IEEE 802 EC 5G/IMT-2020 SC draft report

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5G SC report
Philosophy

• Include and describe all options
  ▫ That are derivatives of the four requested cases

• Expand cost/benefit for each
  ▫ In a prioritized manner based on contributions
    • starting with option 4, then option 1 (per 78, 81)

• SC conclusion recommended
  ▫ Consensus preferred on preference
    • not required
    • Worst case straw poll preference
  ▫ Recommend way forward for preference (s)
What are “costs and benefits”? 

- This is a cost-benefit analysis
  - But without monetary cost, only relative costs
  - A quantitative pros vs cons
  - 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 the unexpected costs?
  - Are there unanticipated benefits?
- Estimate value relative to a baseline
Proposed Table of Contents

• Introduction
  ▫ IEEE 802 5G related projects

• Options Considered
  1. IEEE 5G
     ▪ Description
     ▪ Benefits
     ▪ Costs
  2. IMT-2020 – single technology
     ▪ Description
     ▪ Benefits
     ▪ Costs
  3. IMT-2020 – set of technologies
     ▪ Description
     ▪ Benefits
     ▪ Costs
  4. IMT-2020 – external proposal
     ▪ Description
     ▪ Benefits
     ▪ Costs

• Conclusion

• 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
  ▫ 802.16.1

• 802.21
  ▫ P802.21.1
Report format?

- Following Table of Contents
- Slide deck
  - Allowing for figures, tables, conclusions
    - Suggest a template for SWOT summary
  - Will continue to progress content on calls
  - Easy presentation to EC
  - Chair could be editor
- Document
  - Allowing for more detailed wording
  - Contributions and offline editing required
  - Will need an overview presentation for EC
    - Would require editor
1.a.i - option name

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<th>Objective</th>
<th>Strength</th>
<th>Weakness</th>
<th>Opportunity</th>
<th>Threat</th>
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Description

<table>
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<th>Cost</th>
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What is 5G?
There are two contexts for 5G

- **IEEE 5G**
  - Some sort of description will be required
  - This may include use cases and requirements

- **IMT-2020**
  - Usage scenarios (as defined by ITU-R M.2083)
    - Enhanced Mobile Broadband (eMBB)
    - Ultra-reliable and low latency communications (UrLLC)
    - Massive machine type communications (mMTC)
  - Capabilities (as defined by ITU-R M.2083)
    - Peak Data rate, User experienced data rate, Latency, Mobility, Connection density, Energy efficiency, Spectrum efficiency, Area traffic capacity
IMT-2020 (per ITU-R M.2083 - Figure 2)
IEEE 5G architecture

... simplified
There are also two contexts for 3GPP

- **IEEE 5G**
  - There is no focus on the ITU-R IMT-2020 submission
    - 3GPP defines solely, or jointly with IEEE 802, the requirements and use cases for IEEE 802 technology
    - This could be equivalent to, or a subset of, 3GPP 5G

- **IMT-2020 5G**
  - There is an ITU-R IMT-2020 submission
    - By either 3GPP or IEEE 802
    - The requirements placed on IEEE 802 are based on the usage scenarios and capabilities defined by ITU-R M.2083
What are all the derivatives of options?
1. IEEE 5G

- Description
  - Cost/benefit analysis does not include submission to IMT-2020
  - At least simplified architecture, but likely more
  - A combination of multiple IEEE standard technologies, profiled in a single standard

a) IEEE 802 wireless 5G
   i. 802.11 only
      a. P802.11ax – high aggregate throughput. High density of users.
      b. P802.11ay, IEEE Std 802.11ad – high individual throughput, short range.
      c. P802.11ah - <1 GHz for IoT requirements
      d. 802.11p - wireless access in vehicular environments
   ii. 802.15 only
      a. P802.15.3d
      b. 100Gb/s THz project
      c. P802.15.7 REVa, Optical Wireless Communications,
      d. P802.15.4 family.

