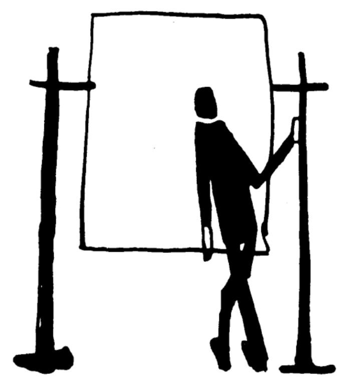
Kafka

high-throughput, persistent,
multi-reader streams

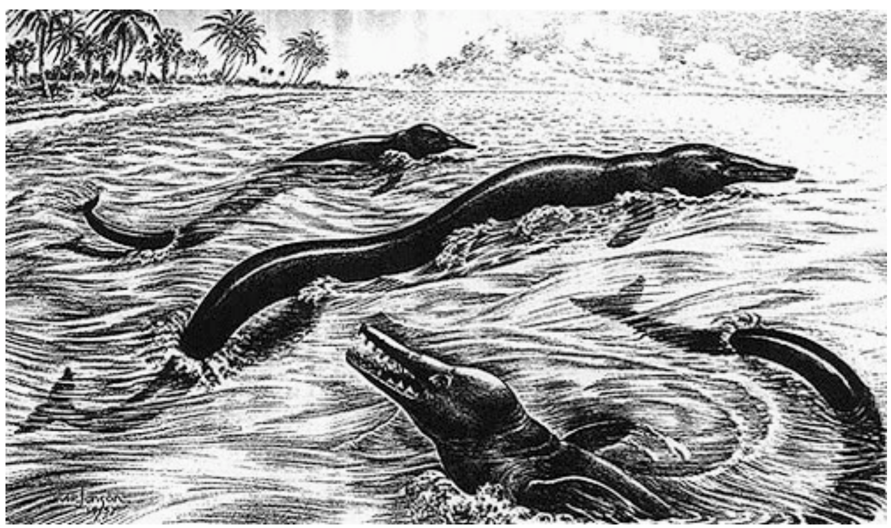


http://sna-projects.com/kafka

- LinkedIn SNA (Search, Network, Analytics)
- Worked on a number of open source projects at LinkedIn (Voldemort, Azkaban, …)
- Hadoop, data products

Problem

How do you model and process stream data for a large website?



