HIPERLAN

What is HIPERLAN?

HIPERLAN - HIgh PErformance Radio LAN

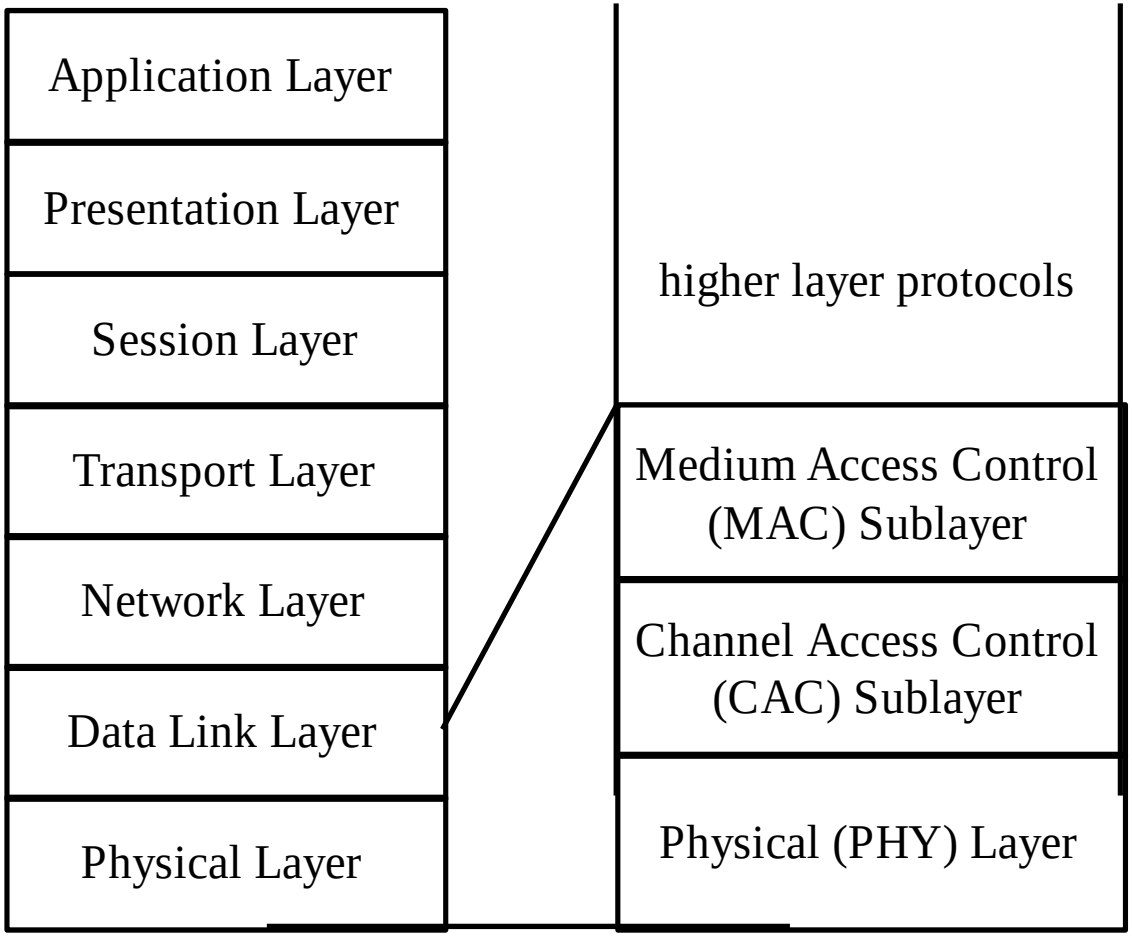
HIPERLAN is a new standard for Radio LANs developed in Europe by ETSI

HIPERLAN is an interoperability standard which specifies a common air interface MAC and PHY layers in OSI model

HIPERLAN will be a family of standards

HIPERLAN 1 is described in detail

HIPERLAN - reference model



Origins of HIPERLAN

Early wireless LANs operating in the ISM bands (900MHz and 2.45GHz)

