
Σ
@summingbird

Streaming MapReduce with Summingbird

Tuesday, September 3, 2013 | By Sam Ritchie (@sritchie) [15:47 UTC]

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Today we are open sourcing Summingbird on GitHub under the ALv2.

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Oscar Boykin - @posco
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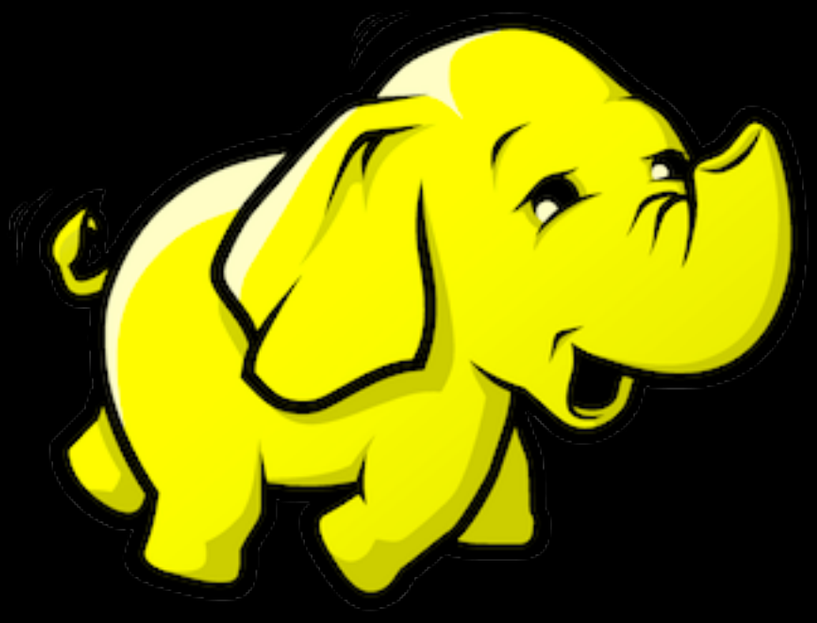
- What is Summingbird?
- What can it do today?
- Why you should use it to write Storm!
  - Currently deployed systems
  - Upcoming Features

Vision

Twitter's Scale

- 200M+ Active Monthly Users
- 500M Tweets / Day
- Several 1K+ node Hadoop clusters
- THE Realtime Company (ostensibly)

Write your logic once.



Solve systems problems **once**.

Make **non-trivial** realtime compute as accessible as Scalding.

What is Summingbird?

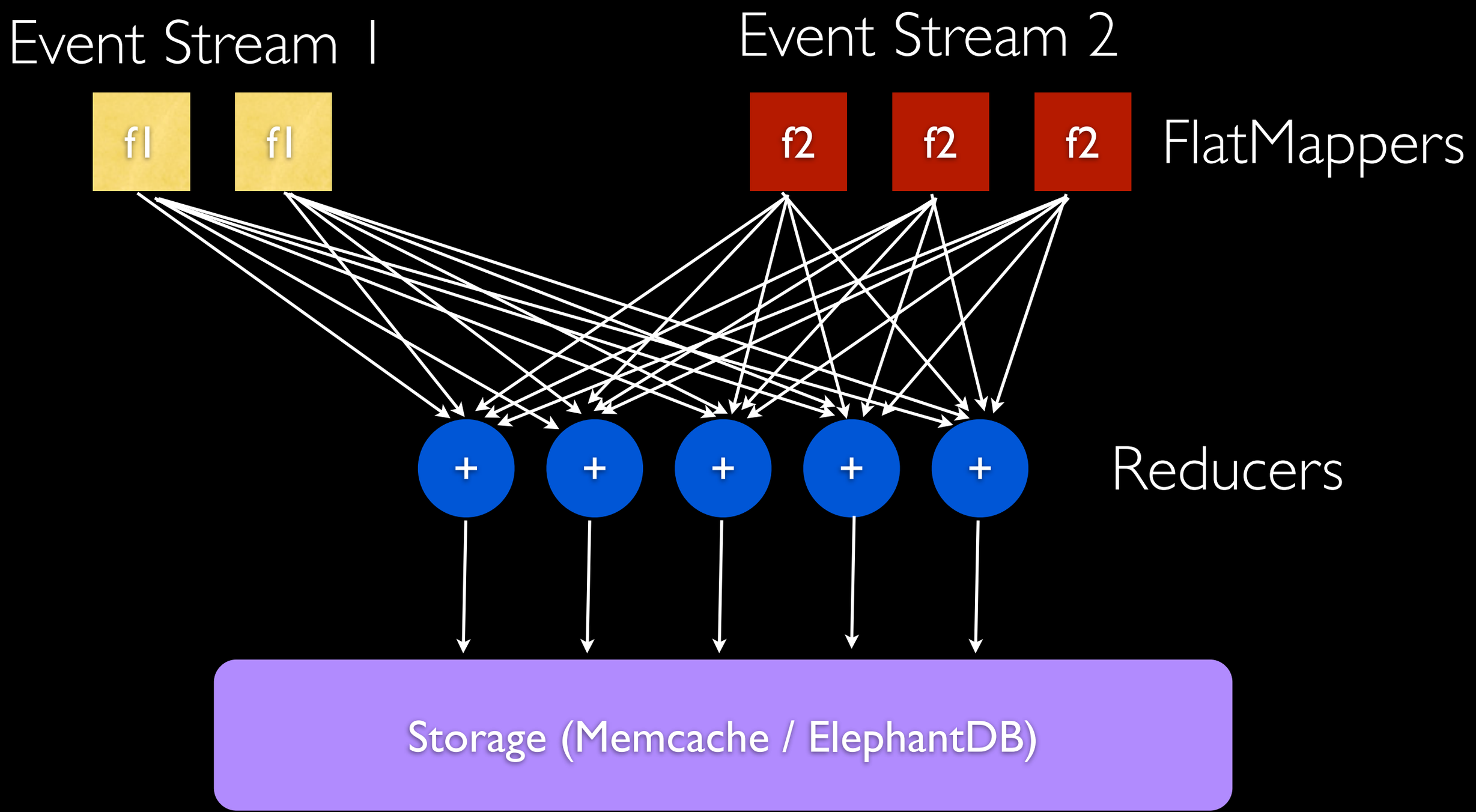
- Declarative Streaming Map/Reduce DSL
- Realtime platform that runs on **Storm**.
- Batch platform that runs on Hadoop.
- Batch / Realtime Hybrid platform

