

IEEE P802.11 Wireless LANs

[Minutes of High Throughput Task Group .11n Session]

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Abstract

Cumulative minutes of the High Throughput Task Group meetings held during the IEEE 802.11 Interim session in Hawaii from January 16 through 20, 2006. The session was chaired by TGn chair Bruce Kraemer from Conexant.

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Executive Summary (also see Chairs' meeting doc 11-05-1249r5 and closing report doc. 11-06-0222r0):

1. TGN Joint Proposal team presented their complete proposal to the IEEE 802.11TGN body as contained in documents:
 - 11-05-1095r5 [MAC]
 - 11-05-1102r4 [PHY]
2. The JP proposal overview was presented to the body in documents:
 - 11-06-0045r0 - Overview
 - 11-05-1161r2 – Phy Details
 - 11-05-1165r5 – MAC Details
3. Ample time was made available for Q&A
4. Confirmation vote on adopting the JP as the TGN baseline document was held and the body approved it unanimously (184,0,4)
5. A Technical Editor Election was held and Adrian Stephens from Intel was elected by acclamation.
6. An ad hoc committee was formed to develop a PICS and MIB in time for the March meeting; Adrian Stephens volunteered to chair this committee; first conference call set for Feb 20 at 11 AM EST
7. An ad hoc committee was formed to develop a Coexistence Assurance document; Sheung Li volunteered to chair this committee; first conference call set for Feb 20 at 4 PM EST
8. Plans for March meeting were discussed and included:
 - Presentation of draft & discussion
 - Presentation of CA; discussion; joint meeting with .19; vote?
 - Presentation of MIB & PICS; discussion; vote to incorporate in draft?
 - Review timeline
 - Set logistics for TGN peer review of draft before going to first LB

Note: Relative to presentations, these minutes are intended to offer a brief summary (including document number) of each of the presentations to facilitate review and recall without having to read each of the presentations. Most of the 'presentation related' minutes are built directly from selected slides and therefore are not subjective. An effort was made to note obscure acronyms. As always Q&A is somewhat subjective/interpretive on my part and therefore subject to question.

Detailed cumulative minutes follow:

Monday; January 16, 2006; 10:30 AM – 3:30 PM [~ 175 attendees; 9 new]

1. Meeting was called to order by Task Group chair at 10:30PM
2. Chairs' Meeting Doc 11-05-1249rx

3. Chair read IEEE-SA Standards Board Bylaws on Patent Policy and additional Pat Com Guidance; chair noted change to 2006 version!
4. Chair reviewed topics NOT to be discussed during the meeting including – licensing, pricing, litigation, market share
5. Letters of Assurance (LOA) can be sent to Pat Com but details should not be discussed here
6. Attendance reminder – for this meeting attendance will be manual (IEEE registration desk) and on an honour system
7. Now is the time to confirm your voting status especially in view of the likely confirmation vote later this week – see Harry if you are unsure
8. Reminders:
 - 8.1. Make sure your badges are visible especially when voting
 - 8.2. No company logos on presentations
9. Chair reviewed history of .11n in order to provide the background to set the agenda for this meeting:
 - 9.1. HTSG formed in 9-11-02
 - 9.2. TGn formed 9-15-03
 - 9.3. Mar 05 1st confirm vote which failed
 - 9.4. July 05 formed JP
 - 9.5. Jan 06 JP proposal made to .11n
 - 9.6. Goal remains a ratified standard in April 2007
10. Nov proposal for January's Agenda reviewed and noted that it was based on JP proposal put on server by Jan 9, 2006
11. Exec Summary from Nov minutes 11-05-1148r0 presented
- 12. Motion by Amer Hassan to approve Nov minutes, 11-05-1148r0, was seconded by Jon Rosdahl and approved unanimously**
13. Chair listed doc numbers posted by JP prior to this meeting as:
 - 13.1. 11-05-1095-04-000n Joint Proposal MAC Specification
 - 13.2. 11-05-1102-04-000n Joint Proposal PHY Specification
 - 13.3. 11-05-1268-01-000n TGn Joint Proposal MAC1 Results
 - 13.4. 11-05-1267-01-000n TGn Joint Proposal MAC Simulation Methodology
 - 13.5. 11-05-1266-01-000n TGn Joint Proposal MAC Results
14. Chair listed doc numbers of JP supporting documents
 - 14.1. 11-05-1269-00-000n TGn Joint Proposal MAC2 Results
 - 14.2. 11-05-1270-00-000n TGn Joint Proposal MAC3 Results
 - 14.3. 11-06-0046-00-000n TGn Joint Proposal FRCC Compliance
 - 14.4. 11-06-0067-00-000n TGn Joint Proposal PHY Results
 - 14.5. 11-06-0045-00-000n Joint Proposal Opening Report
15. Changes to Chair's list?
 - 15.1. 11-05-0067r0 to r1
 - 15.2. add new doc from Institute for Infocom Research, 11-06-0084r0
 - 15.3. add 11-05-1165r5, Joint Proposal MAC Detail which will be posted before lunch
16. Chair proposed an agenda for this meeting (granted 16 hours total) which was modified; the modified agenda is shown in the following table which is followed by a description of how the acceptance of the modifications were achieved:

Jan 16**Jan 17****Jan 18****Jan 19**

Time	Monday	Tuesday	Wednesday	Thursday	Friday
8:00-10:00				First Confirmation vote at 9:00 AM	
10:30-12:30	Opening JP Overview			Comment Resolution	
13:30-15:30	PHY Rationale and Q & A			Second Confirmation vote	
16:00-18:00		MAC Rationale and Q&A		Technical editor Coexistence Plans for March	
19:30-21:30		Q & A			

17. Agenda overview

- 17.1. Monday – AM2 admin and JP presentation, PM1 Q&A
- 17.2. Tuesday 4 hours for Q&A
- 17.3. Wednesday – no time allocated
- 17.4. Thursday – AM1 Q&A, AM2 confirmation vote special order, PM1 Technical editor election (Sean Coffey has withdrawn his candidacy leaving only Adrian Stephens but nominations are still open), PM2 plans for Mar

18. Recommended change – Monday PM1 devoted to PHY presentation and MAC presentation Tuesday PM2 and evening was accepted

19. Other presentations? A – none

20. Other agenda items? A – none

21. Suggested 9 AM confirmation vote as special order on Thursday with a 2nd confirm vote if needed for Thursday PM1 was accepted

22. Confirmation vote procedure alternatives

- 22.1. Show of hands
- 22.2. Verbal but recorded
- 22.3. Paper process

23. Discussion – our process calls for a roll call vote

24. OK - verbal or paper?

25. No objection to a verbal roll call vote

26. Note that the agenda can be changed with 2/3 majority; e.g., not use 2nd roll call vote

27. Need to change dates on columns of agenda from 9-12 to 16-20
- 28. Motion to approve agenda on slide 22 with amendments by John Barr and seconded by Jim Petranovich was accepted without objection**
29. Presentation "JP Opening Report" 11-06-0045r0 Introduction by Jon Rosdahl
 - 29.1. JP has completed and is READY
 - 29.2. 300 meeting hours by JP since July
 - 29.3. JP team is united in its support of this proposal
30. Phy summary by Aon Mujtaba
 - 30.1. High Level changes since Nov
 - 30.1.1. Mandatory ~150 Mbps -> ~600 Mbps with Optional features (slide 17)
 - 30.1.2. Number of encoders: 1 below 300 Mbps and 2 above (added 5/6 coding)
 - 30.1.3. Parser – Group wise
 - 30.1.4. Antenna mapper – TX Beam Forming (BF) option
 - 30.1.5. GI – 400 ns optional
 - 30.1.6. Short MIMO preamble – Green Field optional
 - 30.1.7. HT-SIG modulation – 2 symbol 90 degree rotated Q-BPSK
 - 30.1.8. Scrambler initialization – Service Field in MAC Header
 - 30.1.9. MCS set – asymmetric MCS sets (for STBC and TxBF)
 - 30.1.10. Advanced Coding - LDPC
 - 30.1.11. Sounding packet Format – staggered preamble & zero-length Frame (both optional)
 - 30.1.12. STBC – 3x1 and 4x1 added as optional
31. MAC summary by Adrian Stephens
 - 31.1. High Level Changes since Nov
 - 31.1.1. Added new features
 - 31.1.1.1. PCO 20/40 MHz operation
 - 31.1.1.2. Greenfield & RIFS operation
 - 31.1.1.3. MIMO power saving
 - 31.1.2. A-MPDU – about 2.5 x Data/ACK (aggregation at bottom of MAC)
 - 31.1.3. A-MSDU - ~20% on top of A-MPDU (aggregation at top of MAC)
 - 31.1.4. Reverse Direction - ~25% benefit
 - 31.1.5. Enhanced Block ACK - ~5-10% benefit
 - 31.1.6. PSMP/MTBA – VoIP call density increase of up to 2x non-PSMP (power save multi-poll)
32. Final Thoughts by Jon Rosdahl
 - 32.1. complete
 - 32.2. Recommend body approve 11-05-1095r4 and 11-05-1102r4 as baseline in confirmation vote
33. Bruce presented changed agenda (see above) and noted we have 45 min remaining this AM; how to use this time?
34. Phy team preferred to wait until PM1 session at 1:30 PM before starting PHY details
35. Questions/Comments on Opening presentations
 - 35.1. really a home coming week for .11n
 - 35.2. proposal looks very good
36. Session was recessed at 11:45 AM until 1:30 PM today
37. Session was reconvened at 1:32 PM by the Chair

