@rantav
totango

WHO AM I?

WHO AM I?

- A developer
  - Google, Microsoft, Outbrain, Gigaspaces, Totango etc
    - Hector, flask-restful-swager, meteor-migrations, monitoring...
- Podcast: reversim.com
- devdev.io
- Gormim

WHAT IS LUIGI?

WHAT IS LUIGI?

WHAT IS LUIGI?

- A **Workflow Engine**.
  - Who the fuck needs a workflow engine?

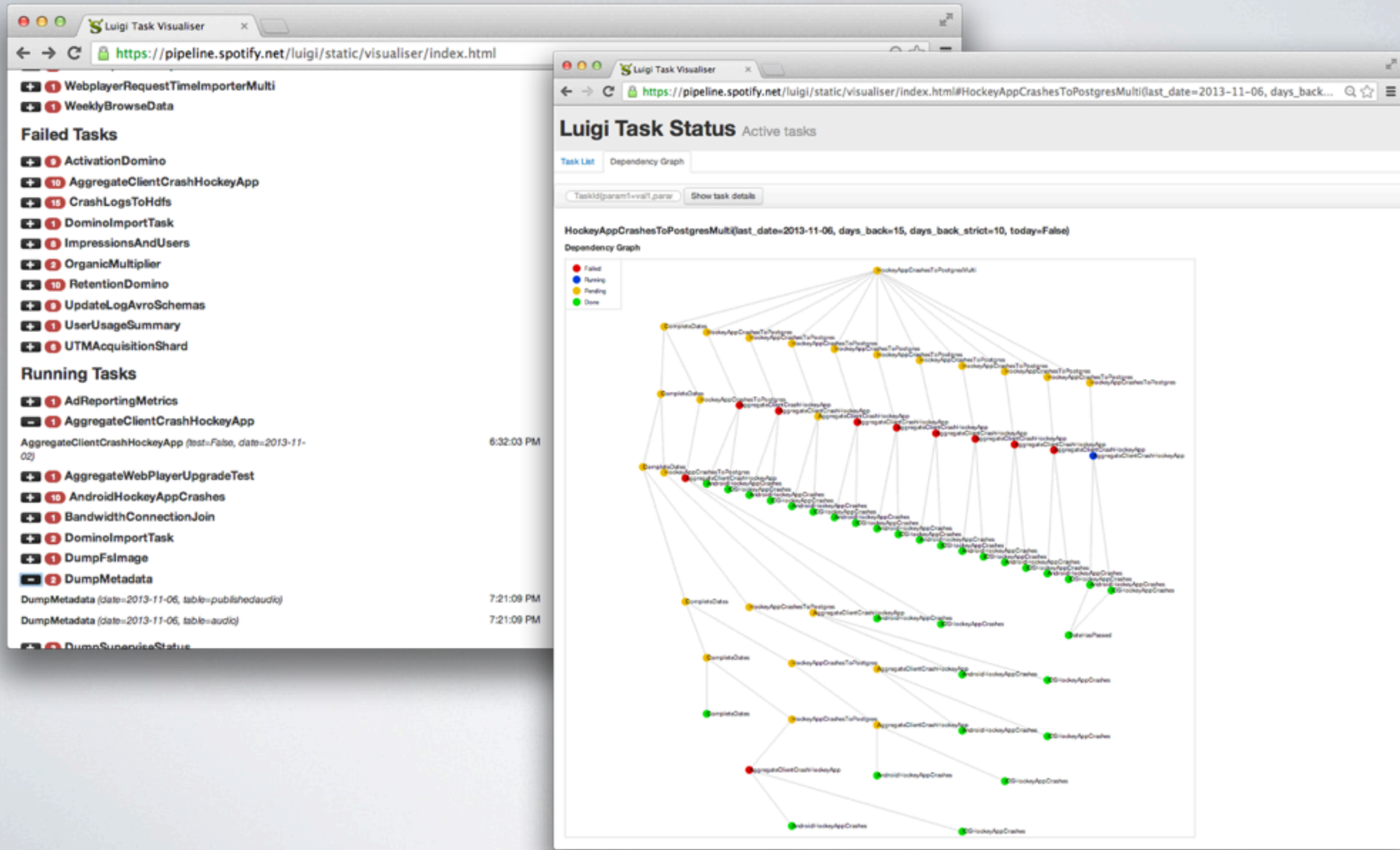
WHAT IS LUIGI?

- A **Workflow Engine**.
  - Who the fuck needs a workflow engine?
- You do!!!
  - If you run hadoop (or other ETL jobs)
  - If you have dependencies b/w them (who doesn't?!)
  - If they fail (`s/if/when/`)

WHAT IS LUIGI?

- A **Workflow Engine**.
  - Who the fuck needs a workflow engine?
- You do!!!
  - If you run hadoop (or other ETL jobs)
  - If you have dependencies b/w them (who doesn't?!)
  - If they fail (`s/if/when/`)
- Luigi doesn't replace Hadoop, Scalding, Pig, Hive, Redshift.
  - It **orchestrates** them

SCREENSHOTS



HOW DO **YOU** ETL YOUR DATA?

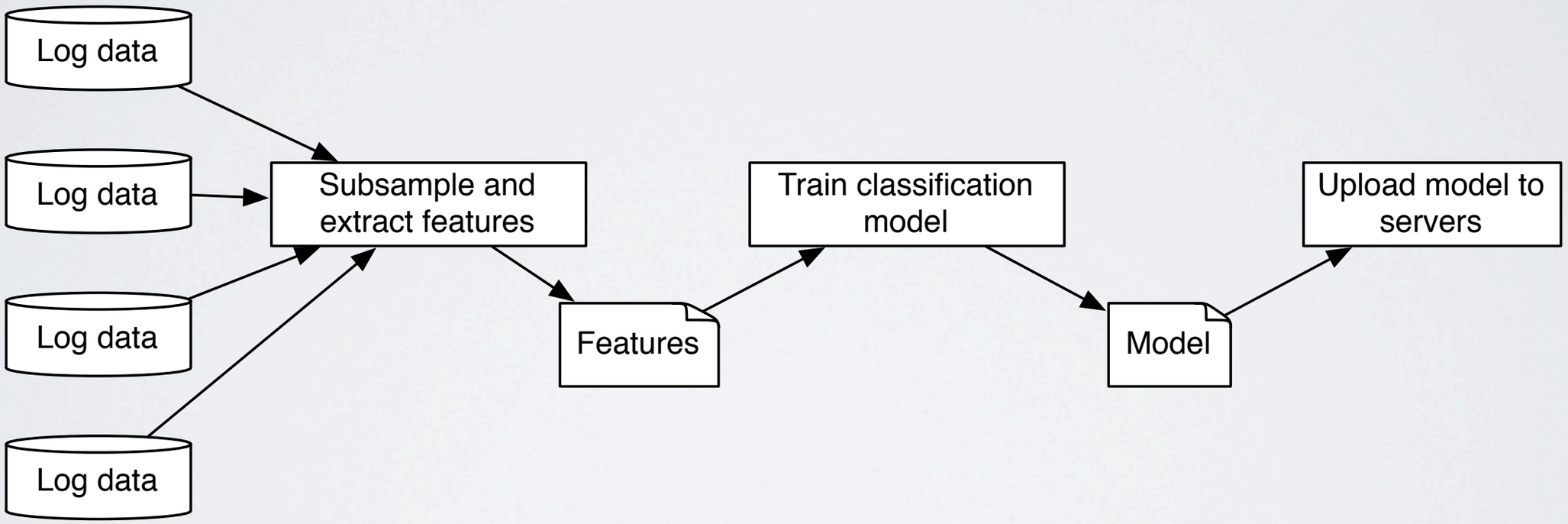
- Hadoop
- Spark
- Redshift
- Postgres
- Ad-hoc java/python/ruby/go/...

