HiperLAN2:Broadband Wireless Communications at 5 GHz

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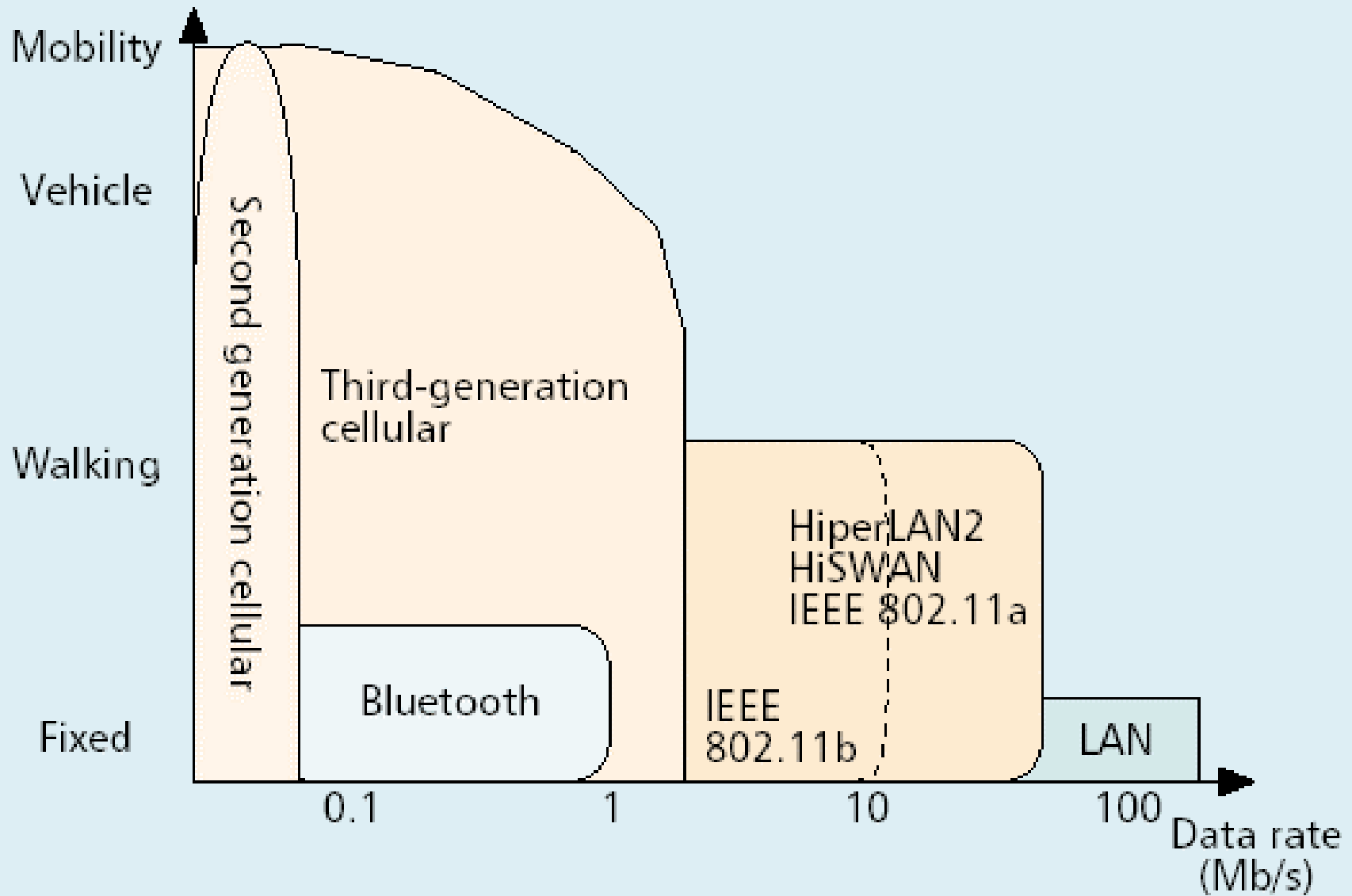8/23

Outline

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- System Overview
- The Convergence Layer
- The Data Link Control Layer
- Physical Layer
- Performance
- Conclusions

Introduction

- Developed by ETSI.
- Operate in the 5 GHz band
- High-speed transmission
- Connection-oriented
- Quality of Service (QoS) support
- Dynamic frequency selection (DFS)
- Power save

Mobility vs. peak data rate

System Overview

- The HiperLAN2 protocol has three basic layers   Physical layer (PHY), Data Link Control layer (DLC), and the Convergence layer (CL).

