Next-Generation Energy-Efficient Coverage Optimization HetNet Self-Organization Resource Management with UER

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Abstract— ***The main aim of this paper is to look at how user equipment can be used as a relay node in heterogeneous networks and evaluate the energy efficiency of such communication. It will be shown that using user equipment as a relay can help increase energy efficiency and that using mobile devices as a relay can help expand cellular coverage while saving money on base station deployment. Analyzes the feasibility of using user equipment as a relay to increase cell edge user performance and proposes a time-based resource partitioning approach for relay user equipment to deal with cross-tier interference. Simulate the obtained SINR and bit rate at UEs. Two scenarios, macro only and macro plus Pico deployment, are used as baselines to compare results.***

Keywords — Heterogeneous Network, Coverage Optimization, UER

I. INTRODUCTION(SIZE 10 & BOLD)

Wireless communication networks are widely used to provide a variety of communication services, including voice, video, packet data, messaging, broadcast, and so on. These wireless networks may be multiple-access networks that share network resources including bandwidth and transmit power to serve multiple users. Code Division Multiple Access networks, Time Division Multiple Access networks, Frequency Division Multiple Access networks, Orthogonal FDMA networks, Single-Carrier FDMA networks, Third Generation Partnership Project Long Term Evolution networks, and Long Term Evolution Advanced networks are all examples of such multiple-access networks.

A wireless communication network might consist of several base stations that can communicate with a variety of user equipment devices. The downlink and uplink are two ways in which a UE can communicate with a base station. The downlink, or forward link, is the communication link between the base station and the user equipment, while the uplink, or reverse link, is the communication link between the user equipment and the base station. A base station can send data and control information to a user equipment (UE) on the downlink and receive data and control information from the UE on the uplink.

A single-input single-output, multiple-input single output, or multiple-input multiple-output device may be used to create this communication connection. A donor base station that communicates with wireless terminals through a relay node, such as a relay base station, is one example of a wireless communication device. A backhaul link connects the relay node to the donor base station, and an access link connects it to the terminals. In other words, the relay node will accept downlink messages over the backhaul link from the donor base station and relay them to the terminals over the access link. Similarly, the relay node will accept uplink messages from terminals via the access connection and relay them to the donor base station via the backhaul link. As a result, the relay node may be used to complement a coverage area and fill coverage gaps.

II. PROPOSED TECHNIQUE

Propose a time-based resource partitioning system in which one group of devices is permitted to transmit in some sub frames while the others are allowed to transmit in the remaining sub frames, ensuring that transmissions never overlap. As a result, by achieving time domain orthogonality in spectrum access, it is possible to reduce interference. Inter Cell Interference Coordination with Almost Blank Subframes is another name for this technique.

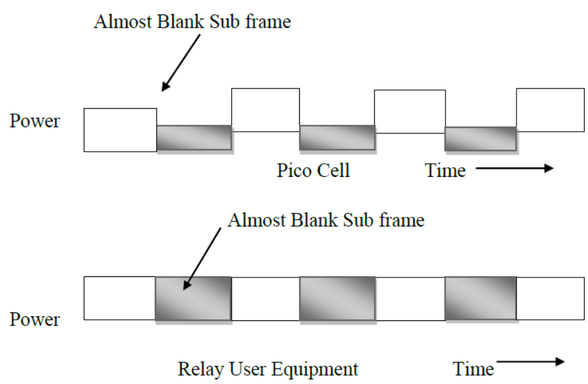

Fig. 1 Almost Blank Sub-Frames

A. Proposed Formula to Calculate the Maximize Throughput of Relay Deployment

In this technique, divide the available wireless resources into two partitions. First partition of FABS = αF subframes are reserved exclusively for REUEs' transmission as to protect their signal quality. While the remaining $F_{nABS} = F - F_{ABS}$ subframes are reused by MBS, PBSs and RUEs to serve their UEs. To protect the signal quality of macro and Pico UEs, perform sub channel power control over F_{nABS} sub frames for REUE. The aim is to maximize throughput of relay deployment by solving the following optimization problem, Maximize

$$\Gamma_j^k \quad \sum_{K=1}^{N_R} \sum_{J=1}^{N_U^k} \frac{F_{nABS}}{N_U^k} \log_2\left(1 + \Gamma_j^k P_{tx}^k H_j^k\right)$$

$$\sum_{k=1}^{N_R} \Gamma_j^k P_{tx}^k H_j^k \leq I_{max} \qquad \forall_j$$

$$\Gamma_j^k \geq 0 \qquad \forall_{j,k}$$

Where N_R and N_U^K represent to total number of RUEs and number of REUEs in k^{th} RUE, respectively. H_j^k represent to path loss. Γ_j^k is the non negative power factor that is applied to each UE of RUEs to perform power control over F_{nABS} subframes. To solve this problem, here is convert it into Lagrange's dual problem and find out the power factor values for each REUE.

