Federal Communications Commission
Technological Advisory Council Meeting

February 28, 2022

FCC Technological Advisory Council Agenda – February 28, 2022

10:00am	–	10:30am	Introduction and Opening Remarks - Welcome Message from TAC Chair - Opening Remark by OET Chief - DFO/Deputy DFO Remarks - Member Introduction/Roll Call
10:30am	–	11:00am	Presentation on Record Retention Policy (FCC/OMD) Presentation on FACA Rules and Guidance (FCC/OGC)
11:00am	–	11:30am	Emerging Technologies WG Presentation
11:30am	–	12:00pm	AI/ML WG Presentation
12:00pm	–	1:00pm	Lunch Break
1:00pm	–	1:30pm	Advanced Spectrum Sharing WG Presentation
1:30pm	–	2:00pm	6G WG Presentation
2:00pm	–	2:20pm	Closing Remarks
2:20pm			Adjourned

FCC TAC Emerging Technologies

TAC meeting February 28, 2022

Co-Chairs: Henning Schulzrinne, SGE (Columbia University)

Brian Markwalter, CTA

FCC Liaisons: Martin Doczkat, Bahman Badipour, Ken Baker, Padma Krishnaswamy

Working Group Roster

Mark Bayliss	Visual Link
Nomi Bergman	Advance
Ranveer Chandra	Microsoft
Bill Check	NCTA
Lynn Claudy	NAB
Jeff Foerster	Intel
Peter Gammel	Global Foundries
Dale Hatfield	UC Boulder
Mark Hess	Comcast
Karri Kuoppamaki	T-Mobile
Steve Lanning	Viasat
Greg Lapin	ARRL
Kaniz Mahdi	VMWare
Jennifer Manner	Hughes
Lynn Merrill	NTCA
Michael Nawrocki	ATIS
Madeleine Noland	ATSC
Jesse Russell	Inc Networks
Lewis Shepard	VMWare
Marvin Sirbu	SGE
Ted Solomon	NRTC

Charter/Questions Posed

- Provide information on emerging technologies, including the **IoT ecosystem** and the spectrum access needs for potential high-bandwidth devices, that are under development or in use that will improve the US consumer experience on applications related to communications. This should include advances in **semiconductor technologies for RF front ends, antennas and digital basebands**.
- What are the new tools to **restore internet access during shutdowns** and other disruptions?
- What are the **new features or additional chipsets** that are expected to be embedded into wireless devices, including **UWB and other sensors**, and how would they promote additional services and applications?

Charter/Questions Posed

- What are the network-driven emerging technologies such as **quantum computing** and **blockchain**, and how would they improve user experience in communications services?
- How is **indoor/outdoor location service** envisioned to improve and what are the technologies that are under consideration?
- What is the status of **small satellite development**, what frequency bands that are under consideration for use, and what services that are envisioned?

Charter/Questions Posed

- What are latest enhancements and capabilities of **cable and broadcasting standards** that may benefit the consumers?
- What **optical/laser** technologies are being utilized for space or terrestrial communications, what is the performance of these technologies in supporting communications, and what steps should be taken to ensure proper use of these technologies?

Shared Topics with Other Working Groups

- Technologies for RF front ends, antennas and digital basebands with *Spectrum Sharing* working group.
- Status of small satellite development, frequency bands under consideration, and services envisioned with *6G* working group.

Grouping Topics for Exploration

- Devices and Technologies
  - Antennas, front ends, new semiconductor technologies and applications (e.g., UWB)
  - New optical technologies
- Internet and Information Access
  - Resiliency and restoring access, cable and broadcasting advancements, streaming (?)
  - IoT networks (e.g., new deployment models)
- Satellite
- Location Services
  - Indoor/outdoor technologies, roadmap for improvement
- Network-driven (Advanced) Technologies
  - Blockchain, Quantum computing & communications, Other(?)

Common Questions

- Technology maturity (e.g., Technology Readiness Level 1-9)
  - generally, “headlight” range of 3-5 years to significant use
- Technology impact (from transformational to incremental)
- Risks (i.e., reason it may not live up to expectation)
- Sources (e.g., US-based manufacturing or development)
- Recommendations:
  - What actions can the Commission take to accelerate technology development?
  - Are there existing rules that are not needed to protect existing technologies and are retarding new technology development?
- What impact could the technology have on key Commission objectives (digital inclusion, rural broadband, network resiliency, competition, accessibility, …)

Criteria: Impact

Impact on:

- new network deployment (cost, reach)
- operational cost (human labor, energy)
- network resiliency
- network performance (speed, latency)
- restoration and emergency recovery
- network security and trustworthiness
- specialized applications (e.g., IoT, sensing, vehicular networks)

Approach

- Refine topics and questions
- Identify speakers and SMEs
- Form topic-based ad hoc groups as needed and propose work outputs
- Goal: Summary report & presentation

Questions?

FCC TAC Artificial Intelligence (AI) WG
Artificial Intelligence and Machine Learning

Chairs: Lisa Guess, Cradlepoint
Adam Drobot, OpenTechWorks, Inc.

FCC Liaisons: Chrys Chrysanthou , Kambiz Rahnavardy , Patrick Sun,
Sean Yun: and Michael Ha, Martin Doczkat

Date: February 28, 2022

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2022 Work Group Team Members - AIWG

Name	Organization	Name	Organization
Mark Bayliss	Visual Link	Mark Hess	Comcast Corporation
Nomi Bergman	Advance/Newhouse	Greg Lapin	ARRL
Dean Brenner	TAC Chair	Jose Mejia	RapidSoS
William Check	NCTA	Amit Mukhopadhyay	Nokia Bell Labs
Krishna Chintalapudi*	Microsoft	Mike Nawrocki	ATIS
Martin Cooper	Dyna LLC	Jon Peha	CMU Metro21
Andrew Clegg	WIE, Google	Balaji Raghothaman*	Keysight
Adam Drobot	OpenTechWorks	Meryem Simsek*	VmWare
Brian Daly	AT&T	Paul Steinberg	Motorola Solutions
Monisha Ghosh	Notre Dame	Michelle Thompson	ORI
Lisa Guess	Ericsson (Cradlepoint)		
* Alternate member undergoing vetting			

Artificial Intelligence and Machine Learning WG 2022

1. Expand pilot project proposal(s) from the 2020 TAC session to provide details and associated quality metrics that will allow the Commission to explore, extract the value, and gauge the success of implementing AI/ML techniques.

