Minutes of PHY Group Meetings at Dayton Ohio during the week of September 14, 1992

Prepared by Orest Storoschuck and Larry Van Der Jagt

The PHY-group had its first meeting of the week on the afternoon of **9/14/92**.

Larry Van Der Jagt (LV): Identified the following as possible agenda items for the week's work:

1) Identify objects common to all PHYs

2) How to get document written, straw man proposals were promised for this meeting and none were received. There are many items in the media independent area that can be written up. For instance, we should be able to write up proposals for DTE-DCE interface. There are many non-contentious topics that can be written now rather than waiting for contributions. One option is to break into groups to start writing. François Simon (FS) has an outline that we might start from.

3) Work on Jonathon Cheah's concepts of media independent methods for MAC/PHY interfacing.

A decision was reached to move forward with filling in François' outline.

In particular, we would work on Section 6 dealing with the PHY-service specification. This Section currently has the following content.

6 PHY Service Specification:

6.1 Overview of PHY Services

6.1.1 General Description

6.1.2 Overview of interaction

6.1.3 Basic service & options

6.2 Detailed Service Specification

6.2.1 PHY_data.request

6.2.2 PHY_data.indication

6.2.3 PHY_data.confirmation

6.2.4 PHY_characteristics.request

6.2.5 PHY_characteristics.indication

Rich Lee (RL): why don't we just adopt François' outline?

Larry: People haven't seen it yet, hopefully we can get an overhead or additional copies.

Dale Gulick (DG):lets just get issues and not wordsmith for now.

6.1 Overview of Phy Services:

6.1.1 General description of services provided

1) Transfer Physical Layer Interface Data Units (PHYIDUs) between MAC and PHY Layers in a manner consistent with ISO 7498

2) This standard is intended to insure interoperability between conformant stations of the same PHY type

3) The intention is to support a variety of different PHYs, using a common medium independent interface, there are three PHY types currently in active work: Direct Sequence Spread Spectrum (DSSS) in the 2.54 GHz ISM Band, Frequency Hopping Spread Spectrum (FHSS) in the 2.54 GHz ISM Band and baseband IR. In addition future work is anticipated in the areas of non-spread spectrum microwave and multi-channel IR.

4) In addition to PHYIDU's, information regarding the characteristics of the receive signal and current state of PHY control parameter vector are passed across the Phy/Mac interface on a frame by frame basis. There is also the capability for the adjustment of transmission parameters by the Data Link Layer on a frame by frame basis. This is in addition to conventional station management information on a per request basis.

6.1.2 Overview of interactions

The PHY entity determines the timing of all transmissions. When the MAC entity has a MAC protocol data unit (MPDU) to transmit and the MAC protocol gives the MAC entity (ME) the right to transmit the ME shall send the MPDU including the concatenated FCS by making a sequence of PHY-data.requests. This sequence of requests consists of a single request specifying start of activity, followed by xxx to yyy consecutive requests specifying data, and concluded by a single request specifying end of data and activity.

The PHY Entity (PHYE) signals its completion of each PHY-data.request and its readiness to accept a new PHY-data.request with a PHY-data.confirmation primitive. A second PHY-data.request should not be issued until the PHY-data.confirmation corresponding to the first request has been received from the PHY Entity

The PHYE reports, using the data service access point (DSAP), a received transmission with a sequence of PHY-data.indications which shall consist of:

a) a single indication specifying start of activity, followed by consecutive indications specifying data, followed by a single indication specifying end of data, and concluded by a single indication specifying end of activity.

b) a single indication specifying start of activity, followed by consecutive indications specifying data, followed by a single indication specifying end data and activity.

or,

c) a single indication specifying start of activity optionally followed by one or more consecutive indications specifying data, and concluded by a single indication specifying end of activity (note: this last sequence is indicative of an incomplete or incorrect reception).

In addition, the PHYE reports, using the signal parameter vector a set of PHY specific parameters (for instance, signal quality, channel used, received signal strength etc.), using the Parameter Service Access Point (PSAP). This reporting is synchronous with the reporting of the data on a frame by frame basis. In addition, when requested by station management, information on the managed objects will be reported by the PHY through the Layer Management Service Access Point (LMSAP).

6.1.3 Basic Service and Options

PHY's shall support the transfer of MAC Protocol Data Units (MPDU).

PHYs shall support a single channel. Support of additional channels is optional. If more than one channel is implemented, the MAC will be informed about the number of channels and the channel in use through the use of the PSAP. The MAC will be able to change channels using the PSAP.