Low data rate (~1Mbps) - an indirect result of the FCC spread spectrum rules part 15.247

Severe interference environment - from unlike wireless LANs and other ISM band systems

Lack of standards - IEEE 802.11 was initiated to satisfy this need but it was taking time to develop

ETSI set up RES10 to develop a standard that would be equal in performance to wired LANs such as Ethernet

HIPERLAN 1 - history

- ETSI set up RES10 group - mid 1991
- RES10 start work on standard - early 1992
- CEPT allocate spectrum - early 1993
- RES10 complete draft standard - mid 1995
- ETSI publish final standard - late 1995
- RES10 start work on type approval - early 1996
- HIPERLAN passes public enquiry - mid 1996

HIPERLAN 1 - spectrum

CEPT identified vacant spectrum at 5GHz

5.00-5.25GHz was allocated worldwide to aviation authorities on a primary basis for MLS but only 5.00-5.15GHz was used

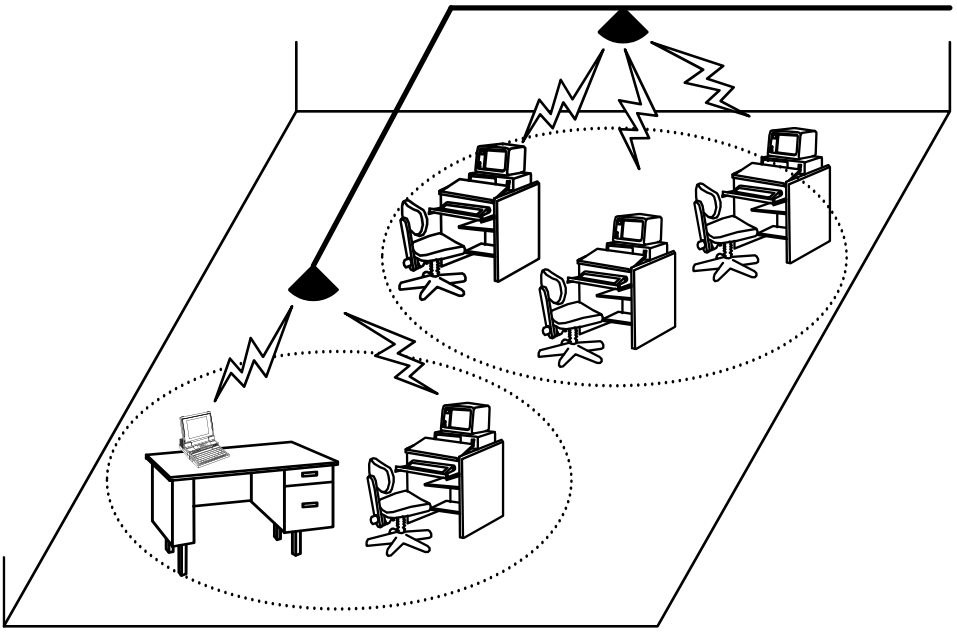
CEPT allocated 5.15-5.25GHz to HIPERLAN on a secondary basis with its status as non-interference, non-protected