2. Explore the use of AI/ML methods and techniques to improve the utilization and administration of spectrum (licensed, unlicensed, and shared) by addressing the fundamental aspects of propagation, interference, signal processing, and protocols.

Artificial Intelligence and Machine Learning WG 2022 - continued

3. Evaluate the use of AI/ML methods and techniques applied to assuring the safety, security, and performance of network equipment, network control, and network operations in a network environment that increasingly relies on automation, is seeing a rapid growth of new network connections, and is increasingly digitized and software-ized.

4. Consider the implications of AI/ML adoption by content providers and the impact on consumers, focusing on understanding causes of and approaches to dealing with addictive behaviors.

Artificial Intelligence and Machine Learning WG 2022 - continued

5. Formulate a better understanding of uses of AI/ML that may result in modification of human behavior, to develop sound policies that encourage positive outcomes (e.g., public health measures, and other benefits) and mitigate against negative outcomes.

AIWG – Early Discussions

First meeting February 23rd , 2022, devoted to introductions and capturing AIWG member interests and backgrounds.

Common themes that emerged:

- Application to AI to Spectrum Sharing
  - Better Models for Propagation
  - Mitigation and avoidance of interference
  - Progression to Dynamic Spectrum Sharing Schemes

AIWG – Early Discussions - continued

- Use of AI in 5G

3GPP has approved the 5G-Advanced Rel-18 work packages in its plenary meeting RAN#94^{e} which includes flagship projects that could help underpin future systems in the run up to 6G.

Known as Release 18, it's the fourth standard for 5G and the first to be dubbed "5G Advanced », and Artificial Intelligence and Machine Learning (AI/ML) is one of the main flagship Rel-18 projects and the top category in terms of defining the "Advanced" aspect unlike Release 16 and 17 which mainly helped extend 5G to new verticals, 3GPP is looking at AI/ML with two different lenses, one for the network and one for the air interface.

Several vendors have also called out AI/ML as a key component of 5G Advanced, with the technology expected to trigger a paradigm shift in future wireless networks and used to improve the radio interface by optimizing performance for multi-antenna systems for applications like XR.

AIWG – Early Discussions - continued

- Use of AI in 5G

AIWG – Early Discussions - continued

- Use of AI in O-RAN

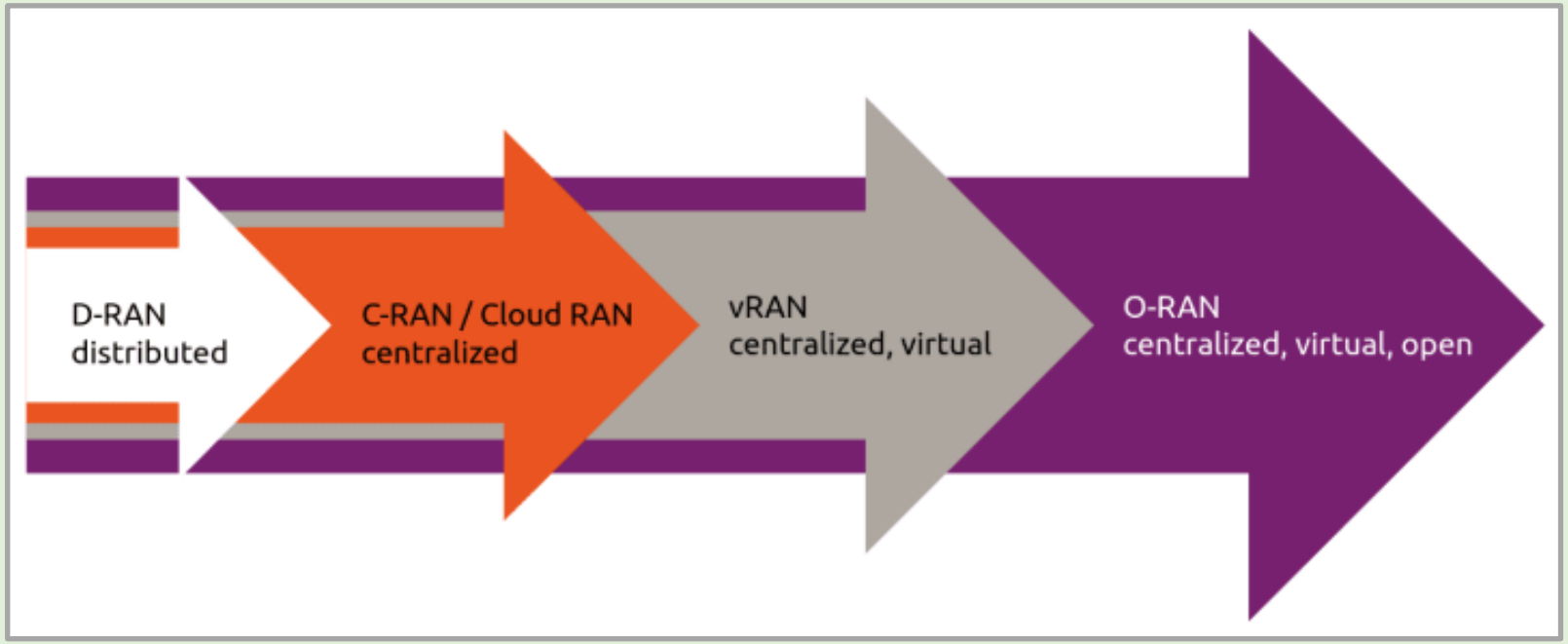
Established in 2018 by AT&T, China Mobile, Deutsche Telekom, NTT DOCOMO, and Orange, the O-RAN Alliance's objective is to "re-shape the RAN industry towards more intelligent (AI), open, virtualized and fully interoperable mobile networks" by introducing global standards that can be used for RAN deployments.