B. Round Robin Scheduler

Round robin scheduler is viewed as where Macro-eNB clients and focus Pico eNB clients are just permitted to be planned in the non-ABS while the range augmentation Pico-eNB clients are just permitted to be planned for the ABS. The requirement on the inside Pico-eNB clients is acquainted for straightforwardness and with permit the range expansion clients some reasonableness in utilizing the ABS in light of the fact that in actuality ABS are shared among focus and range augmentation Pico-eNB clients and it gets more earnestly to figure out which clients are planned for the ABS. Furthermore, a presentation about cooperative scheduler.

Round robin is a basic scheduling system that involves assigning resources to terminals one by one, one by one. This ensures that all users have an equal chance of being scheduled, regardless of their channel quality indicator, as seen in the flow chart.

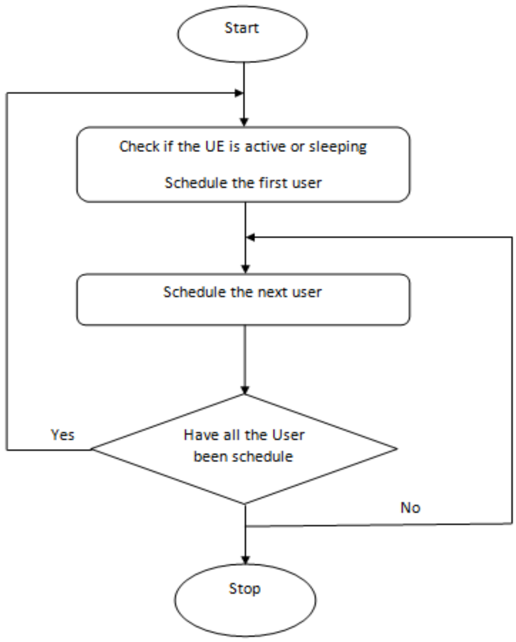

Fig. 2 Flow chart explaining the round robin scheduler

C. Flow Diagram of Proposed Model

1. Formulate the problem is detected by using a formula.
2. Describe the energy efficiency and throughput is the key goal in this phase.
3. Make a project plan the events of the simulation to achieve the goal.
4. Collect Knowledge collect knowledge from survey papers.
5. Develop concept model Using ABS Technique the concept model is developed in heterogeneous networks.
6. Collect data for the SINR and Throughput are collected.
7. Develop bas model the base model is developed depending on proposed technique.
8. Experimental design simulates the developed scenario depending on various scenarios and users.
9. The experiment design is analyzed.
10. Implementation and calibration the developed model is implement and standardized according to the need.

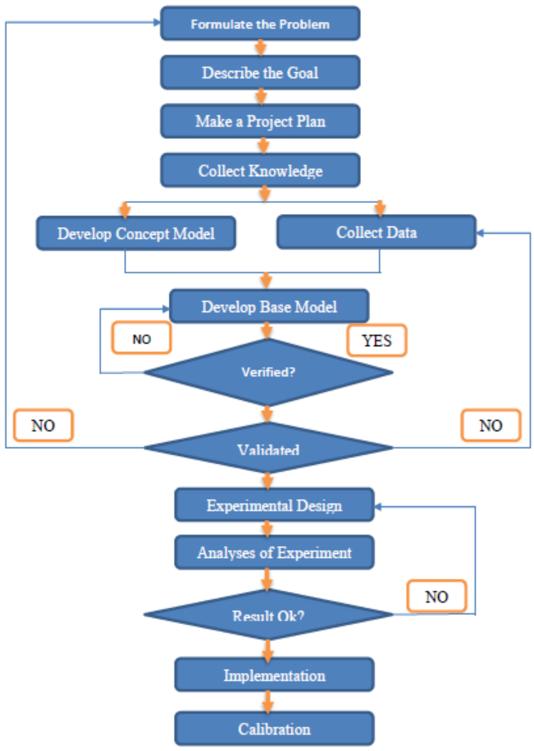

Fig. 3 Flow diagram of the proposed model

D. *Downlink Resource Scheduling*

Booking is a method of efficiently distributing the system's radio assets among the various UEs. Radio assets are assigned to UEs per specific booking. Radio services are allocated to UEs per TTI in dynamic scheduling. The UE radio connection can experience rapid instantaneous variations due to multipath fading. As a result, Channel-Dependent Scheduling and Link Adaptation enable users to make the most of network resources. The former is concerned with adapting quickly to changing radio-link conditions, while the latter is concerned with transmission parameter settings and radio link efficiency.

