Project Details

Sl No	Field	Value	IdentiKey
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Problem Description

Data Analysts and Data Scientists are often tasked with looking at very large datasets, sometimes datasets that do not even fit on their machine. This is a common situation especially for students who cannot afford high-end machines as many Software Companies can. Looking at our own course, during the first assignment our TA faced a similar challenge with the Gutenberg dataset while uploading the same to blob storage.

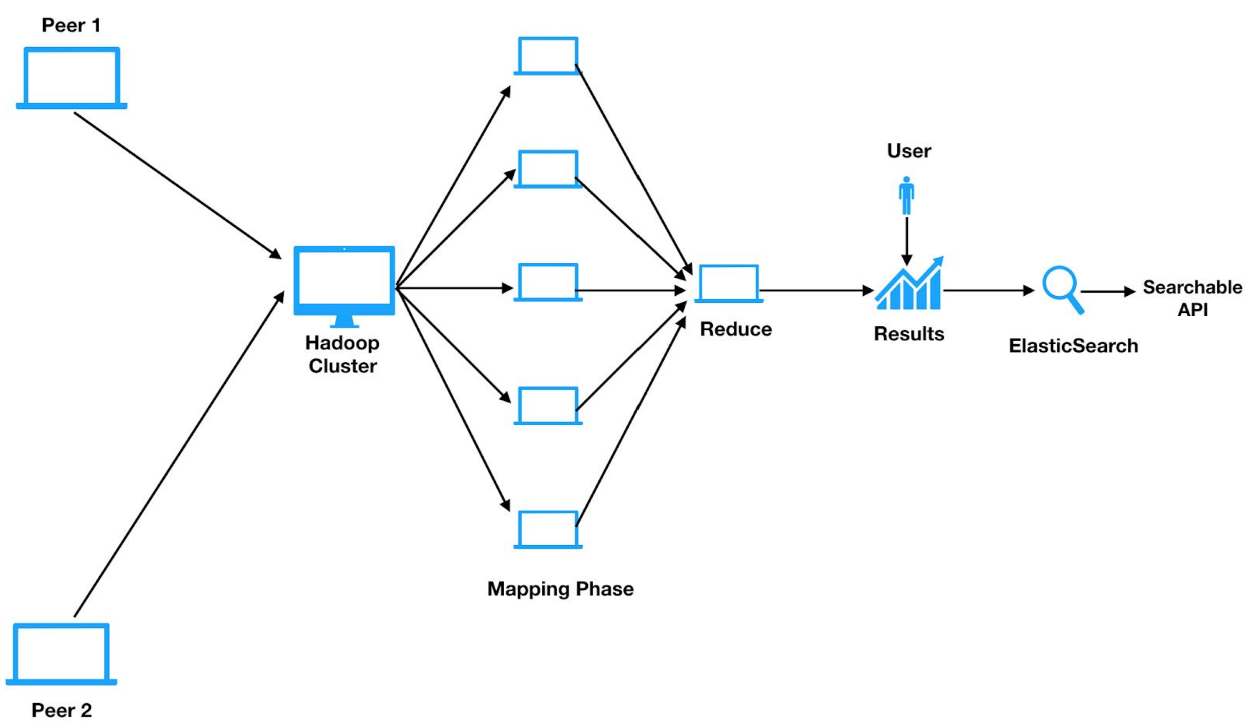
As hard as it is to upload the data, analyzing it becomes a major issue as well. Data is often compressed to a much smaller size than what they originally are. Due to hardware restrictions, often this data that cannot be extracted on local machines it is very difficult for users to envision the structure of the data.

The main advantage that APIs have over static data is that they are searchable, queryable and can be consumed in volume as specified by the user. However, these APIs are often paid and students cannot afford the rates of retrieving this data and need to look for static free alternatives.

Our project tries to solve both these issues. We plan to build a tool that will use peer to peer file transfer (torrents over a private network) to upload the files to an HDFS. Now as we have seen over large data sets that they are compressed with compression over 10 we will let the users upload compressed files and unzip them on the HDFS to reduce the network bandwidth. Once that is done we will analyze the fields in the dataset to give users an overview of all the fields and also the distribution of the fields in there with map reduce jobs. With the results from that users can select which fields to index in Elasticsearch and hence reduce the overhead there. Therefore proving a searchable API for a static dataset.

The section above is explained here:
The point above is highlighted again in the two sections below and explained with more context there. Please refer to the Datasets and challenges section.

High-Level Architecture



The Architecture diagram is as shown above.

The way we intend the architecture to work is as follows:

1. The compressed data files are present on both the peers. The data is uploaded to a compute instance using a peer to peer algorithm similar to that of bit torrent.
2. The data is unzipped here and pushed to the blob storage
3. MapReduce jobs run on the uncompressed data to determine analytics and information about the data that we would like to expose to the users.
    a. The format of the data: The various fields in the data that exist
    b. The count of the different possible values each of these fields can take
    c. The number of times the field is missing or is empty
4. The user has options to choose the fields that he wants to index or select all fields by default
5. The data is then pushed to ElasticSearch and the API is exposed to the user for queries.

