
# Map/Reduce and Queues for MySQL using Gearman

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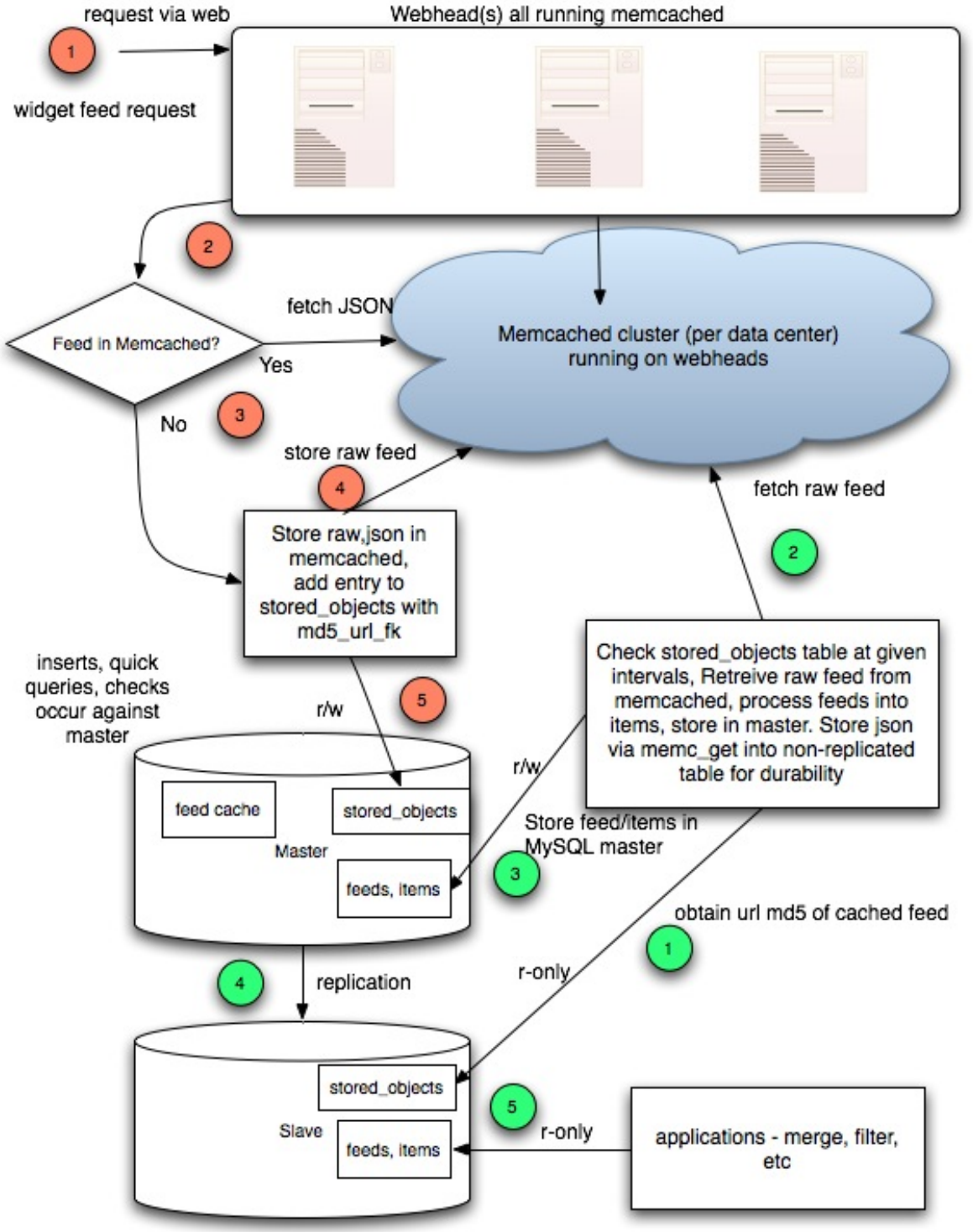
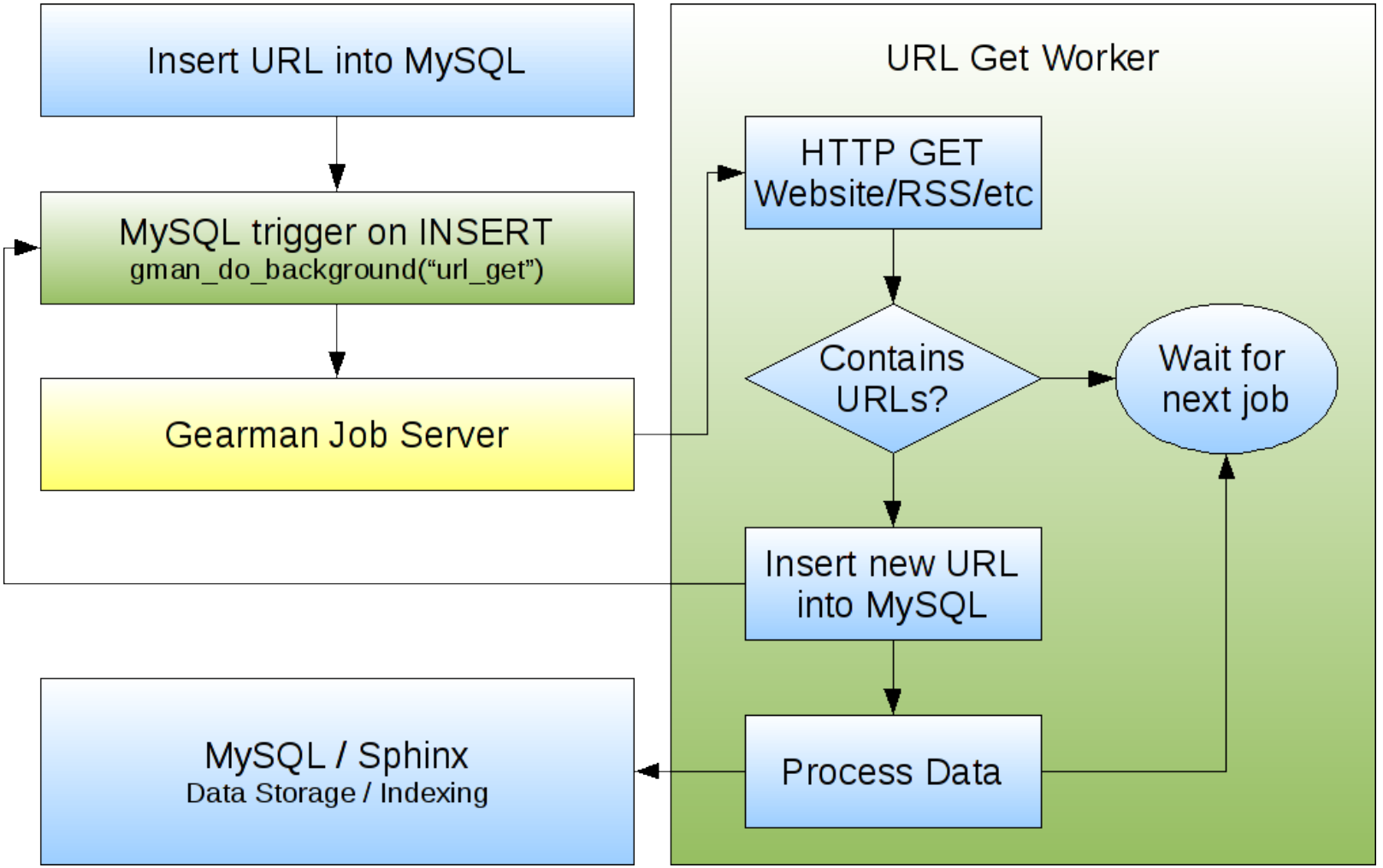
**http://www.gearman.org/**