The CQI is determined for each code word on either the full transmission data transmission design or Wideband CQI or on gatherings of asset squares known as sub-groups. It tends to be likewise used to ascertain the wideband Signal-to- Interference in addition to Noise-Ratio. In figure 4 gives an outline for CQI technique among UE and eNB.

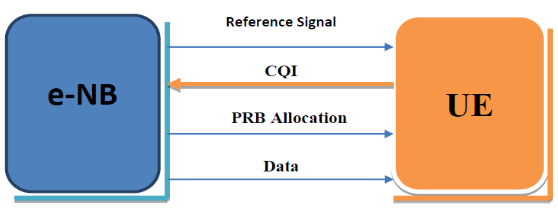

Fig. 4 Down link resource schedule

III.RESULTS AND DISSCUSSION

A discrete occasion reproduction, models the activity of a framework as a discrete grouping of occasions in time. Every occasion happens at a specific moment in time and denotes a difference in state in the framework. Between back to back occasions, no adjustment in the framework is accepted to happen; in this manner the reproduction can straightforwardly bounce in time starting with one occasion then onto the next. This stands out from persistent reenactment in which the recreation ceaselessly tracks the framework elements after some time. Rather than being occasion based, this is called a movement based reenactment; time is separated into little league cuts and the framework state is refreshed by the arrangement of exercises occurring in the time cut. Since discrete-occasion recreations don't need to reenact each time cut, they can ordinarily run a lot quicker than the relating constant reproduction. Another option in contrast to occasion based recreation is process-based reproduction.

In this methodology, every action in a framework relates to a different procedure, where a procedure is regularly reproduced by a string in the recreation program. For this situation, the discrete occasions, which are created by strings, would make different strings rest, wake, and update the framework state.

Simulation Parameters:

Parameter	Value	
Bandwidth	10 MHz	
No. of Sub channels	256	
MBS Transmit Power	46 dB m	
UE Transmit Power	23 dB m	
Wall Loss	10 Db	
Gaussian Noise Figure	-174 dB m/Hz	
UE Power Consumption	1 Watt	
Zero-Load MBS Power Consumption	500 Watt	
Path Loss Coefficient	Macro Cell	2
	Pico Cell	2.5
	Relay UE	2.5
Antenna Gain	Macro Cell	14 dB
	Pico Cell	7 dB
	User Equipment	0 dB

To analyze the performance of the technique, here is compare the SINR and bit rate received at UEs. To compare performance, two scenario viz. macro only or M and macro plus Pico or MP deployment are considered as baseline. In these figures depicts the CDF of SINR and CDF of received bit rate at UEs, respectively. As can be seen, the CDF of UEs for proposed allocation technique outperforms the macro only and macro/pico deployment scenario. In figure is show that UE SINR of MPR or Proposed technique is better as compare to MP and M.

Fig. 5: Throughput vs. Number of RUEs

Figure 5 shows that the value of throughput with increasing number of UE relay by using different Cells i.e. (M) Macro, (MP) (Macro + Pico) and MPR (Macro + Pico + Relay).

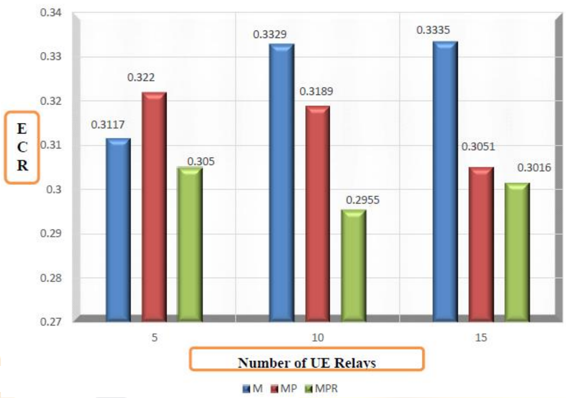

Fig. 6: ECR (Watt) vs. Number of RUEs

Figure 6 shows that the value of ECR with increasing number of UE relay by using different Cells i.e. (M) Macro, (MP) (Macro + Pico) and MPR (Macro + Pico + Relay).

