Relaying for 802.15.13

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Authors:

Name	Affiliation	Address	Phone	Email
Refik Kızılırmak	Nazarbayev University			
Tuncer Baykas	Istanbul Medipol University			tbaykas@ieee.org
Mohamed M. Abdallah	Hamad Bin Khalifa University			
Murat Uysal	Özyeğin Univeristy			

Background on Relaying

- **In LTE, there are two-types of relaying considered. It adopted Type-I.**

Type I

eNodeB

Type II

Relay

Relay

Type II requires less Signaling.

UE

UE
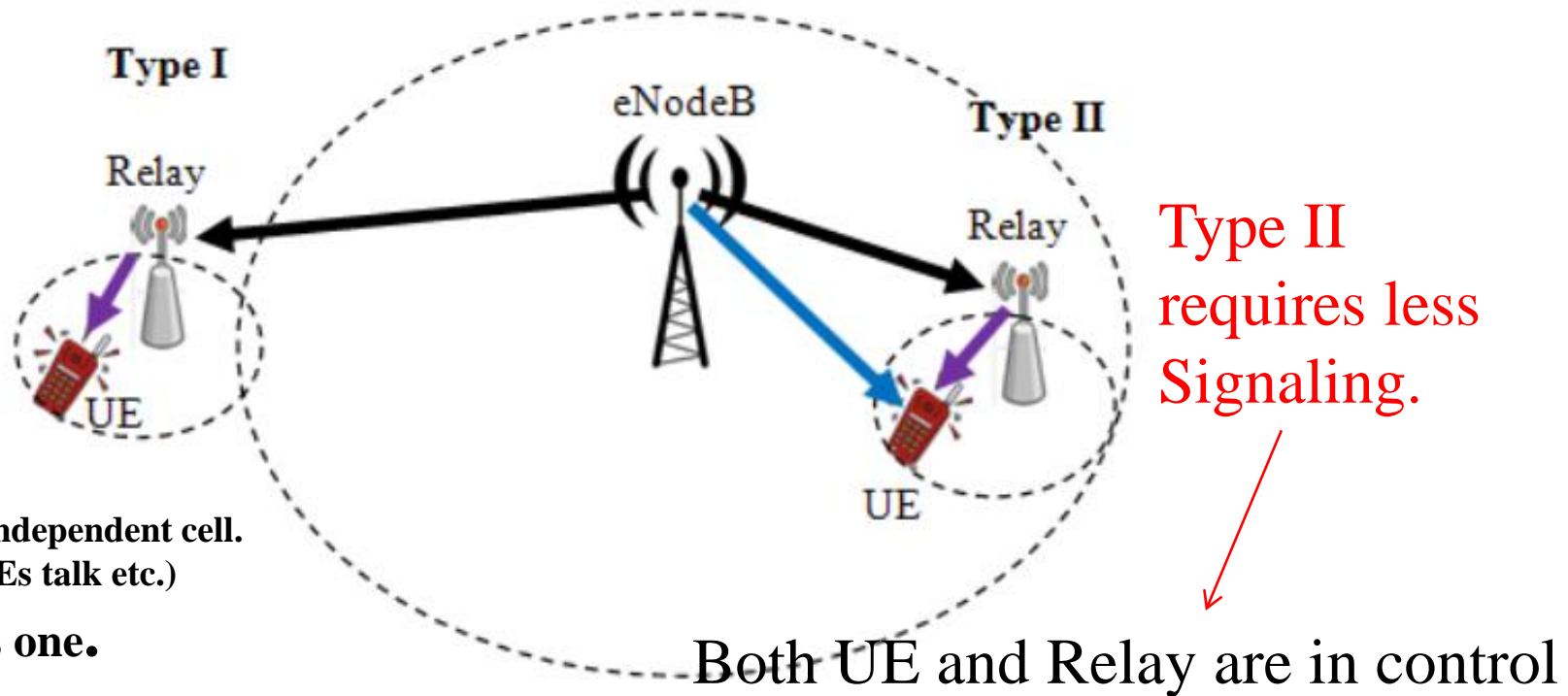
This can behave like independent cell.
(own cell ID, allows UEs talk etc.)

