

hulu | MONITORING THE DATA PIPELINE
LESSONS LEARNED

AGENDA

- Who am I?
- What's a Hulu?
- Beacons & the Data Pipeline
- Monitoring - Take One
- Monitoring - Take Two

Photo Wall





hulu

TRISTAN REID
METRICS & REPORTING TOOLS TEAM LEAD

HULU'S MISSION

Help people find and enjoy
the world's premium content
when, where and how they want
it.

WHY IS HULU EFFECTIVE?

PREMIUM CONTENT

- Premium Content
- 485+ Content Partners
- 6 of 6 Broadcast Networks



QUALITY AD EXPERIENCE

- Ads can't be skipped
- Less ad load than TV
- 100% video completion rate guarantee



USER CONTROL

- On Demand
- Across Devices
- Choice Based Ad Formats



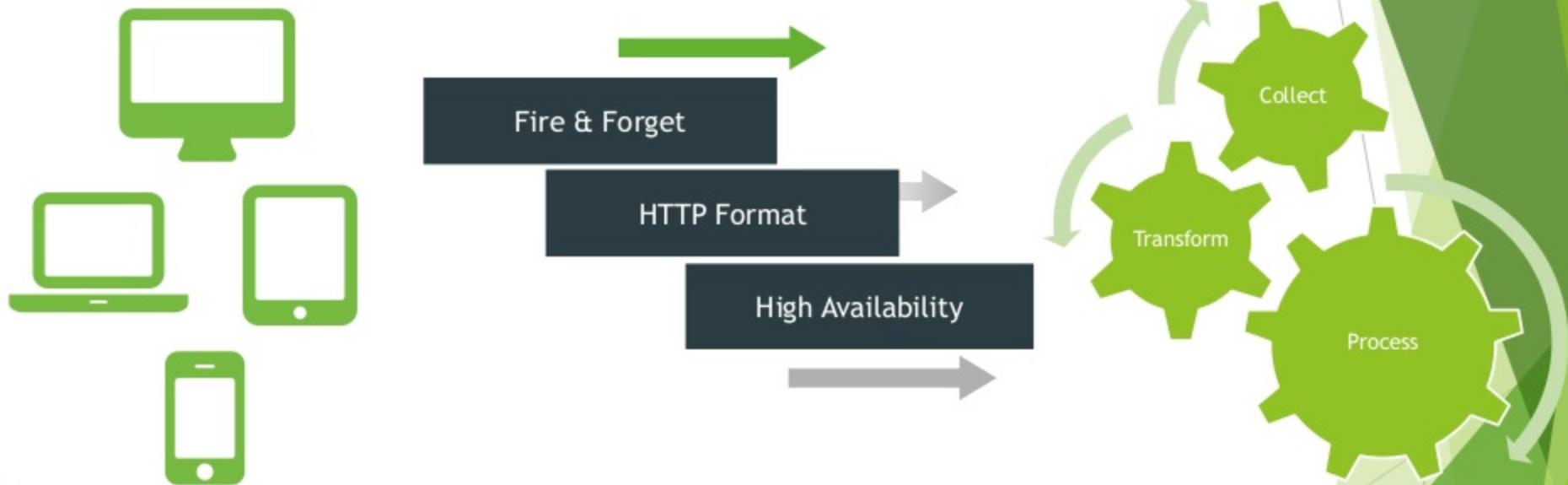
A close-up photograph of a young woman with long dark hair and bangs, smiling and looking down at her smartphone. She is wearing a green top. The background is blurred, showing what appears to be a window with a view of trees.

TECH

- Service Oriented
- Small teams, specialized scopes
- Build tools for other developers
- Right tool for the job

Beacons & The Data Pipeline

External View of Beacons



Beacons



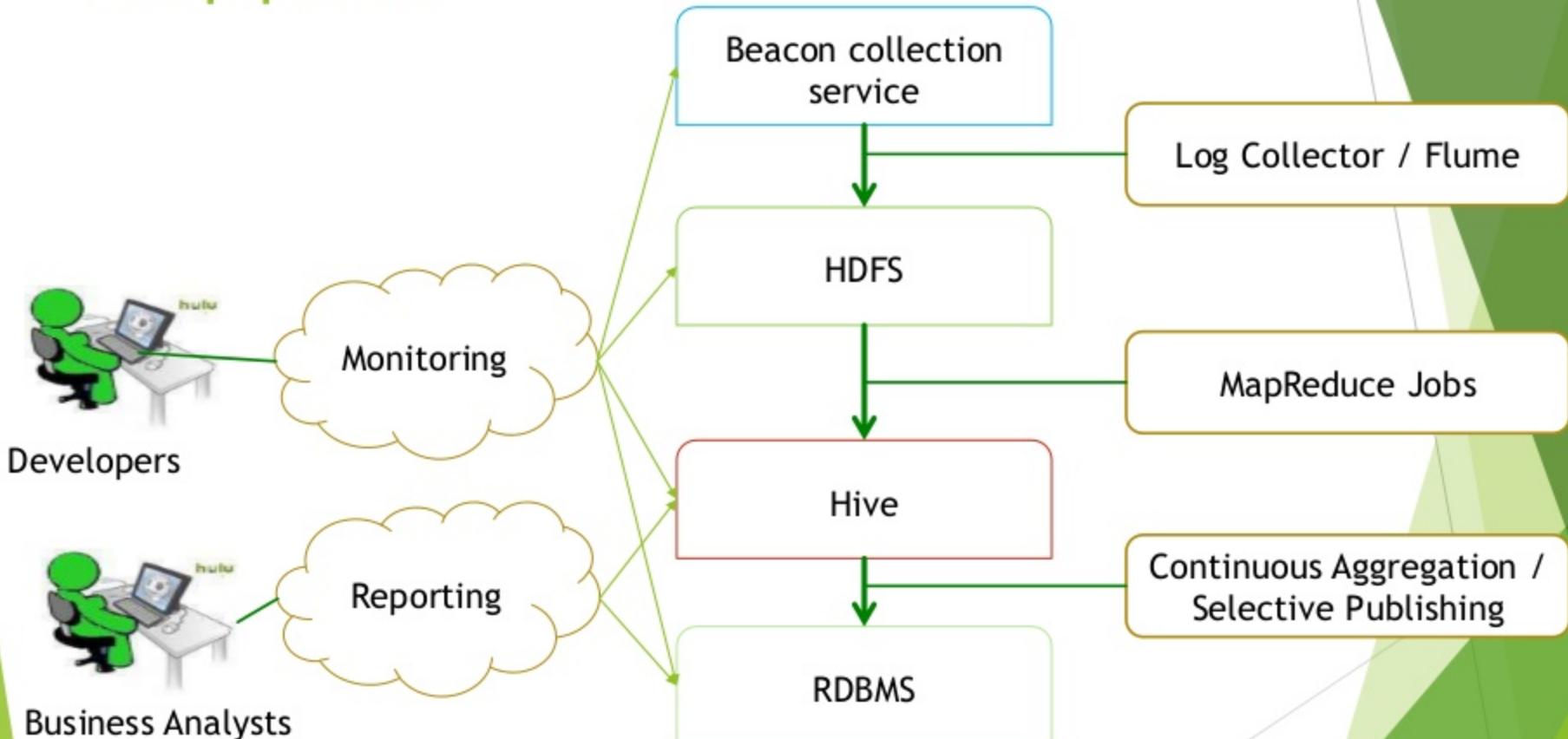
80 2013-04-01 00:00:00

*/v3/playback/start?
bitrate=650
&cdn=Akamai
&channel=Anime
&client=Explorer
&computerguid=EA8FA1000232B8F6986C3E0BE
55E9333
&contentid=5003673*

- ▶ Which show is the user watching?
- ▶ Which pages did they visit?
- ▶ How long did they stay?
- ▶ Where did they come from?
- ▶ Did they become Plus members?

...

The pipeline



A firefighter in full protective gear, including a helmet with a communication system and a oxygen tank, is spraying a powerful stream of water onto a smoky area. The firefighter's back and side are visible, showing the equipment. The background is filled with thick smoke.

