LOON TECHNOLOGY :SOLUTION IN ELEVENTH HOUR

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***Abstract*- In India Balloons are used for numerous purposes, such as party decorations, toys, and so on but in the world another important use is to provide wireless networks communication to the ground with the help of balloons equipped with wireless transceivers present in the sky. The balloon typically floats around 40-100 m (130-300 feet) in the sky. It is used to Internet connectivity to mobile nodes present on the ground. It provides cellular network coverage, and also act as private networks over their own radio frequencies as balloons are equipped with wireless transceivers in stratosphere. The balloons equipped with wireless transceivers hover at 20 km (12 mi) in stratosphere. They are used to provide Internet access and speed up to 3G speed to rural and remote areas. The standard wireless protocol for mesh networks and the framework for UAVs (Unmanned Aerial Vehicles) which are able to be applied to balloon networking. It integrates mesh networking services and protocols with the IEEE 802.11 at MAC Layer.**

***Index Terms*- Balloons Networking, Google, Project Loon, Space Data Inc., Mesh Networks, Internet, Unmanned Aerial Vehicles, SkySite, Wireless, Disasters, UAVNet, IEEE 802.11s**

I. INTRODUCTION

The definition of a balloon is a flexible bag which is generally filled with air or gas. It looks as a very simple toy for decorative purpose, but it is being used for other a variety of purposes. For example, the balloon is also considerably used to gather weather information such as atmospheric pressure, temperature, humidity and wind speed. Radio equipment attached to the balloon reports those weather information to the ground at a radio frequency of 403 or 1680 MHz Besides those purposes, it allows people to communicate with others as well. Historically, in the Three Kingdoms era (220-280 AD), for the military purpose, Chinese used unmanned and small hot air balloons to communicate with allies. [Wiki-Balloon] As the technology has advanced, there have been attempts to provide networks such as Internet or cellular networks since it is much cheaper than satellites. In June 2013, Google launched the first experiments of balloon networking in New Zealand so that it again gets into the limelight. [Wiki-Project Loon] In this paper, three applications and two wireless mesh networks technologies are explained in detail include Kedarnath proposal for disasters. [1]

II. KEDARNATH PROPOSAL FOR DISASTERS

In June 2013, a multi-day cloud burst centered on the North Indian state of Uttarakhand caused devastating floods and landslides in the country's worst natural disaster since the 2004 tsunami. Though some parts of Himachal Pradesh, Haryana, Delhi and Uttar Pradesh in India experienced the flood, some regions of Western Nepal, and some parts of Western Tibet also experienced heavy rainfall, over 95% of the casualties occurred in Uttarakhand. As of 16 July 2013, according to figures provided by the Uttarakhand government, more than 5,700 people were "presumed dead. This total included 934 local residents. Destruction of bridges and roads left about 100,000 pilgrims and tourists trapped in the valleys leading to three of the four Hindu Chota Char Dham pilgrimage sites. The Indian Air Force, the Indian Army, and paramilitary troops evacuated more than 110,000 people from the flood ravaged area. [6]

Landslides, due to the floods, damaged several houses and structures, killing those who were trapped. The heavy rains resulted in large flashfloods and massive landslides. Entire villages and settlements such as Gaurikund and the market town of Ram Bada, a transition point to Kedarnath, have been obliterated, while the market town of Sonprayag suffered heavy damage and loss of lives. Pilgrimage centres in the region, including Gangotri, Yamunotri,Kedarnath and Badri

nath, the hallowed Hindu Chardham (four sites) pilgrimage centers, are visited by thousands of devotees, especially after the month of May onwards. Over 70,000 people were stuck in various regions because of damaged or blocked roads. People in other important locations like the Valley of flowers, Roopkund and the Sikh pilgrimage centre Hemkund were stranded for more than three days. National Highway 58, an important artery connecting the region was also washed away near Jyotirmath and in many other places. Because summers have more number of tourists, the number of people impacted is substantial. For more than three days, stranded pilgrims and tourists were without rations or survived on little food.The roads were seriously damaged at more than 450 places, resulting in huge traffic jams, and the floods caused many cars and other vehicles to be washed away. On 18 June, more than 12,000 pilgrims were stranded at Badrinath, the popular pilgrimage center located on the banks of the Alaknanda River. Rescuers at the Hindu pilgrimage town of Haridwar on the river Ganga recovered bodies of 40 victims washed down by the flooded rivers as of 21 June 2013. Bodies of people washed away in Uttarakhand were found in distant places like Bijnor, Allahabad and Bulandshahr in Uttar Pradesh. Searching for bodies who died during the extreme natural fury of June in Kedar valley continued for several months and even as late as September, 2013, about 556 bodies were found out of which 166 bodies were found in highly decomposed state during fourth round of search operations.

