IEEE 802 EC 5G / IMT-2020 Standing Committee Report

Glenn Parsons - Ericsson

glenn.parsons@ericsson.com
+1 613 963 8141

July 2016

Mentor DCN: EC-16-0119-00-5GSG 7/27/2016

Table of Contents

Introduction

- The IEEE 802 EC 5G/IMT-2020 Standing Committee was chartered (Feb - July 2016) by EC ballot
  - see Appendix 1
- Glenn Parsons served as Chair
- The Standing Committee held face-to-face and electronic meetings
  - see Appendix 2
    - documents:
      - https://mentor.ieee.org/802-ec/documents?is_group=5GSG
    - Standing Committee web site:
      - http://ieee802.org/Stand_Com/5G
- This document provides the requested report

Authorized Scope

- To provide a report on the following items to the EC:
  - Costs and benefits of creating an IEEE 5G specification
  - Costs and benefits of providing a proposal for IMT-2020, considering possible models of a proposal:
    - as a single technology,
    - as a set of technologies,
    - or as one or more technologies within a proposal from external bodies (e.g., 3GPP)
- During its lifetime, to act as the communication point with other IEEE organizations on this topic.

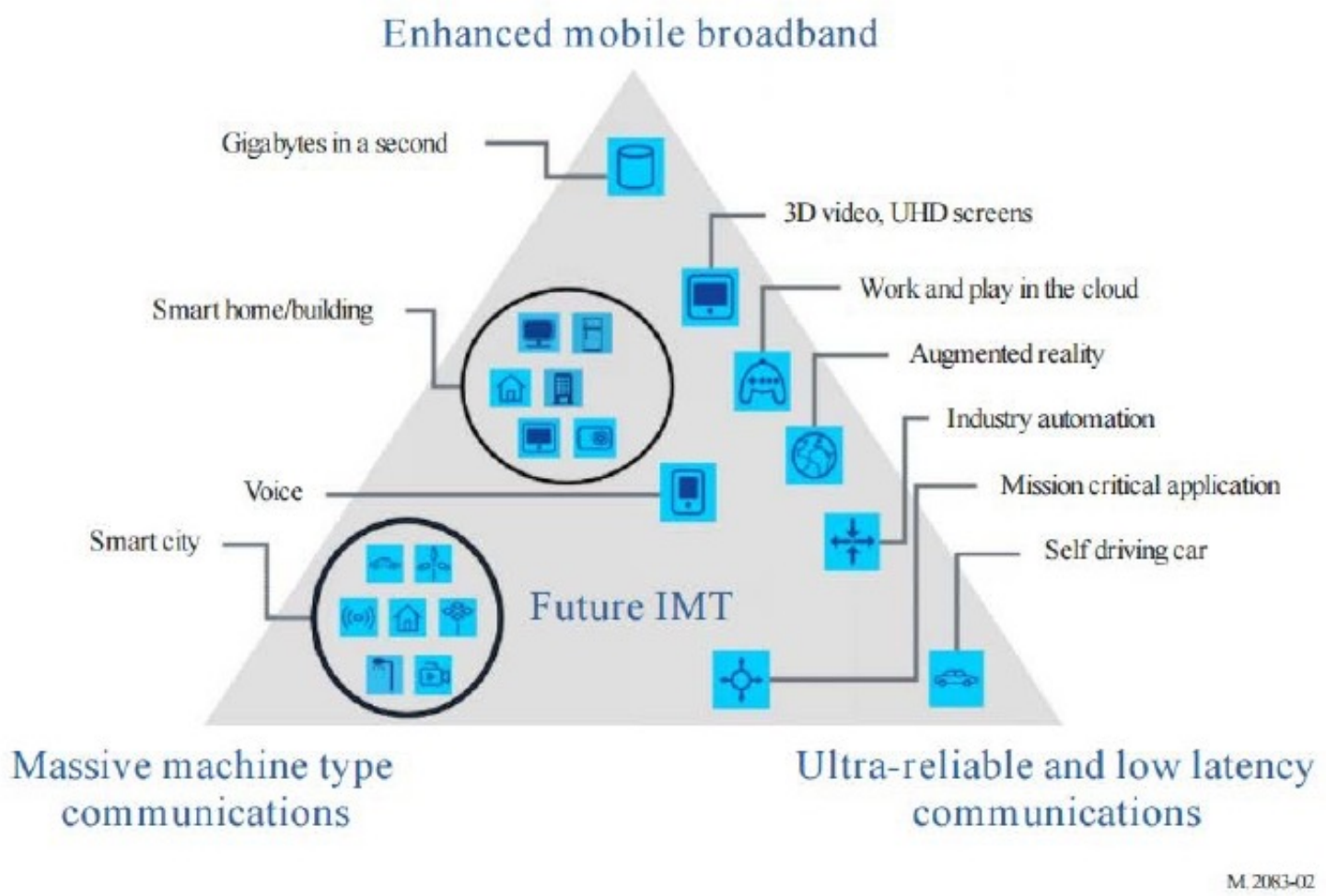
Views of 5G

- 5G is understood many ways.
- Facets that distinguish 5G may include:
  - Technology: radical new technologies or technology sets
    - could include spectrum-related technology issues
      - millimeter wave spectrum
      - technologies designed for unlicensed use
  - Service: provides new services or new service sets
  - Performance: new levels of performance to users, or to operators
  - Operator ecosystem, either:
    - next step for the existing 2G/3G/4G incumbent mobile operators
    - an opportunity for new operators
  - Standards: set of interoperability standards rolled out by an ecosystem according to a roadmap
  - Other Characteristic: a marketing label, a revolution, etc.
- Scope of an “IEEE 5G specification” would likely differ from scope of other 5G endeavors.

5G Context for this study

- Action A: creating an IEEE 5G specification
  - could support incumbent mobile operators
    - via existing cellular ecosystem
  - could support new operators
    - creation/support of new ecosystems
      - this might be a very different 5G
      - would need to identify requirements
  - could do both
- Action B: providing a proposal for IMT-2020
  - supports the 5G of the existing cellular ecosystem
  - usage scenarios and requirements specified in IMT-2020 process
    - 802 could help shape requirements (needs to act soon)
- Actions A and B are not contradictory or exclusive

IMT-2020 (per ITU-R M.2083)



