A Review on Coverage Optimization in Heterogeneous Network

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Abstract- Smart and flexible wireless devices brings with them, associate degree ever continued challenge of finding economical suggests that for resource usage. Scope and avenues for capability and coverage improvement in cellular networks area unit perpetually explored. Readying of little cells like microcells, picocells, hotspots, and relays established a good answer to enhance network coverage and capability. However, this will increase in performance occurs with the price of preparation and maintenance of extra base stations. Another fascinating answer to enhance coverage and network capability is that the use of user instrumentality with relaying support.

Keywords: *Heterogeneous Network, UE Relays, Coverage Optimization.*

I. INTRODUCTION

Wireless communication networks square measure generally deployed to supply completely different communication services like voice, video, packet knowledge, messaging, broadcast, etc. These wireless networks could also be multiple-access networks capable of supporting occupancy multiple users by sharing the on the market network resources e.g., information measure and transmit power. Samples of such multiple-access networks embody Code Division Multiple Access networks, Time Division Multiple Access works, Frequency Division Multiple Access networks, Orthogonal FDMA networks, Single-Carrier FDMA networks, Third Generation Partnership Project future Evolution networks, and future Evolution Advanced networks.

A wireless communication network could embody variety of base stations that may support communication with variety of user instrumentation devices. A UE could communicate with a base station via the down-link and transmission. The down-link or forward link refers to the communication link from the bottom station to the UE, and also the transmission or reverse link refers to the communication link from the UE to the base station. A base station might transmit information and management info on the down-link to a UE and or might receive knowledge and management data on the transmission from the UE.

This communication link could also be established via a single-input single-output, multiple-input single-output or a multiple-input multiple-output system. Wireless communication systems could comprise a donor base station that communicates with wireless terminals via a relay node, like a relay base station. The relay node could communicate with the donor base station via a backhaul link associate degrees with the terminals via an access link. In alternative words, the relay node could receive downlink messages from the donor base station over the backhaul link and relay these messages to the terminals over the access link. Similarly, the relay node could receive transmission messages from the terminals over the access link and relay these messages to the donor base station over the backhaul link. The relay node could, thus, be wont to supplement a coverage space and facilitate fill coverage holes.

II. LTE-ADVANCED AND RELAYING

LTE-Advanced
The LTE-Advanced unleash 10 is associate evolution of LTE, that is to compliant with the IMT-Advanced necessities and targets. It aims to provide peak knowledge rates of up to 1 Gbps for low mobility and 500 Mbps in deciliter and UL severally. LTE-Advanced is needed to cut back the user- and control-plane latencies as compared to LTE unleash 8. It targets to attain peak spectrum potency of 30 bps/Hz and fifteen bps/Hz in deciliter and UL severally.

LTE-Advanced enhances the cell edge user outturn or 5%-ile user outturn so as to attain a homogenized user expertise in cell. It'll support the quality across the cell from 350 km/h to five hundred km/h counting on operational band [1]. The LTE-A is backward compatible with existing LTE system and support the present LTE enabled UEs. LTE-Advanced is predicted to be information measure ascendible and support wider information measure up to a hundred

MHz .It ought to additionally support the FDD and TDD duplexing for the present paired and unmatched band, severally.

It permits network sharing and relinquishment with existing inheritance radio-access technologies. LTE-Advanced additionally considers a coffee value infrastructure preparation. It'll permit the backhauling victimization LTE spectrum so as to scale back the price per bit.

Relaying in LTE-Advanced

A relay could be a specific quite transceiver that repeats the signal of another base station typically to increase the effective coverage of the network. In fig. 1.1 relays square measure operator deployed dbase stations positioned at strategic locations on alter communication to users in extended regions. The first aim of relay preparation is to boost capability and coverage of heterogeneous networks.

Since, relay uses a wireless backhaul to speak with close Macro cell Base Station or Donor MBS, there exists a constraints on usage of wireless spectrum. A special quite relay uses the spectrum otherwise. Associate in band relay uses an equivalent spectrum as donor MBS to speak with its associated user equipment's.

