MBMS Performance Improvement Mechanism for UMTS

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UMTS 를 위한 MBMS 성능 개선 메카니즘

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Abstract 요 약

This paper proposes an efficient scheme to use the MBMS enabled UMTS functionality for the reduction of the number of communication steps between GGSN and multicast users. UTRAN counts the number of multicast users in cells to decide whether to transmit the multicast data in PTP mode or PTM mode. This counting information is used by GGSN efficiently which will reduce considerable amount of communication steps.

본 논문은 GGSN 과 멀티캐스트 사용자 사이의 통신 단계를 축소시키기 위하여 MBMS 가능 UMTS 기능을 사용한 효율적인 기법을 제안한다. UTRAN 은 멀티캐스트 데이터를 PTP 모드 또는 PTM 모드로 전송하기 위하여 셀에 속한 멀티케스트 사용자의 수를 계산한다. 이렇게 계산된 정보는 GGSN 에 의하여 효율적으로 사용되어 상당한 양의 통신 단계를 단축할 수 있다.

I. Introduction

Universal Mobile Telecommunications System (UMTS) is one of the third-generation (3G) mobile telecommunications technologies, which is also being developed into a 4G technology. It is specified by 3rd Generation Partnership Project (3GPP) and is part of the global ITU IMT-2000 standard. Some enhancements on the UMTS Release 6 architecture led to the definition of the Multimedia Broadcast/Multicast Service (MBMS) framework. MBMS is a point-to-multipoint service in which data is transmitted from a single source entity to multiple destinations, allowing networks resources to be shared [1], [2].

Gateway GPRS Support Node (GGSN) node of UMTS serves as a multicast router (IGMP or MLD enabled). MLD (Multicast Listener Discovery) and IGMP (Internet Group Management Protocol) are used by IPv6 and IPv4 routers respectively to discover the presence of Multicast Address Listeners on directly attached links [3] [4]. A group of listeners listening to the same multicast address is considered as a multicast group. After the discovery of the multicast group, the packets are delivered to the multicast group using multicast routing protocols. So, GGSN always check for the last member of a multicast group and update its state at each join or leave of a multicast group member. If the last multicast group member leaves the group, GGSN stops the multicast packet delivery to that group.

II. MBMS in UMTS Architecture

The MBMS bearer service offers two modes: Broadcast Mode and Multicast Mode. MBMS architecture enables the efficient usage of radio-network and core-network resources. UMTS architecture supporting MBMS is as shown below:

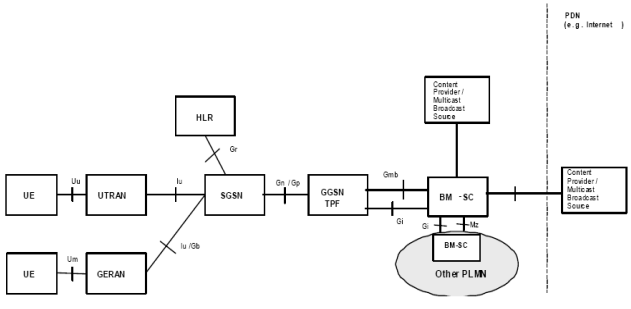


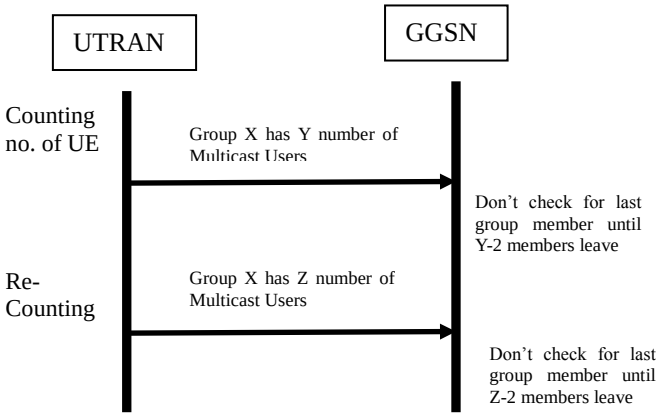
Figure 1: Reference architecture to support the MBMS bearer service

III. Proposed Scheme

UMTS Terrestrial Radio Access Network (UTRAN) is responsible for the radio bearer allocation for efficiently

delivering MBMS data to each MBMS area. The number of users in the cell could be used to choose an appropriate radio bearer. So, UTRAN counts the number of users in a cell. If the number of users is less than a predefined threshold, PTP (point to point) mode of transmission is used for that cell. But, if the number of users exceeds the threshold then PTM (point to multipoint) transmission mode is selected [5], [6].

In the proposed scheme, we want to utilize the work done by the UTRAN to be helpful to GGSN. After counting the number of users, UTRAN will send an IF (Information Flag) to GGSN. Based on the IF, the GGSN will decide about to send Queries to a specific multicast group or not. If the IF value is set it means that the threshold is achieved and there are enough users in the cell receiving a specific MBMS transmissions. The IF will also contain the exact number of available multicast users. So, GGSN will not need to flood that MBMS group with queries if a multicast group member leaves the group. UTRAN does periodic re-counting of the multicast group members and will periodically send the updates to the GGSN. GGSN updates its status accordingly. This process can be illustrated by the following diagram,



It will reduce the number of communication steps in the network and a significant amount of power consumed by the UEs and Base Station (Node B) will also be saved. The plus point of this scheme is that it requires neither extra processing nor extra overheads; rather, the available capabilities of UMTS network are used in an efficient way.

IV. Performance Evaluation

To evaluate the proposed scheme, we consider a scenario where there are 30 users which are subscribed to same multicast group and are distributed in three cells. In the beginning, UTRAN counts the number of users and report it to GGSN. GGSN update its information about the available users in a that multicast group. If one of those multicast group members leaves the group, GGSN doesn't need to check if it is the last member of the group or not. This will happen for 28 members of the group if they leave the group. The value (last group members after which GGSN will start check for available group members) can be more like five or six instead of two depending on the required performance.

V. Conclusion

We can reduce the unnecessary traffic flow in UMTS by using the counting work done by UTRAN. UTRAN only needs to report to GGSN after counting the users in a multicast group. GGSN will use that information to work efficiently. This scheme can be implemented easily.

ACKNOWLEDGEMENTS

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VI. References

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[3] RFC3376 - Internet Group Management Protocol, Version 3

[4] RFC3810 - Multicast Listener Discovery Version 2 (MLDv2) for IP

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