Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: VLC cell mobility clarification
Date Submitted: September 2010
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Re:

Abstract: proposes clarification for the VLC cell mobility concept

Purpose:

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Current text for architecture

A VPAN device comprises of a PHY layer, which contains the light transceiver along with its low-level control mechanism, and a MAC sublayer that provides access to the physical channel for all types of transfers. Figure 3 shows these layers in a graphical representation, which are described in more detail in 4.4.1 and 4.4.2.

The upper layers, shown in Figure 3, consist of a network layer, which provides network configuration, manipulation, and message routing, and an application layer, which provides the intended function of the device. The definition of these upper layers is outside the scope of this standard. A logical link control layer (LLC) can access the MAC sublayer through the service-specific convergence sublayer (SSCS), defined in Annex C.

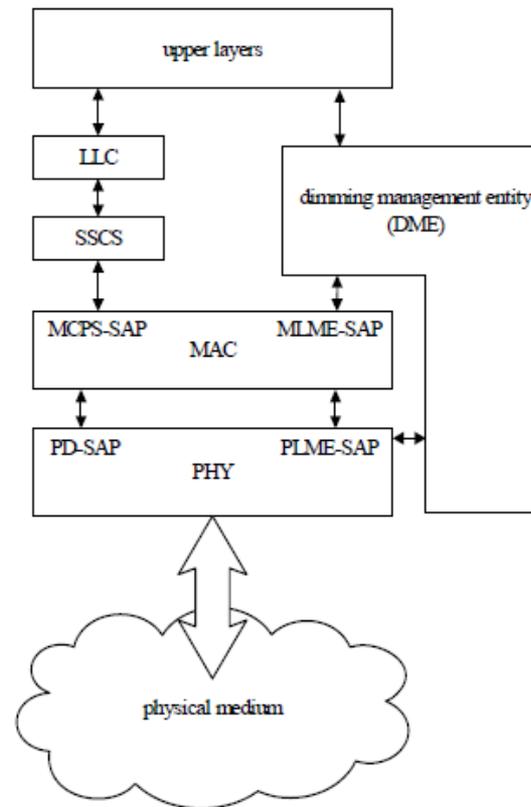# Current system architecture (no mobility support)

