

# Rising Innovations and Exploration Difficulties for 5G Remote Systems

Deepa. B<sup>1</sup> Naeem. N<sup>2</sup> Deepa. Patil<sup>3</sup>

<sup>1,2,3</sup>Guest Faculty

<sup>1,2,3</sup>Department of Computer Science

<sup>1,2,3</sup>Amuv, Torvi, India

*Abstract*— As the take-up of Long haul Advancement (LTE)/4G cell quickens, there is expanding enthusiasm for innovations that will characterize the people to come (5G) media transmission standard. This paper recognizes a few rising advancements which will change and characterize the future ages of media transmission norms. Some of these innovations are as of now advancing into principles, for example, 3GPP LTE, while others are still being developed. Also, we will take a gander at a portion of the exploration issues that these new advances posture.

**Key words:** 5G Remote System

## I. INTRODUCTION

The cell phone has advanced quickly finished the previous decade from a monochrome gadget with a tiny screen and small handling energy to one with high determination, palm estimated screen and preparing power equaling a workstation. This change, combined with an extending store of transmission capacity hungry applications have activated requests for higher information rates. Versatile information activity has been estimated to develop more than 24-overlap in the vicinity of 2010 and 2015, and more than 500-crease in the vicinity of 2010 and 2020 [1]. This has thusly impelled the take-up of 4G contracts and driven administrators worldwide to convey 4G systems.

As the clean around 4G starts to settle, consideration is presently gradually turning towards future 5G advancements. A key component of 4G, is its capacity to help high information rate (up to 1 Gbit/s) on the downlink. Be that as it may, while 5G will no uncertainty keep on upping the bet on the information rate, we trust that the spotlight will likewise be on scope and client encounter. There are as of now stewing interests in past 4G innovations, and the business is beginning to support ventures investigating such advances. Notwithstanding, the industry's perspective without bounds remote standard is for the most part centered around information rates and productivity, with heavyweights, for example, Qualcomm and Nokia Siemens Systems taking a gander at advances which will adapt to activity development of 1000 times.

While there is no industry agreement on what 5G will eventually be, aside from the typical higher information rate and vitality productivity, there are some developing indications of things to come. For instance, in the new IEEE 802.11 High Productivity Remote (Slash) think about gathering, there is an articulated increment within the sight of cell administrators, something not already observed. This demonstrates developing interests to amalgamate diverse innovations to help future network and information rates. In this manner, we trust that 5G will comprise of numerous interconnected correspondence benchmarks, extending from remote metropolitan zone organizes down to remote individual systems, giving the required throughput and network.

In this article, we recognize a few advances, positioned in apparent significance, which will be pivotal in future remote models. These may enhance limit, scope, or vitality productivity. We have characterized some of these innovations as per what they are attempting to accomplish in Table 1. Table 2 demonstrates another scientific categorization of these advancements as far as their functionalities in the system. We additionally introduce the status of a portion of the remote institutionalization bodies, including 3GPP, IEEE 802.11, and OneM2M and recognize a portion of the exploration challenges that these innovations will bring.

## II. HETEROGENEOUS SYSTEMS

The cell phone has advanced quickly finished the previous decade from a monochrome gadget with a tiny screen and small handling energy to one with high determination, palm estimated screen and preparing power equaling a workstation. This change, combined with an extending store of transmission capacity hungry applications have activated requests for higher information rates. Versatile information activity has been estimated to develop more than 24-overlap in the vicinity of 2010 and 2015, and more than 500-crease in the vicinity of 2010 and 2020 [1]. This has thusly impelled the take-up of 4G contracts and driven administrators worldwide to convey 4G systems.

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### III. NEW CARRIER TYPE

One of the key ideas supporting the activity of improved little cells is the division of the control plane and the client plane. The control plane gives the network and versatility while the client plane gives the information transport. In such a situation, the client gear (UE) will keep up association with two diverse base stations, a large scale and a little cell, at the same time. The large scale cell will keep up network and versatility (control plane) utilizing lower recurrence groups, while the little cell gives high throughput information transport utilizing higher recurrence groups [1]. This is shown in Figure 1. An elective form is the part of uplink and downlink crosswise over various classes of base stations.