Examples

Tracking and Logging – Who/what/when/where

Metrics – State of the servers

Queuing – Buffer between online and “nearline” processing

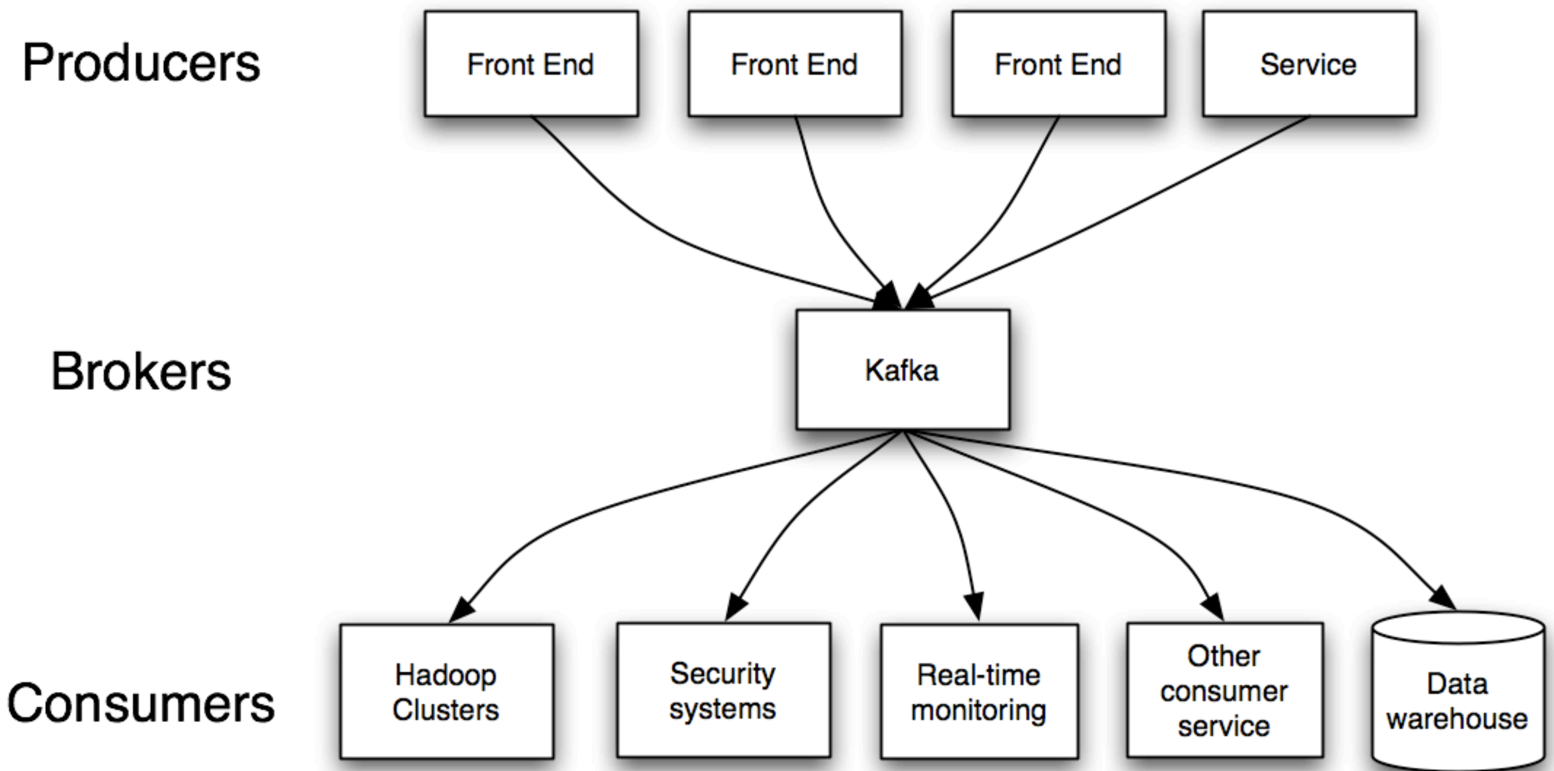
Change capture – Database updates

Messaging Examples: numerous JMS brokers, RabbitMQ, ZeroMQ

The Hard Parts

persistence, scale,
throughput, replication,
semantics, simplicity

Tracking


Producers
Front End
Front End
Front End
Service
Brokers
Kafka
Consumers
Hadoop Clusters
Security systems
Real-time monitoring
Other consumer service
Data warehouse

Tracking Basics

- Example “events” (around 60 types)
  - Search
  - Page view
  - Invitation
  - Impressions
- Avro serialization
- Billions of events
- Hundreds of GBs/day
- Most events have multiple consumers
  - Security services
  - Data warehouse
  - Hadoop
  - News feed
  - Ad hoc

