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Design Of An Algorithm For Channel Allocation By Enhancing Quality Of Service In Wireless Computer Network

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Abstract:

The lack of available spectrum is a problem for everyone involved in the telecommunications sector. Recent research has demonstrated that inefficient use of the spectrum, rather than a lack of spectrum, is the primary cause of the availability problem. Inspiring from this line of thinking is the concept of New Radio(5G)that can make use of the spectrum as it becomes accessible in a manner similar to how natural frequencies are used. In this setting, we take on the dual challenges of power regulation and frequency allocation. Specifically, we develop a simple, near-optimal method with linear complexity to maximize the capacity of a new radio network by optimizing the distribution of channels among users. We also take into account a conservative design in which primary users must meet certain requirements.With the advent of 5G networks, it has become crucial to provide quality of service (QoS) for channel allocation for base station to macro-cell, to accommodate the enormous data rates and low latency of 5G's internet-connected devices, a new method for the delivery of quality of service has evolved. For over decades, there has been a rapid rise in the number of data users. In terms of bandwidth availability and reliability, data demandis at peak than standard voice services. Allocating a channel based on, the proposed method for decision-making algorithm trained using machine learning to detects when a channel becomes available for channel allocation, the proposed model will have lower average delay and a higher success rate.

Keyword: Channel Allocation, Wireless networks,5G,QoS,LTE,FOM

I. INTRODUCTION:

With the first generation of wireless communication became widely accessible, the cellular sector grown significantly, rising consumer utilizing network services is the key cause of its growth. Network service consumers have many requirements, like internet connected devices, media streaming, file transfer, and online transactions. GSM, the first 2G digital communication system, followed. 3G technology developed from 2G's data rate enhancement led to UMTS. Mobile Wi-max and LTE (4G) overcame 3G's restrictions[1-4] with higher data rates and bandwidth needs.

In order to deliver these services, network operators must ensure excellent quality of service (QoS) while making efficient use of available network resources.Thus, 5G networks utilize a wide range of technologies, including Network Slicing, to serve the needs of a diverse set of end users. When a physical network is "sliced," it is logically partitioned into several independent virtual networks. These virtual networks are tailored to the demands of individual users. Network slicing maximizes radio resource utilisation by making available just the parts of the network that actually need it.Because to network slicing, all available network resources are utilised to their full potential. In 5G networks, where seamless communication across cell boundaries is expected, mobility management presents a significant challenge for delivering an acceptable QoS.Current plans for 5G wireless connectivity will contribute in the open-source implementation of multiple data sets upon which a prominent channel allocation for the smart city depends. The adventof 5G network will be driven by the channel allocationfor higher data rate and network connectivity since the user.

In order to ensure reliable communication during handovers, 5G networks utilize well-organized algorithms to regulate the number of handoffs executed and the probability with which calls are dropped or missed near handoffs. The vertical handover algorithm makes use of multiple bandwidth reserve techniques to prioritise incoming calls, ensure continuous high quality of service, and handle handoffs gracefully.

Wang.et al. suggested JCAC algorithm[6]In order to ensure reliable communication during downlink in a cellular networks, 5G networks utilize well-organized algorithms to regulate the number of handoffs executed and the probability with which channel are allocatted. The vertical handover algorithm makes use of multiple bandwidth reserve techniques to prioritise incoming calls, ensure continuous high quality of service, and handle handoffs gracefully.

Researcher (Chen et al,2009) suggested a Markov chain model and a threshold-based call admission control system based on sensitivity analysis was suggested. The sensitivity evaluation is used to minimize the number of recompilations performed by the method, while the Markov model is implemented to determine the most effective policy. When investigated in event-driven systems, the method outperformed guarded channel and complete sharing algorithms.

