IEEE 802.16 網狀網路環境中降低媒體存取延遲研究

摘要

本研究在減低 Wimax mesh mode 環境中 media access 階段會造成的 delay 現象。我們發現當 subscriber station (SS)訊務繁忙時，競爭 transmission opportunity (TO)以及 3-way handshake 的過程容易失敗，造成傳輸效率降低，封包的 delay 也會增加。同時我們也發現封包的延遲還來自 minislot 的不良配置。因爲原始的 Wimax mesh mode 對於 minislot 的配置會造成預約過晚的問題，當預約時間被延長，資料就必須無條件的增加等待時間，因此我們將針對這些問題進行改善，降低在訊務繁忙的狀況下，傳輸效率低落的問題。

我們使用兩種方式來改善上述的問題，其一是由 Bayer [4]所提出的動態調整 holdoff 指數(dynamic holdoff exponent)的方式，藉由調整 holdoff 指數的大小來縮短 holdoff 時間，以縮短傳輸延遲；另外，我們也提出一個以節點的臨接區域爲配置基準(Neighborhood-Based Minislot Allocation, NBMA) 的方法，透過與其相鄰的節點交換訊息，優化 minislot 的配置。我們用這兩種方式減少 IEEE 802.16 中媒體存取階段所造成的傳輸延遲。

實驗結果顯示，在網路負載較輕的情況下，NBMA 可以有效的將 delay 降低爲原來的七分之一，改善幅度將近 85%，抖動率(jitter)的部分亦有 20%的改善，並略爲提高傳輸效能 8%左右；而當網路負載較重時，delay 的改善程度仍有 40%左右，jitter 部分改善了 12%，傳輸效能亦有 6%的改善。證明了我們的方法確實可行，並且在改善 delay 方面有顯著的效果。

Delay Reduction of Media Access for IEEE 802.16 Mesh Network

Abstraction

IEEE 802.16 mesh network is a new environment of wireless network. It was designed as a self-organized, distributed scheduling, and multi-hop network. However, it is not robust enough to handle a heavy loading environment for lacking of QoS support. Our research is trying to reduce its media access delay, which comes from both TO (transmission opportunity) competition and improper minislot allocation. TO competition will extend the MSH-DSCH (mesh distributed scheduling) interval and slow down the exchanging speed of control message. Improper minislot allocation comes from the distributed scheduling of minislot. When a subscriber station (SS) allocates too much minislot for low-level traffic, it will defer the allocation of other neighbors' high-level traffic.

We use Bayer's [4] dynamic exponent to reduce holdoff time of SS, and speed up the exchange of control message. On the other hand, we design an "importance factor" (IM-factor) to score the importance of request. Through the exchange of IM-factor, SS and its neighbors will produce a threshold of IM-factor to filter the unimportant requests, and prevent minislot from being assigned too late.

In our experiments, the proposed methods can reduce 85% delay and 20% jitter, and increase bandwidth utility by 7%. It shows that our method in reducing transmission delay is pratical and effective.