RUNNING **ONE** JOB IS EASY
RUNNING **MANY** IS HARD

- 100s of concurrent jobs, 1000s Daily.
- Job dependencies.
  - E.g. first copy the file, then crunch it.
- Errors / retries
  - Idempotency
- Monitoring / Visuals

THE **WRONG** WAY TO DO IT

EXAMPLE WORKFLOW



THE CRON PHENOMENON

THE **WRONG** WAY TO DO IT

pydata_pres — emacs — 139×13

```
# m h dom mon dow user  command
0 1 * * * spotify-analytics /usr/bin/spotify_extract_features --date `date +%Y-%m-%d`  # let's hope the log files are available by 1am
0 2 * * * spotify-analytics /usr/bin/spotify_train_model --date `date +%Y-%m-%d`       # hopefully previous job finished by 2am
0 3 * * * spotify-analytics /usr/bin/spotify_update_model --date `date +%Y-%m-%d`      # same here... OMG ugly!!!
```

```
-uu-:---F1  crontab        All L3     (Fundamental)----------------------------------------------------------------------------
Wrote /Users/erikbern/pydata_pres/crontab
```

THE CRON PHENOMENON

THE **WRONG** WAY TO DO IT

pydata_pres — emacs — 139×13

```
# m h dom mon dow user  command
0 1 * * * spotify-analytics /usr/bin/spotify_extract_features --date `date +%Y-%m-%d`  # lat                og files are available by 1am
0 2 * * * spotify-analytics /usr/bin/spotify_train_model --date `date +%Y-%m-%d`                        s job finished by 2am
0 3 * * * spotify-analytics /usr/bin/spotify_update_model --date `dat                                   ugly!!!
```

Don’t try this at home!!!

```
-uu-:---F1  crontab        All L3     (Fundamental)----------------------------------------------------------------------------
Wrote /Users/erikbern/pydata_pres/crontab
```

ENTER LUIGI

ENTER **LUIGI**

- Like Makefile - but in python
  - And - For data
- Integrates well with data targets
  - Hadoop, Spark, Databases
  - Atomic file/db operations
- Visualization
- CLI - really nice developer interface!

LUIGI TASK

```
class MyTask(Task):
    def output(self):
        pass

    def requires(self):
        pass

    def run(self):
        pass
```

LUIGI TASK

```
class AggregateArtists(Task):
    def output(self):
        return HdfsTarget("data/artist_streams.tsv")

    def requires(self):
        return Streams()

    def run(self):
        with self.input().open('r') as in_file:
            ... # read stuff from in_file

        with self.output().open('w') as out_file:
            ... # write stuff to out_file

if __name__ == "__main__":
    luigi.run()
```

Store output in HDFS

Run - actual work
Read from input
Write to output

Run with __main__

RUN FROM THE CLI

Run on the command line:

```
$ python dataflow.py Aggreg

DEBUG: Checking if AggregateArtists() is complete
INFO: Scheduled AggregateArtists()
DEBUG: Checking if Streams() is complete
INFO: Done scheduling tasks
DEBUG: Asking scheduler for work...
DEBUG: Pending tasks: 1
INFO: [pid 74375] Running   AggregateArtists()
INFO: [pid 74375] Done      AggregateArtists()
DEBUG: Asking scheduler for work...
INFO: Done
INFO: There are no more tasks to run at this time
```

TASK PARAMETERS

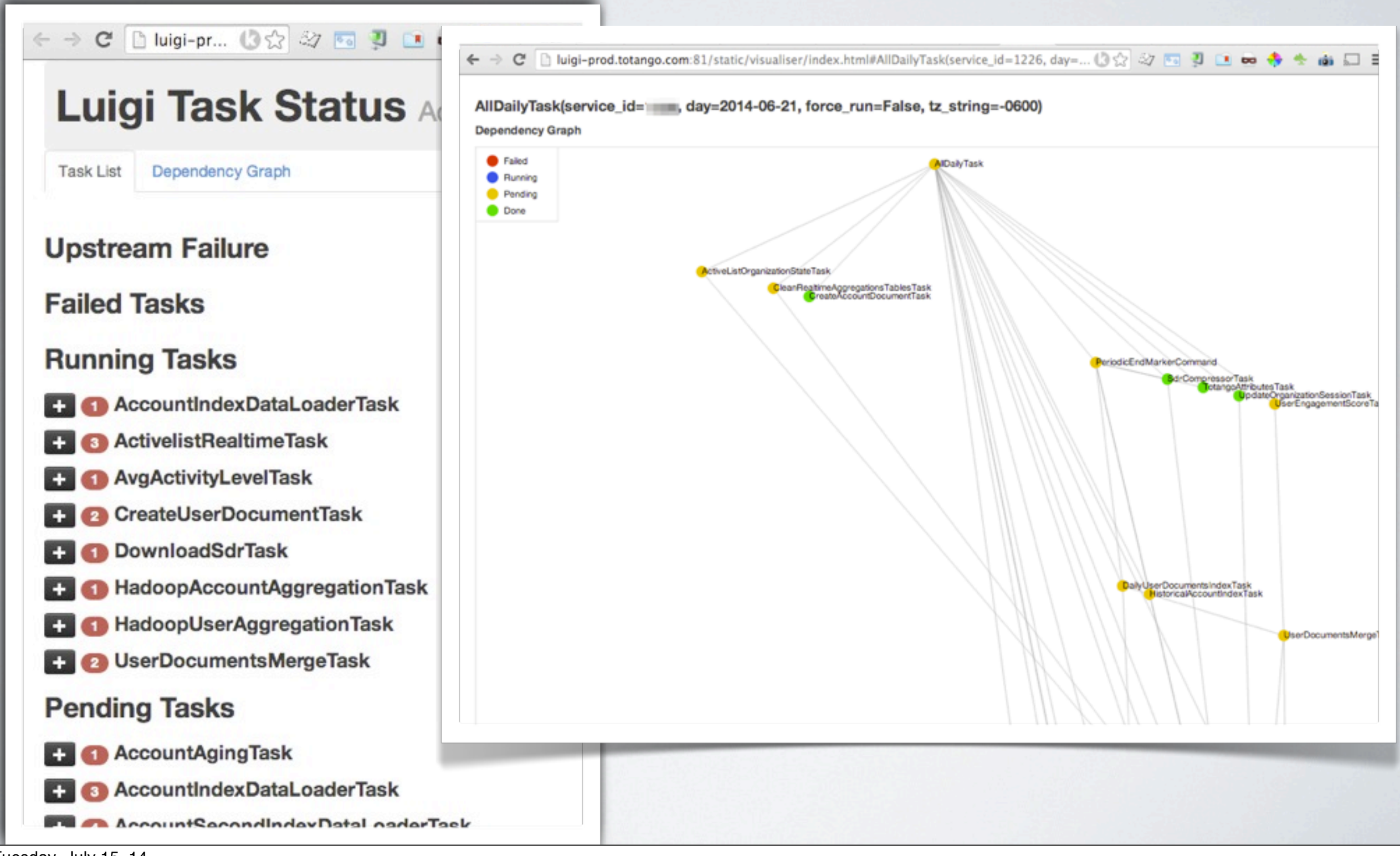
```
class AggregateArtists(Task):
    date = DateParameter()
```

```
$ python dataflow.py AggregateArtists --date 2013-03-05
```