Data Collection

Avg. 12,000
events per
second

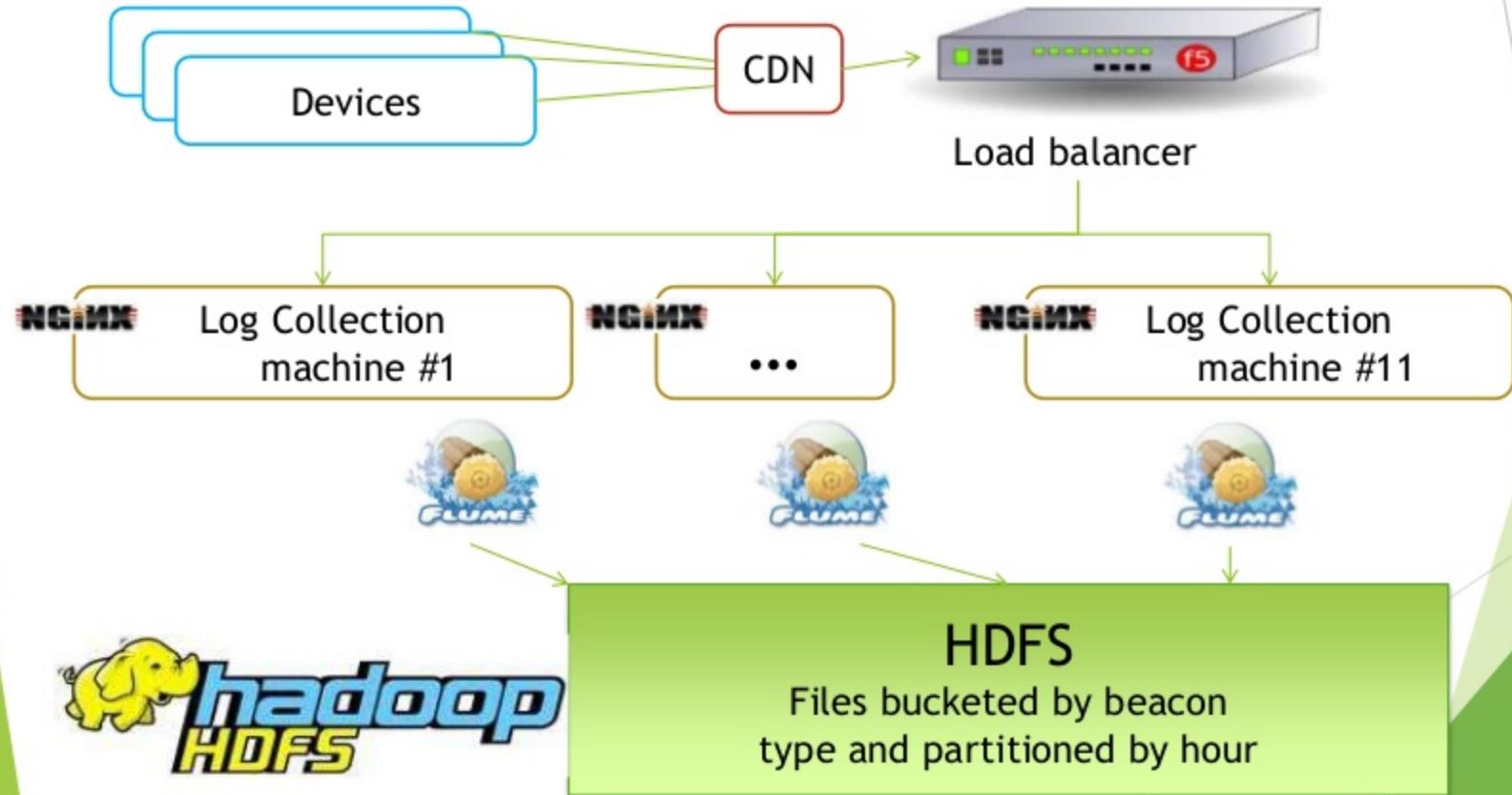
Peak: ~35K

A blurry background image of a woman with blonde hair tied back, wearing a pink sleeveless dress, running towards the right on a paved path. The background is a soft-focus outdoor setting with greenery and a building.

Data never stops
coming...

and we can't lose
any data

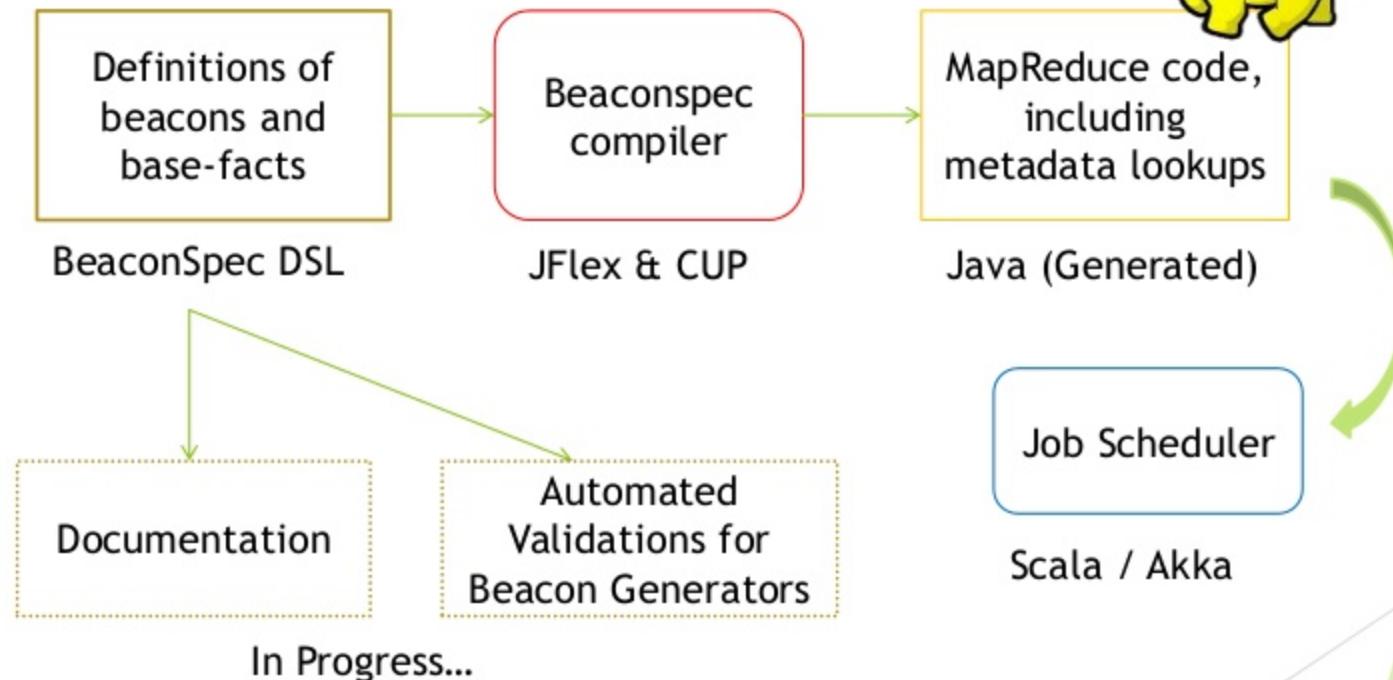
Log Collection



MapReduce - from beacons to basefacts

video_id	289696
content_partner_id	398
distribution_partner_id	602
distro_platform_id	14
is_on_hulu	0
...	
hourid	383149
watched	76426

Hulu MapReduce Metrics Jobs



Job name

Enter a short description for this job

Send results to:

MVEL:

Region

client contains 'Chrome' &&

File types

fullscreen == true &&

Regular exp

(os contains 'Windows' || os contains 'Mac')

MVEL Expression. [How to?](#)

A MVEL expression matching the beacon

Validate!

