

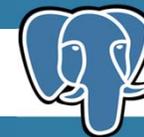


# Greenplum 5.0 and Roadmap

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2016Postgres中国用户大会



# Safe Harbor

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# Greenplum is Growing Steady

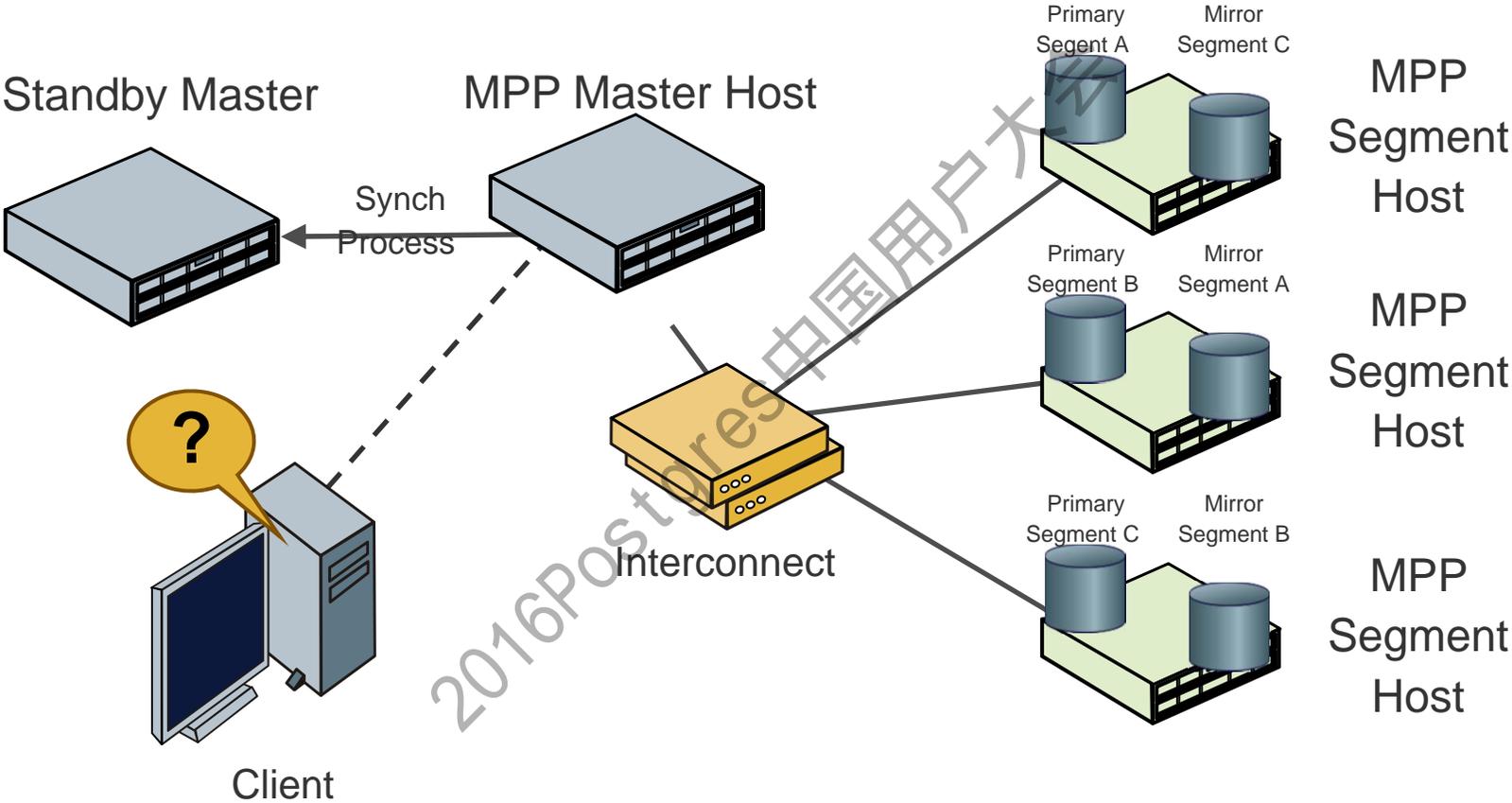
- Greenplum is Growing Steady
  - Operating in 34 countries globally
  - Customer count and revenue growing
  - Pivotal engineering investment growing
  - 9 Greenplum Database releases in 2016
  - Open source code contribution growing
  - 1417 commits to the github repo of Greenplum in 2016
  - 111 unique contributors on github repo of Greenplum in 2016
  - Major Greenplum 5.0 release planned early 2017