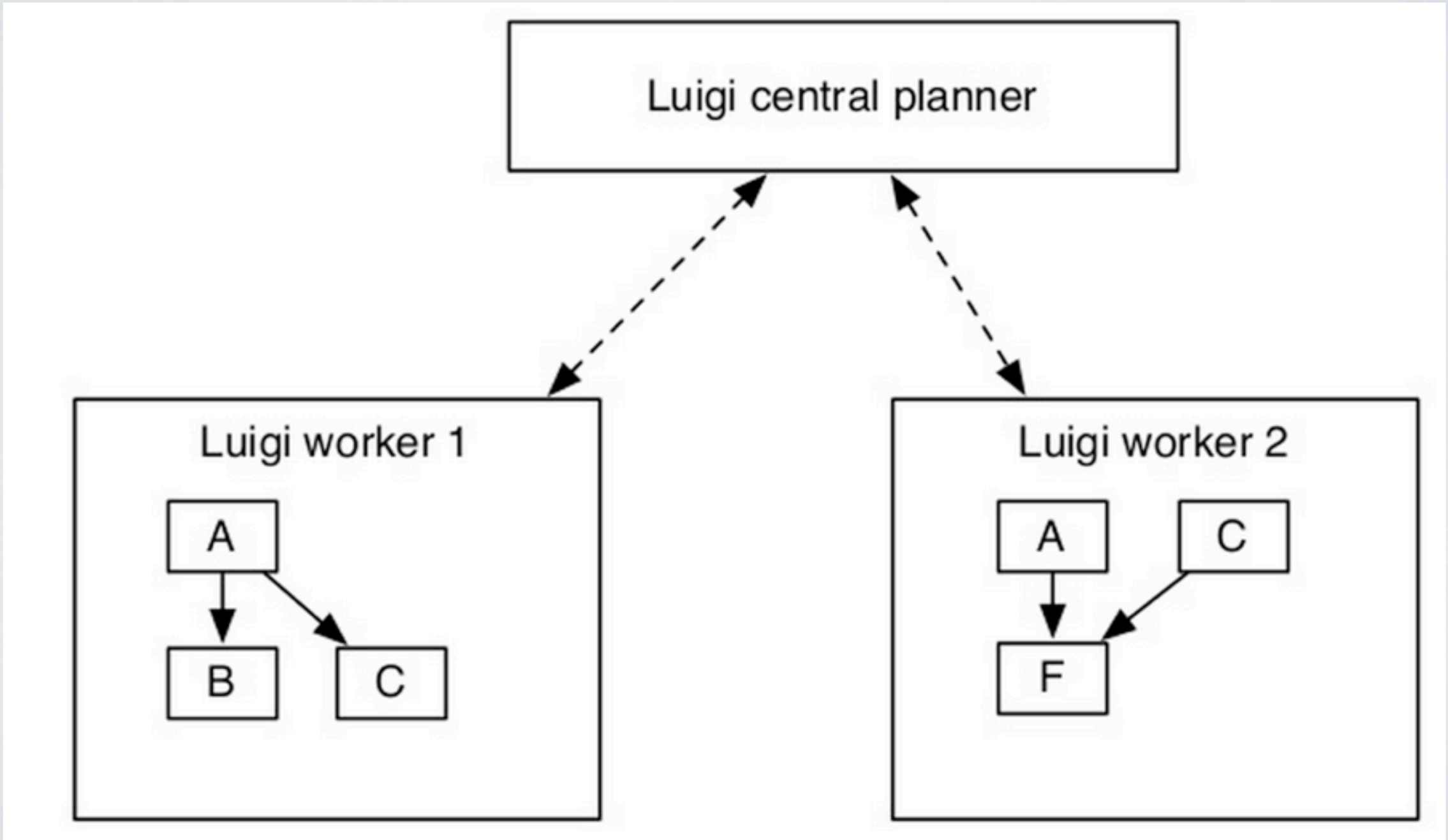
AWESOME HADOOP (MR) SUPPORT

```
class AggregateArtists(luigi.hadoop.JobTask):
    def requires(self):
        return Streams()

    def output(self):
        return HdfsTarget("data/artist_streams.tsv")

    def mapper(self, line):
        timestamp, artist, track = line.split('\t')
        yield artist, 1

    def reducer(self, artist, streams):
        yield artist, sum(streams)
```

WEB UI


luigi-pr...
Luigi Task Status
Task List
Dependency Graph
Upstream Failure
Failed Tasks
Running Tasks
1 AccountIndexDataLoaderTask
3 ActivelistRealtimeTask
1 AvgActivityLevelTask
2 CreateUserDocumentTask
1 DownloadSdrTask
1 HadoopAccountAggregationTask
1 HadoopUserAggregationTask
2 UserDocumentsMergeTask
Pending Tasks
1 AccountAgingTask
3 AccountIndexDataLoaderTask
luigi-prod.totango.com:81/static/visualiser/index.html#AllDailyTask(service_id=1226, day=...
AllDailyTask(service_id=[redacted], day=2014-06-21, force_run=False, tz_string=-0600)
Dependency Graph
Failed
Running
Pending
Done
AllDailyTask
ActiveListOrganizationStateTask
CleanRealtimeAggregationsTablesTask
CreateAccountDocumentTask
PeriodicEndMarkerCommand
SdrCompressorTask
TotangoAttributesTask
UpdateOrganizationSessionTask
DailyUserDocumentsIndexTask
HistoricalAccountIndexTask

PROCESS SYNCHRONIZATION

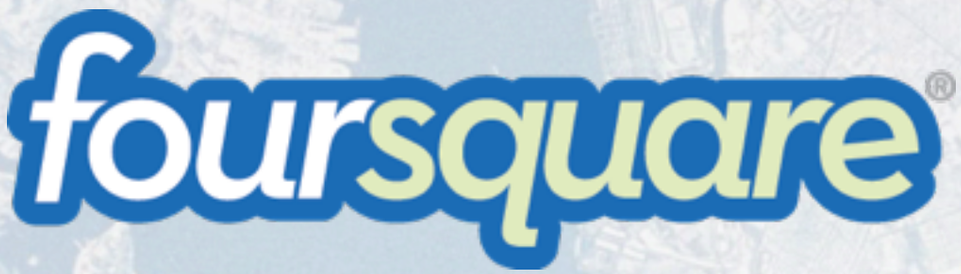


USED BY


C1
CAPITAL ONE LABS


Spotify®


iHeart
RADIO


foursquare®


bitly


MORTAR


VisualDNA™


UPPSALA
UNIVERSITET

SEMI-DEEP DIVE

Programming for Luigi

LUIGI TASKS

- Implement 4 method:

```
def input(self) (optional)

def output(self)

def run(self)

def depends(self)
```

LUIGI TASKS

- Or extend one of the predefined tasks
  - **S3CopyToTable**
  - **RedshiftManifestTask**
  - **SparkJob**
  - **HiveQueryTask**
  - **HadoopJobTask**

EXAMPLE
LOCAL WORDCOUNT

```
class WordCount(luigi.Task):
    date_interval = luigi.DateIntervalParameter()

    def requires(self):
        return [InputText(date) for date in self.date_interval.dates()]

    def output(self):
        return luigi.LocalTarget('/var/tmp/text-count/%s' % self.date_interval)

    def run(self):
        count = {}
        for file in self.input():
            for line in file.open('r'):
                for word in line.strip().split():
                    count[word] = count.get(word, 0) + 1

        # output data
        f = self.output().open('w')
        for word, count in count.iteritems():
            f.write("%s\t%d\n" % (word, count))
        f.close()
```

EXAMPLE
HADOOP WORDCOUNT

```
class WordCount(luigi.hadoop.JobTask):
    date_interval = luigi.DateIntervalParameter()

    def requires(self):
        return [InputText(date) for date in self.date_interval.dates()]

    def output(self):
        return luigi.hdfs.HdfsTarget('/tmp/text-count/%s' % self.date_interval)

    def mapper(self, line):
        for word in line.strip().split():
            yield word, 1

    def reducer(self, key, values):
        yield key, sum(values)
```

LUIGI TARGETS

- HDFS
- Local File
- Postgres / MySQL, Redshift, ElasticSearch
- ... Easy to extend

DEFINING A **TARGET**

- Implement:

```
def exists(self)
```

And optionally:

`connect` or **`open / close`**

EXAMPLE MYSQL TARGET

```
class MySqlTarget(luigi.Target):

    def touch(self, connection=None):
      ...

    def exists(self, connection=None):
      cursor = connection.cursor()
      cursor.execute("""SELECT 1 FROM {marker_table}
                        WHERE update_id = %s
                        LIMIT 1""".format(marker_table=self.marker_table),
                     (self.update_id,)
      )
      row = cursor.fetchone()
      return row is not None

  def connect(self, autocommit=False):
    ...

  def create_marker_table(self):
    ...
```