Existing messaging systems

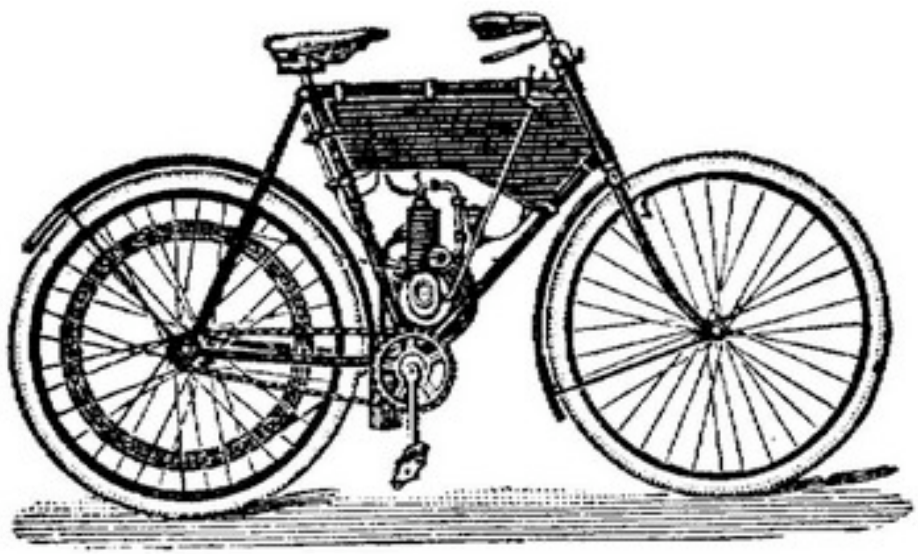
- JMS
  - An API not an implementation
  - Not a very good API
    - Weak or no distribution model
    - High complexity
    - Painful to use
  - Not cross language
- Existing systems seem to perform poorly with large datasets

