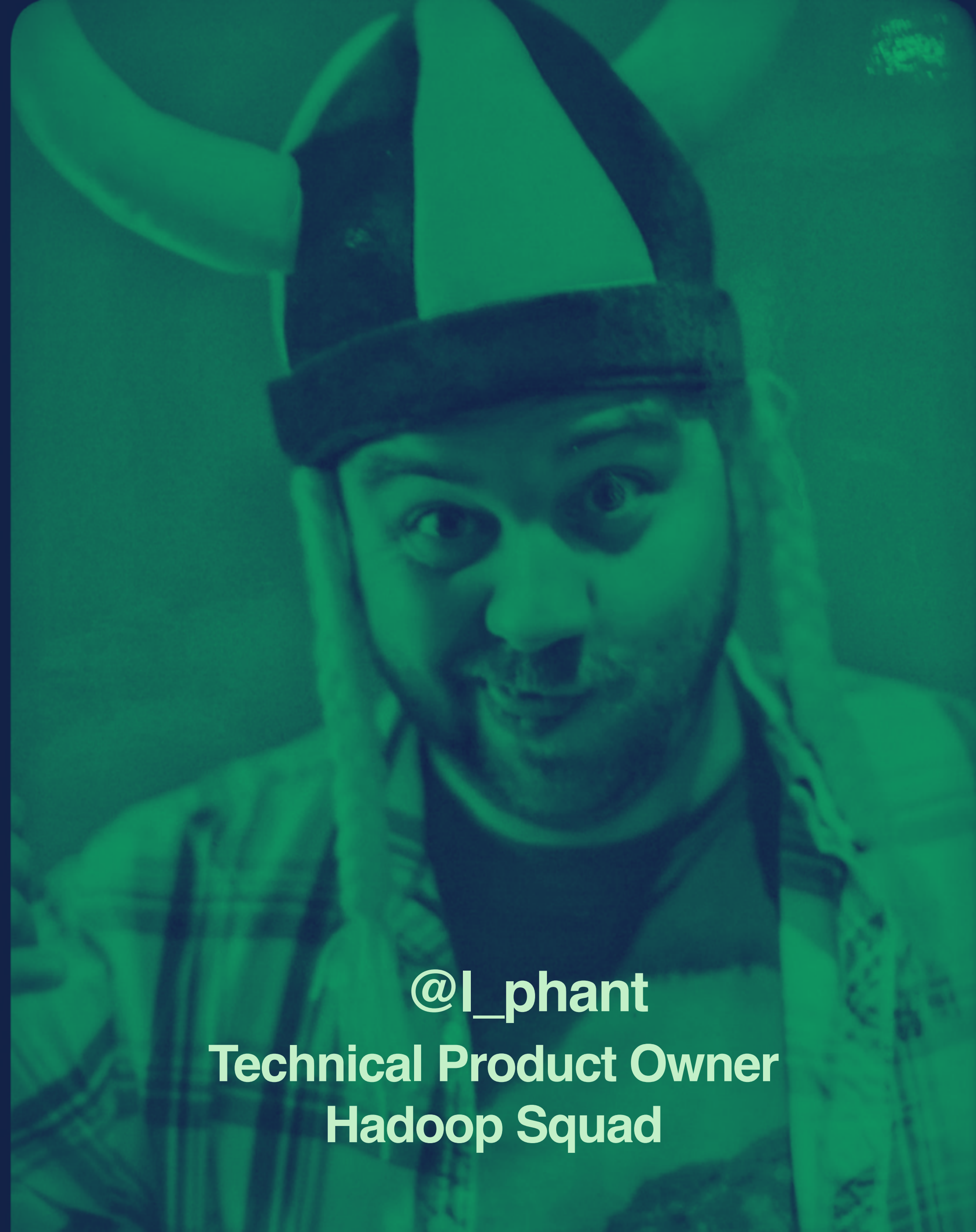


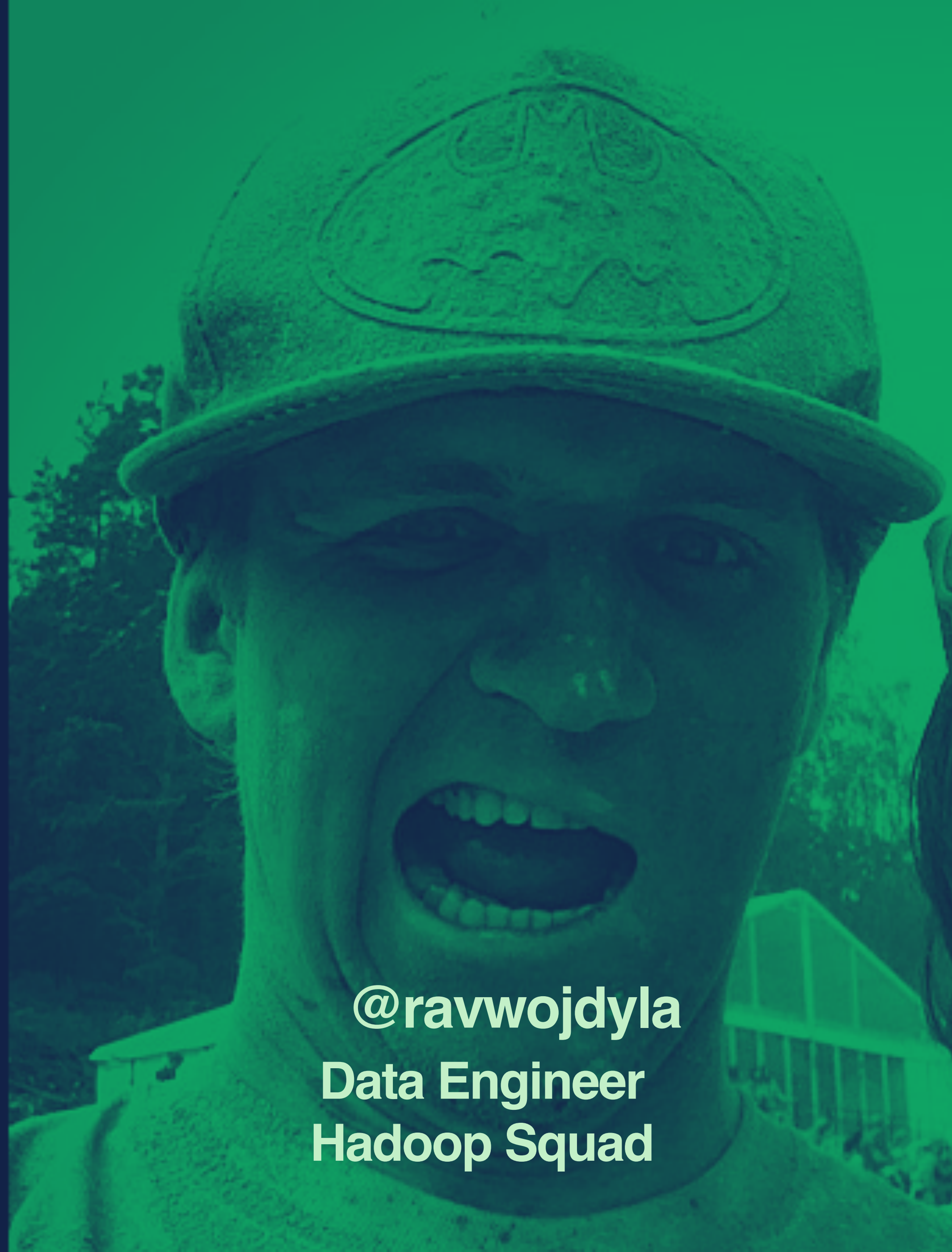
The Evolution of Hadoop at Spotify

Rafal Wojdyla (rav@spotify.com)
Josh Baer (jbx@spotify.com)





@I_phant
Technical Product Owner
Hadoop Squad



@ravwojdyla
Data Engineer
Hadoop Squad

Overview

