IEEE P802.22 Wireless RANs

|  |
| --- |
| 2016 November Plenary IEEE 802.22 Working Group Minutes |
| Date: 2016-11-07 |
| Author(s): |
| Name | Company | Address | Phone | email |
| Apurva Mody | BAE Systems/ WhiteSpace Alliance | Merrimack, NH, USA | 404-819-0314 / 603-809-0459 | apurva.mody@baesystesms.com; apurva.mody@WhiteSapceAlliance.org  |
| Roger Hislop | Internet Solutions | Johannesberg, South Africa |  | roger.hislop@is.co.za  |

**IEEE 802.22 Wireless Regional Area Networks**

**Notice:** This document has been prepared to assist IEEE 802.22. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.

**Release:** The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE’s name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE’s sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.22.

**Patent Policy and Procedures:** The contributor is familiar with the IEEE 802 Patent Policy and Procedures

<[**http://standards.ieee.org/guides/bylaws/sb-bylaws.pdf**](http://standards.ieee.org/guides/bylaws/sb-bylaws.pdf)>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair Apurva N. Mody <**apurva.mody@ieee.org**> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.22 Working Group. **If you have questions, contact the IEEE Patent Committee Administrator at <****patcom@ieee.org****>**.

Abstract

This document contains the minutes of the IEEE 802.22 Working Group 2016 November Plenary Meeting held in San Antonio from 6th to 11th, November 2016.

**November 2016 Plenary**

**MINUTES**

##### 7th November Monday PM1 (WG Opening Plenary and Elections)

The WG chairman, Dr Mody, called the meeting to order at 1:30 PM local time. There were 9 participants (5 are voting members) in the room at the opening of the session.

WG announced that the meeting was in quorum since it was announced more than 45 days in advance.

**1.1 Approval of Agenda**

**The WG chair, Dr. Mody, explained agenda for the plenary session in San Antonio.**

***Motion - Approval of Agenda***

Move to Approve the Agenda as shown in Document 22-16-0029 Rev1

(<https://mentor.ieee.org/802.22/dcn/16/22-16-0029-01-0000-802-22-november-plenary-wg-agenda.xls>)

Move: Jerry Kalke

Second: Roger Hislop

For: 4

Against: 0

Abstain: 1

**Motion Passes**. Agenda is approved

**1.2 Approval of the minutes of the last session**

The minutes of the 802.22 March 2016 WG Plenary Meeting can be found at:

<https://mentor.ieee.org/802.22/dcn/16/22-16-0005-00-0000-ieee-802-22-march-plenary-working-group-meeting-minutes.docx>

***Motion- Approval of Minutes***

Move to approve the 802.22 WG March Plenary meeting minutes held in Macau as shown in Document 22-16-0005 Rev0

(<https://mentor.ieee.org/802.22/dcn/16/22-16-0005-00-0000-ieee-802-22-march-plenary-working-group-meeting-minutes.docx>)

Move: Roger Hislop

Second: Jerry Kalke

For: 4

Against: 0

Abstain: 1

**Motion Passes**. Minutes are approved

**2. Administrative Issues**

The WG Chair, Dr. Mody, reviewed the usual administrative slides on Patent Policy, Letter of Assurance, Anti-trust statement, IEEE code of ethics, etc.

The WG Chair, Dr. Mody, reminded everyone that the attendance recording is being done electronically as usual.

**1.3 802.22.3 Task Group Elections**

Mr. Roger Hislop – Internet Solutions (South Africa) was elected to be the Chair of the IEEE 802.22.3 Task Group on Spectrum Characterization and Occupancy Sensing (SCOS) during the March 2016 Plenary Meeting.

The position of the Vice Chair, Editor and Secretary is still open.

Interest from Oliver Holland as well as Michael Cotton.

We may also have the position of the 802.22 Vice Chair and Secretary which may need to be filled.

**Working Group Motions**

***Motion- Election of the Vice Chair of the IEEE 802.22.3 Spectrum Characterization and Occupancy Sensing (SCOS) Task Group***

The IEEE 802.22 Working Group elects Oliver Holland (King’ s College, London) to be the Vice Chair of the IEEE 802.22.3 Task Group with acclamation

Move: Roger Hislop

Second: Apurva Mody

For: 5

Against: 0

Abstain: 0

**Motion Passes**

##### 7th November Monday PM2 – Spectrum Characterization and Occupancy Sensing

In attendance:

Ken Baker, Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Oliver Holland, King’s College London

Apurva Mody, BAE Systems/ WhiteSpace Alliance

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

William Suriaputra, Cognitive Systems

Task Group reviewed the structure of the 0.4 version of an 802.22.3 draft.