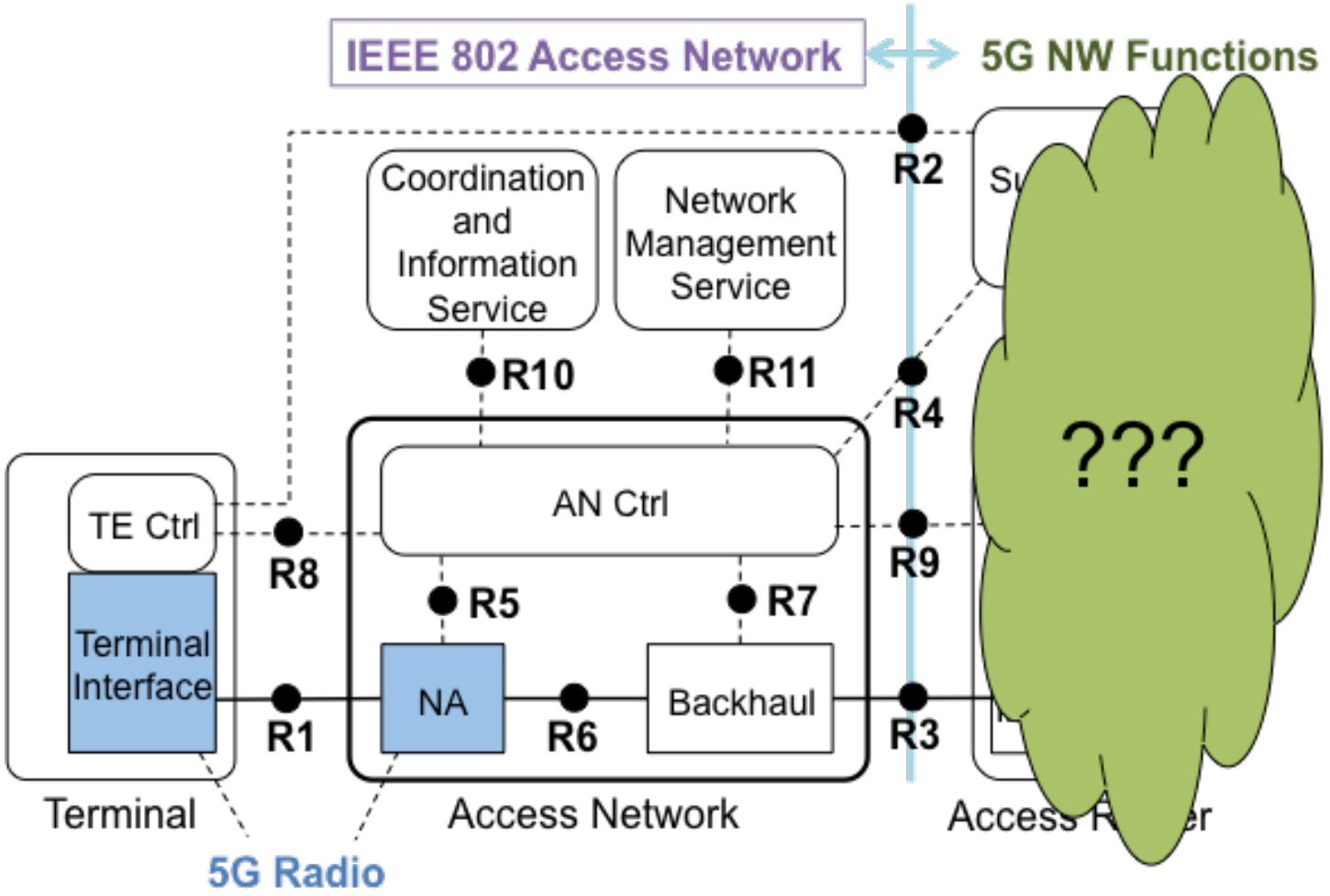
Cost benefit analysis of options/actions

Action A: IEEE "5G" specification

Candidate Approach

- specify an 802 access network
  - could be based on P802.1CF
    - "network reference model defines a generic foundation for the description of IEEE 802 access networks, which may include multiple network interfaces, multiple network access technologies, and multiple network subscriptions, aimed at unifying the support of different interface technologies, enabling shared network control and use of software-defined networking (SDN) principles"
  - provides an external view into general 802 access network
  - could support many 802 MACs and PHYs
  - could plug into incumbent mobile operator networks
    - for example, expand the notion of LWA so that the cellular network supports 802 rather than 802.11
    - gives 802 a strong supporting role in cellular 5G networks
  - could support integration into other operator networks
    - e.g. cable TV or fixed telecom
    - gives 802 a central role in non-cellular 5G networks
  - feasible for 802 access network to support both
  - need not promote it as an "IEEE 5G" network

P802.1CF Interface option to 5G



Source: IEEE 802-EC-16-0083-00-5GSG

Action A: Routes to success

802 Access Network

- engage with 3GPP to specify interface details
  - could support many 802 MACs and PHYs
- engage with other parties to specify interface details
  - build partnership with other operator communities
- support internationalization
  - standardize within partner communities
  - standardize in JTC1
  - standardize in ITU-R (WP 5A) in support of spectrum needs
    - WP 5A: “Land mobile service excluding IMT”
    - refer to WP 5A’s “Guide to the use of ITU-R texts relating to the land mobile service, including wireless access in the fixed service”
  - could standardize in ITU-R IMT-2020 (see Action B)

Action A: Possible partners
802 Access Network

- IEEE
  - Communications Society standards activities; e.g. IEEE 1904 Access Networks Working Group
- 3GPP
- ITU-R (WP 5A; WP 5D)
- IETF, Broadband Forum, CableLabs, MEF, ETSI BRAN, Open Networking Foundation, Wi-Fi Alliance, ZigBee Alliance, Ethernet Alliance, WiMAX Forum, CPRI, …

Action A – IEEE 802 Access Network

Objective
Adoption of IEEE 802 Access Network specification in multiple disparate operator networks.

