

Roadmap for Coexistence and Convergence in 5G

Market Research



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ABOUT THE WIRELESS BROADBAND ALLIANCE

Founded in 2003, the mission of the Wireless Broadband Alliance (WBA) is to champion the development of the converged wireless broadband ecosystem through seamless, secure and interoperable unlicensed wireless broadband services for delivering outstanding user experience. Building on our heritage of NGH and carrier Wi-Fi, WBA will continue to drive and support the adoption of Next Generation Wi-Fi services need coexistence and convergence of unlicensed and licensed networks across the entire public Wi-Fi ecosystem, including IoT, Big Data, Converged Services, Smart Cities, 5G, etc. Today, membership includes major fixed operators such as BT, Comcast and Time Warner Cable; seven of the top 10 mobile operator groups (by revenue) and leading technology companies such as Cisco, Microsoft, Huawei Technologies, Google and Intel. WBA member operators collectively serve more than 3 billion subscribers and operate more than 30 million hotspots globally.

The WBA Board includes AT&T, Boingo Wireless, BT, China Telecom, Cisco Systems, Comcast, Intel, KT Corporation, Liberty Global, NTT DOCOMO, Orange and Ruckus Wireless. For a complete list of current WBA members, please [click here](#).

Wi-Fi is aimed to take an important role in 5G development, and on-going convergence developments between licensed and unlicensed wireless will have a significant impact on the future of wireless communications.

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1 Introduction and Objectives

5G intends to enable a seamlessly connected society in the 2020 timeframe and beyond that brings together people along with things, data, applications, transport systems and cities in a smart networked communications environment.

Several industry bodies are currently defining and working on 5G related topics, such as ITU, ETSI, 3GPP, NMGM, among others.

WBA have been working on the Carrier Wi-Fi roadmap development along with key work on bridging the cellular and Wi-Fi world together.

WBA vision is not to focus on the definition of 5G but rather on the use cases being discussed and how Wi-Fi and other unlicensed technologies can play a key role in enabling those in a 5G framework. Thus, WBA plan to issue in the near term the 5G <> Wi-Fi interfaces standardization. In fact, 5G is one of key streams under WBA's vision 2020 and its Members will focus on the following work streams:

- 1) Summarize the definition of 5G networks and its components/technologies/architecture, leveraging on ongoing key forums work and use cases
- 2) Explore how 5G will increase network capacity, offload, services enablement, policy, etc.
- 3) Explore how to combine licensed and unlicensed technologies on the 5G architecture to meet the broad range of IMT-2020 requirements
- 4) Explore how to address gaps between the different technologies (authentication, user usability, devices management, etc.)
- 5) Foreseen Wi-Fi evolution to cope with 5G predicted requirements and use cases - How WBA Members (Vendors & Operators) can work together to promote upcoming Wi-Fi capabilities, including standardization of interfaces
- 6) Future vision of mobile networks evolution to cope with 5G

As a result, the objective of this market research is twofold, 1) provide an initial industry assessment on how unlicensed technologies will contribute to 5G framework definition and 2) invite the ecosystem to join this effort.

1.1 Market Assessment

The Wi-Fi industry has gone through a vast expansion in recent years. It is expected that public wide Wi-Fi deployment will ramp-up in the upcoming years according to the following forecast:

