The "Big Data" Ecosystem at LinkedIn

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 Based on the paper "The Big Data Ecosystem at LinkedIn", written by Roshan Sumbaly, Jay Kreps, and Sam Shah.

The Ecosystems

Hadoop Ecosystem



Data Integration Problem

"Some analysts performed this integration themselves. In other cases, analysts especially application users and scripters relied on the IT team to assemble this data for them."

-Sean Kandel et al. Enterprise Data Analysis and Visualization: An Interview Study



Ecosystem at LinkedIn





Offline production datacenters



Offline production datacenters

Online datacenters







More information about *ETL* is available from Cloudera

Extract-Transform-Load

Online Datacenters

Voldemort Oracle

Voldemort

- system
- Possible to emulate the storage layer
- Reads and Writes scale horizontally
- Simple API
- Transparent data partitioning

More information about Voldemort is available at: <u>http://www.project-voldemort.com/voldemort/</u>

Combines In-memory caching and storage

Ingress and egress out of Hadoop system

Data flows

Next



Hadoop for ETL





Database

includes information about users, companies, connections, and other primary site data.

Event data

includes logs of page views being served, search queries, and clicks.

manual intervention or processing.

Challenges

Provide infrastructure that can make all data available without

Chalenges Datasets are so large

- Data is diverse
- Data schemas are evolving Data monitoring and validating



Kafka

A high-throughput distributed messaging system, for *all activity data*.

 Persists messages in a write-ahead log, partitioned and distributed over multiple brokers



 Allows data publishers to add records to a log

 New data streams to be added and scaled independent of one another.

 Collecting data about searches being performed. The search service would produce these records and publish them to a topic named "SearchQueries" where any number of subscribers might read these messages.

EXample



- Two common solutions:
 - Load data streams in whatever form they appear.
 - Manually map the source data into a stable, well-thoughtout schema.

Data Evolution

LinkedIn's Solution

- Retains the same structure throughout our data pipeline Enforces compatibility and other correctness
- conventions
- Schema evolves automatically • Schema check is done at compile and run time.
- · Review process.

Load into Hadoop

- a Map-only job.
- Recurrence every 10 minutes.
- system

Pull data from Kafka to Hadoop with

Scheduled by Azkaban scheduling



Two Kafka clusters kept synchronized automatically.

 The primary Kafka supports production.



- Each step in the flow all publish an audit trail
- Consist of the topic, machine name, etc.
- Confirm all published event reached all consumers by aggregating audit data.



Workflow

Processed offline

Workflow in Hadoop

 A directed acyclic graph of dependencies.

 Wrappers help restrict data being read to a certain time range based on parameters specified.

 Hadoop-Kafka data pull job places the data into timepartitioned folders.

Workflow in Hadoop A directed acyclic graph of dependencies.

One workflow can have a size of 50-100 jobs.



Azkaban

An open-sourced workflow scheduler.



- Supports multiple job types
- Run as individual or chained
- Configurations and dependencies are maintained
- Visualize and manipulate dependencies via graphs in UI.

Construction of Workflows

- Experimenting, massage it into a useful form
- Transform features into feature vectors
- Trained into models
- Iterate workflows



Kafka

Azkaban

Hadoop for development

Staging Voldemort Read-

Offline Production Datacenters

Azkaban

Hadoop for production



Results

 Usually pushed to other systems (Back online or for further consumption)

Three main mechanism

Key

Key-Value

Streams OLAP

Voldemort

Reference: Slides of The big data ecosystem at LinkedIn, presented at SIGMOD 2013

Based on Amazon's Dynamo
Distributed and Elastic
Horizontally scalable
Bulk load pipeline from Hadoop
Simple to use

Stream output performed by Kafka Implemented using Hadoop API
Each MR slot acts as a Kafka produce
More details available at http://kafka.apache.org



OLAP by Avatara

 Automatically generates corresponding Azkaban job pipelines.

 Small cubes are multidimensional arrays of tuples

 Each tuple is combination of dimension and measure pairs

Output cubes to Voldemort as a read-only store.



Applications





graphs

low-latency data processing

MapReduce for processing large

Streaming System for near line