request via web
Webhead(s) all running memcached
1
widget feed request
2
Feed in Memcached?
fetch JSON
Yes
Memcached cluster (per data center) running on webheads
No
3
store raw feed
4
Store raw,json in memcached, add entry to stored_objects with md5_url_fk
fetch raw feed
2
Check stored_objects table at given intervals, Retreive raw feed from memcached, process feeds into items, store in master. Store json via memc_get into non-replicated table for durability
inserts, quick queries, checks occur against master
r/w
5
feed cache
stored_objects
Master
feeds, items
r/w
Store feed/items in MySQL master
3
obtain url md5 of cached feed
1
r-only
4
replication
stored_objects
Slave
feeds, items
5
r-only
applications - merge, filter, etc

# Grazr

# Solution


Insert URL into MySQL
MySQL trigger on INSERT
gman_do_background("url_get")
Gearman Job Server
MySQL / Sphinx
Data Storage / Indexing
URL Get Worker
HTTP GET
Website/RSS/etc
Contains
URLs?
Wait for
next job
Insert new URL
into MySQL
Process Data

“The way I like to think of Gearman is as a massively distributed, massively fault tolerant fork mechanism.”

- Joe Stump, Digg

# Overview

- History
- Recent development
- How Gearman works
- Map/Reduce with Gearman
- Simple example
- Use case: URL processing
- Use case: MogileFS
- Use case: Log aggregation
- Future plans

# History

- Danga – Brad Fitzpatrick & company
- Technology behind LiveJournal
- Related to memcached, MogileFS, Perlbal
- Gearman: Anagram for “manager”
  - Gearman, like managers, assign the tasks but do none of the real work themselves
- Digg: 45+ servers, 400K jobs/day
- Yahoo: 60+ servers, 6M jobs/day
- Core component for MogileFS
- Other client & worker interfaces came later

# Recent Development

- Brian started rewrite in C
  - Slashdot problem
- Eric joined after designing a similar system
- Fully compatible with existing interfaces
- Wrote MySQL UDFs based on C library
- New PHP extension based on C library thanks to James Luedke
- Gearman command line interface
- New protocol additions
- Job server is now threaded!

