A Brief Time of History

Date: 2013-07-07

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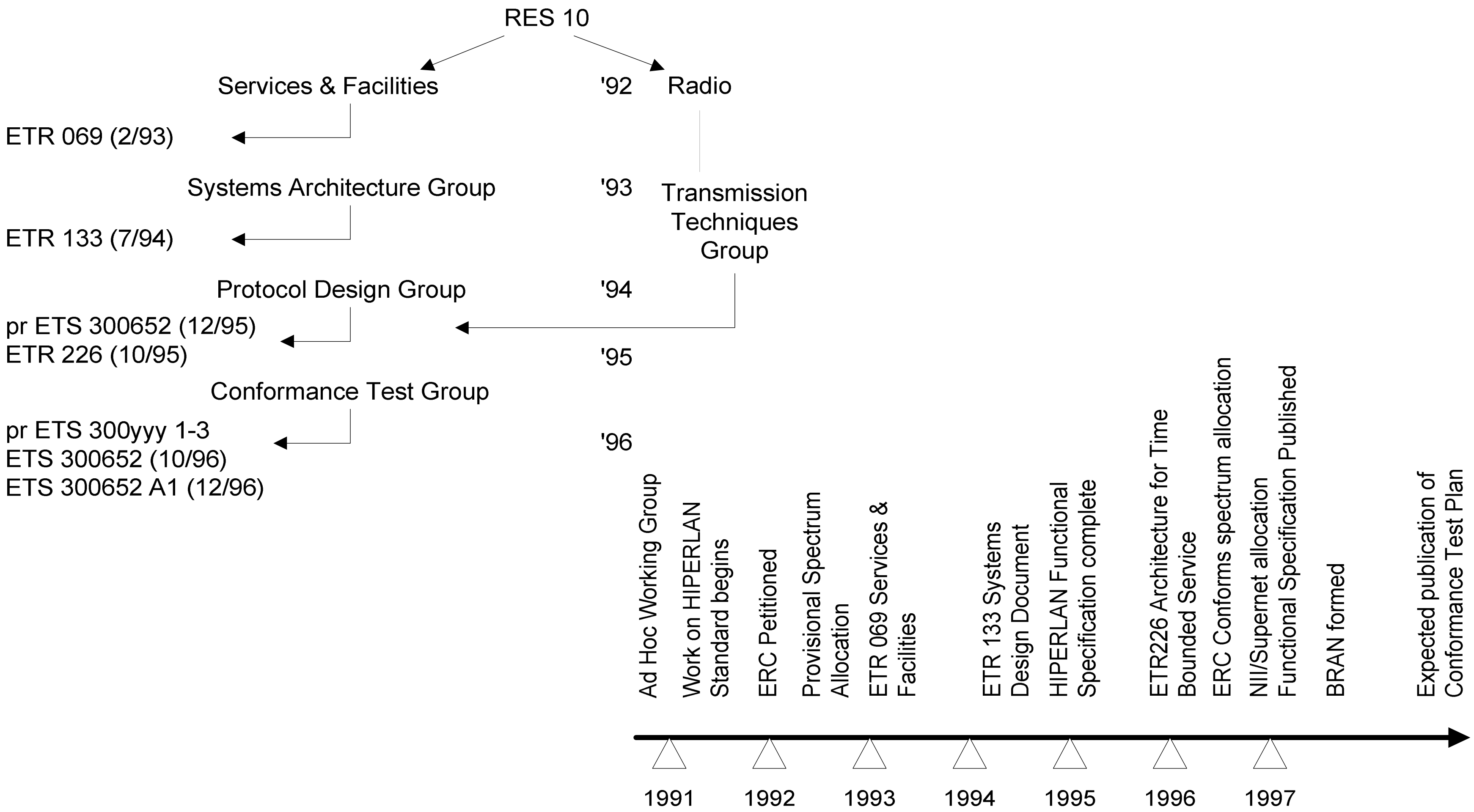
Abstract

This submission recalls the design of the HIPERLAN Channel Access Mechanism (CAM) which provided multiple levels of access priority, hierarchical independence of priority classes and medium access fairness.

The CAM was fundamentally stable under all conditions of channel load and was designed to efficiently support a large number of contenders for the channel.