(Alfoudiet.al,2018) suggested flexible multipath routing, in which each slice has a distinct module that maximizes its mobility requirements and applies slice mobility management policies [5]. The proposed solution is founded on a shared abstraction that permits slices to ultimately share resources. Every address is assigned a slice ID to support sustainable connectivity, and when the user is relocated to a different RAN, the slice ID is analyzed to evaluate which slice offers the best service. User satisfaction is high, and resource use is effective.

In order to ensure that the entire system remains within the schedulable region in terms of channel allocation and call(mobile) users in 5G guided network, the condition of channel allocation is based on the availability of resources. With the enhanced demand IoT [9-12]connected devices for wireless networks the lower priority of the call being handed over during network transition,will be dropped. Prioritization techniques used in a cellular network often centre on reserving channels for traffic. More notable strategies in prioritising include channel adoption, reservation, and call queuing. Our algorithm incorporates channel adoption, reservation, and queuing techniques to improve QoS and reduce the likelihood of dropped calls for the suggested area.Prioritization methodology benefited from channel adoption. Channel adoption lets mobile users use free channels from underlying pool. Cells can adopt the free channel if it does not interfere with ongoing calls. Cellular networks use several channel adoption methods. Our study focuses for 5G network that utilizes the algorithm for the expected mobile user. Employing channel adoption, permanent users are higher priority than transient mobile users, therefore call dropping is less probable.

To accommodate intermittent users, the algorithm employs a call queuing strategy. If there is no available channel in the network, the call will be sent to the next available queue. The mobile call is queued if all available channels have been used in the destination cell. You can classify the queue as either finite or infinite, and when a channel becomes available, it is given to the next call in the handoff queue. Predefined queue schemes are more accurate, but infinite queue schemes are more convenient for analysis. The FIFO queuing strategy utilized in our analysis. To enhance the scheme's functionality, the queuing method is necessary. The time spent on delay is a key consideration in queuing systems. To optimize access to available channels, the priority established queuing method gives higher priority to handoffs amongst novel calls in that queue. [20]

In channel selection, for new 5G band and upper generation networks, a significant metric is the expected number of stations in the network. The channel reservation strategy's principal objective is to lessen the chances of calls being dropped or blocked. When resources are reserved in [13-18] advance and never changed, efficiency suffers. Several methods for dynamically reserving channels were offered in attempt to figure out this issue. The optimal number of network channels is periodically determined only with arrival of a user in the dynamic reservation technique. Level of reservation, user arrival, and accepting or declining calls are the parameters. Prediction systems use past data to make educated guesses about the future, adjusting their settings as they go to prevent (QoS) drops that aren't warranted. Using a prediction technique informed by locally accessible data, the predictive system generates an approximation of the ad hoc network's global province.

II. Proposed Model and algorithm:

For a standard hexagonal cell utilized in mobile cellular networks at sub 6 Ghz bandwidth and other wireless networks.A set ‘X’ on {n} discrete cells are determined for predefined 1,2…n, an exact vector V = (a_i), $1 \leq i \leq n$ is regarded to mention the total number of channels needed for network cell i as a_i. Then, a matrix for channel allocation (D_Q) is determined with each and every component $Z_{ij}$to specify the assignment of j^{th} channel in i^{th} cell of the channel, where,$1 \leq i \leq n$, 1 $1 \leq j \leq y$ .Initially, available network channels are partitioned into the appropriate number of groups and allocated to Base Stations using a concept called "Collaborative Exclusion," in which just a small number of channels are set aside for the handing over of callsbased .

The persistent channels are also termed as the classic channels although these are capable of both call initiation and call handoff. The originating base station determines if the calling user is a typical or rare one based on the characteristics of the originating[19] call. In the case of a regular user, the base station will allocate a channel if one is available; otherwise, it will borrow one. An irregular user is assigned a channel only if one is available; otherwise, the request is added to a queue.

