Cloud Computing and Big Data

Hadoop Adjuncts and Extras

Oxford University
Software Engineering
Programme
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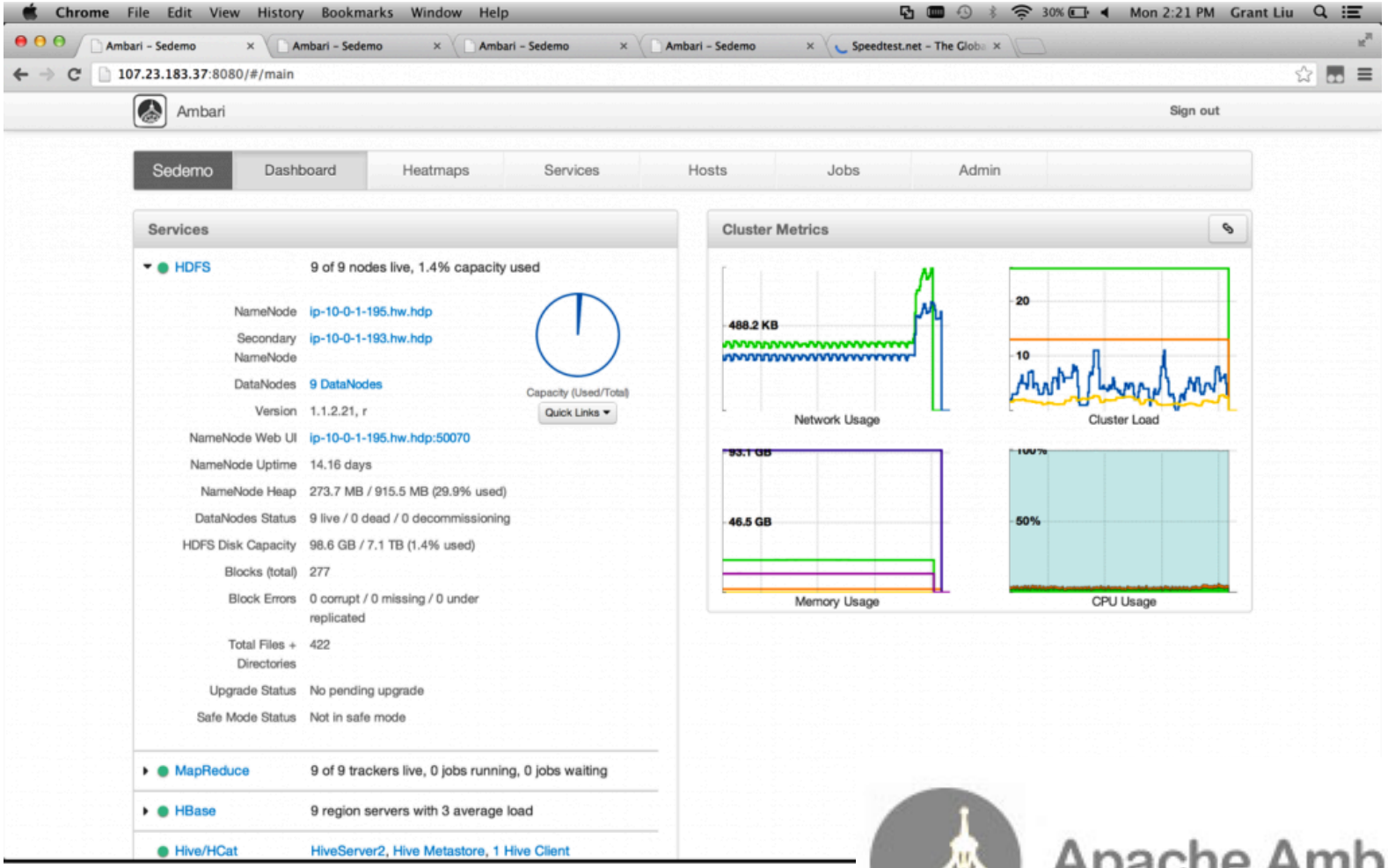
Hadoop related projects at Apache