Why does Storm Care?

```java
public class WordCountTopology {
  public static class SplitSentence extends ShellBolt implements IRichBolt {
    public SplitSentence() {
      super("python", "splitsentence.py");
    }

    @Override
    public void declareOutputFields(OutputFieldsDeclarer declarer) {
      declarer.declare(new Fields("word"));
    }

    @Override
    public Map<String, Object> getComponentConfiguration() {
      return null;
    }
  }

  public static class WordCount extends BaseBasicBolt {
    Map<String, Integer> counts = new HashMap<String, Integer>();

    @Override
    public void execute(Tuple tuple, BasicOutputCollector collector) {
      String word = tuple.getString(0);
      Integer count = counts.get(word);
      if(count==null) count = 0;
      count++;
      counts.put(word, count);
      collector.emit(new Values(word, count));
    }

    @Override
    public void declareOutputFields(OutputFieldsDeclarer declarer) {
      declarer.declare(new Fields("word", "count"));
    }
  }

  public static void main(String[] args) throws Exception {

    TopologyBuilder builder = new TopologyBuilder();

    builder.setSpout("spout", new RandomSentenceSpout(), 5);

    builder.setBolt("split", new SplitSentence(), 8)
      .shuffleGrouping("spout");
    builder.setBolt("count", new WordCount(), 12)
      .fieldsGrouping("split", new Fields("word"));

    Config conf = new Config();
    conf.setDebug(true);


    if(args!=null && args.length > 0) {
      conf.setNumWorkers(3);

      StormSubmitter.submitTopology(args[0], conf, builder.createTopology());
    } else {
      conf.setMaxTaskParallelism(3);

      LocalCluster cluster = new LocalCluster();
      cluster.submitTopology("word-count", conf, builder.createTopology());

      Thread.sleep(10000);

      cluster.shutdown();
    }
  }
}
```

```
def tokenize(text: String) :
TraversableOnce[String] =
  text.toLowerCase
    .replaceAll("[^a-zA-Z0-9\\s]", "")
    .split("\\s+")

def wordCount[P <: Platform[P]](
  source: Producer[P, Status],
  store: P#Store[String, Long]) =
  source
    .filter(_.getText != null)
    .flatMap { tweet: Status =>
      tokenize(tweet.getText).map(_ -> 1L)
    }.sumByKey(store)
}
```

Map/Reduce


Event Stream 1
Event Stream 2
f1
f1
f2
f2
f2
FlatMappers
+
+
+
+
+
Reducers
Storage (Memcache / ElephantDB)

Functions, not Bolts!

```
flatMap: T => TraversableOnce[U]

// g: (x: T => U)
map(x) = flatMap(x => List(g(x))

// pred: T => Boolean
filter(x) = flatMap { x =>
  if (pred(x)) List(x) else Nil
}
```

- Source[+T]
- Store[-K, V]
- Sink[-T]
- Service[-K, +V]

The Four Ss!

