freezing and anything else that could dirty a page (other than an update)
  • Allowing in-place updates when index column is updated by providing delete-marking in index
  • Indexes are not touched if the indexed columns are not changed

• Smaller in Size
  • Narrower tuple headers – most transactional info not stored on the page itself
  • Eliminate most alignment padding
PARTITIONING IS MORE THAN JUST SHARDING
EVOLVING TO SUPPORT MORE AND MORE USE CASES

Systems of Record (SoR)
- Partitioning
- Rapidly Advancing in Core

Systems of Engagement (SoE)
- Sharding
- Citus Extension

True General Purpose DBMS
- 54% % Users
- 63% % Users
- 17% % Users

Systems of Analysis (SoA)
- MPP Data warehouses
- Greenplum, RedShift…

“Corner Cases” that require specialized technologies, e.g. MPP, NoSQL, RAC

% Percentage of Postgres users who run each data management workload
**LOGICAL REPLICATION ENABLES MANY NEW USE CASES**

- Table-base, logical replication
- Row level filtering
- Multi-master (MMR) replication for Postgres
- Real time integration & migration from Oracle and MS SQL Server
- Leverages Kafka & Zookeeper for HA & Horizontal Scalability
- Multi-region and geographically dispersed databases
POSTGRES – 3RD MOST DEPLOYED CONTAINER

Top Technologies Running on Docker

% of Companies Running This Technology

Source: Datadog
POSTGRES: UBIQUITOUS IN CLOUD
Rapidly Evolving and Highly Mature

Logos of various cloud providers and IT companies.
BUT NOT ONLY CLOUD?

We asked a 1,000 downloaders from postgresql.org....

What is Timeline to Run Databases in Cloud?

- Never/No plans to deploy DBs in the cloud: 33%
- More than 12 months out: 17%
- In 6 to 12 months: 9%
- Within 6 months: 12%
- Currently running DBs in the cloud: 29%
QUESTIONS & DISCUSSION
KEYNOTE SPEAKER

World Wide Web Inventor, Sir Tim Berners-Lee to Deliver Keynote at Postgres Vision 2019

LEARN MORE
THANK YOU
CONTINUALLY IMPROVING PERFORMANCE

Global mobile ad network
- Largest database is 14TB
- 1.2 billion transactions a day, 55K transaction per second
- 400 concurrent users
- Analyzes 240TB of data per day

Online Brokerage Firm
- 1 billion writes a day
- 3,000 transactions per second
- 800 concurrent users

Global consumer financial services provider
- Example application database is 2TB
- 200K SELECT statements per second
- 25K WRITE transactions per second

Global stock trade underwriter
- Largest database is 8 TB
- 6 to 10 million transactions per day
Reduce Open DB Cloud operating costs with Power L922 Server running EnterpriseDB Postgres Advanced Server 10
2.4X price-performance leadership over tested Intel Xeon SP Gold 6148 servers

<table>
<thead>
<tr>
<th>EDB POSTGRES</th>
<th>IBM Power L922 (20-core, 256GB, 4 LPARs)</th>
<th>Intel Xeon SP based 2-socket server (40-core, 256GB, 4 VMs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Server price</td>
<td>$27,480 (3-year warranty: $29,247)</td>
<td>$29,247</td>
</tr>
<tr>
<td>Solution Cost</td>
<td>$144,557 (Server + RHEL OS + Virtualization + EDB Annual Subscription @ $1,750 per core/yr: $243,166)</td>
<td></td>
</tr>
<tr>
<td>EDB pgbench 1</td>
<td>853,709 tps</td>
<td>611,118 tps</td>
</tr>
<tr>
<td>TPS/$</td>
<td>5.9 tps/$</td>
<td>2.5 tps/$</td>
</tr>
</tbody>
</table>

2.8X per core performance
40% Lower solution costs

2.4X Better Price-performance

1. Based on IBM internal testing of multiple VM images running pgbench benchmark at scale factor of 300, 20 GB buffer size. Results valid as of 4/19/18 and conducted under laboratory condition with speculative execution controls to mitigate user-to-kernel and user-to-user side-channel attacks on both systems, individual result can vary based on workload size, use of storage subsystems & other conditions.
2. IBM Power L922 (2x10-core/2.9 GHz/256 GB memory) 2x 300GB SATA 7.2K rpm LFF HDD, 10Gb two-port, 1x 16Gbps FCA, EDB Postgres Advanced Server 10, RHEL 7.5 with PowerVM (4 partitions@5-cores each).
3. Competitive stack: 2-socket Intel Xeon Skylake Gold 6148 (2x20-core/2.4 GHz/256 GB memory), 2x 300GB HDD, 1G two-port, 1x 16Gbps FCA, EDB Postgres Advanced Server 10, RHEL 7.5, KVM (4 VMs@10-cores each).
ROBUST POSTGRES EXTENSIONS

On the Rise from an Expanding Partner Ecosystem

TIME SERIES  GEO-SPATIAL  GRAPH  MPP