# Greenplum Database Overview

- Massively Parallel Processing (MPP) database system
  - Scales out to hundreds(\*) of nodes
- Shared nothing architecture
- Comprehensive SQL support with OLAP extensions
- Full ACID support
- Data distributed across nodes
  - Hashed distribution
  - Random distribution



# Greenplum Database Architecture



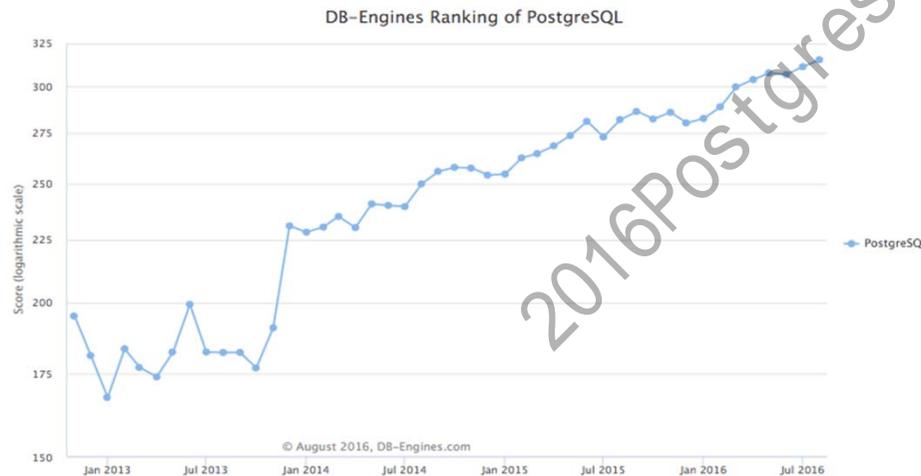
# PostgreSQL Heritage



Greenplum  
Open Source  
Launch



**PGCONF.EU 2015**



- Widely used
- Open Source
- Enterprise class relational engine

# PostgreSQL Base



PostgreSQL



## Vision

Greenplum in the long run will be based on latest PostgreSQL

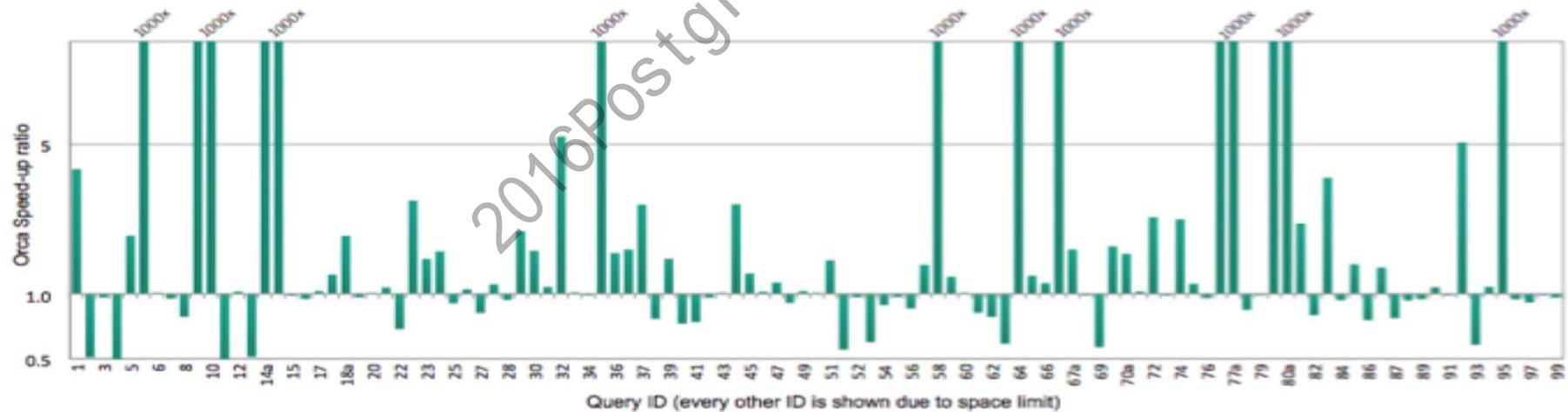
## Upcoming Roadmap

- GPDB 5.0 release upgrade from PG 8.2 to PG 8.3 (2017 time frame)
- JSON/JSONB
- Full Text Search
- Improved XML Type/Functions
- UUID Type
- Raster PostGIS
- Anonymous Code Blocks
- PostgreSQL based Analyze (faster)
- Extension Framework
- Foreign Data Wrapper (FDW)



# Pivotal Query Optimizer — ORCA

- First Open Source Cost Based Optimizer for BIG data
- Applies broad set of optimization strategies at once
  - Considers many more plan alternatives
  - Optimizes a wider range of queries