THE GRAND SCHEME

THE GRAND SCHEME

Run Task

THE GRAND SCHEME

Run Task

Check Deps

THE GRAND SCHEME

Run Task

```
self.requires()
```

Check Deps

THE GRAND SCHEME

Run Task

```
self.requires()
```

```
target.exists()
```

Check Deps

THE GRAND SCHEME

Run Task

```
self.requires()
```

```
target.exists()
```

Check Deps

Run Deps

THE GRAND SCHEME

Run Task

```
self.requires()
```

```
target.exists()
```

Check Deps

Run Deps

Use Deps Output

THE GRAND SCHEME

Run Task

Invoke Run

```
self.requires()
```

```
target.exists()
```

Check Deps

Run Deps

Use Deps Output

THE GRAND SCHEME

Check Scheduler

Run Task

Invoke Run

```
self.requires()
```

```
target.exists()
```

Check Deps

Run Deps

Use Deps Output

THE GRAND SCHEME

Run Task

Invoke Run

Check Scheduler

`self.input()`

`self.requires()`

`target.exists()`

Check Deps

Run Deps

Use Deps Output

THE GRAND SCHEME

Run Task

Invoke Run

Check Scheduler

`self.input()`

`self.output()`

`self.requires()`

`target.exists()`

Check Deps

Run Deps

Use Deps Output

THE GRAND SCHEME

Run Task

Invoke Run

Check Scheduler

`self.input()`

`self.output()`

`self.requires()`

`target.exists()`

Check Deps

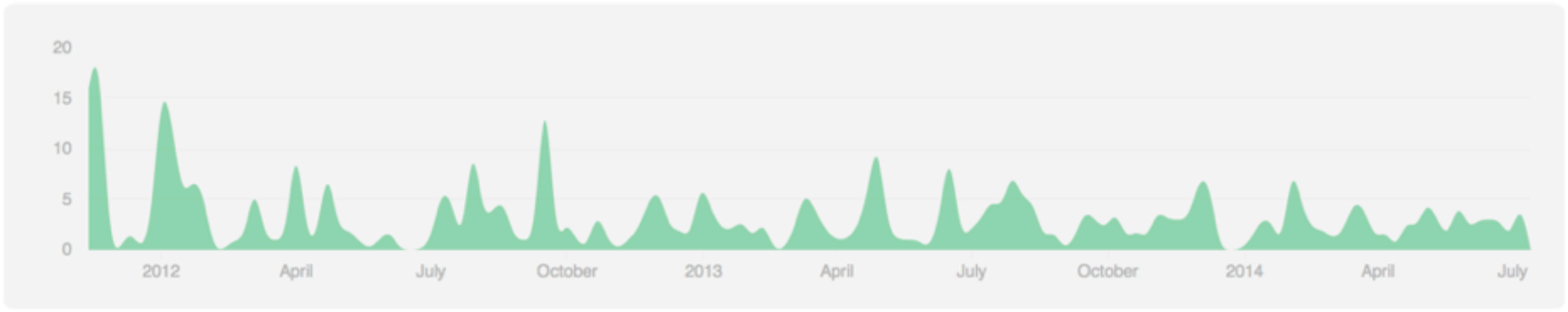
Write Output

Run Deps

Use Deps Output

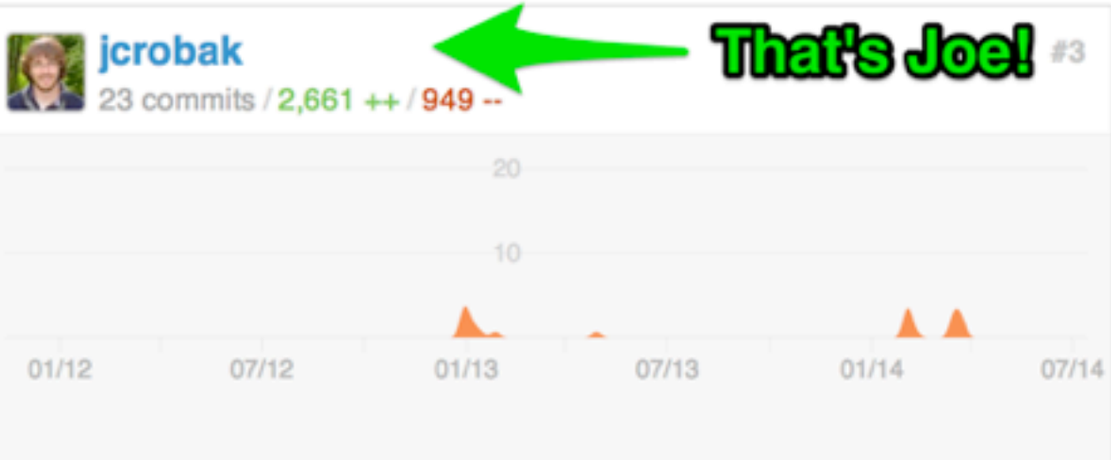
OPEN SOURCE

BY

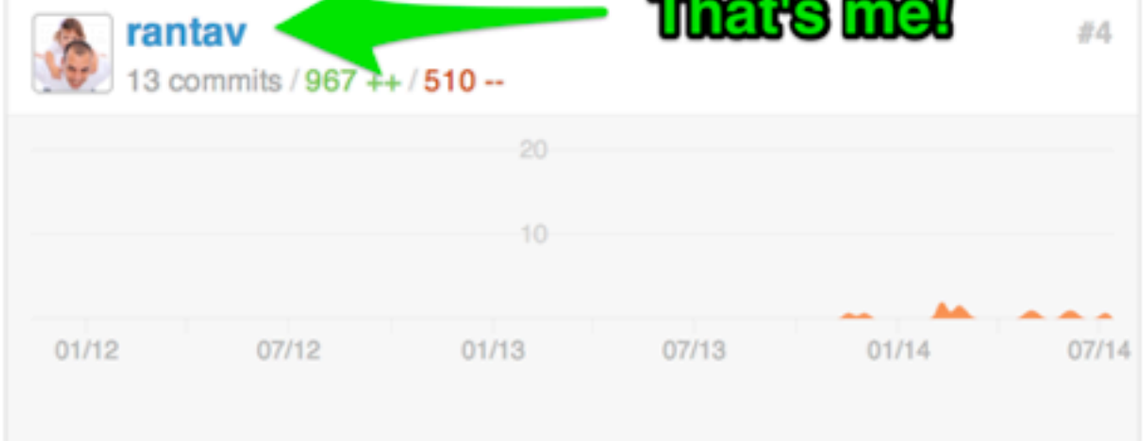


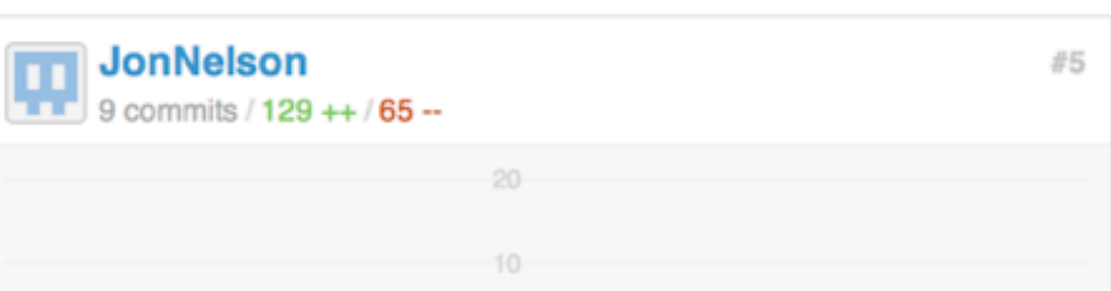
authors, spotify

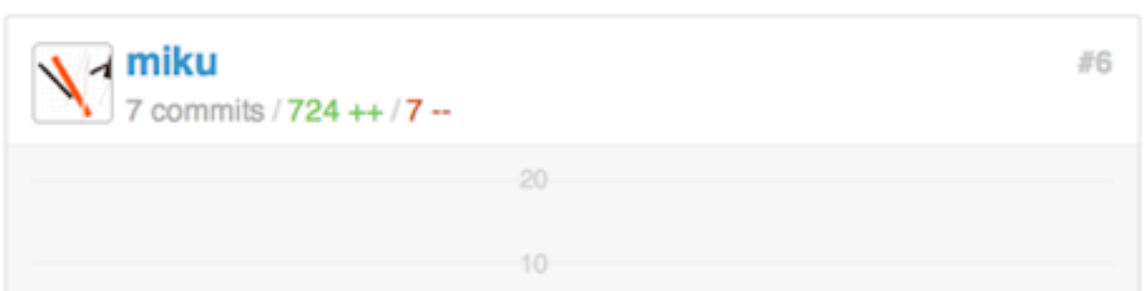
That's Joe!



That's me!







WHAT DID I DO?

- Add **Redshift** support
- Add **MySQL** support
- Various small features (improved **notifications**, **dep.py, historydb** etc)
- Various bug reports
  - And fixes!