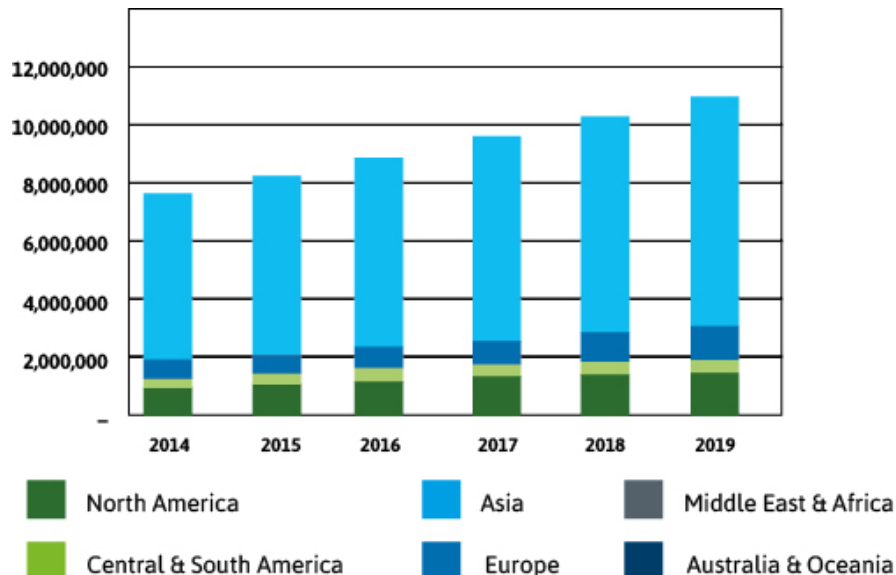


Figure 1. Installed base of public Wi-Fi hotspots by region (source: WBA Industry Report 2015)

5G umbrella network encompasses a virtually limitless number of verticals which will directly or indirectly leverage on Wi-Fi and other unlicensed spectrum technologies:

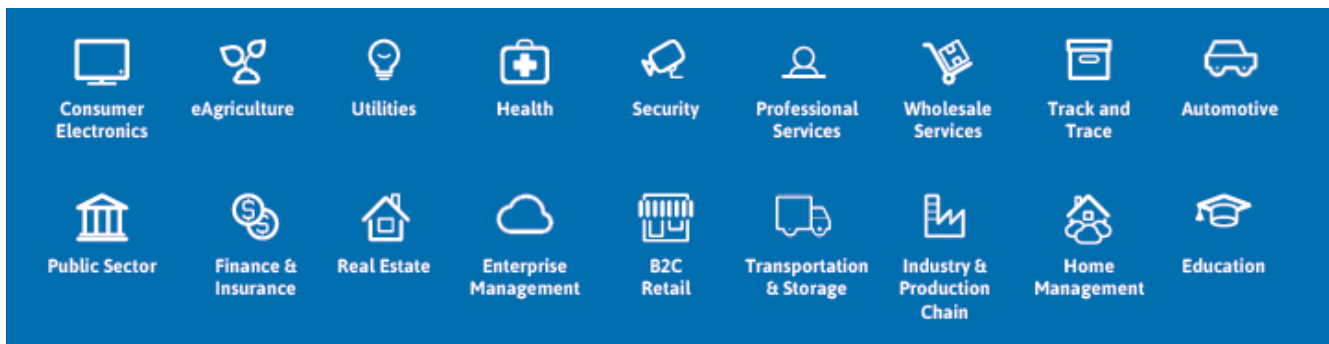


Figure 2. Virtually Limitless Number of Verticals, non-exhaustive (source: Beecham research)

These market indicators and opportunities set the scene for a successful Wi-Fi evolution. Further industry engagement and alignment is needed.

2 Industry Survey Results

An industry survey was conducted by WBA to gather latest data and industry developments which will be an integrating part of this market research report.

WBA members and the industry in general was invited to fulfil to participate on global survey focusing in current 5G topics.

The respondents profile include: Operators, vendors and hubs. In total, more than 65 companies, spanning though 6 different continents, have provided their extensive inputs.

The results and analysis of the survey are provided on followings sections of this paper.

KEY TAKEAWAYS OF THE WBA MARKET RESEARCH "ROADMAP FOR COEXISTENCE AND CONVERGENCE IN 5G"

Anticipated time frame for 5G standardization



expect that 5G will be standardized by **2020**



expect the standardization process will run until **2025**

5G deployment timelines

36% have deployments in place by **2020**

52% have deployments in place by **2025**

62% think that 5G will be a combination of

Licensed and Unlicensed

TECHNOLOGIES

Main drivers are

- Cost and coverage
- Energy/battery life
- Latency

The TOP 3 critical topics for 5G:

1



Convergence of services and technologies

2



Regulation of shared spectrum models

3



Virtualization

80% think Wi-Fi will play a relevant role in 5G

How relevant are unlicensed spectrum technologies for 5G?