  - Optimizes memory usage
- New Extensible Code Base
  - Rapid adoption of emerging technologies



TPC-DS 10TB, 16 nodes, 48 GB/node



# Performance: Query Optimization

## Vision

Our new cost-based optimizer, Orca, will become the default optimizer in GPDB for all workloads, performing equal or better than legacy optimizer in all cases.

## Current Status

Complex workloads for analytics produce large gains with ORCA

## Upcoming Roadmap

- Parallelizing Union and Union All Queries
- Expanding ORCA's index support to larger class of predicates
- Reduce optimization time:
  - Auto-disable unnecessary transformations
  - Investigation: Optimization Levels



# Performance: Query Execution

## Vision

Dynamic Code Generation is a next gen performance enabling technology

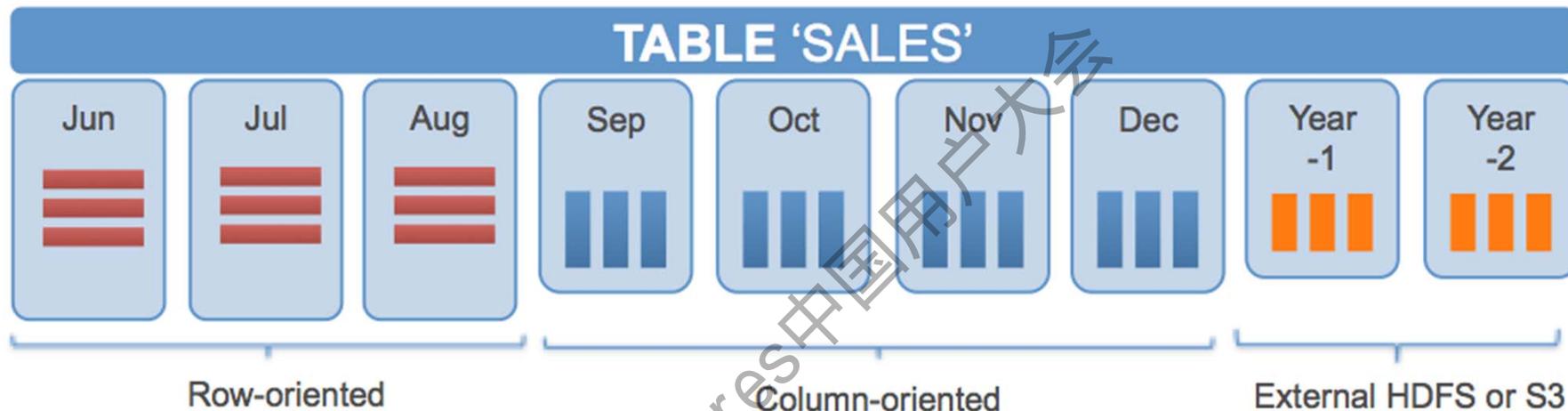
## Upcoming Roadmap

- LLVM Dynamic Code Generation for faster query execution
- Dispatcher refactoring for improved performance and scalability
- More accurate query memory accounting internally
  - Optimizer and zlib memory usage accounting can be improved
- Reduce Intra-Transaction Memory
- Reduce Idle-Time Memory Usage
- Catalog data caching in the optimizer to speed short running queries