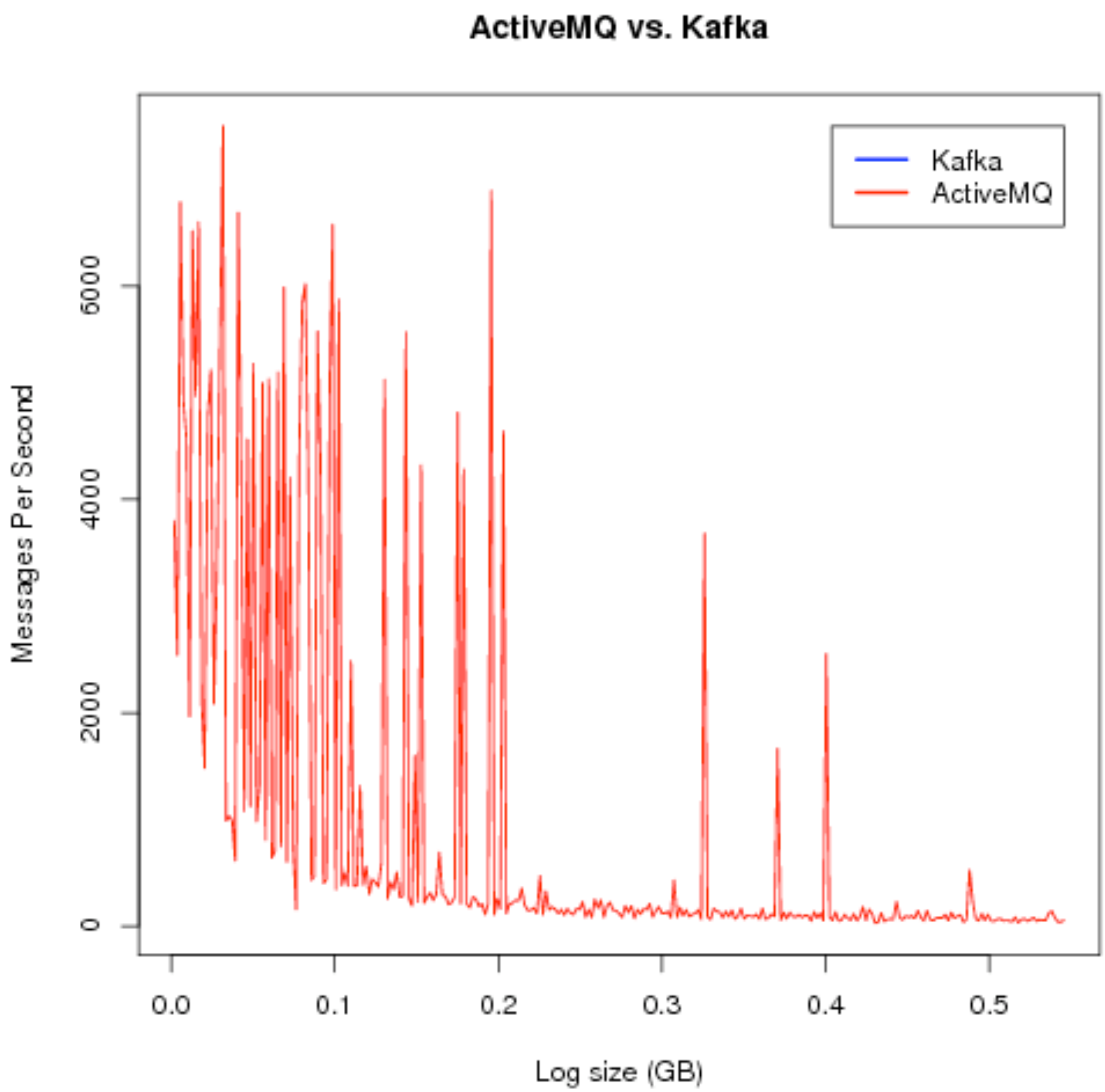
Ideas

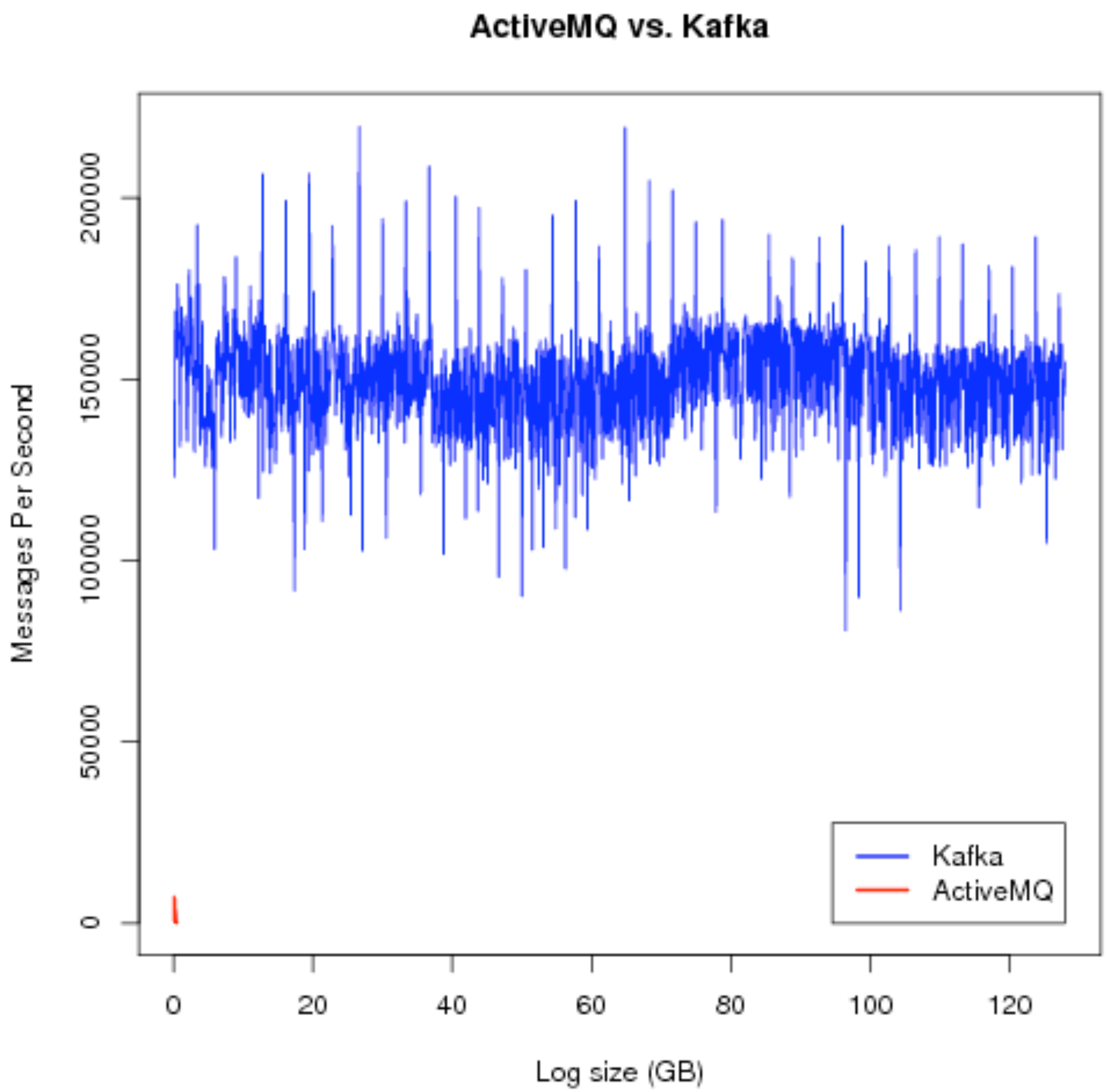
1. Eschew random-access persistent data structures
2. Allow very parallel consumption (e.g. Hadoop)
3. Explicitly distributed
4. Push/Pull not Push/Push