- Source[+T]
- Store[-K, V]
- Sink[-T]
- Service[-K, +V]

The Storm Platform

```
Source[+T] = Spout[(Long, T)]

Store[-K, V] = StormStore[K, V]

Sink[-T] = () => (T => Future[Unit])

Service[-K, +V] = StormService[K, V]

Plan[T] = StormTopology
```

```
Source[+T] = Spout[(Long, T)]
```

```
Store[-K, V] = StormStore[K, V]
```

```
Source[+T] = Spout[(Long, T)]
```

Type Safety

README.md

Tormenta

build passing

Scala extensions for the Storm distributed computation system. Tormenta adds a type-safe wrapper over Storm's Kafka and Kestrel spouts. This type safety allows the user to push mapping and filtering transformations down to the level of the spout itself:

```
// produces strings:
val scheme: Scheme[String] = new StringScheme

// produces integers w/ string length:
val mappedScheme: Scheme[Int] = scheme.map(_.length)

// filters out all tuples less than 5:
val filteredScheme: Scheme[Int] = mappedScheme.filter(_ > 5)

// produces lengths for input strings > length of 5
val spout: KestrelSpout[Int] = new KestrelSpout(filteredScheme, hostSeq, "spout")
```

To use a `Spout[T]` in a Storm topology, call the `getSpout` method:

```
topologyBuilder.setSpout("spoutName", spout.getSpout, 10)
```

Now you're cooking with gas.

```scala
trait Spout[+T] {
  def getSpout: IRichSpout
  def flatMap[U](fn: T => TraversableOnce[U]): Spout[U]
}
```

```
val spout: Spout[String] =
  Spout.fromTraversable {
    List("call" "me" "ishmael")
  }

val evenCountSpout: Spout[Int] =
  spout.map(_.size).filter(_ % 2 == 0)

val characterSpout: Spout[String] =
  spout.flatMap { s =>
    s.toSeq.map(_.toString)
  }
```

```
val characterSpout: Spout[String] =
  spout.flatMap { s =>
    s.toSeq.map(_.toString)
  }

val builder = new TopologyBuilder
builder.setSpout("1", characterSpout.getSpout, 1)
builder.setBolt("2", new TestGlobalCount())
   .globalGrouping("1")
val topo: StormTopology = builder.createTopology
```

```
Store[-K, V] = StormStore[K, V]
```

version.sbt add changes, bump version 14 days ago

README.md

Storehaus

build error

Storehaus is a library that makes it easy to work with asynchronous key value stores. Storehaus is built on top of Twitter's Future.

Storehaus-Core

Storehaus's core module defines two traits; a read-only `ReadableStore` and a read-write `Store`. The traits themselves are tiny:

```
package com.twitter.storehaus

trait ReadableStore[-K, +V] extends Closeable {
  def get(k: K): Future[Option[V]]
  def multiGet[K1 <: K](ks: Set[K1]): Map[K1, Future[Option[V]]]
  override def close { }
}

trait Store[-K, V] extends ReadableStore[K, V] {
  def put(kv: (K, Option[V])): Future[Unit]
  def multiPut[K1 <: K](kvs: Map[K1, Option[V]]): Map[K1, Future[Unit]]
}
```

The `ReadableStore` trait uses the `Future[Option[V]]` return type to communicate one of three states about

```scala
trait ReadableStore[-K, +V] extends Closeable {
  def get(k: K): Future[Option[V]]
  def multiGet[K1 <: K](ks: Set[K1]): Map[K1, Future[Option[V]]]
  override def close { }
}
```

```scala
trait Store[-K, V] extends ReadableStore[K, V] {
  def put(kv: (K, Option[V])): Future[Unit]
  def multiPut[K1 <: K](kvs: Map[K1, Option[V]])
    : Map[K1, Future[Unit]]
}
```

```scala
trait MergeableStore[-K, V] extends Store[K, V] {
  def monoid: Monoid[V]
  def merge(kv: (K, V)): Future[Unit]
  def multiMerge[K1 <: K](kvs: Map[K1, V])
      : Map[K1, Future[Unit]]
}
```

What values are allowed?

```scala
trait Monoid[V] {
  def zero: V
  def plus(l: V, r: V): V
}
```

- Tons O'Monoids:
- CMS, HyperLogLog, ExponentialMA, BloomFilter, Moments, MinHash, TopK

https://github.com/twitter/algebird/tree/develop/algebird-core/src/main/scala/com/twitter/alg

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algebird / algebird-core / src / main / scala / com / twitter / **algebird** /

Merge pull request #136 from ccsevers/add_foldM ···

johnynek authored 3 days ago

..

mutable	a month ago	Adds priority queue aggregator [johnyne
AdjoinedUnitRing.scala	18 days ago	Cleans up intTimes [johnynek]
AffineFunction.scala	a month ago	test [sritchie]
Aggregator.scala	a month ago	test [sritchie]
Approximate.scala	a month ago	test [sritchie]
AveragedValue.scala	a month ago	test [sritchie]
BloomFilter.scala	a month ago	test [sritchie]
CountMinSketch.scala	3 days ago	Hotfix for CMS [johnynek]
DecayedValue.scala	a month ago	test [sritchie]
DecayedVector.scala	a month ago	test [sritchie]
Eventually.scala	a month ago	add eventually [sritchie]
Field.scala	a month ago	test [sritchie]
GeneratedAbstractAlgebra.scala	a month ago	test [sritchie]
Group.scala	18 days ago	Cleans up intTimes [johnynek]
HyperLogLog.scala	a month ago	test [sritchie]
IndexedSeq.scala	a month ago	test [sritchie]
JavaMonoids.scala	a month ago	test [sritchie]
MapAlgebra.scala	17 days ago	Adds a comment (to restart travis) [johny
Metric.scala	a month ago	test [sritchie]
MinHasher.scala	a month ago	test [sritchie]


Did you just tell me to go fuck myself?
I believe I did, Bob.