PHYs shall support a single level of transmit power. Support of additional levels is optional. If more than one level is implemented, the MAC will be informed about the number of levels and the level in use through the use of the PSAP. The MAC will be able to change transmit power levels using the PSAP.

PHYs shall report the received signal strength relative to one threshold level. Support of additional thresholds is optional. If more than one threshold is implemented, the MAC will be informed about the number of thresholds, the value of the threshold, through the use of the PSAP. The MAC will be able to change channels using the PSAP.

PHYs shall implement a jabber control function. (Note:the need for an indication of a jabber control condition to the MAC is to be determined later).

6.2 Detailed Service Specification

6.2.1 PHY_data.request (class, data)

The parameter class specifies the PHY interface control information component of the PHY Interface Data Unit. Its possible values are:

start of activity - transmission of PHYPDU's which precede PHY user data should commence

data - the single octet value of indicating data transfer

end of data and activity - the PHYPDU that terminates the transmission PHY user data should be transmitted after the

last preceding PHY user data, culminating in the cessation of active transmission.

The parameter data specifies the PHY Interface Data component of the PHYIDU. It consists of one octet of PHY user data to be transmitted.

6.2.2 PHY_data.indication (class, data)

The parameter class specifies the PHY interface control information component of the PHY Interface Data Unit. Its possible values are:

start of activity- reception of an apparent transmission from one or more PHYEs has commenced

data- specifies that the associated Data parameter was received as part of a continuous correctly formed reception

end of data- the ongoing continuous correctly formed reception of PHY-user data has concluded with correct reception of PHYPDU implying end of data

end of activity- the ongoing reception (of an apparent transmission from one or more PHYEs) has concluded, with no further evidence of PHYE transmission

end-of-data-and-activity- the simultaneous occurrence of end of data and activity

The parameter data specifies the PHY Interface Data component of the PHYIDU. It consists of one octet of PHY user data that was received successfully.

6.2.3 PHY_data_confirmation (status)

The parameter status specifies either success or the locally detected reason for inferring failure. PHY_data.confirmation provides the critical timing feedback necessary to inhibit the MAC from starting a second transmission before the first is completed. The final PHY_data.confirmation should not be issued until the PhE has completed the current transmission.

9/15/92

Discussion, free association period on what was important for us to respond to in NPRM 90-314.

for the 1310-1320 band, the following were identified

Power spectral density

Channelization, 10MHz, 4*1.25MHz, 50*100KHz

2*10MHz, 16*125, 200*100KHz

Spectral Efficiency Metric

1 ppm frequency stability

Duty cycle

A decision was taken to address channelization first.

Larry: Do we want to have maximum bandwidth and to put up with interferers, or less bandwidth and no interferers

Vic Hayes (VH):MPRN min 6 DB is 2 MHz, is this implied channelization

Larry: I think this is a minimum bandwidth only.

VH : They allow you to transmit at 2 MHz, where do you do this?

LV: It appears that you can channelize to a minimum of 2 MHz.

John Eng (JE): Wim's small 1.5 MHz channelization may conflict with FCC.

LV: I am interested in seeing a maximum energy density specified.

Rich Lee (RL): It appears that they mean peak output power and peak output energy

LV: They state peak power is 1 watt and power density of peak 1.5 mw/3KHz in any 1 second.

RL: This is just a restatement of part 15 ISM number

LV: If we worry about interferers, we worry about their duty cycle, if we know what it is we can take different evasive action. In addition, I am not sure if power specification is clear because of questions about the time period of the measurement. Perhaps this is intended to be some kind of CISPR quasipeak measurement.

RL: Is it our position that we want to have limited dedicated spectrum, or more spectrum shared with regulated interferers (i.e. other legal ET band users)

John McKown (JM): We want dedicated spectrum even if it is less.

RL: If that is all we get are we satisfied?

JM: That question becomes obsolete after this takes off.

RL: Do we improve our position by asking for more if shared with other ET users?

LV: I believe that given today's techniques, channelization is wrong because you waste bandwidth through guardbands. I would prefer more bandwidth shared if the other ET have limits on power and duty cycle.

RG: Is the decision to channelize voice and data in or out of the 1.910 MHz-1.920MHz band one of coexisting with other users?

Nathan Silberman (NS): Is FCC allocating much more elsewhere for PCS?

LV: If we can define an environment where all have the same power and duty cycle, can we coexist or should each type be

given a smaller channel of their own, what is the 802.11 desire?

JM: Do we allow multiple PHYs?