- Ambari
  - Web based monitoring for Hadoop
- HBase
  - Scalable, Distributed database
- Hive
  - SQL query language for Map Reduce
- Pig
  - Dataflow and execution language for parallel execution
- Mahout
  - Machine Learning
- Chukwa
  - Log collection and processing on top of Hadoop
- Spark
  - Large scale data processing on top of YARN or Mesos
- Sqoop
  - Transfer of data into Hadoop from traditional databases
- Tez
  - Going beyond Map Reduce on top of YARN

Apache Ambari

http://ambari.apache.org



Apache Ambari

Apache HBase

- More in the NoSQL section

Apache Hive

http://hive.apache.org

- Just like SQL except it generates Map Reduce jobs
- Works on Hadoop and Spark
  - Part of SparkSQL
- Includes DDL (Data Definition Language) as well as SQL
- Makes many processing tasks very simple

Hive example

```
CREATE TABLE page_view(viewTime INT, userid BIGINT,
                page_url STRING, referrer_url STRING,
                ip STRING COMMENT 'IP Address of the User')
COMMENT 'This is the page view table'
PARTITIONED BY(dt STRING, country STRING)
STORED AS SEQUENCEFILE;


LOAD DATA LOCAL INPATH /tmp/pv_2008-06-08_us.txt INTO TABLE page_view
PARTITION(date='2008-06-08', country='US')

INSERT OVERWRITE TABLE xyz_com_page_views
SELECT page_views.*
FROM page_views
WHERE page_views.date >= '2008-03-01' AND page_views.date <=
'2008-03-31' AND
      page_views.referrer_url like '%xyz.com';
```

Apache Pig

http://pig.apache.org

- Pig is a language for parsing, sorting, and working with data from HDFS
- Pig scripts are runnable on Hadoop MapReduce
- Very effective approach

Pig Latin example

```
raw = LOAD 'excite.log' USING PigStorage('\t') AS (user, time, query);
clean1 = FILTER raw BY org.apache.pig.tutorial.NonURLDetector(query);
clean2 = FOREACH clean1 GENERATE user, time,
org.apache.pig.tutorial.ToLower(query) as query;
houred = FOREACH clean2 GENERATE user, org.apache.pig.tutorial.ExtractHour(time)
as hour, query;
ngramed1 = FOREACH houred GENERATE user, hour,
flatten(org.apache.pig.tutorial.NGramGenerator(query)) as ngram;
ngramed2 = DISTINCT ngramed1;
hour_frequency1 = GROUP ngramed2 BY (ngram, hour);
hour_frequency2 = FOREACH hour_frequency1 GENERATE flatten($0), COUNT($1) as
count;
uniq_frequency1 = GROUP hour_frequency2 BY group::ngram;
uniq_frequency2 = FOREACH uniq_frequency1 GENERATE flatten($0),
flatten(org.apache.pig.tutorial.ScoreGenerator($1));
uniq_frequency3 = FOREACH uniq_frequency2 GENERATE $1 as hour, $0 as ngram, $2
as score, $3 as count, $4 as mean;
filtered_uniq_frequency = FILTER uniq_frequency3 BY score > 2.0;
ordered_uniq_frequency = ORDER filtered_uniq_frequency BY (hour, score);
STORE ordered_uniq_frequency INTO '/tmp/tutorial-results' USING PigStorage();
```

mahout

/məˈhaʊt/

noun

(in South and SE Asia) a person who works with and rides an elephant.