Dr Oliver Holland presented P1900.6 elements, with detailed discussion then ensuing on specifics of the standard. The group in particular went through the primitives and definitions for sensing hardware definition and configuration (Measurement Service Access Point, M-SAP).

##### 7th November Monday EVE – Spectrum Characterization and Occupancy Sensing

Ken Baker, Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Oliver Holland, King’s College London

Apurva Mody, BAE Systems/ WhiteSpace Alliance

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

William Suriaputra, Cognitive Systems

The earlier conversation continued as to using the definitions of P1900.6 primitives as potentially normative in 802.22.3. Under discussion was where certain of the metrics would be sourced from, as a considerable number in the P1900.6 M-SAP are based on datasheet values from the equipment manufacturer.

The discussion focused on strengthening aspects in 802.22.3 that cover the discovery and management of sensing resources, how users access them, and how the sensing data is exposed to the users. There was support for the objective of defining a simple sensing model that could make use of previously completed work, and where the data from the sensor would be comprehensively described with metadata, with the specific implementation of the sensing system being a “black box”, pushing the requirement for interpretation back towards the system user (who would interpret it with cognisance of the system builder/operator’s implementation).

[ADDENDUM: Item missing from previous minutes doc – updated by RWH] Dr Oliver Holland presented DCN 22-16-0033-00-0003. There was detailed discussion on adding antenna angle/directionality-related parameters to the parameters covered in the current first-pass submissions (DCN 22-16-0021-01-0003), and there was general agreement that this should be done. Oliver indicated that he and his colleagues will develop a final proposal for that, as they were still considering aspects such as how the overall gain and the azimuth and inclination antenna patterns should be represented (perhaps in combination). Uncertainty was expressed regarding the possibility of sensing in a full-duplex context (trans-sensing) due to the necessary sensitivity (typically) of sensing systems and the implied necessary level of isolation of the transmission and reception in a full duplex context given that. However, strong interest in full duplex in the context of 802.22 in general was expressed, and the contribution was also earmarked for consideration in the 802.22 Revision session later in the meeting.

##### 8th November Tuesday AM1 - Spectrum Characterization and Occupancy Sensing

Ken Baker, NTIA

Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Apurva Mody, BAE Systems/ WhiteSpace Alliance

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

William Suriaputra, Cognitive Systems

##### 8th November Tuesday AM2 - Spectrum Characterization and Occupancy Sensing

Ken Baker, NTIA

Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Apurva Mody, BAE Systems / WhiteSpace Alliance

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

William Suriaputra, Cognitive Systems

Apurva Mody presented his contribution based on the IEEE MILCOM Paper titled: On Making Any Radio Cognitive, without hardware or firmware modifications.

The paper included distributed spectrum sensing using Application Layer messages enabled by Registration, Registration ACK, Heartbeat and Heartbeat ACK messages.

<https://mentor.ieee.org/802.22/dcn/16/22-16-0035-00-0000-distributed-spectrum-characterization-and-occupancy-sensing-system.pdf>

##### 8th November Tuesday PM1 - Spectrum Characterization and Occupancy Sensing

Ken Baker, NTIA

Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Oliver Holland, King’s College London

Apurva Mody, BAE Systems

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

William Suriaputra, Cognitive Systems

Roger Hislop briefly presented a block diagram outlining an architecture that included multiple “Users” (of varying priviledge level) communicating with the SSM, which orchestrated resources of the SSDs, and then transmitted the scan data back to “UserDataStores” (UserDS), which could be attached to the User, or separate. This transmission would be done using a message queue system such as MQTT, allowing UserDataStores to subscribe to one or more scan data transmission topics, as allowed for by the priviledge levels.

Nilesh Khambekar presented his contribution to the draft standard, outlining the Spectrum Sensing API.