As an example, Google is working with O-RAN initiatives in software application, 5G, network-based artificial intelligence (AI) technologies and multi-cloud environments.
Google published its Global Mobile Side Cloud (GMEC) strategy in March 2020. Google Cloud is now focused on three areas:

1- The monetization of 5G networks "especially in connection with Business services and solutions"
2- Data-driven customers experiences
3- The improvement of operational efficiency across critical telecommunications systems.

AIWG – Early Discussions - continued

- Use of AI in O-RAN



AIWG – Early Discussions - continued

- Other areas discussed

  - The role of AI in 6G and beyond
  - Impact of AI on Implementation (Quality, Safety, and Security)
  - Testing, Validation, ……
  - Engagement with larger AI Community
  - Alignment with AI Investments - Public and Private Initiatives
  - Emergency response and recovery (situational analysis,….)
  - Broadband for rural and underserved areas (planning, deployment, operations, and maintenance)

AIWG – Early Discussions - continued

- Other areas discussed
  - Energy Efficiency for Wireless Systems
  - Economic impacts of AI uses and new requirements for the Network
    - Manufacturing
    - Business Processes
    - Consumers
  - Safe uses of AI (societal considerations, Network robustness, …)
  - Converged infrastructure (Communications, Computing, Data Storage)
  - Data, Data, and Data – who owns it, who pays for it, who curates it!

General Approach for 2022 AIWG

- Two sub working groups
- Balance of time devoted to WG deliberations and external Speaker/SME presentations
  - Follow the items spelled out in the Charter
    - Narrow down the scope to accomplish meaningful results in 2022
  - Will start off with internal discussions
  - Followed by a set of targeted speakers on subjects of interest
  - Still contemplating WG output (presentations, white papers, …..)

- Early at this point to articulate likely areas for recommendations

2020 AI Working Group recap

Our past white paper can be found here:

https://www.fcc.gov/sites/default/files/fcc_aiwg_2020_whitepaper_final.pdf

The FCC TAC AIWG identified five 2020 recommendation areas:

1. **"Unlock transformational change" - The incorporation of considerations for Artificial Intelligence in the FCC Strategic Plan.**
2. **"To build knowledge, unleash the Data" - The creation of a Task Force to address how the FCC can best address important aspects of Data governance and curation for AI/ML applications to serve its internal needs, and those of industry and the public.**
3. **"Cast a wide net" - Develop a plan and strategy for designing, developing, deploying, operating, and maintaining a Broadband Map that takes advantage of the best technologies and capabilities available.**
4. **"Keep humans in control of the loop" - Policies and approaches to ensure the safe use of Artificial Intelligence as it impact the nation's networks, communication needs, and important applications.**
5. **"Get your feet wet" - Develop the FCC's capability for extracting value from Artificial Intelligence in solving issues and problems that come before the FCC by conducting pilot projects with near term return.**

FCC TAC AIWG Activities in FY2020

Issues Addressed

1. Leveraging Federal Investments in AI
2. Understanding Data needs for AI
3. Extracting value from AI and Data to address issues of importance to the FCC
4. Safe use of AI

Strategic Priorities

1. Closing the Digital Divide
2. Promoting Innovation
3. Protecting Consumers and Public Safety
4. Reforming the FCC's Processes