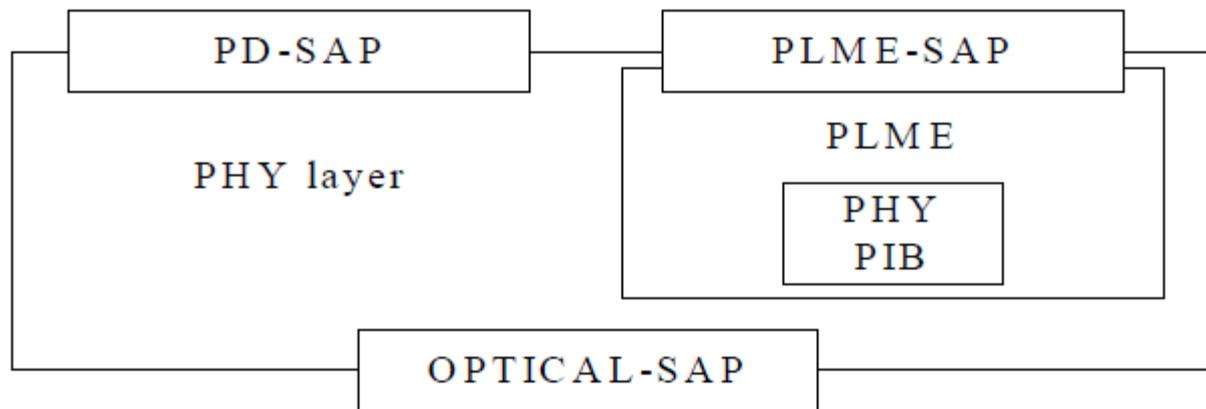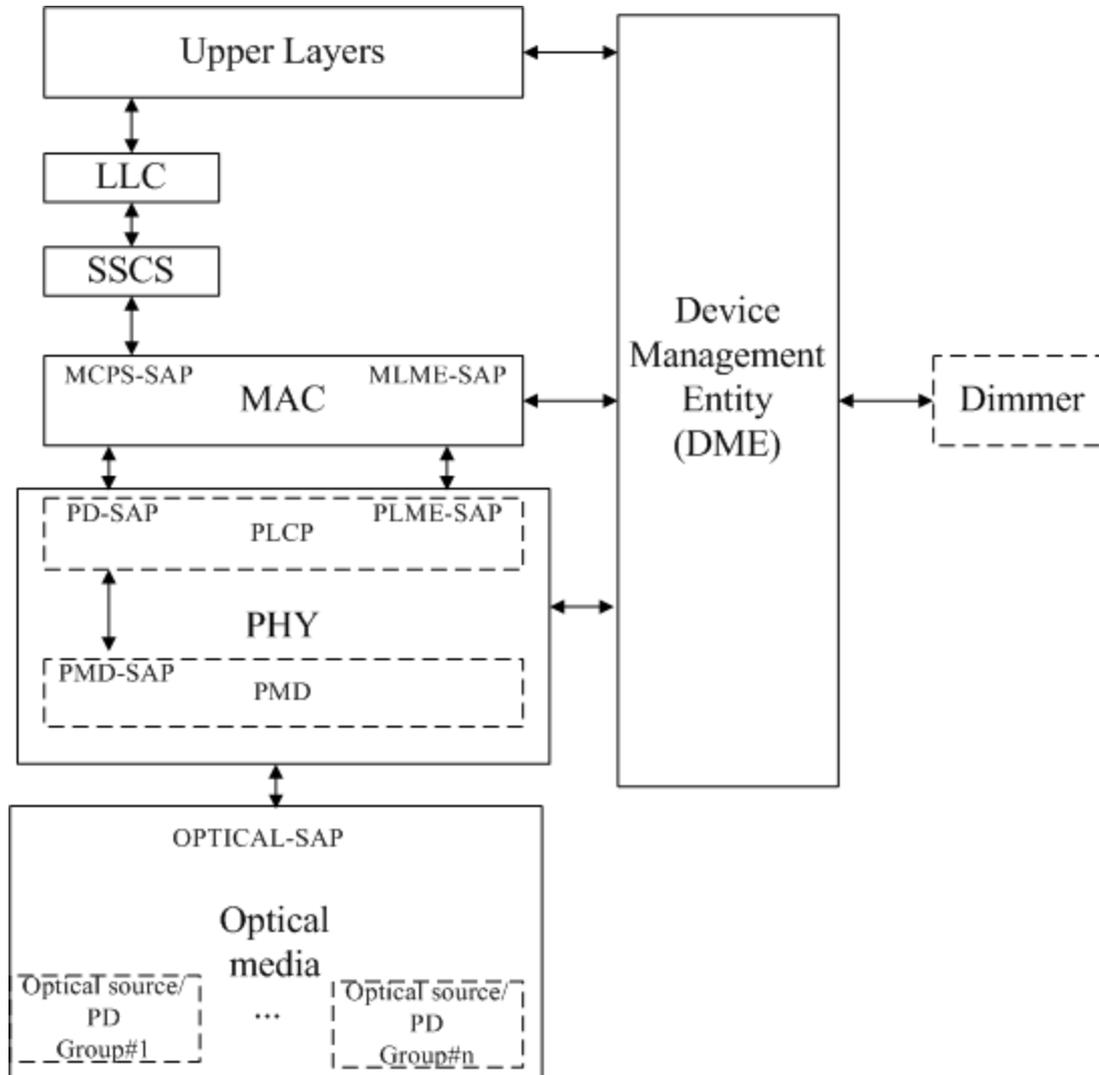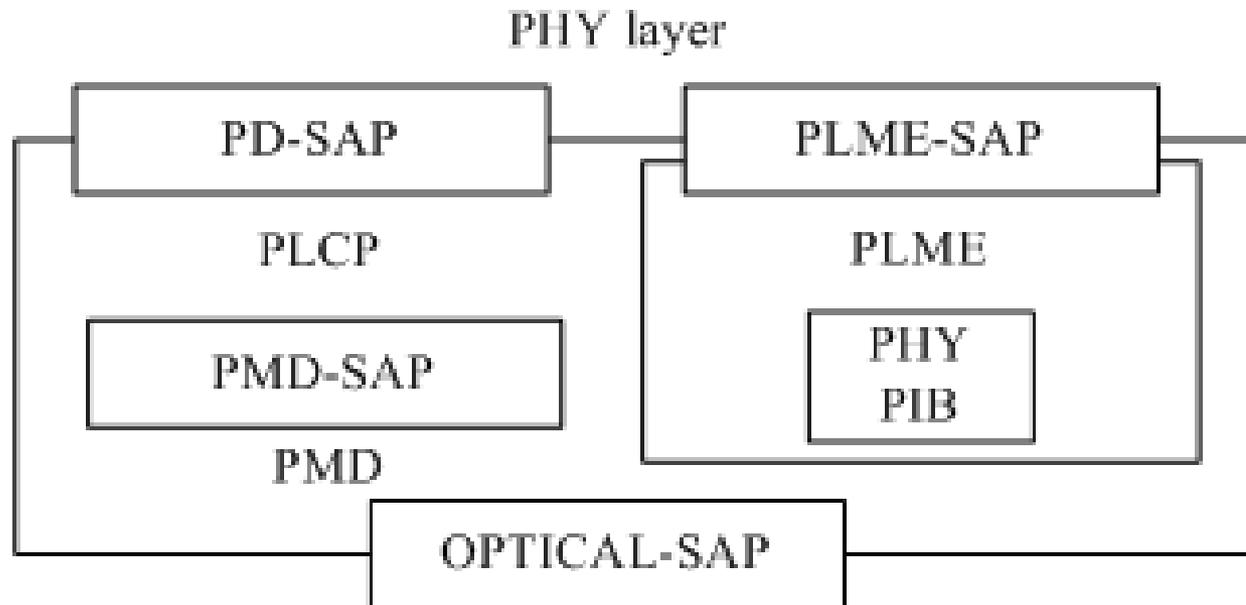

