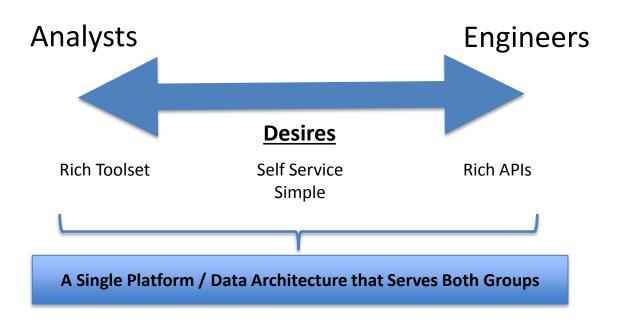


#### Motivation

Data should be accessible, easy to discover, and easy to process for everyone.



## Big Data Users at Netflix





## Netflix Data Warehouse - Storage

#### S3 is the source of truth

Decouples storage from processing.

Persistent data; multiple/ transient Hadoop clusters

#### **Data sources**

Event data from cloud services via Ursula/Honu

Dimension data from Cassandra via Aegisthus

~100 billion events processed / day Petabytes of data persisted and available to queries on S3.

Cloud Data Warehouse





## Netflix Data Platform - Processing

Long running clusters

sla and ad-hoc

Supplemental nightly bonus clusters

For high priority ETL jobs

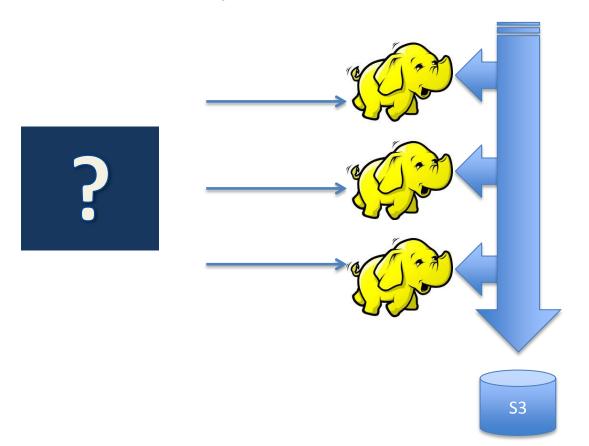
3,000+ instances in aggregate across the clusters



Cloud Data Warehouse









Complex backend infrastructures shouldn't yield complex interfaces to users.

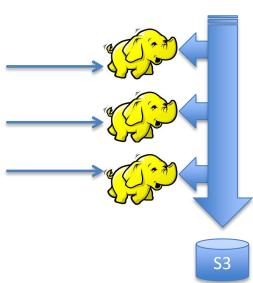


#### Infrastructure desires:

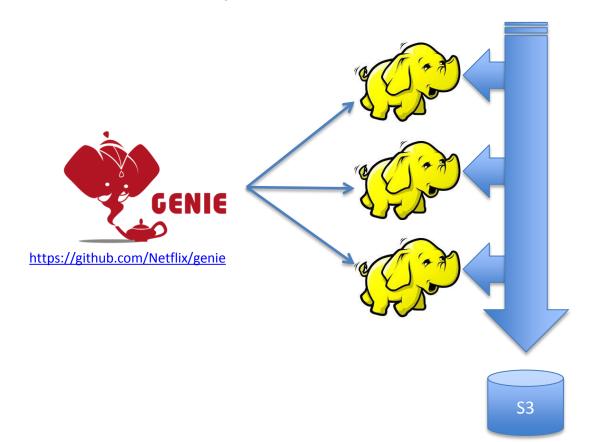
- Elastic, flexible, & non-disruptive scaling
- High degree of automation
- Loose coupling to platform customers

#### **Users desire:**

- Simplicity
- Adequate, scalable compute capacity
- Abstraction from physical details of backend clusters







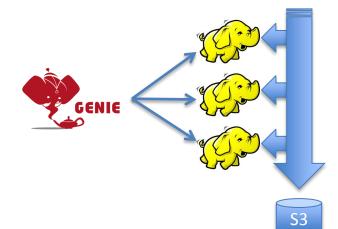


#### **Genie service layer:**

- Abstracts job submission to a complex backend into a simple REST interface.
- Cluster registration / job routing

#### Some Netflix Use Cases:

- "Red/Black" pushes
- Opportunistic provisioning of excess engineering capacity
- Easy experimentation with infrastructure

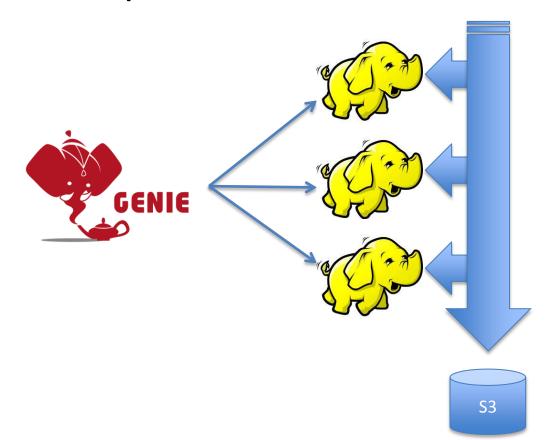


### Franklin

Data should be easy to use and discover.