- Growing Pains
- Gaining Focus
- The Future

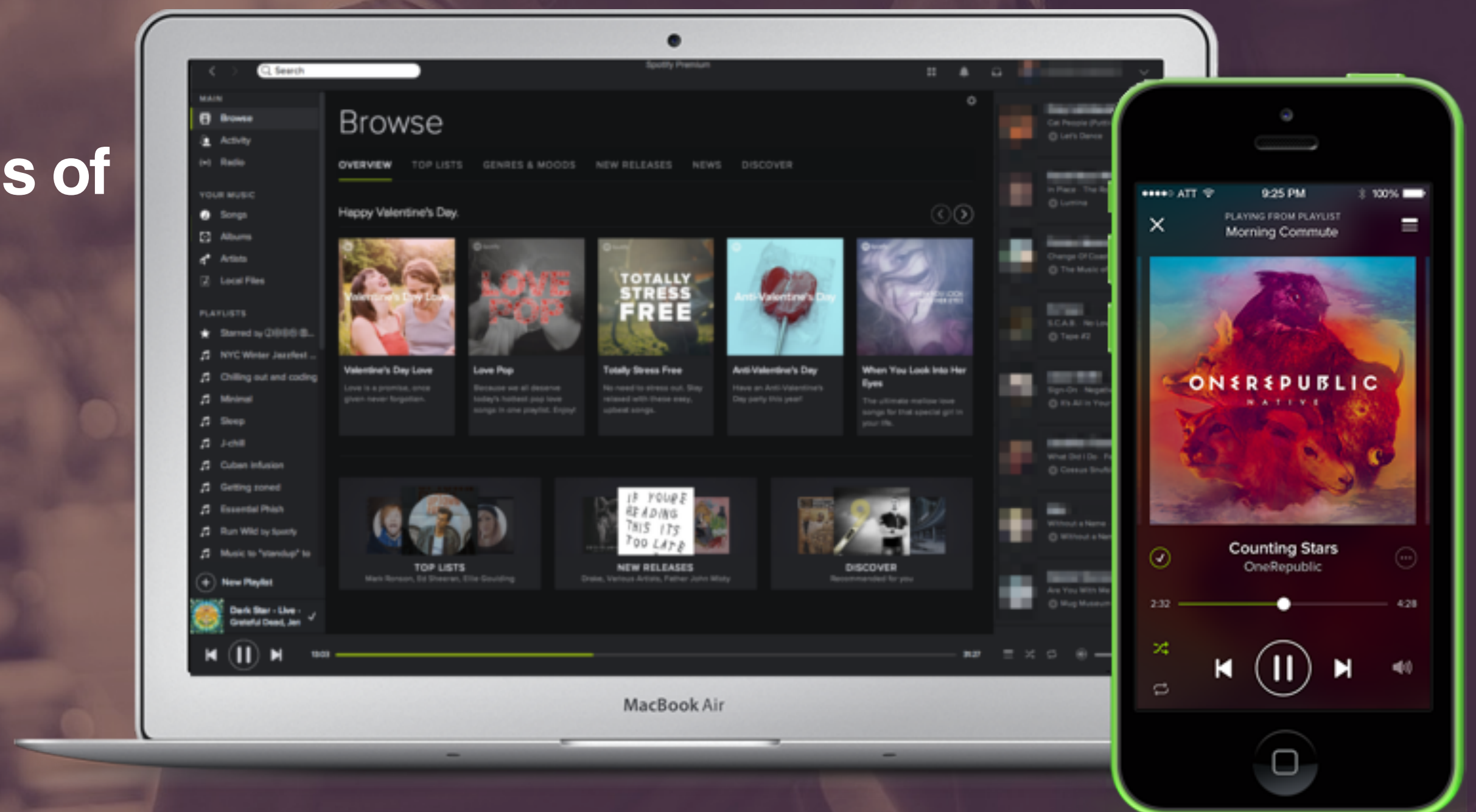


Growing Pains



What is Spotify?

- Music Streaming Service
- Browse and Discover Millions of Songs, Artists and Albums
- Just announced
 - 75 Million Monthly Users
 - 20 Million Paid Subscribers



