Organic Computing has similar characteristics of organism whose can be self-adjustment for a variety of conditions. The goal of Organic Computing is to develop a computing system which meets people demands and operates automatically in the information network. WiMAX (Worldwide Interoperability for Microwave Access) provide high-speed access and a coverage range several kilometers, but actual coverage range was few kilometers only due to the shelter of buildings or terrain. IEEE 802.16 working group designed 802.16j-based RS (Relay Station) to overcome above problem. In this paper, we present a mechanism called Self-Optimization Handover Mechanism which uses GPS (Global Positioning System) navigation system to combine with mobility characteristics of Mobile Relay Station, especially, the concept of Self-Optimization of Organic Computing integrated into this mechanism. An ASN-establishment of a database server is the most important hope that through this database to store information related to GPS navigation, and through this server to calculate the base station handover. By using our proposed mechanism, a base station can be planned in advance on the path of choice. To reduce the number of possible handover, scanning the channels and by the waste channel scanning the time it takes, hoping to provide a more stable WiMAX services.

Keywords- WiMAX; 802.16j; handover; Mobile Relay Station; GPS navigation

I. INTRODUCTION

Organic Computing [1][2][3] is a computation form to take the human as the central, and organic biological characteristics similar conditions can be used for a variety of self-adaptation. With the development of information network, various forms surrounded peoples of information. Apart from the specific experts, the general users cannot understand and grasp the information easily. To solve above problem, we must develop a form calculated to meet the people's needs, flexible and able to operate automatically in the information network. We call the above approach "organic computing systems". The system adapts to the environment is dynamic, and has the characteristics of self-characteristics: self-organization, self-configuration, self-optimizing, self-healing and self-protection.

The telecommunications equipment operator claimed that the 802.16-based WiMAX [4][5] provide better data transmission rate and further coverage range than mobile communication systems. However, when the MS is far from the MR-BS or obscured terrain and buildings, the data rates decreased with increased distance from the MR-BS and the coverage range of MR-BS is only a few kilometers. Base on the above factors, IEEE 802.16 working group discuss the feasibility of using relay technology in IEEE 802.16. At the same time, working group proposed 802.16j [6].

![Figure 1. Use Case for 802.16j](image-url)
At present, there were several relevant literatures to explore ways to shorten time the handover but may very likely to be limitation of handover technology [7][8][9]. Therefore, how to predict the MS path has become an important field of investigate. We note that the current popularity of GPS navigation system and GPS navigation system can provide information about path planning and found property of self-adaptation of Organic Computing. To propose a mechanism which used GPS-based navigation system to combine MRS and using property Self-Optimization of Organic Computing integrated into this mechanism.

The outline of this paper is as follows. In Section II, the handover procedures of MRS and forecast the path of developed are introduced. Section III describes the mechanism of Self-Optimization Handover Mechanism. Section IV presents the simulation results. Finally, the conclusion and the future works are discussed.

II. RELATED WORK

In this section, we will introduce the following types of technology: Self-Optimization of Organic Computing, GPS, network architecture of WiMAX backbone and characteristics of the mobility support of MRS.

A. Self-Optimization of Organic Computing

Self-Optimization is a characteristic of organic computing. The main characteristics of the system is amended to make it work more efficiently or to reduce the use of resources and so on. The original idea of self-optimization is that be able to more quickly to help the implementation of the program after the computer program may be optimized. Its concept is based on the system automatically detects and given the several references for judging the reference basis for the terminal can be the basis of the parameters of the results of the calculations make the optimization of choice. For instance, to choose best path based on some parameter of system such as MOS scores of VoIP, retransmit rate, delay/jitter, link quality, residual battery capacity, node mobility, security level and so on.

B. GPS (Global Positioning System)

GPS is the most popular positioning system technology, developed by the U.S. Department of Defense. In the past GPS only be used in some high-tech areas, for example: for military, aviation or maritime, it's for public now. The "car navigation systems" now is an example of practical application. GPS is constructed from 24 satellites, including three preparatory satellites. The overall operation of the satellite positioning system can be divided into three parts: Space Segment, Control Segment and User Segment.

In fact, there has been a combination of GPS and handover of wireless networks design proposed in the literature as Fig. 2 [10], it mainly integrates 802.11 wireless network, Mobile IP and GPS systems constitute the entire structure of the environment, but simply through the GPS to locate the current location of MS, to make an AP database from all APs around current position. Tell MS of Mobile IP that it can use the database as a handover list, but it does not have the designated base stations to handover. Overall, this is a network environment architecture which is decision by MS to handover.