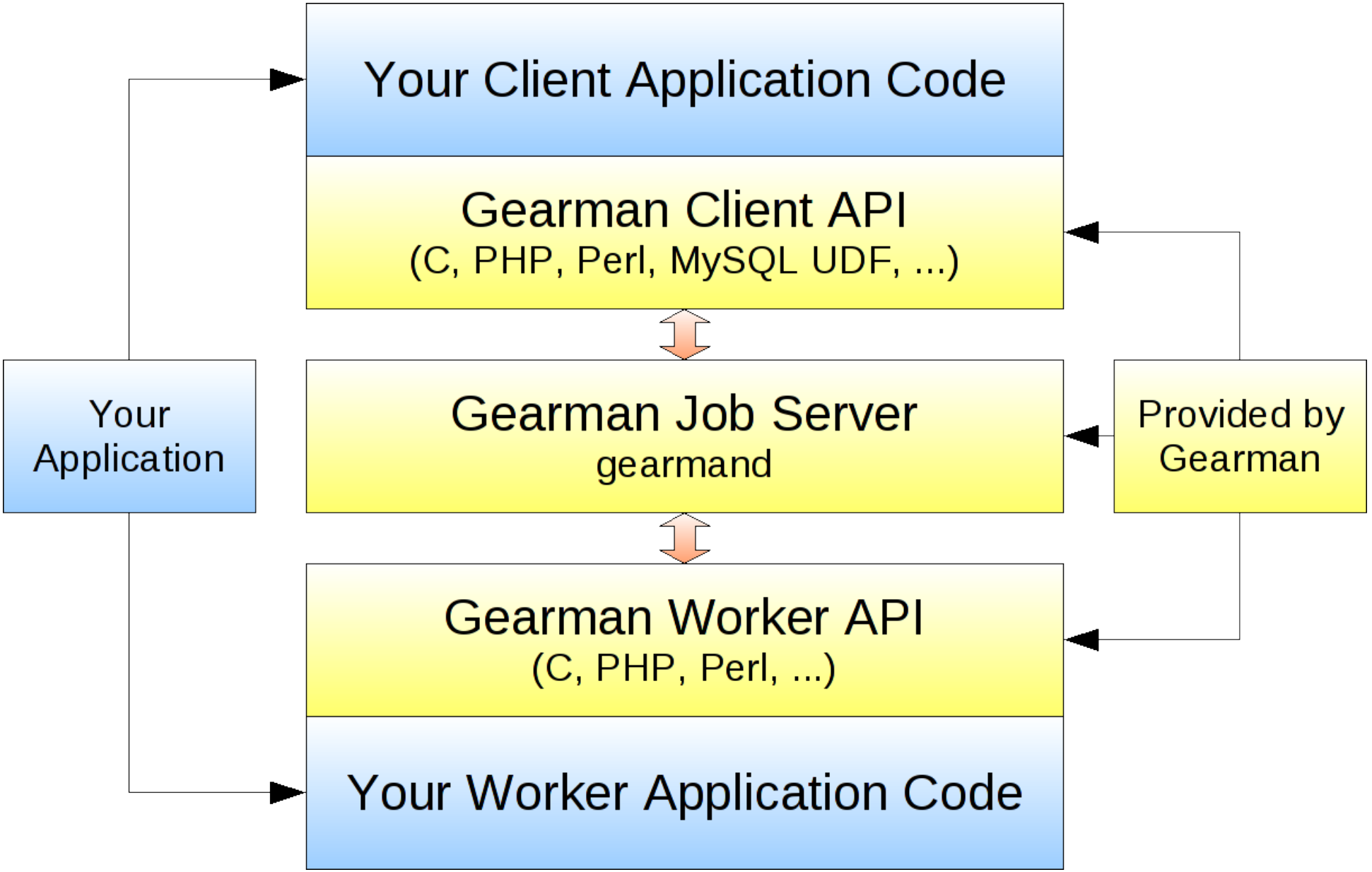
# Gearman Benefits

- **Open Source (BSD)**
- **Multi-language**
  - Mix clients and workers from different APIs
- **Flexible Application Design**
  - Not restricted to a single distributed model
- **Fast**
  - Simple protocol, C implementation
- **Embeddable**
  - Small & lightweight for applications of all sizes
- **No single point of failure**