# Polymorphic Storage™

## User Definable Storage Layout



- Row oriented faster when returning all columns
- HEAP for many updates and deletes
- Use indexes for drill through queries

- Columnar storage compresses better
- Optimized for retrieving a subset of the columns when querying
- Compression can be set differently per column: gzip (1-9), quicklz, delta, RLE

- Less accessed partitions on external and seamlessly query all data
- All major Hadoop distributions
- Amazon S3 storage
- Others in development

# External Tables

## Vision

- Wide variety of data source and targets for external data querying
- Leveraging external partitions on cheap and deep storage for online archiving

## Upcoming Roadmap

- S3 Writable External Tables
- Certification of GPHEFS with latest Cloudera, MapR, Hortonworks
- Porting PostgreSQL Foreign Data Wrappers to GPDB (longer term)



# Storage & Backup

## Vision

More '9s', and increased support for mission critical systems

## Upcoming Roadmap

- PostgreSQL WAL Replication Segment Mirroring (Longer Term)
- Data Domain and NetBackup Version Upgrades
- Reduce pg\_class locking during backups
- Support for all special characters in catalog names
- Discovery investigations on next-gen backup improvements





# Scalable, In-Database Machine Learning

Apache MADlib (incubating): Big Data Machine Learning in SQL for Data Scientists

Open source,  
commercially friendly  
Apache license

Supports PostgreSQL,  
Greenplum Database™,  
and Apache HAWQ  
(incubating)

Powerful analytics for  
big data

- Open source <https://github.com/apache/incubator-madlib>
- Downloads and docs <http://madlib.incubator.apache.org/>
- Wiki <https://cwiki.apache.org/confluence/display/MADLIB/>



# Madlib



## Vision

In database analytics, machine learning and data science tools

## Upcoming Roadmap

- Pivotal R Support for SVM and LDA
- Grouping Support and Cross Validation in Elastic Net
- Improved Python Language Support
- Investigation on Graph Support
- Investigation on GPU support
- Performance improvements

# GPDB Geospatial



## Current Key Features:

- Points, Lines, Polygons, Perimeter, Area, Intersection, Contains, Distance

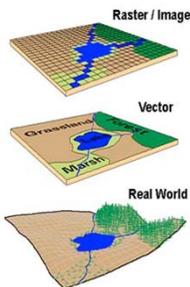
Ability to store geospatial data and query with joins and operators

```
geodemo=# SELECT
nyc_subway_stations.long_name AS subway,
nyc_neighborhoods.name AS neighborhood
FROM nyc_neighborhoods
JOIN nyc_subway_stations
ON ST_Contains(nyc_neighborhoods.geom, nyc_subway_stations.geom)
WHERE nyc_neighborhoods.name = 'Greenwich Village';
```

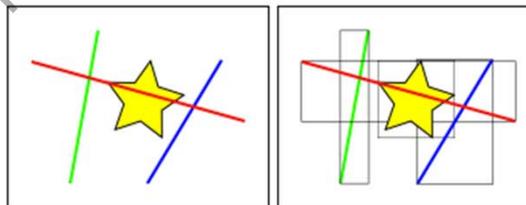
subway	neighborhood
W 4th St (B,D,F,V) Manhattan	Greenwich Village
14th St / Union Sq (4,5,6) Manhattan	Greenwich Village
14th St (1,2,3) Manhattan	Greenwich Village
Bleecker St / Broadway-Lafayette St (6) Manhattan	Greenwich Village
Christopher St / Sheridan Sq (1) Manhattan	Greenwich Village
Union Sq / 14th St (L,N,Q,R,W) Manhattan	Greenwich Village
6th Ave / 14th St (F,L,V) Manhattan	Greenwich Village
8th St / New York University (N,R,W) Manhattan	Greenwich Village
Astor Pl (6) Manhattan	Greenwich Village
W 4th St (A,C,E) Manhattan	Greenwich Village