HIPERLAN STANDARD DEVELOPMENT (The history bit…)



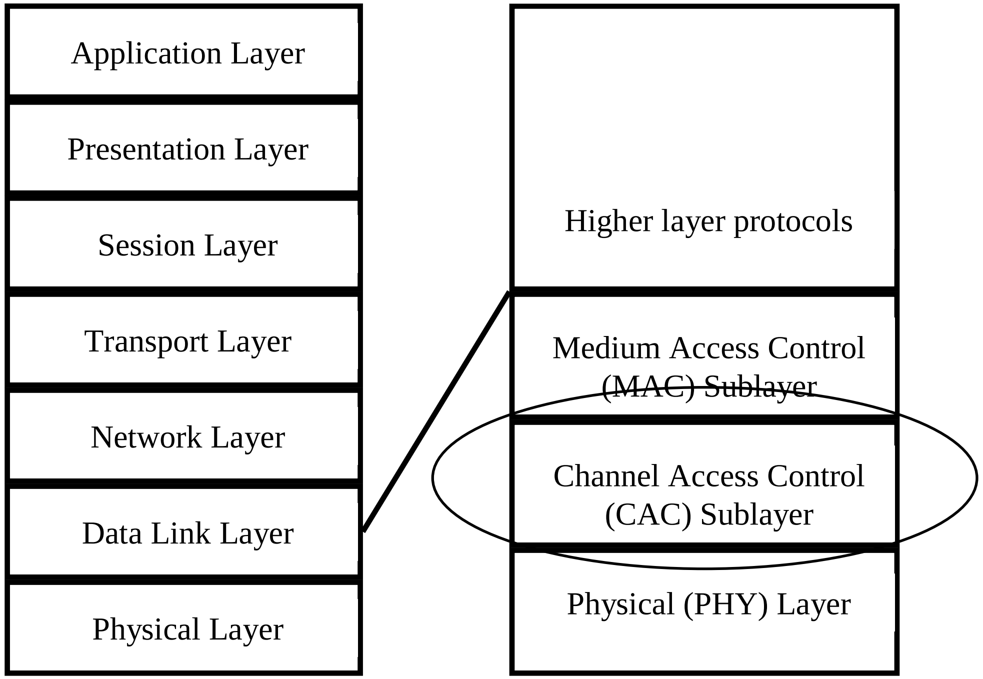
HIPERLAN CHARACTERISTICS (More history bit…)

- **licence exempt spectrum**
- **infrastructure-based or ad-hoc deployment**
- **independent node mobility**
- **ISO/IEEE 802 LAN compatible**
  - ISO/IEEE MAC Service support
- **european frequency allocation: 5.15-5.30 GHz (5 channels)**
  - 5.25-530 GHz (2 channels) subject to country permission
- **on-air data rate: 23.5294 Mb/s**
  - Expected user data (MSDU rate around 10 Mb/s
- **radio range: 50m**
- **time-bounded applications support**
  - user data (MSDU) QoS qualification: user priority and MSDU lifetime

HIPERLAN MAC OVERVIEW

- **HIPERLAN identification**
  - identification of overlapped HIPERLANs
  - reunion of fragmented HIPERLANs
  - exploitation of HIPERLANs within range
- **HIPERLAN confidentiality**
  - minimum measure against eavesdropping
- **HIPERLAN relaying**
  - Multihop communication with unicast and broadcast relaying by forwarders
- **HIPERLAN power conservation**
  - power conservation with co-ordinated reception
- **best-effort time-bounded data transmission support**
  - EY-NPMA, a priority-based hierarchically independent channel access mechanism
  - HMPDU selection for transmission attempt according to channel access priority
  - dynamic channel access priority determination according to normalised residual HMPDU lifetime and HMPDU priority

