NETWORK CODING BASED RELIABLE DATA STORAGE AS A SERVICE IN CLOUD

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ABSTRACT: *Cloud computing is today a buzz word. It provide us a virtual storage in order to retrieve data from anywhere. Data storage also plays an important role in order to provide reliable data retrieval service. Network coding is one of the successful tool to achieve the same. Network coding provides the reliability and also provides security. In network coding, transmitted data is encoded and decoded to increase a throughput, reduced delay and increase network more robust. This motivates us to work in the direction of designing a robust and reliable framework for data storage on cloud. For this purpose we use fog computing, network coding for better reliability.*

Key Words: Cloud, reliable, storage, service, coefficient, etc.

I. Introduction

Cloud computing is the use of computing resources (software and hardware) that are delivered as a service Over a network (Internet). It ensures remote services with a user's data, software and computation [1]. Nowadays data is stored over the internet using cloud storage environment. The data over the cloud must be stored in such a way that its integrity should be maintained [2]. Cloud computing is the internet depend technology which is providing the services to user, small and large organization on demand. Cloud computing stored the user data and maintain in the data canter of cloud provider like Amazon, Oracle, Google, Microsoft etc. [3].Network coding is networking technique in which transmitted data is encoded and decoded to increase network throughput, reduce delays and make the network more robust. The received transmissions are decoded at their destinations. This means that fewer transmissions are required to transmit all the data[4].

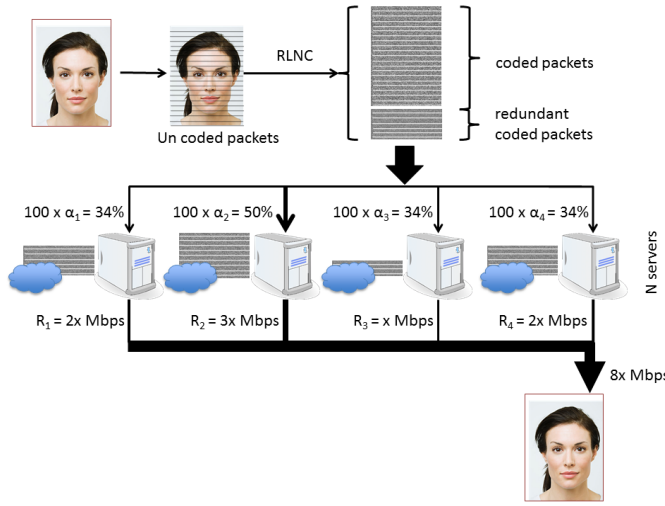

Fig 1:main idea of distributed clouds with network coding [4]

The main idea of this paper is to store data in a distributed fashion over multiple cloud providers. This should help to increase reliability and resolve the privacy issues to some extent. Additionally, using random linear network coding makes storage more efficient in terms of storage space and time to retrieve the distributed data[4]. The concept of network coding is a linear combination of multiple packets which belong

to a generation (i.e., chunk). We use the words generation and chunk interchangeable with similar meaning. A number of native packets (i.e., original packet without coding) is also the chunk size [5].

Random linear network coding

Linear coding extends simple network coding by incorporating additional information and including it in the packet payload. A node can multiply some coefficient with a fixed size of data in the original message, and combine its own data with a coefficient [4].

Cloud computing model

a) Service Model[6]

In cloud computing everything is provided as a service (Xaas). Services may be in the form of hardware, software, storage, platform, infrastructure database and many more.

1. **Software as a service (Saas)**: Software (application) is delivered over Internet. Software, which runs on provider's cloud infrastructure, is delivered to multiple clients (on demand) through web browser over the Internet.
2. **Platform as a service (Pass)**: Platform is provided to the client to build (develop, test, deploy) the applications. The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider.
3. **Infrastructure as a service (Iaas)**: It offers users elastic on demand access to resources (server, storage, networking) through service API.

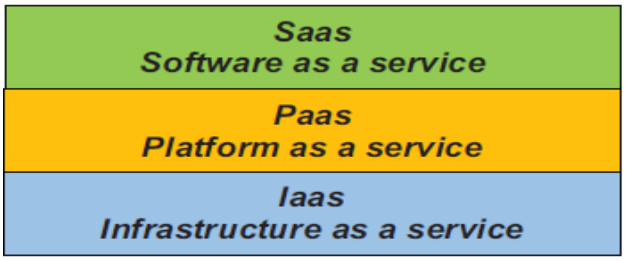

Fig2: Service Model[6]

b) Deployment Model[7]

There are mainly four types of cloud, namely private cloud, public cloud, community cloud and hybrid cloud.

- **Private cloud:**A private cloud is a cloud infrastructure, which is solely operated by a single organization. It can be managed by an organization or by a third-party.
- **Public cloud:**In the public cloud, the CSP provides the resources, such as network, server, etc.
- **Community cloud**: It is managed by all these organizations or by a third party. The community cloud sometimes is used for national security purpose.