(10 rows)

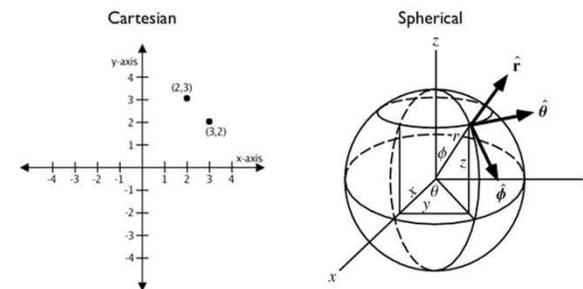
Raster Image Processing



Spatial Indexes & Bounding Boxes



Round earth calculations



# GP Text: Full Text Search and Text Analysis (proprietary)



## Vision

Integrated Data Warehouse for SQL and Text Search in one system leveraging Apache Solr and GPDB

## Upcoming Roadmap

- GPText 2.0 GA
- Solr Cloud based high availability and Solr mirroring
- Gptext-recover
- Gptext-expand
- Gptext-backup
- Gptext-restore previous index

# Command Center (proprietary)

## Vision

Clean and Rich Graphical User Interface for GPDB DBAs

## Current Status

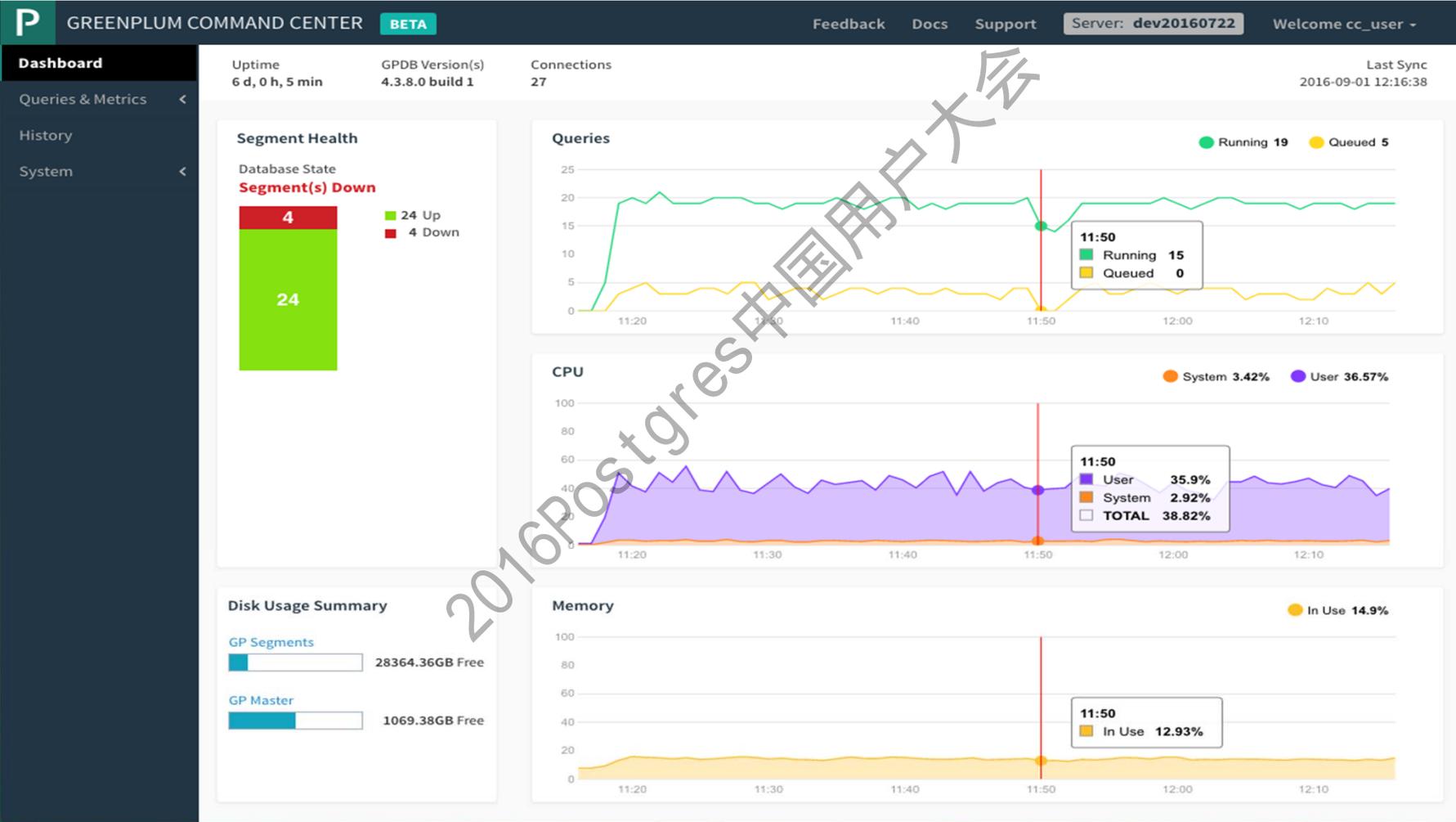
HTML5 rewrite nearly at parity with original Flash-based GUI

