Enhancing Data Reliability using Multi-Generation Mixing for Decoding In Cloud Computing: A Survey

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ABSTRACT

Wireless access networks constitute an important part of mobile cloud computing. Using mesh networks is a promising solution to quickly provide connectivity infrastructure for cloud service access. While mesh networks can be easily set up, the wireless nature of the links interconnecting mesh routers compromises the network performances. Due to the broadcast nature of wireless networks they have been a natural platform for applying Network Coding (NC). Wireless networks can benefit significantly from NC due to their broadcast nature and the opportunity of enhancing bandwidth utilization. In this survey, a study of different network coding theories have been carried out and a comparision has been done.

Keyword: *Data Reliability, Network Coding, Multi-Generation Mixing, Cloud Computing.*

1. INTRODUCTION

Cloud Computing is an innovative technology that is revolutionizing the way we do computing. The key concept of cloud computing is that you don't buy the hardware, or even the software, you need anymore, rather you rent some computational power, storage, databases, and any other resource you need by a provider according to a pay-as-you-go model.

Data reliability is a state that exists when data is sufficiently complete and error free to be convincing for its purpose and context. In addition to being reliable, data must also meet other tests for evidence. Computer-processed data must meet evidence standards before it can support a finding.

Within the cloud computing world, the virtual environment lets users access computing power that exceeds that contained within their own physical worlds. To enter this virtual environment requires them to transfer data throughout the cloud. Consequently, several data storage concerns can arise. Typically, users will know neither the exact location of their data nor the other sources of the data collectively stored with theirs.

In network coding, routers and switches are replaced by devices called coders. Instead of directing the packets toward their ultimate destination like blood cells through a system of arteries, the coders transmit metadata in the form of digital evidence about the message along multiple paths simultaneously. Conversely, the metadata arriving from two or more sources may be combined into a single packet. This distribution method can increase the effective capacity of a network by minimizing the number and severity of bottlenecks. The improvement is most pronounced when network traffic volume is near the maximum capacity obtainable with traditional routing. When a receiver has

enough digital evidence, it can compute the intended message/packet. Even if some packets on some of the routes are lost or mutilated, the original message gets through if the received digital evidence is sufficient.

In network coding, the data does not depend only on one transmitted message but also on the contents of other messages that happen to be sharing the route at the time of transmission. For this reason, network coding is more resistant to hacking, eavesdropping and other forms of attack than traditional data transmission. The extent of throughput improvement that network coding can provide depends on the network topology and on the frequency and severity of bottlenecks. In no event does network coding reduce the throughput compared with the routing method. Network coding may prove especially useful n multicast networks, wireless sensor networks, digital file distribution and peer-to-peer (P2P) file sharing.

2 RELATED WORK

[1] Yanbo Lu, Jie Hao, Xin-ji Liu, Shu-Tao Xia have proposed "Network Coding for Data-Retrieving in Cloud Storage Systems"

Storage systems such as Facebook cluster, Microsoft Azure have been rapidly expanding nowadays. Efficiency, reliability are critical requirements for storage systems. As the rapid growth of data, more and more storage systems are increasingly evolving their data storage strategies from replication to erasure codes in order to reduce storage cost. The most promising storage codes are Maximum-Distance-Separable (MDS) codes, which provide optimal storage efficiency.

While cloud storage systems with “hot data” must ensure that data is not lost and must be easily and quickly accessible to users whenever required. The performance of data-retrieving, i.e., the latency (time to retrieve a file from a storage system), is the key metric of cloud storage systems, which are applied for Internet applications, web services, big data applications and so on. It has been shown that the performance of data-retrieving has a large impact on user experience and service provider revenue.

In this paper, authors make the following contributions:

- 1) They are the first to transfer the perspective of study of based on MDS codes to that of optimizing MDS codes, that is, we are the first to consider optimizing the coding schemes to improve the performance of data-retrieving in cloud storage system with “hot data”, to the best of our knowledge.
- 2) Thy apply Network Coding to optimizing MDS codes. In other words, we propose a new family of MDS codes, which greatly improve the performance of data-retrieving and reach optimal performance in theory.

[2] Marton Sipos, Frank H.P. Fitzek, Daniel E. Lucani and Morten V. Pedersen have proposed "Distributed Cloud Storage Using Network Coding"

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.