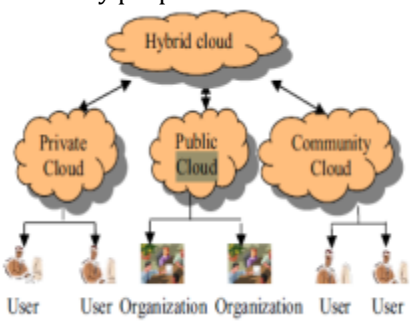

Fig 3: Deployment model[7]

II. PROBLEM STATMENT

Today data reliability in cloud is one of the prime issue as it involves so encoding and decoding. Conventional, mechanism incurs huge time complexity in order to retrieve the data on demand. In this work, network coding based reliable data storage leveraged by the fog computing paradigm for achieving minimum latency for data retrieval.

III. RELATED WORK

In my proposed system, I will develop an algorithms for data uploading and data retrieval which uses the concepts of network coding in which data owner divides data into chunks and Apply Random linear network coding on that data for which cloud controller will play an role of Third party for coefficient generation(i.e. key).

Whenever user want to access the data cloud controller will provide respective co-efficient (i.e. key) in a secure manner. By using that key user will be able to decrypt the data. In whole process the key will be secure using Network coding.

Our proposed algorithm will outperform the existing approaches in form of computational complexity also provides robust confidentiality and provide high reliability of data.

IV. PROPOSED ALGORITHM

RLNC algorithm (Encoding)

1. Let there are k original packets M1,M2,M3,…,Mk
2. Each packet contains encoding vector Ai=α^i1, α^i2, α^i3,…, α^ik and
   $$Xi= \sum_{k=1}^{n} \alpha^i k\ Mk$$
3. Let out of these, m packets (A1,X1),….,(Am,Xm)
   Needed to be linearly coded with co-efficient β1,….,βm in Galois field
4. $X_{new}=\sum_{i=1}^{m} \beta i\ Xi$

RLNC algorithm (Decoding)

1. Let a receiver gets n packets (A1,X1),……..,(An,Xn)
2. Receiver needs to solve the following n linear equation:
   $$X1= \sum_{k=1}^{n} \alpha^1\ k\ Mk$$
   $$X2= \sum_{k=1}^{n} \alpha^2\ k\ Mk$$
   $$\vdots$$
   $$Xn= \sum_{k=1}^{n} \alpha^n\ k\ Mk$$
3. Where n>=k i.e, number of received packets is no less than that of original packets.

Algorithm for Data Uploading/Downloading

For Sending
Step 1: Sender send request to edge controller for key co-efficient
Step 2: Edge controller generates key coefficient using rand () Function based on Finite field
Step 3: Edge controller suggests numbers of encoded copies of file to be done to user device
Step 4: Encode the data using RLNC algorithm
Step 5: Uploading encoded data on cloud storage
For Downloading
Perform the network decoding as mentioned in RLNC algorithm

Algorithm for Reliability_Edge controller

Repeat through the steps at regular Interval
Step 1: Edge controller periodically check the reliability of all the server
Step 2: Determine the aggregated reliability of available pool of servers
Step 3: Based on aggregated reliability determines the no of network encoded copies to be done.

V. IMPLEMENTATION AND RESULTS

This is the screenshot of encoding. In this screenshot, file is to be converted into ASCII number. The edge controller generates the key coefficient using rand () function based on finite field. This key is in form of 3X3 matrix. The file is set in matrix format and then multiply with key coefficient. And then encode the file. And that encoded file is store on cloud. This can be shown in below figure:

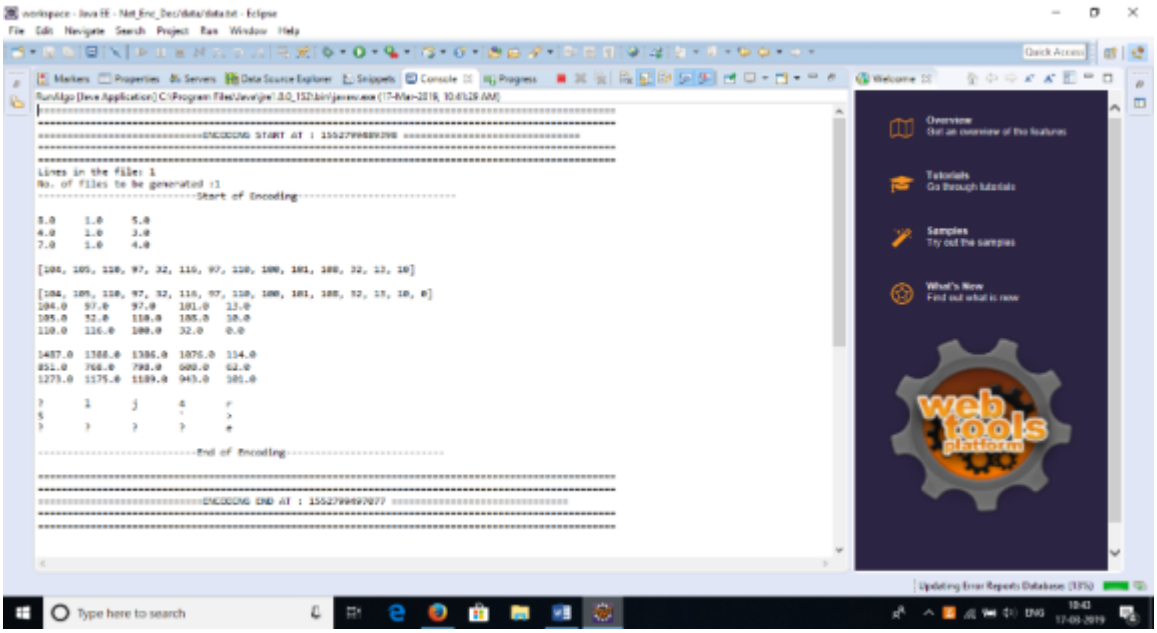

Fig 4: data decoding

This is the screenshot of decoding. In the decoding, user send request to the edge controller for data retrieving. Then edge controller check the reliability of all the server.After checking, the encoded data is decoded and user download the data in the original format.
This can be shown in below figure:

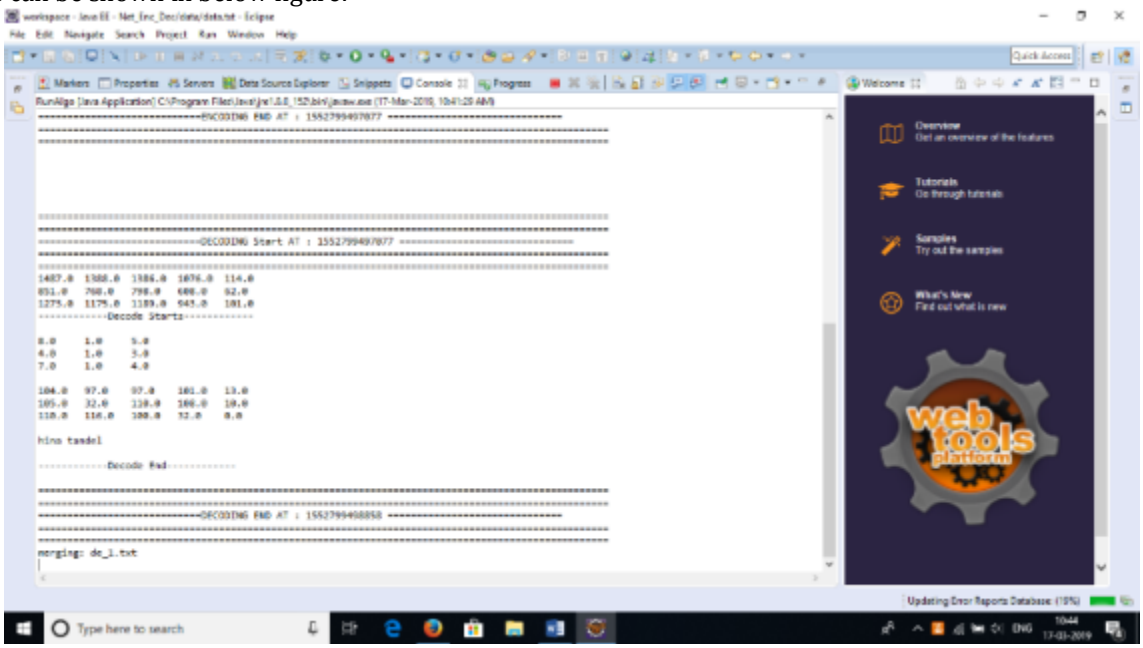

Fig 5: data encoding

This is the screenshot of storage service. File is store on AWS s3. In AWS S3, we have created bucket. Bucket name is ncrdass. The file is store in this bucket. This can be shown in below figure:

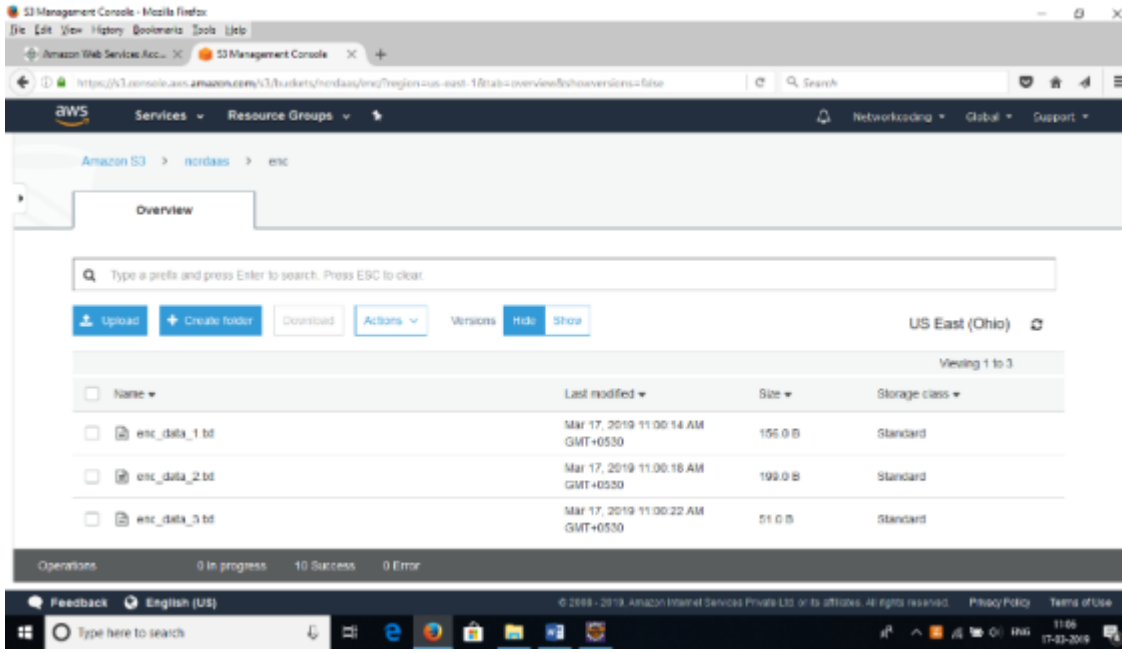

Fig6: data storage in AWS S3

This is the screenshot of generating a no of copies of original file. This can be shown in below figure:

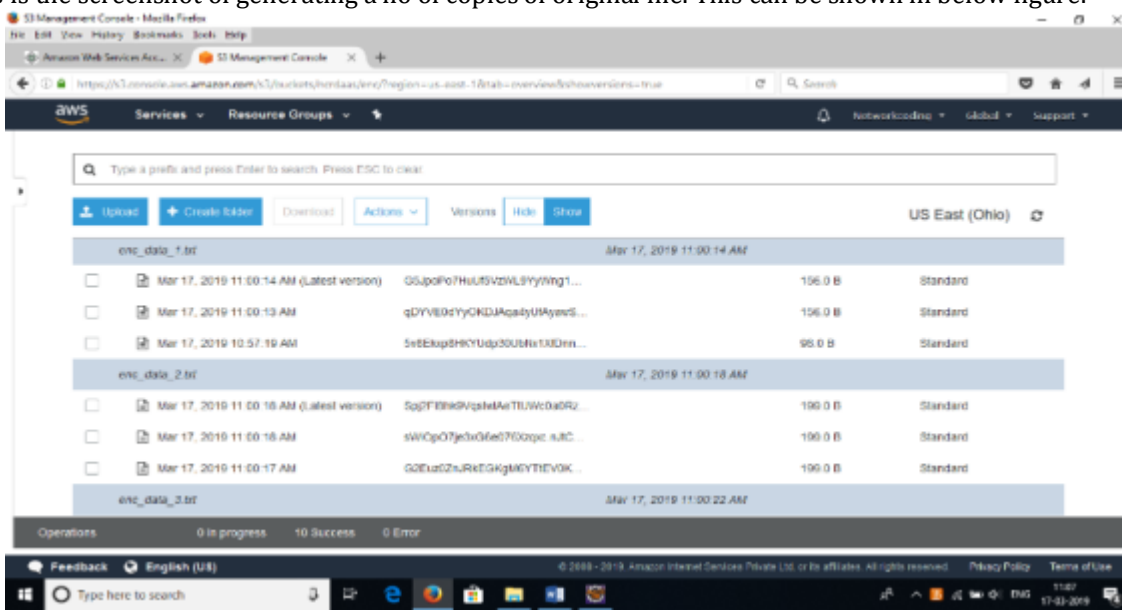

Fig 7: file distribution

VI. CONCLUSION

In this proposed approach, Network coding (NC) is the efficient mechanism for data storage on cloud for fault tolerance. Optimal number of NC encoded copies improves the efficiency of the system reliability. Also Edge computing minimizes the latency which proves a drastic improvement over existing infrastructure. For data uploading and data retrieving we have used Network coding.

VII. FUTURE DIRECTION

Fault prediction module will assist our approach for the better reliability provision by regularly checking the health of the servers. In Future direction, we will review and implement a better fault prediction mechanism for reliability.

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