In light of previous discussions, the main elements of this were described as “southbound” control messages falling into three main groups:

1. Registration (ID, key exchange, authorisation)

2. Query (sensor model, signal processing capability (occupancy, characterisation, calibration, DF), health, availability, location)

3. Configuration (sensing config, scheduling config, calibration, [operational])

The “northbound” elements would include confirmations, as well as

4. Notification of Change (reverse of the Query messages for relay of configuration or hardware changes back to Users)

5. Notification of Busy (a message indicating that a scan schedule could not be met)

Additional elements were proposed in terms of the system decomposition into:

 **SCOS**

 |

 Spectrum Sensing Device Spectrum Sensing Manager

 | | | | | |

Sensing Model Sensing C&C Sensing Policy Data Model Manager C&C Data Policy

Consensus emerged that the SSM would act as the Command & Configuration master for the SSDs, and would act as a gate-keeper to the SSDs’ functions. This would create a security layer and resource management layer in terms of what the SSDs can/should do. These include a policy-based management system that only allows certain scan types, or number of scans per session, etc, by a particular type of User.

Similarly, a Policy layer would apply to the data store within the SSM. This data store would be simple, and intended as a store & forward buffer. It would transmit scan data from the SSDs as soon as possible to any for-purpose data stores (e.g. regulator’s spectrum utilisation database, an operators interference monitoring system, etc). These third party systems would be out of scope for 802.22.3. The Policy would provide a level of security (i.e. that transmissions could only be made the authorized Data Stores), and governance/priority (i.e. that data would not be stored locally longer than a certain time to meet regulations, or that the data of higher-priority Users would get priority access to local storage if it was running out (e.g. if the transmissions upstream of data was slower than data was being generated).

##### 8th November Tuesday EVE - Spectrum Characterization and Occupancy Sensing

Ken Baker, NTIA

Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Apurva Mody, BAE Systems/ WhiteSpace Alliance

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

William Suriaputra, Cognitive Systems

This session was largely devoted to unpacking the relationship between one or more SCOS system users, what scanning requirements they may need to schedule, insertion of scan requests into a schedule and how that would be managed – particularly in how resources would be allocated, and what would happen in the event that not enough scan resources were available to meet that schedule.

Various design scenarios were considered, the most workable being that the SSM would hold a master schedule, which would be populated with resource slots provided for by a recurring discovery task performed on associated SSDs. At the time a User requests a scan schedule, the SSM would confirm whether it could meet that request, and then send it on to the SSD as needed.

A scan would take the form of a “recipe” indicating measurement parameters (M-PARS) and the type of scan object (e.g. an energy detection algorithm), with a scheduling wrapper around it giving the recurrence and period. For a single ad hoc scan, this schedule would be “once, immediately”.

During this session a message flow was examined based on submissions and the breakdown of functions/responsibilities of the User, the SSM, the SSD and the UserDataStore.

To future proof the standard, to allow it to scale and to enable a distributed and meshed architecture (where multiple users could potentially send scan requests to multiple SSMs which would in turn orchestrate scan requests across multiple SSDs) the User would request a scan, which would be processed down the stack to the scanner, and the data would then be transmitted to one or more UserDataStore. Each task request would get a handshake confirmation back to the User (i.e. task received, scheduled, performed, data transmitted), but data containing scan results would be left to be ingested and interpreted by any user that was authorized to access the scan results in the relevant UserDataStore.

##### 10th November Wednesday AM1 – IEEE 802.22 Revision

During the Wednesday AM1 meeting slot, the Chair of the 802.22 Working Group went over the 802.22 Revision PAR that may be found here:

<http://www.ieee802.org/22/P802_22_3_PAR_Detail_Approved.pdf>

The Chair of the WG thanked the IEEE SA Staff – Michelle Turner for turning around the first 802.22 revision draft that folded in the IEEE Std. 802.22-2011, IEEE Std. 802.22a-2014 and IEEE Std. 802.22b-2015 into the document.

Five contributions were received for the new revision project. These contributions were as follows. They were reviewed. The chair said that he will schedule further telecons to go over these contributions and the resolutions for the same:

1. <https://mentor.ieee.org/802.22/dcn/16/22-16-0033-00-0003-directional-antennas-full-duplex-communication.pdf>
2. <https://mentor.ieee.org/802.22/dcn/16/22-16-0025-00-0000-corigenda-errata-802-22-base-std-upstream-channel-descriptor.docx>
3. <https://mentor.ieee.org/802.22/dcn/16/22-16-0023-00-0000-corrigenda-ttg-errata.docx>
4. <https://mentor.ieee.org/802.22/dcn/16/22-16-0007-00-0000-802-22-corrections-tracking.docx>
5. <https://mentor.ieee.org/802.22/dcn/16/22-16-0006-00-0000-802-22-correction-sts-lts-sequences.docx>

##### 9th November Wednesday AM2 – IEEE 802.22 Revision and Spectrum Characterization and Occupancy Sensing

Please see the Wednesday, AM1 meeting minutes for 802.22 Revision.

