Proposed Draft Report:
IEEE 802 EC 5G/IMT-2020 SC

Source:
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Re:
  5G/IMT-2020 Standing Committee
Base Contribution:
  [none]
Purpose:
  For discussion at 5GSG meeting of 2016-06-24

Summary:
  This document is a proposal for a draft final report of the IEEE 802 EC 5G/IMT-2020 Standing Committee. This is significantly based on 802-EC-16-0065-10-5GSG ("IEEE 802 EC 5G/IMT-2020 SC draft report", or "5G SC report layout"). However, it is also quite different. 802-EC-16-0065-10-5GSG includes material intended for a final report as well as material relevant to planning the production of that report; the current contribution addresses only the former. Also, this contribution is streamlined with respect to 802-EC-16-0065-10-5GSG, leaving out some material that was addressed by in the course of discussions but may not be critical to a summary report. The report uses the methodology of identifying specific Candidate Approaches to the actions under consideration, analyzing those Candidate Approaches rather than all possible approaches to those actions. The proposal could form the basis of a final draft report. Additional material could be added. The structure of the proposal could be adapted as the structure of a text-based report, for which the slide format could serve as a summary.

Proposed Draft Report:
IEEE 802 EC 5G/IMT-2020 SC

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Introduction

- The IEEE 802 EC 5G/IMT-2020 Standing Committee was chartered by EC ballot (2016-02 to 2017)
  - 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.
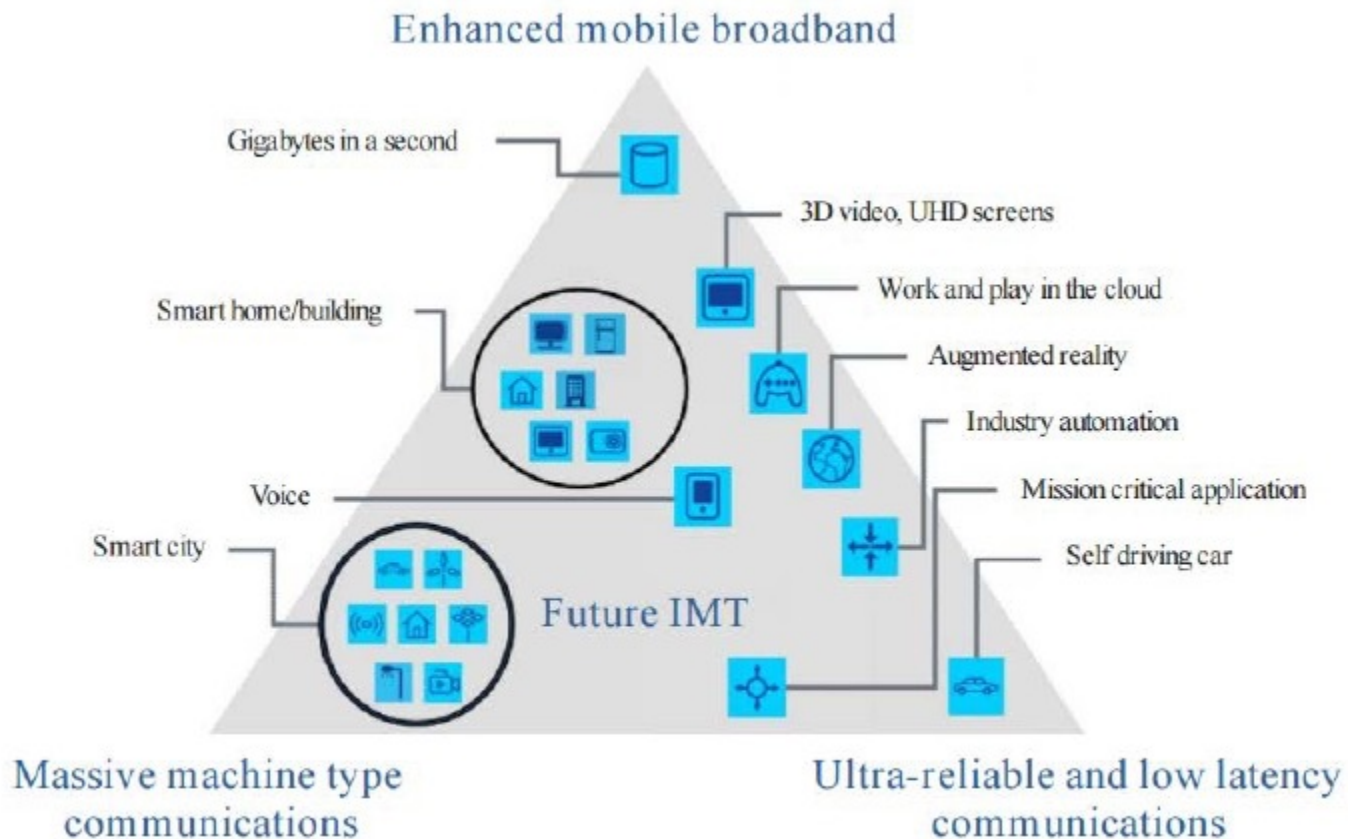
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Views of 5G

- 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.