Large-scale natural disasters frequently occur in many places around the world. When they happen, the first response focuses on relief supplies such as water, foods, and medicines. However, such disasters damage network infrastructures such as cell towers and Internet cables as well as power cables so that people in the area cannot communicate with outside world and even within the same area. That impedes supplying those goods and recovering the disaster area.[2]

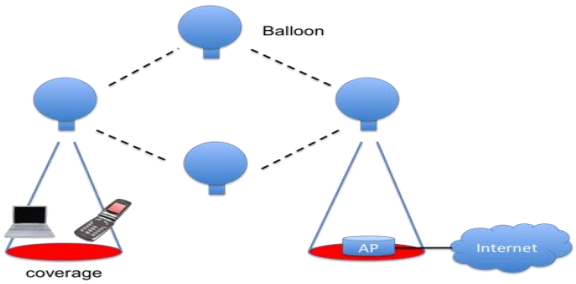

fig 1: loon technology model

We proposed a new ballooned wireless mesh network system for disaster. It consists of normal rubber balloons and wireless network devices. The balloon typically floats around 40-100 m (130-300 ft) in the sky. Each balloon has two wireless network devices for

(1) The vertical network

(2) the mesh network.

(1) The vertical network is for communications between the wireless network node attached to the balloon and mobile PCs or devices on ground. It uses the access method, IEEE 802.11b,g [Wiki-802.11b] with the maximum distance around 600 m (2000 ft). That is a standard Wireless Local area network (WLAN) protocol which in general terms is known as Wi-Fi. It uses a hexahedral antenna because it can cover a ground area of around 100 m (328 ft) diameters from 40 m (131 ft) above the area. (2) The mesh network is for between balloons. It works over Wi-Fi IEEE 802.11j [Wiki-802.11j] with 4.9 GHz transmission frequency, 250 mW power density, and 54Mbps network bandwidth, which is now incorporated into the IEEE 802.11-2007 standard. The wireless mesh network is made up of the balloons by auto configuration functions. This is achieved by electro-magnetic field power density. For example, a balloon tries to find one of its neighbor balloons which has the strongest power density and establish a connection with it. Then, the mesh network eventually has a minimum spanning tree network.[3]If a balloon moves by wind or falls down, the connection between balloons is closed. The neighbor node immediately notices the failure, and tries to find another neighbor node automatically as the same way. This makes the mesh network stable.

If a disaster occurs, some balloons would be launched. One of them, which is the closest to the area which hasInternet access, establishes a connection over IEEE 802.11b,g. Other balloons organize a mesh network in the sky through the

procedures above. Mobile devices on ground can join the closest balloon network in the sky over Wi-Fi, and communicate with the balloon as shown in Figure 1. The ballon forwards the received data packets from the mobile device to its neighbor balloon through the mesh network. If a balloon, which has an Internet connection, receives the packet, it sends the packet to the AP on ground.[4]

	Mesh Network	Vertical Network
Standard	IEEE802.11j	IEEE802.11b,g
Frequency	2.4 GHz	4.9 GHz
Signal Power	250 mW	10 mW
Trans. Speed	54 Mbps	54 Mbps
Max. Distance	600 m	100 m
Antenna	octagonal plains	co-linear

III. CONCLUSION

This paper described application of loon technology for disaster management which is proposed as Kedarnath Model. Moreover, it presented that technologies in typical wireless mesh networks are able to be applied to balloon networking. While it has been shown that using balloons to provide wireless networks has several advantages, unfortunately balloon networking is not being actively researched.[5] This is because only few papers have been published and other works are not unveiled. However, we can anticipate that balloon networking would be a eleventh hour solution to disaster management problems.

REFERENCES

1 http://en.wikipedia.org/wiki/Project_Loon
2 www.google.com/loon/
3. [Shibata09] Shibata, Y.; Sato, Y.; Ogasawara, N.; Chiba, G.; Takahata, K., "A New Ballooned Wireless Mesh Network System for Disaster Use," Advanced Information
4.http://blogs.computerworld.com/mobilewireless/22005/wireless-dead-zones-arent-just-rural-areas
5. http://www.spacedata.net/
6
http://en.wikipedia.org/wiki/2013_North_India_floods