Since majority of the 802.22 Revision discussion were completed, part of this session was devoted Spectrum Characterization and Occupancy Sensing.

Attendees:

Ken Baker, NTIA

Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Apurva Mody, BAE Systems

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

Ken Baker presented ongoing work in creating a flow diagram for User to SSM to SSD and to UserDataStore. Considerable time was spent understanding how this would work in practice, and what the best approach would be to enable a successful SCOS standard.

Agreement emerged around messages coming from Users (with handshake), which would be processed by SSM according to scheduling capability and policy riles, and then communicated to SSDs (with handshake), and scan data sent to UserDSs (with handshake back to User that scan was complete, and data transmitted).

Separately, the SSD would associate with an SSM similar to a mobile phone to a base station, which would keep a list of available SSDs and their resources. When an SSD knew it would be removed from the sensor network, it would dis-associate from the SSM. Also (in case of link/device failure), a periodic “heartbeat” would verify the SSD (and it’s resources) was still available.

Wherever possible, to conserve network/processin resources, any message exchange between SSD and SSM would piggy-back a heartbeat).

##### 10th November Thursday AM1 – Spectrum Characterization and Occupancy Sensing

Attendees:

Ken Baker, Mike Cotton, NTIA

Nilesh Khambekar, SpectrumFi

Apurva Mody, BAE Systems

Jerry Kalke, CBS Corp.

Roger Hislop, Internet Solutions

Group reviewed structure of summary spec document developed, which outlines SCOS standard purpose, flow diagram, architecture block diagram and interfaces. It was decided that this would form a new basis for the 802.22.3 standard to replace the current draft as the structure was more concise and accessible.

The issue of scheduling was revisited, with discussion around the need for the SSM to run the master schedule based on a current (and periodically updated) resource slot list for each SSD currently associated with it. This schedule would be synched to the SSD if it changed, and available to a User on request to allow them to plan their scan scheduling.

It was considered that it would also be useful for the scan request from the User to indicate whether it needed the scheduling to be “exact” (i.e. the SSM would need to try fit the scan exactly as requested) or “closest match” (i.e. SSM would fit scan into closest available slot).

Discussions also concluded that the scan performed could be of any type, depending on the method/algorithm used, and that this could be abstracted by passing a set of parameters (M-PARS) and named scan object type to the SSD, which would perform the scan using the relevant sensing object, and pass the resulting data, scan object name and M-PARS back through the stack. These scanning objects would be defined and implemented by the system designer.

In the first version of the standard, only an energy detection scan type would be defined as normative.

##### 10th November Thursday AM1 – IEEE 802.22 Closing Plenary

The WG chairman, Dr Mody, called the meeting to order at 10:30 AM local time. There were 6 people in the room at the time of 802.22 WG Closing Plenary.

The Working Group Chair announced that he plans to appoint the following participants to be the 802.22 WG Voting Members due to their contribution to the IEEE 802.22.3 SCOS Task Group.

They include:

Oliver Holland (Kings College)

Mike Cotton (NTIA) – re-affirmed

Ken Baker (NTIA)

Nilesh Khambekar – SpectrumFi

William Suriaputra – Cognitive Systems

***Working Group Membership by Participation in Initial Sessions***

Any objection to WG Chair appointing the following slate of participants to be the Working Group Voting Members based on their continued participation and contribution to the IEEE 802.22.3 Spectrum Characterization and Occupancy Sensing Task Group.

Oliver Holland (Kings College)

Mike Cotton (NTIA) – re-affirmed

Ken Baker (NTIA)

Nilesh Khambekar – SpectrumFi

William Suriaputra – Cognitive Systems

Move: Roger Hislop

Second: Jerry Kalke

Any discussions. Any objection. No objections heard.

**Motion Passes**

***Motion- Withdrawal of the IEEE 802.22.1 Revision PAR***

The proposed revision to the 802.22.1 standard had planned to create a technology enabler called Advanced Beacon to share the spectrum between Radar and Communications Systems.

The Federal Communications Commission considered the use of this enabler as a means of sharing spectrum between the Department of Defence Radars and Commercial Communications Systems.