LUIGI @ TOTANGO

- Daily computation
- Hourly computation
- Ad-hoc data loading (for data analysis activities, to redshift)

TOTANGO'S SETUP

Luigi Scheduler

invoke

Luigi Workers

coordinate

report

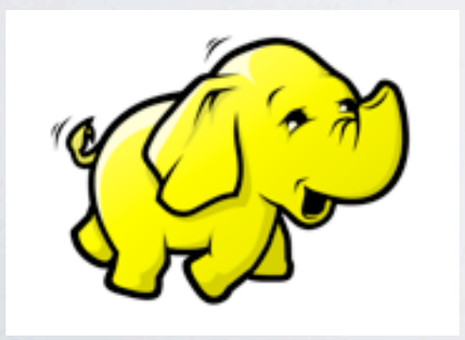
librato™

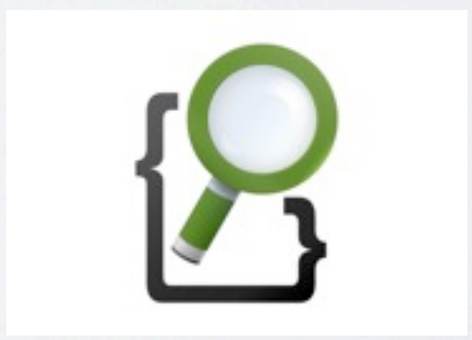
logentries

TOTANGO'S SETUP

Luigi Worker

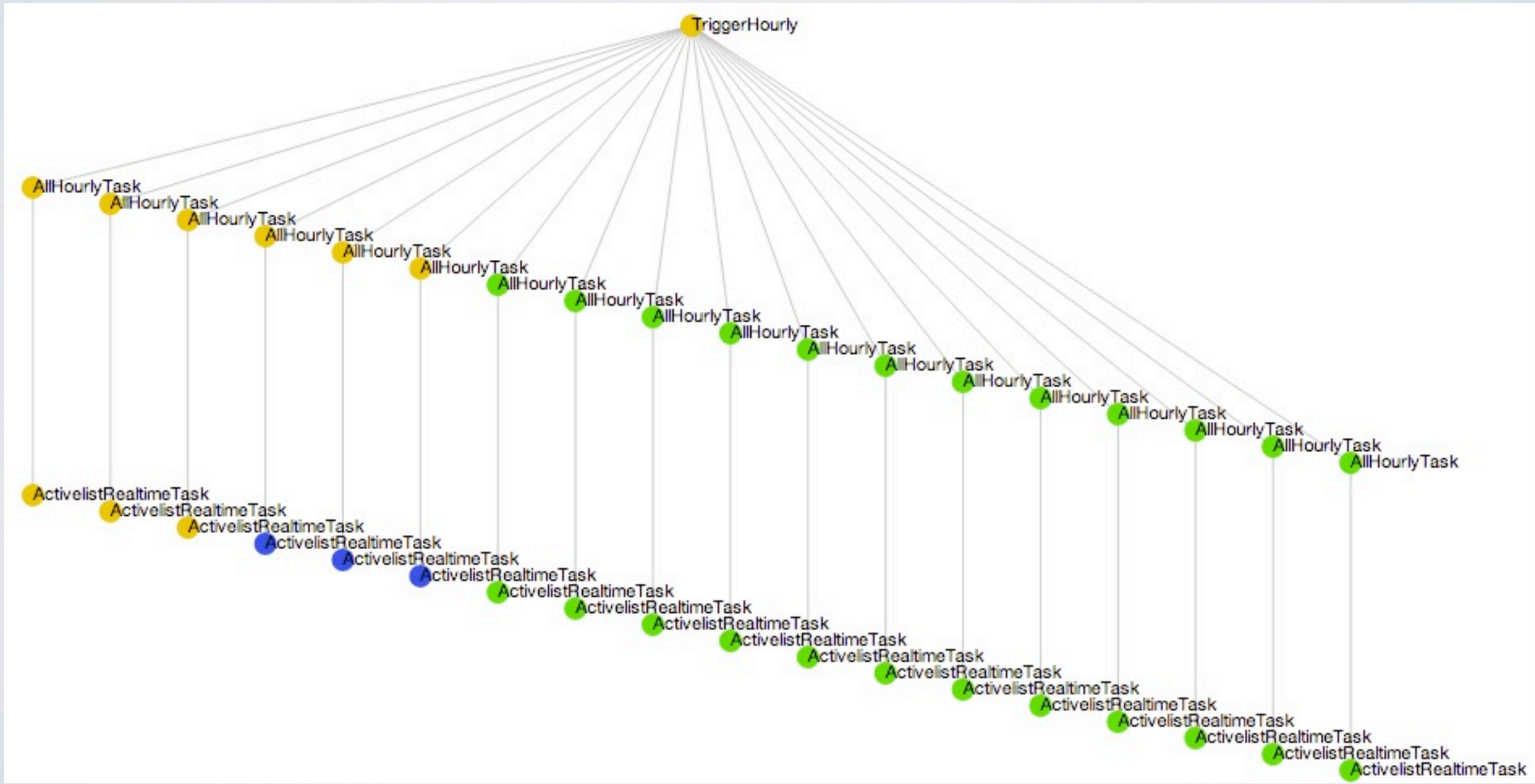
read / write



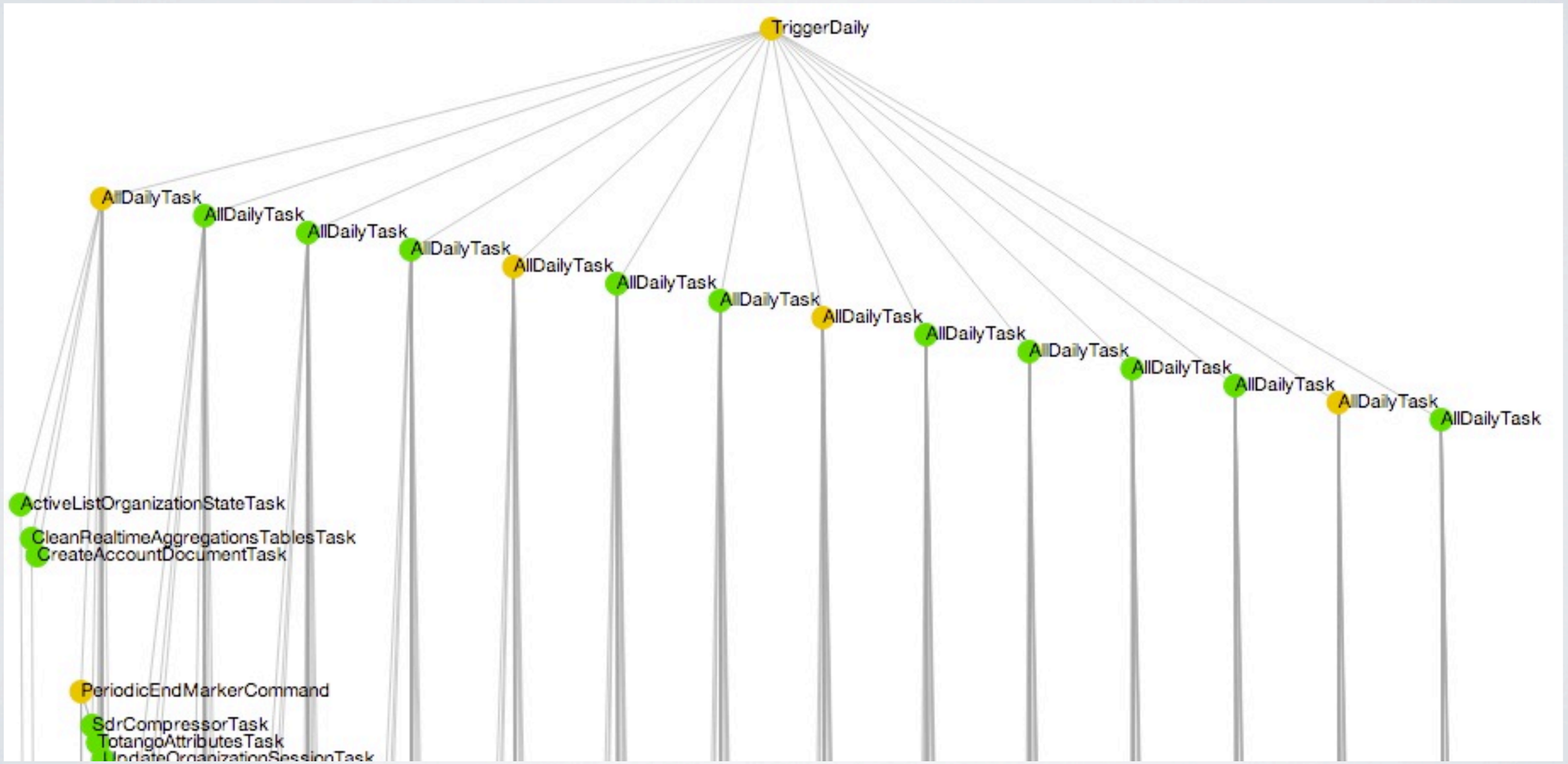


MOAR SCREENSHOTS