LTE adopted this one.

Both UE and Relay are in control

LTE Type II Relay

- **There is no dedicated control channel between Relay and Controller.**

- **All control signaling can reach Device through Coordinator (not from Relay).**

- **This is to boost data rate. (not coverage extension)**

802.15.13

- **We consider transparent relaying <u>to keep the complexity minimum.</u>**
- **<u>Relay device is NOT "Coordinator-capable"</u> and does not perform any task of Coordinator**

4.3 Topologies

- **No Change!**

- **Relay device is NOT "Coordinator-capable".**

- **802.15.13 relies on star topology, and all mentioned topologies can support relaying.**
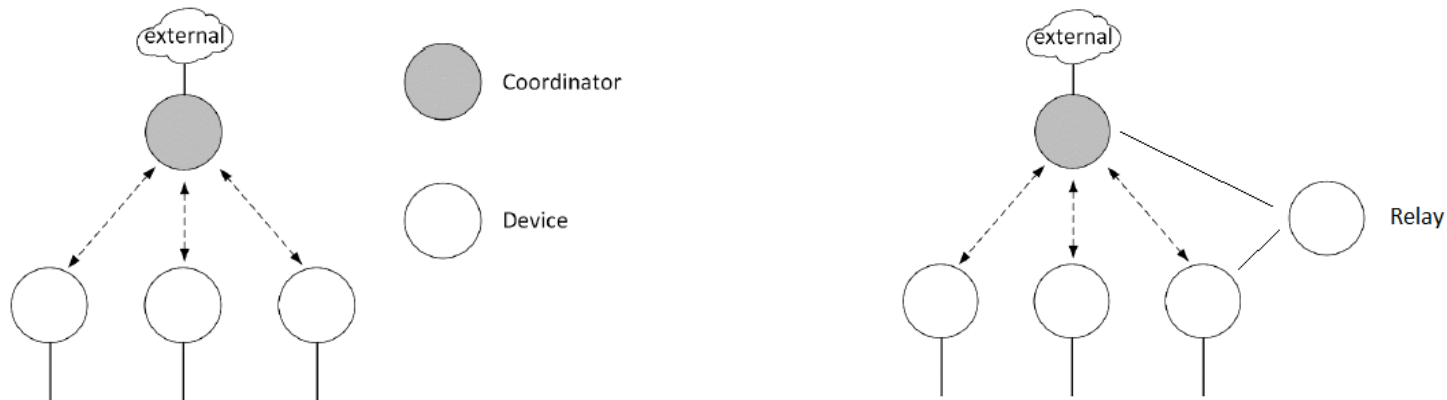
Figure 1 Basic star topology