Description
Specify an IEEE 802 Access Network, incorporating IEEE 802 MAC/PHYs and supporting standards, with a unified interface to end-to-end networks. Promote standardization of the integration of the IEEE 802 Access Network into end-to-end networks.

Strength	Weakness	Opportunity	Threat
1. Builds on traditional 802 presentation of interface to support many networks	1. Could require compromises in the support of any specific network	1. Can be applied in both 3GPP networks and in alternative networks	1. Coordination efforts required– may not be accepted
2. Enhances interoperation with identified end-to-end networks	2. Requires liaison activity to coordinate interface requirements.	2. Offers an advantage for end-to-end networks to use 802	2. Specifications may come too late or under-perform
3. Could be leveraged to promote spectrum for non-IMT systems; e.g. WAS	3. May require development of uses cases and requirements	3. Increases value of the entire range of 802 MAC/PHYs; could support spectrum expansion	3. Non-802 technologies may be used at the specified interface

Cost	Benefit
IEEE 802 needs to develop Access Network spec; 802 MAC/PHYs may need to develop new amendments; external ecosystems need to be developed	Makes IEEE 802 the central player in heterogeneous access and in access networks for 5G of all forms; IEEE has no responsibility to specify end-to-end

Action B: IMT-2020 proposal Candidate Approaches

- B1: Direct IMT-2020 – single technology
  - Develop and submit an IEEE proposal to adopt some IEEE 802.11 radio interface technology into IMT-2020 RIT.
- B2: Direct IMT-2020 – set of technologies
  - Develop and submit an IEEE proposal to adopt coherent set of IEEE 802 radio interface technologies into IMT-2020 RIT, possibly integrated in an IEEE 802 Access Network.
- B3: IMT-2020 – external body proposal
  - Support development of a 3GPP proposal incorporating references to the use of IEEE 802.11, or an IEEE 802 Access Network.

Action B1: single technology Candidate Approach: more detail

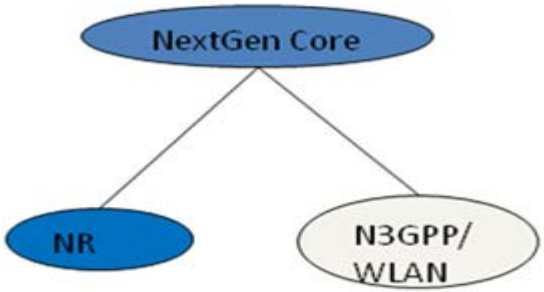
- IEEE 802.11 radio interface technology based on IEEE P802.11ay
  - Addressing eMBB usage scenario
  - Targeting indoor hotspot test environment

Action B3: external partner proposal Candidate Approach: more detail

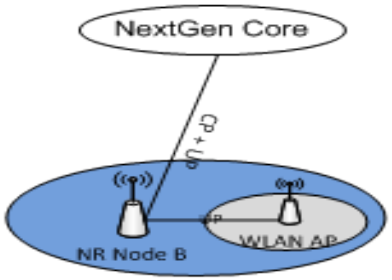
- Support development of a 3GPP proposal incorporating reference to the use of IEEE 802.11, or an IEEE 802 Access Network.
- Reference 802 network presumed to operate in non-IMT bands
  - for example, 802.11ax in 5 GHz bands, 802.11ay in 60 GHz, etc.
  - for example, evolution of LWA, eLWA, LWIP
  - would not be proposed as IMT-2020 RIT
- Does not preclude parallel action B1 or B2 to propose IMT-2020 RIT
- Serves as a feature enhancement to 3GPP network operation
  - not evaluated against IMT-2020 technical requirements
  - 3GPP meets IMT-2020 technical requirements with 3GPP SRIT
  - requires technical analysis to select appropriate architectural models for integration with 3GPP network
    - Identify Interfaces to IEEE 802 technologies
  - requires coordination with 3GPP on details