38. JP PHY Overview, 11-05-1161r2 by Jim Petranovich and Aon Mujtaba
- 38.1. What's New, Basic – Jim Petranovich
 - 38.1.1. Spatial Division Multiplexing through MIMO (most basic is # SS= # TX antennas)
 - 38.1.2. Bandwidth Expansion
 - 38.1.3. New MCS Sets
 - 38.1.3.1. Note – symmetrical indicates each spatial stream uses the same MCS
 - 38.1.4. Higher Rate Binary Convolutional Code
 - 38.1.5. New Frame Formats
 - 38.1.6. RIFS (Reduced Inter-frame Spacing)
 - 38.2. What's New, Advanced by Aon Mujtaba (Motivation was increased robustness and performance)
 - 38.2.1. Short GI option
 - 38.2.2. Spatial Expansion (all are linear transformations unlike SDM)
 - 38.2.3. Space-Time Block Codes (good for single stream devices)
 - 38.2.4. Channel Sounding (antenna to antenna sounding)
 - 38.2.5. Transmit Beam Forming (complex - affects virtually everything in PHY spec; due to loss of reciprocity over time use reciprocity with care)
 - 38.2.6. Low Density Parity Check Code (systematic => input data + redundancy is transmitted)
 - 38.2.7. Synopsis – took Shannon's law and used every trick known to get as close as possible to it
 - 38.3. Conclusion
 - 38.3.1. JP PHY submission is a good basis for the 802.11n PHY specification
 - 38.3.1.1. Standardizes use of SDM and bandwidth expansion
 - 38.3.1.2. Provides for data rates up to 600 Mbps
 - 38.3.1.2.1. Includes state-of-the-art techniques to enhance throughput, including TxBF, STBC, and LDPC
 - 38.3.1.3. Extensible architecture meets the needs of many segments of the industry
 - 38.3.1.3.1. One spatial stream in clients and STBC support for hand-held segment
 - 38.3.1.3.2. Multiple spatial streams, TxBF, and channel sounding for CE segment
39. Chair asked for Questions from the floor
- 39.1. PAR specs at least a 100 Mbps mode? A - yes but <100 Mbps modes are permitted and AP always supports >100 Mbps since 2 SS supported
 - 39.2. Options typically are not implemented? A – disagree in this case since options are NOT redundant and will be essential for some features
 - 39.3. The confluence of many markets drove this spec and precipitated the wide range of options and performance levels
40. If no more Qs now remember that email Qs can be submitted this week
41. Recall that we need a CA doc to go to LB; tomorrow 1:30 PM .19 TAG will review methodologies to analyze co-existence
42. We have 45 minutes remaining, should we start MAC? A – will require more than 1 hour so would rather not
- 43. Motion to recess until Tuesday at 4:00 PM by Jon Rosdahl and seconded by Jim Petranovich passed unanimously**
44. Chair recessed the session at 2:38 PM until 4 PM tomorrow