- Allocation of a channel: Figure 1 shows the procedure involved during channel allocation based on inputs i.e number of station, number of network channel,

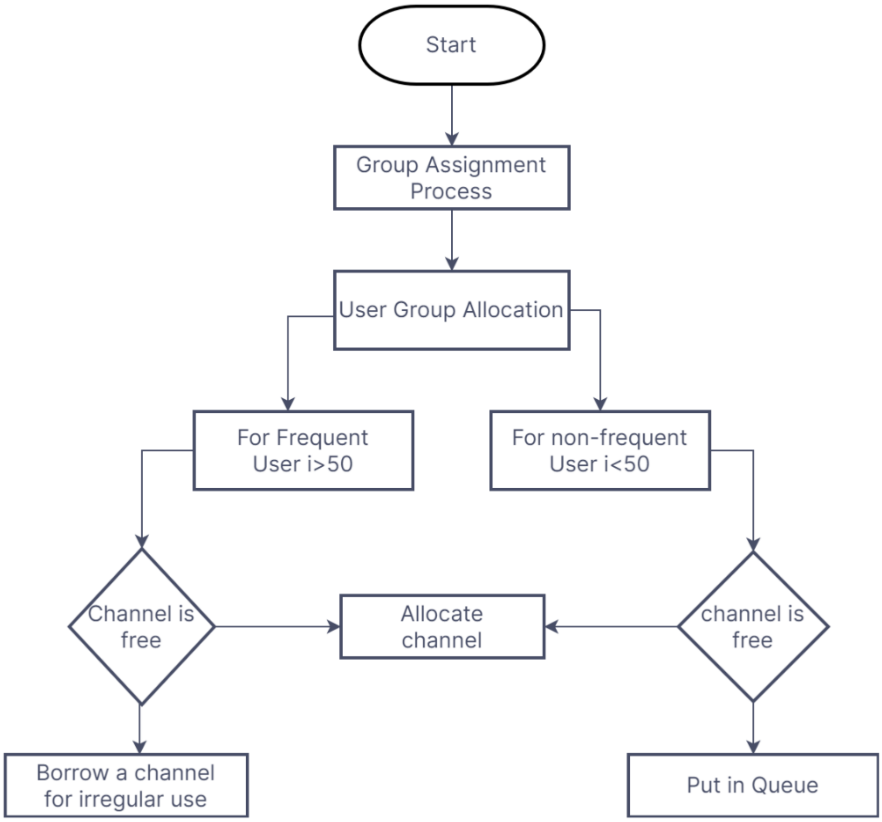

Figure 1: Flowchart for call allocation

Multiple channels exist in a mobile data transmission to accommodate a wide variety of users and boost the network's efficiency. Our suggested technique makes use of a method termed hybrid channel assignment, which allows for improved performance compared to the standard channel reservation mechanism. This algorithm integrates Advanced Network Allocation and Load Balancing techniques. The network's regular users make use of a technique called channel borrowing, whereas the network's irregular users must resort to a queuing system. This algorithm improves QoS by making more effective use of the available channel capacity and minimising the likelihood of calls being dropped or blocked.

Based on our calculations, we can say that there are 85 channels, 130 users, and 15 new users.The system goes through a variety of procedures to figure out which channel each user will be placed on. Users are classified into "frequent" and "non-frequent" categories by first examining the user groups they belong to. Each user is given a threshold value by the network. If the value is below 50, the user is considered an irregular user, whereas if it is above 50, the person is considered a regular user by the network. If the network determines that the user who has arrived is a frequent users, it will verify the availability of channels and give the user access to one if one is free. In any other case, the network verifies the reservation. If the network's reservation status is at capacity, it will allocate a regular user's channel from the reserved pool. [20]Given that the average user might play a crucial role in the functioning of the cellular communication network.