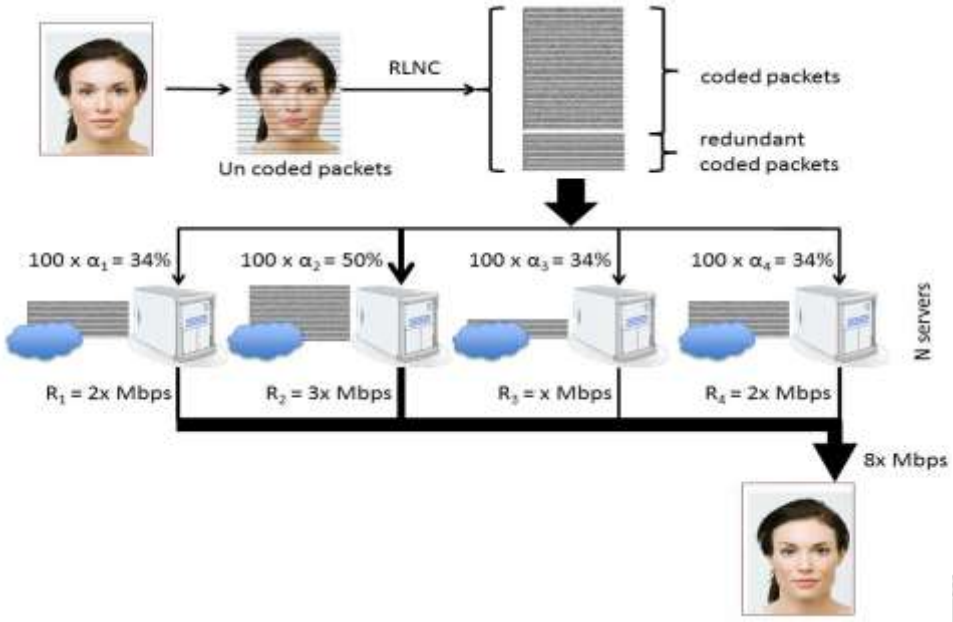

Figure 1. Main idea of distributed clouds with network coding[2]

From the user's point of view, the distributed approach increases data availability and data privacy. The distributed approach allows those users to accumulate several small clouds into one large overlay cloud. Even commercial cloud users can benefit from the distributed cloud approach. Network coding, as no other coding technique nowadays, has the possibility to derive extra redundancy on the fly in a very efficient way. Such a flexible scheme enables the cloud providers to allocate the cloud space more efficiently.

[3] Pengxu Tan, Vue Chen, Chaoling Li have proposed "A Secure Regenerating Code for the Fault-Tolerant of Distributed Networked Storage"

In this paper, a secure regenerating code called secure regenerating code with semi-adaptive (SRCS) is proposed.

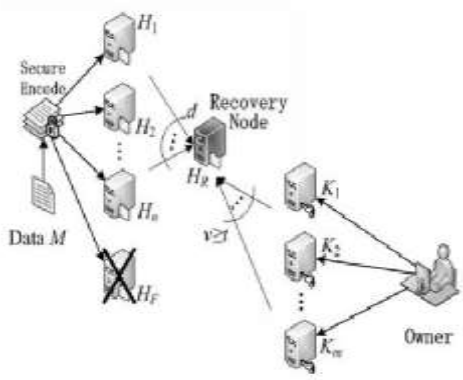

Figure 2. The Model of SRCS System[3]

The SRCS uses the threshold public-key encryption. The messages are stored in an encrypted form. If the attacker compromises more than **d** storage nodes, he can't regenerate the original data. In the storage system based on the SRCS, the data owner shares his private key to a set of key servers. If the attacker compromises less than t key servers, the private key is safe. So, the attacker can't tamper the data stored in the system as long as he can't get the private key.

[4] Mohammed Halloush, Hayder Radha have proposed "Network Coding with Multi-Generation Mixing: Analysis and Applications for Video Communication"

In this paper we will apply the generalized approach of network coding with Multi-Generation Mixing (MGM) in networks communicating video contents. First, we evaluate the performance of MGM network coding through an analytical study as well as simulations. We show that MGM improves the performance of network coding in situations where traditional Generation by Generation (G-by-G) may not be a viable option.