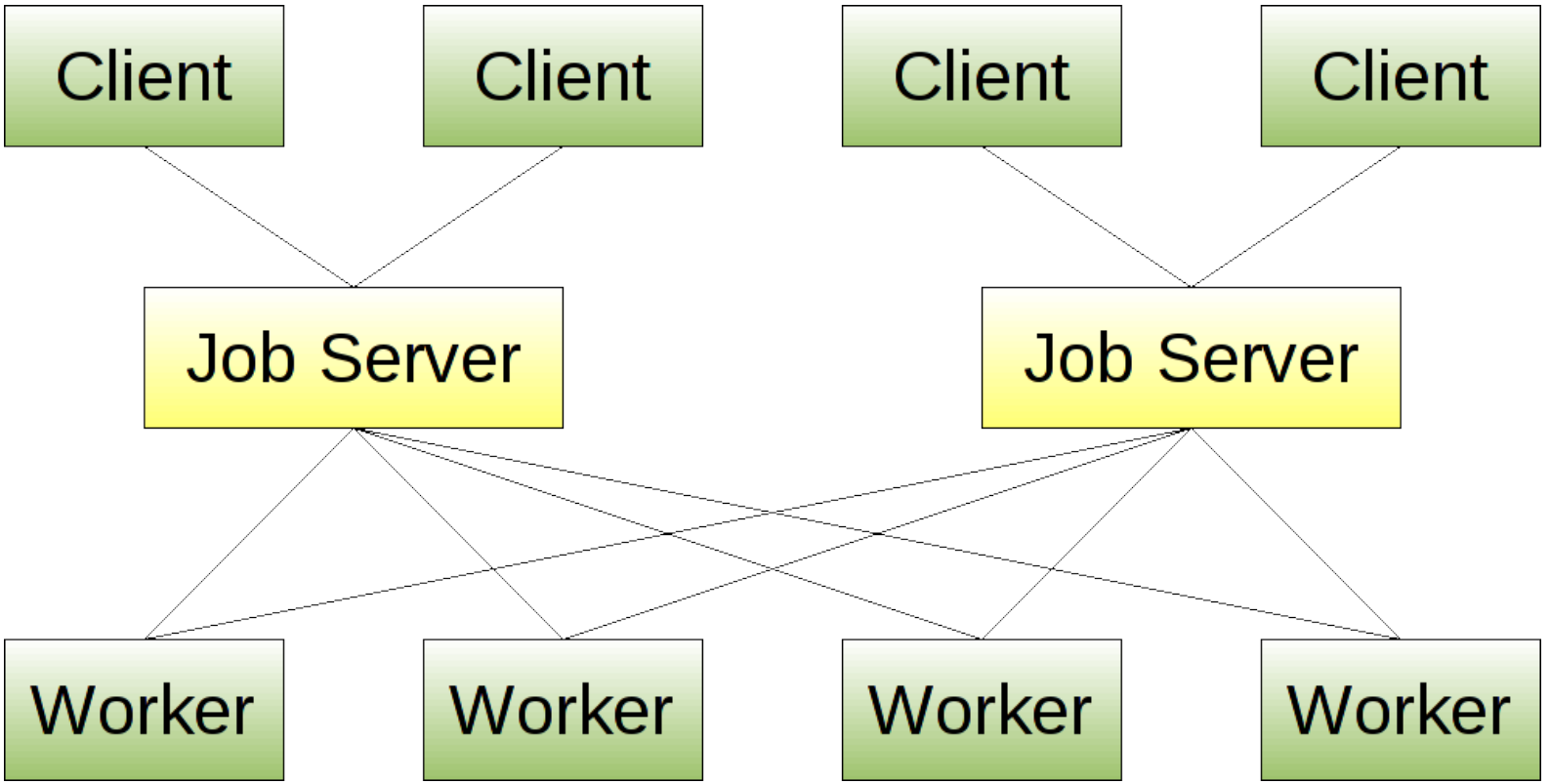
# Gearman Basics

- Gearman provides a distributed application framework, does not do any real work itself
- Uses TCP, port 4730 (was port 7003)
- **Client** – Create jobs to be run and then send them to a job server