The inspiration driving this is in the current 3GPP standard (Rel. 8-10), cell particular reference signals are constantly transmitted paying little respect to whether there are information to transmit or not, and transmitters can't be turned off notwithstanding when there is no information to transmit. Be that as it may, with the meaning of another transporter compose [3], where cell particular control signals, for example, reference and synchronization signals, are expelled, this is not true anymore. The full scale cells will now give the reference signs and data squares, while the little cells, utilizing the new bearer, can convey information at higher range proficiency, throughput, and vitality investment funds. Also, they would now be able to be turned off when there is no information to transmit. This can likewise give extra advantages, for example, bring down obstruction [4]. Such a plan is required to enhance cell edge client throughput by up to 70 percent and diminish full scale hub vitality utilization by 20 percent at low loads [4].

### IV. GADGET TO GADGET CORRESPONDENCES

Another way to deal with taking care of the exceedingly thick system issue will be through Gadget to Gadget (D2D) correspondences, where every terminal can discuss specifically with different terminals so as to either share their radio access association, or to trade data. Combined with control, D2D correspondences can diminish impedance, particularly in non-authorized recurrence groups.

In 4G cell correspondences, there are no arrangements made for gadgets to discuss straightforwardly with adjacent gadgets. All correspondences should be directed through the base station, and the door. This is to a great degree wasteful, particularly when the gadgets are close

by. In situations, for example, machine to machine (M2M) correspondences, where the quantity of gadgets included can conceivably be extensive, it would be more sensible if gadgets can discuss specifically with each other when vital.

In unlicensed range, gadgets would already be able to speak with each other outside of the cell standard utilizing innovations, for example, Bluetooth or Remote LAN in specially appointed mode. Be that as it may, these associations are defenseless to impedance. Then again, utilizing authorized range will ensure a specific level of nature of administration if the association is overseen appropriately. These D2D correspondences will more likely than not require the base station to encourage.

### V. NUMEROUS RADIO ACCESS INNOVATIONS

Despite the fact that the 3GPP characterize heterogeneous systems as the simultaneous task of various classes of base stations, we trust that heterogeneous systems in 5G will be a blend of various radio access advances also. This will incorporate future Remote Neighborhood (WLAN) innovations which can offer consistent handovers to and from the cell framework, and gadget to gadget interchanges. This will help the weight on cell systems and move stack far from the cherished authorized groups. In the meantime, it can likewise simultaneously give higher throughput to clients. This would already be able to be executed to a limited extent utilizing the 3GPP Access System Revelation and Choice Capacity (ANDSF) [5]. In any case, in circumstances where there is a high centralization of client terminals, offloading of information to WLANs may bring about poor throughput, as WLANs are not all around prepared to deal with a substantial number of clients. This issue is perceived by the IEEE 802.11 Working Gathering, which has started an examination aggregate on High Productivity WLANs (Cut) to handle circumstances where there is a high thickness of access focuses as well as a high thickness of client terminals.

### VI. DIFFICULTIES OF HETEROGENEOUS SYSTEMS

Between cell Obstruction One of the most concerning issues for HetNets is between cell impedance. This is particularly risky with impromptu arrangement of little cells, where the administrators have next to zero control of the area of the little cell. Furthermore, the simultaneous task of little cells and customary full scale cells will deliver unpredictable molded cell sizes, and thus between level impedance, which will require propelled control and asset designation to keep away from between cell obstruction.

Circulated Impedance Coordination In sending of access focuses where there are practically zero coordination, for example, between WLANs, dispersed obstruction shirking will be required. This will be progressively essential as more gadgets get to unlicensed range to supplement their throughput.

