Cloud based Convergent Unrestricted Mobile Communication Assistance via Evolutionary Adaptive Ad hoc Strategies for Disaster Relief

Manual Selvaraj Bexci, Sandeep Poddar, Antony Athithan

***Abstract*: The mobile communication networks and towers go down or cease to exist leading to poor connectivity during disasters. When communication becomes paralyzed, it is vital to build a disaster relief solution with available resources. Without data connectivity, it is essential that an emergency protocol should be implemented by the government that uses the available paralyzed communication resources spread across various communication networks by pooling to form one single communication network backed by cloud facilities to restore connectivity. In this paper the authors introduce a new emergency protocol approach to design an unrestricted cloud-based mobile technology during disaster enabling instant communication services to the disaster zones that works best under the command of the government. This protocol can act faster than the existing communication network put in place for public communication, with the additional advantage of being more robust and capable of withstanding disaster conditions.**

Index Terms*: *Disaster Relief, Convergent Communication Networks, Evolutionary Ad hoc Communication, Cloud based Disaster Communication

I. INTRODUCTION

Quick, easy and effective communication is essential in a disaster, however due to the nature of resource damage during disaster time, these characteristics become very low and may many times be unusable. Quality of data and exchange of communication through video and voice conversations for better disaster preparedness and disaster relief and research in such areas are vital [1]. The advantages of 5G after its launch in 2019 have boosted mobile cloud applications that were previously impossible to accomplish between client-server architecture [2]. 5G services have been launched by major telecommunication operators which provide diversified and value-added services using cloud platform. Cloud networks allows control of mobile communications and enables all mobile services to direct centralized data mobility across various disaster management contact points regardless of location or device [3]. There are two main challenges that hamper emergency communication during disasters. First, very little is known about the obstacles when it comes to sharing and coordinating information effectively between private and government bodies. Cloud applications and its infrastructure is owned by private players and not linked to government or local authorities who fail to provide a comprehensive framework for establishing a dedicated cloud application. This leads to ineffective use of disaster risk information for public awareness [4-6]. Second, the mobile service network is restricted commercially and has no international treatise for unrestricted use even in case of emergencies. Several alternative routing solutions have been proposed to establish communication in disaster management services [7–12] but they have been rarely adopted during disasters. In this paper, authors propose an innovative communication solution using cloud-based unrestricted mobile assistance during disasters for rescue volunteers and people.

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II. OPERATION OF UNRESTRICTED CLOUD-BASED MOBILE CLOSED USER GROUP

A mobile communication is achieved via its mobile service provider through its own mobile towers and mobile exchanges. It cannot communicate through any other, even if signal strength is better or communication can be had better also. This is because of the international norms regarding mobile communications. During disasters, Government intervention is necessary to achieve a convergent data network using available undamaged resources to create a working communication network, irrespective of differences of mobile service providers or telephone exchanges or towers or signals. The government then redirects all communications from the disaster zone to specialized disaster command and control centers set up at distributed locations for this purpose. The result of this communication becomes an unrestricted mobile closed user group.

Let the following hypothetical cases be considered during disasters.

Case 1: In a disaster struck area, consider few towers fail to transmit signals. In this case, communication is interrupted that affects disaster relief measures. Usually, 800 MHz is required to establish proper communication but during disaster time, the interruption occurs due to the variation in required frequencies. Since there is one mobile tower which is still working, but

unfortunately, it has lost connection with the telephone exchange of its mobile service provider, though there is another telephone exchange of an unrelated mobile service provider

which it can latch with. Under the proposed framework (fig.1) with reference to the same hypothetical case considered above, the active network will latch with the mobile tower of another mobile service provider, which will in turn latch with the telephone exchange of an unrelated mobile service provider and the telephone circuit gets completed.

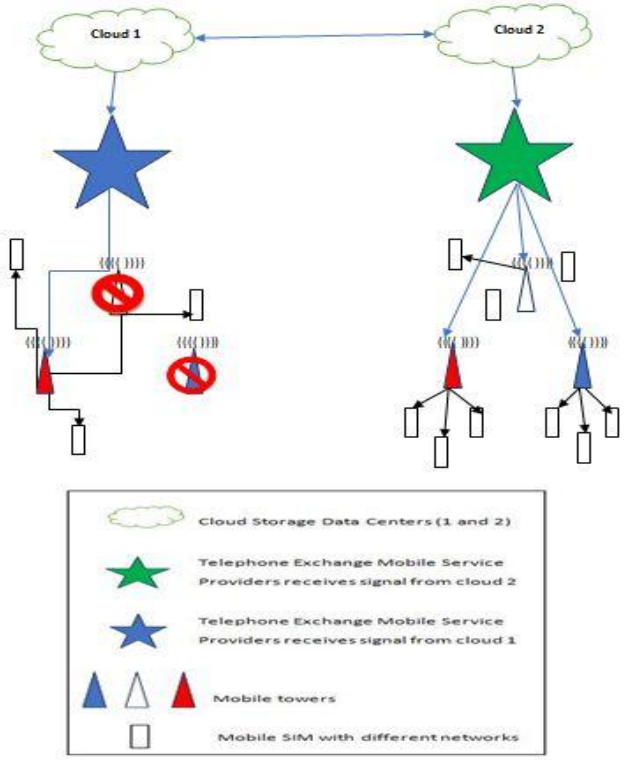

Fig 1. Framework of Mobile Communication System in the absence of Tower during Disasters