Time range

mm/dd/yyyy

to

mm/dd/yyyy

IP range

From IP

to

To IP

Required fields

Space-separated fields that must be present

Optional fields

Space-separated fields that are optional

Output

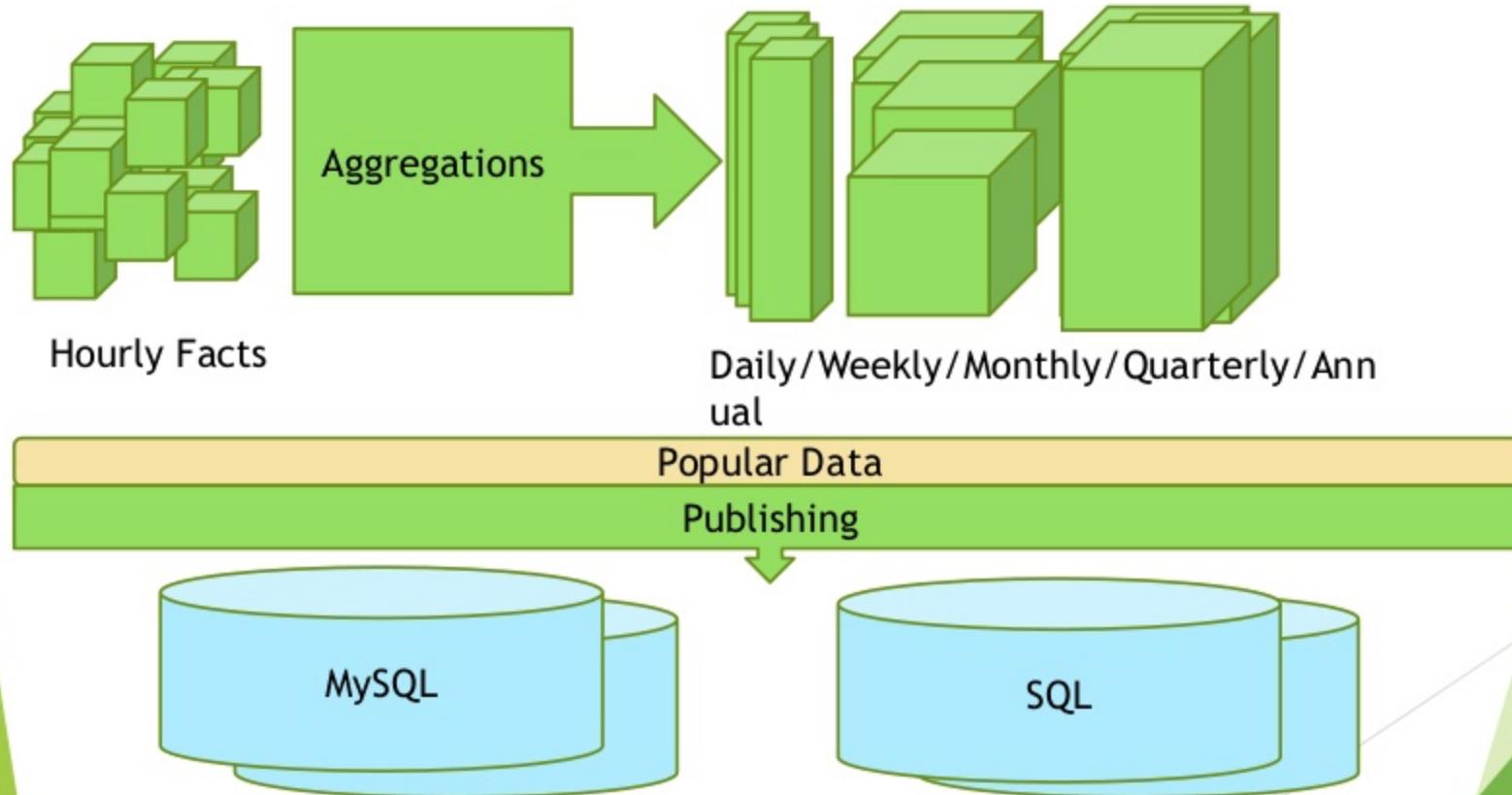
Tab-separated

▼

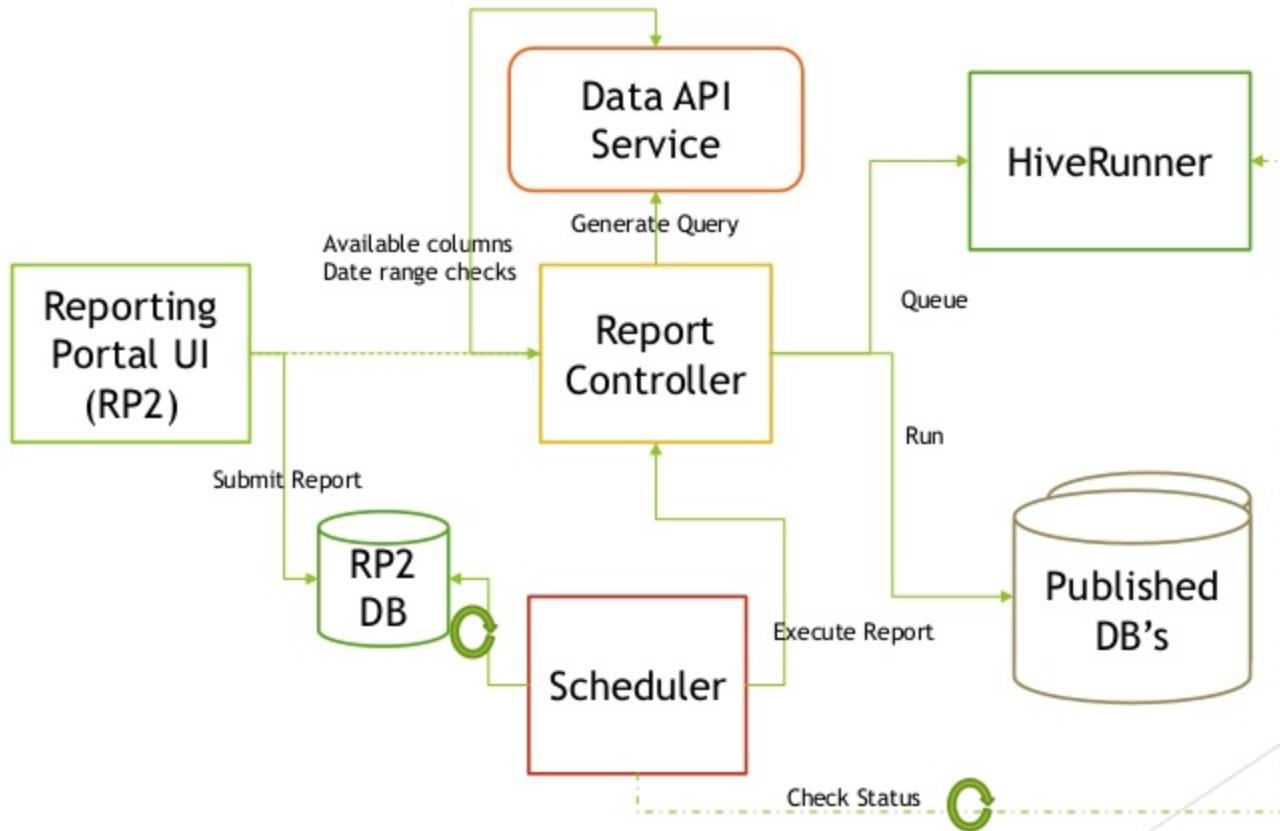
 Dump original beacons

Submit Job

Aggregation & Publishing



Reporting Flow



New Report

Metrics

- Search contains
Active Users
- Avg ViewThru %
- Close Captioned Views
- Time Watched (min)
- Unique Users
- Video Views
- Views 0% To 25%
- Views 25% To 50%
- Views 50% To 75%
- Views 75% To 100%
- Views Over 100%

drop here to select

Dimensions

- Search contains
Campaign
- CaptionsAvailable
- Channel Type
- Content Partner
- Content Partner Identifier
- Content Rating
- Country of Origin
- Current Vs Library
- DMA
- Device Family
- Device Higher Category
- Device Lower Category
- Device Manufacturer

drop here to select

- Video Views
- Select report type
- Video Views
- Video Views Japan
- Realtime Trends
- Referring Domains
- Unique Users
- Unique Users_JP
- Active Users
- AutoPlay
- Content Interactions
- Impressions
- Masthead
- Masthead_JP
- Masthead Session
- SiteMetrics
- SiteMetrics_JP
- Search Tracking
- DevicePairing

click here to add filter

Total ▼

05/25/2014 - 05/25/2014

Selected

Preset

 Search contains

Save

Save As

Details

Run Now

Schedule

Advanced



Click to update report type

Report

Metrics

- Search contains
- Active Users
- Avg ViewThru %
- Close Captioned Views
- Time Watched (min)
- Unique Users
- Views 0% To 25%
- Views 25% To 50%
- Views 50% To 75%
- Views 75% To 100%
- Views Over 100%