Industry Trends

Considerations

1. The FCC's Strategic Priorities
2. Industry Trends
3. Technology Maturity
4. Timeliness
5. Impact

The FCC
Service Providers
Consumers
Industry
The Public Sector

Inputs

1. AIWG SME Discussions
2. External Presentations
3. Supporting Documents
4. FCC Liaisons

Nature of Recommendations

Lasting Impacts on the FCC

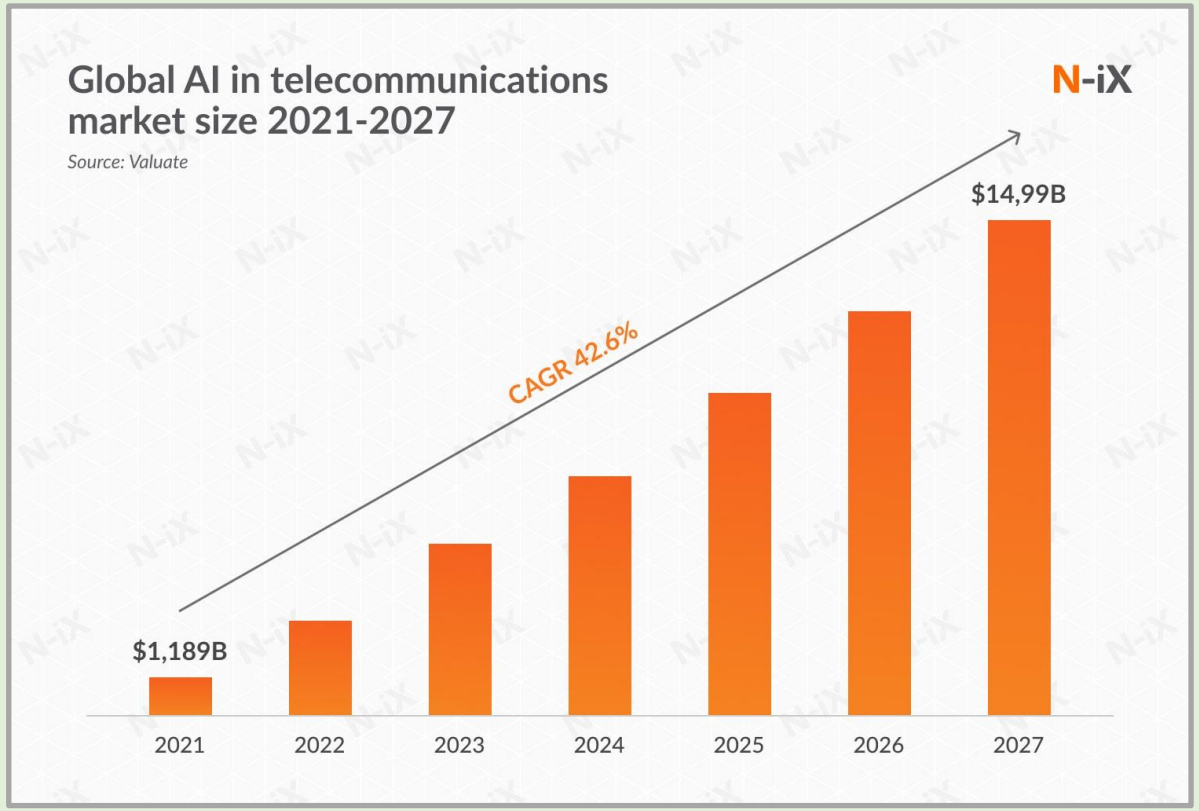
(Two) AI in FCC Strategy, and Data

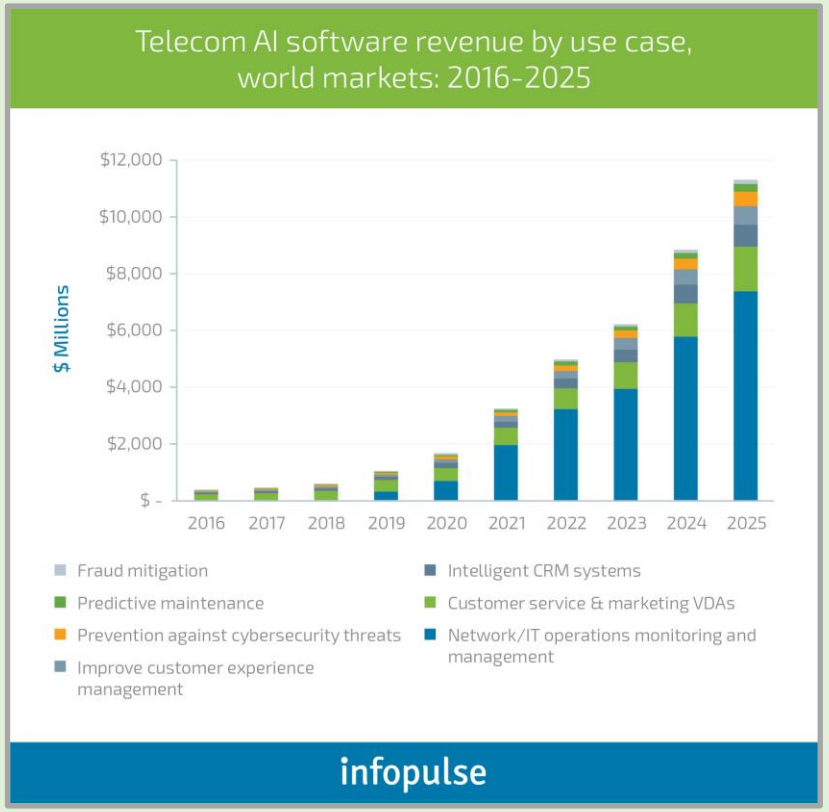
Immediate Impacts on FCC, Service Providers, Consumers, Industry, and the Public Sector

(Three) Broadband Map, Safe Use of AI, and Pilot Projects

Turning Back to the 2022 AIWG

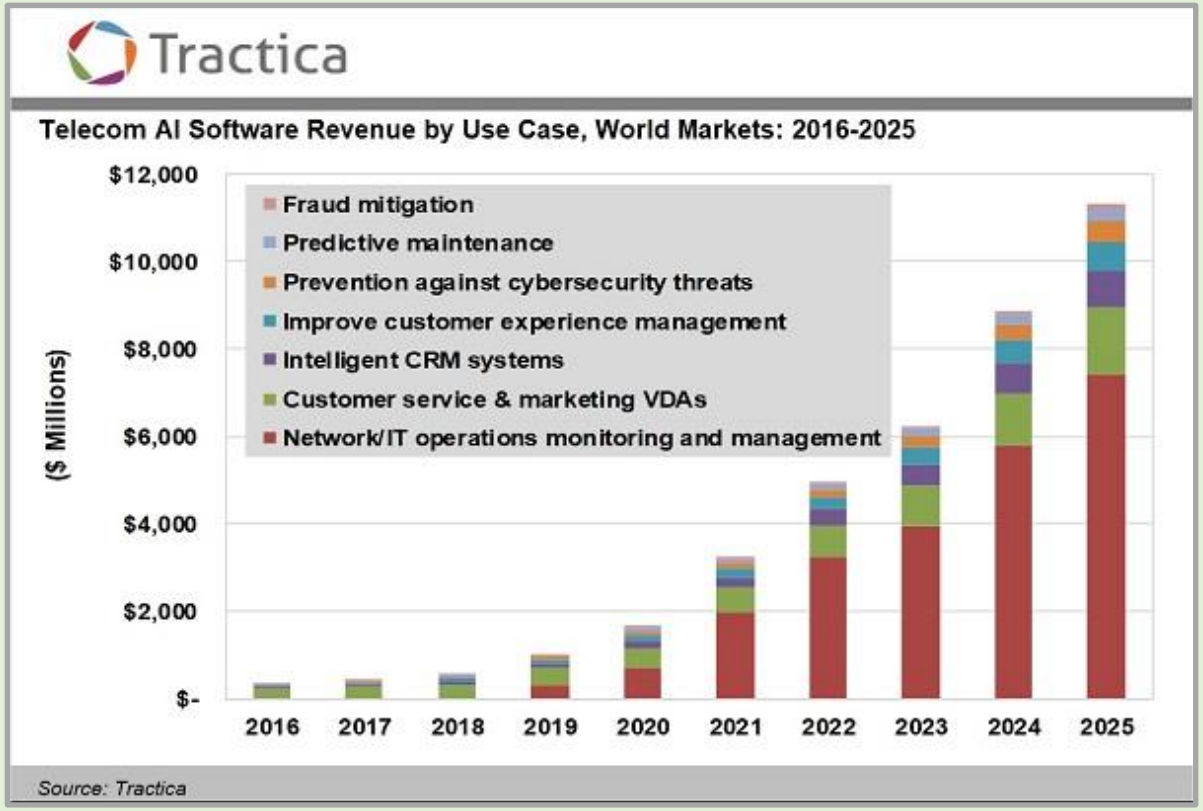
- Understanding Trends in AI for Telecommunications