88%

find unlicensed spectrum critical or important for 5G

What major applications and/or services will be enabled/improved by using unlicensed technologies as part of 5G?



Smart Cities



IoT Sensor Networks



Safety & Surveillance



Smart Home



Healthcare

Key Takeaways of the WBA Market Research

2.1.1 General

- 1) 82% of the respondents are already looking into 5G related topics, and 75% of the respondents expect that 5G will be standardized (at least in its initial version) by 2020. 21% expect the standardization process will run until 2025.
- 2) Although standardization is not expected to be finished until 2020, 36% of the respondents expect to have deployments in place by 2020. 52% of the respondents expect to have deployments in place by 2025. Another interesting takeaway is that only 20% of the operator respondents believe that deployments will be in place by 2020, primarily stemming from Asian operators. 65% of the operators expect to have deployments in place by 2025.
- 3) For a successful deployment, the following topics are seen to be critical or important for 5G: convergence of services and technologies; virtualization; and regulation of shared spectrum models. For operators, virtualization almost reaches a score of 100% in terms of importance.
- 4) Standardization appears to be a major industry gap towards the deployment of 5G, with more than 80% of companies agreeing with this. Other issues include coexistence of technologies (55%), convergence of services (43%) and certification (40%).

2.1.2 Unlicensed vs Licensed

- 5) In general, 62% of the respondents believe that 5G will be a combination of licensed and unlicensed technologies and 23% believe that it will be predominantly licensed technologies. Among Operators respondents, on the other hand, the percentage shifts to almost a 50/50 split between a combination of licensed and unlicensed technologies and predominantly licensed technologies. Moreover, 88% of the respondents find unlicensed spectrum technologies relevant for 5G
- 6) With a response rate of 80%, Wi-Fi is - by far - the unlicensed spectrum technology that companies see as the main candidate to play a relevant role in 5G. To a lesser extent, other technologies such as CBRS (3.5 Ghz technologies), Sigfox and LoRa are also expected to play a relevant role.

2.1.3 Applications and Services using Unlicensed.

- 7) Major applications and/or services that will be enabled/improved by using unlicensed technologies as part of 5G are Smart cities, IoT Sensor Networks, Safety and Surveillance, Smart Home and Healthcare – all scoring more than 50%. This seems to contradict other industry forecasts and industry efforts to create licensed LPWA that are focusing on Smart City and IoT Sensor Network deployments.
- 8) Main drivers that are mentioned for using unlicensed spectrum technologies within 5G are enhanced throughput, cost and coverage, and to a lesser extent, coverage, latency and energy/battery life.
- 9) Whilst 5G is often mentioned as “a solution in search of a problem”, less than 30% of the companies mention the lack of use cases as a major gap towards deployment.

2.2 5G Roadmap Building Blocks

The industry was asked to indicate, from 2016 until 2020, what are the major building blocks to consider in the roadmap of 5G. The results are quite descriptive and include most of the topics currently being depicted in the industry - these can be divided in 5 key building blocks:

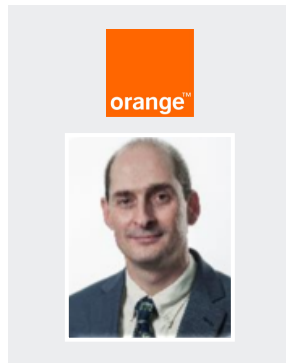
- 1) 5G Technologies
- 2) Convergence & Coexistence
- 3) Business Cases & Services
- 4) Spectrum
- 5) Standardization