Associativity

```
;; 7 steps
a0 + a1 + a2 + a3 + a4 + a5 + a6 + a7
```

```
;; 7 steps
(+ a0 a1 a2 a3 a4 a5 a6 a7)
```

```
;; 5 steps
(+ (+ a0 a1)
   (+ a2 a3)
   (+ a4 a5)
   (+ a6 a7))
```

```
;; 3 steps
(+ (+ (+ a0 a1)
      (+ a2 a3))
   (+ (+ a4 a5)
      (+ a6 a7)))
```

Parallelism

Associativity

Clients

Storehaus

Tweet Embed Counts

Four more years. pic.twitter.com/bAJE6Vom

8:16 PM - 6 Nov 2012

800,833 RETWEETS 299,776 FAVORITES

How to Embed a Tweet on your Website

Every Tweet on twitter.com and Tweetdeck has a set of Tweet actions at the bottom, including Reply, Retweet, Favorite, and More. Click the "More" Tweet action and select “Embed Tweet”:

Popular Latest

0

Acquires Mobile Advertising
ge MoPub
0

hn Is Excited About Twitter.
0

CEO Talks About How To Be
r
0

low Lets You Access ALL
ITTERS
0

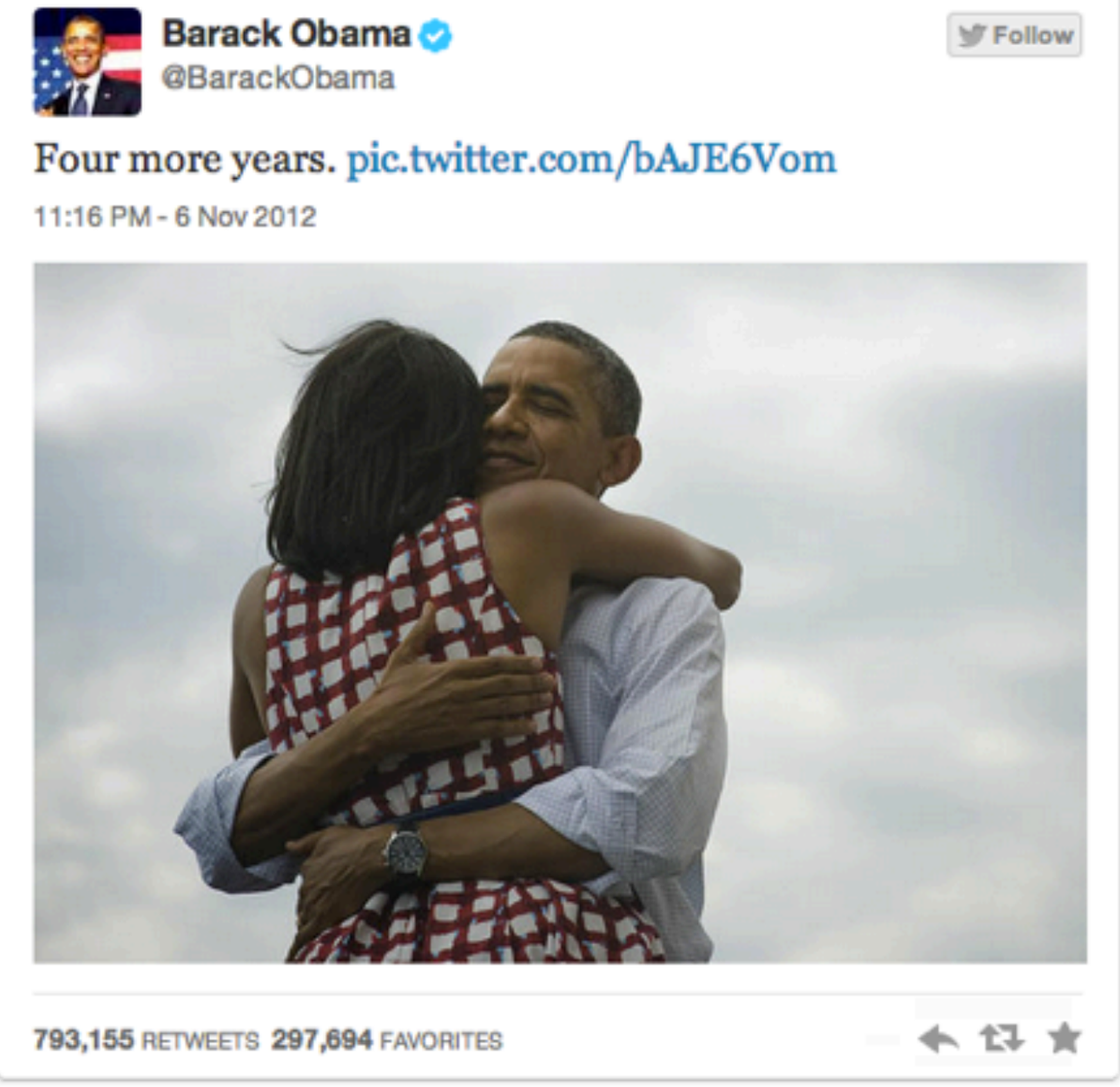
ur Twitter Profile May be an

0

Amplify Signs Its First Video
ship in Europe
0

Load More

This one pretty much speaks for itself. A simple message that acknowledges what everyone reading the tweet will already know.