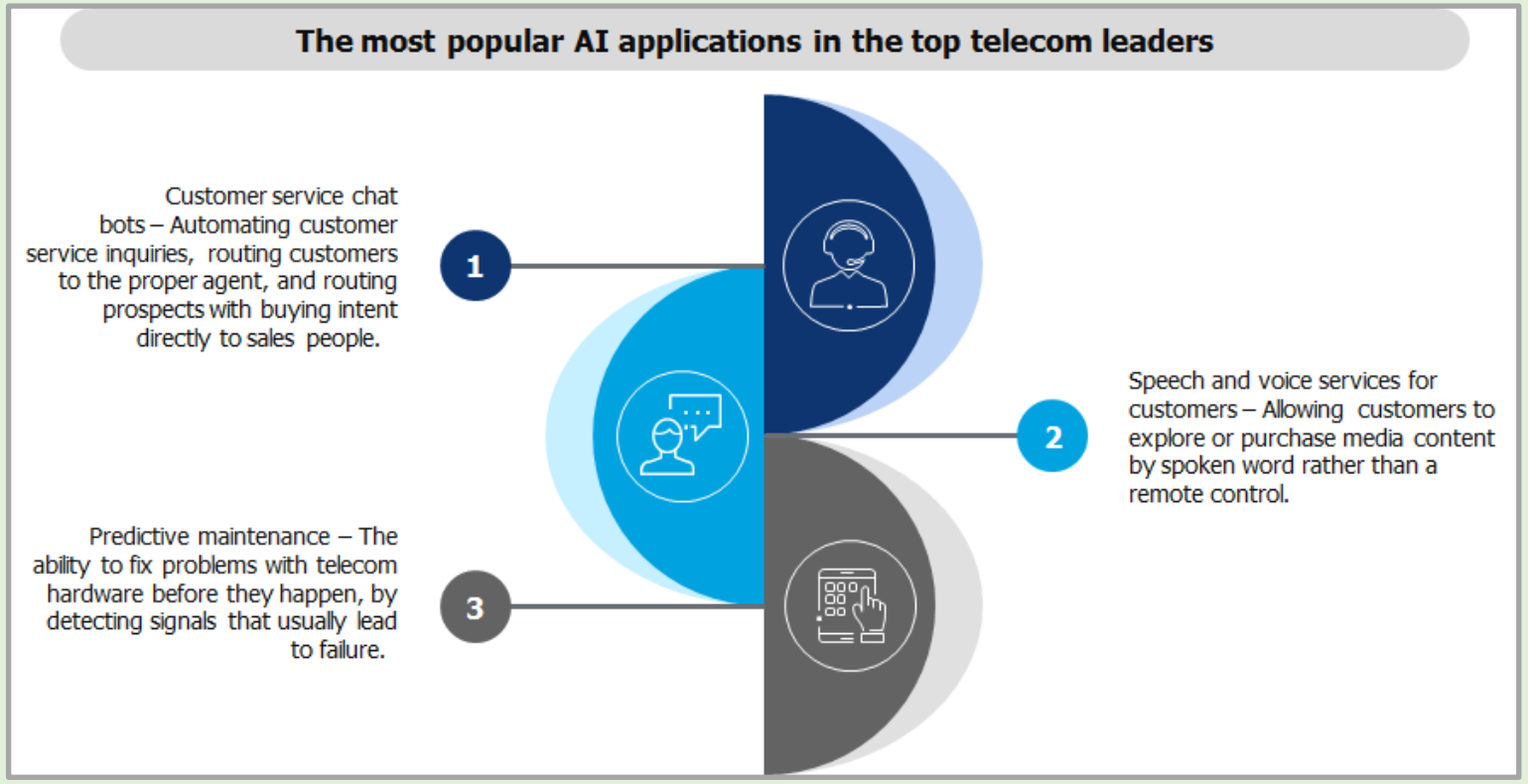
Turning Back to the 2022 AIWG

- Understanding Trends in AI for Telecommunications



Turning Back to the 2022 AIWG

- Understanding Trends in AI for Telecommunications



Source: Wipro

Turning Back to the 2022 AIWG

- Understanding Trends in AI for Telecommunications

  - Is AI over hyped in the telecoms space?

"The AI that relates to the network is sorting itself out," said José Palazón, Director CTO, Chief Data Office at Telefónica. "It's such a huge space and there's a lot of work we can do with that but there's a big dependency on the infrastructure. It doesn't matter if AI is amazing if, at the end of the day, you don't have the pieces of technology to interact with. Maybe it's not entirely overhyped but the results are overhyped in the sense that AI has come a little later than people expected."

Turning Back to the 2022 AIWG

- A few takeaways

  - Align deliberations with the FCC's Strategic Plan
  - Capture use trends in industry (2-to-5-year impact horizon).
  - Examine maturity of AI Technologies
  - Look at a variety of use cases
  - Focus in on sweet spots
    - Impacts on the FCC, the Industry, and End-users
    - Maturity of AI and accompanying Technologies
    - Value
  - Useful deliverables and actionable requirements

Questions and Comments?

Thank you!!

Lunch Break

FCC TAC Advanced Spectrum Sharing Working Group

Co-Chairs: Andrew Clegg, Wireless Innovation Forum
Monisha Ghosh, Wireless Institute, University of Notre Dame

FCC Liaisons: Michael Ha, Martin Doczkat, Nicholas Oros, Bahman Badipour, Robert Pavlak, Navid Golshahi

Date: February 28, 2022

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2022 Work Group Team Members