THE 5G ROADMAP MATRIX		
5G Technologies	Convergence & Coexistence	Spectrum
5G Core technology	Aggregation over licensed-unlicensed	3.5 GHz Spectrum Policy
60GHz Access Points / Pico-cells	Coexistence of licensed/unlicensed	Licenses
60GHz enabled mobile devices	Convergence	New spectrum
Antenna design and power levels	Extensible Authentication Protocol	Regulatory
Appliances	HetNet provisions	Restrict 5G licensed use only
Architecture	Interworking seamlessly with 4G	Rules for sharing un-lightly-licensed
Backhaul capacity	Legacy technology inter-working	Spectrum
Chip/Device Manufacturers	Non-SIM authentication	Spectrum Allocation
Chipsets	Policy	Spectrum allocation and usage
Connection management SW/MW	Vendor deployment and e2e testing	Spectrum Coexistence
Edge computing services	Wi-Fi - 5G integration	Spectrum Cost
Indoor MBB consumption	Wi-Fi Coexistence in 5.8GHz band	Spectrum Regulation
Infrastructure refresh and buildout		Spectrum worldwide allocation
IoT services	Business Cases & Services	Unlicensed 5G infrastructure
IoT-5G certification		
LAA/LWA/LWIP	Application Adoption	Standardization
Management systems (OSS)	Business case	
Massive MIMO	Business models for URLL & MMTTC	3GPP New RAT Specification
Network densification	Deployment Strategy (Small Cells)	Complete standardization
Network intelligence	Ecosystem	Device Support
Network virtualization	Evolution building blocks	Industry agreement on standardization
New Radio Access	Financial proposition/ business case	LTE-u Standards
New Radio Technology	Get industry partners on board	New 3GPP R15 RAN technology
Next Generation Mobile Core	Improve coverage	New Radio specifications (e.g. 3GPP)
RF Components	Information value & monetization	Protocol Standardization
SDN/NFV	Infrastructure costs	Standardization
Security across access types	Multi-stakeholder partnerships	Testing and interoperability
Technical solutions	New Operators Business Models	Trials
Technology developments	Roadmap of activities	Who's doing what
Terminals	Use cases	Worldwide collaboration
TV White Space	Wi-Fi Coexistence in 5.8GHz band	Normalization
Virtualization		

3 5G - Key Influencers Interviews

WBA has conducted a series of interviews with senior executives from companies playing a key role in 5G.

3.1 Interview – Nick Sampson, Orange



“5G will extend existing and open up new opportunities to vertical markets”

Mr. Nick Sampson, Director,
Wireless/Core Network Standards

1) How do you define 5G and what are the benefits it will introduce in the industry and major use cases for end users?

A: For Orange, 5G is the technology we will operate in the 2020-2030 decade. It will include existing (4G, Wi-Fi) and new radio technologies, with a converged core network managing both fixed and mobile accesses. As well as classical mobile broadband evolution (increased capacity, throughput and coverage), 5G should offer a consistent user experience over the coverage area. We consider it essential that 5G is significantly more energy efficient than current mobile networks, and that it offers options for ultra-low cost networks to enable worldwide Internet Access in an economically sustainable way.

For industry, 5G will extend existing and open up new opportunities to vertical markets – factories, utilities, health, automotive, agriculture, cities etc. These vertical markets have an enormous variety of use cases – probably too many to list, and even more yet to be identified – and hence a very broad range of requirements, which will be an essential part of shaping 5G. 5G needs to be able to adapt to these different requirements, whilst still providing mobile broadband, hence flexibility and versatility will be essential to allow these industries to take advantage of 5G.

2) How relevant is the role of unlicensed technologies, including Wi-Fi, MuLTEfire, LAA, LWIP, etc., on the 5G framework?

A: Network operators will need to access various spectrum resources to deliver ubiquitous services. Orange believes exclusive licensing spectrum offers predictability and safeguards long term investments; however that is not to say there is no role for unlicensed technologies in 5G. As said before, 5G will integrate different access technologies and use these to provide the user with their required experience and performance. Thus unlicensed technologies such as LAA and LWA are seen as complementing licensed technologies to provide increased capacity for small cells in a variety of locations such as indoor for enterprises and public venues, and outdoor hotspots and events.