Performance Test

- Two Amazon EC2 large instances
  - Dual core AMD 2.0 GHz
  - 1 7200 rpm SATA drive
  - 8GB memory
- 200 byte messages
- 8 Producer threads
- 1 Consumer thread
- Kafka
  - Flush 10k messages
  - Batch size = 50
- ActiveMQ
  - syncOnWrite = false
  - fileCursor

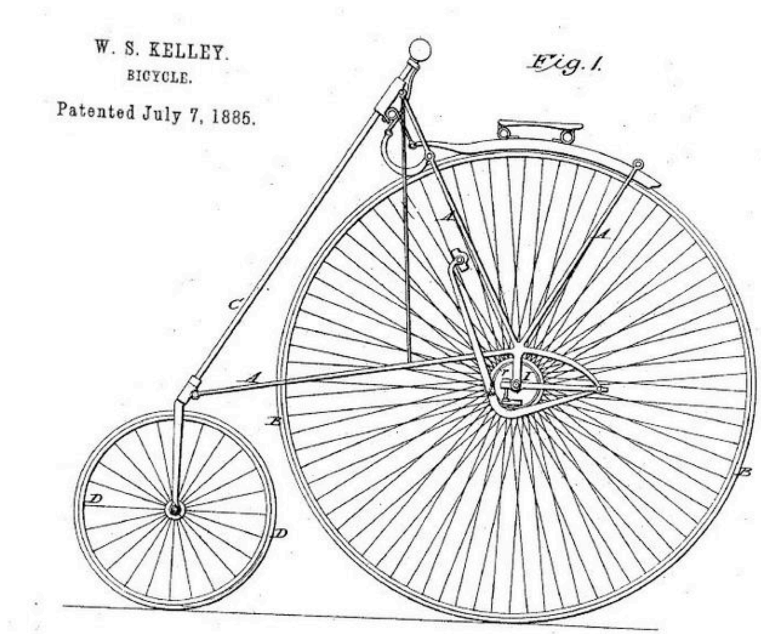



ActiveMQ vs. Kafka
Kafka
ActiveMQ
Messages Per Second
0
2000
4000
6000
0.0
0.1
0.2
0.3
0.4
0.5
Log size (GB)


ActiveMQ vs. Kafka
Messages Per Second
Log size (GB)
Kafka
ActiveMQ
0
50000
100000
150000
200000
0
20
40
60
80
100
120

Performance Summary

- Producer
  - 111,729.6 messages/sec
  - 22.3 MB per sec
- Consumer
  - 193,681.7 messages/sec
  - 38.6 MB per sec
- On on our hardware
  - 50MB/sec produced
  - 90MB/sec consumed



How can we get high performance with persistence?

