一决高下，分布式流处理框架孰优孰劣

本文PPT来自技术专家毛玮于10月16日在2016年杭州云栖大会上发表的《分布式流处理框架--功能对比和性能评估》。

目前，分布式流处理框架数量不少，各有特色，究竟哪个性能更好、哪个效率更高、哪个更适合我呢？一般来说，当选择不同的流处理系统时，我们往往需要关注以下六大方面：1.运行时和编程模型2.函数式原语3.状态管理 4.消息传输保障 5.容错 6.性能。

其中，运行时模型主要包括原生的流处理和微批处理。流处理意味着所有输入的记录一旦到达即会一个接着一个进行处理，微批处理则把输入的数据按照某种预先定义的时间间隔分成短小的批量数据，流经流处理系统。编程模型一般分为组合式和声明式。组合式编程提供基本的构建模块，它们必须紧密结合来创建拓扑，相对应地，声明式API操作是定义的函数。

在下面的图中我们不仅会具体介绍每个要点，而且还会列出主流的框架，如Spark Streaming、Storm、Flink、Heron框架的性能对比测试结果数据。

- Streaming Core
- MISC
- Performance Benchmark

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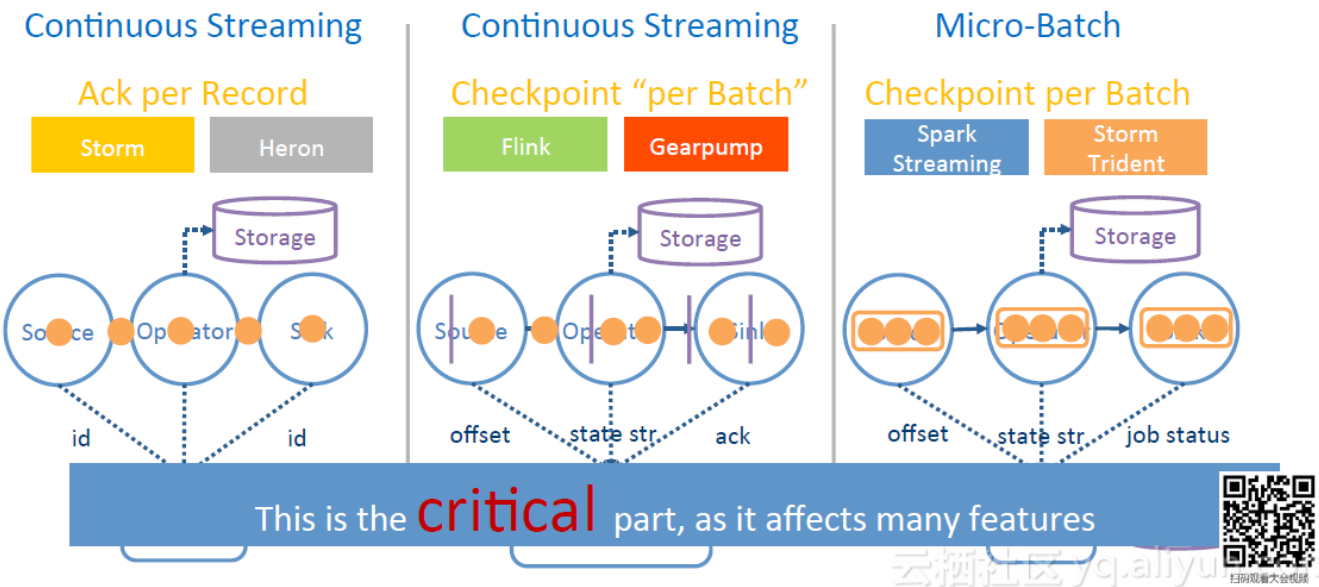

Delivery Guarantee

Storm | Heron

At least once

- Ackers know about if a record is processed successfully or not. If it failed, replay it.
- There is no state consistency guarantee.

Flink | Gearpump | Spark Streaming | Storm Trident

Exactly once

- State is persisted in durable storage
- Checkpoint is linked with state storage per Batch