Tuesday January 17, 2006; 4:00 – 9:30 PM

1. Chair called session to order at 4:01 PM
2. Adrian Stephens presented doc 11-05-1165r5, Joint Proposal MAC Detail; Part A up to slide 33
 - a. Primary function of the MAC is aggregation
 - i. A-MPDU (bottom of MAC)
 - ii. A-MSDU (top of MAC)
 - iii. Little benefit for fragmentation within Aggregation
 - iv. Power Save Multi-poll (PSMP)/Multi-TID Block Ack (MTBA)
 - v. Reverse Direction (RD)
 - vi. High Throughput Control Bit
 - vii. MIMO Power Save
 - viii. Link Management
 - ix. Implicit Channel Feedback
 - x. Explicit Channel Feedback
3. Matt Fischer presented Part B of doc 11-05-1165r5; slide 33 to end
 - a. Zero Length Frame
 - b. Transmit Antenna Selection
 - c. Coexistence Mechanisms
 - i. PCO= Phased Coexistence Operation
 - d. RIFs ~ 2 usec
 - e. MAC Capabilities
 - f. PHY Capabilities
 - g. Summary of Value of Features
4. Questions
 - a. MCS Request Feedback, is it in the HT control field? A – MCS is only a recommendation; end point will monitor carefully; no calibration testing
 - b. Length information included? A – no
 - c. MIMO Power Save; what does it mean? A – allows Rx to shut down all but one receiver until multiple Rx needed
 - d. How much power saving? A – difficult to simulate; a mechanism to ensure not disadvantaged wrt SISO device
 - e. A-MSDU mandatory? A – yes
 - f. Will you always have QOS control field? A – no
 - g. Slide 52; differences between 2nd and 3rd rows? A – simulation scenarios
 - h. Non-QOS? A – QOS references VoIP and video, non-QOS does not
 - i. Ratio? A – BW delivered vs. BW offered; QOS and non-QOS flows are simultaneously offered and load sized to be impossible to meet; measures how close a system can come
 - j. Slide 20; is TID set a bit map? A – yes, EDCA only has 8 bits
 - k. Slide 71; AS criteria time durations for sounding frames? A – 16 usec between frames and updating of selection info is implementation specific
 - l. Slide 56; who should I talk to? A – Adrian re: Table 43 in spec
 - m. Similar to clause in 7.2.2 in current standard; question use of BSS ID in address fields? A – sub frame header contains src and des; multiple src addresses are possible now so we choose BSSID; refer to Figure 28
 - n. Text not clear? A – may need to clarify
 - o. Note: A-MSDU is always a single hop frame and not forwarded

5. Are there enough questions (MAC or PHY) to justify using the evening session? No response
6. Comments from Floor
 - a. Use reflector or directly email authors
 - b. Also we have the Thursday 8:00 AM hour
7. Chair reviewed agenda for the rest of the week, namely:
 - a. Confirmation Special Order at 9 AM on Thursday
 - b. Technical Editor Election on Thursday
 - c. Planning for March on Thursday
8. Chair noted that there still was only one nominee for editor, Adrian Stephens, and there is still time for additional nominations; sooner the better!!!
9. **Motion to recess until Thursday morning at 8:00AM by Jim Petranovich and seconded by Assaf Kasher passed unanimously**
10. Chair recessed session at 5:42 PM

Thursday January 19, 2006; 8:00 AM – 6:00 PM

1. Chair called the session to order at 8:04 AM
2. Chair reviewed plan for the day:
 - a. 8-9AM – Q&A
 - b. PHY doc now at rev 2 as two new companies have contributed to the sim results
 - c. 9 AM – special order verbal roll call vote
 - d. Comments or questions?
 - e. Could we bring forward other topics to be addressed today? A - yes
3. Jon Rosdahl – spoke to encourage the membership to confirm the JP proposal as the baseline for TGn and noted that this does not mean it is accepted but rather that it is just the start of the amendment development process
4. **Motion by Jon Rosdahl and seconded by Adrian Stephens to “Conduct a confirmation vote on the existing proposal of record, the Joint Proposal, in 802.11-05/1095r5 and 802.11-05/1102r4 pursuant to the selection process step 17 (802.11-03/0665r9)” passed without objection**
5. Sheung Li gave TGn an update on the .19 as follows:
 - a. PAR & 5C was created in .19 on Tuesday to form a coexistence recommended practice Task Group
 - b. Need volunteers from .11n to join the task group when it is approved
 - c. Coexistence with cordless phones and BT for example
 - d. Pending confirmation of the JP Sheung will make a formal motion to form a .11n ad hoc group to develop a coexistence analysis which will comply with the recommended practice
 - e. Document will be a PHY level analysis – e.g., if within x meters of a y radio you can expect z degradation
6. Only one nomination for Tech Editor has been received but floor is still open
7. Again chair asked for Questions? A – none
8. No objection to terminating Q&A
9. Chair recessed the session at 8:22 AM until 9 AM
10. Chair reconvened the session at 8:58 AM
11. **The verbal roll call confirmation vote was held and counted by WG executive**