Figure 3—VPAN device architecture

Current PHY architecture

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Agreed direction for system architecture

Agreed direction for PHY architecture

PHY layer

PD-SAP	PLME-SAP

PLCP

PLME

PMD-SAP

PHY PIB

PMD

OPTICAL-SAP

Add text – PLCP/PMD definitions

Split PHY to PLCP sublayer and PMD sublayer. Change description to current PHY layer to PLCP sublayer.

PLCP sublayer

- maps the IEEE 802.15.7 MPDUs from the MAC with operations such as channel coding, line coding and modulation into a format suitable for transmission and reception through the optical channel

PMD sublayer

- provides a transmission interface between the PLCP sublayer and the optical SAP and is used to send and receive data to a single or multiple optical sources and photodetectors in a selective manner with a PHY switch.
- Also, allows precise definition for PHY III support

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Add text - Layer partitioning

While the PLCP sublayer and the PMD sublayer are described separately as parts of the PHY, the separation and distinction between these sublayers is artificial, and is not meant to imply that the implementation must separate these functions. This distinction is made primarily to provide a point of reference from which to describe certain functional components and aspects of the PMD. The functions of the PLCP can be subsumed by a PMD sublayer; in this case, the PMD will incorporate the PHY-SAP as its interface, and will not offer the PMD_SAP. For example, if only a single optical source or photodetector is used, the PMD_SAP may not be implemented.

Add text - DME

"A device management entity (DME) is also supported in the architecture. The DME can talk to the PLME and MLME for the purposes of interfacing the MAC and PLCP sublayer of the PHY with a dimmer. The DME can access certain dimmer related attributes from the MLME and PLME in order to provide dimming information to the MAC and PHY. The DME can also talk to the PMD sublayer of the PHY in order to control the PHY switch for selection of the optical sources and photodetectors. The details of the DME are outside the scope of this standard.