Brenner, Dean	Consultant		**Mahdi, Kaniz**	VMWare
Chandra, Ranveer	Microsoft		**Manner, Jennifer**	Echostar
Claudy, Lynn	NAB		**Mansergh, Dan**	Apple
Clegg, Andrew	Wireless Innovation Forum		**Markwalter, Brian**	CTA
Daly, Brian K.	AT&T		**Merrill, Lynn**	NCTA
Drobot, Adam	Open Techworks		**Mukhopadhyay, Amit**	Nokia
Ghosh, Monisha	Notre Dame		**Noland, Madeleine**	ATSC
Gosain, Manu	Northeastern U		**Peha, Jon**	CMU
Guess, Lisa	Cradlepoint		**Russell, Jesse**	incNetworks
Hatfield , Dale N.	University of Colorado		**Sawanobori, Tom**	CTIA
Jindal, Manish	Charter		**Schulzrinne, Henning**	Columbia U
Lanning, Steve	Viasat		**Welsh, Patrick**	Verizon
Lapin, Greg	ARRL			

fcc-tac-ss-wg@googlegroups.com

Advanced Spectrum Sharing WG - 2022 Charter

- Several sharing mechanisms (static/dynamic or centralized/decentralized) have been deployed to enable sharing between Federal and non-Federal users, licensed and unlicensed users or among licensed users. What are the long-term goals of these approaches? How can AI/ML and sensing-based cognitive radio techniques enhance the effectiveness of the sharing mechanisms and optimize network performance?
- What steps can be taken to better facilitate spectrum repurposing efforts? How can potential intra-band and inter-band issues be identified and addressed early in the process? How can incumbent services be better informed about the nature of adjacent or nearby spectrum environments and how can users be encouraged to take steps needed to accommodate new spectrum uses in those environments? What steps and processes should be used regarding adjacent band spectrum users' wide receiver bandwidths (i.e., the passband extends into adjacent bands)?
- What state of the art filter technologies can be utilized to mitigate potential harmful interference? How can advanced antenna systems help reduce both inter-system and intra-system interference and enhance intra-system performance? What are the cost benefit tradeoffs on utilizing the current filter technologies or advanced antenna systems?
- What are the candidate bands or services that can co-exist with low-power, indoor-only operation such as factory automation? What are the sharing mechanisms to consider?
- What are the sharing mechanisms to consider among various services above 95 GHz, including passive services?

Some Areas of Mutual Interest with Other Working Groups

- How can AI/ML and sensing-based cognitive radio techniques enhance the effectiveness of the sharing mechanisms and optimize network performance? (AI/ML WG)
- What state of the art filter technologies can be utilized to mitigate potential harmful interference? How can advanced antenna systems help reduce both inter-system and intra-system interference and enhance intra-system performance? What are the cost benefit tradeoffs on utilizing the current filter technologies or advanced antenna systems? (Emerging Technologies WG) (May include any other technology related to sharing)
- What are the sharing mechanisms to consider among various services above 95 GHz, including passive services? (May also consider lower bands) (6G WG)

Topic 1: Potential new bands for sharing

- Deep dive into 7-24 GHz bands (excluding 12 GHz) (“the rest of midband”)
  - Which sub-bands are appropriate for sharing/clearing/etc.
  - Can we extend our techniques from sub-6 GHz to these higher bands, or are new techniques needed?
  - Are specific types of secondary uses most compatible with a given sub-band?
  - Include global aspect of these sub-bands
- What are the primary incumbents in these bands?
- What should be the primary coexistence mechanism: lightly licensed, licensed or unlicensed?
- How best to share with passive services about 95 GHz?

Topic 2: Best practices for spectrum sharing

- Develop standardized/best practices for centralized spectrum sharing
  - We seem to be looking at each sharing framework anew each time. Can we identify commonalities for future shared spectrum systems, based on learning from TVWS and CBRS?
  - How band-specific should these sharing mechanisms be?
- Can sharing mechanisms like low-power indoor devices without AFC be extended into new bands?
  - Are there robust methods of identifying if devices are “indoors”?
    - E.g.: should devices near windows be more appropriately classified as outdoors?
- What are some of the considerations related to aggregate interference (its estimation and its actual impact)?
- Challenges related to incumbent sensing
- Improved propagation models for spectrum sharing
- How do we react to reported cases of interference, how do we record & measure it, and how do we effect enforcement when necessary?
  - Can centralized spectrum management systems be “deputized” to enforce FCC rules?
- How can we move to more dynamic operations (compared, for example, to CBRS)?

Topic 3: Receiver standards and technology advances

- What degree of interference is acceptable to an incumbent in a particular band, and should the responsibility of mitigation fall on the new entrant rather than the incumbent, even if the new entrant is adjacent channel?
- Should we define a level of interference that the incumbent must be able to accept, i.e. define “harm thresholds”?
  - If yes, how do we account for legacy devices?
- Smart antenna technologies are primarily being deployed to improve performance (throughput, coverage, density): how may they be better leveraged for spectrum sharing (i.e., directionality, including directionality of 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?
- Is there an interplay between spectrum sharing and increased risk for security and resiliency, both for the incumbent and the secondary user?

Topic 4: Modeling of interference

- It is clear from recent spectrum disputes that there is a need for better modeling of potential sources of interference. Example:
  - Spatial interference rejection potential of Massive MIMO arrays.
  - Propagation models focused on interference modeling rather than coverage
    - Validation of long-distance propagation models such as troposcatter
  - How to avoid multiple “worst-case” assumptions (i.e., application of joint statistics)?
  - In a broader sense, how should we deal with statistics of interference, rather than static/deterministic interference calculations? “Risk-informed analysis”
  - How to adapt interference modeling based on real-world measurements and sharing experience?
- How can potential interference scenarios be tested at-scale prior to rulemaking?
  - Testbeds, in academia (e.g. PAWR), industry and government labs like ITS.
  - Industry-accepted interference models for accurate simulations.
  - Lab testing

Topic 5: Economic Incentives of Shared Spectrum

- Impacts to legacy systems
  - Is it more economically efficient to pay for legacy systems to upgrade? Is this a viable option in all cases? Most cases? Few cases?
  - What are the components of legacy systems that need to be addressed? (Front-end filter, pre-amps, IF filters, etc.)
- Impacts to incumbents
  - Changes in conops
- Impacts to the new entrants

Advance Spectrum Sharing WG General Approach

- Invite SMEs to present to the group on topics of interest
- Develop subject-specific task groups?
- What is/are the most effective work product(s)?
  - White papers?
  - Presentations?
  - Other?