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Native State Operator

Storm | Heron

Yes*

- Storm:
  - ✓ KeyValueState
- Heron:
  - X User Maintain

Flink | Gearpump

Yes

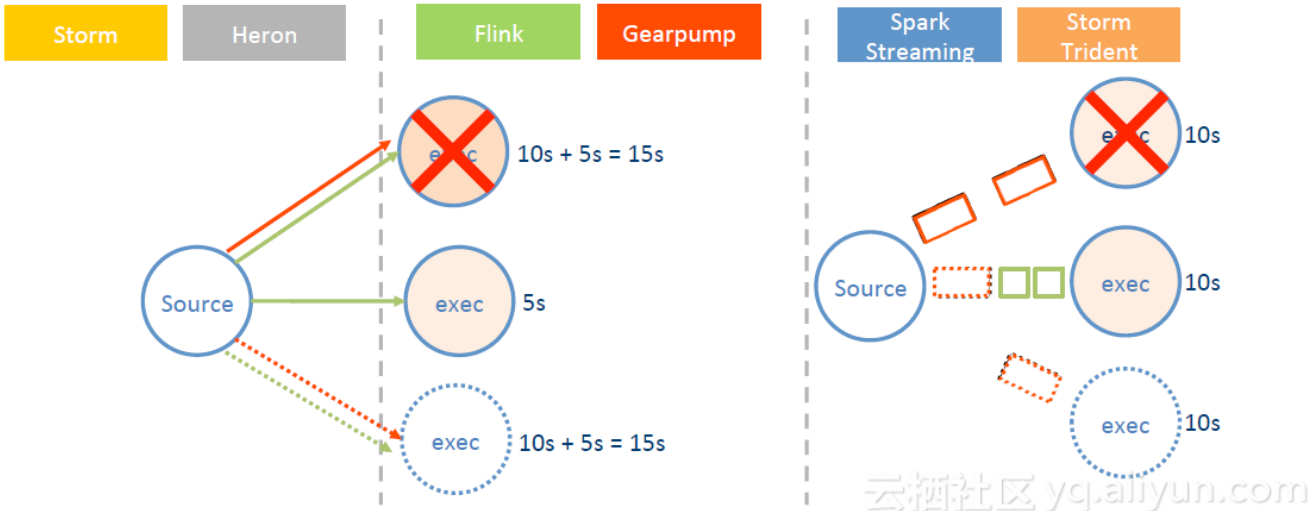
- Flink Java API:
  - ✓ ValueState
  - ✓ ListState
  - ✓ ReduceState
- Flink Scala API:
  - ✓ mapWithState
- Gearpump
  - ✓ persistState

Spark Streaming | Storm Trident

Yes

- Spark 1.5:
  - ✓ updateStateByKey
- Spark 1.6:
  - ✓ mapWithState
- Trident:
  - ✓ persistentAggregate
  - ✓ State

Dynamic Load Balance & Recovery Speed



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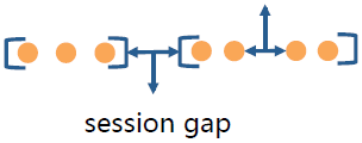
Summary

	Compositional	Declarative	Python/R	SQL
Spark Streaming	X	√	√	√
Storm	√	X	√	NOT support aggregation, windowing and joining
Storm Trident	X	√	X	
Gearpump	√	√	X	X
Flink	X	√	X	Support select, from, where, union
Heron	√	X	√*	X

Window Support

- Sliding Window 
- Count Window 
- Session Window 

	Sliding Window	Count Window	Session Window
Spark Streaming	√	X	X*
Storm	√	√	X
Storm Trident	√	√	X
Gearpump	√*	X	X
Flink	√	√	√
Heron	X	X	X

Out-of-order Processing

	Processing Time	Event Time	Watermark
Spark Streaming	√	√*	X*
Storm	√	√	√
Storm Trident	√	X	X
Gearpump	√	√	√
Flink	√	√	√
Heron	√	X	X

Memory Management

	JVM Manage	Self Manage on-heap	Self Manage off-heap
Spark Streaming	√	√*	√*
Flink	√	√	√
Storm	√	X	X
Gearpump	√	X	X
Heron	√	X	X

Resource Management

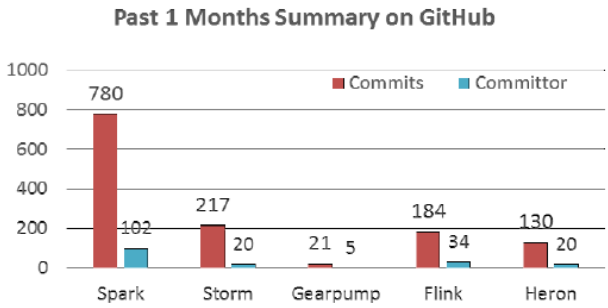
	Standalone	YARN	Mesos
Spark Streaming	√	√	√
Storm	√	√*	√*
Storm Trident	√	√*	√*
Gearpump	√	√	X
Flink	√	√	X
Heron	√	√	√

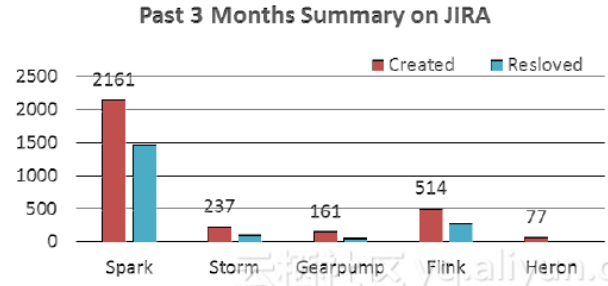
Web UI

	Submit Jobs	Cancel Jobs	Inspect Jobs	Show Statistics	Show Input Rate	Check Exceptions	Inspect Config	Alert
Spark Streaming	X	√	√	√	√	√	√	X
Storm	X	√	√	√	√*	√	√	X
Gearpump	√	√	√	√	√*	√	√	X
Flink	√	√	√	√	X	√	√	X
Heron	X	X	√	√	√*	√	√	X

Community Maturity

	Initiation Time	Apache Top Project	Contributors
Spark Streaming	2013	2014	926
Storm	2011	2014	219
Gearpump	2014	Incubator	21
Flink	2010	2015	208
Heron	2014	N/A	44





Data Input Rate

Throughput	Message/Second	Kafka Producer Num
40KB/s	0.2K	1
400KB/s	2K	1
4MB/s	20K	1
40MB/s	200K	1
80MB/s	400K	1
400MB/s	2M	10
600MB/s	3M	15
800MB/s	4M	20