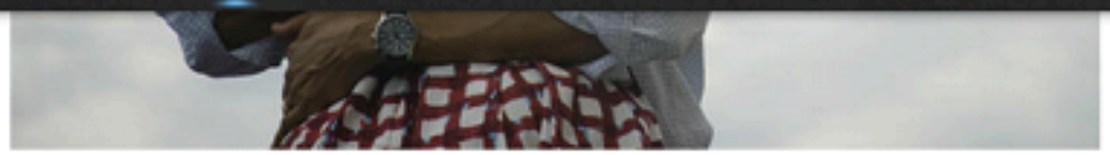
President Obama's message became the most shared tweet of all time within a day of it going out.

9. Bill Gates' tribute to Steve Jobs

tter / BarackObama: Fo × | 10 tweets that gripped the × | (1) Twitter × | Taking Screenshots in Mac ×

witter, Inc. [US] https://twitter.com/BarackObama/status/266031293945503744

Home | Connect | Discover | Me | Search



793,155 RETWEETS | 297,694 FAVORITES

8:16 PM - 6 Nov 12 — Flag media

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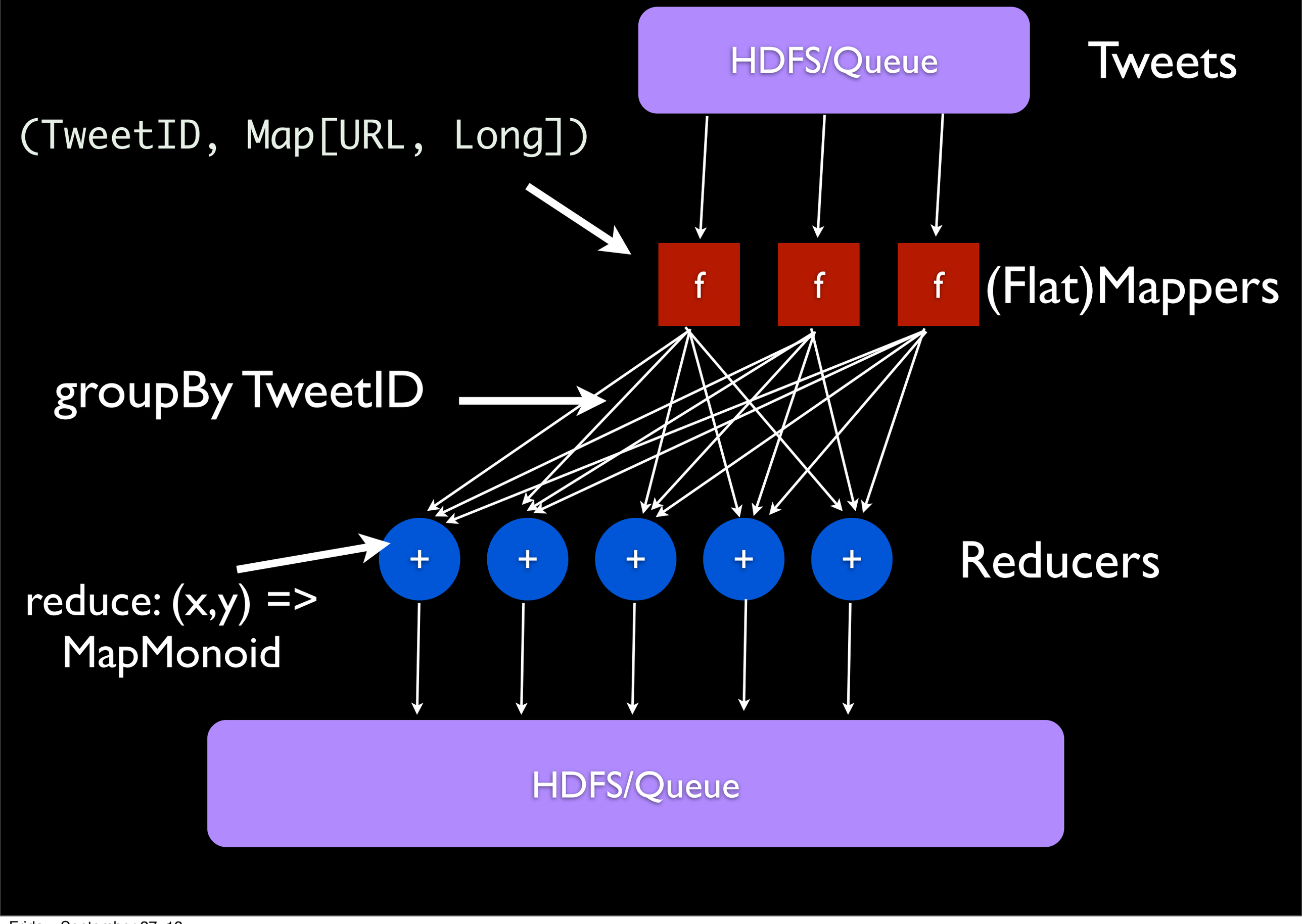
HDFS/Queue
Tweets
(TweetID, Map[URL, Long])
f
f
f
(Flat)Mappers
groupBy TweetID
+
+
+
+
+
Reducers
reduce: (x,y) =>
MapMonoid
HDFS/Queue

```scala
object OuroborosJob {
  def apply[P <: Platform[P]](source: Producer[P, ClientEvent], sink: P#Store[OuroborosKey, OuroborosValue]) =
    source.filter(filterEvents(_))
      .flatMap { event =>
      val widgetDetails = event.getWidget_details
      val referUrl: String = widgetDetails.getWidget_origin
      val timestamp: Long = event.getLog_base.getTimestamp
      val widgetFrameUrlOpt: Option[String] = Option(widgetDetails.getWidget_frame)
      for {
        tweetId: java.lang.Long <- javaToScalaSafe(event.getEvent_details.getItem_ids)
        timeBucketOption: Option[TimeBucket] <- timeBucketsForTimestamp(timestamp)
      } yield {
        val urlHllOption = canonicalUrl(referUrl).map(hllMonoid.create(_))
        val widgetFrameUrlsOption = widgetFrameUrlOpt map { widgetUrl: String =>
          widgetFrameUrlsSmMonoid.create((referUrl, (widgetFrameUrlSetSmMonoid.create((widgetUrl, 1L)), 1L)))
        }
        val impressionsValue: OuroborosValue = RawImpressions(
          impressions = 1L,
          approxUniqueUrls = urlHllOption,
          urlCounts = Some(embedCountSmMonoid.create((referUrl, 1L))),
          urlDates = Some(embedDateSmMonoid.create((referUrl, timestamp))),
          frameUrls = widgetFrameUrlsOption
        ).as[OuroborosValue]
        Seq(
          (OuroborosKey.ImpressionsKey(ImpressionsKey(tweetId.longValue, timeBucketOption)), impressionsValue),
          (OuroborosKey.TopTweetsKey(TopTweetsKey(timeBucketOption)), topTweetsValue)
        )
      }
    }.sumByKey(store)
      .set(MonoidIsCommutative(true))
}
```

```
object OuroborosJob {
  def apply[P <: Platform[P]](source: Producer[P, ClientEvent], sink: P#Store[OuroborosKey, OuroborosValue]) =
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          (OuroborosKey.TopTweetsKey(TopTweetsKey(timeBucketOption)), topTweetsValue)
        )
      }
    }.sumByKey(store)
      .set(MonoidIsCommutative(true))
}
```