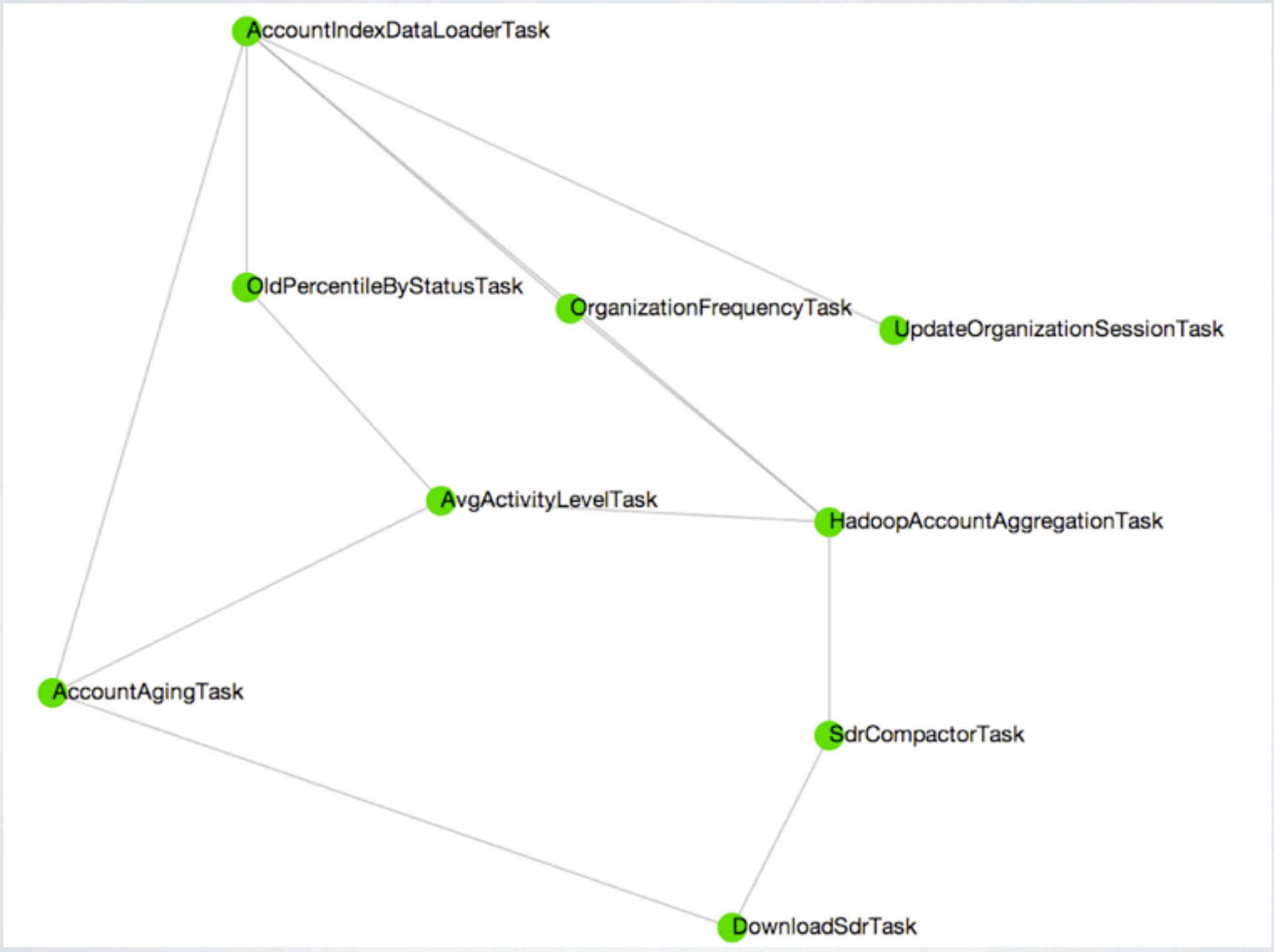
MOAR SCREENSHOTS



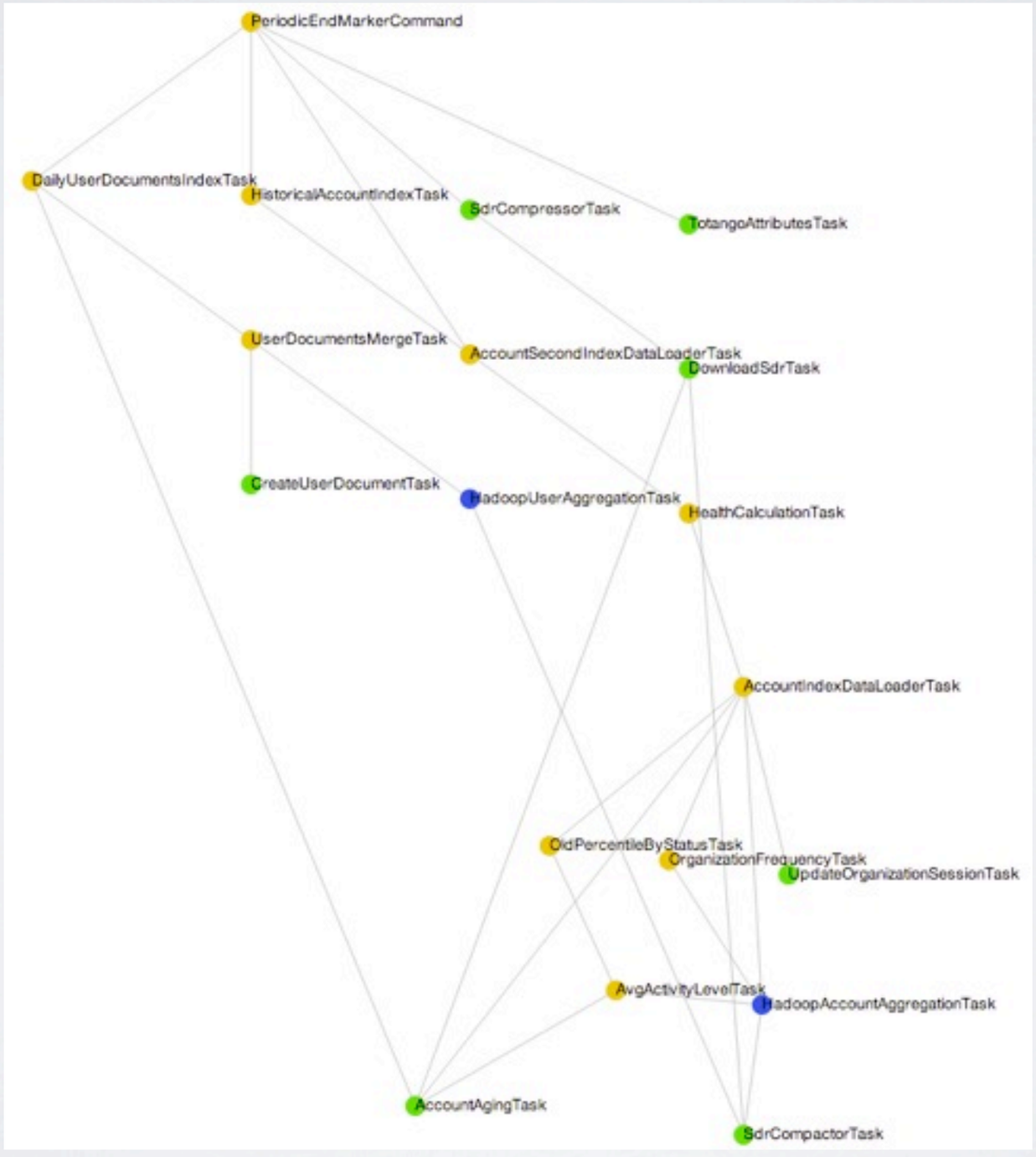
MOAR SCREENSHOTS



MOAR SCREENSHOTS

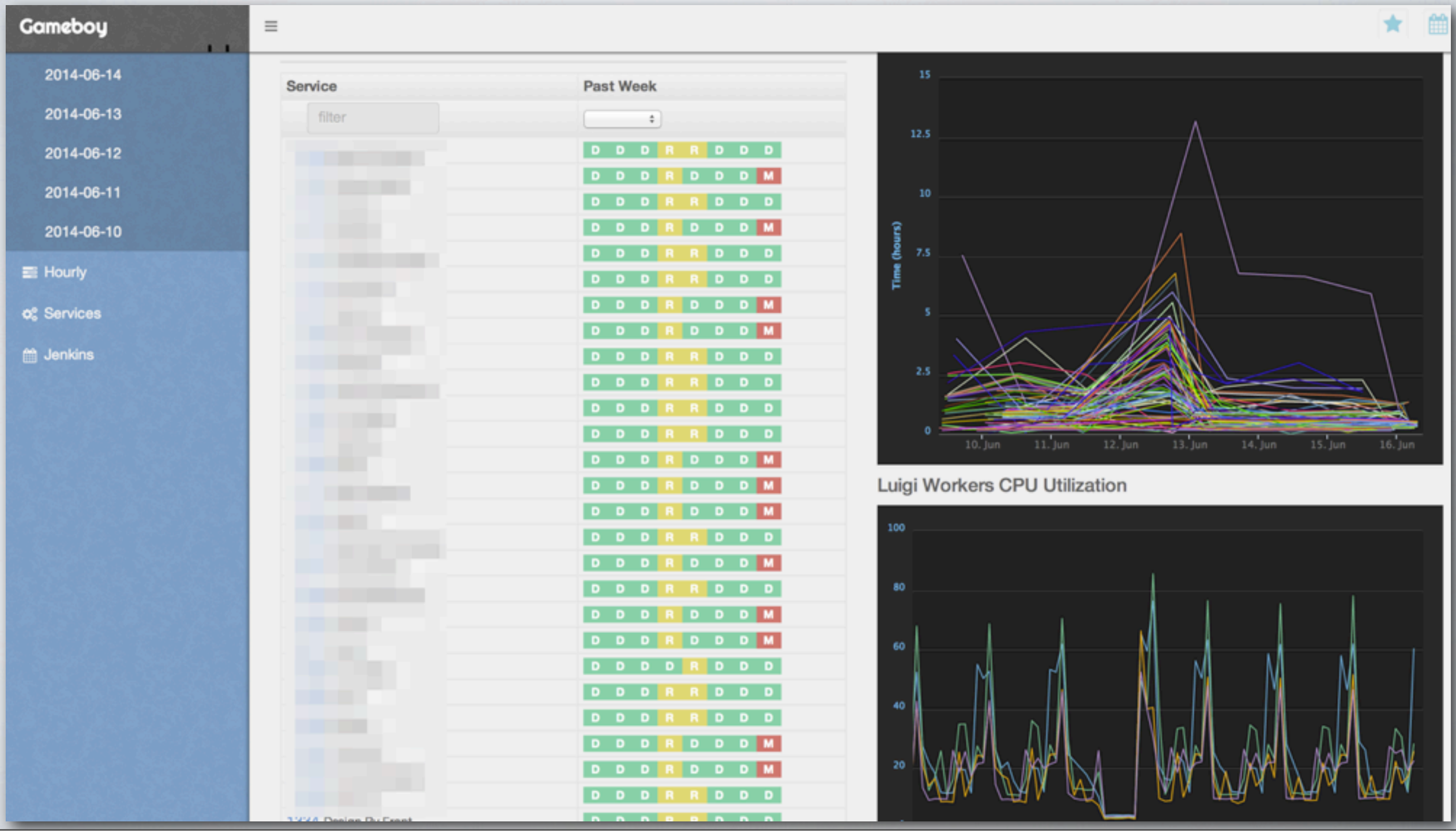


MOAR SCREENSHOTS

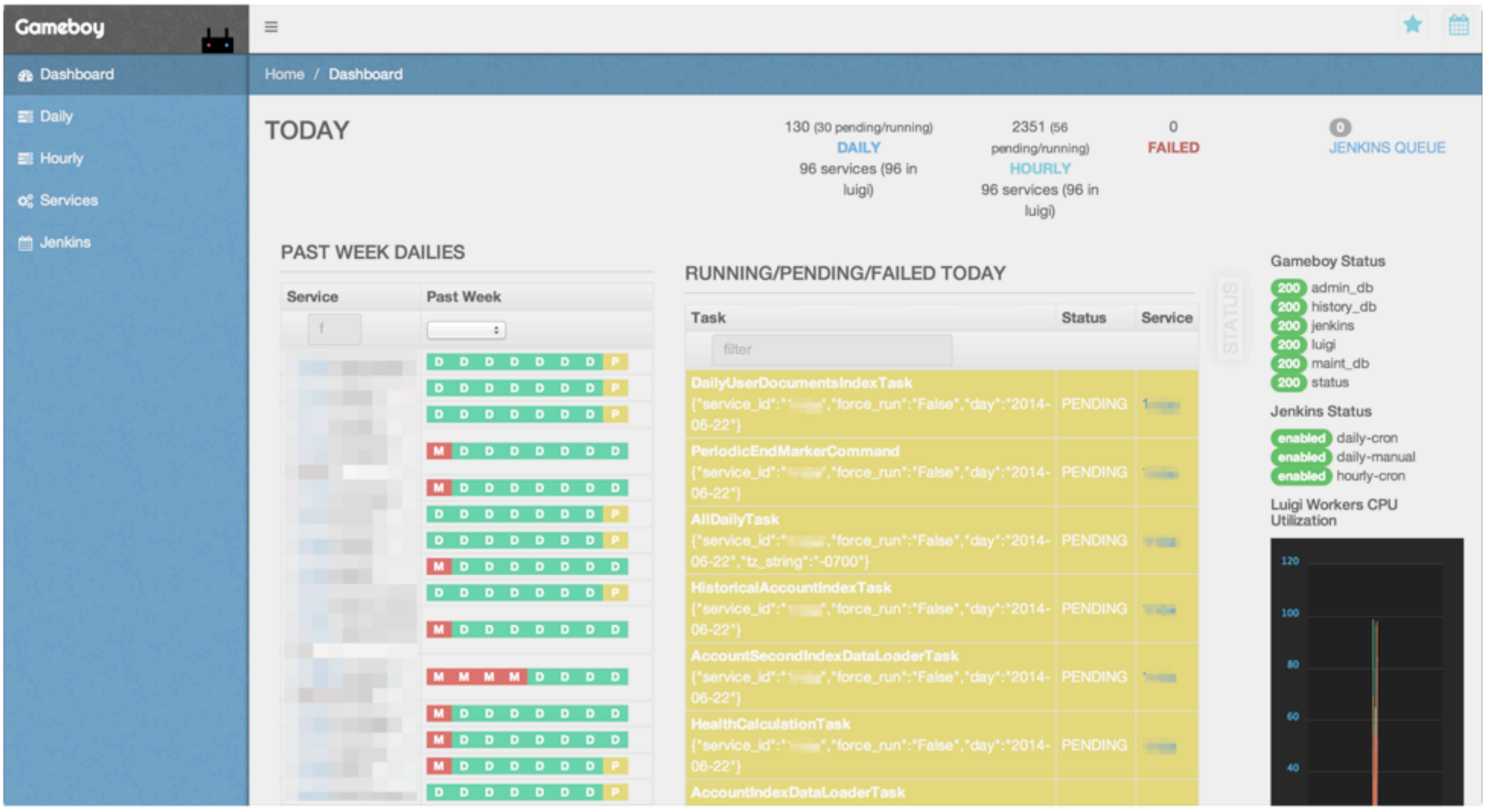


GAMEBOY!!!

