

Low-cost-relay interaction with BS (the case for centralized frame builder)

Document Number:

IEEE C802.16j-06_047r1.

Date Submitted:

2006-07-02.

Source:

Matty Levanda

Winetworks

32 Maskit St. Herzelia 46733

Israel

Voice: +972-9-9519556 (221)

E-mail: mattyl@winetworks.com

Venue:

IEEE 802.16 Session #44, San-Diego

Base Document:

None

Purpose:

Descriptions of low-cost relay interaction with BS (elaboration of the concept introduced in IEEE C802.16j-018/031).

Notice:

This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

Release:

The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.

IEEE 802.16 Patent Policy:

The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <<http://ieee802.org/16/ipr/patents/policy.html>>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <<mailto:chair@wirelessman.org>> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <<http://ieee802.org/16/ipr/patents/notices>>.

Scope

- Low-cost relay (A.K.A. simple relay)
 - Summary of fundamentals
 - Interaction with BS

Simple-relay concepts, usage models, deployment scenarios and frame structures are described in contributions IEEE_C802.16j-018 and IEEE_C802.16j-031, May 2006.

Simple relay fundamentals (1)

Cost	Approximately CPE cost
Usage models	Fixed Infrastructure; in building and temporary coverage
Mobility	Fixed; nomadic
Ownership	Infrastructure provider; user
Deployment	Planned; opportunistic

Simple relay fundamentals (2)

Availability	Obtained by RS coverage areas overlapping
Radio planning	BS dynamic updates to compensate for RS failures
Management	Centralized at BS
Frame building	Centralized at BS

Simple relay fundamentals (3)

Low cost implications:

⇒ Self installed – Minimal installation cost

⇒ No RS' HW redundancy

⇒ Half-duplex

⇒ Performs simple tasks only; most processes are in the BS SW; reduced set of RS ↔ BS MAC messages

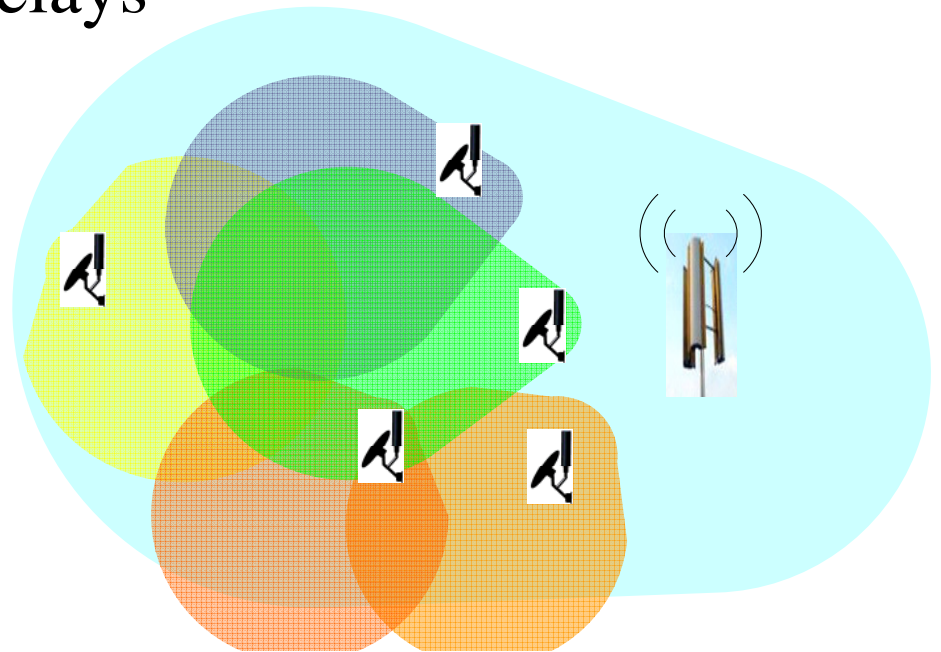
Simple relay fundamentals (4)

Availability:

⇒ Obtained with redundant relays

⇒ Coverage areas overlap

⇒ Relay antenna's beam
adaptive and compensate
other RS availability



Simple relay fundamentals (5)

Relay vs. BS radio planning:

BS only system

MS communicates to BS it receives best

BS & RS system

MS may communicate to the BS while masked by nearby RS (c.f. C802.16j-06_082 slide 9)