b) “All IEEE 802” 5G
   i. And submit to ITU-R as non-IMT (i.e., WAS/RLAN) and complimentary to IMT-2020

c) IEEE 802 5G plus others
   i. 3GPP 5G
   ii. IETF

d) “All IEEE” 5G
   i. IEEE 802 and ComSoc projects

e) IEEE 5G plus others
2. IMT-2020 - single technology

- Description
  - Just radio interface of simplified architecture. Single or multiple singles...
  - IMT-2020 proposal by IEEE

a) eMBB (<6GHz)
   - i. IEEE 802.11ax
   - ii. IEEE 802.11ac
   - iii. IEEE 802.11n

b) eMBB (>6GHz)
   - i. IEEE 802.11ay
   - ii. IEEE 802.11aj
   - iii. IEEE 802.11ad

c) UrLLC – IEEE 802.11p

d) mMTC – IEEE 802.11ah

e) eMBB
   - a) P802.15.3d
   - b) 100Gb/s THz project
   - c) P802.15.7 REVa, Optical Wireless Communications,

f) mMTC - P802.15.4 family.
3. IMT-2020 – set of technologies

- Description
  - At least radio interface of simplified architecture, but likely more
  - A combination of multiple IEEE 802 standard technologies, profiled in a single standard
  - IMT-2020 proposal by IEEE

  a) IEEE 802.11
     i. eMBB (<6GHz) – IEEE 802.11 ax,ac,n
     ii. eMBB (>6GHz) – IEEE 802.11 ay,aj,ad
     iii. UrLLC – IEEE 802.11p
     iv. mMTC – IEEE 802.11ah

  b) IEEE 802.11 with 802.1/3

  c) IEEE 802.15
     a) eMBB
        a) P802.15.3d
        b) 100Gb/s THz project
        c) P802.15.7 REVs, Optical Wireless Communications,

     b) mMTC - P802.15.4 family.

  d) IEEE 802.11 with 3GPP 5G
     i. LWA
     ii. LWIP
     iii. eLWA
     iv. New?
4. IMT-2020 - external proposal

• Description
  ▫ Part of a complete architecture
  ▫ A combination of IEEE 802 standard technologies with other technologies (e.g., 3GPP)
  ▫ IMT-2020 proposal by external party (e.g., 3GPP)

a) IEEE 802.11 with 3GPP 5G
  i. LWA
  ii. LWIP
  iii. eLWA (Release 14)
  iv. Release 16?
What are all the initial cost/benefits?
Approach Analysis (4.a)

- **IMT 2020 – external party (i.e., 3GPP)**
  - IEEE802 is as a part of 5G radio and networks of other technologies.
    - Radio interface
      - IEEE802.11 using (e)LWA or LWIP
    - Network management, control, etc.
      - under external party’s submission.

- **Benefits:**
  - IEEE802.11 is a component in ITU-R/3GPP 5G architecture
    - Align with industry 5G branding momentum
  - Align with the current scope of IEEE802.11: PHY and MAC
  - Help ITU-R to study the need of new spectrum for IMT-2020
  - The least effort among four approaches
    - IEEE 802 could just let 3GPP include IEEE 802 technology autonomously

- **Costs:**
  - IEEE 802 needs to coordinate with 3GPP for their submission of IMT-2020 proposal in ITU-R.
Approach Analysis (1.b.i)

- **IEEE802 5G as ITU-R non-IMT**
  - Submit 5G proposals to ITU-R WP5A WAS/RLAN as a complementary solution of IMT-2020
  - Possible IEEE802 technology for component of 5G
    - Radio interface
      - IEEE802.11, IEEE802.15, etc
    - Network management and control (TBD)
    - Back haul and front haul
      - IEEE 802.1/3, IEEE 802.11, etc

- **Benefits:**
  - Align ITU-R WP5A scope for non-IMT systems: WAS/RLAN
  - May identify some use cases and requirements for non-IMT 5G services.
  - Support new spectrum sharing mechanism with other technologies
  - Promote IEEE802 in ITU-R 5G branding as non-IMT and complementary to IMT-2020

- **Costs:**
  - Requires more work than the approach 4.
Next Steps
Contributions requested

- **IEEE 5G**
  - Use cases and Requirements
    - Endorse others, subset others, develop new
  - Describe architecture and/or technology

- **Derivative options**
  - Expand list
  - Prioritize list

- **Report content**
  - Agree on template and format
  - Indicate which option
  - Expand costs and benefits