Filter Events

```
object OuroborosJob {
  def apply[P <: Platform[P]](source: Producer[P, ClientEvent], sink: P#Store[OuroborosKey, OuroborosValue]) =
    source.filter(filterEvents(_))
      .flatMap { event =>
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      val referUrl: String = widgetDetails.getWidget_origin
      val timestamp: Long = event.getLog_base.getTimestamp
      val widgetFrameUrlOpt: Option[String] = Option(widgetDetails.getWidget_frame)
      for {
        tweetId: java.lang.Long <- javaToScalaSafe(event.getEvent_details.getItem_ids)
        timeBucketOption: Option[TimeBucket] <- timeBucketsForTimestamp(timestamp)
      } yield {
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          urlCounts = Some(embedCountSmMonoid.create((referUrl, 1L))),
          urlDates = Some(embedDateSmMonoid.create((referUrl, timestamp))),
          frameUrls = widgetFrameUrlsOption
        ).as[OuroborosValue]
        Seq(
          (OuroborosKey.ImpressionsKey(ImpressionsKey(tweetId.longValue, timeBucketOption)), impressionsValue),
          (OuroborosKey.TopTweetsKey(TopTweetsKey(timeBucketOption)), topTweetsValue)
        )
      }
    }.sumByKey(store)
      .set(MonoidIsCommutative(true))
}
```

Filter Events

Generate KV Pairs

```
object OuroborosJob {
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      .flatMap { event =>
      val widgetDetails = event.getWidget_details
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      val timestamp: Long = event.getLog_base.getTimestamp
      val widgetFrameUrlOpt: Option[String] = Option(widgetDetails.getWidget_frame)
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        timeBucketOption: Option[TimeBucket] <- timeBucketsForTimestamp(timestamp)
      } yield {
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          urlDates = Some(embedDateSmMonoid.create((referUrl, timestamp))),
          frameUrls = widgetFrameUrlsOption
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        Seq(
          (OuroborosKey.ImpressionsKey(ImpressionsKey(tweetId.longValue, timeBucketOption)), impressionsValue),
          (OuroborosKey.TopTweetsKey(TopTweetsKey(timeBucketOption)), topTweetsValue)
        )
      }
    }.sumByKey(store)
      .set(MonoidIsCommutative(true))
}
```