Figure 2. GPS navigation system combines with 802.11

C. Network Device of WiMAX Backbone

Network device of WiMAX backbone is introduced by following:

- Access Service Network (ASN): Components include MR-BS and ASN Gateway. ASN provided MSs' wireless signals to access, including WiMAX Layer 2 link, transfer WiMAX AAA message, establishment of Layer 3 link and the tunnel with CSN.
- Connectivity Service Network (CSN): CSN was a core network of operator. Main role included to provide IP connection for MS. Components included AAA Server, Network Management System (NMS), Foreign Agent (FA), and Home Agent. Function included supporting ASN connected to CSN, charging strategy, and roaming between different CSN.

D. Mobility Support of MRS

The operation of MRS Handover is divided into two steps: MRS handover and MRS attached MS handover [6].

Before handover procedure, MRS must know the topology nearby, serving MR-BS will be cyclical send MR_NBR-INFO to the MRS, message contained in the surrounding MR-BS DCD UCD, and other access information. MRS will measurements RSSI and CINR with surrounding MR-BS and sends the measurement report for serving MR-BS. Serving MR-BS estimate in accordance with a report and according to QoS and other considerations choose a fit MR-BS for handover.

MRS initiates handover by serving MR-BS sending MOB_BSHO-REQ message to MRS or initiated by MRS sending the MOB_MSHO-REQ to serving MR-BS. If MRS handover launched by MRS, MR-BS will reply MOB_BSHO-RSP to MRS. At the same time, if Target MR-BS decides to
change the MRS’ preamble after the handover, it sends a preamble index to the serving MR-BS over the backbone network. Serving MR-BS sends it to the MRS by MOB_BSHO-REQ/RSP. Then MRS will inform MSs the new access link channel by MOB_NBR-ADV. The message signaling of MRS handover is shown in Fig. 3.

III. SELF-OPTIMIZATION HANDOVER MECHANISM

In this section we will explain our mechanism which how to provide the MRS handover through MR_NBR-INFO without modifying standard protocol.

A. System Description

We show our mechanism scenario in Fig. 4. Before driving car, users will normally orientate current position by GPS-based navigation system and point destination into the system. Navigation system will plan the path information for user reference, and sends the information to server through serving MR-BS.

B. Through MR_NBR-INFO appoint MR-BS

Handoff mechanism includes three steps: Discovery, Re-association, Re-authentication.

Whether a handover decision will be made is based on the Discovery, and Discovery is used for scanning MR-BS for handoff. Self-Optimization mechanism proposed in this step.

In 802.16e, serving MR-BS will obtain the neighbor MR-BS’s DCD/UCD and other channel information over backbone network. In the fixed interval, serving MR-BS broadcast above information to MS using MOB_NBR-ADV message. This step let that MS reduce the time of measurement channel. In addition, serving MR-BS use MR-NBR-INFO to broadcast the neighbor MR-BS channel information to MRS, and forward to MS by MOB_NBR-ADV in 802.16j. We were set up a Handover Management Server (HMS) in ASN of backbone network. HMS sent BSID for serving MR-BS which BSID is appointed for MRS handover. Then serving MR-BS forwards this BSID for MRS handover by MR_NBR-INFO.

N_NEIGHBORS is set to 1 and Neighbor BSID is filled our appointed MR-BS’BSID, which syntax is in MR_NBR-INFO, since N_NEIGHBORS syntax that denote the quantity of neighbor MR-BS around serving MR-BS. Table I illustrates the parts of MR_NBR-INFO message format. In addition, UCD/DCD of appointed MR-BS is placed in MR_NBR-INFO encodings to provide MS connect. Table II shows the parts of MR_NBR-INFO encodings [6].

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Size(bit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N_NEIGHBORS</td>
<td>8</td>
</tr>
<tr>
<td>For(j=0;j&lt;N_NEIGHBORS;j++)</td>
<td></td>
</tr>
<tr>
<td>Neighbor BSID</td>
<td>24</td>
</tr>
</tbody>
</table>

At first, GPS will use Triangulation Method to find the current position and label the values of longitude and latitude. After user deciding the destination, user should point the destination clearly in GPS navigation system. Navigation system using own algorithms calculate the path between source and destination. Navigation system will deliver path information to serving MR-BS and deliver to Handover Management Server (HMS) which in ASN. According to this information, HMS will calculate the amount of MR-BS which affected the coordinative value respectively and saving it in database. Before HMS saving MR-BS list in database, HMS analyze whether MR-BS provide enough bandwidth for multi-user handover. If not, HMS must find other MR-BS for MRS. The database of HMS is shown in Table III.