PostBox Message Service for multibeam mobile satellite service over S band

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Abstract— ***Satellite mobile communication is one of the most important directions in satellite communication. A novel approach – Post Box Message Service (PBMS) for reliable satellite communication over S-band Mobile Satellite Service (MSS) using multi-beam is proposed in this paper. The service enables mobile users to communicate with each other as well as in group. Having the unique characteristics of reliable communications and multi-beam concept for frequency utilization, a new protocol technique is required for such a PBMS service. In this paper proposed scheme is discussed with its features, architecture and probability analysis model.***

Keywords- satellite mobile communication; s band; post box message service.

I. INTRODUCTION

Satellite mobile communication (SMC) system is the system which provides mobile communication service by satellites in the sky. Mobile Satellite Service (MSS) has been of utmost importance for national disaster management, maritime, societal and strategic application needs. Indian Space Research Organization (ISRO) has launched multi-beam satellites in MSS band.

Currently, ISRO has developed four services in MSS band i.e. Reporting Service, Voice Service (SMR), Multimedia Service (PMT) and Broadcast Service. Reporting service is used to send and receive the information from remote terminals but it is one way i.e. from terminal to hub only. Voice service (SMR) requires heavy terminal at user end. For Multimedia service (PMT), heavy terminal as well as huge database is needed. Broadcast service consumes more network bandwidth. Hence, a reliable and cost effective communication system for communication among mobile terminals is the motivation behind the proposed scheme. It is proposed to create a cost efficient, simple and user friendly communication system in the form of text i.e. message and email, for large coverage with no geographic limitations.

The remainder of this paper is organized as follows. Section 2 details the proposed system with the block diagram. Section 3 describes the features of proposed system. Finally, in Section 4 we present analytical model for the proposed system followed by conclusion in section 5.

II. PROPOSED SYSTEM

The proposed system – Post Box Message Service (PBMS) is a messaging service which offers two way reliable communications between two remote terminals as well as among the group of users. Terminals can be battery operated terminals or mobile devices. Communication is in the form of text only i.e. message or e-mail, with size constraint of 80 bytes per message as protocol for proposed system will be designed for working in MSS S-band. PBMS provides the reliability by two level acknowledgment of sent message i.e. level 1 acknowledgment from hub (sever) and level 2 acknowledgement from recipient to sender of the delivered message.

The PBMS system allows the communication between mobile devices hence it may also be the case that sometimes the terminal is off. In such situations, POST BOX will be created at server to store the messages for that particular terminal, hence named Post Box Message Service (PBMS).Whenever the terminal will be on; messages will be delivered to that terminal.

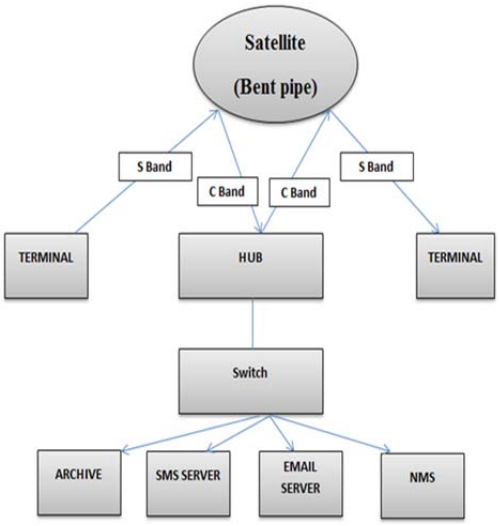

Figure 1. Block diagram for PBMS.

As shown in fig 1, satellite will have SXC transponders for communication. Hub will have SMS Server, E-Mail Server, Database and archive machine. SMS and E-Mail server is for storage of messages and mail respectively. Archive machine is for permanent storage of data.

III. FEATURES

The proposed system PBMS consists of following salient features: PBMS will provide two ways reliable communication between terminal-terminal, mobile- mobile, terminal-mobile, mobile-terminal in the form of text i.e. message or e-mail. As the communication is in the form of text, it is not required to have heavy terminal or huge database so it is cost effective. Terminal authentication as well as e-mail authentication will be provided for secure communication. It supports the terminal roaming by storing the messages in Post Box. Creation of Post Box at server to store the messages in case the terminal is off is the essential feature of proposed system. In order to allow the multiple terminal interactions, system supports group communication.

Another vital feature of the proposed system is the compression of text messages as well as destination ID, which leads to effective utilization of bandwidth. Multi-beam environment support is significant characteristic of PBMS. Multi-beam technology is a good solution for the use of frequency resource. It consists to form at the satellite a throng of narrow beams instead of a single wide beam. In other words, it divides a wide frequency band into some narrow frequency bands. That leads to a regular reuse of the frequency resource and therefore, a significant increasing of the system capacity. Thus, each carrier frequency, which characterizes a beam, is a common channel shared between the users of the zone covered by this beam. Thereafter, in order to use the same frequency, users, which are in the same zone or cell, can adopt a TDMA or CDMA multiple access etc.[1]. This allows the use of PBMS system among no. of users and with far coverage.

There is also a provision to control the terminals in case of any abnormal situations. Status of terminal can be as follow:

Terminal Normal: Terminal can send and receive the messages.

Terminal Dead: Terminal can neither send messages nor receives messages.

Terminal Debar: Terminal can only receive messages, it cannot send messages. It can send messages to only emergency numbers.

Admin will be given access rights to add or delete the terminal, maintain the terminal status, monitor the activity log of terminals etc. System provides the support for android, windows and Linux platforms.

IV. ANALYSIS

We assume a system consists of n terminals. The power on probability of terminal is P_{on}. The failure probability id P_f. The average roundtrip time from sending a message to receiving an acknowledgment is T_r seconds. Timeout period to receive acknowledgment is T_{out} seconds. Hub can retry up to l-1 delivery. Since the delivery is only affected by the power off of the terminal, success probability of one delivery is, $(1- P_f)$ given the terminal is on.

The success probability of delivery is:

$$P = P_{on} \sum_{i=1}^{l} P_f^{i-1}(1 - P_f) = P_{on}(1 - P_f^l) \quad (1)$$

Average delay time for a success delivery is:

$$D = (1 - P_f) \sum_{i=1}^{l} [T_r + (i-1)T_{out}] P_f^{i-1} \quad (2)$$

V. CONCLUSION

PBMS is virtually immune to terrestrial network congestion and infrastructure destruction. It provides reliable two way communication among users in the text form. It provides the support for the number of users that may operate simultaneously by providing multi-beam support. The scheme also provides full control to HUB operator to manage the terminals. We have derived a probability model to analyze the reliability and delay performance of PBMS.

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