IEEE P802.11
Wireless LANs

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| LRLP TIG Meeting Minutes, November 2015 |
| Date: 2015-11-12 |
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Abstract

This document contains minutes of the three sessions of the Long-Range Low-Power (LRLP) Topic Interest Group (TIG) meeting held at the IEEE 802 Plenary in November 2015.

# Session 1 – Monday PM1

Called to order by Tim Godfrey, 13:32, November 9, 2015.

Attendance is approximately 65 people.

Call for secretary to record minutes for this week, Michael Fischer volunteered.

Agenda in document 15/1277r1 approved by unanimous consent.

IEEE meeting guidelines and IP notices read. No new IP was reported.

Schedule for week was announced (3 sessions, Monday PM1, Wednesday AM1, Thursday AM1).

**MOTION** to approve minutes from the September 2016 meeting in document 11-15-1194r0

Moved by: Steve Shelhamer

Seconded by: Jim Lansford

**Approved by unanimous consent**

List of contributions:

11-15-1308r0, Minyoung Park (Intel)

11-15-1306r0, Tim Godfrey (EPRI)

11-15-1365r0, Chittabrata Ghosh (Intel)

11-15-1380r0, Henrik Rantala (Nokia)

11-15-1383r0, Minseok Oh (Kyonggi University)

Order of presentations was discussed and approved.

Chair gave summary of LRLP origin and objectives to set context prior to presentations.

**Presentation 1:**

Minyoung Park (Intel), document 11-15-1308r0, Link Budget Analysis

Rough summary:

 Analysis uses the TGax indoor channel model D with 100B payload per frame.

For indoor use a 2MHz channel width at 20dBm transmit power increases range by roughly 1 floor vertically and 1-2 rooms per floor horizontally when compared to a 20MHz channel (at 2.4GHz, MCS0). For outdoor use the line of sight range can be up to 875m with MCSS0 and 550m with MCS3.

Discussion:

Questions were raised regarding which channel model is appropriate to use and how floor/wall penetration should be parameterized. It was suggested to refer to TGax documents 11-14-0882r4 and 11-14-0621r3 about channel modelling. There was also a concern as to whether the channel model is applicable to ranges as long as the outdoor LOS distances being discussed, and a response that it is, perhaps out to several thousand meters. Questions were raised as to whether Bluetooth interference is a problem for a WLAN channel that is only 2MHz wide.

**Presentation 2:**

Tim Godfrey (EPRI), document 11-15-1306r0, Use Case for LRLP and Full Function in STA

Rough summary:

Are dual-mode station devices, which support both full-rate and LRLP, useful? Yes, because, station hardware can be used along with software to provide an AP function, such as mobile handsets that can function as tethered APs. Call this the “cord cutter” use case – a residence with no Wi-Fi router having a wired infrastructure connection, the internet connectivity at the residence via the mobile device. Another use case is for the mobile device to actually operate as an LRLP STA due to range issues outside the residence (or on a Wi-Fi only service plan).

Discussion:

Clarification was requested of use case 3 versus 1. It was stated that the incremental cost for an AP that supports LRLP is supposed to be very low, but the intention is not to make LRLP support mandatory for future APs. The question was raised regarding the usefulness of a dual-mode station that uses LRLP when high bandwidth is not required and switches to full function when high bandwidth is required. Another question was raised as to why LRLP is desirable versus having the AP support both Wi-Fi and Bluetooth Low Energy, which was answered by pointing out that such an approach would require a second radio, verus a second operating mode of the same radio, hence having a very different cost impact. It was re-stated that the objective of LRLP is to be simple and inexpensive enough to be present in even low-end APs in the 802.11ax generation. A potential risk is that the existence of dual-mode station operation, in contrast to a station that could serve as an LRLP AP when running appropriate software, could drag along a lot of other complexity because then dual-mode station operation becomes a power save/battery life extension strategy rather than a means of meeting any of the stated LRLP objectives.