Potential 3GPP NextGen Core & New RAT

- 3GPP is developing a new 5G "New RAT" (NR) and a new 5G Core Network ("NextGen Core")
- Several candidate architectures might allow 802.11 integration into 3GPP 5G network, e.g.:

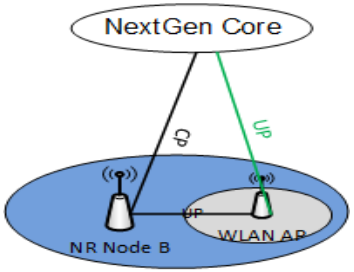


(1) 802.11 WLAN interfaces directly to NextGen Core



WLAN Integration with NR

(2) 802.11 WLAN interfaces with NR base station, e.g., similar to "dual connectivity" architecture used by LWA/eLWA/LWIP [see R2-163969]



WLAN Integration with NR

(3) 802.11 WLAN data plane interfaces with NR base station, while control plane interfaces with NextGen Core

Source: IEEE 802-EC-16-0099-01-5GSG

Integration of 802.11 in 3GPP 5G networks

- Different architectures may suit different operator deployments and use cases, e.g.
  - Some architectures imply increased load on backhaul
  - "Dual connectivity" architectures may not allow for macro coverage if NR base station operates at higher frequency than WLAN
- Availability of specifications for the different architectures depends on future 3GPP progress, decisions and specification timeline
  - Out of the control of IEEE
- Commercial deployment of the different architectures depends on handset vendor roadmaps, cellular infrastructure vendor roadmaps and network operator decisions
  - Out of the control of IEEE

➔ Any technical activities for 5G undertaken by 802 should focus on enablers / building blocks / interfaces that are as generic as possible and can be utilized by any architecture.
  - Consider gap analysis for any necessary specification work

Action B1 – IMT-2020 proposal, single technology

Objective
IMT-2020 recognition for some IEEE 802.11 radio interface.

Description
Develop and submit an IEEE proposal to adopt some form of IEEE 802.11 radio interface technology into IMT-2020.

Strength	Weakness	Opportunity	Threat
1. An 802.11 radio interface can be recognized as IMT-2020	1. Difficult application process; may require new standards to meet requirements	1. IMT-2020 recognition can add marketing value	1. May become more difficult to convince regulators to identify more RLAN spectrum
2. Allows independent IEEE proposal	2. Requires 3GPP to agree to merge result into a SRIT	2. Allows 802.11 to optimize proposal	2. 3GPP may prefer alternative and may not agree
3. Allows IEEE to propose use of unlicensed technology for IMT	3. Unclear how technologies built for unlicensed use would fit into IMT spectrum	3. IMT recognition can promote use of that 802.11 radio interface in IMT spectrum	3. RIT simulation modeling required by ITU-R may fail to produce convincing results

Cost	Benefit
Developing standards, preparing and pitching proposal, developing administration support, supporting evaluations, negotiating SRIT, perpetual maintenance	Marketing value. Possibility of better access to spectrum, particularly by targeting a specific segment of new mm-wave spectrum to be identified for IMT

Action B2 – IMT-2020 proposal, set of technologies

Objective
IMT-2020 recognition for several IEEE 802 radio interfaces.

Description
Develop and submit an IEEE proposal to adopt coherent set of IEEE 802 radio interface technologies into IMT-2020, possibly integrated in an IEEE 802 Access Network.