- HiperLAN2 specifies a radio access network that can be used with a variety of core networks.

- The Mobile Terminals (MT) communicate with the Access Points (AP) over an air interface. HiperLAN2 will ensure that the user and the MT get the best possible transmission performance.

Centralized mode

- Used in the cellular networking topology, where each radio cell is controlled by an AP covering a certain geographical area.

- MT communicates with other MTs or the core network through the AP.

- Mainly used in business applications, where an area much larger than a radio cell has to be covered.
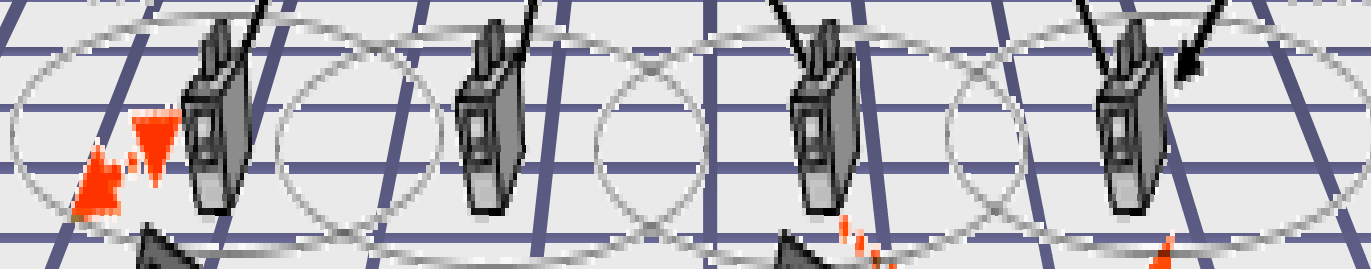
Direct mode

- Used in the ad hoc networking topology, where a radio cell covers the whole serving area.

- MTs in a single-cell home network can directly exchange data.

- Mainly used in typical private home environments.

Distribution Network (e.g. Ethernet)

"Network" mode"
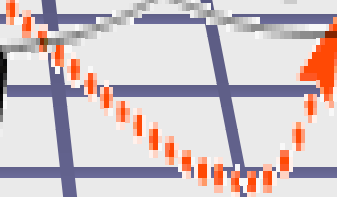
Access Point (AP)

"Peer-to peer" mode"

AP - AP Mobility (link level)

Mobile Terminal (MT)

Convergence Layer (1/2)

- Adapt service requests from higher layers to the service offered by the DLC and to convert the higher-layer packets with fixed or variable size into a fixed-size service data unit (SDU).

- The generic architecture of the CL makes HiperLAN2 suitable as a radio access network for a diversity of fixed networks.

Convergence Layer (2/2)

- Packet-based convergence layer handles higher layers with variable length packets. (e.g. Ethernet)

- Cell-based convergence layer handles higher layers with fixed length packets.

- A higher-layer packet such as an Ethernet packet is mapped onto one or more DLC SDUs by padding and segmentation.

Data Link Control Layer

- The DLC layer consists of a radio link control (RLC) sublayer, an error control protocol, and a MAC protocol.

Radio Link Control

1. The association control

   association/disassociation, authentication, key management, encryption seed.

2. Radio resource control (RRC)

   handover, dynamic frequency selection, MT alive/absent, power saving and control.

3. DLC user connection control

   release of user connections, multicast, broadcast.

- The RLC is used for exchanging data in the control plane between an AP and an MT.

Error Control

- The acknowledged mode

    Provides reliable transmissions by using retransmission to improve the link quality.

- The repetition mode

    provides reliable transmission by repeating the data-bearing DLC PDUs.

- The unacknowledged mode

    provides unreliable low-latency transmission.

Medium Access Control (1/2)

- The air interface is based on time-division duplex (TDD) and dynamic time-division multiple access (TDMA).

- The basic MAC frame structure has a fixed duration of 2 ms and comprises transport channels for broadcast control, frame control, access control, downlink and uplink data transmission and random access.