Add text – optical media

The PMD sublayer interfaces to the optical media, which may consist of a single or multiple optical sources and photodetectors. Multiple optical sources and photodetectors are supported in the standard for PHY III as well for VLC cell mobility. The PMD sublayer uses a PHY switch in order to select a group of optical sources and photodetectors.

A group of optical sources or photodetectors is defined as the number of optical sources or photodetectors having similar or different optical characteristics but are transmitting or receiving the same information during communication.

A PHY III, for example, uses 3 groups for data communication and 1 group for link establishment

PMD_SAP primitives

PMD_DATA.request (Check for packed/burst mode)

- This primitive defines the transfer of data from the PLCP sublayer to the PMD entity.
- **When generated**
  - This primitive is generated by the PLCP sublayer to request the transmission of a frame on the PMD sublayer.
- **Effect of receipt**
  - The receipt of this primitive will cause the PMD entity to encode and transmit a frame.

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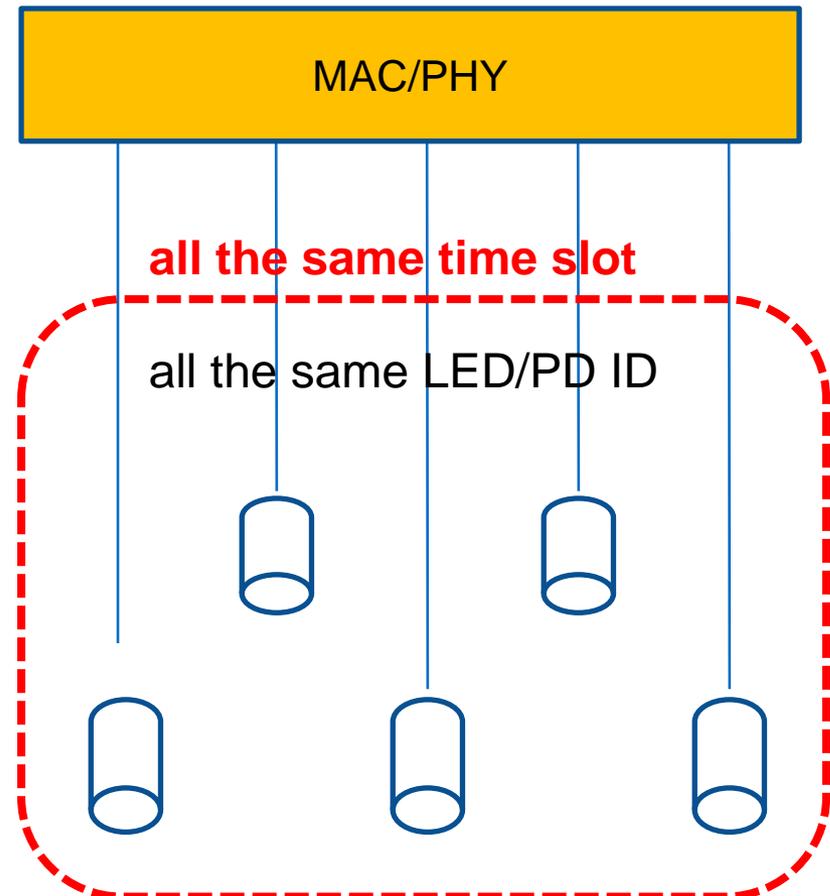
PMD_SAP primitives

PMD_DATA.indicate (Check for packed/burst mode)

- This primitive defines the transfer of data from the PMD entity to the PLCP sublayer.
- **Not sure if required**

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Functionality#1 – Static

MAC : same ID assignment and time slot assignment

Static mode (no mobility)

