FCC TECHNOLOGICAL ADVISORY COUNCIL (FCC-TAC) : SUMMARY OF 2022 ACTIVITIES

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What is FCC-TAC?

The Technological Advisory Council (TAC) provides technical advice to the Federal Communications Commission (FCC). The TAC is organized under the authority of the Federal Advisory Committee Act.

The TAC is comprised of a diverse array of leading experts that helps the FCC identify important areas of innovation and develop informed technology policies supporting America's competitiveness and job creation in the global economy.

The FCC Charter defines the purpose of the organization.

Guidelines for 2022

According to FCC Chairwoman Jessica Rosenworcel, "careful planning and execution" is required to maintain US "leadership in high-priority emerging technology".

She emphasizes the importance of the nation being at the forefront of "advancing ambitious 6G" R&D and notes "the need for more spectrum" and supply chain frailties as areas requiring the FCC's attention.

"We are starting that work here and now by re-establishing the TAC and charging it to conceptualize 6G".

WInnForum and TAC

Interests of WInnForum are represented on TAC

- WInnForum CTO Andrew Clegg serves on behalf of WInnForum; co-chairs Advanced Spectrum Sharing Working Group
- WInnForum member Amit Mukhopadhyay (Nokia) is a member

Work groups & topics addressed

6G

- Development and deployment of technology
- O-RAN /V-RAN ecosystem and security
- Spectrum needs
- Applications & Verticals
- Digital divide

Advanced Spectrum Sharing

- Potential spectrum for sharing in 7-24 GHz and > 95 GHz
- Best practices for spectrum sharing
- Receiver Standards and technology advancements
- Interference modeling
- Economic incentives of shared spectrum

AI/ML

- Pilot projects for FCC
- Safe uses of AI
- Use of AI/ML for spectrum sharing
- Use of AI/ML in Telecommunication Networks

Emerging Technologies

- Semiconductors, RF front ends, antennas, digital basebands, chipsets
- Internet resilience tools
- Quantum computing and block chain
- Indoor/outdoor location services
- Small satellites
- Cable and broadcasting
- Optical/laser technologies

6G Work Group

Key activities and recommendations

Highlights

Development and deployment of technology	• 5G Deployments are still nascent and potential impact still needs to be realized. 5G Advanced Evolution to continue for future 3GPP Releases (18,19) • 6G Fundamental research is underway with Federal and Industry Investments • ITU defined IMT--2030 and will set 6G radio performance requirements • 6G is an undefined formal term not adopted by any SDO or Consortia
O-RAN /V-RAN ecosystem and security	• Focus on demonstrating multi-vendor interoperability in disaggregated O-RAN Networks • Federal incentives need to align with subsystem integration and demonstrate performance parity with legacy networks • Securing the Open Fronthaul interface real time system from targeted attacks
mmWave and Sub-THz	• Opportunity: joint comms and sensing, large transmission bandwidth, indoor and personal area network deployment • Challenge: High cost for deployment due to very high path loss • Focus on highly directional systems
Spectrum needs	• Mid Band: >500MHz in 7-24 GHz, enhancements to existing sharing mechanisms needed • Sub THz: 100--1000 GHz for highly demanding use cases: Immersive comms, • To achieve 1 Tbps, 50GHz spectrum is required in the 300 GHz--1 THz domain • Heterogeneity of access: Space,Aerial,TerrestrialSpace,Aerial,TerrestrialIntegrated Networks requires Integrated Networks requires coordinationcoordination
6G Use Cases and Application Verticals	• Focus on application centric view with Multi-sensory and Immersive Communication use cases are quickly emerging • Emergence of Key Value Metrics (KVI) beyond traditional metrics for 5Gmetrics for 5G • Focus on energy efficiency, sustainability, inclusion and deployment economics