4.4 Coexistance

- **No change**

4.5 Architecture

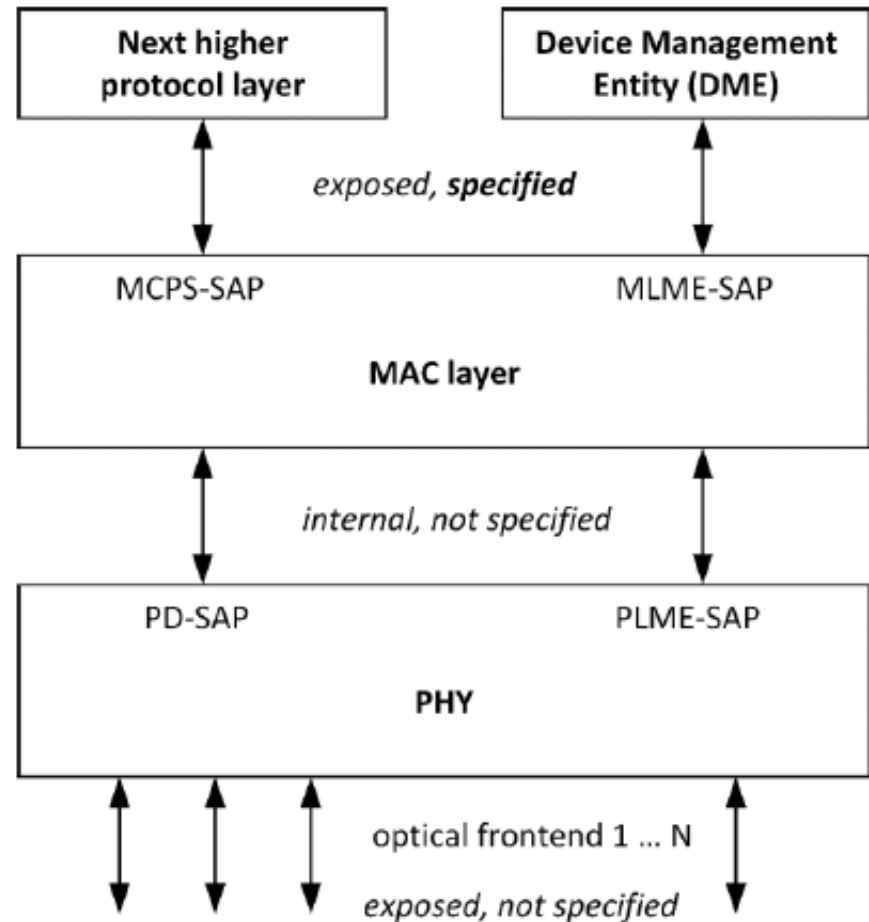- **Relay device follows the same architecture as other devices in the network.**
- **No Change**

Figure 5 OWPAN device architecture

4.5.1 PHY Layer

- **Relaying can work with all mentioned PHYs**
- **PM-PHY**
- **LB-PHY**
- **HB-PHY**

Preamble	Channel Estimation	PHY header	HCS	Optional Fields	PSDU
SHR		PHR			PHY Payload

Figure 6 Format of the PPDU

4.5.2 MAC Sublayer

"Moreover, the 802.15.13 MAC supports the use of advanced MIMO schemes with distributed, networked optical wireless frontends and for multiple mobile devices, as well as relaying operation."

The last highlighted part can be added.

4.5.3 Dimming Support
4.5.4 Flicker Mitigation Support

- **No change!**

4.6 Functional Overview

4.6.1 Data transfer model

"Direct communication between non-coordinator devices is not foreseen. "

This sentence should be modified. Relay device is "non-coordinator" device.

4.6.1.1 Data transfer from a device to a coordinator

4.6.1.2 Data transfer from a coordinator to a device

In these two short subsections, relaying can be mentioned and at least its Clause can be simply referred.

4.6.2 Clock-rate selection

- **Relay device also sets its OCR like other devices in the network.**

- **No Change!**

4.6.3 MAC Frames

- **Same!**

4.6.4 Improving probability of successful delivery

- **4.6.4.1 Channel access mechanism**

The relay device takes part in beacon-enabled and nonbeacon enabled channel access as other devices.

4.6.4.2 Frame acknowledgment

- **May require minor (or no) modification for relaying.**

- **Relay can also forward the ACK of the device to the Controller.**

4.6.4.3 Data verification

- **It is up to relay to do CRC verification or not. Not very critical.**
- **No change!**