Proficient Medium Access Control This is especially pertinent for thick sending of access focuses and client terminals where the medium access is appropriated, for example, that of WLANs. In such circumstances, the client throughput is low, dormancy is high, and hotspots won't have the capacity to supplement cell innovation to give a high throughput. Existing medium access control should be

overhauled for such a domain to enhance the channel utilization.

Gadget Revelation and Connection Setup In non-organize helped gadget disclosure in D2D interchanges, there could be issues when there is an expansive number of gadgets around. Moreover, setting up and keep up joins with in excess of one gathering can turn out to be troublesome, particularly while working in a similar recurrence.

## VII. PROGRAMMING CHARACTERIZED CELL SYSTEM

In parallel with the improvement of programming characterized radio (or psychological radio) in remote interchanges, Programming Characterized Systems administration (SDN) has assembled force in the systems administration industry in the previous couple of years. The idea of SDN starts from Stanford College's OpenFlow framework [10], which empowers reflection of low level systems administration usefulness into virtual administrations. Thusly, the system control plane can be decoupled from the system information plane, which fundamentally streamlines organize administration and encourages the simple presentation of new administrations or arrangement changes into the system. At present in both scholarly world and industry, an unmistakable meaning of SDN is as yet deficient. In any case, as indicated by an institutionalization group of SDN, Open Systems administration Establishment (ONF), the SDN design (as appeared in Figure 2) has the accompanying highlights [11]:

- Directly programmable: the system control plane is intelligently concentrated and decoupled from the information plane. System knowledge lives in programming based SDN controllers that keep up a worldwide perspective of the system.
- Open: SDN improves arrange outline and activity by means of open guidelines based and merchant impartial APIs (northbound and southbound).
- Agile: System administrators can powerfully design, oversee, and enhance arrange assets and alter activity streams to address changing issues rapidly by means of dynamic and computerized SDN programs.

As of late, there are additionally developing interests in both scholarly world and industry to apply SDN to portable systems. The fundamental inspiration driving this is SDN may enable cell administrators to streamline their system administration and empower new administrations to help the exponential activity development imagined for 5G systems. The creators of [12] contend that with open APIs and virtualization, SDN can isolate the system benefit from the hidden physical framework, consequently moving towards a more open remote biological system and encouraging quick advancement. Like the programmable switches in wired SDN systems, programmable base stations and bundle passages are imagined in cell SDN designs with expansions, for example, arrange virtualization on supporter qualities and adaptable adjustment of air interfaces [13]. In this way, we trust that remote or cell SDN could be a plausibility in future remote systems.

Future 5G applications may have different attributes and nature of administration (QoS) necessities. For example, M2M movement has altogether different dormancy,

throughput, and need highlights contrasted with Human to Human (H2H) activity. The same can be said for continuous video movement and normal web perusing information activity. The adaptability offered by SDN can empower fine-grained asset control (e.g. in view of supporter traits) to upgrade client Nature of Experience (QoE) while meanwhile amplifying system use [13].

Right now, the remote business presently can't seem to achieve an agreement on a bound together perspective of future 5G organize design. Some support a more conveyed arrange engineering with self-sorting out ability, while others have upheld more unified cloud-based access systems (e.g. China Portable's C-RAN). The improvement of cell SDN is to some degree orthogonal to this continuous development as it gives an open, adaptable, and programmable middleware arrangement that can be utilized as a part of various system structures. Two essential issues are versatility (to help countless cells and countless) and power (to give a dependable reflection without adversely affecting the adaptability).

## VIII. DIFFICULTIES OF PROGRAMMING CHARACTERIZED SYSTEMS ADMINISTRATION

Remote SDN is still at its early stages. There are various remarkable issues to be settled before it can understand its maximum capacity [14]. Right off the bat, assist advancement is expected to apply SDN ideas at arrange foundation level, e.g. bringing SDN into transporter systems. For instance, there is right now no agreement yet on how the programmable switch can be accomplished in the most ideal path (as far as execution and adaptability exchange off). Besides, worldwide institutionalization is still on-going and a bound together cell programmable interface for actualizing SDN foundations presently can't seem to rise. Specifically, the standard advancement of a dependable System Activity Framework (NetworkOS) that gives brought together access to registering, stockpiling and system assets is critical for SDN usage in a multi-merchant condition [14]. At long last, security in SDN is an open issue.