Filter Events

Generate KV Pairs

Sum into Store

Brief Explanation

This job creates two types of keys:

1: ((TweetId, TimeBucket) => Map[URL, Impressions])
2: TimeBucket => Map[TweetId, Impressions]

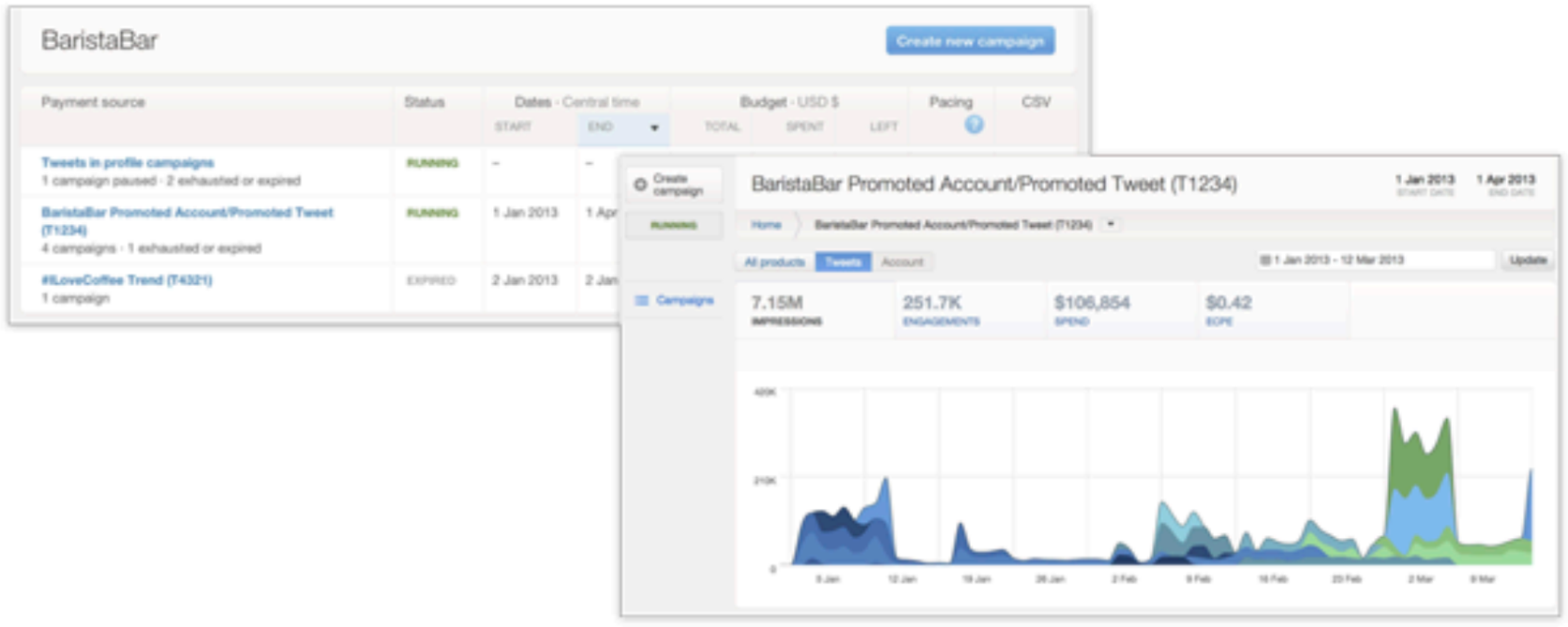
What Else?

Twitter Advertising

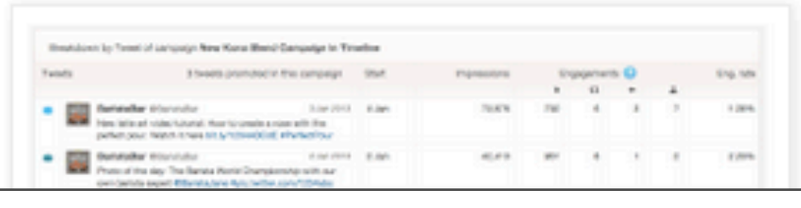
WEDNESDAY, MARCH 13, 2013

The new Twitter Ads center

Today, we're excited to share some changes we've made to the Twitter Ads center. Based on feedback from our advertisers, we've created a revamped experience that improves campaign reporting, provides more visibility into campaign performance analytics and spend, and also makes it easier to manage campaigns in real time.



A major focus of ours is improving campaign analytics. With this in mind, we are now reporting all engagements that Promoted Tweets receive — not just engagements that advertisers pay for, but earned media as well. This change gives marketers more complete insight into the impact Promoted Tweets have in driving engagement and exposure on Twitter.