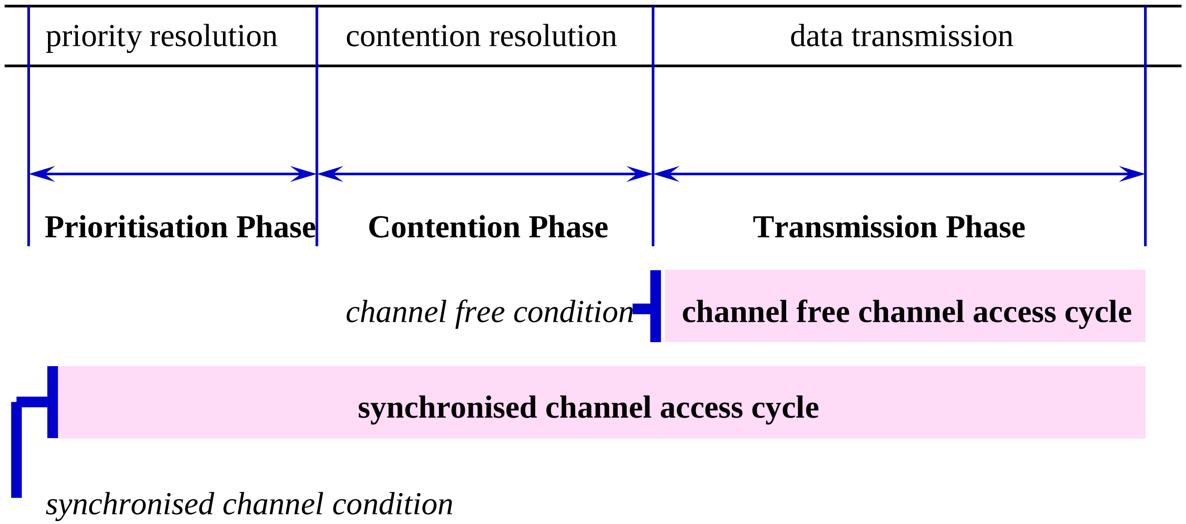
HIPERLAN COMMUNICATION MODEL



OSI Reference Model

HIPERLAN Reference Model

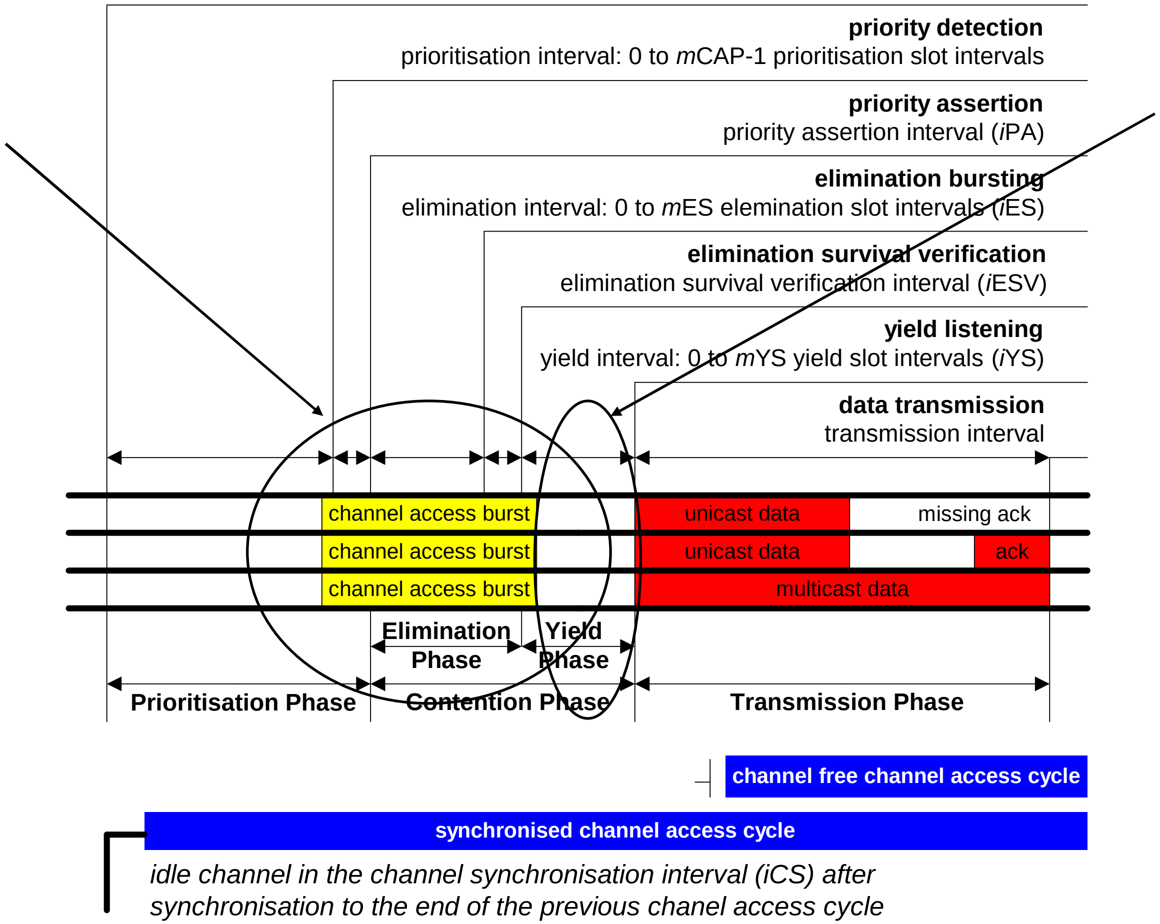
NON-PRE-EMPTIVE MULTIPLE ACCESS (NPMA)