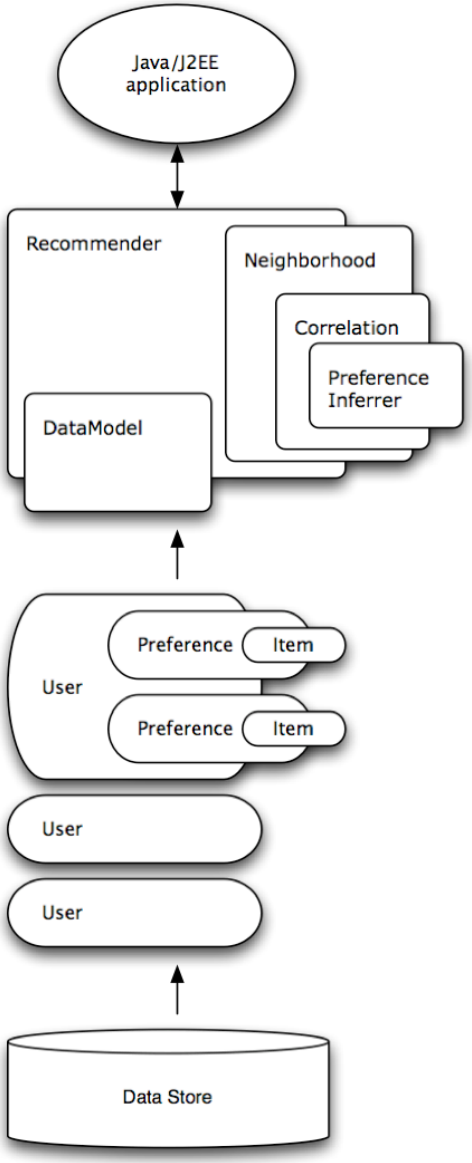
Apache Mahout

http://mahout.apache.org

- A system for creating **scalable machine learning** and data mining systems
  - Clustering
  - Classification
  - Recommendation
  - Frequent ItemSet

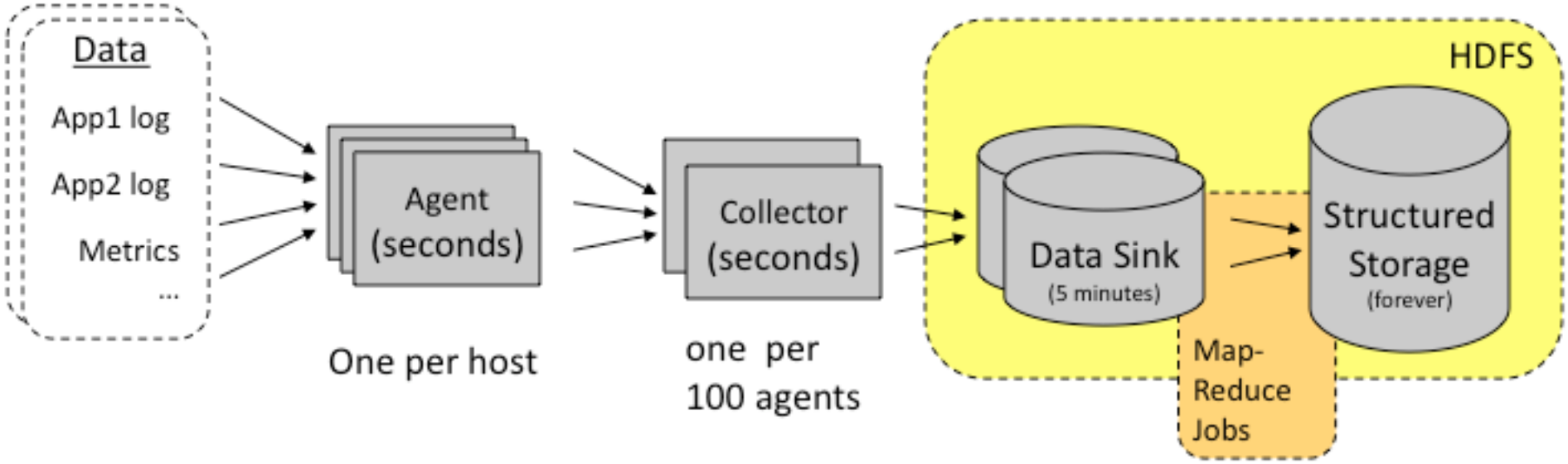
e.g. Recommender

- Takes users preferences
  - "Likes"
- Estimates preferences for other items
- For example, which books you might like to read next