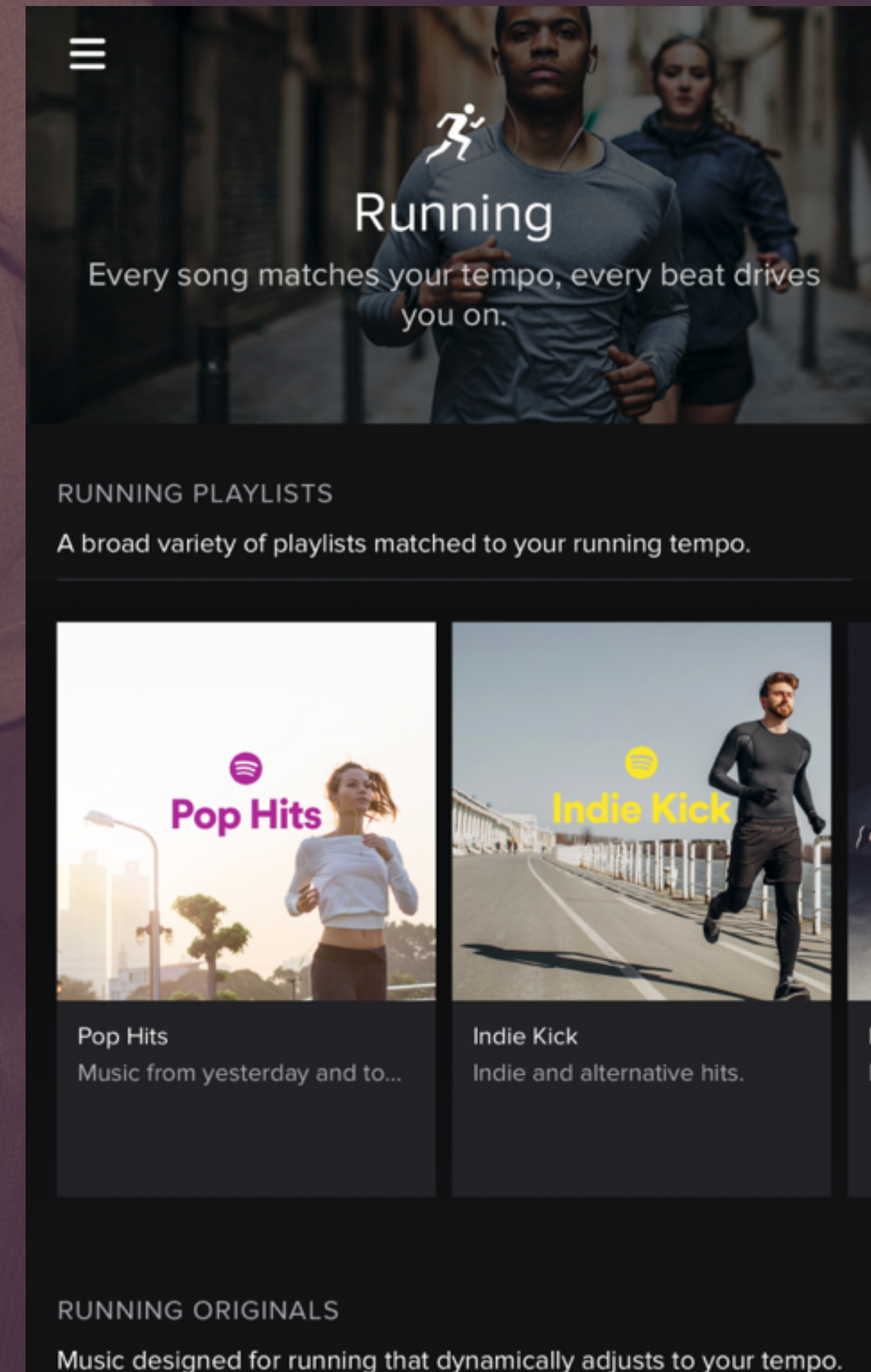
What is Spotify?

- Data Infrastructure
 - 1300 Hadoop Nodes
 - 47 PB Storage
 - 30 TB data ingested via Kafka/day
 - 400 TB generated by Hadoop/day



Powered by Data

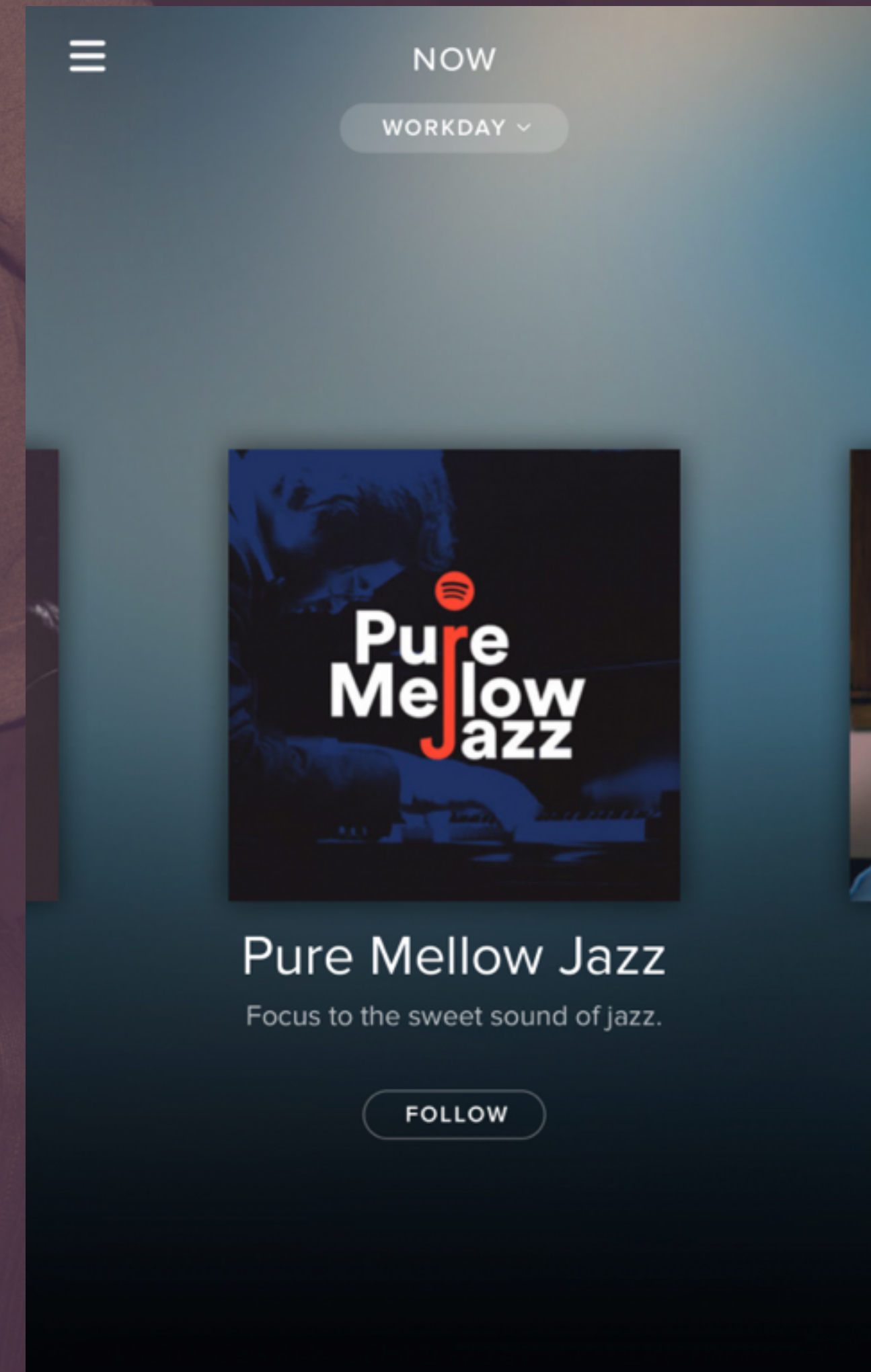
- **Running App**
 - **Matches music to running tempo**
 - **Personalized running playlists in multiple tempos for millions of active users**