MAC/PHY

all the same time slot

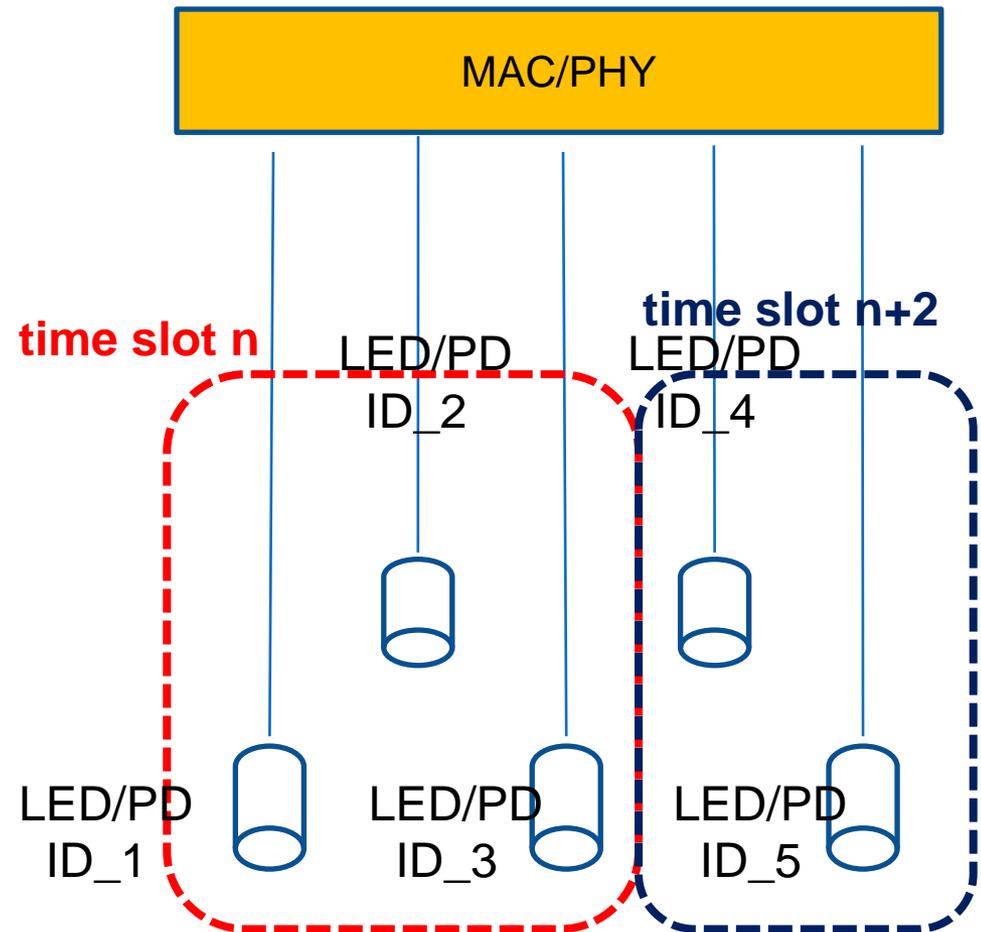all the same LED/PD ID

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Functionality#2 - Dynamic

MAC : time slot assignment based on ID

Dynamic mode (mobility) based on grouping

- All PHYs within a group operate in the same manner
- Group size can be varied
- **Only one group active at a time for VLC communication**

MAC/PHY

time slot n

time slot n+2

LED/PD ID_2

LED/PD ID_4

LED/PD ID_1

LED/PD ID_3

LED/PD ID_5

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This model is similar to model #2 in doc 10/687r0

The PHY switch is part of the PMD and is controlled by the DME. The cell IDs are used to select the subset of PHYs to be used for communication. The other PHYs that are not used for communication are simply providing illumination. The design of the PMD is left to the implementer.

Single MAC frames can be routed to/from any combination of PHYs

To Link Layer

MAC SAP

MAC

PHY SAP

PHY SWITCH

PHY

PHY

PHY

PHY

PHY

PHY

PHY

PHY

PHY

Optical Node
(e.g. PD and LED)

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