3) What is the anticipated roadmap for 5G architecture (might indicate the importance of key blocks such as, Coexistence, Convergence, Virtualization, New policy mechanisms, New partnership models, etc.)?

A: Research and standardisation of 5G, including both access technology and architecture is now well underway. Standards will emerge from around 2018, with commercial deployment of standards-based

solutions from around 2020. There will be architectural options for 5G, with evolved ‘legacy’ 4G core supporting a new 5G radio technology, as well as a new core aggregating both 5G radio technology and LTE. We anticipate 5G being the first generation that will be natively designed with a full software approach (through NFV Network Function Virtualisation and SDN Software Defined Networks). It will integrate networking, computing and storage resources into one programmable and unified infrastructure in order to deliver more than connectivity. Starting in data centers and at the network edges, networking services, capabilities and business policies will be instantiated as needed over this underlying infrastructure. This will provide the agility and flexibility to provide on-demand customized network slices, effectively allowing us to run specialized networks fulfilling very different requirements from the same infrastructure. Performance and policies can be tailored to specific customers’ needs, supporting a variety of business models and development of partnerships with third partners and customers themselves. The ability to dynamically allocate and adjust resources will also reduce energy consumption. Of course, virtualisation and SDN are not limited to 5G, and we expect to see these technological approaches being introduced to 4G and other technologies before 5G.

We also believe 5G is an opportunity for delivering real Fixed-Mobile Convergence, or rather, Fixed-Mobile Integration. There has been some convergence in the past, for example with specific functions and the IMS platform supporting both fixed and mobile accesses; we 5G think we can go further and target a seamless customer experience across fixed and mobile domains. As well as continuity of availability of services across both domains, this would include hybrid access to giving combined bandwidth, global network management and orchestration, potential network architecture simplification, and cost and energy savings.

4) What are the major challenges for 5G to become a reality? How industry forums like WBA can help develop technology roadmap for 5G, particularly, to define the role of coexistence and unlicensed?

A: The standardisation process is clearly well underway and several operators have announced trial and even deployment plans. However, as with any new generation, 5G will require significant investment from operators; with revenues decreasing, one major challenge is to have a regulatory environment that encourages investment in connectivity. Industry forums can help by promoting sustainable business models with fair reward for the whole value chain. For the WBA, analyzing and understanding the opportunities of unlicensed spectrum, and how it can be used as a complement to licensed spectrum, will help define the role of unlicensed spectrum in 5G.

3.2 Interview – Gang Bai, ZTE



“In dense environments, unlicensed technologies coupled with Core networks can increase the access network capacity and benefit users’ wireless experience”

Mr. Gang Bai, General Manager for 5G network

1) How do you define 5G and what are the benefits it will introduce in the industry and major use cases for end users?

A: With rising adoption of mobile networks and smart devices globally, more and more people now have the ability to access electronic information and interact with computing systems. This trend will accelerate in the future, as 5G revolutionizes how humans acquire, manage and engage with information. User experience and satisfaction will be fundamental in driving innovation and convergence of 5G devices, networks and services. Businesses and industries, in addition to the general public, will embrace 5G services, which will be carried on networks with greater intelligence, user-friendliness and versatility, combining the best characteristics of cellular and wireless local networks. Increasingly, humans will have their lives touched by 5G, which will form part of the fabric of the future world together with other successful technologies.

5G will be a fundamental pillar of the “M-ICT” era envisioned by ZTE, when ubiquitous mobility empowers innovations in all walks of life, transforming education, healthcare, industry, government, transportation, finance and technology, welding together the physical and digital worlds.

2) How relevant is the role of unlicensed technologies, including Wi-Fi, MuLTEfire, LAA, LWIP, etc., on the 5G framework?

A: Unlicensed technology is a component of the 5G framework. In dense environments, unlicensed technologies coupled with Core networks can increase the access network capacity and benefit users’ wireless experience.