Series Title : Name of the series
[Metrics Glossary](#)

Add filters to Series Title

Presets

- Search contains
 - 2014 TVMA TV14 P
 - Deadbeat P
 - East Los High P
 - espn 30 for 30 P
 - FOX FX P
 - Hulu Originals P
 - kids P
 - Kids Series P
 - Moone Boy P
 - The Awesomes P
 - The Wrong Mans P

All

- Search contains
 - egy
- A Tale of Egypt
- Elegy
- Fighting Elegy
- Godzilla VS. Megaguirus: The G Annihilation Strategy
- Kishiwada Shonen Gurentai: An Elegy of a Rude Queen -The Battle of Kaoru
- Osaka Elegy

Selection

- Search contains
 - Egypt
 - Egypt (1998)
 - Egypt Exposed: The True Origins of Civilization
 - Egypt: Behind the Revolution
 - Egypt Underworld

Actions

-
-
-
-
-

Buttons

- Confirm**
- Cancel**

Total ▾

05/25/2014 - 05/25/2014

Preset

 Search contains
Save**Save As****Details**

here to add filter to series title

Run Now**Schedule****Advanced**

Recent Report Runs

 View Only My Report Runs[Create New Report](#)[Status View](#)[Summary V](#)

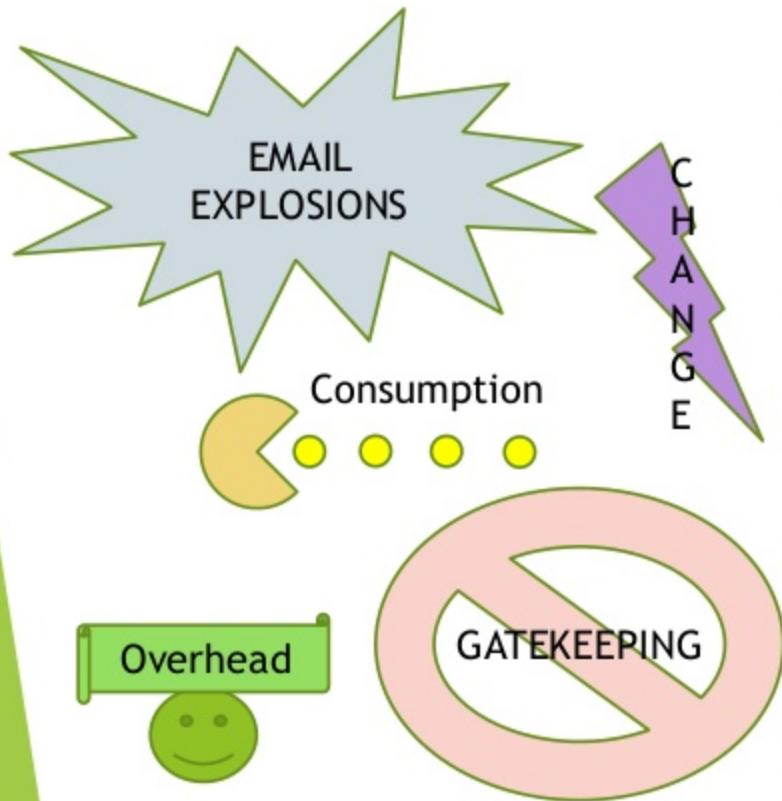
Show 25 ▾ entries

Search:

Title	Owner	Status	Help	From	To	Started	Finished	Duration	HiveID
Title	Owner	Status							
Active Users - Series Title, Package, Content Partner, Channel Type, Distribution	tristan.reid	queued	Help	2/23/2014	3/1/2014	5/26/14 1:30	—	—	903541
Active Users - Series Title, Package, Content Partner, Channel Type, Distribution	tristan.reid	queued	Help	4/27/2014	5/3/2014	5/26/14 1:29	—	—	903534
Active Users - Series Title, Package, Content Partner, Channel Type, Distribution	tristan.reid	running	Help	5/4/2014	5/10/2014	5/26/14 1:02	—	—	903524
Masthead Loads JP - Is Plus By Plan, Series, Programming Type_2	yukiko.sato	succeeded	Help	5/25/2014	5/25/2014	5/26/14 0:10	5/26/14 0:10	a few seconds	
Masthead Loads JP - Is Plus By Plan, Series, Programming Type_1	yukiko.sato	succeeded	Help	5/25/2014	5/25/2014	5/26/14 0:09	5/26/14 0:09	a few seconds	
Masthead Loads JP - Is Plus By Plan, Series, Programming Type_2	yukiko.sato	succeeded	Help	5/24/2014	5/24/2014	5/26/14 0:09	5/26/14 0:09	a few seconds	
Masthead Loads JP - Is Plus By Plan, Series, Programming Type_1	yukiko.sato	succeeded	Help	5/24/2014	5/24/2014	5/26/14 0:08	5/26/14 0:08	a few seconds	
Masthead Loads JP - Series, Is Plus By Plan_47	geo.lee	succeeded	Help	5/25/2014	5/25/2014	5/25/14 21:38	5/25/14 21:38	a few seconds	
Masthead Loads JP - Series, Is Plus By Plan_46	geo.lee	succeeded	Help	5/25/2014	5/25/2014	5/25/14 21:36	5/25/14 21:36	a few seconds	
Masthead Clicks JP - Series, Is Plus By Plan_46	geo.lee	succeeded	Help	5/25/2014	5/25/2014	5/25/14 21:36	5/25/14 21:36	a few seconds	
Active Users - Distribution Platform_11	erika.harman	succeeded	Help	5/18/2014	5/24/2014	5/25/14 20:55	5/26/14 3:10	6 hours	903269
Active Users - Series, Content Partner, Is Plus By Plan_3	geo.lee	succeeded	Help	4/1/2014	5/25/2014	5/25/14 18:55	5/26/14 3:30	9 hours	903236
Active Users - Series, Content Partner, Is Plus By Plan_2	geo.lee	succeeded	Help	4/1/2014	5/25/2014	5/25/14 18:20	5/25/14 23:40	5 hours	903230
Masthead Loads JP - Is Plus By Plan_4	geo.lee	succeeded	Help	5/1/2014	5/25/2014	5/25/14 18:15	5/25/14 18:15	a few seconds	
Masthead Clicks JP - Is Plus By Plan_2	geo.lee	succeeded	Help	5/1/2014	5/25/2014	5/25/14 18:15	5/25/14 18:15	a few seconds	

Monitoring

Some Issues...



BIG DATA PIPELINE?

I'LL BET THAT'S GOING
GREAT FOR YOU

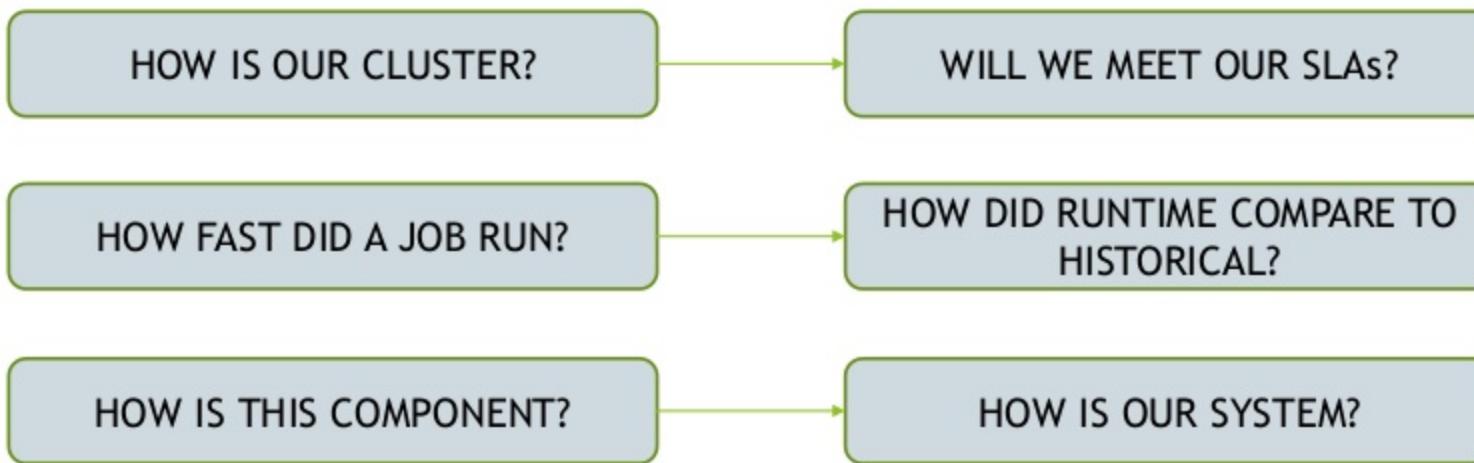


Lots of Monitoring Tools Available

OpenTSDB & Graphite



WHAT's GOING ON??!??