Targeted Speakers (all tentative/suggested):

- [Pierre de Vries, Silicon Flatirons, Harm Claim Thresholds]
- [Mark Gibson, Comsearch, Overview of Shared Spectrum Frameworks; and/or 7/8 GHz]
- [Preston Marshall, Google, Receiver Expectations]
- [TBD, Sharing with Passive Services]
- [Charles Cooper/Ed Drocella, NTIA, Discussion of 7-24 GHz federal incumbencies]
- More to come

Thank you

FCC TAC 6G Working Group

Co-Chairs:	Brian Daly, AT&T
	Abhimanyu (Manu) Gosain, Institute for Wireless Internet of Things, Northeastern University
FCC Liaisons:	Michael Ha, Martin Doczkat, Kamran Etemad, Nicholas Oros, Sean Yun
Date:	February 28, 2022

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2022 6G Working Group Team Members

Bayliss,Mark	Visual Link Internet			
Brenner, Dean	Consultant			
Chandra, Ranveer	Microsoft			
Clegg, Andrew	Wireless Innovation Forum			
Cooper, Alissa	Cisco		**Awaiting FCC Vetting:**	
Drobot, Adam	Open Techworks		**Simsek, Meryem**	VMWare
Gammel, Peter	GlobalFoundries		**Bali, Ramneek**	Charter
Ghosh, Monisha	Notre Dame			
Guess, Lisa	Cradlepoint			
Kuoppamaki,Karri	T-Mobile			
Lynn Merrill	NTCA			
Lapin, Greg	ARRL			
Manner, Jennifer	Echostar			
Markwalter, Brian	CTA			
Mansergh, Dan	Apple			
Mukhopadhyay, Amit	Nokia			
Nichols, Roger	Keysight			
Peha, Jon	CMU			
Schulzrinne, Henning	Columbia U			
Thakker, Rikin	WIA			
Welsh, Patrick	Verizon			

6G WG - 2022 Charter

- Provide information on the **development and deployment of 6G technology**, make recommendations and provide technology insights on new developments that need our attention, from the need for more **spectrum to the vulnerabilities of supply chain to the changing dynamics of global standards development**.
- How does **Open RAN/vRAN** continue to benefit 6G technology development and the ecosystem?
- What are the efforts to ensure an **adequate level of security is provided in Open RAN/vRAN architecture** and what are the cost/benefit tradeoffs to consider?
- What are the opportunities for using **mmW/terahertz bands for fronthaul/backhaul** in support of dense deployment of 6G systems given the capacity capabilities and corresponding bandwidth demands anticipated for 6G systems?
- How is 6G technology envisioned to enhance or be utilized in **autonomous driving, edge computing, emergency alerting, and smart city technology** deployments?
- How can **6G help bridge the digital divide** by bringing down the costs of delivering broadband particularly to rural and urban underserved areas?

Some Areas of Mutual Interest with Other Working Groups

- AI/ML methods and techniques to improve the utilization and administration of spectrum (licensed, unlicensed, and shared) (AI/ML WG)
- Emerging edge AI techniques support 6G applications (AI/ML WG)
- Use of AI/ML methods and techniques applied to assuring the safety, security, and performance of network equipment, network control, and network operations in a network environment that increasingly relies on automation (AI/ML WG)
- Technology insights on new development including the IoT ecosystem and the spectrum access needs for potential high-bandwidth devices; small satellite development, what frequency bands that are under consideration for use, and what services that are envisioned (Emerging Technologies WG)
- What are the sharing mechanisms to consider among various services above 95 GHz, including passive services? (Advanced Spectrum Sharing WG)

Topic 1: Development and Deployment of 6G technology

- What is “6G”?
- What lessons have we learned from global 5G deployments and how will that shape 6G development?
- What is the “6G” timeline?
- What candidate Radio Access, Network, Compute, Chipset Technologies will drive 6G Development?
- What research is underway – in the U.S., globally?
  - What is the role of the Next G Alliance and federal funding agencies in North America?
  - How does the US prepare a competitive workforce to develop and deploy 6G?
- What is the anticipated 6G standardization plan?
  - What standards groups will be involved? (e.g., 3GPP, O-RAN Alliance, IETF, …)
  - What dynamics come into play for 6G standards development?
  - How can US standard representation bodies coalesce to help U.S. maintain standards leadership?
  - What is the risk of fragmentation of standards due to a global pandemic and geopolitics?
- What are the spectrum considerations and timeline for access for 6G?
- How do we get a head start on early potential regulatory barriers that could slow down 6G deployments?
  - Are there issues that could come up in coexistence between 6G and adjacent services regulated in part by agencies other than the FCC which we should highlight now?
  - What are the likely issues about siting for 6G, which implicates state and local government regulation too?
- What are the supply chain considerations and vulnerabilities?

Initial view - What is “6G”?

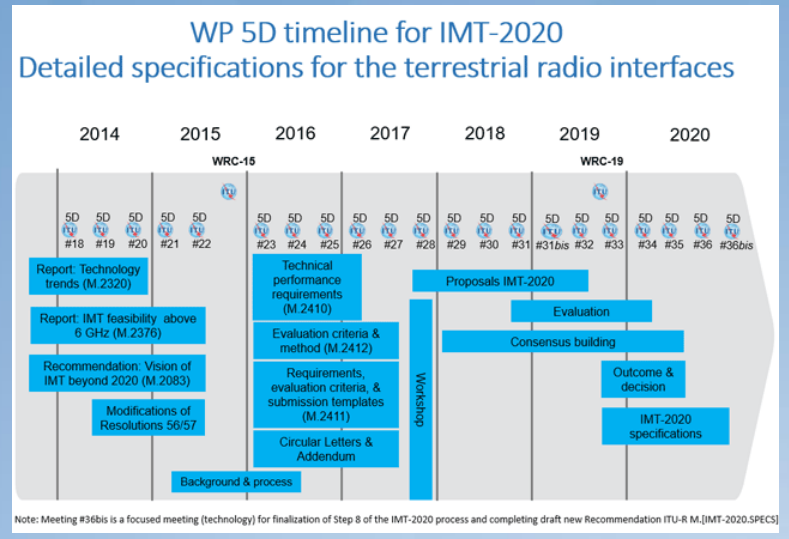
- ITU Defines a new “Vision” for International Mobile Telecommunications (IMT) ~ every 10 years:
  - IMT-2000
  - IMT-2020