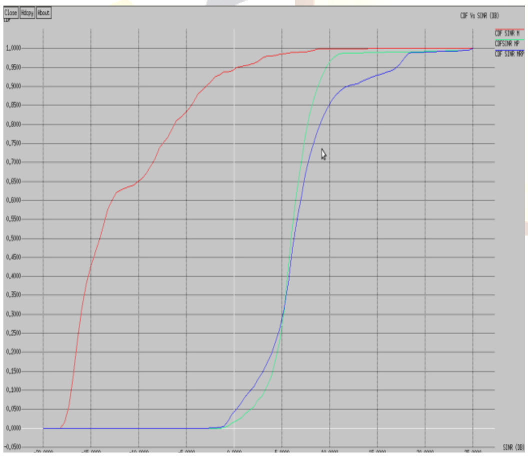

Fig. 5 CDF of UE SINR

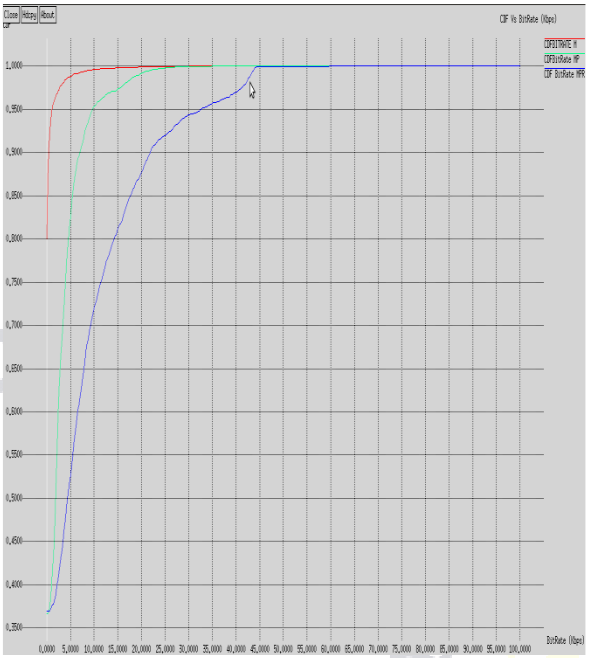

Fig. 6 CDF of UE Bitrate

IV. CONCLUSION

Deployment of Relay User Equipment's in a heterogeneous network not only shows improvement in coverage and capacity of the network, but also helps in decreasing networks' energy consumption. While the current simulation is done with fixed almost blank frame density, the same can be made dynamic based on system load and relay node availability. Combined with the efficient discovery algorithms, let's see relay user equipment as a natural extension for heterogeneous cellular networks to improve capacity and coverage.

REFERENCES

1. R. Shah, S. Roy, S. Jain, and W. Brunette, "Data mules: Modeling a three-tier architecture for sparse sensor networks," in Proc. IEEE SNPA, May 2013.
2. R. Thakur, A. Sengupta, and C. Siva Ram Murthy, "Improving capacity and energy efficiency of femtoCell based Cellular network through Cell biasing," in Proceedings of the 11th International Symposium on Modeling Optimization in Mobile, Ad Hoc Wireless Networks, 2013.
3. A.Damnjanovic, J. Montojo, Y. Wei, T. Ji, T. Luo, M. Vajapeyam, T. Yoo, O. Song, and D. Malladi, "A survey on 3gpp heterogeneous networks," Wireless Communications, IEEE.
4. Y. Zhao, G. Yu, and H. Xu, "6G mobile communication networks: vision, challenges, and key technologies," *Scientia Sinica Informationis*, vol. 49, no. 8, pp. 963–987, 2019.
5. J. A. Khan, H. K. Qureshi, and A. Iqbal, "Energy management in wireless sensor networks: a survey," *Computers & Electrical Engineering*, vol. 41, pp. 159–176, 2015.
6. Y. Zhao, G. Yu, and H. Xu, "6G mobile communication networks: vision, challenges, and key technologies," *Scientia Sinica Informationis*, vol. 49, no. 8, pp. 963–987, 2019.
7. J. G. Andrews, S. Buzzi, W. Choi et al., "What will 5G be?" *IEEE Journal on Selected Areas in Communications*, vol. 32, no. 6, pp. 1065–1082, 2014.

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