An extension of the band from 5.25-5.3GHz is available in most countries

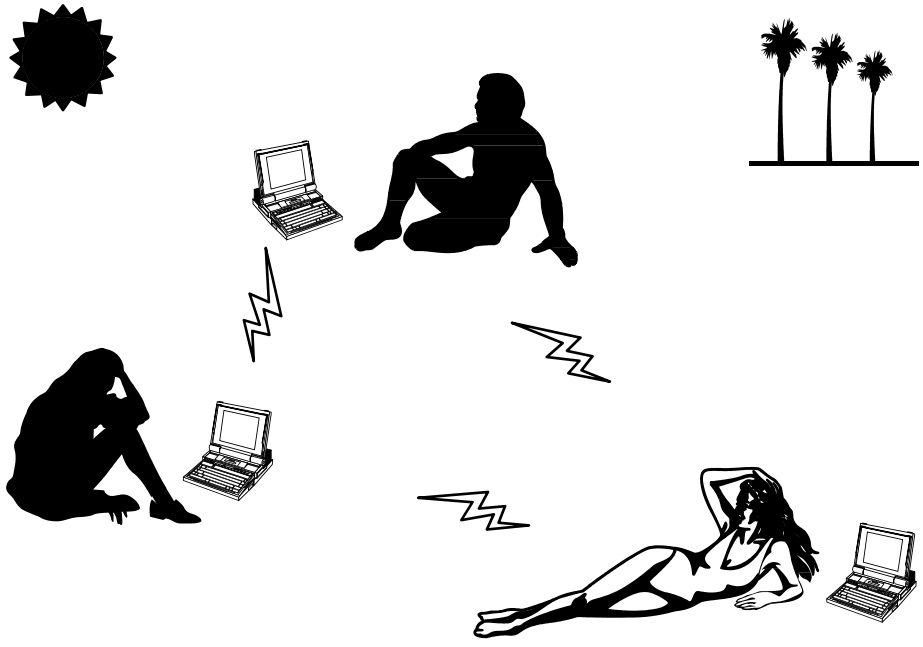
HIPERLAN - applications

Early ideas

with infrastructure



without infrastructure



Others include - many vertical applications, wireless dockin
public access to the NII, home networks