4.7 Concept of primitives

- **No Change!**

5. MAC functional specification
5.1 MAC transmissions overview

- **No Change!**
- **Relaying can be supported in both beacon-enabled and nonbeacon-enabled.**
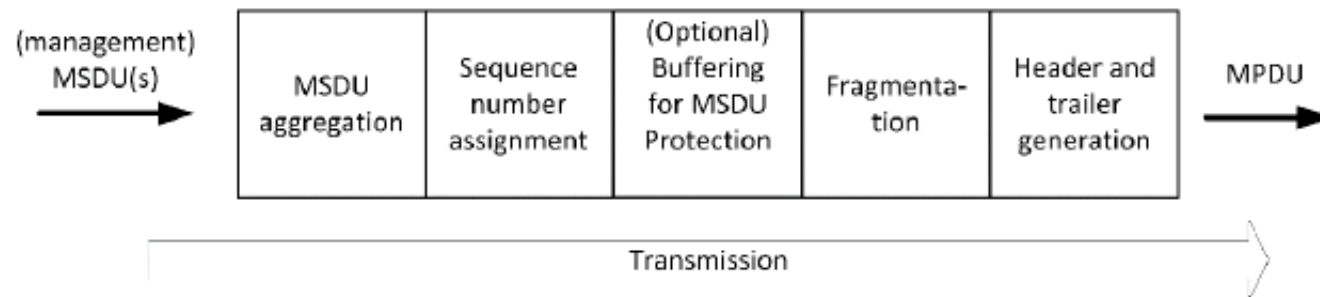
5.1.1 Addressing

- **No Change!**

"each device shall be addressable through a 48-bit MAC address compatible with IEEE Std. 802-2014 (EUI-48). "