Some tricks

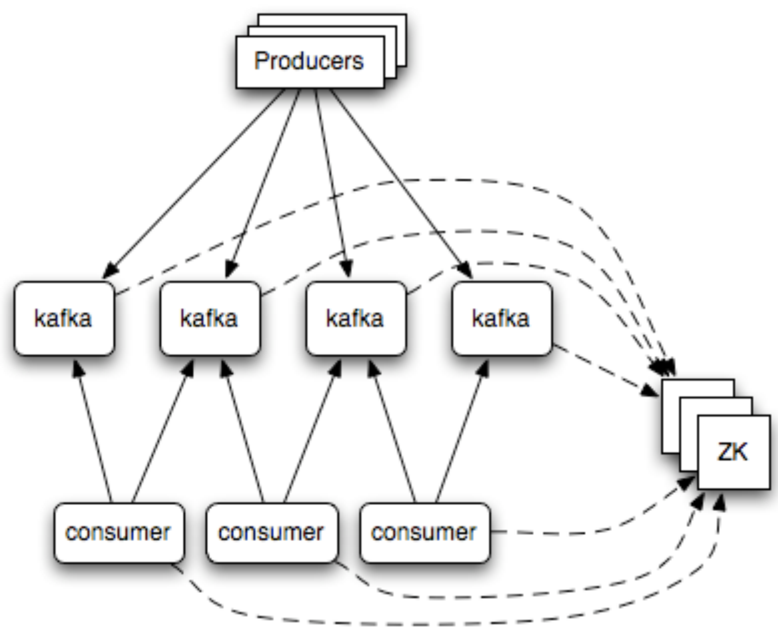
- Disks are fast when used sequentially
  - Single thread linear read/write speed: > 300MB/sec
  - Reads are faster still, when cached
  - Appends are effectively O(1)
  - Reads from known offset are effectively O(1)
- End-to-end message batching
- Zero-copy network implementation (sendfile)
- Zero copy message processing APIs

Implementation

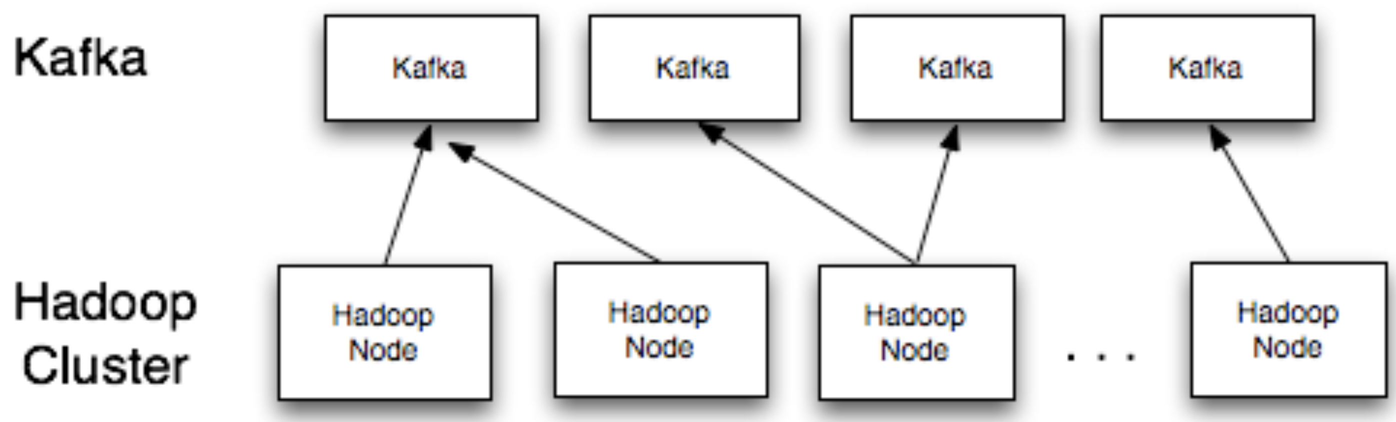
- ~5k lines of Scala
- Standalone jar
- NIO socket server
- Zookeeper handles distribution, client state
- Simple protocol
    - Python, Ruby, and PHP clients contributed

