Welcome to the second Workshop on Big data Open Source Systems (BOSS)

September 10th, 2016
Co-located with VLDB 2016

Tilmann Rabl & Sebastian Schelter
Hands on Big Data

• 6 parallel tutorials
• 6 systems
  • Open source
  • Publicly available
• Presenters
  • System experts
• Hands on
  • This is not a demo!
• You can pick two!
But why?

• Mike Carey
  • Doing It On Big Data: a Tutorial/Workshop
  • Driving force

• Other people involved
  • Volker Markl
  • Kerstin Forster

• Second instance
  • Last time: 8 systems
  • Tell us what you think
  • Email: rabl@tu-berlin.de
Public Voting

• 9 Submissions, 6 tutorials selected
• Google forms vote
• 236 votes, 137 individuals
• Max 46, min 11 votes

• Did you vote?
Presented Systems

• Apache Flink

• Apache SystemML

• HopsFS & ePipe

• LinkedIn’s Open Source Analytics Platform

• rasdaman

• RHEEM
Massively Parallel Program

- Bulk Synchronous Parallel
- People Flow
- Danger of skew!
Polyglot Session

Big Data processing using Polybase. Karthik Ramachandra (Microsoft Gray Systems Lab)

Multistore Systems: Retrospection on CloudMdsQL. Jose Pereira (Univ. do Minho & INESC)

Exploiting the data center in contemporary commodity boxes: The scaling-in approach. Jignesh Patel (Univ. of Wisconsin-Madison)

LeanBigData: Blending OLTP and OLAP to Deliver Real-Time Analytical Queries. Ricardo Jimenez-Peris (LeanXcale)
Flash Intro
Apache Flink
Kostas Kloudas
Vasia Kalavri
Jonas Traub

Introduction to Stream Processing with Apache Flink®

dataArtisans
Overview

- What is Stream Processing?
- What is Apache Flink?
- Windowed computations over streams
- Handling time
- Handling node failures
- Handling planned downtime
- Handling code upgrades
A data processing engine

Apache Flink is an open source platform for distributed stream and batch processing
What does Flink provide?

- High Throughput and Low Latency
- Event-time (out-of-order) processing
- Exactly-once semantics
- Flexible windowing
- Fault-Tolerance
# The Apache Flink Ecosystem

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Its Users

- Alibaba.com
- Netflix
- Uber
- Ericsson
- King
- ResearchGate
- Bouygues Telecom
- Zalando
- Capital One

...https://flink.apache.org/poweredby.html
Time for demo…

Robust Stream Processing with Apache Flink®: A Simple Walkthrough
http://data-artisans.com/robust-stream-processing-flink-walkthrough/#more-1181
Apache SystemML
Apache SystemML:
Declarative Large-Scale Machine Learning

Matthias Boehm
IBM Research – Almaden

Acknowledgements:
A. V. Evtimievski, F. Makari Manshadi, N. Pansare, B. Reinwald, F. R. Reiss, P. Sen, S. Tatikonda,
M. W. Dusenberry, D. Eriksson, N. Jindal, C. R. Kadner, J. Kim, N. Kohlilkyan, D. Kumar, M. Li, L. Resende,
A. Singh, A. C. Surve, G. Weidner, and W. P. Yu
Case Study: An Automobile Manufacturer

**Goal:** Design a model to predict car reacquisition

![Diagram](image)

- **Features:** Warranty Claims, Repair History, Diagnostic Readouts
- **Labels:** Machine Learning Algorithm, Algorithm, Algorithm

- **Predictive Models:**
  - Class skew
  - Low precision

**Result:** 25x improvement in precision!
Common Patterns Across Customers

- Algorithm customization
- Changes in feature set
- Changes in data size
- Quick iteration

Custom Analytics

Declarative Machine Learning
Abstraction: The Good, the Bad and the Ugly

[adapted from Peter Alvaro: "I See What You Mean", Strange Loop, 2015]

\[ q = t(X) \%\% (w \ast (X \%\% v)) \]

The Ugly: Expectations ≠ Reality

- (Missing) Rewrites
- Operator Selection
- Local / Remote Memory Budgets
- (Missing) Size Information
- Data Skew
- Complex Control Flow
- (Implicit) Copy-on-Write
- Distributed Operations
- Latency
- Load Imbalance
- Distributed Storage