Same as Relay devices

5.1.2 The transmit process

- **No Change!**

Figure 9 The MAC transmit process

5.1.3 The receive process

- **No Change!**
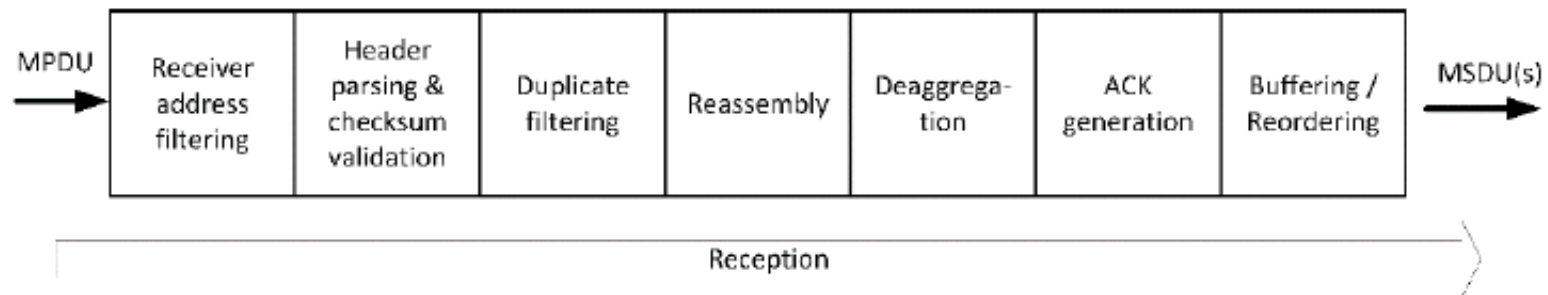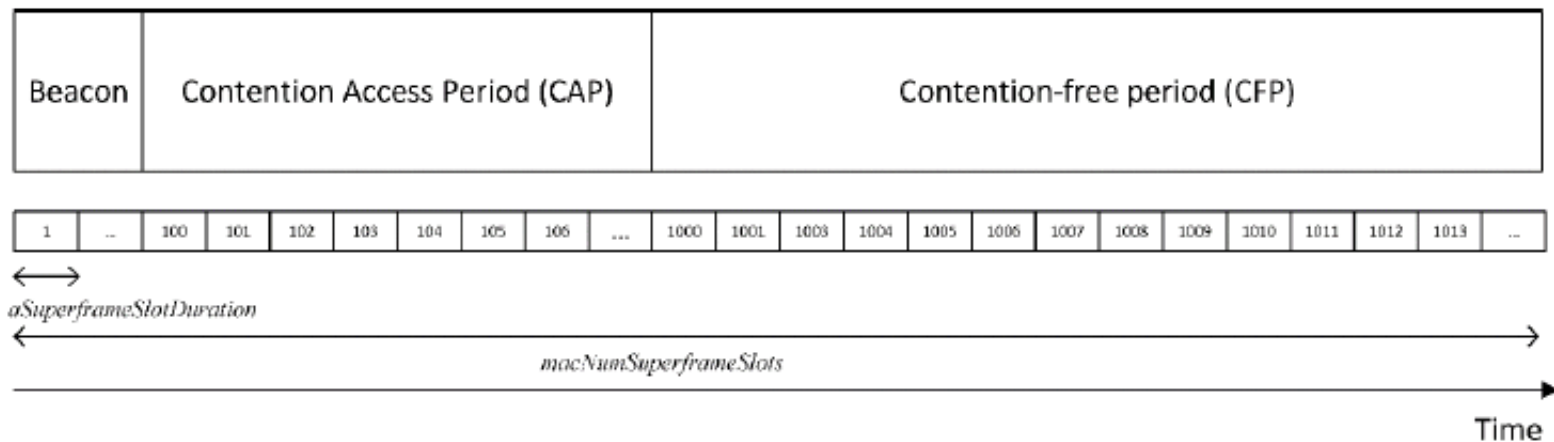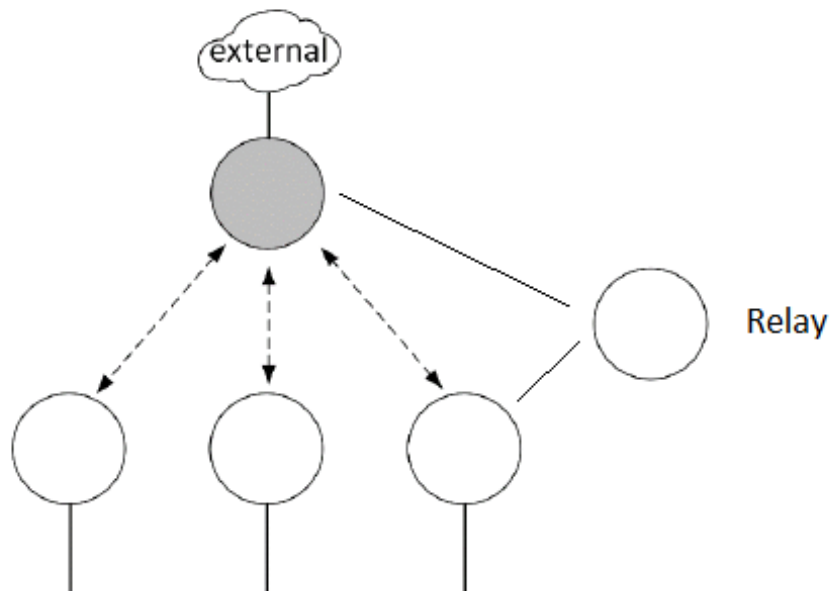

Figure 10 The MAC receive process

5.2 Beacon-enabled channel access

- **Relay participates channel access as all other devices.**

Beacon	Contention Access Period (CAP)	Contention-free period (CFP)

| 1 | .. | 100 | 101 | 102 | 103 | 104 | 105 | 106 | ... | 1000 | 1001 | 1003 | 1004 | 1005 | 1006 | 1007 | 1008 | 1009 | 1010 | 1011 | 1012 | 1013 | ... |