HIPERLAN 1 - requirements

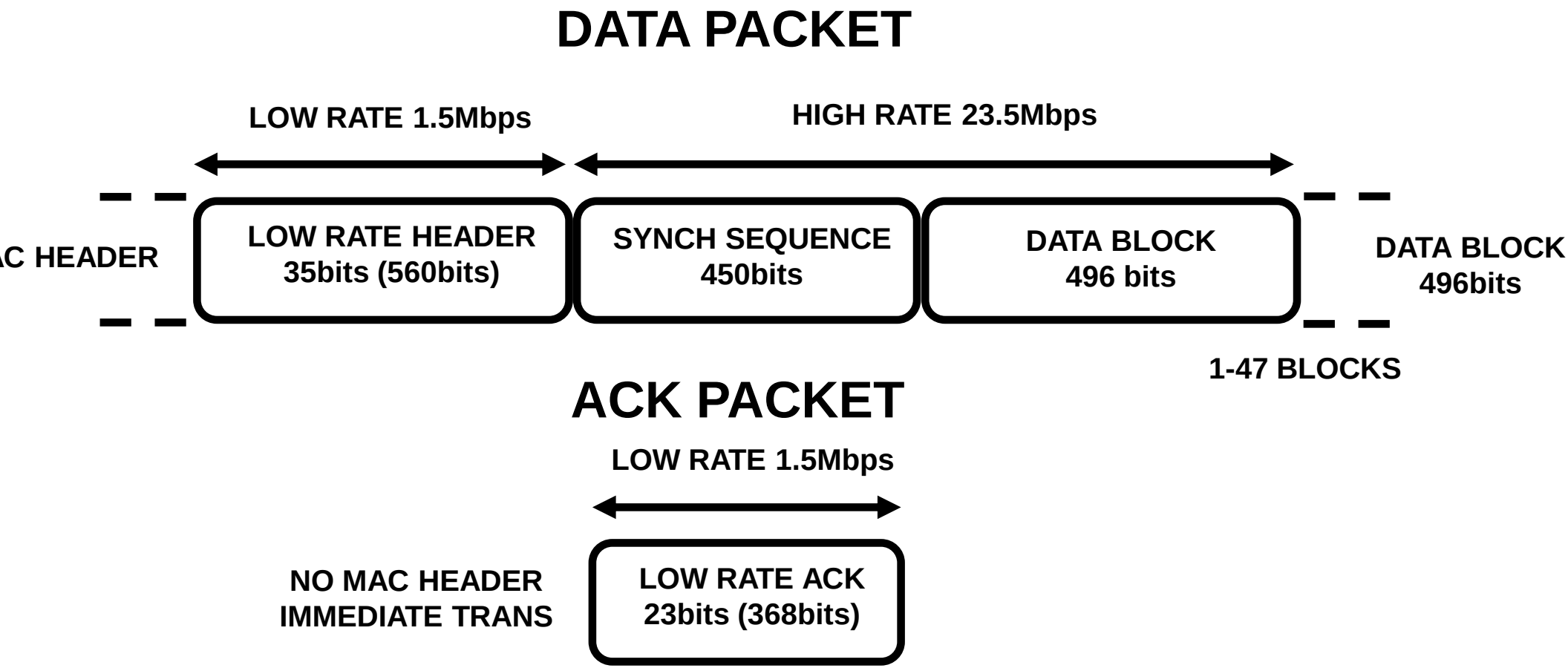
- Short range - 50m
  Low mobility - 1.4m/s
  Networks with and without infrastructure
  Support isochronous traffic
  audio 32kbps, 10ns latency
  video 2Mbps, 100ns latency
  Support asynchronous traffic
  data 10Mbps, immediate access

