HIPERLAN MAC Overview
For IEEE 802

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MAC Service Definition

• Service definition is based on ISO 15 802-1
  – To a higher layer the HIPERLAN MAC service
    interface looks very much like an “ordinary” MAC
    layer
  – IEEE 48 bit addresses
  – Quality of Service (QoS)
    • User Priority (0 or 1)
    • MAC SDU Lifetime (in milli-seconds)
HIPERLAN Architecture

- All nodes are equal
  - Peer-to-peer communication
  - No central controller, or “hub”
- A node may bridge to a wired network
  - Acts as an “access point”
  - It does not have any other “special” functions just because it is a bridge

Distributed MAC Architecture

- Unlike 802.11 there is no centralised PCF
  - HIPERLAN only has a few channels available and so different systems may have to share the same channel “fairly”
  - QoS can be supported in non-centralised manner
- Can bridge to a wired network
  - Bridges learn the location of MAC entities and copy data from input to output port if appropriate
  - HIPERLAN MAC layer and wired MAC layer can bridge data between themselves
    - HIPERLAN can be used for broadband radio access to an infrastructure network
    - This Access Point (AP) has no other special functions
- All functions are distributed
  - For example: Channel Access Control, Power Saving, Generating lookup confirm PDUs
**HIPERLAN Differentiation**

- Two HIPERLANs may occupy the same channel and location
  - Differentiation is by HIPERLAN identifier (and name)

```
HIPERLAN Name = X, ID = i

HIPERLAN Name = Y, ID = j
```

**Differentiation**

- HIPERLAN differentiation
  - How to differentiate logical groups of nodes (HIPERLANs)?
  - A string, the HIPERLAN name
  - A number, the HIPERLAN identifier
    - Name to identifier mapping should not clash
  - Similar to the 802.11 concept of a Basic Service Set (BSS) or an Extended Service Set (ESS)
  - You belong to a HIPERLAN if you have the same name and identifier

- HIPERLAN discovery
  - Joining node sends Lookup PDU
  - One of the established nodes sends a Confirm PDU including the HIPERLAN name and identifier
  - Similar to 802.11 probe and probe response
MAC Service Provision

- Queue of packets is NOT necessarily a FIFO
- Packet selected for transmission based on priority
- Priority determined by
  - Residual lifetime
  - User priority
  - Expected number of radio hops
- Highest priority packets jump to the front of the queue!
  - Shorter lifetime means higher priority means less queuing time
  - Therefore, QoS can be supported for a mixture of applications
- Channel Access Control (CAC)
  - Accepts MAC packets for transmission, with priority as a parameter
  - (CAC covered by another presentation)

MAC Service Provision

- Mapping MAC QoS to MAC priority
  - 1. Generate priority
  - 2. Order by priority
  - 3. Select head of queue for CAC
MAC Layer Error Control and Filtering

- **Error Control**
  - Packet is discarded once a good acknowledgement (ACK) is received
    - Multicast and broadcast packets are not acknowledged
  - OR when lifetime expires

- **Receive Filtering**
  - Duplicates may occur in radio networks
    - Because of missing ACK
    - Broadcast may be relayed by more than one node
  - Receiver filters on destination address
  - Receiver also checks source sequence number for duplicates

Security

- Implementation of security features is optional

- Security is based on encryption with a secret key
  - A node may have 3 keys
  - The key index is sent “in the clear”
  - User data is encrypted

- Encryption algorithm is specified
  - There is only one algorithm

- Key distribution mechanism is not specified
**Power Saving**

- Implementation of power saving features is optional

- Power Saving Node (p-saver)
  - Advertises when it will wake to receive individual (point-to-point) data
  - The advertised pattern is the Individual Pattern (IP)
  - IP includes regular wake and sleep phases

- Power Supporting Node (p-supporter)
  - Delays transmission to p-saver until the next wake phase
  - Advertises when it will send group (point-to-multipoint) data
  - The advertised pattern is the Group Pattern (GP)
  - GP includes regular wake and sleep phases that p-savers can follow
  - P-supporter ensures that group data is sent during wake phase of the GP

**Management Information Base**

- Power saving / supporting capability

- Current radio channel

- Observed load

- RSSI

- HIPERLAN name and identifier

- Heard HIPERLANs

- (Note that this list is not exhaustive)
Local Topology Maintenance

- Sending and Receiving Hellos
  - Nodes announce their presence with regular “Hello” PDUs
  - Mutual existence is derived from sending and receiving Hello PDUs
  - Nodes who determine “mutual existence” become Neighbours

- Decoding Hellos
  - Hello PDUs include information about Neighbours
  - Decoding a received Hello PDU gives information about my neighbour’s neighbours
    - “Two Hop” topology

Multiple Radio Hop Network

- HIPERLAN extends beyond one radio hop
  - Range extended using “forwarder” nodes
Forwarding

- Implementation of forwarding features is optional
- Forwarders
  - A HIPERLAN may extend over a range greater than one radio hop
  - Data may be relayed over multiple radio hops via forwarders
- Topology Maintenance
  - Topology is maintained over the whole HIPERLAN
  - Multipoint relays are forwarding nodes chosen to ensure multicast coverage of 2 hops with the minimum number of transmissions
- Routing
  - Each node computes the best next hop on the route to the destination
  - The use of a routing table is similar to IP routing, but the generation of the routing table is done automatically by the HIPERLAN protocol

HIPERLAN and 802.11 MAC Comparison

<table>
<thead>
<tr>
<th></th>
<th>HIPERLAN 1 MAC</th>
<th>IEEE 802.11 MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ad-hoc network</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Access Point bridge to wired network</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Power Saving</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Encryption</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Authentication</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Association</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Quality of Service</td>
<td>Yes</td>
<td>Not standardized</td>
</tr>
<tr>
<td>Multiple radio hop network</td>
<td>Yes</td>
<td>Yes (wireless Distribution System)</td>
</tr>
<tr>
<td>Roaming</td>
<td>Outside standard</td>
<td>Outside standard (Inter Access Point Protocol)</td>
</tr>
</tbody>
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