The Design...

Comprehensive Web UI



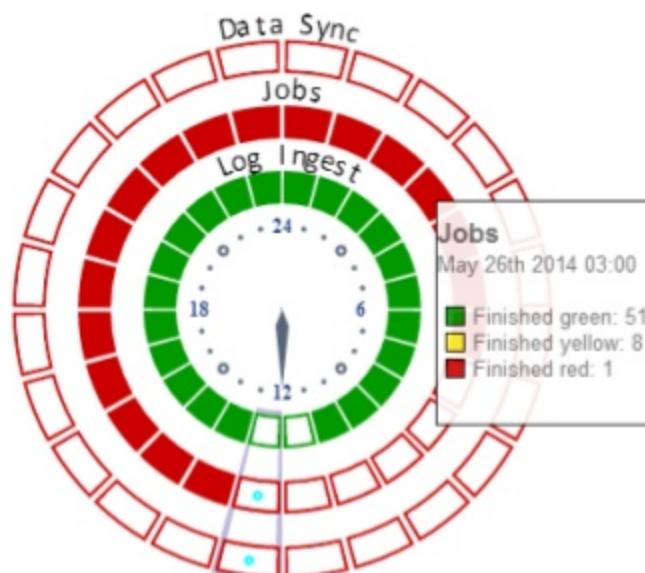
Access all your tools in one place...



...but avoid multitasking

Service Oriented Architecture

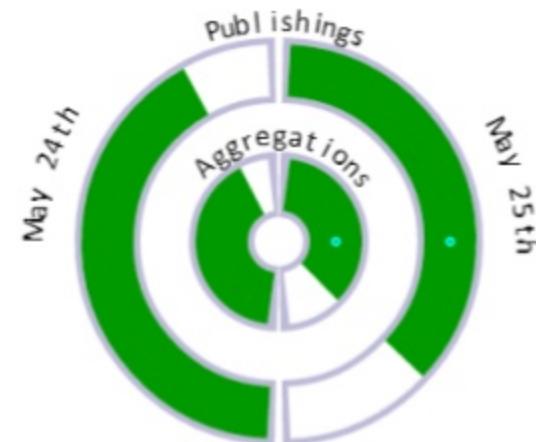
Hourly Data

**Apply Filters****Clear Filters**

SLA Estimates (UTC)

Estimate as-of (PT):	May 26th 05:03
KPI (US)	May 27th 03:24
KPI (JP)	Not Loaded
All Enabled Pubs (US)	May 27th 03:24
SLA Historical View	

Daily Data



Ingest

- adinteraction(JP)
- adinteraction(US)
- contentinteraction(US)
- contentinteraction(JP)
- engagement(US)
- engagement(JP)
- meta(US)
- moto(ID)

Jobs

- adinteraction_adswap_interaction
- adinteraction_events
- adinteraction_fanconnect
- adinteraction_housepromo
- adinteraction_select
- adinteraction_select_harpybasefactory2

Base Facts

- adinteraction_adswap_enabled
- adinteraction_adswap_interaction
- adinteraction_events
- adinteraction_fanconnect
- adinteraction_housepromo
- adinteraction_multibrandselector_v1

Aggregations

- faust_revenue_end_day_est
- hululogs_playday_anonymous_day_est
- hululogs_playday_reclassic_day_est
- hululogs_playwatchedday_anonymous_d
- hululogs_playwatchedday_reclassic_da
- mobile_daily_aggregation

Publishings

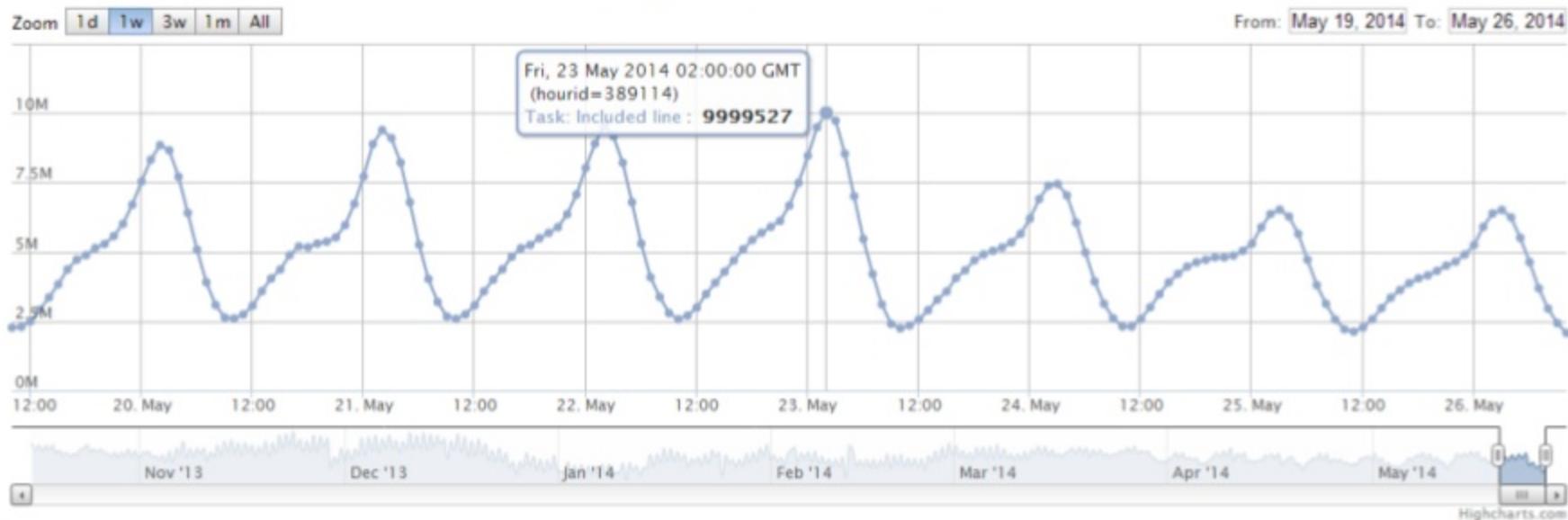
- mobile_daily_agg_app_version
- mobile_daily_agg_app_version_bdm_id
- mobile_daily_agg_app_version_bdm_id_c
- mobile_daily_agg_app_version_carrier
- mobile_daily_agg_app_version_os_versi
- mobile_daily_agg_app_version_os_versi

Job Info — revenue_start_v3 (US)

Counters

Click on an hour to view the error trapped lines. Select an area to view the total values for selected counters.