HIPERLAN 1 PHY - specifications

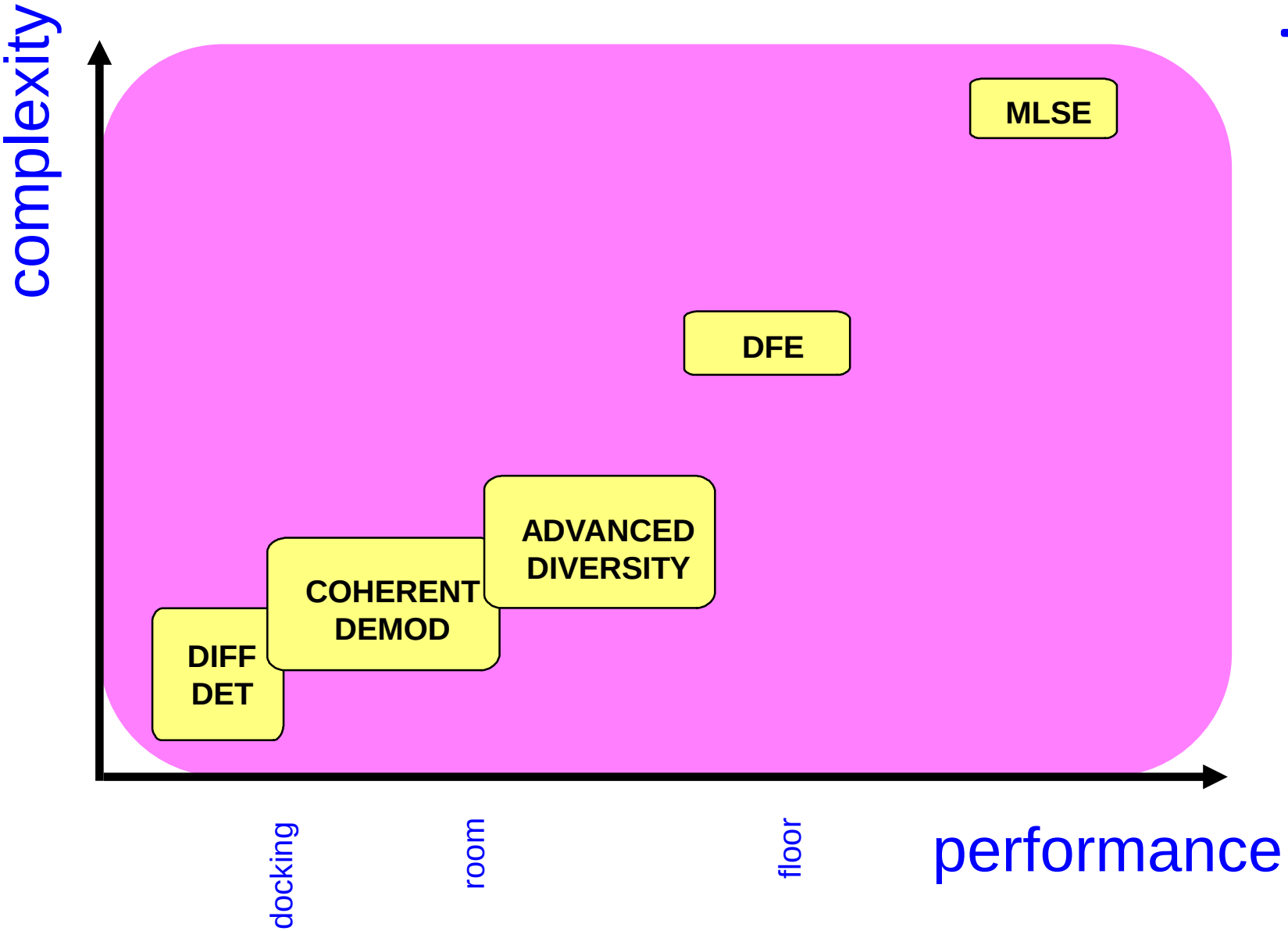
High transmission rate - 23.5294Mbps

- **Modulation - non diff GMSK, BT = 0.3**
- **Error control - FEC, BCH(31,26)**
- **Packet failure rate - 0.01 (4160 data bits)**
- **Low transmission rate - 1.470588Mbps**
- **Modulation - FSK, freq dev = 368kHz**
- **Channelisation - 5 channels, 5.15-5.30GHz**
- **Transmit power - +10, +20, +30dBm**
- **Receive sensitivity - -50, -60, -70dBm**

HIPERLAN 1 PHY - packets



HIPERLAN 1 - modem options



HIPERLAN 1 PHY - quirks

A HIPERLAN can only use one Channel

There is no mechanism for changing channel

Antenna diversity an option but...

Must use same antenna for CCA
and transmission for correct MAC function
Must reduce transmit power by antenna gain
to maintain EIRP as specified by CEPT

Power saving with...