## IX. MONSTROUS MIMO AND 3D MIMO

Another innovation which is being considered is the utilization of an expansive exhibit of radio wire components, a few requests more than the number being used today, to give assorted variety and remunerate to way misfortune [7]. Also called Monstrous Numerous Info/Various Yield (MIMO), it likewise takes into consideration high determination beamforming and is particularly helpful at higher frequencies where radio wire components can be scaled down.

Gigantic MIMO can purportedly build the limit by a few requests and all the while enhance the emanated vitality productivity [8]. What's more, it gives vast number of degrees of flexibility, which can be misused utilizing beamforming if the channel state data is accessible. Another favorable position of Monstrous MIMO is its vitality productivity, and every receiving wire component is required to utilize to a great degree low power [8].

In any case, there are a few research challenges which should be understood before Huge MIMO can be fused into future remote frameworks. Beamforming will require a

lot of channel state data, and this will be hazardous particularly for the downlink. Subsequently, Monstrous MIMO might be unrealistic for FDD frameworks, yet can be utilized as a part of TDD frameworks because of the channel correspondence. On the other hand, constrained criticism can be utilized. Moreover, Enormous MIMO experiences pilot tainting from different cells if the transmit control is high, and will experience the ill effects of warm commotion generally [8]. To wrap things up, there is an absence of channel models for Gigantic MIMO frameworks, without which, scientists won't have the capacity to precisely check calculations and methods.

Another intriguing method presently considered is 3D MIMO, which takes into account 3D beamforming. This is some of the time considered as an extraordinary kind of extensive scale MIMO which is just worried about utilizing the receiving wire components for beamforming. While ordinary beamforming techniques frame shafts in two measurements, 3D MIMO permits bar control in both flat and vertical bearings. This extra control takes into consideration advance sectorization inside a cell. A case of sectorization made by 3D MIMO is represented in Figure 3. Similarly as with Gigantic MIMO, 3D MIMO requires new channel models. As of now, 3GPP has begun a work thing on demonstrating 3D channels [9]. 3D MIMO will likewise require extra adjustments to the criticism component.

#### X. DIFFICULTIES OF ENORMOUS/3D MIMO

Channel Estimation/Input Presently, just time division duplexing situations are considered for enormous MIMO because of the restrictive cost of channel estimation and criticism. Notwithstanding for time division duplexing to work, channel alignment for Enormous MIMO can end up being an accomplishment. New techniques for channel estimation and criticism plans should be proposed for gigantic MIMO to accomplish standard status.

Quick Preparing Calculations to manage the huge measure of information from the RF chains, to a great degree quick calculations to process these information will be required.

Pilot Defilement Gigantic MIMO experiences pilot tainting from different cells. Work around for this will be required for Enormous MIMO to convey its guaranteed execution

#### XI. MACHINE TO MACHINE CORRESPONDENCES

As the empowering innovations portrayed above keep on developing apace, fuelling the development of administration scope and limit, new utilize cases and applications are being distinguished, their rise requesting yet a greater amount of our worldwide systems. A significant number of these new business regions include self-governing correspondence between gadgets, regardless of whether these gadgets are segments in a brilliant vitality organize, insightful home machines or vehicles and framework in an incorporated transportation framework. Without a doubt, we are as of now observing cases of these "machine to machine" (M2M) gadgets: consider the most recent age of in-auto satellite route ("sat-nav") gadgets with their necessary cell modems, downloading activity data refreshes undetectably out of sight.

These new applications can possibly cause a stage change in the extent of the broadcast communications advertise.