Medium Access Control (2/2)

- The broadcast channel (BCH) contains control information that is sent in every MAC frame, mainly to enable some RRC functions.

- The MAC frame and the transport channels form the interface between DLC and the physical layer.

One DLC connection

One PDU train (to be mapped on one PHY burst)
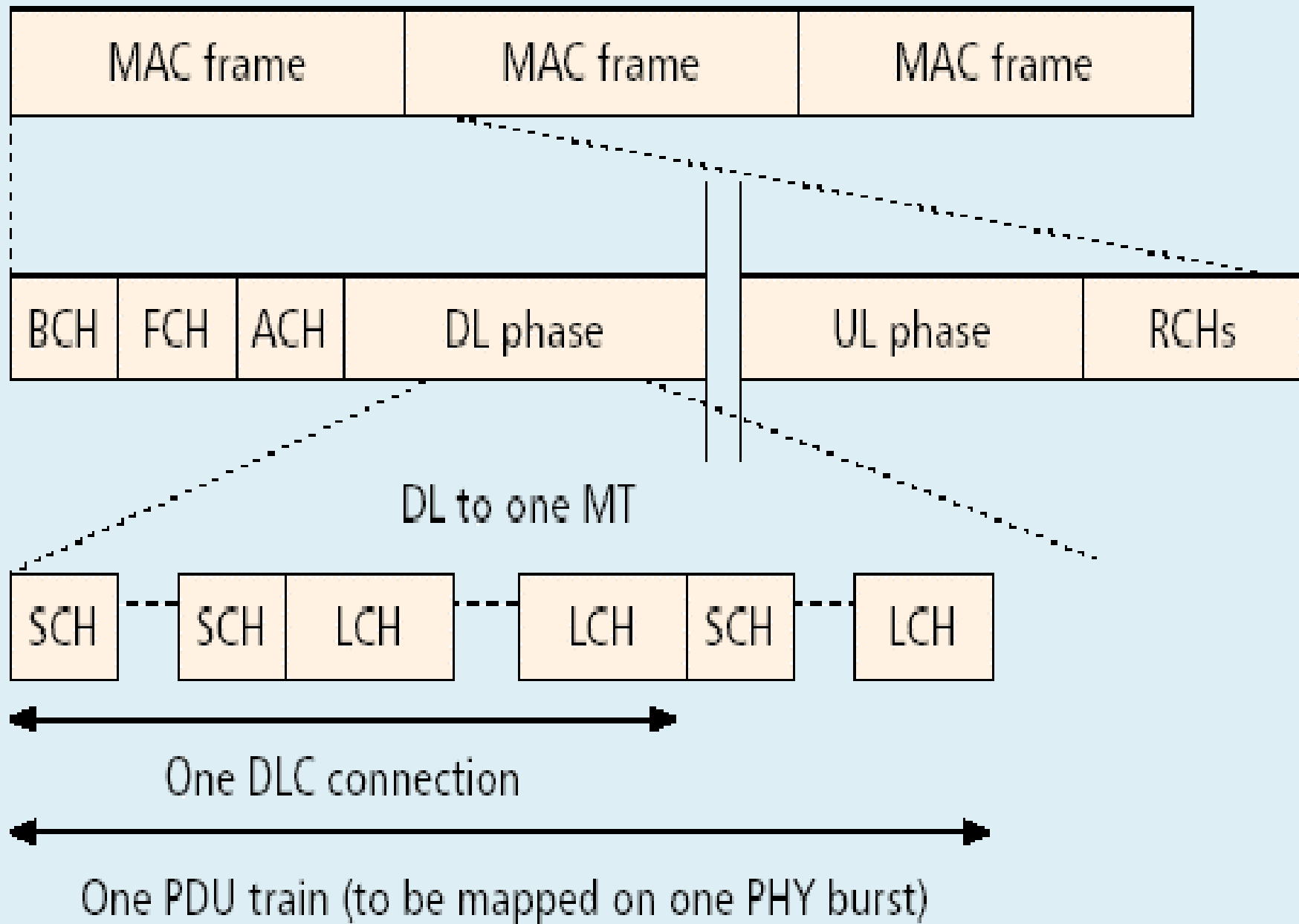
Radio Network Functions

- The HiperLAN2 standard defines measurements and signaling to support a number of radio network functions.