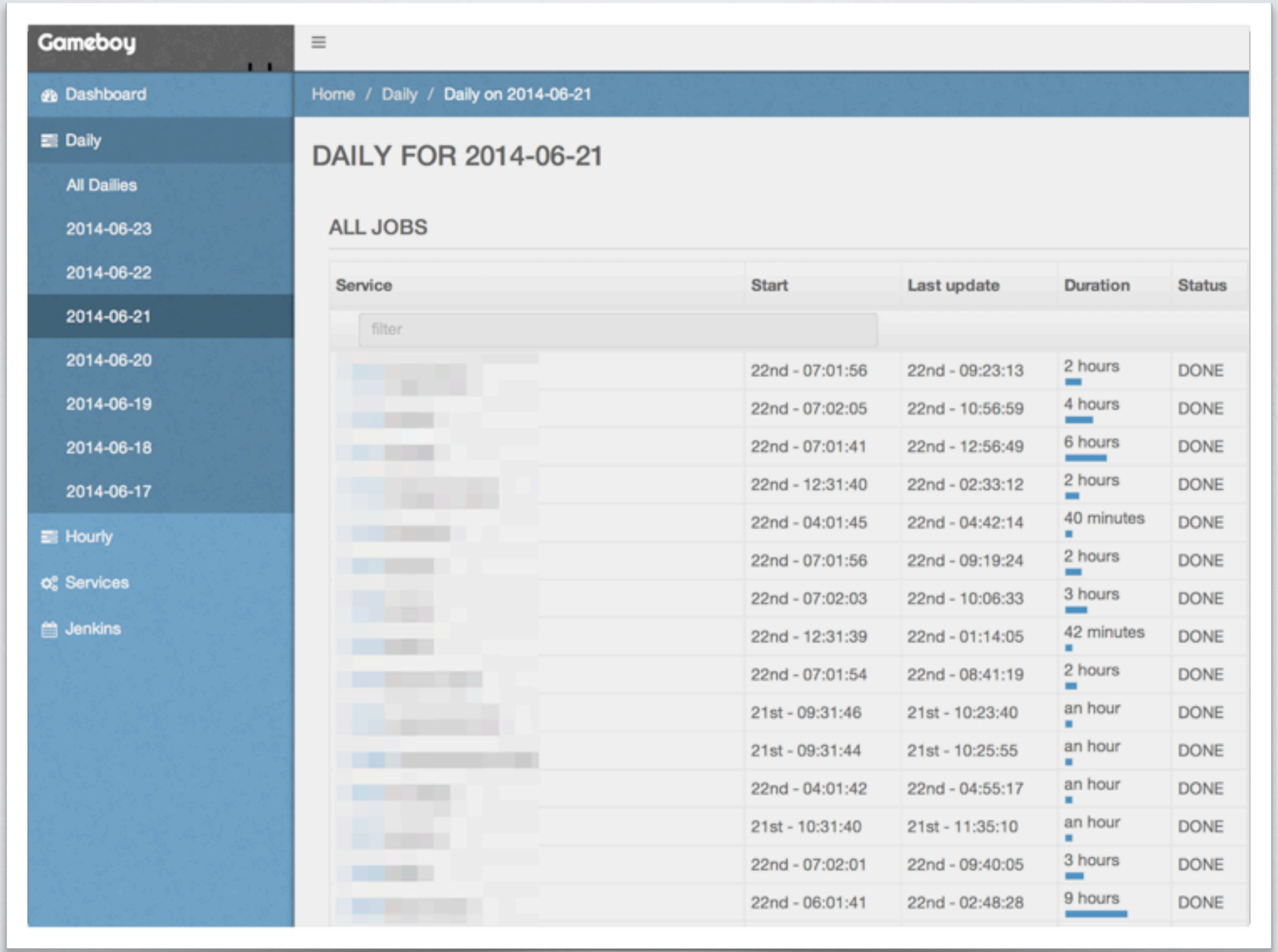
AND... **GAMEBOY**


Gameboy
2014-06-14
2014-06-13
2014-06-12
2014-06-11
2014-06-10
Hourly
Services
Jenkins
Service
Past Week
filter
Time (hours)
15
12.5
10
7.5
5
2.5
0
10. Jun
11. Jun
12. Jun
13. Jun
14. Jun
15. Jun
16. Jun
Luigi Workers CPU Utilization
100
80
60
40
20

GAMEBOY


Gameboy
Dashboard
Daily
Hourly
Services
Jenkins
Home / Dashboard
TODAY
130 (30 pending/running)
DAILY
96 services (96 in luigi)
2351 (56 pending/running)
HOURLY
96 services (96 in luigi)
0
FAILED
0
JENKINS QUEUE
PAST WEEK DAILIES
Service
Past Week
RUNNING/PENDING/FAILED TODAY
Task
Status
Service
filter
DailyUserDocumentsIndexTask {"service_id":"1","force_run":"False","day":"2014-06-22"} PENDING
PeriodicEndMarkerCommand {"service_id":"","force_run":"False","day":"2014-06-22"} PENDING
AllDailyTask {"service_id":"","force_run":"False","day":"2014-06-22","tz_string":"-0700"} PENDING
HistoricalAccountIndexTask {"service_id":"","force_run":"False","day":"2014-06-22"} PENDING
AccountSecondIndexDataLoaderTask {"service_id":"","force_run":"False","day":"2014-06-22"} PENDING
HealthCalculationTask {"service_id":"","force_run":"False","day":"2014-06-22"} PENDING
AccountIndexDataLoaderTask
STATUS
Gameboy Status
200 admin_db
200 history_db
200 jenkins
200 luigi
200 maint_db
200 status
Jenkins Status
enabled daily-cron
enabled daily-manual
enabled hourly-cron
Luigi Workers CPU Utilization
120
100
80
60
40

GAMEBOY


Gameboy
Dashboard
Daily
All Dailies
2014-06-23
2014-06-22
2014-06-21
2014-06-20
2014-06-19
2014-06-18
2014-06-17
Hourly
Services
Jenkins
Home / Daily / Daily on 2014-06-21
DAILY FOR 2014-06-21
ALL JOBS
Service
Start
Last update
Duration
Status
filter
22nd - 07:01:56
22nd - 09:23:13
2 hours
DONE
22nd - 07:02:05
22nd - 10:56:59
4 hours
DONE
22nd - 07:01:41
22nd - 12:56:49
6 hours
DONE
22nd - 12:31:40
22nd - 02:33:12
2 hours
DONE
22nd - 04:01:45
22nd - 04:42:14
40 minutes
DONE
22nd - 07:01:56
22nd - 09:19:24
2 hours
DONE
22nd - 07:02:03
22nd - 10:06:33
3 hours
DONE
22nd - 12:31:39
22nd - 01:14:05
42 minutes
DONE
22nd - 07:01:54
22nd - 08:41:19
2 hours
DONE
21st - 09:31:46
21st - 10:23:40
an hour
DONE
21st - 09:31:44
21st - 10:25:55
an hour
DONE
22nd - 04:01:42
22nd - 04:55:17
an hour
DONE
21st - 10:31:40
21st - 11:35:10
an hour
DONE
22nd - 07:02:01
22nd - 09:40:05
3 hours
DONE
22nd - 06:01:41
22nd - 02:48:28
9 hours
DONE

GAMEBOY IS

- A Totango specific controller for Luigi
  - The transition process (to Luigi)
  - Provide **high level** overview
  - Manual **re-run** of tasks
  - Monitor **progress**, **performance**, **run times**, **queues**, **worker load** etc...
  - Implemented using **Flask** and **AngularJS**

IS GAMEBOY OPEN SOURCE

- Well, no. At least not right away
- Right now it's very totango-specific.
  - Integrations to Librato-metics
  - Queries on Totango Databases
  - Uses Jenkins for controlling executions
  - Displays Totango's Account metadata (totango's business logic)
- Maybe some other day...

WHAT ELSE IS OUT THERE?

WHAT ELSE IS OUT THERE?

- Oozie
- Azkaban
- AWS Data Pipeline
- Chronos
- spring-batch
- Dataswarm (facebook)
- River (outbrain internal)
- What's your favorite WF engine? (did you build one?)

MY OTHER PROJECTS

- https://github.com/hector-client/hector
- https://github.com/rantav/flask-restful-swagger
- https://github.com/sebastien/monitoring
- https://github.com/rantav/meteor-migrations
- https://github.com/rantav/node-github-list-packages
- https://github.com/rantav/devdev

REFS

- https://github.com/spotify/luigi

- Facebook's Dataswarm https://www.youtube.com/watch?v=M0VCbhfQ3HQ

- Outbrain's River https://www.youtube.com/watch?v=EzsckTggDiM