Strength	Weakness	Opportunity	Threat
1. 802 radio interfaces can be recognized as IMT-2020	1. Difficult application process; may require new stds, and internal coordination, to meet requirements	1. IMT-2020 recognition can add marketing value	1. May become more difficult to convince regulators to identify more 802-friendly spectrum
2. Allows independent IEEE proposal	2. Requires 3GPP to agree to merge result into a SRIT	2. Allows 802 to optimize proposal	2. 3GPP may prefer alternative and may not agree
3. Allows IEEE to propose use of unlicensed technology for IMT	3. Unclear how technologies built for unlicensed use would fit into IMT spectrum	3. IMT recognition can promote use of those 802 radio interfaces in IMT spectrum	3. RIT simulation modeling required by ITU-R may fail to produce convincing results

Cost	Benefit
Developing standards, preparing and pitching proposal, developing administration support, supporting evaluations, negotiating SRIT, perpetual maintenance	Marketing value. Possibility of better access to spectrum, particularly by targeting a specific segment of new mm-wave spectrum to be identified for IMT

Action B3 – IMT-2020 proposal, external proposal

Objective

3GPP incorporation of IEEE 802 features, referenced in IMT-2020.

Description

Support development of a 3GPP proposal for IMT-2020 incorporating references to integration of IEEE 802.11 or an IEEE 802 Access Network.

Strength	Weakness	Opportunity	Threat
1. IEEE 802 technologies are referenced in IMT-2020, aligning with industry momentum	1. 3GPP would make the final decisions about the details of the proposal	1. Encourages use of IEEE 802 in 3GPP 5G networks	1. Focus on 3GPP may reduce applicability of 802 radio interfaces to non-cellular networks
2. No need for IEEE 802 radio interfaces to meet IMT-202o requirements or be evaluated in ITU-R WP 5D	2. IEEE 802 radio interfaces are not identified as IMT-2020 and are not applicable to IMT spectrum, including future mm-wave IMT spectrum	2. A peripheral role in IMT-2020	2. IEEE 802 radio interfaces would be in a weaker position than IMT-2020 radio interfaces for IMT spectrum, including future mm-wave IMT spectrum
3. align with industry momentum		3. 3GPP includes IEEE 802 technology autonomously with minimal effort from IEEE 802	3. 3GPP changes IEEE 802 functionality

Cost	Benefit
Development of the interface, and coordination with 3GPP on integration of the interface	Encourages use of IEEE 802 in 3GPP 5G networks; aligns with industry momentum.

Proposed Approach – 2 prongs:

- Action B3: Ensure relevant IEEE 802 technologies are part of the incumbent mobile operator 5G universe
  - Complementary - Propose we recommend only world class winning technologies that already have a foothold in mobile community to ensure credibility with 3GPP.
  - Focus on some specific use cases/test environments, e.g. in-home entertainment, indoor hotspot, outdoor hotspot, community
  - Liaise with 3GPP as the Release 13/14 features and specifications evolve into Release 15/16/NR/…
    - IMT-2020 requirements will evolve in ITU-R and need to be tracked
    - IEEE deliverables must ensure that a 5G network including 3GPP and IEEE technologies support the appropriate IMT-2020 requirements
- Action A: Ensure IEEE 802 technologies interface with networks of new wireless operators as well as incumbent mobile operators

Next Steps

- Actions toward B3 (for Mobile Incumbents)
  - Encourage review and technical analysis within the WGs
  - "Exploring further involvement of IEEE in this work should be initiated by liaison to 3GPP"
    - Suggested by 3GPP representatives in IEEE 802-EC-16-0065-10-5GSG
- Actions towards A
  - Encourage review and technical analysis within the WGs
  - Consider a common interface with Action B3
- Identify those who will actually perform the Actions

Summary, Conclusion & Next Steps

Summary

- The Standing committee benefitted from a wide breadth of contributions and views that helped derive the cost-benefit analysis and conclusion of this report.