- Dynamic frequency selection

- Link adaptation

- Handover

- Multibeam antennas

- Power control

QoS support

- HiperLAN2 supports QoS by allowing different radio bearers to be set up and treated by the AP during transmission.

- Scheduling is performed on the MAC layer. AP determines the radio bearers to access the medium as well as the amount of data and control signaling in the MAC frame.

Physical Layer

- The units to be transmitted via the physical layer are bursts with variable length.

- Orthogonal Frequency Division Multiplexing (OFDM) has been selected as the modulation scheme due to its excellent performance on highly dispersive channels.

- Provide several physical layer modes with different code rates and modulation schemes.
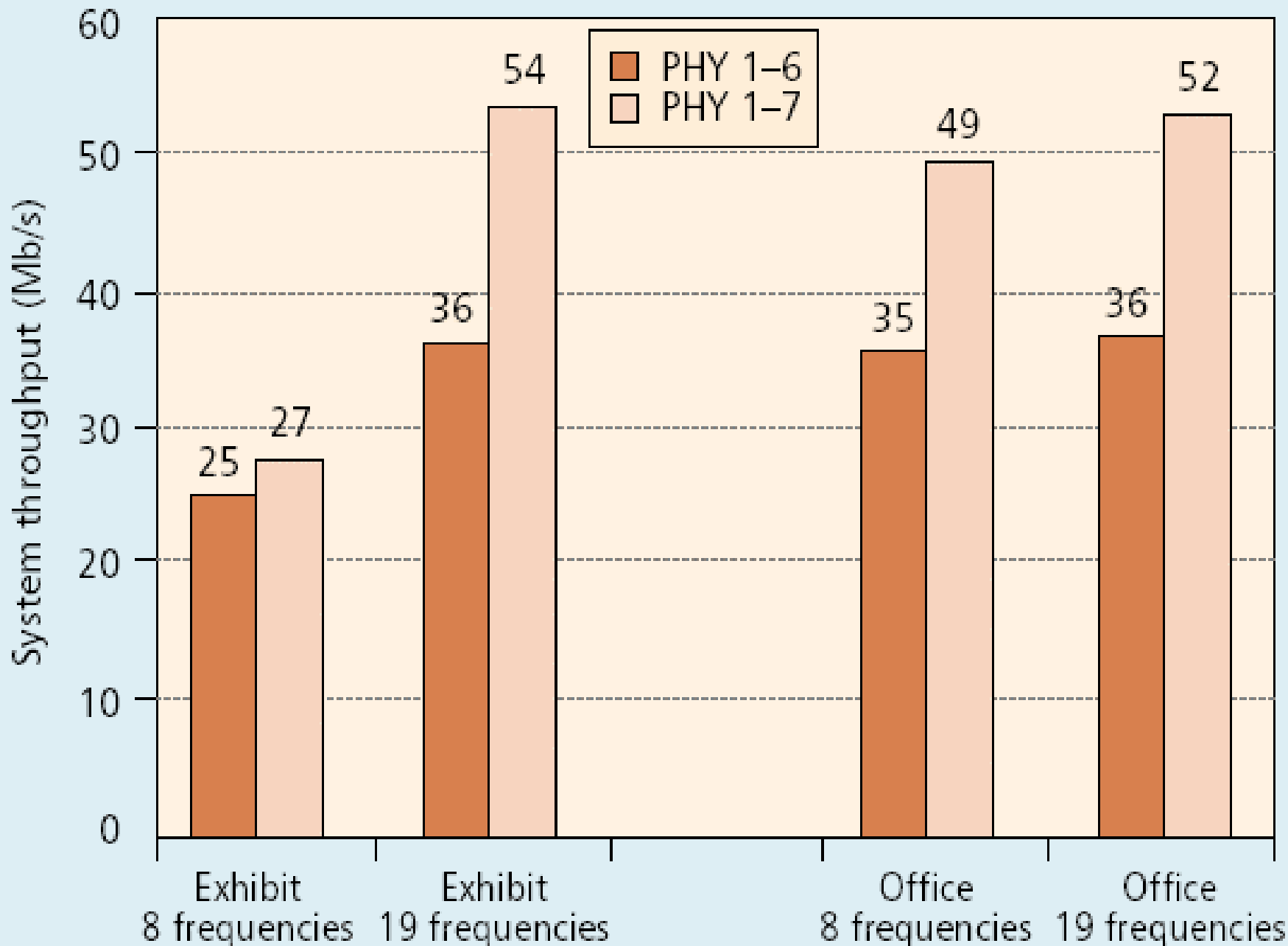
- Forward error control (FEC) is performed.