$\longleftrightarrow$

aSuperframeSlotDuration

macNumSuperframeSlots

Time

external
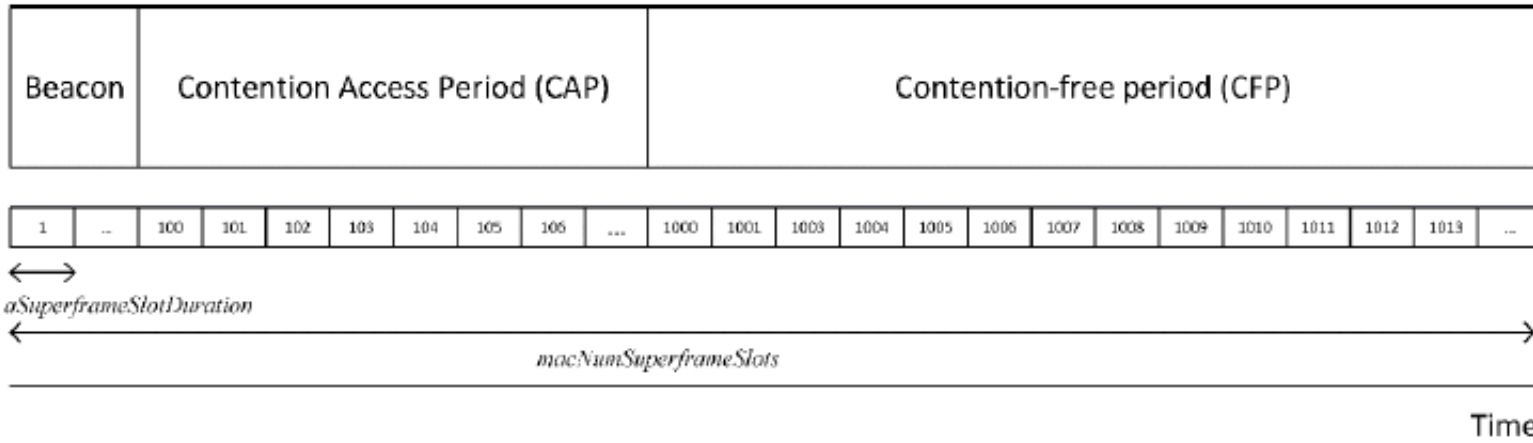
Relay

5.3 Non-beacon-enabled channel access

- **Similar, should be updated!**

5.4 OWPAN management
5.4.1 Scanning for OWPANs

- **No Change!**

- **Relay device will scan OWPANs like other devices.**

5.4.2 Starting an OWPAN

- **No Change!**

- **Only coordinator can start a new OWPAN!**
- **Relay device has no coordinator role.**

5.4.3 Maintaining an OWPAN

- **No Change!**

- **Relay device will do the same as other devices.**

5.4.4 Stopping an OWPAN

- **No Change!**

- **Relay device will do the same as other devices.**

5.4.5 Associating with an OWPAN

- **No Change!**

- **Relay device will do the same as other devices.**

5.4.5.1 Association request
5.4.5.2 Association response
5.4.6 Disassociating from an OWPAN
5.4.7 Interference detection

- **No Change!**
- **Relay device will do the same as other devices.**
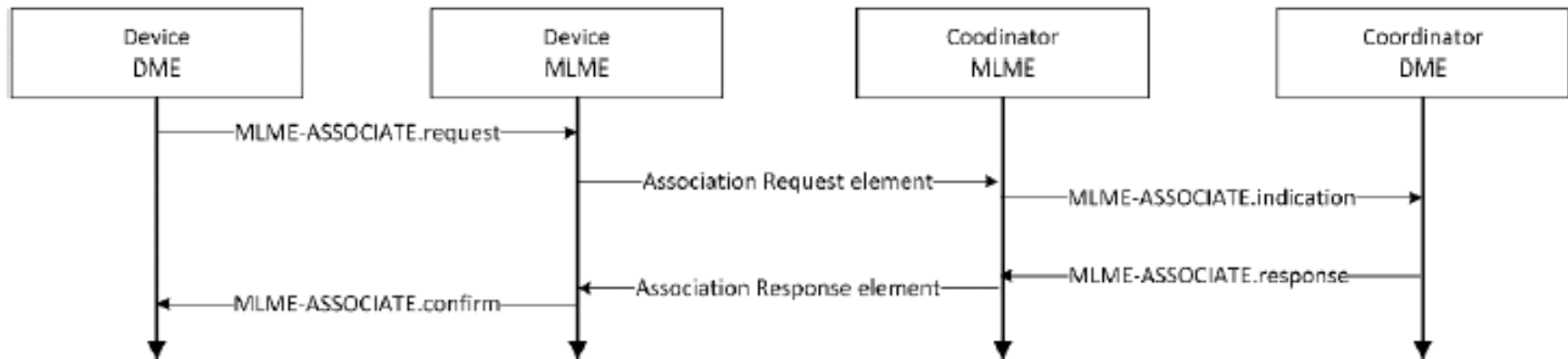
Figure 23 Association procedure message exchange