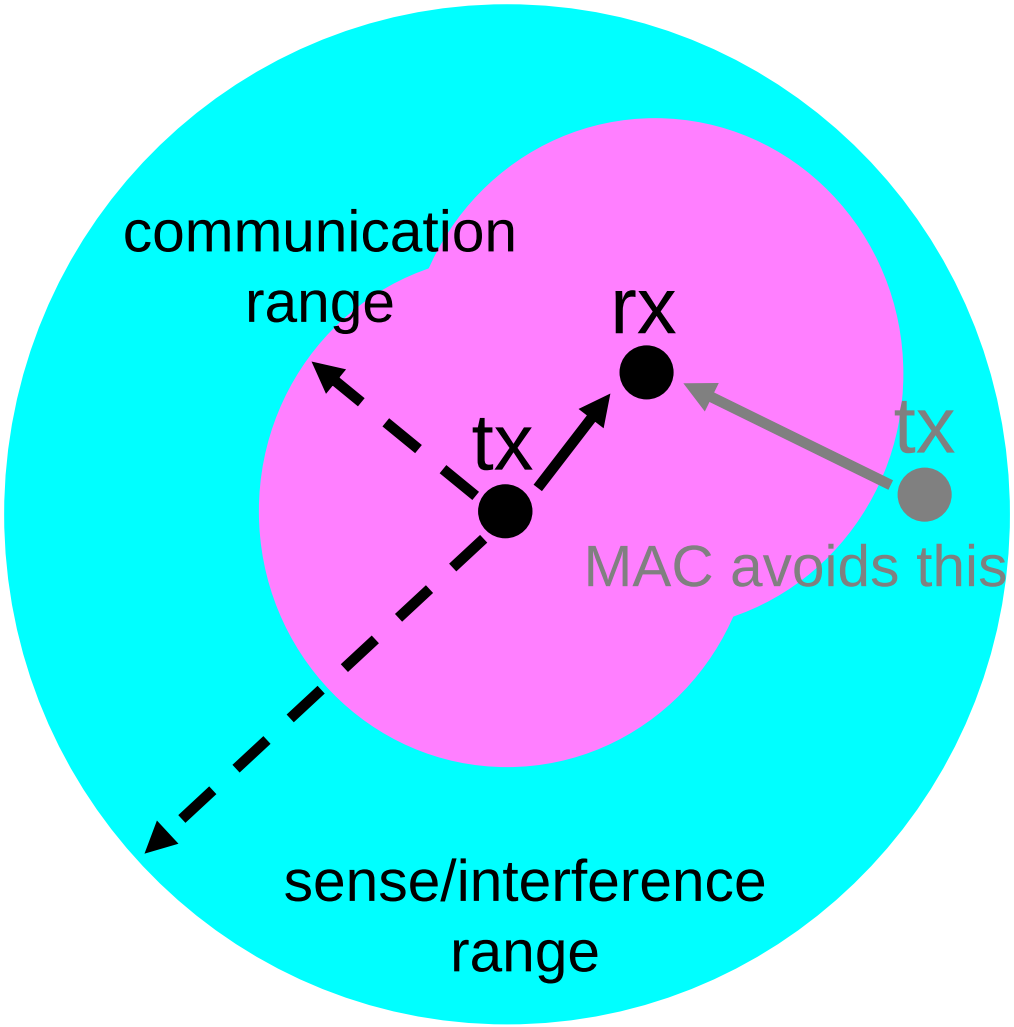
Low rate header for modem power saving
Power saving cycle strategies sleep/wake modes