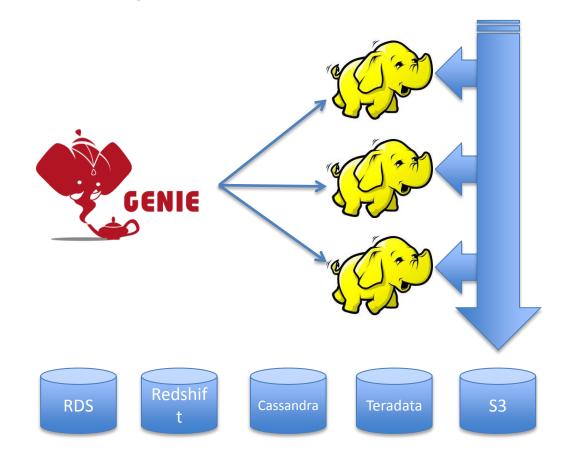


## Hadoop Platform as a Service



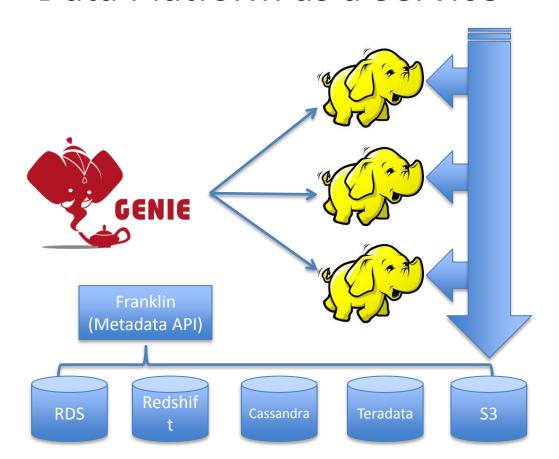


## Hadoop Platform as a Service





#### Data Platform as a Service



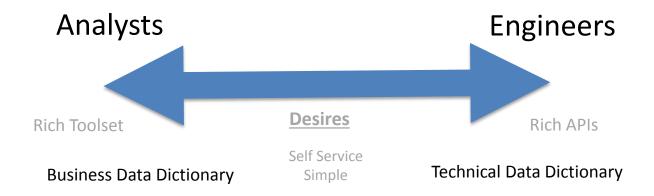


#### Franklin

- Homogenizes the interface into multiple data stores.
  - Single API to program on
  - Single reference point for all data
- Abstracts name → (location, format, schema, ...)
- Searchable catalog of all metadata of interest to analytics.
  - e.g. find all datasets with a field named 'userid'



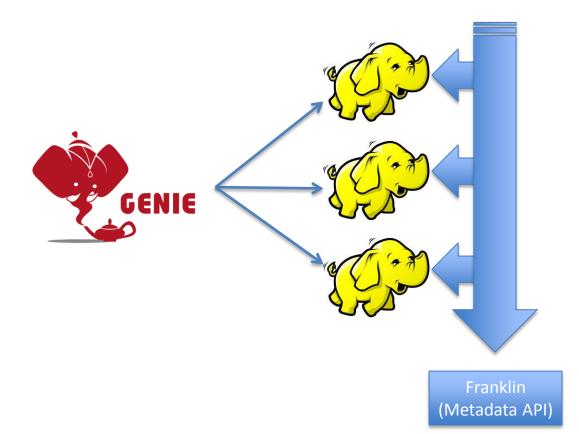
#### Franklin



Single Point of Reference for All Data JavaScript GUI for one-off tasks



### Data Platform as a Service





## Netflix Data Platform – Primitive Service Layer

Franklin Hadoop Platform **Event Service** (metadata as a Service (orchestration) service) GENIE Hadoop (EMR) Clusters Cloud Data Warehouse S3 Simple Storage Service

Primitive, decoupled services

Building blocks for more complicated tools/services/apps

Serves 1000s of MapReduce Jobs / day

100+ jobs concurrently

#### Netflix Data Platform – Tools

Ignite (A/B Test Analytics) Lipstick (Workflow Visualization)

Spock (Data Auditing)

Sting (Adhoc Visualization)

Looper (Backloading) Forklift (Data Movement) Heavily utilize services in the primitive layer.