Datasets

Since the problem we are not trying to solve is not a Machine Learning problem, we do not need "datasets" for this. However, we do have to validate the performance of the system we will be using various datasets, some of which were used for the assignments during the course
For our test data we plan to use the Twitter monthly archive. It is a compressed dataset of 40GB and uncompressed is almost 400 GB. The fields are unstructured with over 2000+ unique fields over the dataset which are not structured, and a skewed distribution of data over the fields. We feel this dataset will be as challenging as it gets as it will test every aspect of our project.

Challenges

We will face various challenges during the course of our project.

1. The first step involves getting familiar with how peer to peer networks work. Peer to Peer networks involves distributed systems and learning new

protocols for getting the system up and running. Since we have not worked with such frameworks before, we could run into hurdles along the way.

2. We intend to write bash scripts to uncompress the data on the cloud. Uncompression will involve writing bash scripts to take care of nested compressed files. Also, files can have various compression algorithms/formats used which need to be handled.
3. Transferring files to blob storage would be an extremely slow process, from what we have seen in the assignments. This needs to be done in a multi-threaded manner.
4. Determining structures in the data by exploring various parsers could be a complex issue as we see more datasets.
    a. The datasets that we intend to use is Twitter JSONs. Although this seems like structured data, it is semi-structured in our opinion. There are 2000+ unique fields and analytics on these are not going to be a trivial task. The datasets are also continuously changing due to this semi-structured nature. The aim of the project is for the analytics, summarization rather than parsing.
5. ElasticSearch is a cluster that is distributed as well, setting that up via a script could be complex.
6. Exposing data analysis to a user in an interactive manner is involves coming up with good UI designs.

Timeline

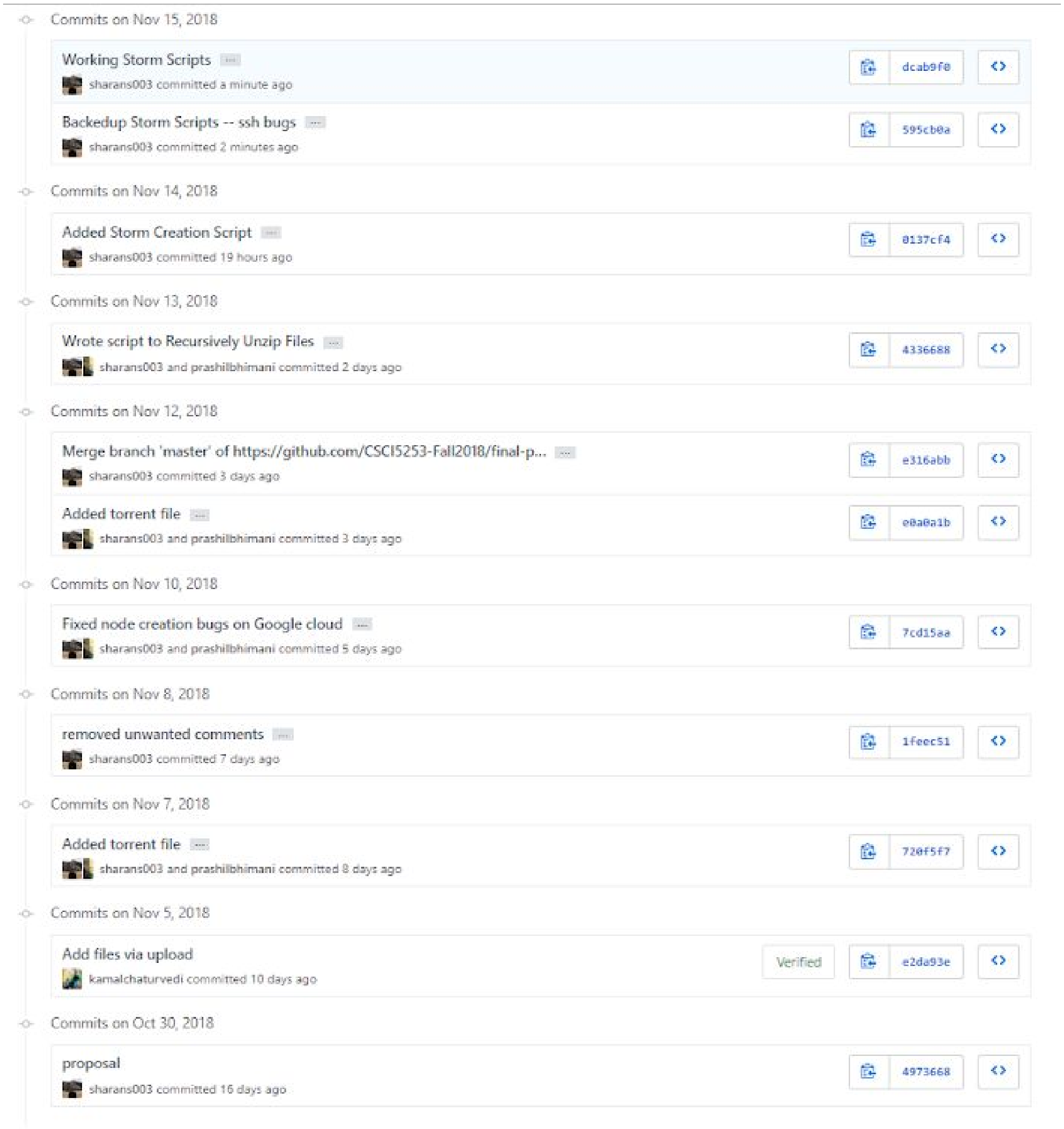
Sl No	Story Title	Story Description	Date
1	Project Proposal	Project report with Description, Timelines, Architecture and Challenges	30/10/2018
2	Set up a Private Peer to Peer network to upload data	Working on Building a tracker file and work on uploading the Compressed data files onto a Computer Node on AWS/Google Cloud	5/11/2018
3	Bucket Transfer	Detect when the entire data is uploaded onto the Compute Node, Uncompress the Data and Upload the data into a Blob storage	10/11/2018
4	Data Structure	Write MapReduce jobs to determine the structure of the data that is present in the uncompressed file.	15/11/2018
5	Perform Analytics	Write MapReduce jobs to present Analytics about the Dataset to the user	20/11/2018
6	Selection Framework	Provide a Framework to the User, where the user can choose which fields to select for indexing	25/11/2018
7	Spawn ES Cluster	Write a Script to create an ElasticSearch cluster to push data, based on the size of the uncompressed data that we have	30/11/2018
8	Push Data to ES	Write MapReduce jobs to Push Data to ElasticSearch such that the data is searchable through HTTP Protocols	10/12/2018