There are a few difficulties particular to M2M interchanges, not minimum of which are the self-governing task and frequently prohibitive power, size and multifaceted nature necessities. The run of the mill M2M activity is additionally very unmistakable: having spent the previous decades upgrading our systems, from the most elevated amount servers to the least level PHY station codes, to help the trademark movement streams connected to discourse, perusing and informing, we are presently looked with an alternate type of movement: short, occasional (or aperiodic) telemetry blasts and machine-produced refreshes. The circulation and nature of these M2M activity streams don't sit promptly inside the present system models, so expansions and alterations are required.

The innovation expansions created and conveyed to help these M2M applications have been showing up in a generally impromptu and piecemeal mold, in particular norms bodies as well as associations with specific specialized or local transmits. Plainly, this vertical approach, while getting arrangements out to showcase rapidly, isn't perfect in the long haul. There are zones of shared trait in M2M arrangements where predictable, institutionalized and open flat methodologies will help build up the economies of scale and interoperability that will prompt a really worldwide M2M advertise.

It was to this end the "oneM2M" Organization Undertaking (PP) was framed amid 2012, to create worldwide, get to innovation freethinker Administration Layer details for M2M, in an indistinguishable shape from 3GPP. This global body was framed by Benchmarks Advancement Associations (SDOs) from over the world: ETSI from Europe, ATIS and TIA from the USA, TTC and ARIB from Japan, CCSA from China and TTA from South Korea. Each of these SDOs as of now had interests in (and, as a rule, answers for) various parts of, and minor departure from, M2M frameworks: for instance, the ETSI Specialized Board M2M had just delivered a whole tranche ("Discharge 1") of specialized prerequisites and details. These current benchmarks extend from engineering portrayals to interface definitions, for example, benefit layer connections with basic cell get to frameworks, for example, those created by 3GPP and 3GPP2 (who are as of now creating and discharging augmentations to their suggestions to help M2M movement).

After this first year, the oneM2M members (delegates from 200+ taking part organizations and invested individuals) have thought about, converged, down-chose and blended "best of breed" commitments and recommendations from around the globe. The greatest difficulties have frequently been discovering shared opinion and vocabulary between various proposition.

The engineering is based around Basic Administration Capacities (from Gadget Administration to Session Administration) living inside Normal Administration Elements (CSE), with interfaces between the CSE and the applications above and the hidden system benefits underneath obviously characterized. The present feeling is that both administration and asset orientated models on the key CSE interfaces ought to be bolstered.

The framework is planned receiving the REST reasoning (a "Serene" framework). That is, the framework is stateless, with particularly addressable elements. Moreover, the framework must have all around characterized interfaces amongst customer and server, and between layers, to permit free advancement and development of segments. This Peaceful approach is a key empowering innovation for the "Web of Things" as well as the more drawn out term "web of things", which we accept will be an application inside 5G frameworks.

Correspondence streams based around ask for/reaction connections are additionally characterized, and conventions for the diverse interfaces are being distinguished and checked.

The key, top-level archives have just been concluded and concurred, and are currently under change control forms. Work proceeds inside the diverse Working Gatherings to settle and concur the rest of. The gathering is expected to convey a first discharge amidst 2014.

## XII. DIFFICULTIES OF M2M

Particular difficulties fluctuate as per the correct M2M application, however there are two topics that repeat in many, if not all, M2M applications:

**Huge access:** Contrasted with ordinary human to human activity in cell organizes, an enormous number of M2M gadgets in a cell can posture genuine framework challenges as far as radio access arrange (RAN) clog and over-burden. Right now various proposition have been proposed in 3GPP to address the RAN over-burden issue, e.g. back-off change, get to class notwithstanding, and M2M prioritization. Be that as it may, every one of these techniques has its qualities and shortcomings and none of them is broadly recognized as the best arrangement.

**Security and protection:** Security has been generally talked about in different institutionalization bodies. For example, in ETSI M2M [15], M2M security centers around a few qualities of a client and their correspondences, including validness, specialist, honesty, and privacy. To empower wide organization of M2M administrations and particularly upgrade purchaser acknowledgment, M2M protection is of foremost significance. Diverse M2M applications and parts (e.g. e-wellbeing and keen metering) may have distinctive protection necessities which must be considered ideal from the earliest starting point of framework outline.