BS power planning

RS coverage area overlap
Large fringes area

BS static coverage

RS coverage changes with RS availability

Frame building at BS and at RS

Distributed	Centralized
Each RS builds its own frames	BS builds all RS frames (centralized hierarchic scheduling)
Infringement controlled by RS locations and subcarrier reuse	Better BW utilization (due to infringement control) when RS locations are not well controlled
Standby	Macro-STC (Virtual BSs)
End-to-end QoS	Next hop QoS

Virtual BS (VBS)

- Macro-STC uses the virtual-BS notion.
- Virtual-BS described with examples at:
<http://www.ieee802.org/16/arc/802-16list2/msg03430.html>

Task partition

(concept illustration)

Function	BS	RS	Comments
Scheduling and BW allocation	y	n	Messages tunnel via RS
MAC management	y	n	
ARQ	y	~y	
Ranging	y	~y	CDMA detection
Mobility management	y	n	
Security	y	n	

BS \Leftrightarrow RS connection scheme

- No scheduling and policing is done at the RS
 - \Rightarrow MS \rightarrow BS traffic tunnels via one RS \rightarrow BS connection
 - \Rightarrow BS \rightarrow MS traffic tunnels via RS or a group of RS (macro-diversity); if the RS belongs to more than one Tx diversity groups, the BS opens a connection per-group

Some RS ↔ BS MAC messages (concept illustration)

- **Data-Tunnel-Downlink**
 - BS sends data, to be sent to the MS, to the RS
- **Data-Tunnel-Uplink**
 - RS sends data, received from the MS, to the BS
- **RS transmission parameters**
 - BS controls the RS frame parameters
- **RS CDMA received**
 - RS reports to the BS what CDMA codes it detected

Data-Tunnel-Downlink

RS tunnel payload fields:

- **DL_RS_Tunnel_IE**
 - The MAC PDU as to be sent by the RS
- **Subchannel offset, OFDMA Symbol offset, Boosting, Modulation and FEC rate**
 - Burst parameters for RS transmission
- **STC matrix used, RS_index, diversity antenna presented by the RS**
 - Indicating the RS its role in the macro-STC

Data-Tunnel-Uplink

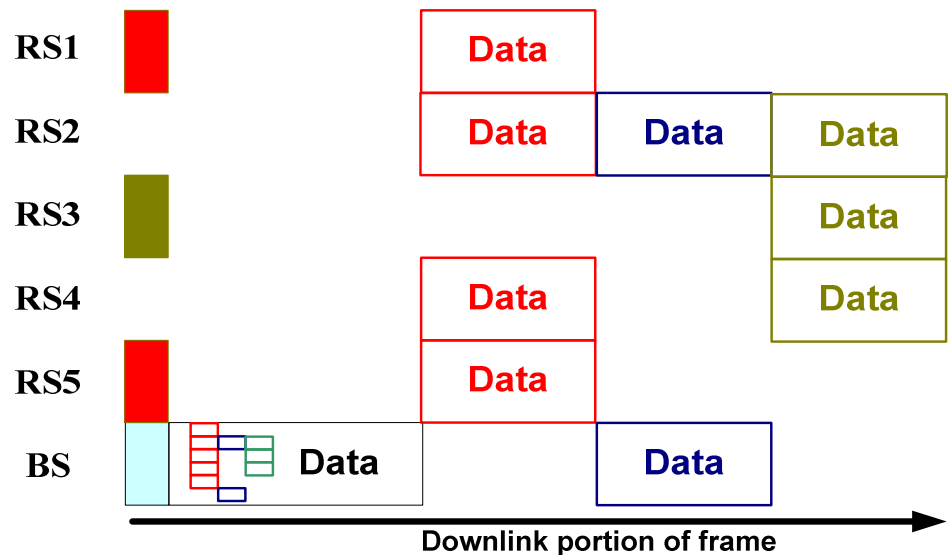
RS tunnel payload fields:

- **UL_RS_Tunnel_IE**
 - The MAC PDU as sent by the RS
- **Received OFDMA Symbol offset and received subchannel offset**
 - Indexing the messages for the BS

RS transmission parameters

MAC message fields:

- **Preamble Index (if sent)**
 - The Preamble sent by the RS
- **Preamble time shift**
 - Frame alignment for RS location compensation
- **Max transmit power**
 - Radio planning



RS CDMA received

MAC message fields:

- **UL_PermBase**
 - Seed of the CDMA codes detected
- **Ranging code, Ranging symbol, Ranging subchannel, Frame Number Index, CDMA signal strength, CDMA signal time shift**
 - CDMA received parameters

Thank you