Hadoop Counters for revenue_start_v3



- ▶ Task
- ▶ Task-LostLine
- ▶ Task-Info
- ▼ Job Counters

- Launched reduce tasks
- Rack-local map tasks
- Launched map tasks
- Data-local map tasks
- Total time spent by all maps in occupied slots (ms)
- Total time spent by all maps waiting after reserving slots (ms)

Recent Job Runs

Job Scheduler status:	Running
Gatekeeping status:	Passing

ID	Started	Beacon Time Period	Ready for Harpy	Completed	Duration	Status	Hadoop ID
3358916	2014-05-26 12:40:46Z	2014-05-26 11Z				running	job_2014051618
3358826	2014-05-26 11:40:51Z	2014-05-26 10Z	2014-05-26 12:19:30Z	2014-05-26 12:19:44Z	39 minutes	succeeded	job_2014051618
3358743	2014-05-26 10:46:47Z	2014-05-26 09Z	2014-05-26 11:23:05Z	2014-05-26 11:25:45Z	39 minutes	succeeded	job_2014051618
3358653	2014-05-26 09:46:50Z	2014-05-26 08Z	2014-05-26 10:22:09Z	2014-05-26 10:22:44Z	36 minutes	succeeded	job_2014051618
3358561	2014-05-26 08:46:51Z	2014-05-26 07Z	2014-05-26 09:25:08Z	2014-05-26 09:25:46Z	39 minutes	succeeded	job_2014051618
3358472	2014-05-26 07:49:47Z	2014-05-26 06Z	2014-05-26 08:28:23Z	2014-05-26 08:28:44Z	39 minutes	succeeded	job_2014051618
■ ■ ■							
3356658	2014-05-25 14:43:48Z	2014-05-25 13Z	2014-05-25 15:21:07Z	2014-05-25 15:22:43Z	39 minutes	succeeded	job_2014051618
3356558	2014-05-25 13:46:49Z	2014-05-25 12Z	2014-05-25 14:18:48Z	2014-05-25 14:19:43Z	33 minutes	succeeded	job_2014051618
3356446	2014-05-25 12:40:51Z	2014-05-25 11Z	2014-05-25 13:20:56Z	2014-05-25 13:22:42Z	42 minutes	succeeded	job_2014051618

Gaps in Job Runs

Time Period Processed (GMT)

No Gaps Found

Muffins Job History

Action	Timestamp (UTC)	Timestamp (local)
scrubber deployed	2014-04-09 21:49:25Z	2014-04-09 14:49:25 (2 months ago)
scrubber deployed	2014-04-03 00:57:15Z	2014-04-02 16:57:15 (2 months ago)

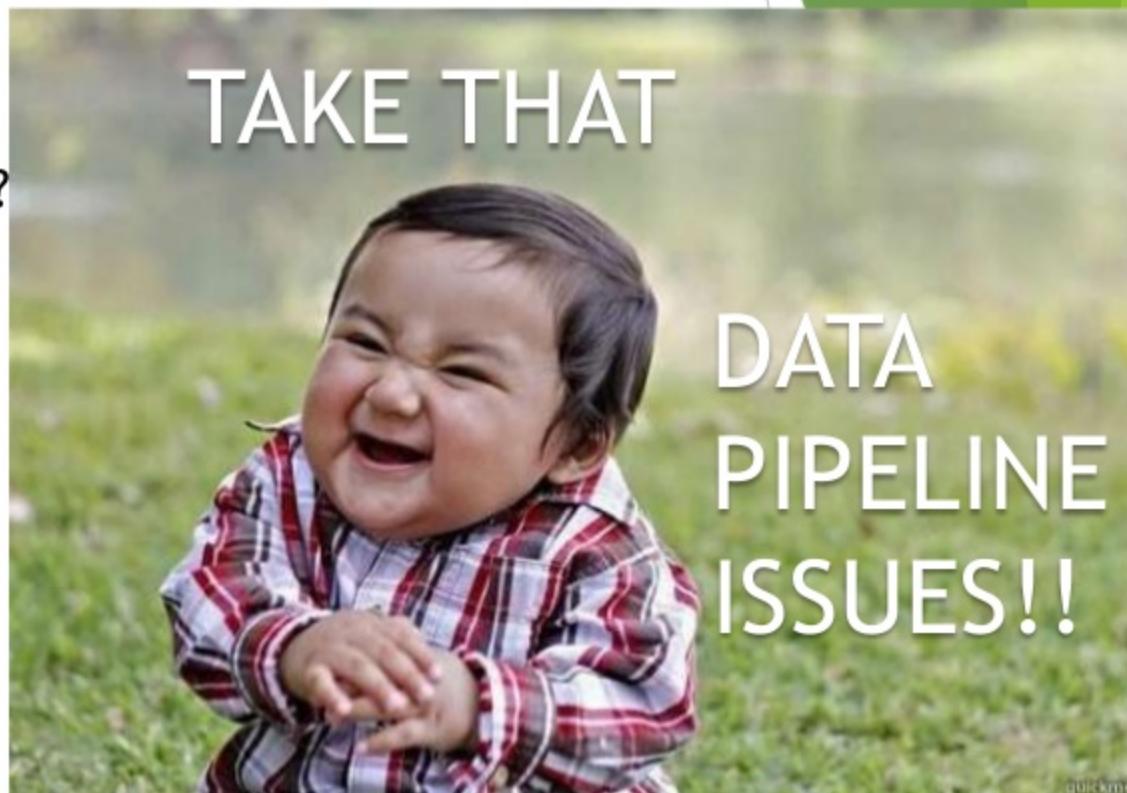
scrubber deployed	2013-11-10 20:20:10Z	2013-11-10 13:20:10 (3 months ago)
scrubber deployed	2013-10-19 03:02:02Z	2013-10-18 20:02:02 (7 months ago)
migrated	2013-10-16 03:33:07Z	2013-10-15 20:33:07 (7 months ago)
harpy deployed	2013-10-16 03:33:06Z	2013-10-15 20:33:06 (7 months ago)

Job Metadata

Name	Value
allowpickup	false
cluster	10.16.80.251
custom_jar	/home/hadoop/jobs/taskjars-cdh4/revenue_start-1.0-SNAPSHOT-jar-with-dependencies.jar
dependson	720
enabled	true
error_threshold	1000
fileTypes	start,assetimpression
filebatch	1
hardstop_action	0
harpy_output_basepath	/mnt/10_16_20_51/datastore/harpy/ingest/revenue_start
hoursafterday	0
hoursbeforeday	0
ignoreleadingdata	false
ignoretailingdata	false
inputfiletype	revenue
isKPI	true
jobid	118
jobtype	Hourly Forward
mappers	
maxdate	
mindate	2010-06-01
mindaterangestart	0
muffinsHistoryUrl	http://monster.prod.hulu.com/jobs/revenue_start_v3/muffins-history/
name	revenue_start_v3
priority	1
recentRunsUrl	http://monster.prod.hulu.com/jobs/revenue_start_v3/runs/
reducers	
region	US
runpriority	0

Does this solve our problems?

- Single Point of Access?
- Maintain services separately?



Our Users' Perspective?

- We detect platform issues
- We quickly troubleshoot errors
- We track relative performance
- We know where we are re: SLAs

DETECTION

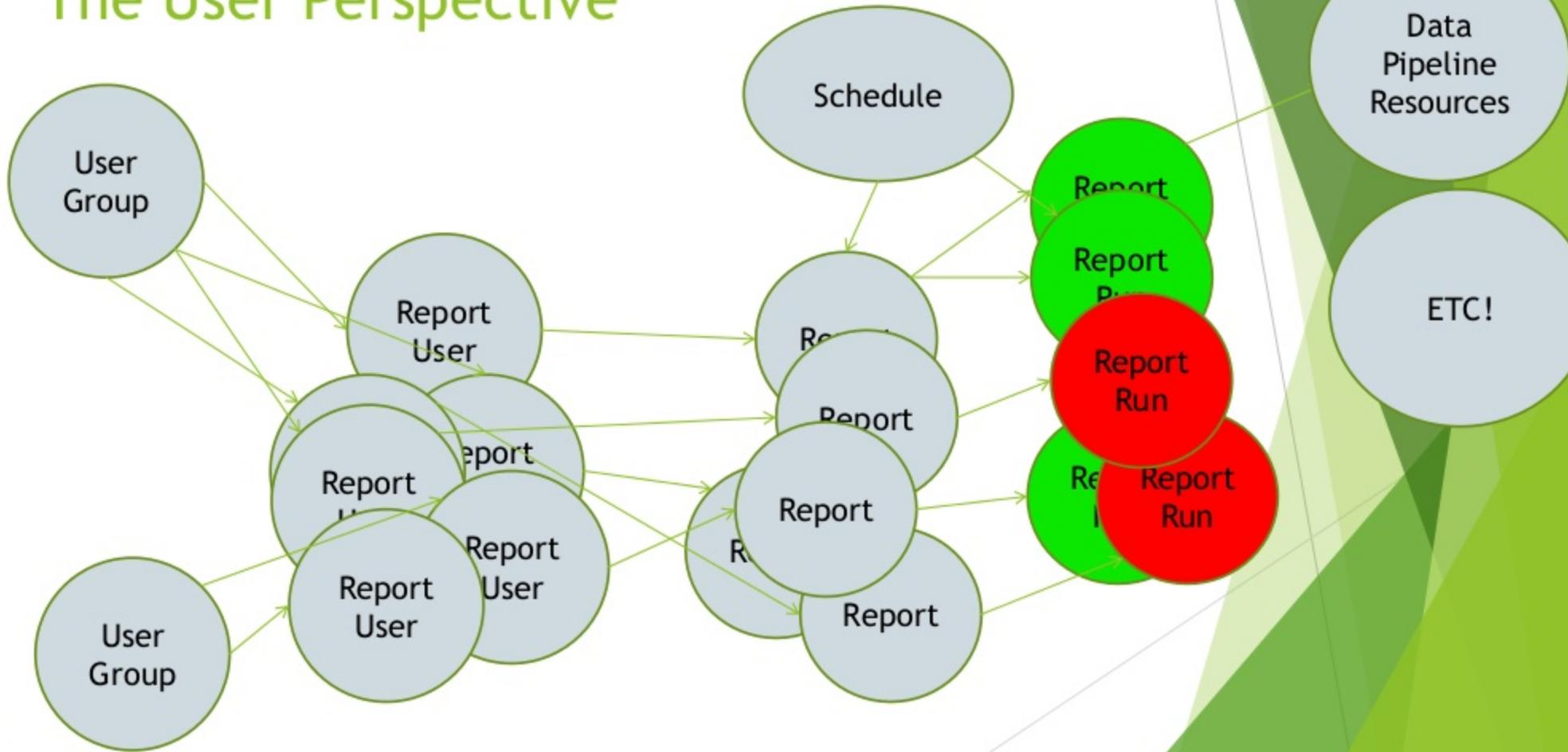
...but is detection of a problem enough?