HIPERLAN 1 MAC - concept

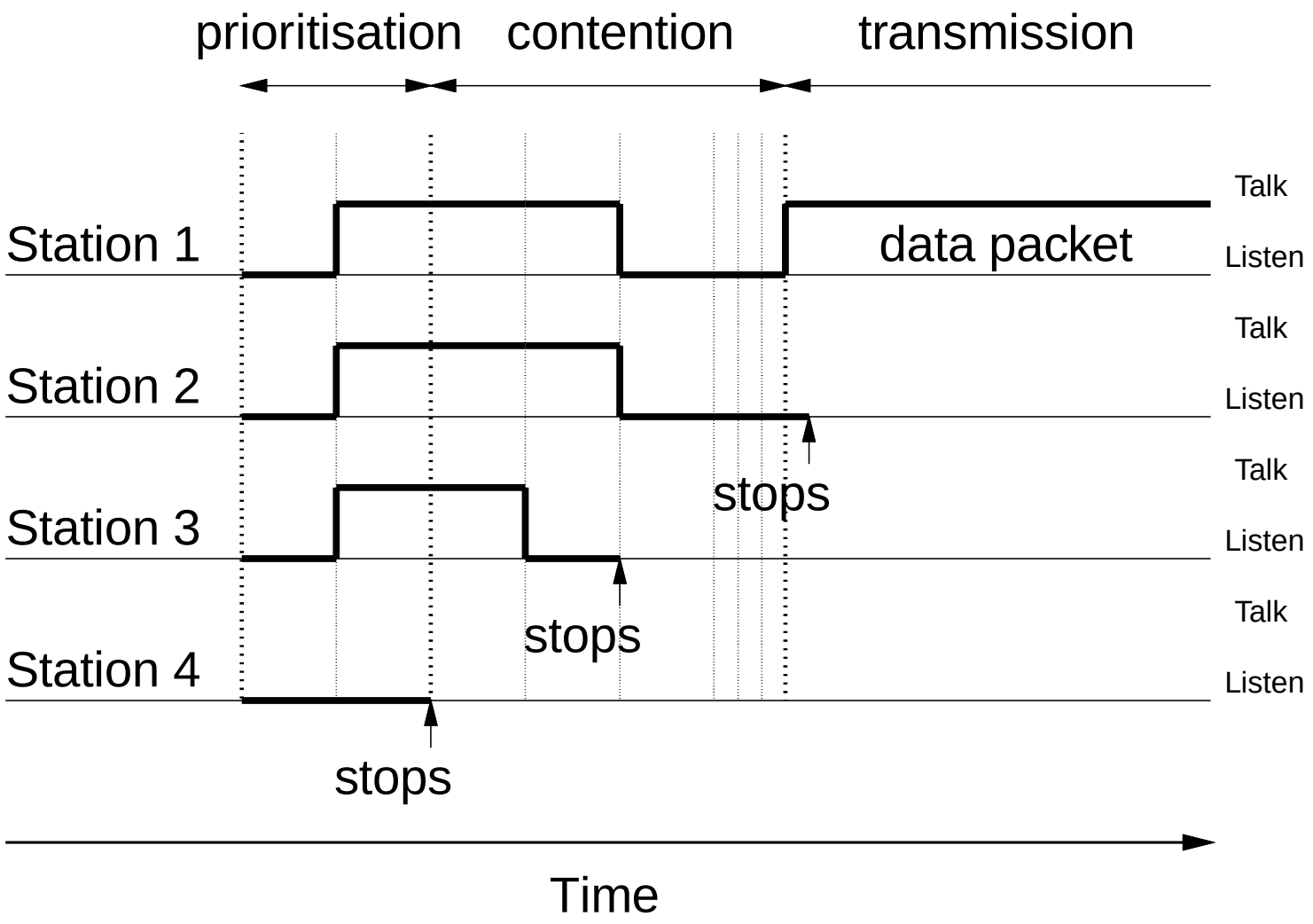
Fully distributed MAC

- **Networks with and without infrastructure**
- **Permits multi-hop relaying via neighbours**
- **Based on LBT - uses CCA**
- **with adaptive threshold**
- **EY-NPMA - Elimination Yield Non-pre-emptive**
- **Multiple Access**
- **Prioritiy assertion using listen-talk**
- **Contention resolution using talk-listen**
- **Immediate packet acknowledgment**

HIPERLAN 1 MAC - hidden nodes



HIPERLAN 1 MAC - function



HIPERLAN 1 MAC - phase

Prioritisation

1-5 slots of 168bits (talk)

Contention

Elimination - 0-12 slots of 212bits (talk),
1 slot of 256bits (listen), prob(talk-listen) = 0.5
Yield - 0-9 slots of 168bits (listen), prob(n) = 0.1

Tx to Rx turn around time 6μs

256 contenders, 3.5% collision probability

Total of 0-5152bits (0-219μs) MAC header

HIPERLAN 1 MAC - priority

Priority is a function of lifetime and user priority

NORMALISED RESIDUAL LIFETIME	HIGH USER DEFINED PRIORITY	LOW USER DEFINED PRIORITY
NRL < 10ms	0	1
10ms < NRL<	1	2
20ms < NRL <	2	3
40ms < NRL <	3	4
NRL > 80ms	4	4

If lifetime expires packet is discarded in the MAC

Either best effort latency for isochronous traffic

Or best effort integrity for asynchronous traffic

HIPERLAN 1 MAC - performance

Simulations show that the HIPERLAN MAC can simultaneuosly support

- **25 audio links @ 32kbit/s, 10ms delivery**
- **25 audio links @ 16kbit/s, 20ms delivery**
- **1 video link @ 2Mbit/s, 100ms delivery**
- **Asynch file transfer @ 13.4Mbit/s**