This sharing of the spectrum ends up in inflated interference to neighboring users. Associate out of band relay uses the spectrum that's orthogonal to the donor MBS. Consequently, this lowers the interference, however imposes the next information measure demand for system wide communication.
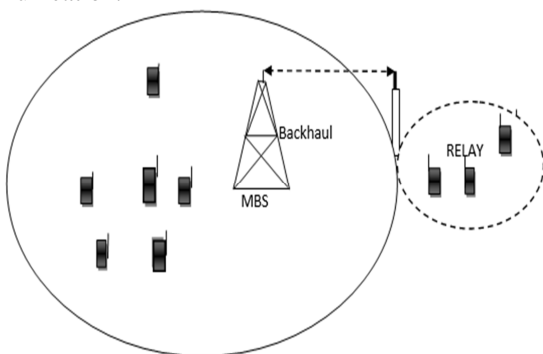
User Equipment Relays

The primary objective to use mobile device as relay is to increase cellular coverage while saving cost of base station preparation. A further improvement in system capability and energy potency could be an end. The motivation comes from the very fact that if 2 devices area unit near one another, they'll communicate directly between themselves rather than involving macrocell /picocell base station to route the decision.

Hence, this approach not solely save further information measure needed at transmission and downlink however additionally reduces load on macrocell. Literature is galore

with proposals for such economical mobile Device to Device communication.

III. RELAYING ADVANTAGES AND DISADVANTAGES

1. Advantages

a) The most purpose of relaying is to produce peak knowledge rates so as to support high knowledge services. Results show that Relay enhanced Cell network has higher downlink performance in terms of UE outturn as compared with single-hop eNB-only network [2].

b) RNs enhance the general network turnout by expeditiously utilizing the network resources. Results have shown that UE experiencing sensible propagation conditions towards RNs. It invoke the UEs to perform relinquishment towards RNs particularly at the cell edge, therefore, increasing the network capability likewise as improve the resource fairness to UEs. It conjointly provides sensible performance at cell edge by sanctioning a network coverage extension [3] - [4].

c) RNs being a price economical readying resolution, gained the network operator interest. Attributable to less advanced web site coming up with, acquisition, cost-effective and low power necessities, they will be simply mounted on structures like lamp posts. Therefore, with low CAPEX/OPEX price, REC networks outdo the eNB-only deployed network [5].

d) RN yields a stimulating SINR gains on the relay link through correct web site coming up with. It additionally reduces the shadow attenuation impact by choosing best web site location for RN preparation [6]

2. Disadvantages

a) In relaying, the DeNB utilizes an equivalent radio resource pool among 3 links particularly direct, relay and access links. Moreover, in band relaying, the relay and access link utilize an equivalent radio resources through time-division multiplexing, therefore, limiting the RN performance. It creates high competition for the offered radio resources at the DeNB, which requires associate degree economical and sophisticated resource programing techniques [7].

b) RN possess tiny coverage space attributable to its low transmit power, low antenna gains and high path-loss exponent. Thus, less range of UEs are connected to RNs, because inefficient utilization of resources as well as load imbalance between RN and macro base station. Moreover, RN-served UEs may additionally expertise interference from high power transmission of macro base station [8].

IV. CHALLENGES IN RUE DEPLOYMENTS

Here is discussing the challenges that exits once a UE acts as a relay for vary extended UEs on offer cellular property.

The foremost challenges that exists in implementation and operation of such devices square measure,
Implementation Challenge
A UE acts as a relay, it's to play the practicality of a base station for the E UEs to that it serves an affiliation to the network. And decision those UEs within the extended region as Extended Region User Equipment's. For this, the protocol stack implementations in UEs ought to be changed to supply this practicality.

Work in [9] explains the stack enhancements that may be exhausted UEs on use them as relay. In fig 1.2 whereas associating ERUEs with the RUE, appropriate discovery mechanisms is one challenge, and therefore the second challenge is the way to effectively use the spectrum which will ends up in less interference and better output. To analyze this, think about two options for unlink transmission viz. shared information measureand dedicated information
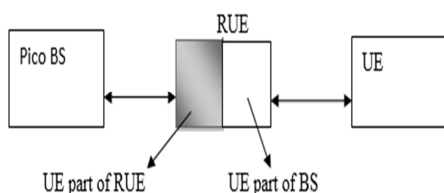
measure.

Association/Discovery Challenge
In this section is discuss once a UE ought to begin taking part in the role of Relay User instrumentality and indicates its donor base station that it's in relay mode. Some discovery mechanism is additionally needed to indicate accessibility of RUE to different UEs as an attainable base station for association.

RUE as Base Station
Before any UE decides to play the role of RUE, following criteria ought to be considered. A RUE could be a mobile device with restricted battery constraints. Being a relay needs RUE to expend its energy consumption to transmit or receive information from different UEs or donor BS. This involves additional power to be exhausted on prime of RUE's self-data communication necessities. Therefore a UE will determined to play the role of a RUE whenever its power levels will support further knowledge transmission. Another criteria ought to be thought of for RUEs is quality. A UE being mobile in nature poses a challenge to support further devices. Therefore a UE will commit to play the role of RUE once it might verify that its quality won't hamper the communication of associated REUEs.