Apache Chukwa

http://chukwa.apache.org



Spark

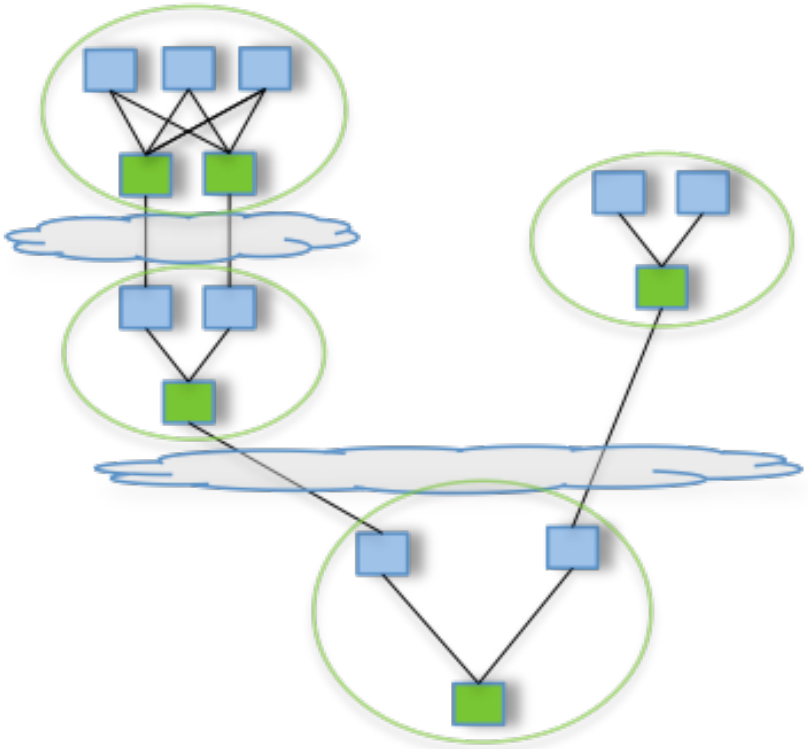
- Much more later!