**Presentation 3:**

Minseok Oh (Kyonggi University), document 11-15-1383r0, Long Range Low Power Use Cases for Indoor & Outdoor

Rough summary:

The 802.11 community has not addressed IoT to date. Several IoT use cases were proposed. One case was LRLP for control in home theater environment, which requires pairing between stations and direct station-to-station communication. Another case was sensor networks, which requires fast wakeup and secure communication for security monitoring and alarm applications. Another case was manufacturing, which requires support for stable data rate (known in advance), very dense deployment, multihop communication, and a lightweight authentication for sensors.

Discussion:

The need for multihop was questioned; with the questioner pointing out that this requirement could be met using an ESS with a multiple LRLP-capable APs.

The chair reviewed the output document report outline, document 11-15-1181r1, which is intended to permit an LRLP SG to develop the PAR rapidly. The chair suggests that ad-hoc groups could generate proposed content for sections of this outline, and such work could be considered by the group on Wednesday, but nobody volunteered to lead the ad-hocs

Because no more further material was ready for presentation the session was recessed at 15:05.

# Session 2 – Wednesday AM1

Called to order by Tim Godfrey, 8:02, November 11, 2015.

Attendance was approximately 40 people, but was limited by insufficient space in the meeting room.

**Presentation**

Henkka Rentala (Nokia), 11-15-1380r0, LRLP Digital Health Use Case

Rough summary:

Use case 1 is assisted living, with a mobile device for vital signs monitoring and responder alerting (falls, fainting, etc.). This case involves a facility-managed network and requires power efficient network discovery, fast link setup, reliable data delivery, days of battery lifetime, and facility-wide location services. Use case 2 is medication reminder for home use. This case involves a home network and requires reliable data delivery, days of battery lifetime, and reporting to the cloud.

Discussion:

A question was raised about the requested fast link setup versus what will be provided by 802.11ai. Is there something missing from what TGai is working on. It was suggested that the actual “fast” requirement in use case 1 pertains to delivery latency, not the time required for link setup. Wearables require much lower power consumption than typical mobile devices today in order for user experience to be acceptable. Use case 2 involves the cloud so a mechanism for IPv6 support should be part of the standard (but it was pointed out that 802.11 does not have a charter to standardize higher layers). Use case 2 data rates involve isolated alarm events and background data measured in kilobits.

**Presentation**

Chittabarata Ghosh, et. al. (Intel, Mediatek, Marvell, Samsung), 15/1365r0, Use Cases of LRLP Operation for IoT

Rough summary:

LRLP should be defined in a manner that can be integrated in mainstream 802.11 silicon and incur negligible incremental cost for implementation at the AP. The LRLP-capable AP senses and protects the medium for LRLP stations, which are not necessarily able to monitor the whole channel. The indoor use case involves an industrial connected worker. This worker wears a pluralith of sensors, a helmet-mounted camera, and a mobile hub (MH). The MH is a smartphone or smartwatch that receives input from the worker’s sensors and camera, performs sensor fusion and communicates with a WLAN gateway and/or cellular connection to the cloud. This use case requires indoor positioning, sensor fusion at MH, surveillance of factory floor at lower rate by periodic messages. Functional requirements involve data rates of 2-10Mb/s and range of 1m to 20m. Peak power consumption and average current consumption were stated to be important metrics but were not quantified. The outdoor use case involves precision agriculture. The scenario involves sensors for items such as soil moisture, temperature, and pH, as well as controls such as water pumps and power meters. Video surveilance was also mentioned but not illustrated, so it is unclear where this is expected be located. Large tracts are covered using aggregators every 100 acres. The aggregators perform local threshold monitoring and buffers/reduces data prior to transmission to the cloud. Functional requirements include data rates up to 512Kb/s and range longer than 500m (LOS, but possibly with vegetation losses).