- **Worker** – Register with a job server and grab jobs as they come in
- **Job Server** – Coordinate the assignment of jobs from clients to workers, handle restarting of jobs if workers go away

# Gearman Application Stack



# Simple Gearman Cluster



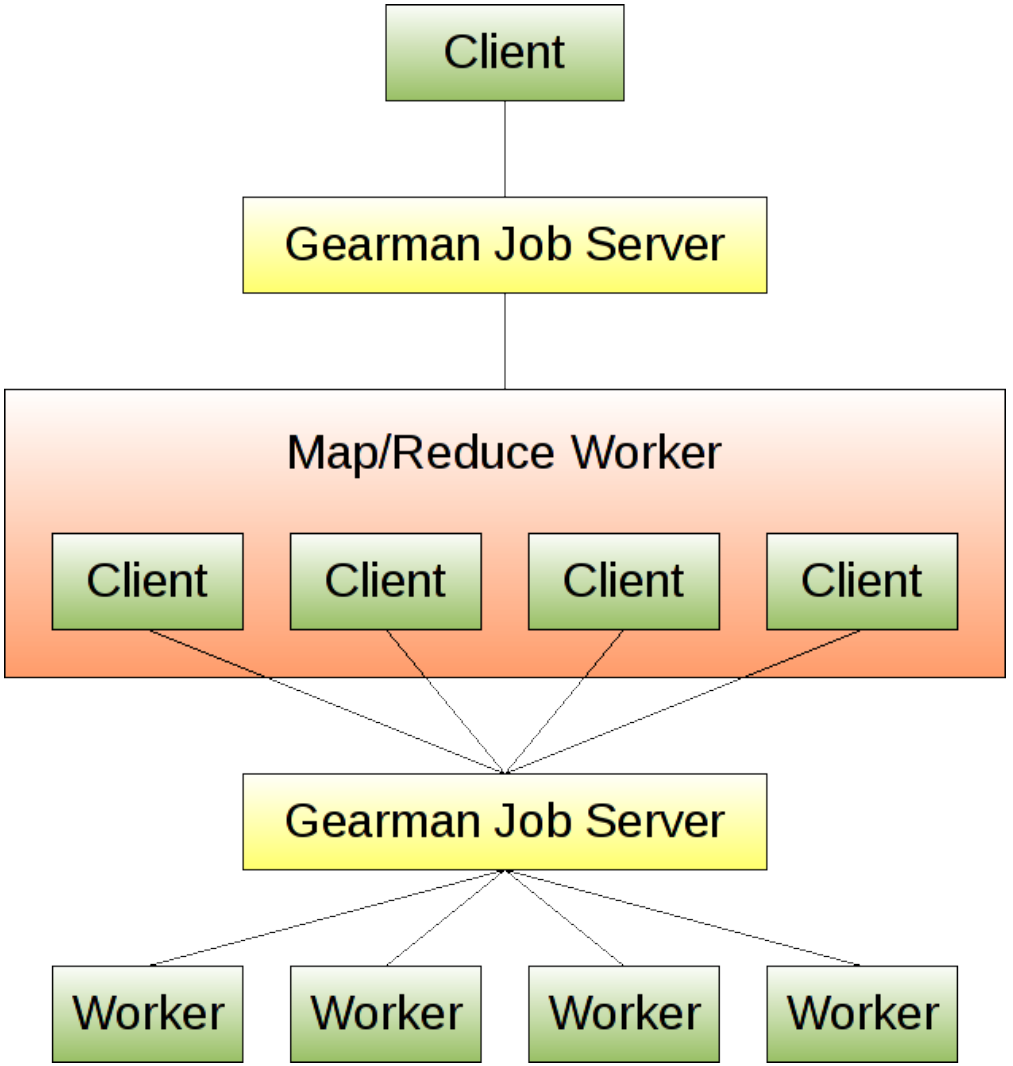
# How is this useful?