- **prioritisation phase**
  - hierarchical independence of performance with channel access priority
  - non-pre-emptive priority resolution
- **contention phase**
  - statistically fair contention resolution
- **transmission phase**
- **channel access cycle**
  - synchronised channel access cycle
  - channel free channel access cycle

HIPERLAN CAM: ELIMINATION-YIELD NPMA (EY-NPMA)

- Choose an algorithm to reduce the contending set to a small number of survivors.
- Define slot size to fit transmission & channel properties
- HIPERLAN used 12 slots with probability of transmission 0.5.
- Residual population from ~100 contenders is small



- Choose an algorithm to select one from the small survivor set.
- HIPERLAN used linear slotted space of 14 slots with probability of listening of 0.9.

FEATURES OF INTEREST

- **Hierarchical Independence**
  - Traffic of a lower class does not affect the operation of traffic of higher classes
    - Passive priority schemes need to include contention resolution within priority space to achieve Hierarchical Independence
    - Active signalling separates priority assertion from contention resolution
- **Two separate contention resolution algorithms**
  - Large population is difficult to resolve efficiently and fairly with a single algorithm
  - Tune the initial separation to the supported contending population and desired survivor size using geometric separation
  - Tune fairness algorithm for the expected survivor size using linear separation
  - Tune overall algorithms for optimum residual collision rate
    - Overhead vs collision rate
    - Depends heavily on packet size
- **Low Complexity**
  - A single, variable length active burst
  - Tx/Rx switching minimized
  - Advantages of active signalling for very low complexity

HIPERLAN ANALYSIS

Table 1. Operation Parameter Settings.

Parameter	Value
Channel Bit Rate (Mbit/sec)	23.5
Channel Access Mechanism Priority Levels (H)	5
Maximum number of subseq. Elimination bursts (n)	12
Probability of bursting in an Elimination slot (q)	0.5
Maximum number of subseq. Yield listenings (m)	14
Probability of listening in a Yield slot (p)	0.9

Note: H = mCAP, n = mES, m = mYS

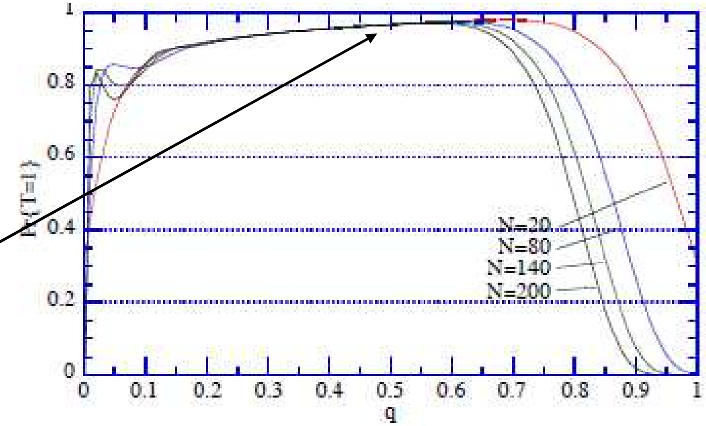


Fig. 4. Probability of successful transmission as a function of q.

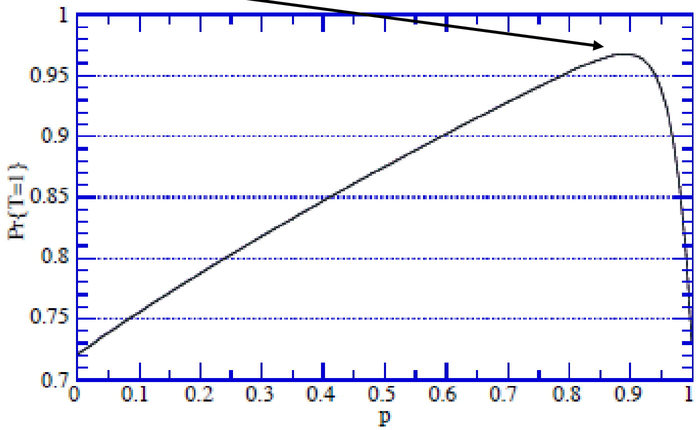


Fig. 5. Probability of successful transmission as a function of p.

Source: Lenzini et al paper – see References

References

- **Stability and Performance Analysis of HIPERLAN, G. Anastasi, L. Lenzini, and E. Mingozzi, Proc IEEE INFOCOM ’98**