USERS

We need to think of things from the report users' perspectives



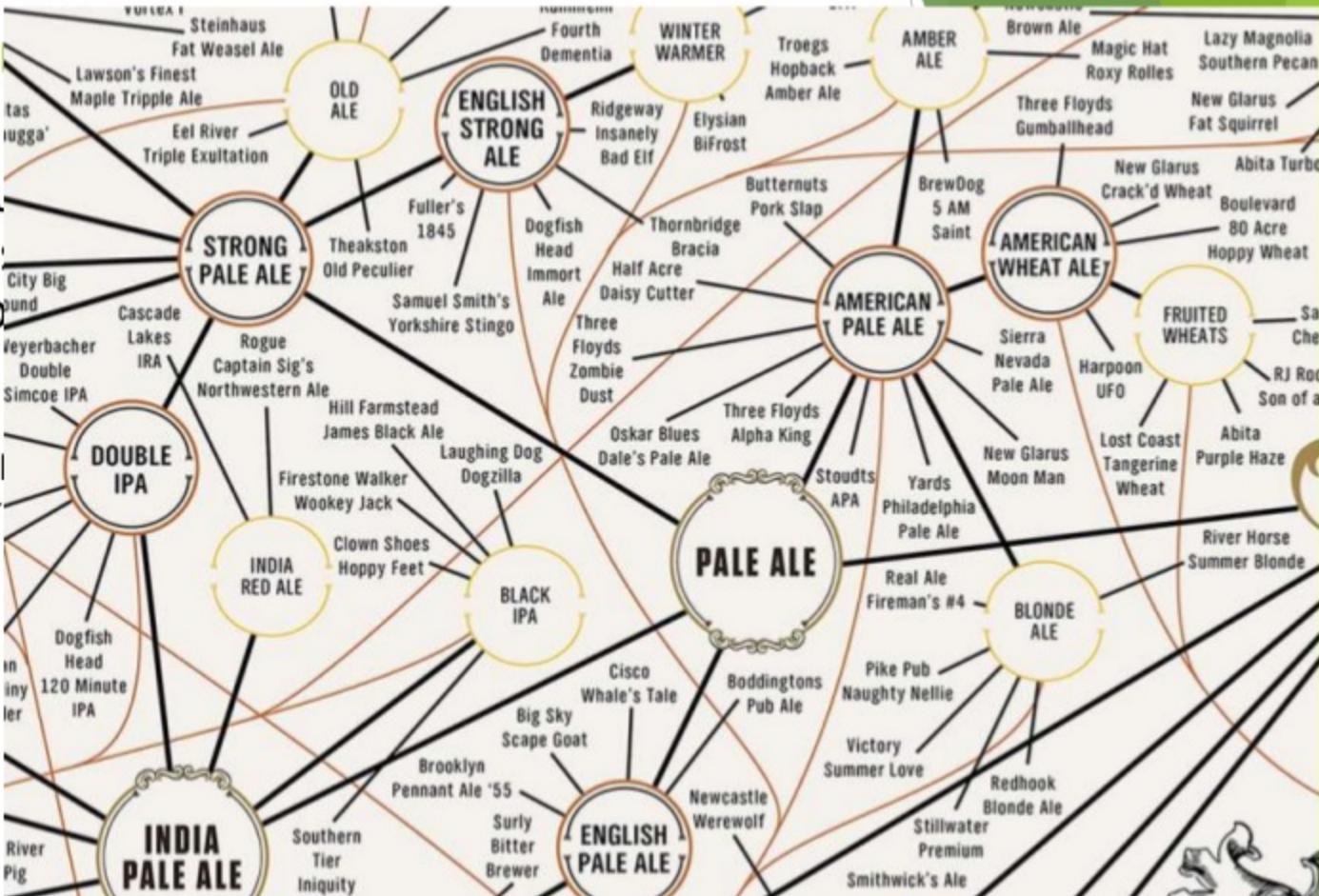
The User Perspective



Contextual Troubleshooting

- Connect issues to bugs
- Better impact assessment
- Tune performance problems

We need a graph data structure populated with the stuff about



Something like this

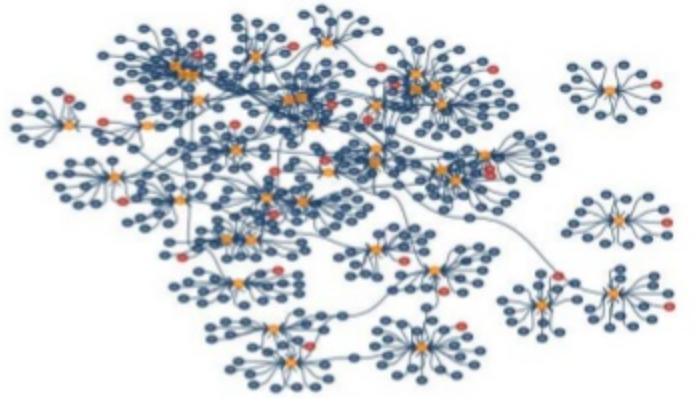
Why a Graph?

- ▶ ...instead of RDBMS

- ▶ Indeterminate # of Joins
- ▶ Query for graph connectedness is trivial and short
- ▶ Query for connectedness w/ SQL relies on knowing the intermediate resources

- ▶ ...instead of a tree?

- ▶ Data is sometimes recombinant (e.g. a metric in multiple reports to same user)



Report Dashboard

05/22/2014 - 05/23/2014 ▼

Fetch Reports

	Cross Filtered	Total
Count	136	136
Average Duration	Ten minutes	Ten minutes

Report Filters

<input checked="" type="checkbox"/>	Last Status	Cross Filtered	Total
<input checked="" type="checkbox"/>	succeeded	102	102
<input checked="" type="checkbox"/>	queued	16	16
<input checked="" type="checkbox"/>	failed	18	18

<input checked="" type="checkbox"/>	Duration(min)	Cross Filtered	Total
<input checked="" type="checkbox"/>	180 - 300	6	6
<input checked="" type="checkbox"/>	more than 300	78	78
<input checked="" type="checkbox"/>	less than 10	32	32
<input checked="" type="checkbox"/>	unknown	17	17
<input checked="" type="checkbox"/>	10 - 30	2	2
<input checked="" type="checkbox"/>	30 - 60	1	1

<input checked="" type="checkbox"/>	User	Cross Filtered	Total
	<input type="text" value="Search"/>		
<input checked="" type="checkbox"/>	Fake Name	25	25
<input checked="" type="checkbox"/>	Notrealius Personus	14	14
<input checked="" type="checkbox"/>	Somebody WhoIUsedToKnow	2	2
<input checked="" type="checkbox"/>	Demo Data	3	3