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 – Figure 2)*

Enhanced mobile broadband

Gigabytes in a second

3D video, UHD screens

Work and play in the cloud

Smart home/building

Augmented reality

Industry automation

Voice

Mission critical application

Smart city

Self driving car

Future IMT

Massive machine type communications

Ultra-reliable and low latency communications
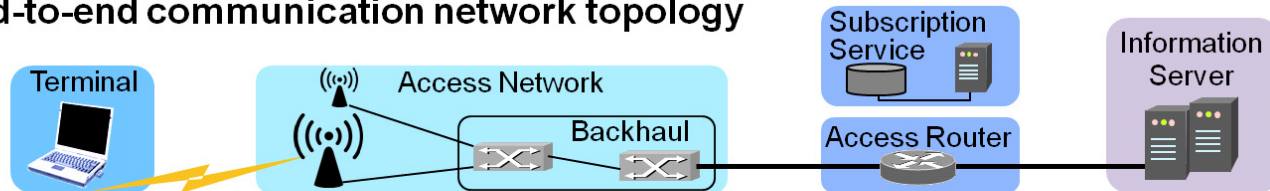
M.2083-02

What are all the derivatives of options?

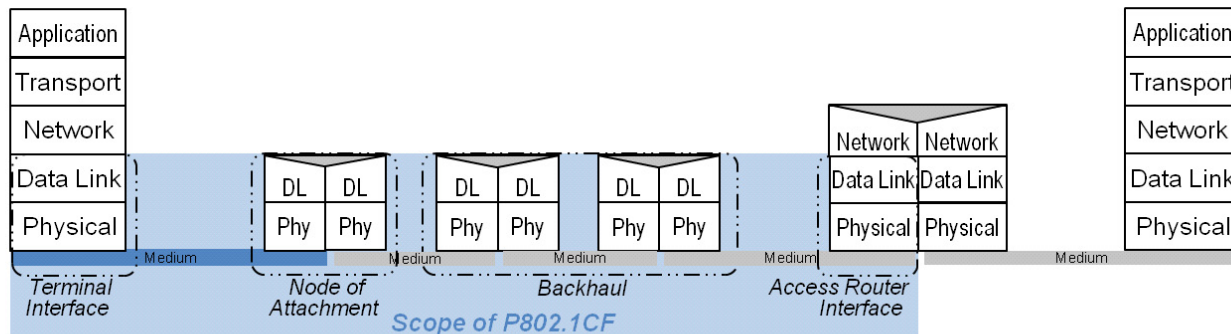# Action A: IEEE 5G specification Candidate Approach

- 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
  - 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
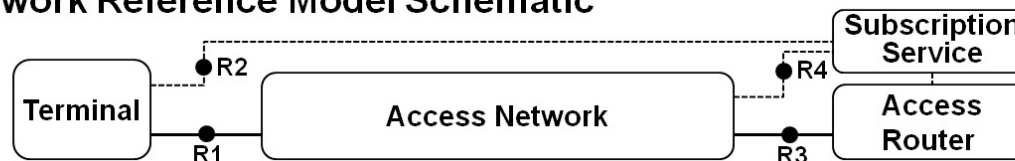
Network Reference Model overview per P802.CF/d0.0

End-to-end communication network topology

Terminal

Access Network

Backhaul

Subscription Service

Access Router

Information Server

Scope of Network Reference Model in the protocol layer architecture

| Application |
| Transport |
| Network |
| Data Link |
| Physical |

| DL | DL |
| Phy | Phy |

| DL | DL |
| Phy | Phy |

| DL | DL |
| Phy | Phy |

Network	Network
Data Link	Data Link
Physical	Physical

| Application |
| Transport |
| Network |
| Data Link |
| Physical |

Medium   Medium   Medium   Medium   Medium

Terminal Interface   *Node of Attachment*   *Backhaul*   *Access Router Interface*

Scope of P802.1CF

Network Reference Model Schematic

Terminal — R1 — R2 — Access Network — R3 — R4 — Subscription Service / Access Router

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Action A: Routes to success
802 Access Network

- engage with 3GPP to specify interface details
  - □ could support many 802 MACs
- 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
  - ComSoc standards; esp. 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. Encourages other end-to-end networks to adapt 802	3. May requires liaison activity to coordinate interface requirements	3. Increases value of the entire range of 802 MAC/PHYs	3. Non-802 technologies may be used at the specified interface

Cost	Benefit
IEEE 802 needs to develop Access Network spec; 802 MAC/PHYs need to develop complementary specs; 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

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Action B: IMT-2020 proposal Candidate Approaches

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

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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. May become more difficult to attain more RLAN spectrum

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

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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 standards, 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. May become more difficult to attain more 802-friendly spectrum

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

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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 the use of IEEE 802.11 or an IEEE 802 Access Network.

Strength	Weakness	Opportunity	Threat
1. IEEE 802 technologies are referenced in IMT-2020	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-2020 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 new mm-wave IMT spectrum to be identified	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 new mm-wave IMT spectrum to be identified

Cost	Benefit
Development of the interface, and coordination with 3GPP on the interface	Encourages use of IEEE 802 in 3GPP 5G networks

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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

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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 6 – 10am ET*
- *July 13 – 6pm ET*
- July 20 – 10am ET
- July 25 & 26