Advanced Spectrum Sharing Work Group

Key activities and recommendations

Highlights

Potential shared spectrum	• Public information about actual spectrum usage (not just allocations) should be collected; detailed quantitative analysis is needed • 10.7 – 13.25, 14.0 – 14.75, 17.8 – 18.6 and 18.8 – 20.2 GHz spectrum identified for potential sharing with incumbent users (non-federal satellite, space research, federal mobile and satellite uplink • Bands could be contiguous or non-contiguous and licensing models could be exclusive, shared or non-exclusive
Best practices for sharing	• Utilize an effective and time--efficient method for certifying and then re--certifying centralized spectrum management systems as they incorporate system enhancements, including better propagation models and other technical systems sharing to improve sharing efficiency. • Explore simplifying the manner in which aggregate interference is taken into account for interference protection. • Avoid the required use of dedicated sensing networks similar to ESC as the sole enabler of shared spectrum. Consider other options such as IIC.
Receiver standards	• What degree of interference is acceptable to an incumbent in a particular band and should the new entrant always be responsible for mitigation? Should we define a level of interference that the incumbent must be able to accept, i.e., define “harm thresholds”? • Smart antenna technologies are primarily being deployed to improve performance; how may they be better leveraged for spectrum sharing (i.e., directionality, nulling,..)? • Do advanced filters play a role? Are there operational limitations to filters and their impact on the ability to share spectrum? What are the costs/benefits?
Interference modeling	• The FCC should continue exploring evaluating the development of propagation and interference models using real--world signal strength data, e.g. from crowdsourced measurements and use tools such as Kriging and AI/ML to predict performance and interference • The FCC should investigate how the data sets they are collecting through their speed test app could be made available to researchers to facilitate the further development of propagation and interference models.
Economic incentives or sharing	• The FCC and NTIA should focus increased attention on promoting economic incentives for entities to voluntarily share spectrum. They should also examine pathways to gather information from incumbent spectrum users to facilitate better analyses of spectrum value and sharing constraints. • It is recommended that the FCC determine a metric or metrics to assess the comparative spectrum utilization between exclusive use and shared use. • Critically review proposals (academic and otherwise) for reducing the friction in spectrum markets and encouraging innovation, competition and investment

AI/ML Work group

Key activities and recommendations

Highlights

Cross cutting Issues	•Artificial Intelligence (AL), Machine Learning (ML), and Data Driven Algorithms (DDAs) play a central role in enabling Digital Transformation to create value. Organizations in Government and in Industry are undergoing major changes •Appropriate staffing, teaming, and access to resources is necessary for success.
AI/ML pilot projects	•Develop a multiyear plan for exploring and piloting a series of projects that will advance dynamic and highly automated spectrum sharing. Secure approval for funding the plan and subsequently launch a series of •Conduct a pilot project around ”Wireless Data” collected by the FCC and data that may be available from other sources. The purpose is to lay the that may be available from other sources.
Safe use of AI/ML	•Address the Concerns and Risks to Consumers, Ecosystem Players, and the FCC related to the use of Artificial Intelligence, Machine Learning, and other Data Driven Algorithms •Develop Policies and Practices that place the FCC ahead of the curve in recognizing the fundamental changes that the use of AI, ML, and Data Driven Algorithms
Spectrum sharing	•Prepare the groundwork for Dynamic Spectrum Sharing with a high degree of automation. Take advantage of evolving technologies (for AI/ML, Radio Architectures, and devices that open up new spectrum) and practices that have a high probability of reaching maturity in time for the deliberations used to define the new generation of wireless spectrum
AI/ML in Telecom	•Prepare for the evolution in Network requirements driven by the advances in technology and by significant changes in Telecommunications Network usage patterns. •Conduct a comprehensive study to understand how the growing complexity of Networks, with the inclusion of AI/ML techniques and Sofwarization, can be managed.

Emerging Technologies Work group

Key activities and recommendations

Highlights

Semiconductors, chipsets, etc	•AI is being incorporated in 5G chipset leading to 5G coverage enhancement and uplink leading to 5G coverage enhancement and uplink performance improvement •Increasing level of technology integration continues in smartphones integration; use of Silicon along with advances in highly dense multi--layer PCB boards have resulted in low--cost phased arrays and transceivers for 5G
Cable and broadcasting	•DOCSIS 3.1 widely deployed and 4.0 in early stages of deployment; latency 10ms with 3.1 and 1ms with 4.0; downstream capacity up to 10GBPS and upstream capacity of 1--2Gps with 3.10 and 6 Gps with 4.0 •IP-based broadcasting ATSC 3.0 gaining penetration in the US – 4.5M TV sets by 2022, 75% of all new TVs by 2025
UWB, location and positioning	•UWB adoption in smartphones is driving rapid growth; more than 500 million UWB devices in the field worldwide; expect one billion per year by 2025 •Wi-Fi based positioning can achieve 1-2 m accuracy today, with <1 m coming; other technologies based on UWB and mmWave can achieve similar results
Optical/laser	•Optical technologies are experiencing rapid growth for satellite systems, including inter-satellite links (ISLs) and satellite imaging •Passive Optical Networks have a path to reach 100Gbps end user rates by 2030 •Free Space Optical Communications are being deployed both indoor and outdoor. Indoor LiFi is an extension of the 802.xx
Small satellite, quantum etc	•Four mega LEOS constellations, with lot more to come soon; space debris a big concern for future, along with interference among inter-satellite links •Significant engineering effort is necessary before quantum spectrum analyzers can be integrated into a field--testable devices