IEEE P802.11

802 LAN Access Method for Wireless Physical Medium

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TITLE: **DYNAMIC ACCESS-POINT REASSIGNMENT, OR THERE IS NO HANDOFF PROBLEM**

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GENERAL

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802.11 has a need for Stations to transfer consecutive messages using different access points so a movable or moving Station always uses an adequate radio path for its communication. Meeting this need has nothing whatever to do with handoff.

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THE HANDOFF FUNCTION

This writer first heard the term used by Collins Radio engineers in connection with air-ground telephone service in 1967. The idea was for a telephone call from an airplane to be continuous as it passed out of the range of one ground station into that of another.

The concept reappeared in descriptions of cellular telephone technology in the early 70's during the "HCMTS" phase (High Capacity Mobile Telephone Service when it was a 1,000 channel plan for one service provider). The function was the same.

The technology was publicly described in some detail when the first detail descriptions of the access protocol appeared about 1976-77, and it works as follows:

1. Initially, the mobile scans 21 possible signaling channels (each coming from a different base station site or antenna) evaluating the received signal level from each selecting one that appears to have the highest level. The synthesizer stepping rate is rarely faster than one channel per 12 milliseconds. A pause of many milliseconds is required to get an average level. It typically takes a mobile a few seconds to choose a new signaling channel. Mobile terminate calls are paged, and mobile originate calls are initiated on the selected signaling channel.

2. After a call is established, the triggering event for a handoff is low signal level at the base station from the transmitting mobile. This fact is detected at the mobile base station, and must be encoded for data transmission on a 2400-9600 baud (maybe 64 Kb/s now) data link to the MTSO (Mobile Telephone Switching Office) a central equipment serving a wide geographic area with many base stations.

3. Knowing the assigned channel on which mobile is talking, the MTSO uses the data link to ask a number of nearby base stations to report the received signal level on the specified talking channel.

4. The sites report back on the data channel the results of the measurement to the MTSO.

5. The MTSO decides that the signal level is highest at a particular site, and it selects a new talking channel number that is idle and equipped at that site.

6. The MTSO sends simultaneous data messages: a) to the mobile to mute the audio path and switch to the new talking channel, b) to the present base station to vacate the present talking channel, and c) to the new base station to activate the

new talking channel. The message to the mobile goes by inband data transmission which, considering redundancy and error correction, nets at about 2.5 Kb/s.

7. The mobile receives the message, mutes the audio path, sends an acknowledgment on the present channel, switches to the new channel and sends another acknowledgment message.

8. If everything happens properly, the audio path is muted less than 0.5 seconds and the call is resumed with a better signal. There are a large number of possibilities for the call being dropped during an attempted handoff.

It is now asserted that this process has very little in common with the needs of IEEE 802.11. The word "handoff" should not be used in this context because by common usage it now has an inappropriate meaning strictly limited to voice telephony.

IMPORTANT RELEVANT CHARACTERISTICS OF PACKET LAN TRAFFIC

The first observation is that one user uses much less than 1% of the available channel time, and that a reasonable maximum duration of one use is roughly 2.5 milliseconds at 1 Mb/s and 250 μseconds at 10 Mb/s.

> During the interval of one message a User will not move far enough to change the Access-point through which he is served. It may also be true that no change is required within the span of one maximum length packet (4,000 octets) requiring a dozen or more segments.

Given the necessary input facts, there is a lot of time between transmissions to process these facts into changes in Access-point assignments for each user.

LOCATION OF SIGNAL LEVEL MEASURING FUNCTION

Notwithstanding that FM IF strip IC's have had a built-in signal level measuring function for more than a decade (RCA CA3089), this is not an easy function for the type and duration of modulation that may be used for LAN. The decision must be made in a far shorter period of time than for well known radio types--even in radar. If this function can be avoided in Station radio, it should be.

One object of an access method, is keeping the Station radio simple and low power drain. Part of that is avoiding measuring and processing into decision received signal level at the Station.

It follows that actions based on signal level will only be made in the infrastructure.

The signal level can only be measured at the Access-point receiver, and the result reported to a Hub Controller common to many Access-points. This raises further important questions about required speed of measurement and transport for logical processing.

EVALUATING AND USING SIGNAL LEVEL INFORMATION

When a Station transmits, a report on current signal level should be appended. The result for several parallel receptions of that message should be compared, and the result posted in a dynamic listing of active Stations.

This will enable the infrastructure to send a message to a Station using a valid Access-point.

Parallel evaluation of received signal level is possible only when one channel in a group is used sequentially. If Access-points are differentiated by the virtual channels of spread spectrum, this information could not be obtained without a separate receiver for each code at each Access-point.

Assuming that at least the setup part of communication is done on a sequentially used channel, it would be possible to decide the Access-point to be used for the next following communication at a relatively leisurely rate. The assigned Access-point for a Station could be changed by subsequent command message if it is not too frequently altered.

The Station may know that the path is inadequate, when it fails to receive data accurately. At this point, the Station may have go back to an earlier state where it asks any readable Access-point to reevaluate its assigned status.

RECOMMENDATIONS

1. To the extent that a Station needs to have a defined Access-point for service, the decision should use data from the current transmission to be applied to a following use of the infrastructure.

2. The selection process should be entirely in the infrastructure.

3. The Station may make use of the fact that it is or is not receiving data accurately to initiate a re-evaluation of the assigned Access-point.

4. Handoff technology is not relevant to the needs of packetized wireless LAN.