Discussion:

It was suggested that the diagrams in the presentation be modified to label which illustrated wireless links are intended to be LRLP and which are expected to be VHT/HEW. It was also observed that these use cases involve both sensors with very low data rates and duty cycles, while others, such as helmet-mounted cameras, can benefit from low power at short ranges, but require significantly higher data rates and essentially continuous duty cycle. It was asked which of the two use cases was more important in the event that both could not be supported using a common mechanism. The response was that the indoor use case (with the features listed plus positioning) is more important than the outdoor use case. It was asked why these use cases could not be met with 802.11ah. The response was that a key difference versus is that LRLP can be integrated with mainstream Wi-Fi infrastructure deployment at 2.4GHz. In answer to the question as to why LRLP is needed when APs can support 802.11ah as an additional band (without the same coexistence issues) it was stated that the intent for LRLP includes the ability to operate over next-generation entry-level APs (where it is hoped that LRLP would be ubiquitous because of the negligible incremental cost), whereas it will be a long time, if ever, before entry-level APs support the new bands such as 900MHz or 60GHz. There was considerable discussion of how, for the indoor use case, the proposed communication between the sensors and MH can work without interference from the Gateway/AP because the Gateway/AP does not know about, and likely cannot detect, the traffic between the sensors and the MH. Some sort of technique involving synchronized service periods was suggested to permit transfers between the MH and sensors to occur. There were many architectural questions regarding role of the device designated “MH” and whether it functioned as a gateway / bridge / aggregator / coordinator / buffer, etc. In regard to the outdoor use case it was pointed out that the LRLP standard will arrive at least a couple of years after 802.11ah, so sensors using 802.11ah will already be deployed, and it was unclear why an agricultural user would have any reason to switch back to 2.4GHz sensors.

Presentations of all submissions for this week have been completed.

It appears to be very important to address the coexistence and overlapping BSS issues for operation in the 2.4GHz band in future work of this TIG.

The chair proposed to proceed with two ad-hoc groups to begin generating text for the output report:

 Use cases and metrics, led by Chittabrata Ghosh (Intel)

 Technical feasibility & material for standardization, led by Michael Fischer (Freescale)

The session recessed at 9:56.

# Session 3 – Thursday AM1

Called to order by Tim Godfrey, 8:04, November 12, 2015.

Attendance is approximately 50 people.

Output document working draft will be in document 11-15-1446. The intent is to continue writing the output document at the meeting in Atlanta in January 2016.

Chair presented list of architectural components that are expected to be part of LRLP and therefore in need of definition and clarification in the output document. These appear in 11-15-1277r3.

Chair stated that he would issue a call for contributions (via the reflector) concerning coexistence, including issues such as hidden node problem, OBSS coordination, understanding narrowband waveform as seen by wideband receiver and vice versa, how low duty cycle of LRLP actually impact coexistence.

Group discussion of issues:

It was pointed out that the use of narrowband channels 2MHz wide fits poorly with the 5MHz channel spacing used by many existing PHYs, and will make the interference issues more complex due to some narrowband channels spanning the boundary of existing channels. It was suggested to use a channel width that has an integer relationship to the existing channelization.

Caution was advised regarding the “chatiness” in large sensor deployments because even though the duty cycle per sensor is low, in large deployments the duty cycle as seen at the AP can be large.

It was requested that use case presenters provide quantification of their cases, including numbers pertaining to duty cycle, data rate, range, number of devices, power consumption and/or battery life. This could feed in to a table in the output document that would summarize the range of use cases.

Chair asked about collaboration and joint meetings with other 802.11 task groups. An alternative would be to request collaboration with specific contributors to those task groups.

Teleconferences: Chair will attempt to schedule one teleconference for each ad-hoc team before the January 2016 meeting.

As this completes the agenda it is suggested that we adjourn and reconvene as an ad-hoc to discuss

**MOTION** to adjourn

Moved by: John Notor

Seconded by: Shusaku Shimada

**Approved by unanimous consent**

Adjourned at 8:50.