- Natural load distribution, easy to scale out
- Push custom application code closer to the data, into “the cloud”
- For MySQL & Drizzle, it provides an extended UDF interface for multiple languages and/or distributed processing
- It acts as the nervous system for how distributed processes communicate
- Building your own Map/Reduce cluster

# Map/Reduce in Gearman

- Top level client requests some work to be done
- Intermediate worker splits the work up and sends a chunk to each leaf worker (the “map”)
- Each leaf worker performs their chunk of work
- Intermediate worker collects results and aggregates them in some way (the “reduce”)
- Client receives completed response from intermediate worker
- Just one way to design such a system

# Map/Reduce in Gearman



# Simple Example (PHP)

Client:

```
$client = new gearman_client();
$client->add_server('127.0.0.1', 4730);
list($ret, $result)= $client->do('reverse',
                                 'Hello World!');
print "$result\n";
```

Worker:

```
$worker = new gearman_worker();
$worker->add_server('127.0.0.1', 4730);
$worker->add_function('reverse', 'my_reverse_fn');
while (1) $worker->work();

function my_reverse_fn($job) {
  return strrev($job->workload());
}
```

# Running the PHP Example

- Gearman PHP extension required

```
shell> gearmand -d

shell> php worker.php &
[1] 17510

shell> php client.php
!dlroW olleH
shell>
```

# Simple Example (MySQL)

- Gearman MySQL UDF required

```
mysql> SELECT gman_servers_set("127.0.0.1:4730") AS result;
+--------+
| result |
+--------+
| NULL   |
+--------+
1 row in set (0.00 sec)

mysql> SELECT gman_do('reverse', 'Hello World!') AS result;
+--------------+
| result       |
+--------------+
| !dlroW olleH |
+--------------+
1 row in set (0.00 sec)
```

# Use case: MogileFS

- Distributed Filesystem
- Replication
- Gearman provides:
  - Routing
  - Tracker notification
- (Recently ported to Drizzle)