<http://www.theverge.com/2015/6/1/8696659/spotify-running-is-great-for-discovery>

Powered by Data

- Now Page
 - Shows, podcasts and playlists based on day-parts
 - Personalized layout so you always have the right music for the right moment





CHART

Netherlands Top 50

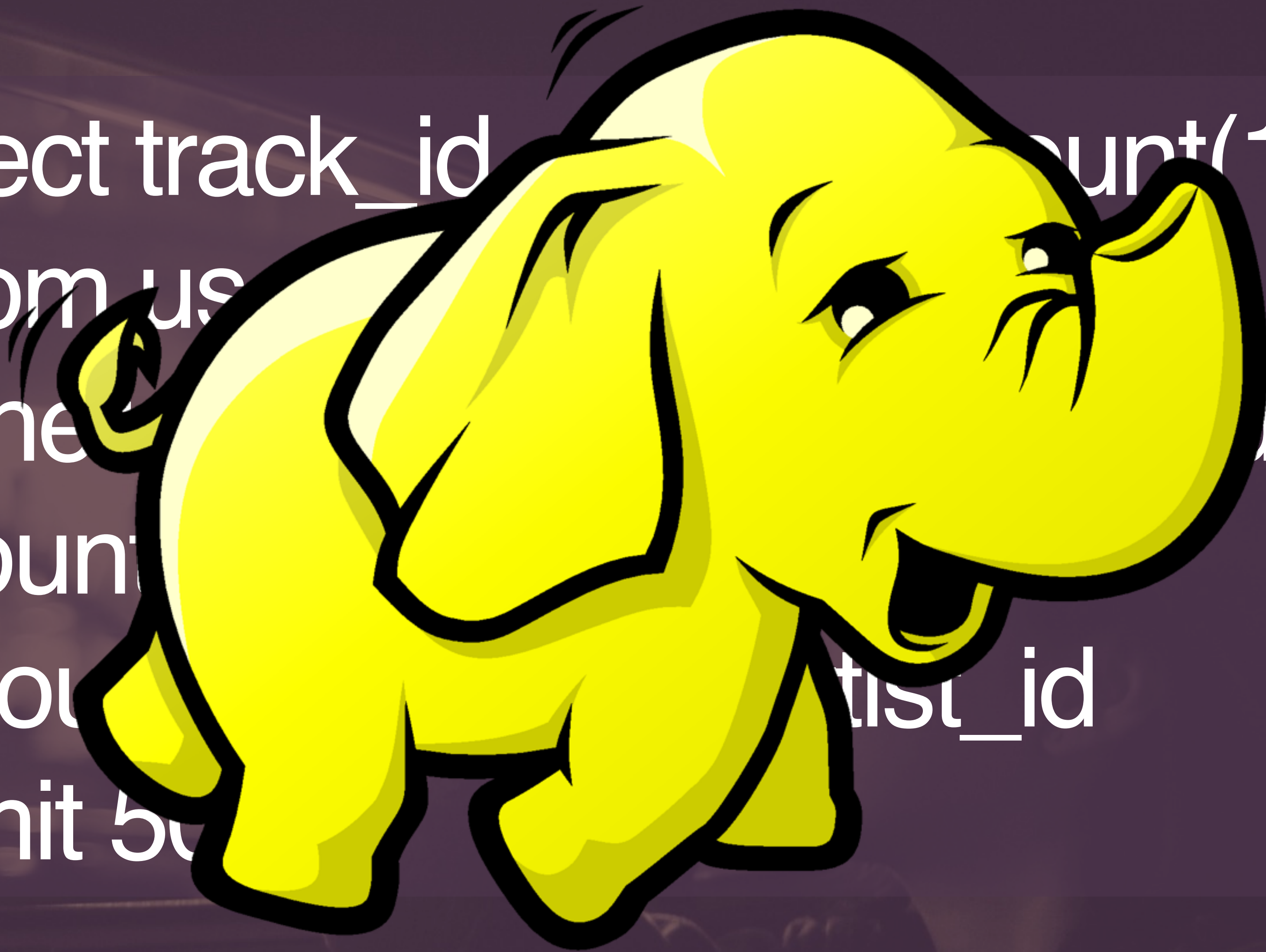
Your daily update of the most played tracks in Netherlands right now.

● 2 New Entries • Last Updated: an hour ago

▶ PLAY

#		SONG	ARTIST	DAILY PLAYS
1	– +	Drank & Drugs EXPLICIT	Lil' Kleine, Ronnie Flex	154,343
2	– +	Ain't Nobody (Loves Me Better)	Felix Jaehn, Jasmine Thompson	128,221
3	– +	Lean On (feat. MØ & DJ Snake)	Major Lazer, MØ, DJ Snake	122,443
4	– +	Stole the Show	Kygo, Parson James	105,768
5	– +	Parijs	Kenny B	101,985
6	– +	See You Again (feat. Charlie Puth)	Wiz Khalifa, Charlie Puth	95,835
7	– +	Waiting For Love	Avicii	92,805
8	– +	Policeman	Eva Simons, Konshens	89,847
9	▲ +	Hey Mama (feat. Nicki Minaj, Bebe Rexha & Afrojack)	David Guetta, Bebe Rexha, Nicki Minaj, Afro...	84,661
10	▲ +	El Perdón	Nicky Jam, Enrique Iglesias	82,633
11	▼ +	Want To Want Me	Jason Derulo	80,176
12	– +	Where Are Ü Now (with Justin Bieber)	Jack Ü, Skrillex, Diplo, Justin Bieber	75,597


```
select track_id, count(1)
from us
where
count
group by track_id
limit 50
```



A man and a woman are shown from the chest up, celebrating with their arms raised in the air. They are both smiling broadly. The man is in the foreground, wearing a light-colored button-down shirt and glasses. The woman is slightly behind him, wearing a dark sweater over a collared shirt. The background is dark and filled with many small, bright white dots, resembling a starry night sky or a particle simulation. The overall tone is celebratory and optimistic.