## XIII. DIFFERENT ADVANCES

Aside from the above advances and applications, the accompanying innovations can likewise possibly affect 5G.

## XIV. MILLIMETER WAVE

A conspicuous method for expanding the throughput will be through data transfer capacity extension. In any case, the accessible data transmission beneath 6 GHz is constrained, and re-cultivating simple television range won't adequately take care of the prospering demand. As of now, there are endeavors to look past 6 GHz and furthermore at the millimeter wave frequencies to assess their practicality for use in future systems. In any case, the qualities of higher

frequencies are not all around considered, and estimation crusades and channel displaying for various situations and conditions will be required before transmission advances can be intended for them. We trust that millimeter wave frequencies holds the most guarantee, and there are as of now on-going endeavors to make this a plausibility. In [15], millimeter wave frequencies of 28 GHz and 38 GHz are widely concentrated to comprehend their spread attributes in various conditions, making ready for their utilization in future remote frameworks.

## XV. SHARED RANGE

Albeit subjective radio was frequently touted as an answer for the issue of recurrence range lack, it is from time to time received as there are dependably worries about the effect on the essential client or permit holder of the range. An elective arrangement proposed which can conceivably understand this difficulty is Approved Range Access (ASA) otherwise called Authorized Range Access (LSA) [17]. The idea of LSA is to enable approved clients to get to authorized range in light of specific conditions set by the licensee of the range. This would permit under-used range to be all the more successfully utilized and furthermore take care of the issue of nature of administration for the essential client.

## XVI. ENORMOUS INFORMATION

Like in numerous other market parts and enterprises, huge information will likewise realize loads of difficulties and openings in 5G remote. Above all else, cell systems need to give proficient foundation support to this information downpour. For instance, the future M2M or Web of Things (IoT) applications will create a huge measure of information. As talked about already, this turns out to be a noteworthy specialized test for RANs. Besides, new system structures may rise up out of the need of running huge information applications. There is close cooperative energy between distributed computing, programming characterized systems administration, and System Capacity Virtualization (NFV). A joining of these advances can be imagined to shape profoundly hearty and dependable 5G stages for enormous information. Thirdly, settling on educated choices and separating knowledge from huge information is a critical but non-trifling errand. For instance, cell administrators can influence utilization of different client to arrange get to information to lessen stir rate and look for new income openings. The savvy matrix, as another case, can be viewed as a tremendous sensor organize, with colossal measures of network sensor information from different sensors, meters, machines and electrical vehicles. Information mining and machine learning strategies are fundamental for productive and streamlined task of the framework.

## XVII. INDOOR SITUATING

While indoor situating itself does not enhance throughput or scope, it has expansive ramifications on different applications and the nature of correspondences. Exact situating of client terminals can furnish the system with extra data that can help in asset assignment and nature of administration change. It can likewise empower a plenty of utilizations, including

position based handover, asset allotment, and area based administrations.

Presently, 3GPP LTE has a few situating techniques, including Cell ID (CID) and Upgraded Cell ID (ECID), and additionally Helped Worldwide Navigational Satellite Frameworks (A-GNSS). It is likewise ready to position utilizing the Watched Time Distinction of Landing (OTDOA) strategy. All these are empowered through the Improved Serving Versatile Area Center (E-SMLC) utilizing the LTE Situating Convention (LPP) [18]. Precision upgrades to the as of now accessible techniques will surely open doors for more area based applications.

#### XVIII. CONCLUSIONS

In this paper, we have given a layout of some creating developments which may make up future 5G remote frameworks. We have moreover depicted some examination issues which these advances appear.

While there is to introduce no unmistakable understanding among scholastics and industrials on what will portray 5G remote frameworks, we assume that future 5G remote frameworks will be a blend of different engaging developments, and the best test will be to influence them all to collaborate.

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