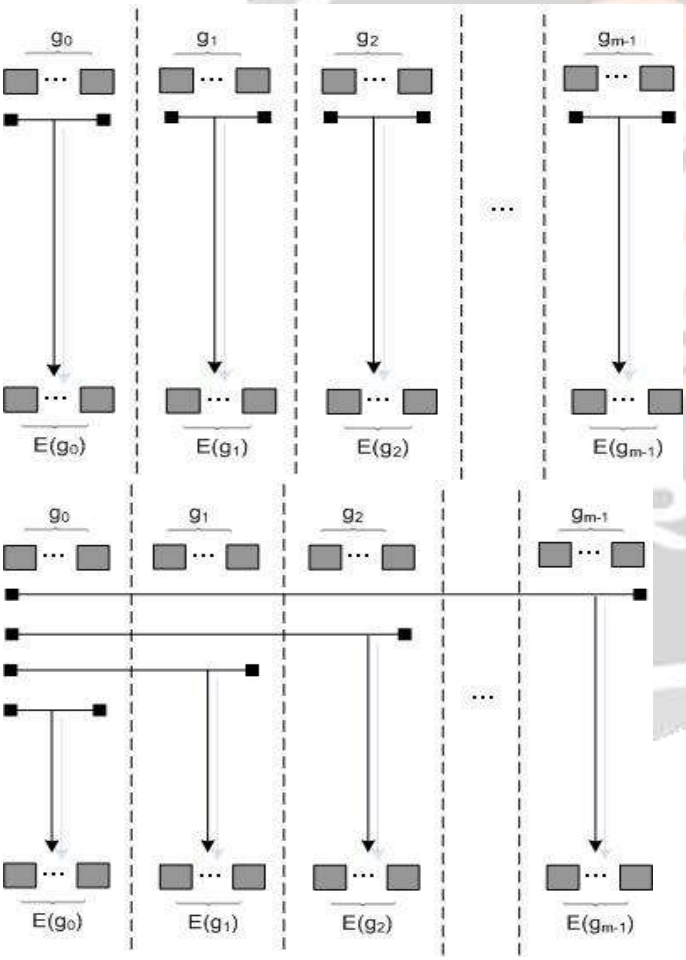

Figure 3. Multi-generation mixing [4]

[5] Tarik Chanyour, Rachid Saadane have proposed "Cooperation based Instantly Decodable Network Coding for Mobile Clouds"

The increase in the number of mobile devices has enabled users to be connected everywhere through wireless and mobile communications technologies. As a result, a new class of resource-constraints user equipment appears without any persistent connectivity requirement and with more demands in terms of additional resources, computational and bandwidth capacities. This has led to a totally progressive kind of mobile cloud computing networks. Hence to deal with all these problems, authors propose an efficient communication scheme based network coding. After the introduction of Network Coding in the field of communication networks as a novel technique, it gains more and more importance.

3. COMPARITIVE ANALYSIS

Sr. No.	Paper Title	Methods/ Techniques	Advantages	Disadvantages
1.	Network Coding for Data-Retrieving in Cloud Storage Systems.	Optimizing MDS Code, OPDRC	Improved performance of data retrieving using OPDRC Scheme	Format specific policy might not always make correct decisions in all scenarios.
2.	Distributed Cloud Storage Using Network Coding	Distributed storage techniques, Cloud Testbed	Less Cost, Reliability, Download Speed and Privacy	Extra delay in decoding
3.	A Secure Regenerating Code for the Fault-Tolerant of Distributed Networked Storage	Regenerating Code, SRCS, Fault-Tolerant	Guarantees the privacy of messages even if all storage servers are compromised	Considering only processing speed is not enough. Other factors need to be considered
4.	Network Coding with Multi-Generation Mixing: Analysis and Applications for Video Communication	MGM Based Network Coding, G-by-G network coding	Improves the flexibility for decoding generations incrementally.	Other parameters like performance is not considered
5.	Cooperation based Instantly Decodable Network Coding for Mobile Clouds.	Mobile Cloud, Instantly decodable network coding	Improvement in terms of packets delay and completion time of broadcast sessions.	The Channel between source and the user group is less reliable and requires much more power to compensate for the path loss

Table 1. Literature Comparison

4. CONCLUSION & FUTURE WORK

In this paper we propose Multi-Generation Mixing (MGM), which is a generalized approach for generation based network coding. With traditional generation based NC sender packets are grouped in generations where encoding and decoding are performed on packets that belong to the same generation. In scenarios i.e. wireless mobile clients, where losses cause insufficient reception of encoded packets, NC losses occur. NC losses are expensive; the minimum unit of loss is the loss of one generation. The proposed MGM framework allows the encoding among generations for the purpose of enhancing NC de-codability. With MGM in scenarios where insufficient number of encodings received of a generation, it is still possible to recover the generation using data encoded in other generations. We will demonstrate the improvements in performance achieved by MGM.

5. REFERENCES

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