5.5 Fragmentation and reassembly

- **No Change!**

- **Relay does not contribute in fragmentation.**
- **Only performed at end devices (Coordinator and Device).**

5.6 Aggregation

- **No Change!**

- **Relay does not contribute in fragmentation.**
- **Only performed at end devices (Coordinator and Device).**

5.7 Protected transmission

- **May require minor (or no) modification for relaying.**

- **Relay can also forward the ACK of the device to the Controller.**

- **5.7.1 Single acknowledgement**

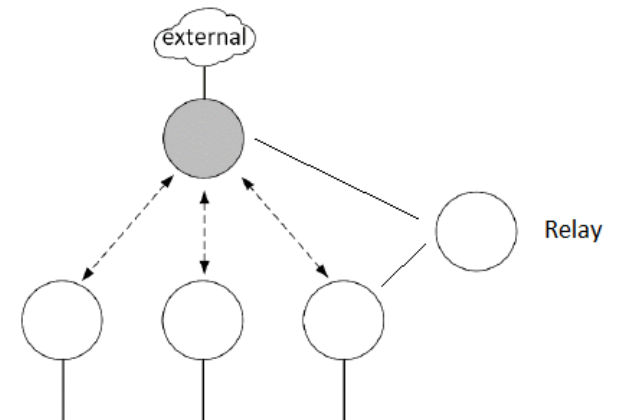- **5.7.2 Block acknowledgement**

5.8 Adaptive transmission

- **5.8.3 MCS request feedback**

- **5.8.3.1 Bitloading MCS request**

- **5.8.4 Multi-OFE channel feedback**

- **5.8.5 Adaptive MIMO transmission**

- **Relay support <u>is difficult</u> as these methods are very sensitive on CSI between S and D, and designed for direct link only.**

- **A NOTE can be added saying relaying is not supported with adaptive transmission.**

6. MAC frame formats

Octets: 2	0/2	2/6	2/6	0/2/6	0/2	variable	4
Frame Control	Poll ACK	Receiver Address	Transmitter Address	Auxiliary Address	Sequence Control	Payload	FCS
			MAC frame header (MHR)				

Figure 32 General MAC frame (MPDU) format

To Backhaul	From Backhaul	Description	Receiver address	Transmitter address	Auxiliary address
0	0	The frame originates from a device and is destined to another device. I.e. coordinator to device or device to coordinator.	Address of the designated receiver. (= *MSDU destination address*). *Optionally short*	Address of the transmitting device. (= *MSDU source address*). *Optionally short*	Coordinator address (= *OWPAN ID*) If short addressing is used. Otherwise, the field does not exist.
1	0	An MSDU originates from a device and is destined to a peer in the integrated LAN	Coordinator address (= *OWPAN ID*)	Address of the transmitting device. (= *MSDU source address*).	MSDU destination address.
0	1	An MSDU originates from a peer in the integrated LAN and is destined to a device.	Address of the designated receiver. (= *MSDU destination address*).	Coordinator address (= *OWPAN ID*)	MSDU source address.
1	1	*reserved*	-	-	-

external

Relay

7. MAC Services

- **Seems no change!**
- **Relay device will be compatible.**
- **There can be minor additions to the capability lists!**

9. PHY Services
10. PM-PHY specifications
11. LB-PHY specifications
12. HB-PHY specifications

- **Not much change is expected!**

- **Relay device will use the same PHY services (pulse modulation, LB-PHY, HB-PHY)**

Acknowledgment