LV: So far only in the 2.5 GHz band, we agreed to revaluate for ET band.

VH: We have consistantly asked for 70 to 140 MHZ, getting only 10 MHz we need to channelize.

RL: Couldn't we ask for the 10 MHz dedicated and ask for the bigger amounts?

LV: There are 2 specific proposals in NPRN, basically all bandwidth in one channel or segmented into smaller bands.

JM: Is this true, or does it stop short of asking for channelization? Should we comment on this or should we just make general statements?

LV: We could do that, but we could play the role of experts and provide recommendations.

JM: But we need to know our limitations.

RL: What do we lose if we leave ourselves open, this will be a splinter which will run out of room.

LV: We can say this is interesting but of little consequence in our efforts to make USA more competitive in the world marketplace.

NS: This will allow for low performance LANS, which will be a big disappointment to users and hurt later high performance LANS.

LV: We need to concentrate on mobility, they stated that anything fixed should be wired.

WD: The MPRN is defining the band only for mobile applications only.

VH: Page 4 states mobile and portable personal use which can coexist with others.

NS: Is there a low performance as well as a high performance LAN being defined in Europe?

VH: They will probaly get 100 MHz around 2.5 GHz plus more at 5 GHz

LV: Japan is getting 100 MHz, Europe 100 MHz, USA only 20 MHz

VH: Japan and Europe is spread spectrum.

Robert Gauthier (RG) : Maybe the distribution is wrong on carrier PCS versus LANS and unlicensed users.

LV: Can we decide on channelized or not?

VH: Can we state it in terms of packetized voive or other uses.

JE: Do we channelize within our 10 MHz?

JM: Channelize, do we move data through one large or two half size channels, but what if there are different types users such as isochronous vs asynchronous.

JE: You could send both types in one type of protocol.

JM: Is this a simple question of guardbands or is there more to it?

LV: There is both a political as well as technical aspect.

RL: We are inside of a building so we should be better off than other applications. We withstand higher interference than other applications.

LV: Others have stated that we could save battery life if we had a clear band and did not have to combat interferers.

RL: Do we burn batteries quicker but still sell something, or maybe get nothing?

MOTION:

Win Diepstraten (WD): Why not ask for 20 MHz with two classes of users primary, and secondary. there are users which will not coexist well in overlaping areas such as bursty vs. time bounded users.

NS: FCC will not accept primary/secondary users due to the problems in ISM bands, they will prefer channelization.

WD: An etiquette can take care of primary/secondary users.

LV: The problem in ISM is massive power differences.

NS: How do you insure coexistence among primary and secondary users operating under the same rules.

WD: We are talking about voice and data.

JM: One way is to reserve resources for isochronous services.

RG: WINTECH tried to come up with an etiquette to handle both voice and data but have not been able to do this.

LV: 802.11 should define what technical position we favor, and define an etiquette.

JM: I would prefer one band and one etiquette, but I don't know how to do this and we need to be able to answer how if we are going to comment in this way.

NS: Can we meet with the FCC and discuss the problem so we don't get backed into a corner.

This was followed by much discussions on what is the difference between multiple 802.11 users and users devoted to voice and data from an interference point of view. Also, did WINForum actually expect to get any convergence between voice and data? Since licensed PCS users already have a PCS-to-PCS interference level requirement that is relatively high couldn't they tolerate the noise we are likely to generate if

we shared their bands? Is it possible for licensed and unlicensed to coexist.

Motion:

RL: NPRM response to NPRM 90-314 accept FCC's tentative proposal for 20 MHz dedicated unlicensed spectrum and to further the goal of additional bandwidth requirements detailed in the July NPRM filing of 802 executive comittee. The 802.11 working group should first prioritize additional dedicated spectrum allocation, but in no way prejudice its support of current 20 MHz allocation. Our position is to seek additional shared bandwidth in absence of additional allocated bandwidth.

LV: Does this say channelize 20MHz into two 10's MHz channels?

RL: We should expand the motion with the concept to ask for the 20MHz and still state the need for the 70 MHz.

Revised Motion

RL 1) Our primary position is we want to expand unlicensed to 70 MHz to 140 MHz, for the reasons described in the July filing.

2) if that does not happen, we want to be considered coprimary, unlicensed in a band adjacent to 1910-1930 MHz 70-140 MHz wide in addition to primary status in 1910-1930.

second: JM

Discussion

JM: Is there any chance for 70-140 MHz?

LV: We can argue that other world wide organizations are working on this problem. We can add a table showing the allocations that other countries are considering to justify the position that we are not being given a competitive amount of bandwidth. We can also add information showing Tim Kwok's wideband application requirements for additional bandwidth.