Checkpoint for Prashil & Sharan

Note : We worked on all stories together and so we have put up one table for this.

Sl No	Story Title	Story Description	Date	Status	Completed on
1	Project Proposal	Project report with Description, Timelines, Architecture and Challenges	30/10/2018	Completed	30/10/2018
2	Upload data using peer to peer networks	Worked on setting up torrent peer architecture on local and Google Cloud machines to download the data using a distributed network	5/11/2018	Completed	8/11/2018
3	Bucket Transfer	Detect when the entire data is uploaded onto the Compute Node, Uncompress the Data and Upload the data into a Blob storage	10/11/2018	Completed	13/11/2018
4	Data Structure	Write MapReduce jobs to determine the structure of the data that is present in the uncompressed file.	15/11/2018	Pending - Worked on scripts to create the distributed computing architecture and tested it with basic topologies	14/11/2018
5	Perform Analytics	Write MapReduce jobs to present Analytics about the Dataset to the user	20/11/2018	Not Started	
6	Selection Framework	Provide a Framework to the User, where the user can choose which fields to select for indexing	25/11/2018	Not started	
7	Spawn ES Cluster	Write a Script to create an ElasticSearch cluster to push data, based on the size of the uncompressed data that we have	30/11/2018	Not started	
8	Push Data to ES	Write MapReduce jobs to Push Data to ElasticSearch such that the data is searchable through HTTP Protocols	10/12/2018	Not started	

Github commits for Prashil & Sharan



Commits on Nov 15, 2018

Working Storm Scripts
sharans003 committed a minute ago — dcab9f0

Backedup Storm Scripts -- ssh bugs
sharans003 committed 2 minutes ago — 595cb0a

Commits on Nov 14, 2018

Added Storm Creation Script
sharans003 committed 19 hours ago — 0137cf4

Commits on Nov 13, 2018

Wrote script to Recursively Unzip Files
sharans003 and prashilbhimani committed 2 days ago — 4336688

Commits on Nov 12, 2018

Merge branch 'master' of https://github.com/CSCI5253-Fall2018/final-p...
sharans003 committed 3 days ago — e316abb

Added torrent file
sharans003 and prashilbhimani committed 3 days ago — e0a0a1b

Commits on Nov 10, 2018

Fixed node creation bugs on Google cloud
sharans003 and prashilbhimani committed 5 days ago — 7cd15aa

Commits on Nov 8, 2018

removed unwanted comments
sharans003 committed 7 days ago — 1feec51

Commits on Nov 7, 2018

Added torrent file
sharans003 and prashilbhimani committed 8 days ago — 720f5f7

Commits on Nov 5, 2018

Add files via upload
kamalchaturvedi committed 10 days ago — Verified — e2da93e

Commits on Oct 30, 2018

proposal
sharans003 committed 16 days ago — 4973668

Note: Due to some issue the coauthored part did not work for newer commit - But each commit message has the tag co-authored