“It’s simple, we just
throw the data into
Hadoop”

A naive data engineer

Moving Data to Hadoop

- Raw data is complicated
 - Often dirty
 - Evolving structure
 - Duplication all over
- Getting data to a central processing point is HARD

```
10.123.133.333 - - [Mon, 3 June 2015 11:31:33 GMT] "GET /api/admin/job/aggregator/status HTTP/1.1" 200 1847 "https://my.analytics.app/admin"
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36"
```

```
10.123.133.222 - - [Mon, 3 June 2015 11:31:43 GMT] "GET /api/admin/job/aggregator/status HTTP/1.1" 200 1984 "https://my.analytics.app/admin"
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36"
```

```
10.123.133.222 - - [Mon, 3 June 2015 11:33:02 GMT] "GET /dashboard/courses/1291726 HTTP/1.1" 304 - "https://my.analytics.app/admin"
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36"
```

```
10.321.145.111 - - [Mon, 3 June 2015 11:33:03 GMT] "GET /api/loggedInUser HTTP/1.1" 304 - "https://my.analytics.app/dashboard/courses/1291726"
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36"
```

```
10.112.322.111 - - [Mon, 3 June 2015 11:33:03 GMT] "POST /api/instrumentation/events/new HTTP/1.1" 200 2 "https://my.analytics.app/dashboard/courses/1291726"
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36"
```

```
10.123.133.222 - - [Mon, 3 June 2015 11:33:02 GMT] "GET /dashboard/courses/1291726 HTTP/1.1" 304 - "https://my.analytics.app/admin"
"Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_4) AppleWebKit/537.36
(KHTML, like Gecko) Chrome/43.0.2357.81 Safari/537.36"
```




LogArchiver

- Original method to transport logs from APs to HDFS
- Lasted from 2009 - 2013
- Relies on rsync/scp and cron to move files around



FAIL



ERR, LESSON?



Log -> HDFS latency reduced from hours to seconds!

Workflow Management Fail!

5	*	*	*	*	spotify-core	hadoop jar merge_hourly_logs.jar
15	*	*	*	*	spotify-core	hadoop jar aggregate_song_plays.jar
30	*	*	*	*	spotify-analytics	hadoop jar merge_song_metadata.jar
0	1	*	*	*	spotify-core	hadoop jar daily_aggregate.jar
0	2	*	*	*	spotify-core	hadoop jar calculate_toplist.jar



Luigi

<https://github.com/spotify/luigi>

A background image showing three people riding bicycles on a sandy beach at sunset. The sky is a mix of orange, pink, and purple, and the ocean is visible in the distance. The people are silhouetted against the bright sky.

```
[data-sci@sj-edge-a1 ~] $ hdfs dfs -ls /data
```

Found 3 items

```
drwxr-xr-x    - hdfs hadoop      0 2015-01-01 12:00 lake
drwxr-xr-x    - hdfs hadoop      0 2015-01-01 12:00 pond
drwxr-xr-x    - hdfs hadoop      0 2015-01-01 12:00 ocean
```

```
[data-sci@sj-edge-a1 ~] $ hdfs dfs -ls /data/lake
```

Found 1 items

```
drwxr-xr-x    - hdfs hadoop 1321451 2015-01-01 12:00 boats.txt
```

```
[data-sci@sj-edge-a1 ~] $ hdfs dfs -cat /data/lake/boats.txt
```

...



snakebite

<https://github.com/spotify/snakebite>


```
$ time for i in {1..100}; do hdfs dfs -ls / > /dev/null; done  
real 3m32.014s  
user 6m15.891s  
sys 0m18.821s
```

```
$ time for i in {1..100}; do snakebite ls / > /dev/null; done  
real 0m34.760s  
user 0m29.962s  
sys 0m4.512s
```