Follow the same design philosophy as primitive apps:

RESTful API
Decoupled javascript interfaces

Hadoop Platform as a Service

Franklin (metadata service)

Event Service (orchestration)

Hadoop (EMR) Clusters



Cloud Data Warehouse





#### **Forklift**

Data should be easy to move between sources.



## Why Forklift

- Frequent need to move around analytical data
  - Hive -> Reporting DBMS
  - DBMS -> S3
  - Hive -> R -> S3
- "Industrial" ETL
  - Highly automated
  - Reliable
  - Simple to use

## Forklift Design

- High level service leveraging
  - Genie
  - Franklin
- REST API
- GUI for adhoc requests
- Rich clients

```
Forklift().

from(Hive('dse/title_dimension')).

to(Teradata('dse/title_dimension')).

executeOn(Genie())
```



## Sting

It should be fast and easy to explore and socialize data.



## Sting

- Caches results of Genie jobs in memory
- Sub second response to OLAP style operations
- Keeps datasets up to date
- Easy to use!



Data environment prod

Use prod data or test data



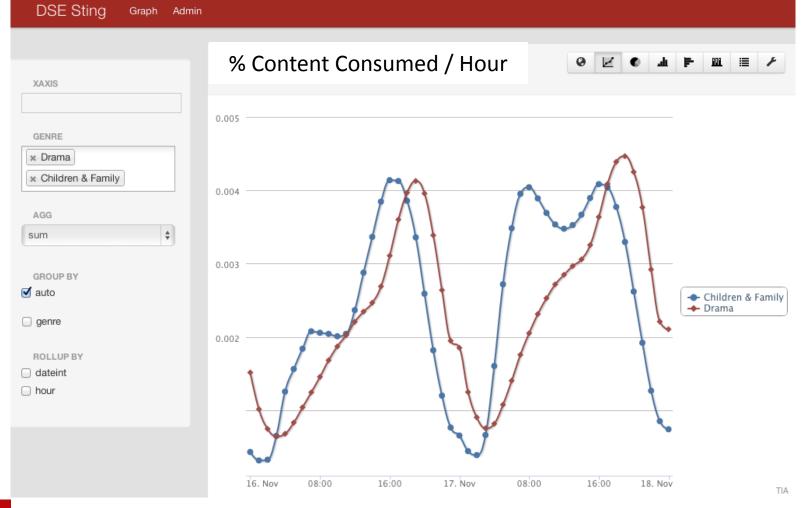
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<b></b>	dateint	time				delete
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<b>*</b>	percentage	fact				delete

Schema should be entered in the order each field appears in the input row.

Schema

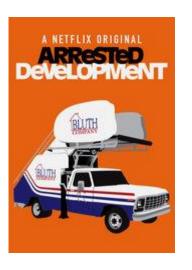


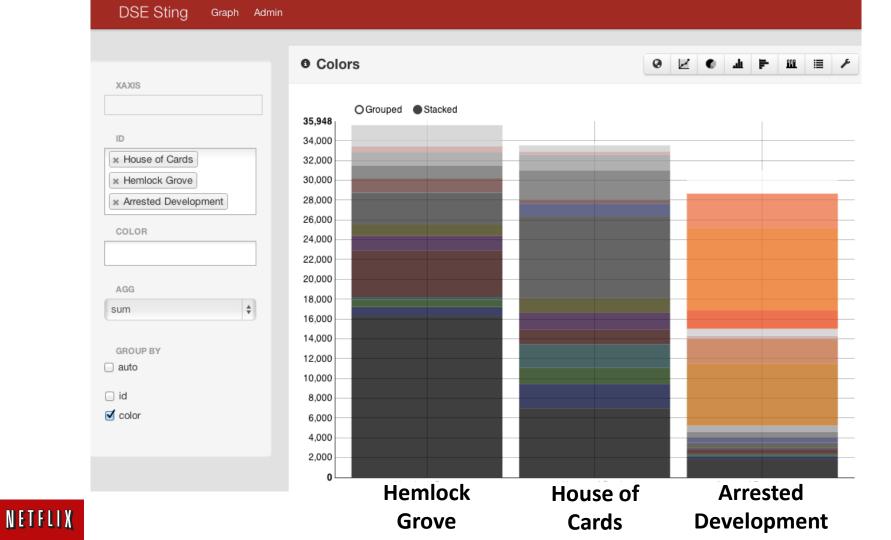












## Sting - backend

http://go/sting/graph/ContentPerHour/sum/percentage/?slicesize=20&sliceorder=desc

```
"series":[
   "data":[
            [ 1381622400000, 0.0581890282854042 ],
            [ 1381626000000, 0.0405827046800486 ],
            [ 1382824800000, 0.0843322981735192 ],
            [ 1382828400000, 0.0632406985680995 ]
   "name": "percentage",
   "xaxis":" ds"
```



## Lipstick

It should be easy to manipulate data and monitor progress of jobs on the infrastructure.