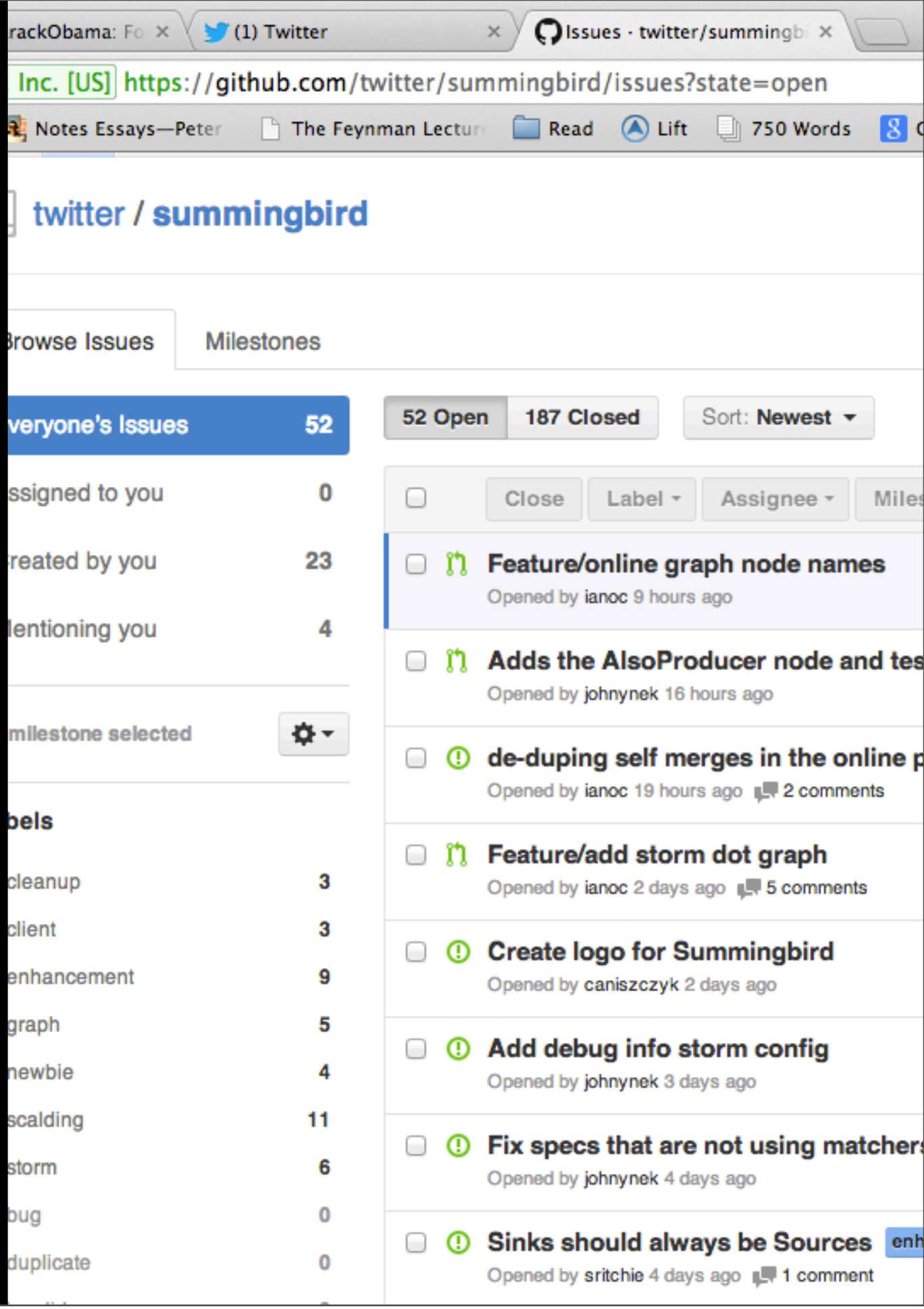


What's Next?

Future Plans

- Akka, Spark, Tez Platforms
- More Spouts, Stores and Monoids
  - Pluggable graph optimizations
  - More tutorials!

Open Source!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(1) Twitter
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Inc. [US] https://github.com/twitter/summingbird/issues?state=open
Notes Essays—Peter
The Feynman Lectur
Read
Lift
750 Words
twitter / summingbird
Browse Issues
Milestones
veryone's Issues 52
ssigned to you 0
reated by you 23
lentioning you 4
milestone selected
bels
cleanup 3
client 3
enhancement 9
graph 5
newbie 4
scalding 11
storm 6
bug 0
duplicate 0
52 Open
187 Closed
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Label
Assignee
Feature/online graph node names
Opened by ianoc 9 hours ago
Adds the AlsoProducer node and tes
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de-duping self merges in the online p
Opened by ianoc 19 hours ago 2 comments
Feature/add storm dot graph
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Create logo for Summingbird
Opened by caniszczyk 2 days ago
Add debug info storm config
Opened by johnynek 3 days ago
Fix specs that are not using matcher
Opened by johnynek 4 days ago
Sinks should always be Sources
Opened by sritchie 4 days ago 1 comment

Summary

- Summingbird is appropriate for the majority of the real-time apps we have.
- Data scientists who are not familiar with systems can deploy realtime systems.
- Systems engineers can reuse 90% of the code (batch/realtime merging).

Thank You!

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