RG: It will be argued against by licensed PCS proponents but we should make this statement nevertheless.

RL: called question

Bob Buass (BB) seconded.

Y	N	A
12	0	3 Passed

9/16/92

During the morning of 9/16/92 the detailed content of NPRM 90-314 with respect to the new proposed for Section 15.253 was discussed. The content of that discussion was distributed at the meeting in order to allow it to be addressed and it appears in IEEE P802.11-92/106. The reader is referred to that document.

9/17/92 AM.

LV: I am concerned that there is no apparent method to synchronize two access points between the MAC and PHY. There is no concept of a clock in the ISO abstraction. The question is how do you synchronize the PSAP with DSAP information as it comes in. Is there any information which would come across the PSAP without DSAP information.

JM: On the transmit side the MAC can synchronize by issuing two separate requests and waiting for confirms on both access points before moving on to a next state.

LV: This will work, but now what do we do on the RX side? First you get start of activity coming across the DSAP but is there a parameter vector for the PSAP at the same time (power, channel, transmit power level that the source sent at, etc.)? Can these be sent at the same time as start of activity or would we prefer to wait some time to either be able to determine what these values are, or perhaps there is some advantage to waiting. There may be a wake up that comes first before any activity.

JM: In some implementations, when the PHY senses activity, it first determines what the best way to adapt to that activity is, and only after it completes that process of adaptation, does it have an indication of what the quality of service may be.

BB. In some implementations of HDLC there was too much activity at the start of an incoming frame for the MAC to follow, resulting in the important information being missed. There may be two modes of operation, a power down sleep and a standby low power mode. There is little sense in operating correlators etc. if there is nothing out on the medium and when the transmitter has nothing to send.

LV: The synchronization between DSAP and PSAP is not required because the MAC can match up the messages passing across the SAPS as needed due to a well defined start of activity on both SAPS and the ability of the MAC to keep track of the order of indications flowing across the SAPS and if needed can keep them synchronized by state transitions (wait for an indication on DSAP and one on the PSAP before taking a specific state transition).

LV: The difference between transmit and receive as we have documented it so far is that TX is three legged while the RX is one legged (TX req. ind. conf, can't send another request till a conf, while the RX uses only indications). Question, on the receive side does the PHY ever need to wait for a confirm? Also on the TX side, will the MAC make a request to which the information coming back will take a longer time coming back so there would be a req. ind. conf. followed by a PHY indication. Should the PHY wait for a confirm. Is there any time that the PHY needs to talk to the MAC where it will

need to wait for a confirm. It seems likely that this may occur, so a mechanism should be provided at least initially.

Issue of MAC group: will there be a MAC (such as in an access point) which will operate over multiple PHYs (such as an access point with option of several PHYs which may be selected based on which may give the best results).

Orest Storoschuck (OS): The issue becomes, where does the decision of which PHY to use is made, in the PHY or MAC. Some implementations might use the CRC to decide, in which case the MAC would do this, but in other cases the quality of service might be signal strength in which case it could be resolved in the PHY.

Jose Aponte: (JA) If you are in a room you hear the main signal, then the echo, how do you integrate that?

JM: That is taken care of in the PHY.

LV: Logical Link control would take care of duplicates. If delay creates a duplicate that comes in separately and correctly, then the PHY and MAC must pass it up and let the LLC take care of it.

JM: There seems to be 3 distinct things, connection to a backbone media, a local "store and forward" relay which provides assistance for two stations to communicate which can not hear each other, and a central controller who mediates access to the media.

A decision was taken to get back to the problem of trying to put words together regarding the primitives used on the PSAP.

6.2.4 Phy-paramater.indication (class,data)

The class parameter specifies

Start of activity- indicates the reception of an apparent transmission from a PHYE has commenced. This indicates, e.g., that the Phy has sensed energy above some threshold of squelch/wakeup.

6.2.5 Phy-parameter.request

6.2.6 Phy-parameter.confirmation

It became obvious that this activity was better left to an editor using the DSAP primitives as a starting point.

Topic: Will all PHYs support at least one level of quality of service indication, optionally more.

OS: I don't see how we can get the MAC to assist the PHY in selecting options (particulaly if CRC calculation is required) without this.

LV: MAC can say that this is all the responsibility of the PHY

Brian Choi (BC): This could be something as simple as deciding when to switch between access points, as simple as signal strength.