12. Confirmation vote results were (184,0,4); a 100% confirmation result which certainly exceeds the required 75% threshold!!!!!!
13. At 9:45 a motion was made by Jim Petranovich and seconded by Adrian Stephens to recess until 10:30 AM passed unanimously
14. Chair reconvened the session at 10:34
15. Technical Editor Election
 - a. No new nominations
 - b. Adrian Stephens accepted the nomination and made a presentation 11-05-0287r2 (his candidacy speech updated from last year)
 - c. Still plans on forming a team of editors at 1 PM
 - d. Goal - Initial Draft by March 2006
 - e. What needs to be done before March?
 - i. Planning meeting today in Kings 1 room
 - f. Adrian Stephens was unanimously confirmed as Technical Editor
16. There will therefore be an editor planning meeting at 1 PM
17. Motion by Jim Petranovich and seconded by Dave Andrus for TGn to instruct the TGn technical editor to include the text from
 - a. 11-05-1095-05-000n Joint Proposal MAC Specification
 - b. 11-05-1102-04-000n Joint Proposal PHY Specification
 - c. and prepare draft 0.01.
18. JP Specs have been on the server for 4 hours
19. Motion passed unanimously
20. Note that existing docs do not contain a MIB and PICS
21. Chair proposed that an ad hoc committee be formed to create the MIB and PICS and would meet between now and the March meeting
22. The earliest possible date given the 3 week notification period would be Feb 20
23. Would someone be willing to volunteer as chair of the ad hoc group?
24. Adrian Stephens volunteered, no one else volunteered
25. Motion by Jim Petranovich and seconded by Eric Tokubo to Form an ad-hoc committee to create MIB and PICS documents for review during the March 2006 TGn meeting. Telecons to be held Feb 20 & 27 at 11:00 am EST passed unanimously
26. Adrian Stephens was confirmed as the chair of the PICS/MIB ad hoc committee
27. Coexistence Committee ad hoc formation topic was introduced by the chair
28. Sheung Li volunteered to chair this ad hoc group should the members approve
29. Motion by Tom Siep and seconded by Joe Levy to Form an ad-hoc committee to create a CA document for review during the March 2006 TGn meeting. Telecons to be held Feb 20 & 27 at 4pm EST.(Call coordinates to be distributed via WG reflector) passed unanimously
30. Sheung was confirmed as CA ad hoc task group chair
31. Floor – add joint session with .19 to the March agenda? Chair agreed to do that.
32. Chair suggested the comments on existing technical docs be emailed to the TGn reflector between now and the March meeting
33. Chair reviewed a proposed agenda for the March meeting as follows:
 - a. Between now and March
 - i. Prepare specification for letter ballot
 - ii. Prepare MIB , PICS & CA
 - iii. Post by 1 week prior to meeting (Feb 27)

- b. March Meeting Plan (3 hours ad hoc + 16 hours)
 - i. Presentation of draft & discussion
 - ii. Presentation of CA discussion, vote?
 - iii. Presentation of MIB & PICS; discussion, vote to incorporate in draft?
 - iv. Review timeline
 - v. Ready to release draft to letter ballot or steps remaining
- 34. Alternative suggestions?
 - a. How have other groups proceeded, what is history
- 35. Editor is aware of next steps
- 36. CA never been done before
- 37. The TGr History was recounted
 - a. 2 meetings to tune up initial draft
 - b. Internal comment period
 - c. CR on internal review
 - d. 1st LB then submitted
 - e. Note that TG must generate a voting pool
 - f. 1st LB is 40 days
 - g. Most comments came in the last 2 days
 - h. So, 4 months between 1st and 2nd LB is likely
- 38. So let's consider an internal comment period after first draft prepared in March and have a LB release planned for May at the earliest?
- 39. Straw Poll to have an internal TG peer review before going to LB? (Y=32, N=1)
- 40. Floor comments
 - a. draft needs much work and will likely take more than 2 months to complete a peer review
 - b. may have draft before March meeting
 - c. Editor job is to simply restructure document and not introduce any new tech content
 - d. With draft will come a list of incomplete items as determined by editorial team
 - e. Draft will not likely be available much before the March meeting; Adrian trying to control expectations
- 41. Chair stated he has enough guidance to create a March agenda proposal
- 42. Should we formally review time line now? A- no, chair should do it informally and address it formally in March
- 43. Motion to adjourn by Jon Rosdahl and seconded by Jim Petranovich was passed unanimously**
- 44. Chair adjourned the meeting at 11:21 AM