Apache Tez

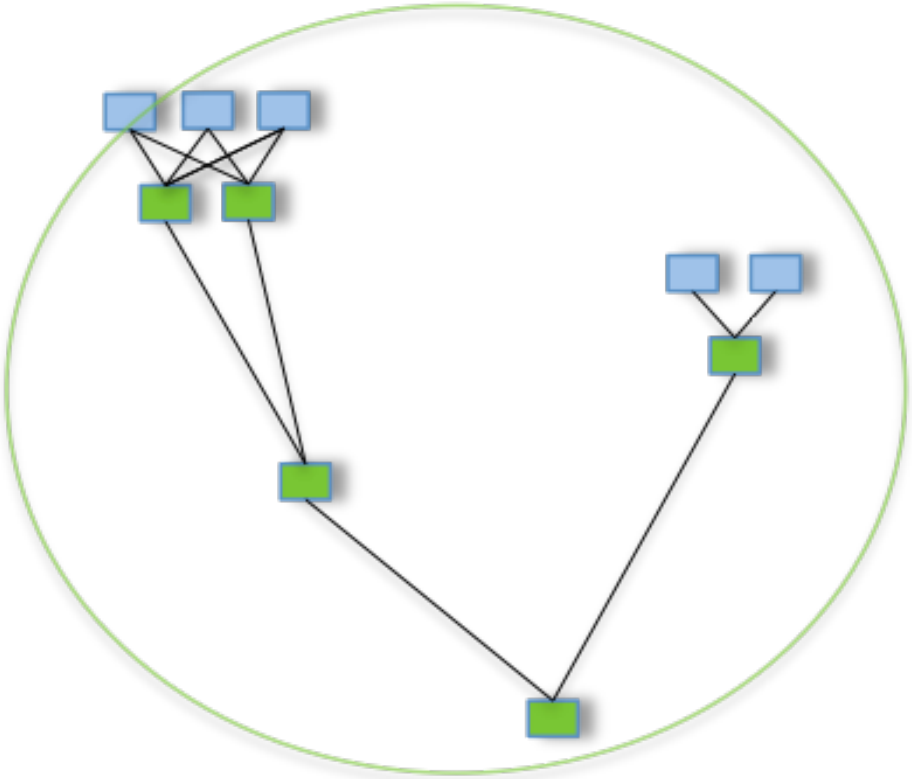
http://tez.apache.org

- Support for complex Directed Acyclic Graphs (DAGs) on top of YARN
  - Supports in memory jobs
  - Simplifies work that would previously be in multiple MR jobs
- Designed to support Pig and Hive

Tez



Pig/Hive - MR



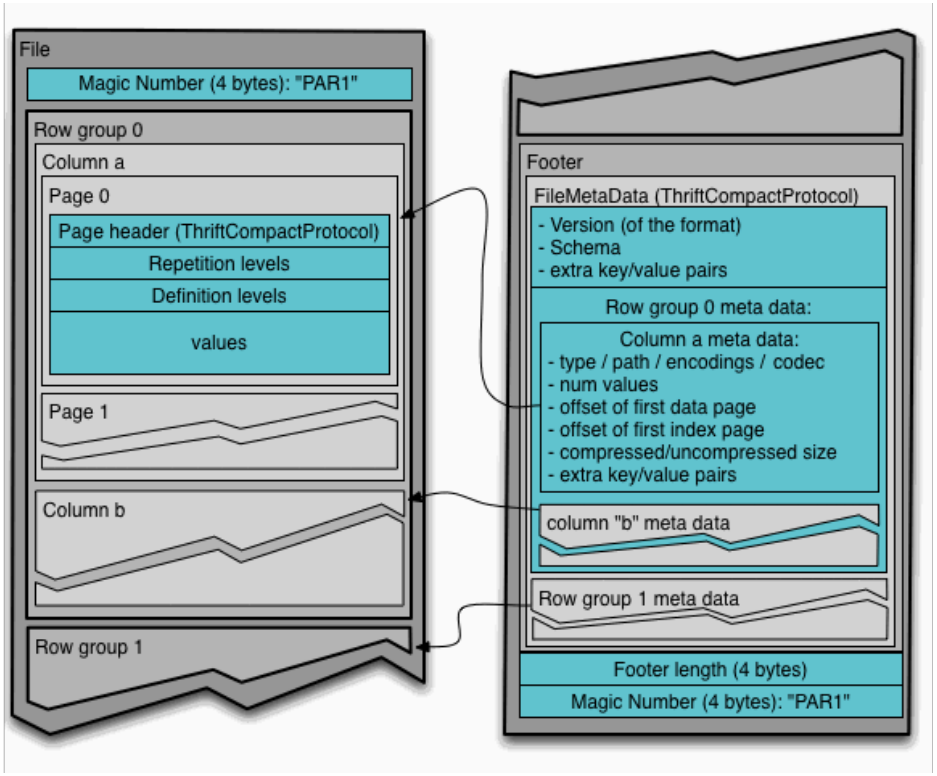
Pig/Hive - Tez

Apache Avro

- A compact data storage and transmission system
  - Uses schemas of data to ensure it can be read by the receiver
  - Supports dynamic typing
- Used by RPC or data collection systems
  - Fast binary protocols
- Also supports storage
  - Hence used by many Big Data apps including Hadoop and Spark

Apache Parquet

- Apache Parquet is a columnar data storage model
  - Works with Hadoop, Spark and many others
  - Efficient storage of data
  - Based on another Google system called Dremel



Questions?