
Elastic Streaming
Spark Streaming + Dynamic Provisioning + Dynamic Allocation
Neelesh Shastry, Architect
Shaun Klopfenstein, CTO
Marketo


The Vision


Requirements

Business Requirements

- Near real-time activity processing
- Billons activities per customer per day
- Improve cost efficiency of operations while scaling up
- Global enterprise grade security and governance

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SAAS Requirements

- Customers are added and removed
- Fairness and throttling *per customer*
- Strict sequential event processing for some applications
- Temporarily suspend a customer, when errors occur

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Technology
Selection

Use Cases

- React to activities
  - Send an email when someone visits a web page
  - Change the score when someone fills a form
- Replicate data
  - Build Solr Indexes, near real-time
  - Update DataXChange – an internal lead cache
  - Sync to/from CRM Systems
- Analytics
  - Incrementally update email reports
  - Enrich activities and feed to Druid for advanced email/web reports

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Why Spark Streaming?

- Micro-batching provides sink-side efficiencies
- Great integration with Kafka
- No strict real time processing requirements
- Great community, industry adoption

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Challenges with Spark + Kafka

- No way to add/remove topics on the fly
- No out of the box support for sequencing RDDs
- No support for turning off topics under errors
- Does not play well with scaling Kafka partitions up/down, when ordering is required

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Challenges - Stragglers

- A batch can't complete until the slowest operation finishes
- Many of our batches include slow operations
  - Sometimes don't complete within the batch time
- Batches are multitenant
  - one customers operation can delay processing for other customers in the same batch
- Severe impact on utilization & batch delay

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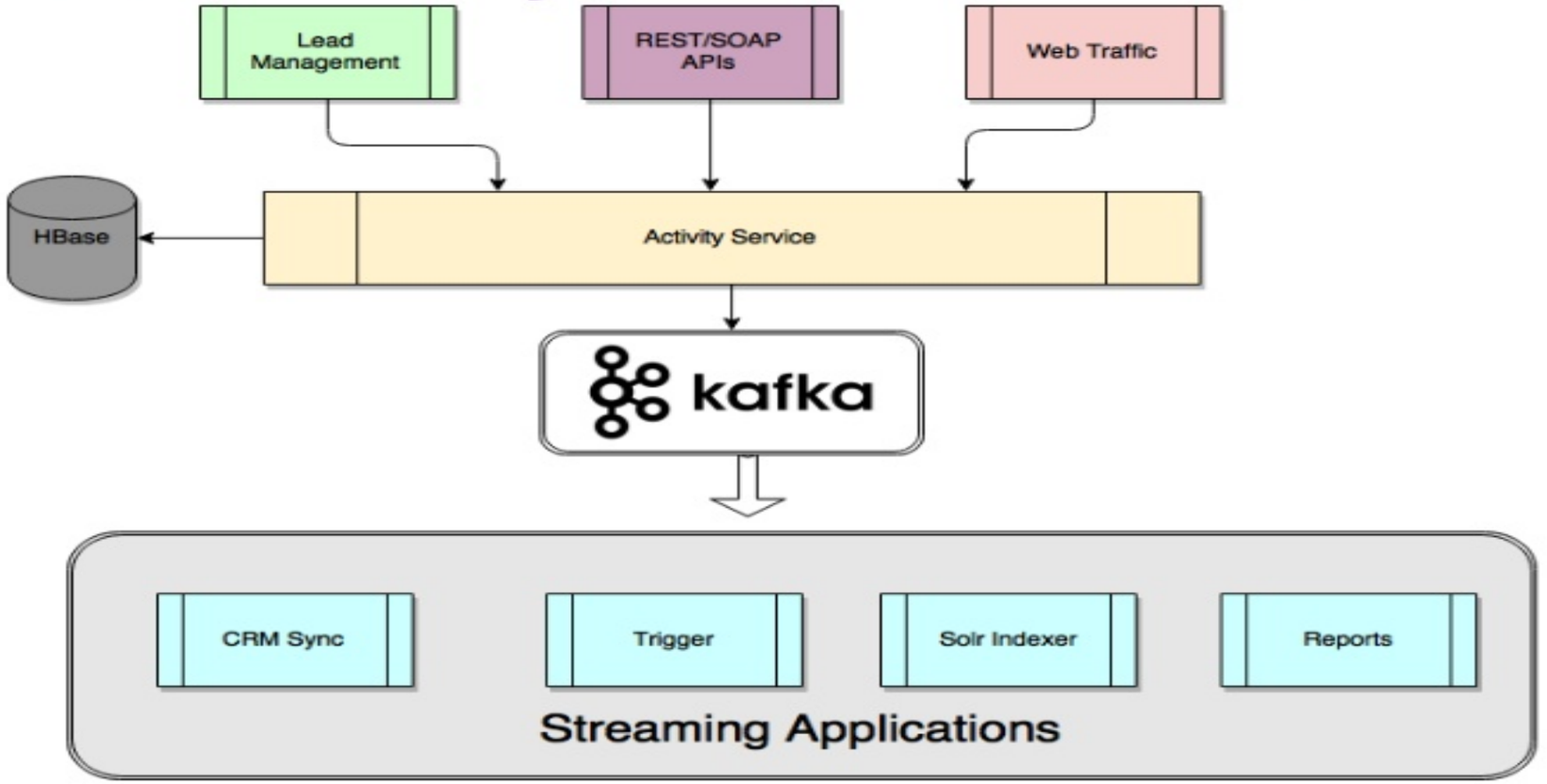
Architecture & Design

