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
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     - Costs
  3. IMT-2020 – set of technologies
     - Description
     - Benefits
     - Costs
  4. IMT-2020 – external proposal
     - Description
     - Benefits
     - Costs
- Conclusion

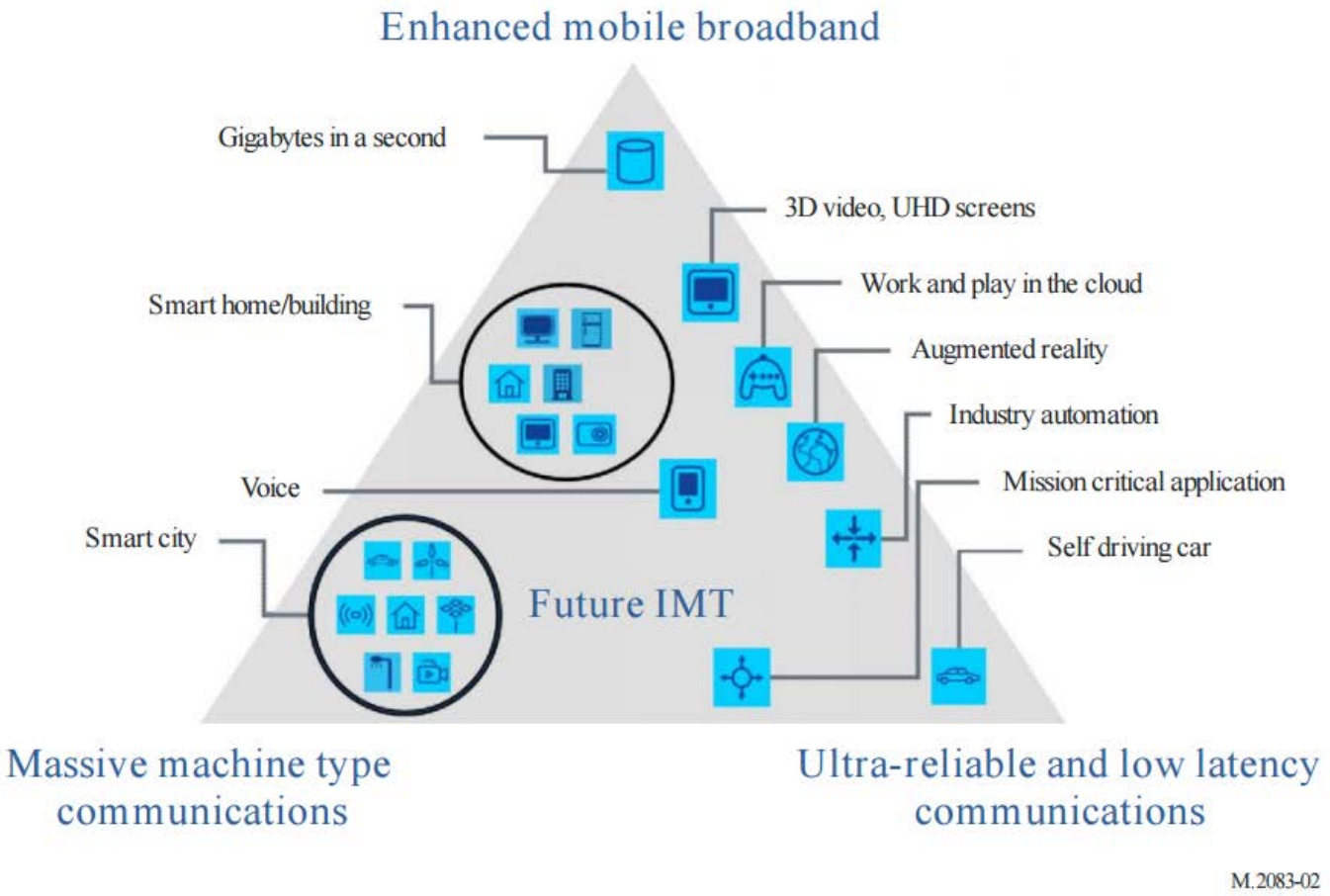
- 802.1
  - P802.1CF – OmniRAN architecture
  - P802.1CM – TSN for Fronthaul
- 802.3
- 802.11
  - P802.11ax – high aggregate throughput. High density of users.
  - IEEE Std 802.11ad – high individual throughput, short range.
  - P802.11ay – next generation of 802.11ad.
  - P802.11ah - <1 GHz for IoT 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

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
    - 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 REVa, 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 is a component in ITU-R/3GPPP 5G architecture
      - Align with industry 5G branding momentum
    - Align with the current scope of IEEE802 SDO: 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
  - Indicate which option
  - Expand costs and benefits