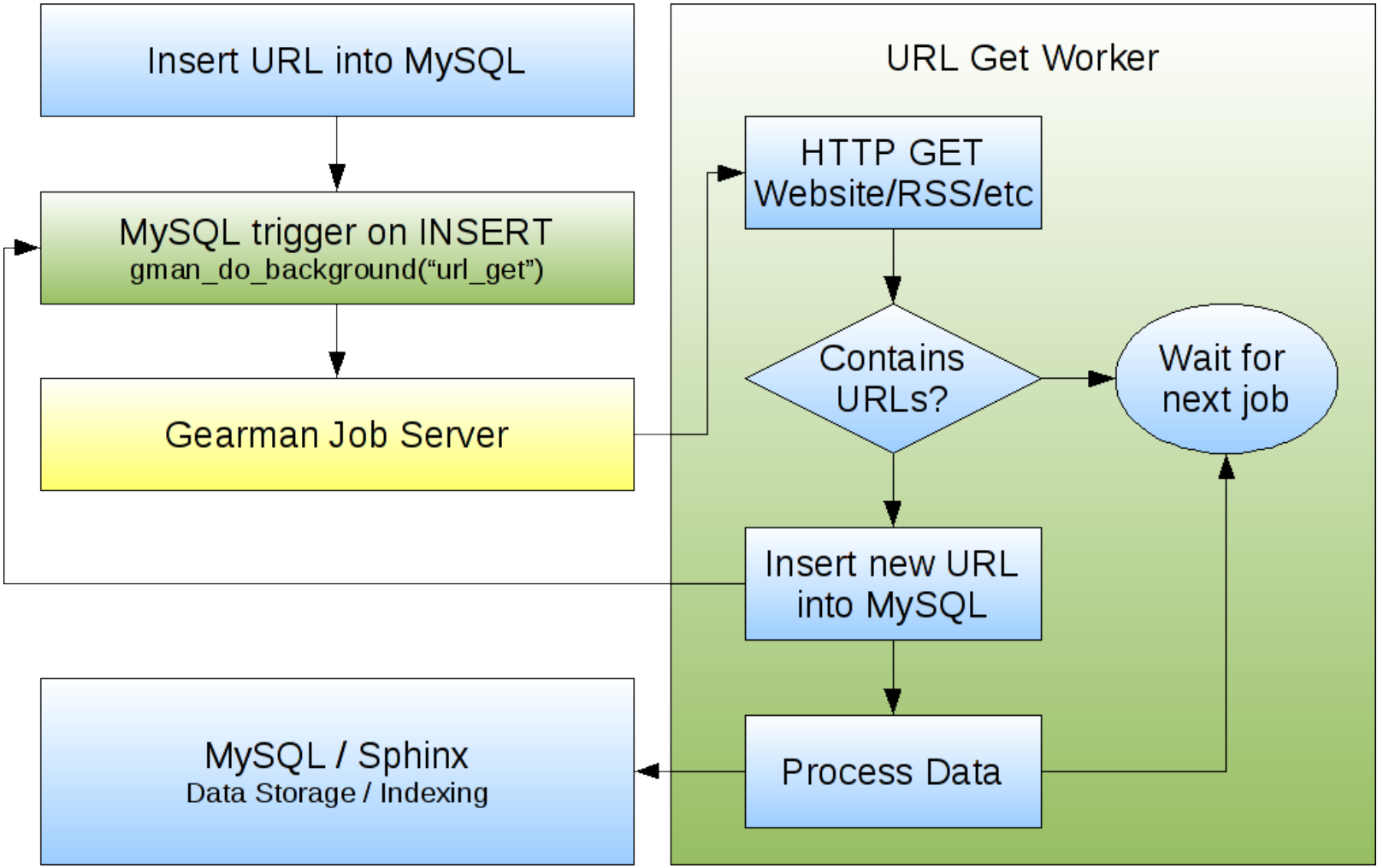
# Use case: URL processing

- We have a collection of URLs
- Need to cache some information about the
  - RSS aggregating, search indexing, ...
- MySQL for storage
- MySQL triggers
- Gearman for queue and concurrency
- Gearman background jobs
- Scale to more instances easily

# Use case: URL processing

- Insert rows into table to start Gearman jobs
- Gearman UDF will queue all URLs that need to be fetched in the job server
- PHP worker will:
  - Grab job from the job server
  - Fetch content of URL passed in from job
  - Connect to MySQL database
  - Insert the content into the 'content' column
  - Return nothing (since it's a background job)

# Use case: URL processing



# Use case: URL processing

```
# Setup table

CREATE TABLE url (
  id INT UNSIGNED AUTO_INCREMENT PRIMARY KEY,
  url VARCHAR(255) NOT NULL,
  content LONGBLOB
);

# Create Gearman trigger

CREATE TRIGGER url_get
BEFORE INSERT ON url
FOR EACH ROW
  SET @ret=gman_do_background('url_get', NEW.url);
```

# Use case: URL processing

```
$worker = new gearman_worker();
$worker->add_server();
$worker->add_function('url_get', 'url_get_fn');
while(1) $worker->work();

function url_get_fn($job)
{
  $url = $job->workload();
  $content = fetch_url($url);

  # Process data in some useful way

  $content = mysql_escape_string($content);
  mysql_connect('127.0.0.1', 'root');
  mysql_select_db('test');
  mysql_query("UPDATE url SET content='$content' " .
              "WHERE url='$url'");
}
```

# Use case: URL processing

```
# Insert URLs

mysql> INSERT INTO url SET url='http://www.mysql.com/';
mysql> INSERT INTO url SET url='http://www.gearman.org/';
mysql> INSERT INTO url SET url='http://www.drizzle.org/';

# Wait a moment while workers get the URLs and update table

mysql> SELECT id,url,LENGTH(content) AS length FROM url;
+----+-------------------------+--------+
| id | url                     | length |
+----+-------------------------+--------+
|  1 | http://www.mysql.com/   |  17665 |
|  2 | http://www.gearman.org/ |  16291 |
|  3 | http://www.drizzle.org/ |  45595 |
+----+-------------------------+--------+
3 rows in set (0.00 sec)
```