3GPP R15/16/17 → 3GPP R18/19/…

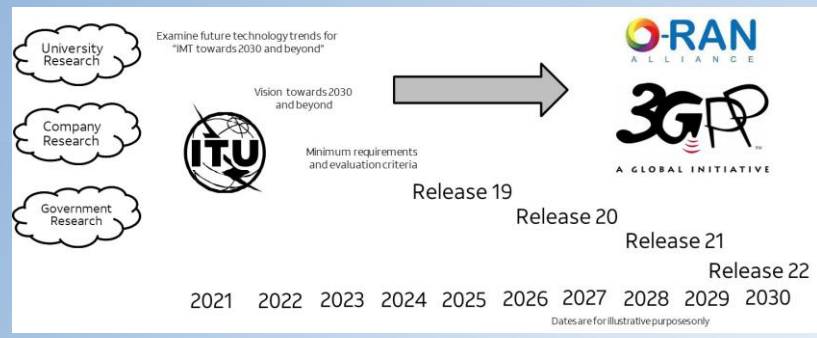
- 3GPP develops specifications (submitted as a candidate technology into ITU), labels releases as indicated above
- ITU-R Working Party 5D (WP 5D) has started to develop a new draft Recommendation “IMT Vision for 2030 and beyond” at their March 2021 meeting
- WP 5D will also develop a new draft Report ITU-R M.[IMT.FUTURE TECHNOLOGY TRENDS] which focuses on the following aspects:
  - “This Report provides a broad view of future technical aspects of terrestrial IMT systems considering the time frame up to 2030 and beyond.”

NOTE: FCC Spectrum Allocations for 5G were completed in 2016 and first auctions happened in 2018-19

Example IMT-2020/5G Timeline



Anticipated IMT-2030/6G Timeline



Topic 2: Open RAN/vRAN

- How does Open RAN/vRAN continue to benefit 6G technology development and the ecosystem?
- Will Open RAN be a "fundamental part of 6G solutions“? What other innovative architecture approaches define 6G?
- What does Open RAN mean for 6G standardization across standard development organizations, e.g. 3GPP, ETSI,ITU and specification forums such as O-RAN Alliance?
- How will AI/ML algorithm design, inference and closed loop optimization paradigm factor in ensuring open RAN is part of 6G?

Topic 3: Security in Open RAN/vRAN architecture

- How will O-RAN implementations be as secure or more secure than closed proprietary implementations?
- What is the security risk assessment of the different O-Cloud/vRAN deployment models, e.g. Private, Public, Hybrid, Community, and the risks in different open RAN cloud deployments?
- How will physical security of component/chip supply chain be implemented?
- How will open RAN architecture specific security requirements and specifications complement 3GPP ?
- Identify new attack surfaces introduced by open RAN logical components such as the RIC(s), the SMO, and O-Cloud, and the software frameworks (e.g., xApps, rApps) ?
- How have specifications addressed potential vulnerabilities in O-RAN components, and potential threats associated with those vulnerabilities that could compromise O-RAN assets?
- How will data integrity and security in context of AI/ML model training be maintained ?

Topic 4: mmW/terahertz bands for Fronthaul/Backhaul/Access/Sensing

- What do we expect the network topology to look like for 6G? (5G mmW entails significant densification)
- There has been a lot of work in 3GPP on integrated access and backhaul (IAB) for 5G. We really have not seen IAB deployed yet. Do we envision IAB or other new topology coming into play for 6G?
- What methods or operational capabilities will mmW/terahertz bands use to prevent interference to incumbent EESS (passive) and radio astronomy operations ?
- How will these spectrum frontier bands support topologies such as repeater, sidelink and Device-to-Device?
- What silicon and device innovations will influence development of cost effective chipsets to support broad deployment in these bands?

Topic 5: 6G for autonomous driving, edge computing, emergency alerting, and smart city technology*

- What are the 6G requirements (spectrum, infrastructure/ubiquitous coverage) to support the aforementioned Industry Verticals and use cases? How will these requirements factor into the standardization process ?
- What are the 6G key enablers, such as THz and AI/ML, that are needed for these services?
- How can 6G address safety for autonomous driving (as well as UAVs)?
- What are the challenges from a security and regulatory perspective? (privacy, etc.)
- How can emerging edge AI techniques support 6G applications?
- Can 6G enhance public warning?
- What will 6G provide to enable smart cities? What are cities expecting?

- **NOT JUST LIMITED TO THE INDUSTRY VERTICALS ABOVE**

Topic 6: 6G helping bridge the digital divide

- Will “6G be the first mobile radio generation truly aiming to close the digital divide”?
  - What are the challenges in rural and remote areas?
  - What requirements need to be included in 6G to meet these challenges?
- What are the lessons learned from the pandemic?
- What architectural approaches combining Non-terrestrial and terrestrial connectivity will help provide robust and wide band service in rural areas ?
- How will 6G address spectrum & backhaul for rural areas ?
- What technologies can address cost-performance-coverage to bridge the digital divide?
- Can 6G provide an affordable “sufficient service” compared to solutions for urban/suburban highly population areas?

6G WG General Approach

- Biweekly meetings (initially)
- Invite SMEs to present to the group on topics of interest
- Joint sessions with other WGs on mutual topics of interest
- Develop subject-specific task groups as needed
- Identify the most effective work product(s)?
  - White papers?
  - Presentations?
  - Other?

Targeted Speakers:

- Marc Grant, Chair, ITU-R WP 5D SWG Radio Aspects
- Mike Nawrocki et. al., Next G Alliance Roadmap
- Victor Peng, Semiconductor Industry Association/AMD-XilinX
- Josep Jornet, Northeastern University/mmWave Coalition
- More to come

Thank you

10:00am	–	10:30am	Introduction and Opening Remarks - Welcome Message from TAC Chair - Opening Remark by OET Chief - DFO/Deputy DFO Remarks - Member Introduction/Roll Call
10:30am	–	11:00am	Presentation on Record Retention Policy (FCC/OMD) Presentation on FACA Rules and Guidance (FCC/OGC)
11:00am	–	11:30am	Emerging Technologies WG Presentation
11:30am	–	12:00pm	Advanced Spectrum Sharing WG Presentation
12:00pm	–	1:00pm	Lunch Break
1:00pm	–	1:30pm	AI/ML WG Presentation
1:30pm	–	2:00pm	6G WG Presentation
2:00pm	–	2:20pm	Closing Remarks
2:20pm			Adjourned

Adjourned