HiperLAN2 protocol architecture
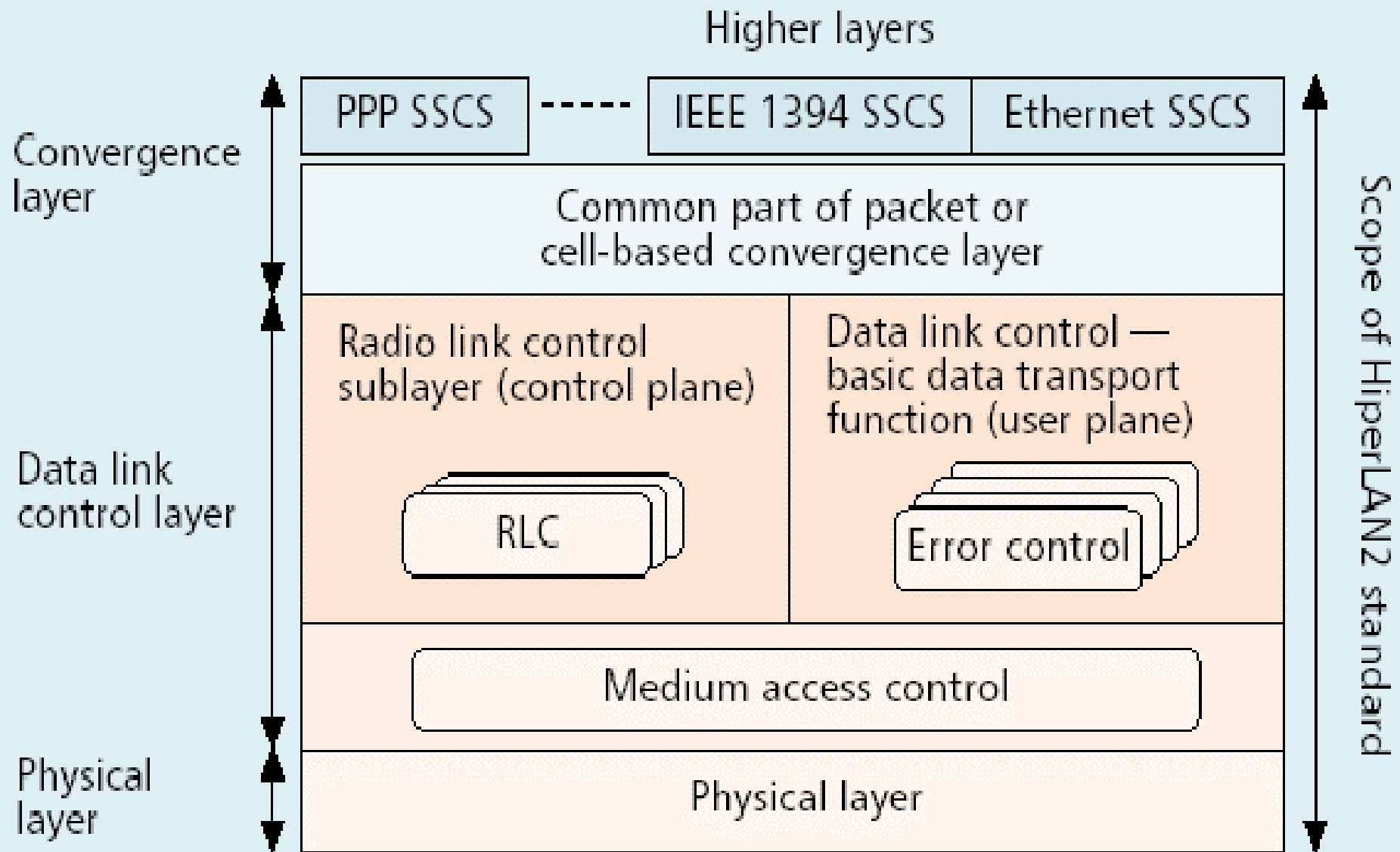
Performance
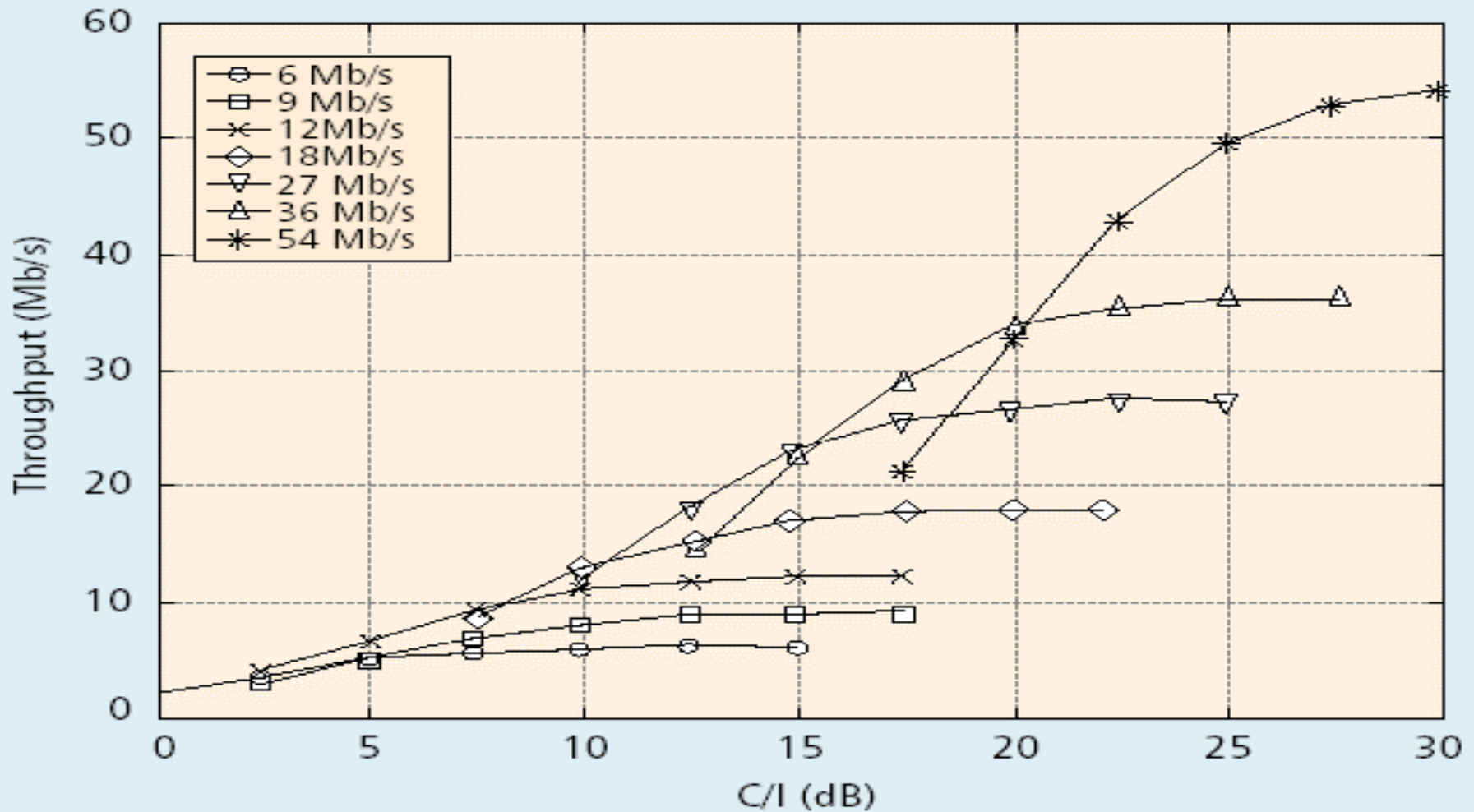
Carrier-to-interference power ratio (C/I)

Conclusions

- The standard is attractive since low-cost devices can be developed for a system that enables high throughput with QoS support.

- The standard has some key features like centralized control with QoS support, selective repeat ARQ, link adaptation, and dynamic frequency selection.

- HiperLAN2 can Interwork with different broadband core networks.