Distribution

- Producer randomly load balanced
- Consumer balances M brokers, N consumers



Hadoop InputFormat



Consumer State

- Data is retained for N days
- Client can calculate next valid offset from any fetch response
- All server APIs are stateless
- Client can reload if necessary

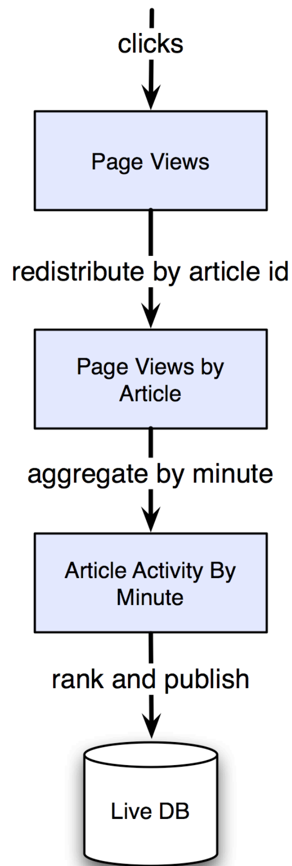
APIs

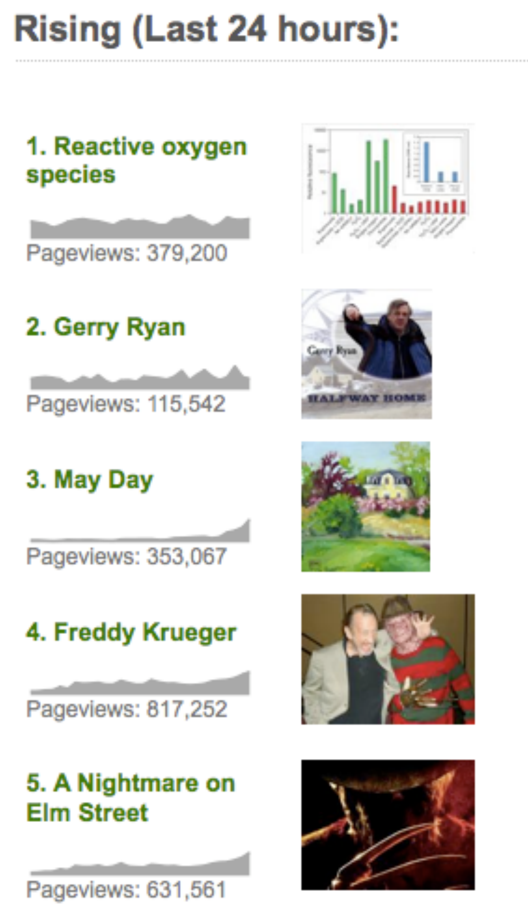
```
// Sending messages
client.send(“topic”, messages)


// Receiveing messages
Iterable stream =
   client.createMessageStreams(…).get(“topic”).get(0)
for(message: stream) {
  // process messages
}
```

Stream processing (0.06 release)

Data published to persistent topics, and redistributed by primary key between stages





Also coming soon

- End-to-end block compression
- Contributed php, ruby, python clients
- Hadoop InputFormat, OutputFormat
- Replication

The End

http://sna-projects.com/kafka

https://github.com/kafka-dev/kafka

kafka-dev@google-groups.com

jay.kreps@gmail.com