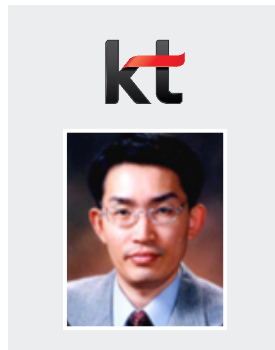
3) What is the anticipated roadmap for 5G architecture (might indicate the importance of key blocks such as, Coexistence, Convergence, Virtualization, New policy mechanisms, New partnership models, etc.)?

A: The roadmap for 5G architecture should be matched with the service requirements, user experience and expectation to innovative technologies. It should not only be driven by technologies, but also the user experiences on services. At an initial stage of 5G being introduced to market, existing and emerging technologies could be well integrated and harmonized in a consensual architecture to meet the user experience requirements of high data throughput and convenient connection. While in an advanced stage, hybrid technologies will be harmonized under a unique architecture to allow end users to even more easily access to information without awareness of the technology being used in the connection.

4) What are the major challenges for 5G to become a reality? How industry forums like WBA can help develop technology roadmap for 5G, particularly, to define the role of coexistence and unlicensed?

A: As 5G will provide great user experiences in various aspects and benefit many vertical industries and services, industries collaboration could be one of the major challenges. SDOs and forums need to collaborate together to define the 5G technology standards to meet requirements for various services and exchange of up-to-date information.

3.3 Interview – Yong-Gyoo Lee, KT



“We are on the road of 5G and the use of unlicensed technology is crucial to practically fostering 5G innovations”

Mr. Yong-Gyoo Lee, VP & Head of Network Strategy, Business Unit & 5G

1) How do you define 5G and what are the benefits it will introduce in the industry and major use cases for end users?

A: In the near future, we expect billions of connected cars talking each other at once using a V2V, V2I, which simply does not exist today. Countless devices will hit the network and access at the same time. Many different types of traffic, from Kbps to massive 3D contents and holograms will go through our future network. Our definition of 5G is to provide the capacity by factor of thousand, a massive seamless connectivity for all the devices, hyper real-time speed and low latency. We also expect industry cross-over services, e.g., connected car, remote medical surgery can provide some synergistic impacts on the markets and be major use cases for users.

KT has researched which innovative services including the aforementioned examples will take the wheel in the next generation communications field and has planned to show them up at the time of 2018 PyeongChang Winter Olympic Games. We expect that our field lesson will be fed back to the telecom industry to be a technical contribution in the growth of 5G industry.

2) How relevant is the role of unlicensed technologies, including Wi-Fi, MuLTEfire, LAA, LWIP, etc., on the 5G framework?

A: KT has commercialized the world first MP-TCP technology above our LTE network. Its service brand is called “GiGA LTE”, which utilizes KT’s 3CA (Carrier Aggregation) LTE and 11ac Wi-Fi networks. We believe that such network convergence and corresponding user experience improvement is a representative proof that we are on the road of 5G and the use of unlicensed technology is crucial to practically fostering 5G innovations.

The other unlicensed technologies would apply leverage as well on improving user experience along with cellular networks and approaching the 5G era. For instance, KT has focused on the research and development of LWA (LTE-WiFi Aggregation) technology in terms of one possible evolution branch toward the convergence of 5G and Wi-Gig.

3) What is the anticipated roadmap for 5G architecture (might indicate the importance of key blocks such as, Coexistence, Convergence, Virtualization, New policy mechanisms, New partnership models, etc.)?

A: The industrial consensus is that there will be a new 5G air interface standard by 2020 and 3GPP has built its two-phase roadmap for the sake of 5G air interface – 1) NSA (Non-StandAlone) and 2) SA. The first phase, NSA assumes basically the coexistence of LTE and 5G air interfaces and their convergence for better user experience.