⇒ Understanding of optimizer and runtime techniques underpinning declarative, large-scale ML
Tutorial Outline

- Case Study and Motivation (Flash) 5min
- SystemML Overview, APIs, and Tools 30min
- Common Framework 15min
- SystemML’s Optimizer (w/ Hands-On-Labs) 45min
HopsFS & ePipe
HopsFS & ePipe

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Gautier Berthou
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From HDFS to HopsFS

- Scale to a million operations/sec
- Scale to billions of files/directories
- Search with sub second latency (ePipe)
Tutorial

- Introducing Github style for Hadoop projects (HopsWorks)
- Installation of Hops on AWS using Karamel
- Managing Datasets
  - create, attach metadata, and search
- Running sample programs on HopsWorks
Goblin & Pinot
Open Source Analytics Pipeline at LinkedIn

Issac Buenrostro
Jean François Im
BOSS Workshop, 2016
Large Scale Analytics

1. Analyze many TB data daily.
2. Multiple, heterogeneous sources, with varying data quality.
3. Fast querying for offline and real-time needs.
4. Integrate with other data processing jobs (MR, Hive, Spark, etc.).
5. Fault tolerance, scalability, manageability, …
Solution: Gobblin + Pinot

- Universal data ingestion framework.
- Extract, transform, quality check, and write data from/to a large variety of data storage technologies: HDFS, S3, Kafka, JDBC, Rest, ...

- Distributed near-realtime OLAP data store.
- Index and combine data from offline data sources (e.g. Hadoop) and real time data sources (e.g. Kafka).
- SQL query interface.
In This Workshop

- App
- Kafka
- REST
- File System
- Query
Find out more:

BBLIN
https://github.com/linkedin/gobblin
http://gobblin.readthedocs.io/
gobblin-users@googlegroups.com

Pinot
https://github.com/linkedin/pinot
pinot-users@googlegroups.com

https://engineering.linkedin.com/
rasdaman
Array Analytics Research @ Jacobs U

- Large-Scale Scientific Information Systems research group
  - Flexible, scalable n-D array services
  - www.jacobs-university.de/lsis

- Most visible results:
  - Pioneer Array DBMS, rasdaman
  - Standardization: OGC Big Geo Data, ISO SQL
rasdaman: Agile Array Analytics

- „raster data manager“: n-D arrays in SQL
- Array Algebra [NGITS 1998]
  - SQL/MDA [SSDBM 2014, DOLAP 2015]
- Scalable, parallel „tile streaming“ architecture
- 130+ TB installations in operational use
Tutorial outline

- Installation & deployment
  - RPM/DEB, VM download, build from source

- Data modelling and concepts
  - What kind of data is supported?

- Query language
  - Typical array analytics queries, hands on

- Storage management
  - Single array datacubes can reach hundreds of TB
  - Learn how rasdaman scales to such volumes

- Domain application: Geo services
Turning a Zoo into a Circus

Zoi Kaoudi
Sebastian Kruse
Jorge Quiané
Data Analytics
Big Data Landscape 2016

Infrastructure
- Hadoop
- Spark
- NoSQL Databases
- NewSQL Databases
- Graph Databases
- MPP Databases
- Cloud EDW
- Data Transformation
- Data Integration

Analytics
- Analyst Platforms
- BI Platforms
- Statistical Computing
- Log Analytics
- Machine Learning
- Speech & NLP
- Real-Time
- Data Services
- For Business Analysts
- Data Sources & APIs

Applications
- Sales & Marketing
- Customer Service
- Security
- Vertical AI

Cross-Infrastructure/Analytics
- Cross-Infrastructure
- Open Source
- Cross-Infrastructure
- Open Source

Frameworks
- SQL
- Hadoop
- Spark
- NoSQL
- NewSQL
- Graph
- MPP
- Cloud
- Data Transformation
- Data Integration

Data Access
- Query/Data Flow
- Data Coordination
- Real-Time
- Stat Tools
- Machine Learning
- Search

Health
- Financial & Economic Data
- Air/Space/Sea
- Location/People/Entities
- Other

Incubators & Schools
- FirstMark Capital

© Matt Turck (@mattturck), Jim Hao (@jimh Hao), & FirstMark Capital (@Firstmarkcap)
Anything but sexy!
Let’s go!

Intro & Polyglot

Maple

BBLIN

RHEEM

ML