Marketo Activity Architecture



Kafka Topics Organization

- One topic per use case, data from all customers
  - Easy to manage
  - A single customer can create backlogs for others during activity storms
  - Fairness/throttling is hard to implement
- One topic per use case, per customer
  - Storms are isolated to the customer
  - Fairness/throttling is easy to control, by tweaking the topic
  - Pressure on Kafka ZK – so far not a problem

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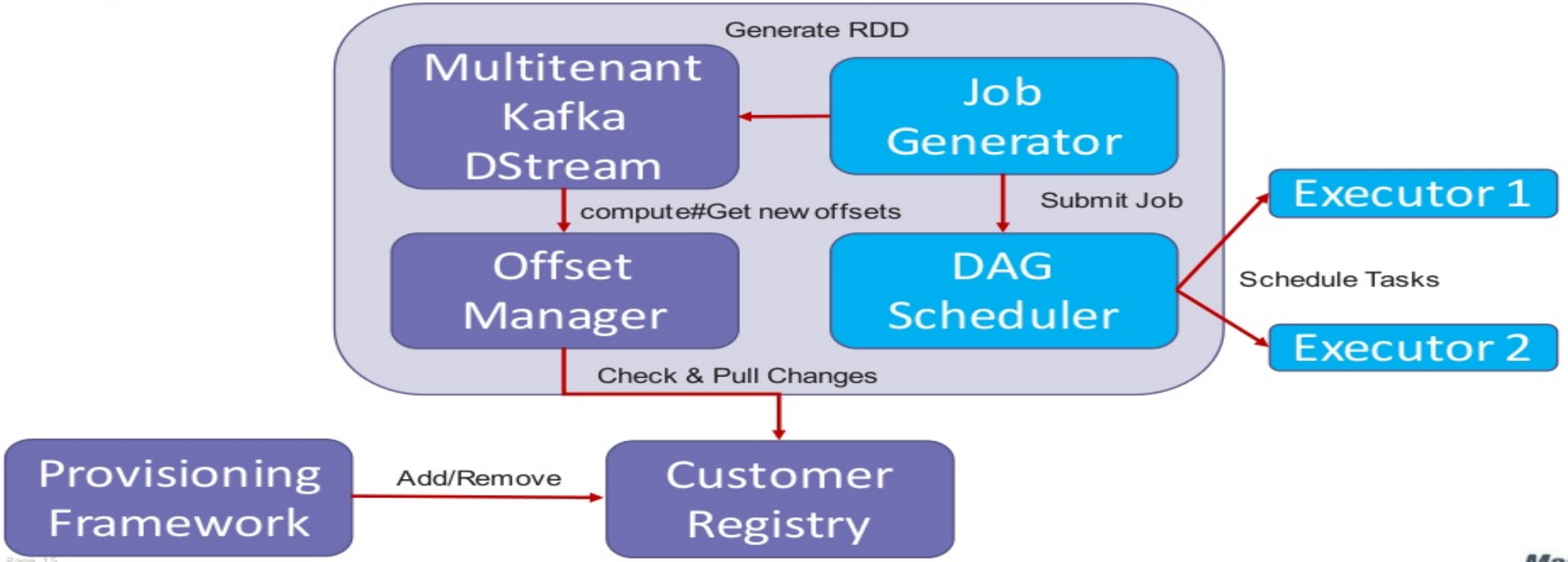
Solutions

Dynamic provisioning capacity



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Marketo Offset Manager

- Tracks multitenancy
- Streaming Jobs process data for many customers
  - Accessing multiple Kafka topics and partitions
- Adds new topics
- Remove/Deactivate/Suspend topics

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Multitenant DStream

- Enables efficient multitenant RDDs
- Controlled sequencing of RDDs
- Coalesce Kafka partitions
  - Bin-packing for efficiency
- Maintains partition lineage for offset management

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Provisioning

- Manages allocating customers to a spark streaming application
- round robin + resource affinity
- Enables rebalancing of customers across spark streaming jobs
- Oozie based framework

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Dynamic Resource Allocation

- SPARK-12133
  - Goal – “make processing time infinitely close to duration”
  - Assumes tasks are roughly similar
- Stragglers throw this goal off
- What we really want :
  - DRA + Safe concurrent job execution

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Results so far

- ~ 10 different use cases
- > 100 Spark Executors
- >1000 Kafka Partitions
- Processing latencies < 5s (99th %)
- Rolled out to ~20% customers

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Future
Work

Application Scheduling

- Scheduling within an application to handle stragglers
- spark.streaming.concurrentJobs
- Exploring scheduler pools
- Changes to Streaming Job Scheduler, to execute multiple RDDs safely

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Scaling Up Kafka Partitions

- Our customers grow in size over a period of time
- Ordering requirements mean we cannot alter topic on the fly
- Coordination required on both producer & consumer fronts
- Enhance provisioner to manage partition up/down scaling

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Architecture Requirements

- Maximize utilization of hardware
- Multitenancy support with fairness
- Encryption, Authorization & Authentication
- Applications must scale horizontally

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Deploying It


Running It