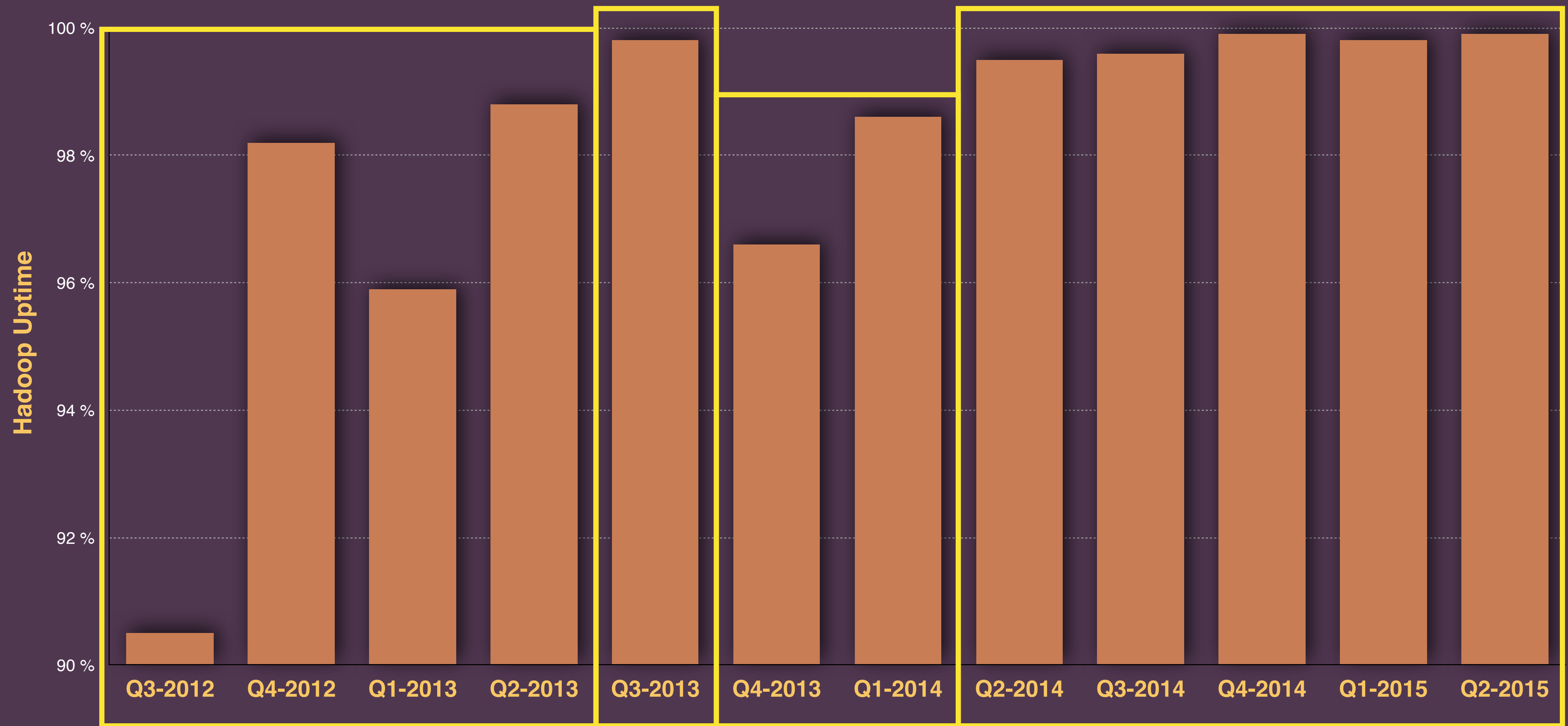

Gaining Focus



Hadoop Availability

- In 2013:
 - Hadoop expanded to 200 nodes
 - Critical but not very reliable
- Created a 'squad' with two missions:
 - Migrate to a new distribution with Yarn
 - Make Hadoop reliable

How did we do?



A classical sculpture of a man, likely a Greek or Roman figure, shown in a state of distress. He is leaning forward, with his head buried in his hands, suggesting a moment of despair or regret. The sculpture is made of a light-colored material, possibly marble or plaster, and is set against a dark, textured background. The lighting highlights the contours of his body and the texture of his hair and skin.

**Uhh ohh.... I think I
made a mistake**



```
[2014.03.12 16:48:02 | data-sci@edge-1 | /home/data-sci/development] $ snakebite rm -R /team/disco/ test-10/
```




```
$ snakebite rm -R /team/disco/ test-10/
```


A clay sculpture of a person, likely a woman, with their head buried in their hands. The sculpture is rendered in a realistic style with visible muscle and skin details. It is set against a dark, solid background. A semi-transparent brown filter is applied over the entire image, and the text "disco/ test-10" is overlaid in white.

disco/ test-10



MOTHER OF GOD



`$ snakebite rm -R /team/disco/ test-10/`

OK: Deleted /team/disco

Goodbye Data!
(1PB)

Lessons Learned

- “Sit on your hands before you type” - Wouter de Bie
- Users will always want to retain data!
- Remove superusers from ‘edgenodes’
- Moving to trash = client-side implementation

A sepia-toned photograph of Monument Valley, featuring prominent buttes and mesas under a hazy sky. The title 'The Wild Wild West' is overlaid in a bold, yellow, serif font across the center of the image.

The Wild Wild West

Pre-Production



Going from Python to Crunch

- Most of our jobs were Hadoop (python) streaming
- Lots of failures, slow performance
- Had to find a better way

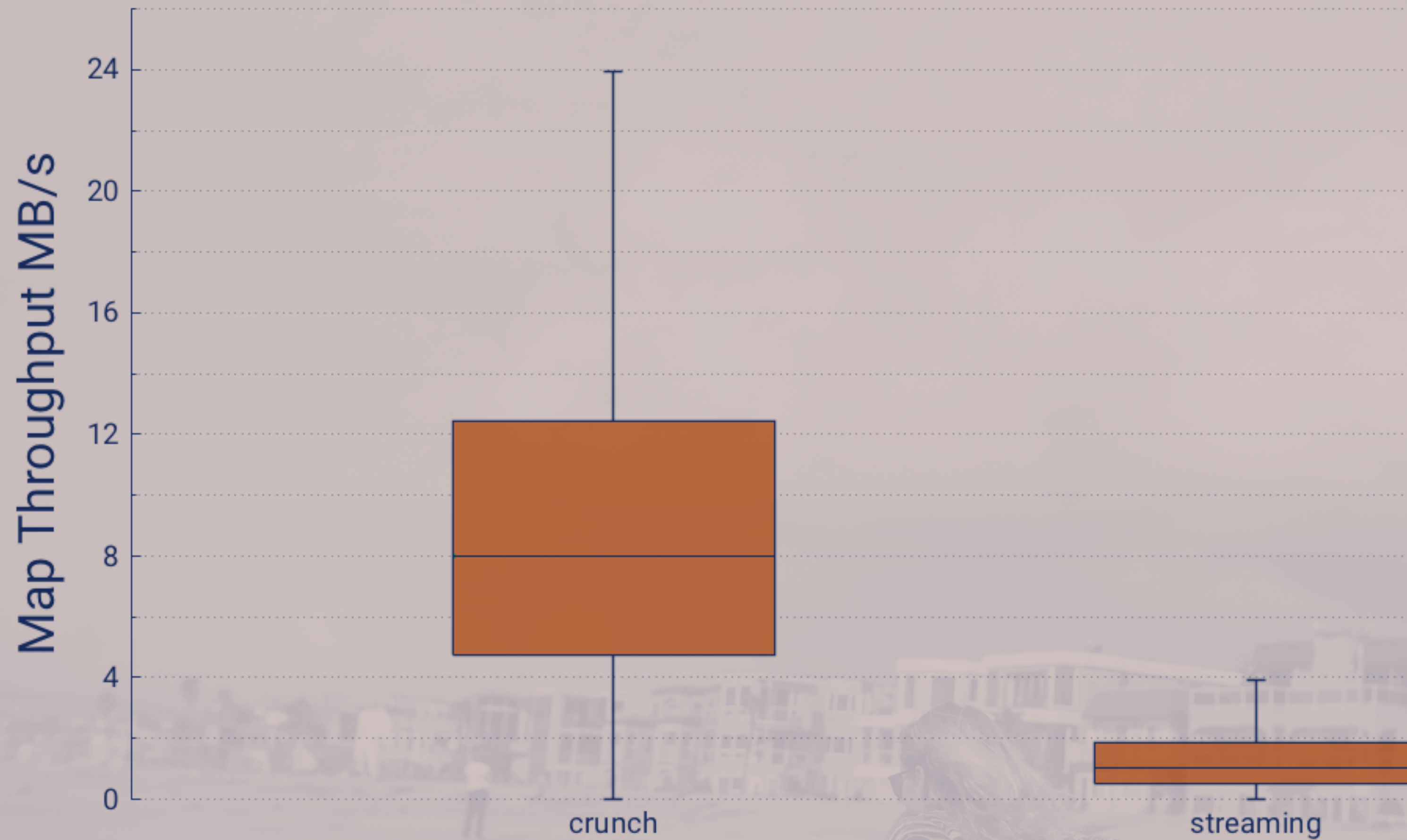


Moving from Python to Crunch

- Investigated several frameworks*
- Selected Crunch:
 - Real types - compile time error detection, better testability
 - Higher level API - let the framework optimize for you
 - Better performance #JVM_FTW