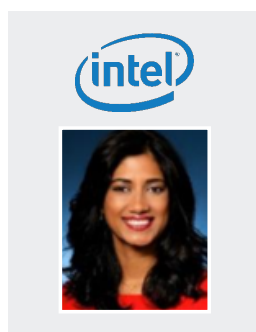
5G systems will also provide an architectural flexibility and enable logical network slices. The term, Network Slicing which is in vogue to the 5G parties will enable operators to provide networks on an as-a-service basis and satisfy the wide range of use cases.

Another important aspect when it comes to network evaluation is to increase the capacity of transport and core network entities. For instance, Backhaul capacity should be increased in a linear scale along with application-layer requirements; however, it goes even serious in the case of Fronthaul. In LTE, the typical requirement of Fronthaul capacity enhancement is more than sixteen times higher than that of Backhaul. KT has studied on the most efficient method to increase the end-to-end system capacity, while reducing the requirement for evolved Fronthaul.

4) What are the major challenges for 5G to become a reality? How industry forums like WBA can help develop technology roadmap for 5G, particularly, to define the role of coexistence and unlicensed?

A: In the early stage, many 5G devices may not be able to achieve high throughput performance, i.e., ~20Gbps. Advanced convergence technique will contribute to satisfy user demand especially in eMBB services. When getting warmed in the market, 5G will lead industries to support cross-over services, as mentioned earlier, connected car, remote medical surgery. Such cross-industry market and related products will not be explained by “increasing download speed”. Various performance metrics require different level of user satisfaction in the field. A combination of metrics announced by ITU 2020 (data rate, mobility, latency, connection density, etc.) is going to be satisfied by enhanced performance supported by emerging 5G services, and in turn they will open a new market. KT believes such emerging tech-base cross-industry evolution cannot be led by a single telecom operator, but has to be realized along with stronger world-wide partnership with operators than before. KT also expects that WBA will show its powerful leadership and have much intimate partnership with global leading players in the 5G era.

3.4 Interview – Asha Keddy, Intel



“Licensed and unlicensed technologies have and will continue to converge and evolve”

Mrs. Asha Keddy, VP
Standards and Advanced Technology

1) What is the role of Wi-Fi and Unlicensed in 5G?

A: Wi-Fi and Unlicensed in general is extremely important to 5G. With 200 billion devices or more, everything is connected, especially machine-to-machine. In an environment like that, we need all of the spectrum we can get, and we need different solutions for different business models.

Licensed and unlicensed technologies have and will continue to converge and evolve, allowing us to use them to solve issues now and as we move forward

2) Is LWA a precursor to 5G, or an interim step forward?

A: It's actually neither. LWA is looking at deployments where you have LTE but need to offload to Wi-Fi, and examining what we can do to give the operator greater control so that they can accomplish this in a more secure, seamless manner. It's the interplay of two technologies working closer together and producing different solutions.

3) What leadership roles is Intel taking in regards to 5G developments?

A: Intel is very active in 5G leadership development discussions, and we've gotten involved with the technology before it's standardized. We've developed a 5G prototype and we're working with operators and partners from around the world to engage and learn in an effort to work towards standardization. Intel is also uniquely positioned in an end-to-end manner, with solutions that span from our clients to networks. In other words, we're engaging very holistically.

3.5 Interview – JL Valente, VP/GM - Service Provider Business Strategy at Cisco Systems and Dan Kurschner, 5G Marketing Lead at Cisco Systems



Dan Kurschner, Senior Solutions Manager –
SP Marketing at Cisco Systems

JL Valente
VP/GM - Service Provider Business Strategy

1) How do you define 5G and what are the benefits it will introduce in the industry and major use cases for end users?

A: 5G is the next major technology stepping stone toward global digitization with the potential to plug everything and everyone in the connective tissue of the Internet. 5G is therefore far bigger than radio and transcends mobility to provide networking as a platform. This is a key enabler of new business opportunities and value chains. Think of the enormous potential for countries, cities, venues, industries, transportation, people and all of the infinite interplay between things, people and services/applications. If we play it right 5G can live up to the hype and expectations to support and deliver new services that have not yet been invented.