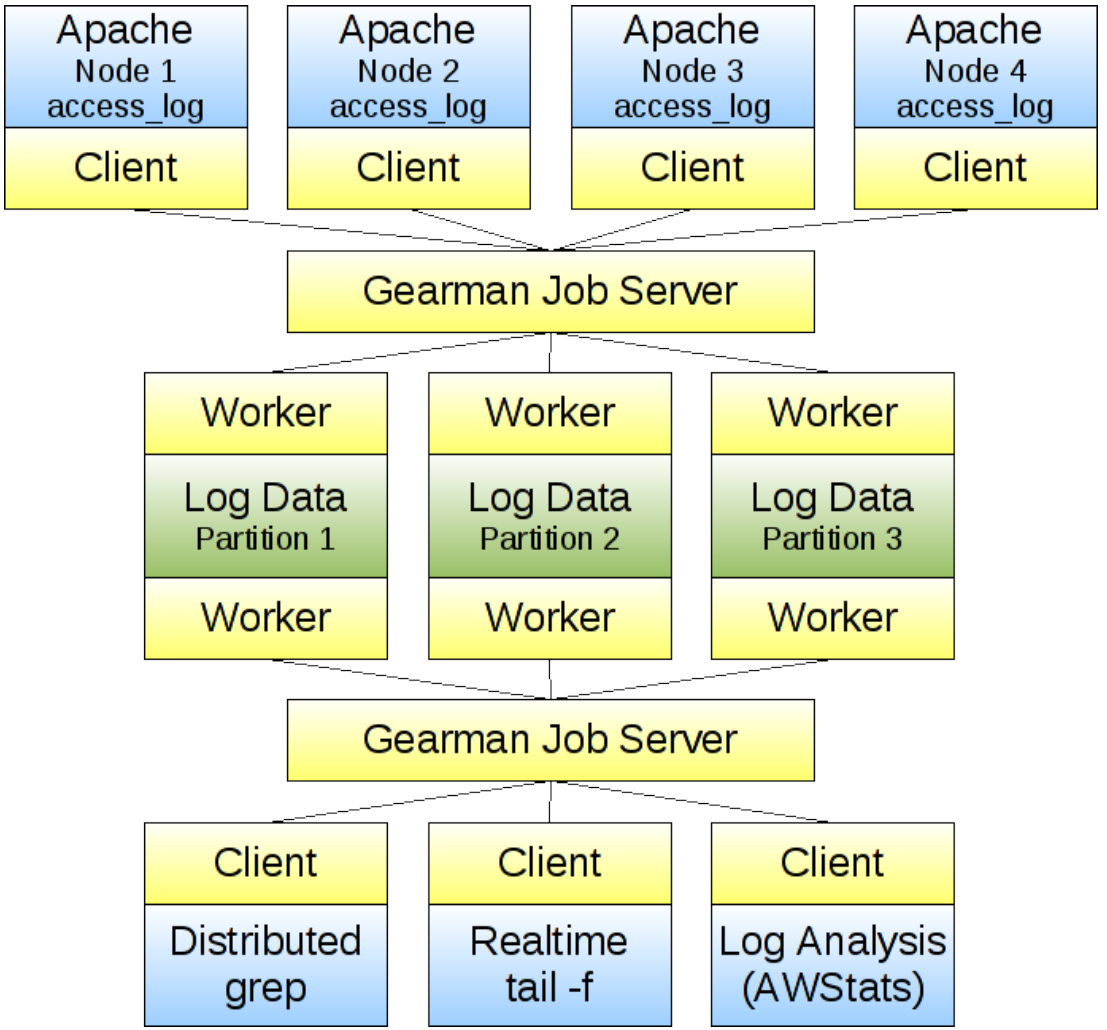
# Use case: Log aggregation

- A collection of logs spread across multiple machines
- Need one consistent view
- Easy way to scan and process these logs
- Map/Reduce-like power for analysis
- Flexibility to push your own code into the log storage nodes
  - Saves on network I/O
- Merge-sort aggregate algorithms

# Use case: Log aggregation

- Look at gathering Apache logs
- Gearman client integration
  - tail -f access_log | gearman -n -f logger
  - CustomLog "|gearman -n -f logger" common
  - Write a simple Gearman Apache logging module
- Multiple Gearman workers
  - Partition logs
  - Good for both writing and reading loads
- Write Gearman clients and workers to analyze the data (distributed grep, summaries, ...)

# Use case: Log aggregation



# What's next?

- Persistent queues and replication very soon
- More language interfaces based on C library (using SWIG wrappers or native clients), Drizzle UDFs, PostgreSQL functions
- Native Java interface
- Improved event notification, statistics gathering, and reporting
- Drizzle replication and query analyzer
- Dynamic code upgrades in cloud environment
  - “Point & Click” Map/Reduce

# Get in touch!

- http://www.gearman.org/
- #gearman on irc.freenode.net
- http://groups.google.com/group/gearman

Questions?