Considerations on Mobile Multi-hop Relay for IEEE 802.16

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Considerations on Mobile Multi-hop Relay for IEEE 802.16

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November, 2005
Objectives of this presentation

• Define our focus, in reply to the discussion raised last meeting, and

• Provide 2G/3G cellular repeater information to cover following topics out of Five criteria
  - Broad Market Potential
  - Technical Feasibility
  - Economic Feasibility
Contents

• Review of our focus
• Relay examples for cellular systems in Japan
  - Common Operator Repeater
  - Development of cellular repeater with echo suppresser
• Summary
Review of our focus [1/4]

- Comment raised at the last meeting: “Fixed RS for client relay shall be “Yes.””
- We need to revisit the “our focus” table.

Focus in MMR SG (Refer to C802.16-05/013)

<table>
<thead>
<tr>
<th>Relay</th>
<th>Ownership</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Infrastructure</td>
</tr>
<tr>
<td>Mesh</td>
<td>No</td>
</tr>
<tr>
<td>Fixed</td>
<td>Yes</td>
</tr>
<tr>
<td>Nomadic</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Review of our focus [2/4]

Infrastructure / Client mode definitions required

<table>
<thead>
<tr>
<th>Item</th>
<th>Infrastructure Mode</th>
<th>Client Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
<td>Each RS is owned by the service provider.</td>
<td>Each RS is owned by a client.</td>
</tr>
<tr>
<td>RS Location</td>
<td>Defined by the provider thus the RS coverage can be optimized.</td>
<td>Defined by each client, thus best-fit for it, meantime, the system optimization can be difficult.</td>
</tr>
<tr>
<td>Authentication</td>
<td>The BS can assume the RS is reliable.</td>
<td>Some measure must be required to find out if the RS is reliable, in the beginning of the RS installation, session initiation and during the communication.</td>
</tr>
<tr>
<td>Notes</td>
<td>The ownership by one provider may restrict a quick service introduction and service enhancement.</td>
<td>Some network level requirements shall be applied to each RS such as 24-hours operation, when it works as an network element. Any RS having MSs of the same owner can be regarded just as a gateway to “SS/MS.”</td>
</tr>
</tbody>
</table>
Review of our focus [4/4]

• Purpose
  - Coverage extension
  - Throughput enhancement

• Condition:
  - Based on 802.16-2004 and 16e with minimum modification

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Infrastructure</th>
<th>Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesh</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Relay Fixed</td>
<td>Yes</td>
<td>No -&gt; Yes</td>
</tr>
<tr>
<td>Nomadic</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Relay examples for cellular systems in Japan [1/4]

- **Common Operator Repeater**
  - A Common Operator Repeater (Analog repeater) was jointly developed by four mobile operators in Japan as follows,
    - 1) KDDI
    - 2) NTT DoCoMo Inc.
    - 3) Vodafone K.K.
    - 4) TU-KA Cellular Tokyo Inc.*
      *TU-KA Cellular Tokyo got merged with KDDI
  - The repeaters have been installed in optimal areas to deliver signals from outdoors to the area with communication difficulty, like stores underground and/or inside buildings.
  - Service started on June 22, 2005
Relay examples for cellular systems in Japan [2/4]

• Common Operator Repeater (cont.)


Relay examples for cellular systems in Japan [3/4]

- Common Operator Repeater (cont.)

Major Characteristic of the repeater

<table>
<thead>
<tr>
<th>Structure</th>
<th>Repeater amplifier</th>
<th>W × H × D</th>
<th>380 × 250 × 300 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight</td>
<td></td>
<td>26 kg</td>
</tr>
<tr>
<td>Antenna</td>
<td>Diameter</td>
<td></td>
<td>200 mm</td>
</tr>
<tr>
<td></td>
<td>Height</td>
<td></td>
<td>80 mm</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td></td>
<td>0.5 kg</td>
</tr>
</tbody>
</table>

- Services
  - Voice and packet services
  - 2G: NTT DoCoMo, Vodafone and TU-KA
  - 3G: KDDI

- Service areas
  - In-store (Service coverage may differ depending on the installation conditions such as the building structure, store interior, etc.)
Relay examples for cellular systems in Japan [4/4]

- Development of cellular repeater with echo suppresser
  - CDMA based cellular repeater
  - Echo suppression using correlation characteristics of spread code in CDMA signal
  - An improvement of RSSI: Approx. 16dB
  - The repeater has already used for 3G cellular coverage extension in Japan
  - Developed by KDDI R&D Labs

Summary

• Review of our focus, re-defined.
• Relay examples for cellular system in Japan, presented
  - To increase number of subscribes, coverage area is very important
  - It is commonly understandable that any operator would like to spread a service area, at wide area, in a quick manner, at low cost.