2) How relevant is the role of unlicensed technologies, including Wi-Fi, MuLTEfire, LAA, LWIP, etc., on the 5G framework?

A: The multitude of 5G use cases require a variety of radio technologies and bands under and above 6GHz to deliver on their promises. 4G will continue to dominate the world for many years to come, complemented by several of the radio access technologies (RAT). Some of those RAT's are very well established, others are fledgling. Some will succeed, others will fall by the wayside for economic or technical reasons. Regardless, 5G is not the purview of a few, it is about leveraging the best access technologies in a seamless manner to stay plugged in the connective tissue of the Internet: enabling all to inform, exchange, capture, and to act. "Seamless Interoperability" is the mantra.

3) What is the anticipated roadmap for 5G architecture (might indicate the importance of key blocks such as, Coexistence, Convergence, Virtualization, New policy mechanisms, New partnership models, etc.)?

A: There has never been a better time to start building the next generation 5G ready network architecture as a platform for innovation. The market knows it, our service provider customers know it as well. The true innovators in our industry are already pushing the envelope of what is possible, feasible and still only imaginable. The long pole is not the “5G New Radio”, it is the entire network transformation toward a digital, cloud-enabled, app-driven world that is money-making and easy to operate. 5G will be as strong as the weakest link across domains: HetNet, Cloud-RAN, IP transport, mobile core, edge and cloud computing, supported by the proper virtualization and SDN capabilities, management, control, orchestration, analytics, and security end-to-end from the device to the app/service. Identity management, policy, charging have to evolve as well to support a seamless and consistent quality of experience. Full automation and CUPS can help to break artificial domains to further seamless interworking. With this advancement, network slicing (through the mobile core, IP transport and radio) becomes an invaluable enablement tool making the 5G network an “enablement platform”.

4) What are the major challenges for 5G to become a reality? How industry forums like WBA can help develop technology roadmap for 5G, particularly, to define the role of coexistence and unlicensed?

A: 5G is work in progress. It will be planet-wide at the confluence of a new converged wireless ecosystem, licensed and unlicensed, broadband and narrowband. Governments, fora and associations, industries, all have a role to play in shaping 5G and delivering on its promises. WBA with 2 billion global subscribers represents a tremendous opportunity and platform for technology vendors of all stripes, incumbents and startups, to come together with enterprises, cities and industries to share their ideas and expectations, voice their concerns, influence outcomes, validate assumptions, and embark on a joint 5G journey that brings the best wireless has to offer.

4 Key Takeaways & Call for Action

Leveraging on the valuable contributions provided on the open interviews with key executives, industry survey answers and open comments, the following takeaways could be derived:

5G Technologies

- The industry is certain on 5G being a combination of licensed and unlicensed technologies
- Wi-Fi is the leading unlicensed technology under the 5G umbrella

Convergence & Coexistence is key on the 5G Roadmap

- Convergence of services and technologies is currently the most important topic to the industry
- Coexistence of technologies in 5G to leverage on efficiency levels achieved nowadays in Wi-Fi networks

Business case & Services development

- High priority industry verticals start to unfold, top ranked 3 were smart cities, IoT sensor networks and safety/surveillance
- Infrastructure investment rationale is key for operators

Spectrum getting worldwide attention

- Spectrum allocation, usage, cost, regulation on the radar of the industry and regulators across the globe

- Shared spectrum topics raise as priority for operators, including new 3.5 GHz technologies such as CBRS, ASA

Standardization as the key milestone towards 5G becoming a reality

- Standardization is clearly underway and highly likely to happen until 2020, however bridging further licensed and unlicensed would fast-track
- Coexistence of technologies, convergence of services, certification and operator guidelines were indicated as major gaps towards 5G

WBA members confirm the current momentum and opportunities on the unlicensed space to contribute to 5G.

The industry is invited to engage with WBA 5G workgroup by contacting pmo@wballiance.com

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