LV: PHY would decide what to use as quality of service

JM: If MAC/PHY interface is like Jonathon's upload type, where a programmable MAC can handle particular MACs, is this a problem?

LV: If MAC has a concept that there is something in all PHYs which he wants to use to build, for example, tables based on address, this will not be an uploaded option.

JM: But would you not upload the whole MAC state machine.

JM: Example, a portable with multiple antennas, telephone application, roaming with slow motion, in contact with an access point which also has diversity, there is a constant activity to determine which set to use, there are "probe" packets used to measure which channel to use. There are both data traffic as well as non_data probing packets

LV: The MAC would generate these probe packets, if they were not inherently in the data packets. The MAC would send the source information, (how the source PHY was configured) the receiving PHY would indicate to its MAC what options it used to get a level of service and what that level is. The receiving MAC would decode the source information (such as TX power). It would use the source information, the local PHY information, and a mapping function that had been provided during initial configuration to determine the PHY source parameters to be used by this station to transmit to the original station.

JM: Is this uploaded to the MAC during the initial upload.

LV: The function is uploaded.

Max Shen (MS): The functions could be placed in station management.

LV: I do not like the need for a probe packet, only perhaps if there has been an extended period of inactivity.

JM: At 5 GHz, these switches can happen extremely quickly, you may need to probe other options which are not currently being used, so how do you know there performance without trying them?

LV: The MAC is keeping a table for connections which tells it what options to use which it updates with info from the local PHY and from the remote MAC and an initial uploaded function which tells the MAC how to use this information to update the connectivity table. The uploaded function can also have memory storage. The uploaded function does not change, only the parameters.

JM: There can be many functions of which a few could be selected based on parameters.

LV: To do these functions in station management, there would need to be communication on a packet by packet basis between station management, PHY and MAC to perform an optimization of medium use. This seems to be, by definition, medium access control.

LV: Probing packets can impose additional overhead and reduce the availability of media for data, but this is a MAC issue.

JM: You can use data packet when they are available, but there are channels, which are not being used which you need to know the quality of before you attempt to use them.

LV: It is not obvious if probing an "unused" channel does not prevent the channel from being used by someone else to move data

JM: It is not obvious which approach is optimal.

LV: Back to the question of should all PHYs report a quality of service.

LV: The MAC designer must add to the MPDU in order to have the parameter control vector the PHY is using to send the data, available at the remote MAC for storage in a table. The parameters must be in the remote table so that a function can be executed at the destination later when communicating back to the source.

JM: Why can't all this be uploaded

LV: Because some of these things need the decoding of the CRC before you can get the information, only the MAC can get at the source generated parameters.

JM: There may be some things sent by the TX MAC to the TX PHY which no one else needs to know

LV: Agreed, only some info needs to get to the remote,

1) how does the TX MAC tell TX PHY how to set up, can be a) part of the PDU, in which case the TX PHY will need to look at it as it comes down and either strip it out or send it on or b) through the psap

2) some info goes to the remote PHY, PHY will not decode bits since he does not have CRC calculation, it goes up to the RX MAC who pulls out the parameter control vector (pcv) and places it into his table along with his local PCV so he knows how his local PHY was set up.

When the remote PHY wants to send back, he pulls out the two PCVs and the function could be done by either MAC or PHY provided the MAC provides the PCVs to the PHY.

JM: The MAC will have to perform some functions because it is a MAC.

LV: To get the PCV to the other MAC it must be built into the MAC PDU. The PHY can not do this, so the only ISO model way of getting the PCV across is by MAC, Local PHY can't talk to

remote MAC. It follows that these functions and tables belong in the MAC.

Work to be done for next meeting:

IR phy ad hoc group will provide submission in November

FH ad hoc group will provide a submission in November

Channel/conformance ad hoc group needs to be formed

DS ad hoc group needs to get more members and get submission, Toshiba will have submission by Nov.

Objective for November meeting:

1) review submissions from IR, FH, DS, and channel/conformance ad hoc groups

Motion: JM form ad hoc group for channel/conformance

BB second

Y	N	
10	0	passes

JM, OS, JA, Bob Aschatz volunteer for channel/ conformance group, copy of RES 10 Data and Masleid Video may be available in November.

2) Continue work in filling in outline of PHY document and contributors are solicited. Much time can be saved if someone could"cut and paste" ahead of time.

3) Respond to any new developments from 90-314 NPRM

Note to anyone reading these minutes, all contributions to any of the above efforts are invited particularly prior to the meeting.

Anyone interested to chair if LV cannot attend next meeting is welcome.