Conclusions

- The four Actions addressed under the Standing Committee scope are not mutually exclusive.
- There is a preference for Action B3, with a secondary desire to progress Action A.
  - This is confirmed by the straw poll results (25 July) presented on following slide.

Straw Poll Results – 25 July

- Support the following Actions (Chicago rules)
  - A: 30
  - B1: 6
  - B2: 2
  - B3: 46
  - None: 6
- Preference for one Action
  - A: 22
  - B1: 0
  - B2: 0
  - B3: 29
  - None: 2

Recommendation: Next Steps

1. Declare success and disband 5G SC
2. Action A
   - Organized by 802.1 WG (Industry Connections project)
3. Action B3
   - Organized by 802.11 WG (Liaison with 3GPP)
4. Spectrum issues handled by 802.18
5. Joint 802.1/802.11 meetings as necessary for coordination of actions A & B3

Straw Poll Results – 26 July

- Support the Next Steps Recommendation
  - 40 Yes
  - 0 No
  - ~10 Did not vote
- Commit to participate in the development of action A
  - 13
- Commit to participate in the development of action B3
  - 13

Appendices

Appendix 1: Authorization by EC Ballot

Motion: Approve the creation of the IEEE 802 5G/IMT-2020 standing committee (per 5.6 2 of the LMSC P&P) with the following scope and organization:

- To provide a report on the following items to the EC:
  - Costs and benefits of creating an IEEE 5G specification
  - Costs and benefits of providing a proposal for IMT-2020, considering possible models of a proposal:
    - as a single technology,
    - as a set of technologies, or as one or more technologies within a proposal from external bodies (e.g., 3GPP)
- During its lifetime, to act as the communication point with other IEEE organizations on this topic.

Organization: The committee is chartered for 6 months (i.e., due July 2016 at the 802 plenary) as an EC SC (type 2). Any 802 WG voting member may participate as a voting member of the committee.

Start of ballot: Monday January 25, 2016
Close of ballot: February 4, 2016 11:59PM AOE

Appendix 2: Meeting History

- March 30 – 10am ET
- April 13 - 10am ET
- April 20 – 6pm ET
- April 27 – 10am ET
- May 11 – 10am ET
- May 20 – 1-4pm HAST
- May 25 – 9-12 CEST
- June 1 – 10am ET
- June 8 – 6pm ET
- June 15 – 10am ET
- June 24 – 9-12 ET
- June 29 – 6pm ET
- July 20 – 10am ET
- July 25 & 26

Appendix 3: Process

- Discuss options
  - Applicable to the four actions to be analyzed
- Include and describe at least one Candidate Approach to each proposed action
- Expand cost/benefit for each
- Standing Committee conclusions
  - Straw-poll views on the possible actions
  - Recommend way forward for preference
  - Consensus sought

Appendix 4: Cost/Benefit Approach

- Provide requested cost-benefit analysis
  - But without monetary cost, only relative costs
  - Strengths, Weaknesses, Opportunities and Threats
- Brainstorm all costs and benefits
  - e.g., resource cost, standards development cost, installation cost, operational cost, energy cost, etc.
  - Are there unexpected costs?
  - Are there unanticipated benefits?
- Estimate value relative to a baseline

Appendix 5: IEEE 802 Standards or Projects of Possible Relevance

- 802.1
  - P802.1CF – OmniRAN architecture
  - P802.1CM – TSN for Fronthaul
- 802.3
- 802.11
  - P802.11ax – high aggregate throughput. High density of users.
  - IEEE Std 802.11ad – high individual throughput, short range
  - P802.11ay – next generation of 802.11ad
  - P802.11ah - <1 GHz for IoT requirements
- 802.15
  - P802.15.3d
  - 100Gb/s THz project
  - P802.15.7 REVa, Optical Wireless Communications
  - P802.15.4 family
- 802.16
  - 802.16
  - 802.16.1
- 802.21
  - P802.21.1