## Upcoming Roadmap

- Richer history
- Integration with Greenplum Workload Manager for Graphical control of WLM



# GPCC New UI Glance



# Greenplum Workload Manager

## ***Rule based query management to monitor and manage queries and resource queues***

- Monitors Greenplum Database queries and host utilization statistics
- Logs when a query exceeds a threshold
- Throttles the CPU usage of a query when it exceeds a threshold
- Terminates a query
- Detects memory, CPU, or disk I/O skew occurring during the execution of a query
- Creates detailed rules to manage queries
- Adds, modified, or deletes Greenplum Database resource queues



# Workload Management (proprietary)

## Vision

Hands off DBA policy management of multi-user environment

## Upcoming Roadmap

- Fine grain configuration management through centralized console
- IDLE session termination ability
- SuSE support
- Multi-action rules (starting with terminate and log)
- Better event reporting and rollup views
- Deeper resource queue integration (still in design)

# G2C (Greenplum Gemfire Connector) (proprietary)



## Vision

Bring the real-time and high concurrency feature of Gemfire together with the full SQL analytics and reporting of Greenplum into an “Operational Data Warehouse” solution that combines the benefits of both

## Upcoming Roadmap

- GA of Gemfire driven Java class library for IMPORT/EXPORT operations to/from Gemfire and GPDB
- Greenplum based External Tables to provide READ/WRITE to Gemfire

# GPDB Pivotal Cloud Foundry (PCF) Tile (proprietary)

## Vision

Bring GPDB to the Pivotal Cloud Foundry ecosystem with a smooth deploy and provisioning experience.

## Upcoming Roadmap

- Single Node Non-Production Release
- Incrementally improve Day 2 operations
- Incorporate Single Node feedback into multi-node



# PL/Container (proprietary)

## Vision

Containerized execution of Python and R (PL/Python and PL/R) providing a security model and an isolated environment to install the interpreter and any dependent libraries independent of the Database and DBA environment

## Upcoming Roadmap

- Docker based containers
- Features which improve usability



# Open vs. Closed

- Open: Core database components, GPDB, ORCA
- Closed
  - 3<sup>rd</sup> party components, eg: compression
  - PI/Containers
  - G2C (Greenplum Gemfire connector)
  - WLM
  - GPCC
  - GPText

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# Greenplum Community

- Since open source from 2015/10/27
  - GPDB: 1652 stars, 472 fork, 299 watch
- Contributions
  - Pull Request(PR): 31 open, 987 closed within 12 months
  - External contributions from China: China Mobile, Alibaba, Huawei, ...
- User groups without any advertisement
  - wechat group: 436



# Thanks!

## Q & A