However, DoD wanted Spectrum Sensing as the only way to detect the presence of Radars at this point, especially since the communications systems in the 3.5 GHz (Citizens Band Radio Service) will be residing outside the Radar bands of operations

DoD is interested in using Advanced Beacons for higher fidelity spectrum sharing at later time when they work on co-channel Radar and Communications spectrum sharing.

So the 802.22 Working Group will re-start this process when DoD and the FCC are ready for it

IEEE 802.22 Working Group moves to allow the chair to put the withdrawal of the 802.22.1 Revision PAR on Advanced Beaconing on the IEEE SA NESCOM Agenda.

Move: Jerry Kalke

Second: Roger Hislop

For: 5

Against: 0

Abstain: 1

**Motion Passes**

***[Re-cap for Information Only] Motion- Approval to Schedule Teleconference Meetings***

Move to authorize the 802.22 WG chair to schedule teleconference meetings as he sees fit to conduct the business of 802.22 WG from now until November 2017 plenary meeting.

Move: Jerry Kalke

Second: Roger Hislop

For: 5

Against: 0

Abstain: 1

**Motion Passes**.

***Motion- Empower the 802.22 WG Chair to Schedule to Face to Face Meetings when Necessary***

Move to empower the 802.22 WG chair to schedule the Face to Face Meetings when necessary as long as 45 day notice is provided.

Description: The 802.22 WG is likely to meet only during Plenary Meetings. But more interim meetings may be necessary

Move: Roger Hislop

Second: Jerry Kalke

For: 5

Against: 0

Abstain: 1

**Motion Passes**.

The chair of the 802.22.3 Task Group, Roger Hislop notified the 802.22 Working Group that he has appointed Dr. Nilesh Khambekar as the editor of the 802.22.3.

***Motion- 802.22.3 First Working Group Letter Ballot***

Move to authorize the 802.22.3 Task Group Chair, and the Editor to issue the first 802.22.3 Draft on, or before February 10th 2017 based existing contributions, and start the first working group letter ballot before February 12th 2017.

Move: Roger Hislop

Second: Jerry Kalke

For: 5

Against: 0

Abstain: 1

**Motion Passes**.

Chair asked the 802.22 WG Members to report any intellectual property. There were no IP reported.

**Motion for Liaison Relationships**

Move to have Dr. Apurva N. Mody to be a liaison from the IEEE 802.22 WG to the WhiteSpace Alliance, VITA 49.2

Move: Ken Baker

Second: Mike Cotton

For: 5

Against: 0

Abstain: 1

**Motion Passes.**

Move to have Dr. Apurva N. Mody and Roger Hislop be the liaisons from the IEEE 802.22 WG to the Dynamic Spectrum Alliance

Move: Ken Baker

Second: Mike Cotton

For: 5

Against: 0

Abstain: 1

**Motion Passes.**

Move to have Ken Baker and William Suriaputra be the liaisons from the IEEE 802.22 WG to the WinnForum.

Move: Roger Hislop

Second: Mike Cotton

For: 5

Against: 0

Abstain: 1

**Motion Passes.**

**San Antonio Location Survey**

Much prettier than expected.

Easy to get to for US participants.

In general good location for future meetings.

**Motion– Motion to adjourn**

Move to adjourn.

Move: Jerry Kalke

Second: Mike Cotton

Any discussions, Any objections.

**Motion Passes.**

The group was adjourned at 11:22 am local time on Thursday 10th November 2016.

**802.22 Attendance List March, 2015 Plenary**

|  |  |  |
| --- | --- | --- |
| **Baker** | **Ken** | NTIA |
| **Cotton** | **Mike** | NTIA |
| Finch | Robert | Select Spectrum |
| **Khambekar** | **Nilesh** | SpectrumFi |
| **Holland** | **Oliver** | King’s College London |
| **Mody**  | **Apurva** | BAE Systems |
| **Nikolich**  | **Paul** | Self |
| **Kalke**  | **Jerry** | CBS Corp. |
| **Hislop** | **Roger** | Internet Solutions |
| **Suriaputra** | **William** | Cognitive Systems |

*Note: Participants who had voting status appear in* ***bold****.*

**ANNEX**

**Working Group Contributions can be found at** [**https://mentor.ieee.org/802.22/documents**](https://mentor.ieee.org/802.22/documents)