Once the active network gets registered it can easily communicate via the mobile service provider and telephone exchange of an unrelated service provider stored in cloud storage data centres worldwide linked via terrestrial lines or satellite or underwater fiber optic cable lines. Previously stored data can also be utilized.

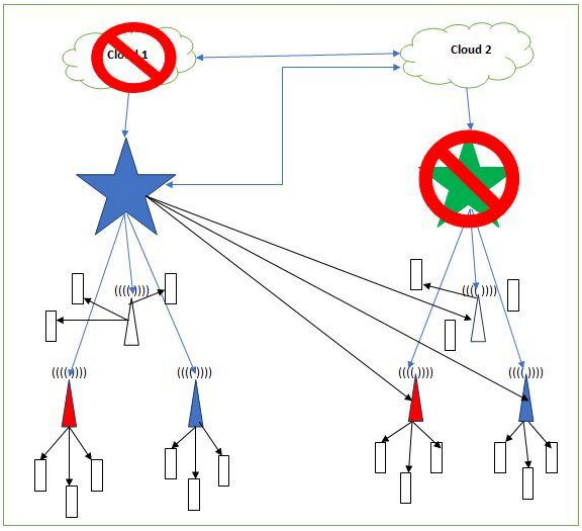

Fig. 2 Framework of Mobile Communication System in the absence of Mobile telephone exchange or cloud during Disasters

Case 2: In a critical situation if one of the cloud storage and telephone exchange mobile service provider fails, another telephone exchange mobile service provider will receive signals from the parallel cloud storage data center (fig.2). It transmits signals to the towers which belongs to the failed mobile service providers. In nutshell, under disaster conditions, any network can connect to any unrelated mobile tower (a SIM need not require connecting X tower of X network, but A SIM can connect to any nearest operating tower).

III. WHY GOVERNMENT TELECOMMUNICATION SHOULD BECOME CLOUD CONTROLLERS?

One of the major challenges facing in cloud based mobile assistance during disasters is its governance and control. Mostly private networks and volunteers work independently based on internationally accepted norms according to agreed-upon policies and procedures and ensure rescue activities. Yet, its goal is limited. The communication services rendered by private players do not alien with government rescue services which hampers the goal to servicing all the affected parties in the disaster. Today, in most countries, cloud-based applications of the government do not have full control over the provisioning and operations of infrastructure. To this effect, the authors strongly advocate the government playing a substantial head role in possessing and governing cloud-based mobile assistance especially during disasters. Creating an ad hoc Cloud-based Unrestricted Mobile Closed User Group by porting-in all authorized disaster relief personnel into a government authorized telecom mobile service provider until the disaster relief measures are completed. Once disaster relief measures are fulfilled and the authorized disaster relief personnel return to their regular duties. This process must be done by the government authorities to restore status quo as earlier as per international norms and

end the convergent disaster unified network and the porting is not appropriate word here government authorized telecom mobile service provider into their original telecom mobile service providers. It is important to reiterate that Government with the support from international communication agencies should get compliance under UN charter or multilateral treaty for disaster relief.

IV. RESULTS AND DISCUSSION

Two practical communication consequences during a disaster is solved in this paper. First, the restoration of mobile communication system during the absence of mobile tower. The Mobile Communication System become active with the telephone exchange of an unrelated service provider stored on cloud storage data centers. Second, when one cloud data centers fail along with the telephone exchange, the mobile communication can be restored using a parallel cloud storage data center connecting via a nearest operating tower. The authors strongly view that this protocol for restoring communication can be executed with a treatise agreed upon and executed by the government as a as a disaster relief measure and recalling it when

the ground bounces back with normalcy. As cloud-based data centers are not completely under the control of the government, this protocol may suffer under the hands of non-compliance by private-public corporate policy agreement. Therefore, the protocol works faster under short-term disaster relief response situation.

V. CONCLUSION

This paper proposes unrestricted mobile communications using cloud storage data centers during disasters. This protocol acts as an alternative source of mobile communication in case of critical situations when the mobile network is interrupted due to failure of telephone exchange mobile service providers or mobile towers or one of the cloud storage data center. This protocol helps cloud storages to support unified controlling and easy deployment of resources during disasters in time to support and respond quickly to disaster requirements to help volunteers to mitigate the situation. This innovative protocol can be used during emergency and will have to surpass international norms where government participation is strongly needed. Only government should call this emergency protocol and issue copy to all nations within UN charter for timely implementation.

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