HIPERLAN 1 - testbeds

Two European collaborative projects

LAURA - not fully standards compliant

Demonstrated some concepts

No ASICs developed

HIPERION - fully standards compliant

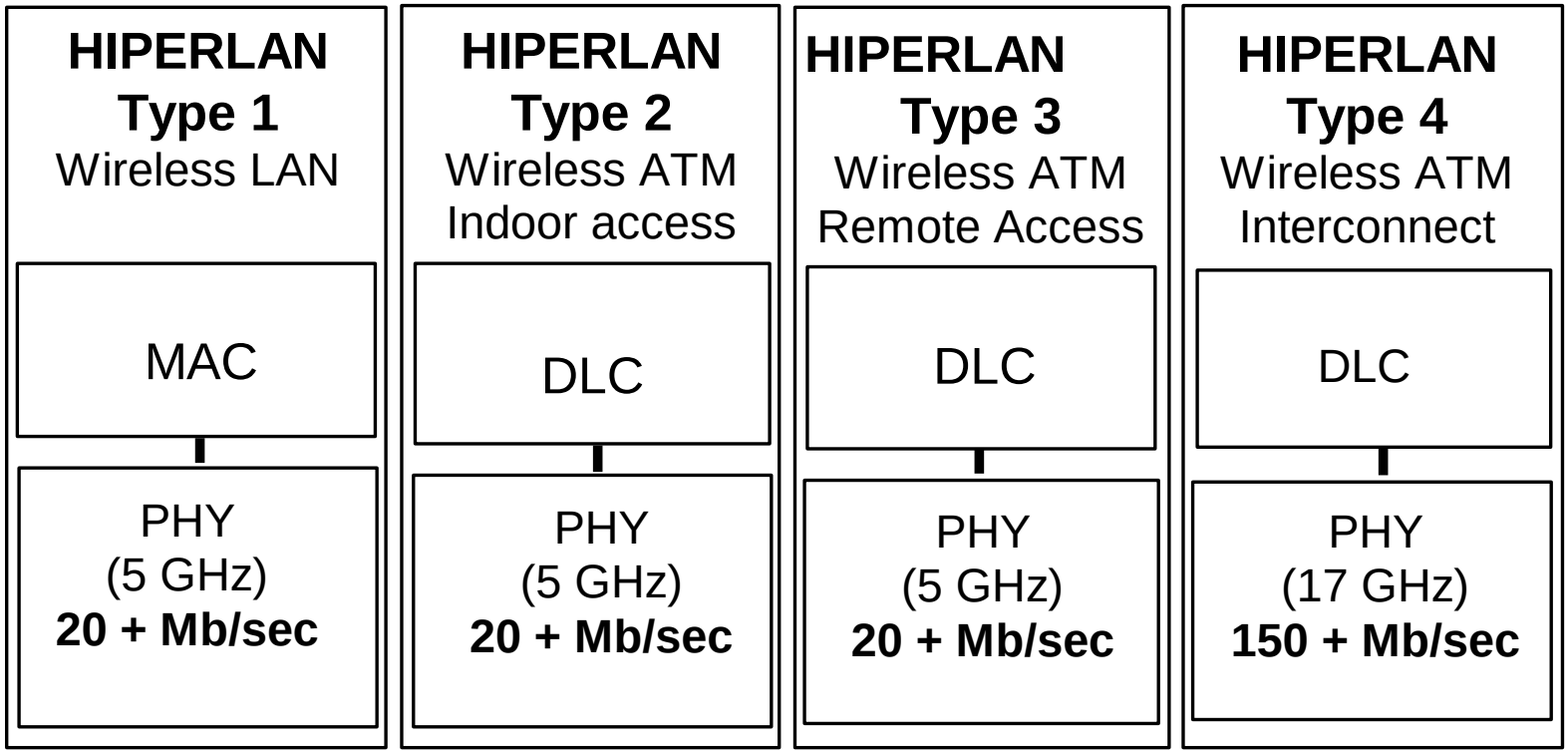
ASICs designed for...

RF MCM with GaAs and Si by GPS

Modem, Codec, D/A, A/D by Apple

MAC controller by ARM

HIPERLAN family (ETSI RES10)



HIPERLAN vision (ETSI RES10)