## Pig and Hive at Netflix

- Hive
  - AdHoc queries
  - Lightweight aggregation
- Pig
  - Complex Dataflows / ETL
  - Data movement "glue" between complex operations



## What is Pig?

- A data flow language
- Simple to learn
  - Very few reserved words
  - Comparable to a SQL logical query plan
- Easy to extend and optimize
- Extendable via UDFs written in multiple languages
  - Java, Python, Ruby, Groovy, Javascript



## Sample Pig Script\* (Word Count)

```
input lines = LOAD '/tmp/my-copy-of-all-pages-on-internet' AS (line:chararray);
-- Extract words from each line and put them into a pig bag
-- datatype, then flatten the bag to get one word on each row
words = FOREACH input lines GENERATE FLATTEN(TOKENIZE(line)) AS word;
-- filter out any words that are just white spaces
filtered words = FILTER words BY word MATCHES '\\w+';
-- create a group for each word
word groups = GROUP filtered words BY word;
-- count the entries in each group
word count = FOREACH word groups GENERATE COUNT(filtered words) AS count, group
AS word;
-- order the records by count
ordered word count = ORDER word count BY count DESC;
STORE ordered word count INTO '/tmp/number-of-words-on-internet';
```



## A Typical Pig Script

```
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## Pig...

- Data flows are easy & flexible to express in text
  - Facilitates code reuse via UDFs and macros
  - Allows logical grouping of operations vs grouping by order of execution.
  - But errors are easy to make and overlook.
- Scripts can quickly get complicated
- Visualization quickly draws attention to:
  - Common errors
  - Execution order / logical flow
  - Optimization opportunities

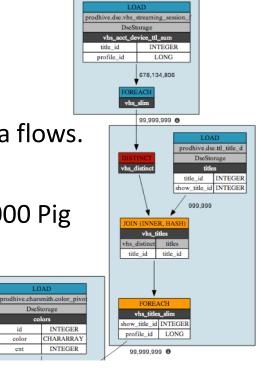


## Lipstick

Generates graphical representations of data flows.

Compatible with Apache Pig v11+

 Has been used to monitor more than 100,000 Pig jobs at Netflix



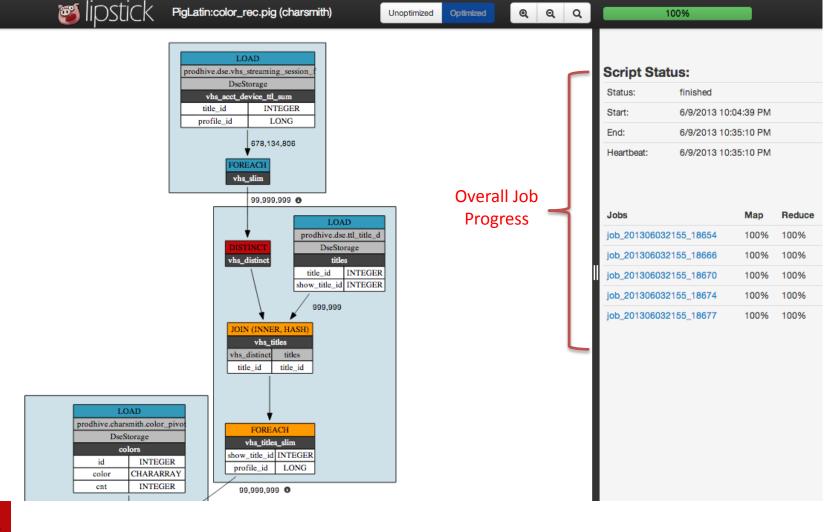
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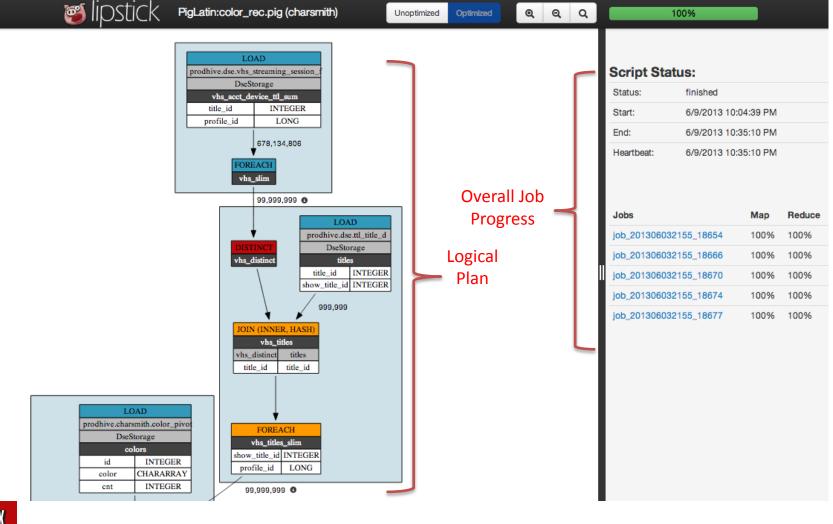