RUE as UE
Once a UE decides to play the role of a RUE, it ought to sporadically transmit beacons that might modify close UEs to get the RUE. To boot, following features ought to be enforced within the protocol stack to take care of communication standards.

1) Secured surroundings
A UE will act as a RUE if it satisfies that everyone the mandatory security protections square measure in place to shield the communication between RUE and REUE.

2) Access and Audit management
All necessary functionalities area unit needed to support licensed UEs to access the network through RUE. This may conjointly facilitate in pursuit the quantity of resources and information measure exhausted by RUE on behalf of REUEs and might be used for appropriate compensation or credit for providing the RUE service.

3) Time sure Access
The RUE will outline an obligation cycle amount, i.e. an amount throughout that it might act as a relay to alternative UEs, whereas within the remaining time still behave as a UE and modify its own transmission. The amount of duty cycle will be determined supported the factors like quality, power, security etc.

V. BACKGROUND

A. Damnjanovic, J. Montojo, [11] say that the most goal of this text is to produce an outline of the topology and also the preparation choices for heterogeneous networks. Preparation of tiny, low power, low price cellular base stations provides AN economical mean to handle this ever increasing demand of knowledge. Heterogeneous cellular network consists of macro cells overlaid with microcells, Pico cells, relays, and hotspots helps up network capability and coverage by economical use of accessible wireless spectrum.

Pico cells square measure regular eNBs with the sole distinction of getting lower transmit power than ancient macro cells. Their transmit power ranges from two50 mW to just about 2 W for out of doors deployments, whereas it's usually one hundred mW or less for indoor deployments.

Femto cells or HeNBs square measure usually shopper deployed (unplanned) network nodes for indoor application with a network backhaul expedited by the consumer's home digital line or cable electronic equipment. Femtocells square measure usually equipped with omni directional antennas, and their transmit power is one hundred mW or less.

An RN may be a network node while not a wired backhaul. The backhaul, that provides the attachment of the RN to the remainder of the network, is wireless and uses the air interface resources of the wireless system in question. Just in case the backhaul communication takes place within the same frequency because the communication to/from UE on DL/UL, severally, the relays square measure denoted as in-band.

Durgamalladi,qualcomminc [12] say that on the transmission, femto UE and macro UE might produce high interference, which might result in high interference variation. Attributable to the downlink power mate, UE that receives similar signal strength from the macro- and femtocells is way nearer to the femtocell than the macrocell. within the case of nominal transmit power of the macro base station at forty three dBm and femto at twenty dBm, the received power distinction on transmission would be as high as twenty three dB i.e., the received power at the femtocell is twenty three dB above the received power at the macrocell. If this UE is served by the macrocell with a targeted received signal-to noise magnitude relation of five dB, the interference caused by this UE would be twenty eight dB on top of the thermal at the femtocell once this UE starts transmittal.

J. Andrews, H. Claussen, [13] say that but, it's been seen that even with additional information measure, higher modulation and cryptography techniques in heterogeneous cellular networks, operators still facing downside to fulfil users' information demands. All the same, these infrastructure incurs terribly high capital and operational expenditure and still unable to resolve indoor coverage downside. Recently, use of miniature indoor cellular base stations referred to as femtocell is usually recommended for indoor users.

J. Kim,K. Vanganuru,Z. Shi, and I. Katzela [14,15,16,17] say that femtocell offer vast performance improvement to users within homes/offices by expeditiously reusing the offered spectrum Femtocell eliminate wall penetration loss to indoor users, and thus able to offer users with higher coverage and bit rates. However, dense femtocell preparation could result in extra co-channel interference to neighboring users. Varied researches square measure current to mitigate the interference from such dense preparation situation. One amongst the simplest approaches is to bring transmitter and receiver spatially nearer to every alternative thus on improve received signal strength from target base station. Another approach is coming up with use of frequency sub channels in a good manner on avoid interference fully. Frequency partitioning ill-natured permits service suppliers to alter prime quality user expertise, however deteriorate spectral potency of the system. Most analysis exists in literature specialize in up capability and coverage of cellular networks by improvement of transmit power and sub channel allocation policy.

VI .CONCLUSION

Deployment of Relay User Equipment's in an exceedingly heterogeneous network not solely shows improvement in coverage and capability of the network, however conjointly helps in decreasing networks' energy consumption. Whereas the present simulation is finished with fastened

nearly blank frame density, identical are often created dynamic supported system load and relay node accessibility.

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