*thewit.ch/scalding_crunchy_pig

Crunch vs Hadoop Streaming Benchmark



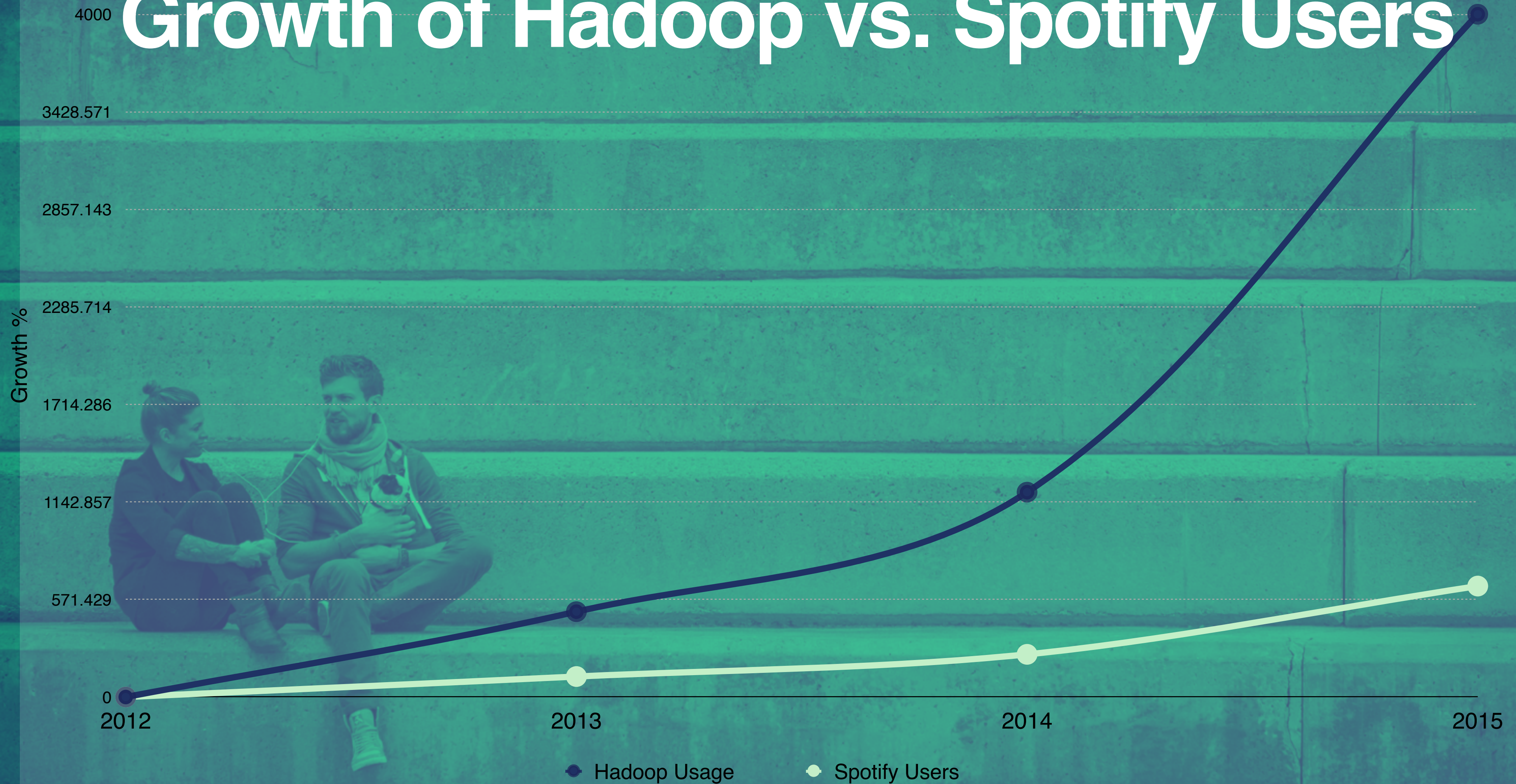
Let's Review

- Getting data into Hadoop
- Deploying data pipelines
- Increasing availability and reliability of infrastructure
- Killing it with performance

The Future



Growth of Hadoop vs. Spotify Users



Explosive Growth

- **Increased Spotify Users**
 - More users -> more data -> longer running jobs
- **Increased Use Cases**
 - Beyond simple analytics
- **Increased Engineers**
 - Adding data scientists and data engineers






Scaling Machines: Easy
Scaling People: Hard

User Feedback: Automate it!



hadoop.spotify.net

 Spotify | HADOOP

TOOLS ▾ DOC LINKS ▾

Hadoop status

Your beloved admin says Hadoop is all good

PagerDuty says Hadoop is all good!

Status of ResourceManager/YARN: up and running.

Status of Namenode/HDFS: up and running.

Contact us

Goalie:
Go to [#data-support](#) channel on Slack

On-call: Rafal Wojdyla
Use only in case of emergency/incident!

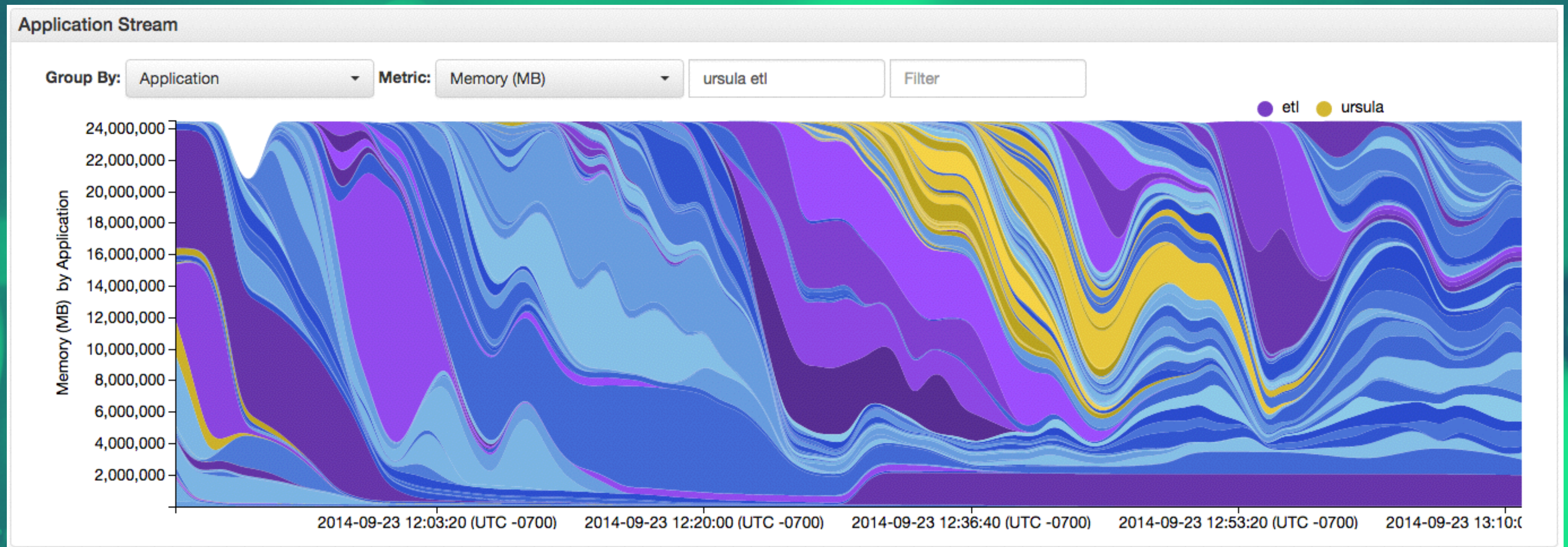
Describe your issue! Include how to contact you back.