<input checked="" type="checkbox"/>	User Department	Cross Filtered	Total
	<input type="text" value="Search"/>		
<input checked="" type="checkbox"/>	Finance & Strategy	29	29
<input checked="" type="checkbox"/>	Inventory, Planning & Analysis	15	15
<input checked="" type="checkbox"/>	Content Operations & Partner Management	7	7
<input checked="" type="checkbox"/>	Product Development	2	2

Last Status	<input checked="" type="checkbox"/> ON
Duration(min)	<input checked="" type="checkbox"/> ON
User	<input checked="" type="checkbox"/> ON
User Department	<input checked="" type="checkbox"/> ON
Database	<input checked="" type="checkbox"/> ON
Table	<input checked="" type="checkbox"/> ON
Location	<input type="checkbox"/> OFF
Granularity	<input type="checkbox"/> OFF
Metric	<input type="checkbox"/> OFF
Dimension	<input type="checkbox"/> OFF
Metric Combo	<input type="checkbox"/> OFF
Dimension Combo	<input type="checkbox"/> OFF

	Last Status	Cross Filtered	Total
	succeeded	0	321
	queued	0	23
<input checked="" type="checkbox"/>	failed	11	22
	running	0	4

Let's investigate...

	Table	Cross Filtered	Total
	Search		
<input checked="" type="checkbox"/>	DAPI_ad_impression_creative_package_videoadmodel_day_est	0	10
<input checked="" type="checkbox"/>	DAPI_ad_impression_flight_product_video_cp_plan_day_est	0	13
<input checked="" type="checkbox"/>	Hive_playback_start_day_est_dapi_v2	6	36
<input checked="" type="checkbox"/>	Hive_playback_watched_uniques_subscription_nogap_day_js_t_jp	1	26
<input checked="" type="checkbox"/>	HIVE_playback_activeusers_m	1	7

	Database	Cross Filtered	Total
	MYSQL	0	109
<input checked="" type="checkbox"/>	HIVE	8	261
<input checked="" type="checkbox"/>	unknown	3	9
	DeliverBoy Cache	0	10
	MSSQL	0	13

These failed before getting to a data store

	Location	Cross Filtered	Total
<input checked="" type="checkbox"/>	DAPIDB1	0	35
<input checked="" type="checkbox"/>	DAPIDB2	0	74
<input checked="" type="checkbox"/>	HiveDB	8	256
<input checked="" type="checkbox"/>	unknown	3	33
<input checked="" type="checkbox"/>	DeliverBoy Cache	0	10
<input checked="" type="checkbox"/>	INVOICECONTENT	0	13

Most of the hive failures were the same table, but it's a common table

Cross Filtered Reports			
Report ID	Run ID	Hive ID	Title
Search	Search	Search	Search
5768	9416	904370	Shortform
5801	9415	904369	WMR Part 2
10300	9388	903541	Active Users - Series Title, Package, Content Partner, Channel Type, Distribution Partner, Distribution Platform, Parent CP, P
10300	9387	903540	Active Users - Series Title, Package, Content Partner, Channel Type, Distribution Partner, Distribution Platform, Parent CP, P

As we filter, the matched reports show up on the bottom of the page. The log link shows us the details

	User	Run Started	Run Finished	Data From	Data To	Log
	Name Changed	05/27/2014 21:08	05/27/2014 21:20	05/18/2014	05/24/2014	log
	Protect Innocent	05/27/2014 21:07	05/27/2014 21:20	05/18/2014	05/24/2014	log
	Nunna Yurbiznis	05/26/2014 15:30	05/27/2014 09:40	02/23/2014	03/01/2014	log
	Wahchu Lukinat	05/26/2014 15:30	05/27/2014 09:40	03/02/2014	03/08/2014	log

Last Status	<input type="radio"/> ON
Duration(min)	<input type="radio"/> OFF
User	<input type="radio"/> OFF
User Department	<input type="radio"/> OFF
Database	<input type="radio"/> ON
Table	<input type="radio"/> ON
Location	<input type="radio"/> ON
Granularity	<input type="radio"/> OFF
Metric	<input type="radio"/> OFF
Dimension	<input type="radio"/> OFF
Metric Combo	<input type="radio"/> OFF
Dimension Combo	<input type="radio"/> OFF
Running At	<input type="radio"/> OFF

Video Views - Distribution Partner

metrics : • VideoViews
dimensions : • DistributionPartner
updated at : 2014-05-15 18:58

Schedule

scheduled : once
date range : 2014-05-15 - 2014-05-15

Attempt

status : succeeded ([result](#))
created at : 2014-05-20 16:36
started at : 2014-05-20 16:36
finished at : 2014-05-20 16:36
duration : a few seconds

Query

database : unknown
location : unknown
tables : • unknown
deliverboy id : -642094595
hive queue id : -

User

owned by : Charlie Kim
title : Software Developer
department : Technology - Finance & Metric Reporting
reports to : Tristan Reid



Each service implements a log-fetching interface, specific to the resources used for a particular report

```
'content_metrics'.`content_view_dp_dplat_playerversion_day_est` `tbl224` left join
'hulu'.`MergedDistributionPartner` `tbl164` on (`tbl224`.`distribution_partner_id` = `tbl164`.`Id`) left join
'huludate'.`ESTDay` `tbl186` on (`tbl224`.`real_date` = `tbl186`.`RealDate`) where ((`tbl224`.`real_date`
between '2014-05-15 00:00:00' and '2014-05-15 23:59:59')) group by `tbl164`.`Identifier`,
`tbl186`.`WeekEndSaturdayDate`'

[INFO] [2014-05-20 16:36:45] [pool-427-thread-5]
deliverboy.datafetch.AbstractFetcher.fetchData(AbstractFetcher.java:75)
fetching singular result set

[INFO] [2014-05-20 16:36:45] [pool-427-thread-5]
deliverboy.utils.DataBaseLogHelper.updateUserQueryStatus(DataBaseLogHelper.java:57)
Updating user_query_id=63351

[INFO] [2014-05-20 16:36:45] [pool-427-thread-5]
deliverboy.utils.DataBaseLogHelper.updateUserQueryStatus(DataBaseLogHelper.java:60)
Updated user_query:63351, records affected:0

[INFO] [2014-05-20 16:36:45] [pool-427-thread-5]
deliverboy.format.FormatHelper.format(FormatHelper.java:38)
Format: queryOutputHandlers:[format=XML_FORMAT&offset=0&length=-1,
emailto=&email_format=CSV_FORMAT&email_title=Video Views - Distribution
Partner&email_text=VideoViews,DistributionPartner&report_run_attempt_id=3852&offset=0&length=-1,
format=JSON_FORMAT&offset=0&length=-1]

[INFO] [2014-05-20 16:36:45] [pool-427-thread-5]
deliverboy.emailresults.EmailResultsHelper.emailData(EmailResultsHelper.java:80)
Email Data to:null

[ERROR] [2014-05-20 16:36:45] [pool-427-thread-5]
deliverboy.utils.MailSenderImpl.sendMail(MailSenderImpl.java:84)
Tried to send an email with no recipients, suspicious!
```

» Hive Runner- non hive job

A close-up photograph of a baby with light brown hair, wearing a green and white long-sleeved shirt. The baby is looking directly at the camera with a neutral expression. In their right hand, they are holding a small, crumpled piece of food, possibly a sandwich or a cookie. The background is a blurred beach scene with sand and water. A vertical graphic element on the right side of the image features a green-to-yellow gradient with a geometric polygonal pattern.

SUCCESS!!!

In Summary...

- ▶ Find the Important Questions => Measure the Right Data
- ▶ Make troubleshooting easy
- ▶ Small distinct services are easy to create, maintain, and wire together

Thanks to...

- Muthu...the Platform GrandMaster
- All of Metrics Platform, Tools, Reporting for making this stuff
 - Mohamed, Chris, Charlie, Robert, Phong, AJ, Ratheesh, Adi, Matt, Shashank, Joanne, Siddhartha, Tamir, Jun, James, Dr. Kevin, Hang
- All of the Hulu DEV team for general awesomeness
- Prasan...thanks for the impetus to do this. I'll look u up
- Kevin...thanks for Hulu. I'll send u a snap

Questions?