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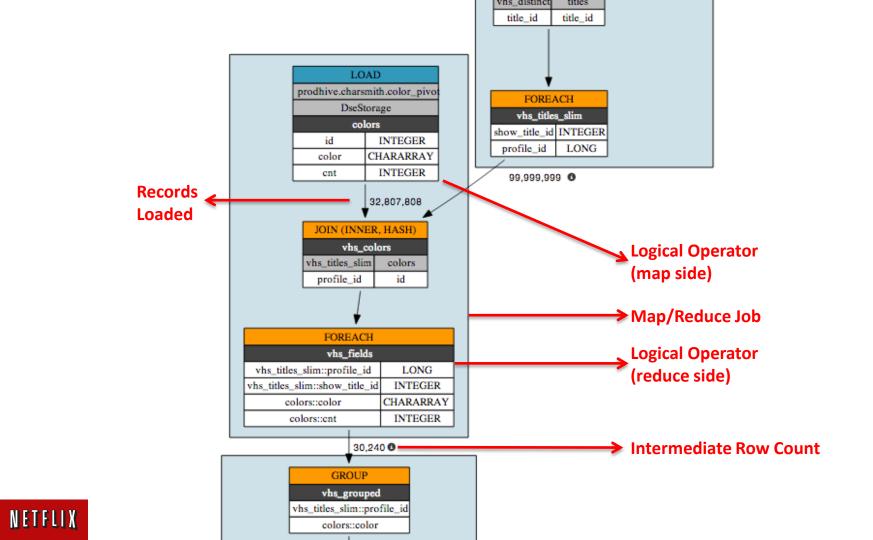
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## Lipstick

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2013-06-07 22:53:23,365 [main] INFO org.apache.pig.backend.hadoop.executionengine.mapRed uceLayer.MapReduceLauncher - 25% complete
2013-06-07 22:53:24,234 [main] INFO com.netflix.lipstick.pigtolipstick.BasicP2LClient - Navigate to http://go/lipstick#job/10971d02-fe67-4f42-a5a0-6e246b870653 to view progress.
2013-06-07 22:53:36,398 [main] INFO org.apache.pig.backend.hadoop.executionengine.mapRed uceLayer.MapReduceLauncher - 50% complete
```







# Lipstick for Fast Development

- During development:
  - –Keep track of data flow
  - –Spot common errors
  - -Easily estimate and optimize complexity



# Lipstick for Job Monitoring

- During execution:
  - Graphically monitor execution status from a single console
  - Spot optimization opportunities
    - Map vs reduce side joins
    - Data skew
    - Better parallelism settings



# Lipstick for Support

- Empowers users to support themselves
  - Better operational visibility
  - Examine intermediate output of jobs
  - One stop shop for job information
- Facilitates communication between infrastructure / support teams and end users
  - Lipstick link contains all information needed to provide support.

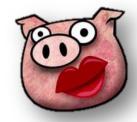


# Big Data + NetflixOSS

Check out all the NetflixOSS tools at <a href="http://netflix.github.io/">http://netflix.github.io/</a>







http://github.com/Netflix/Lipstick



### Thank you!

Jeff Magnusson:

<u>jmagnusson@netflix.com</u> | <a href="http://www.linkedin.com/in/jmagnuss">http://www.linkedin.com/in/jmagnuss</a> | @jeffmagnusson



Jobs: <a href="http://jobs.netflix.com">http://jobs.netflix.com</a>

Netflix OSS: <a href="http://netflix.github.io">http://netflix.github.io</a>

Tech Blog: <a href="http://techblog.netflix.com/">http://techblog.netflix.com/</a>