WAKE UP RAFAL

Built with ♥ by Hadoop squad and friends - send feedback to [hadoop](#)

Single entry point to information

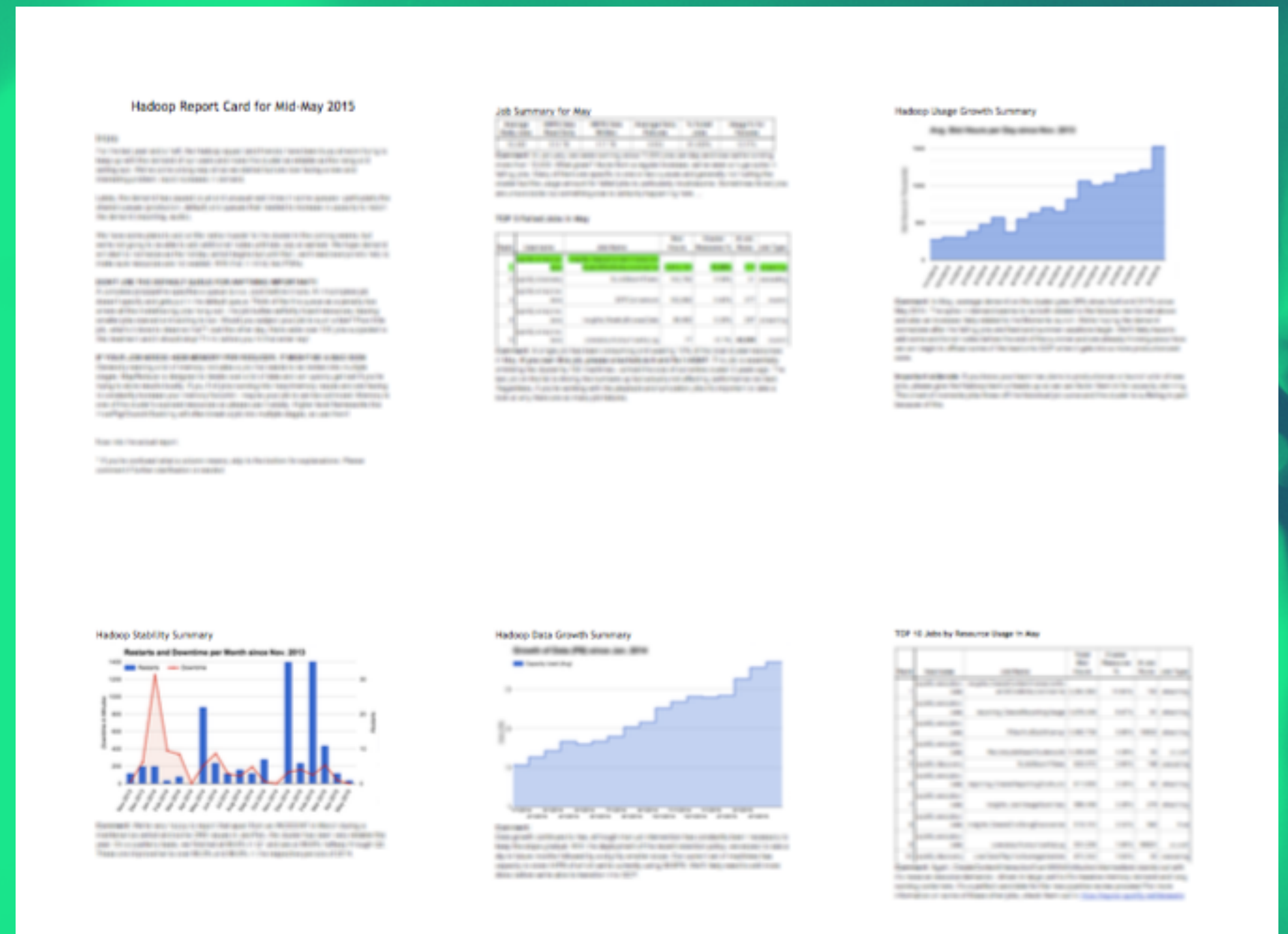
Inviso



Developed by Netflix: <https://github.com/Netflix/inviso>

Hadoop Report Card

- Contains Statistics
- Guidelines and Best Practices
- Sent Quarterly





Real Time Use Cases

- Expanding our use of Storm for:
 - Targeting Ads based on genres
 - Quicker recommendations
- More information:
 - <https://labs.spotify.com/2015/01/05/how-spotify-scales-apache-storm/>

Takeaways

- **There's no golden path**
 - **No perfect solutions, only ones that work now!**
- **Big Data is constantly evolving**
 - **Don't be afraid to rebuild and replace!**

Join The Band!

Engineers needed in NYC, Stockholm

<http://spotify.com/jobs>

Bonus Slides

Hardware Profiles

- ▶ 190 nodes:

Intel Xeon X5675 @ 3.07GHz (12 physical + HT)

32GB RAM, 12x2TB disks

- ▶ 690 nodes:

Intel Xeon E5-2630L 0 @ 2.00GHz (12 physical + HT)

64GB RAM, 12x4TB disks

- ▶ 400 nodes:

Intel Xeon E5-2630L v2 @ 2.40GHz (12 physical + HT)

96GB RAM, 12x4TB disks

Crunch vs Hadoop Streaming Benchmark II