Every cellular communications system has a central pool located at the Switching Office (SO), from which free channels can be borrowed [21]using the channel borrowing approach. Each free channel from a Base Station is added to a central pool, and users borrow channels from the pool as needed to enhance the quality of their calls. After a user call has concluded, the [22] rented channels are put back into the pool. This algorithm guarantees QoS for 5G and lower generation networks to provides a prioritised service for all customers. The network will determine whether or not the channel is available if it determines that the user is not a regular. If there is an open channel, it will be given [23] to that person. When all other options are taken, we check to see if a certain channel is reserved. If the channel's reservation status is full, the irregular user will be added to the queue. If not, the user gets the channel for free. If the queue is already at capacity, the call is automatically disconnected. [25,26] If the requested call channel is currently busy, the request will be queued until it becomes available.

Algorithm of Proposed Model

1.Number of channels =85

2. Number of assumed user =130

3. Arrival rate of new user = 15 user/hour

Step 1:
Channel Available = D_k
Queue generation = G_i
M_i = Frequent User
N_i = Non-Frequent User
P_i =New User
Step 2:

$$For\ (i > 50)$$
$$\{$$
$$Mi = \ Frequent\ User\ Status\ Check$$
$$If\ (M_i < D_k)\ available$$
$$\{$$
$$Allocate\ channel\ to\ available\ user\ M_i$$
$$else$$
$$\{$$
$$Borrow\ channel\ as\ queue\ is\ full$$

$M_i = M_i + G_i\}$
}
}
}
Step 3:

$$For\ (i\ < 50)$$

{

$$N_i = Non - Frequent\ User\ Status\ Check$$

$If\ (B_i < D_k)$
{

$$Allocate\ channel\ to\ the\ available\ user\ Ni$$
$$else$$

{

$$Borrow\ channel\ as\ queue\ is\ full$$
$$M_i = M_i + G_i$$

}
}
}

$$Step\ 4\ (New\ User\ Arrival)$$
$$if\ D_i\ < 50$$
$$\{$$
$$(Frequent\ user)GoTo\ Step\ 3$$
$$Else$$

{

$$(Non - Frequent\ user)GoTo\ Step\ 4$$

}
}

FOM is figure of merit which is used to characterize the quality of signal transmitted to quality of signal received with fundamentally checking the status of the signal or network quality ensuring QoS.Its ensuring customer satisfaction in establishing a new call.

$$F= \frac{(SNR)_O}{(SNR)_I} \quad (1)$$

Let $T_s(r, n)$ is probability of satisfactory completion of service for channel allocation s when using 5G technology r during a measurement period n,v is voice call, p is video call

$$T_v(5G, n) = T_{eps}(5G, n)\ T_{epd}(5G, n) \quad (2)$$

Where

T_{eps} is call success probability that a CSFB (Circuit Switched fall back) to UMTS

T_{epd} is a delay time probability the EPS (Evolved Packet System) fall back is successful during threshold time.

In Case of video call for all r the probability of service is

$$T_p(r, n) = T_{ps}(r, n)\ T_{pd}(r, n) \quad (3)$$

Here we use β_r for the technology we wish to utilize such as 3G,4G,5G for the service we can define like voice, video thus ensuring QoS for period n

$$T_s(n) = \sum_{r\in\{3,4,5\}} \beta_r T_s(r, n) \quad (4)$$

For FOM we can suggest the priority of service used on the fraction of revenue σ_s.If 70% of service is derived from data networks as per the present approach then

$$T_s(n) = \sum_{r\in\{3,4,5\}} \sigma_s T_s(n)\,, 0 < FOM < 1 \quad (5)$$

III. Performance Evaluation:

Figure 2 compares number of channel allocation rate its basically a comparison of proposed algorithm and traffic intensity can be calculated it is exponential in nature. Thus evaluation result has better efficiency and call handover switching rate for the algorithm .Figure 3 is comparison of various figure of merittechniques with the call dropping probability as the number of user get connected only when the handoff between the call is excellent this guarantee QoS as well for a 5G connected networks, here the proposed algorithm justifies yielding better result. Figure 4 as justifies its shows comparison between channel available and call connect probability for a new connected user as we are taking 15 user/hour it’s a minimal user joining rate.

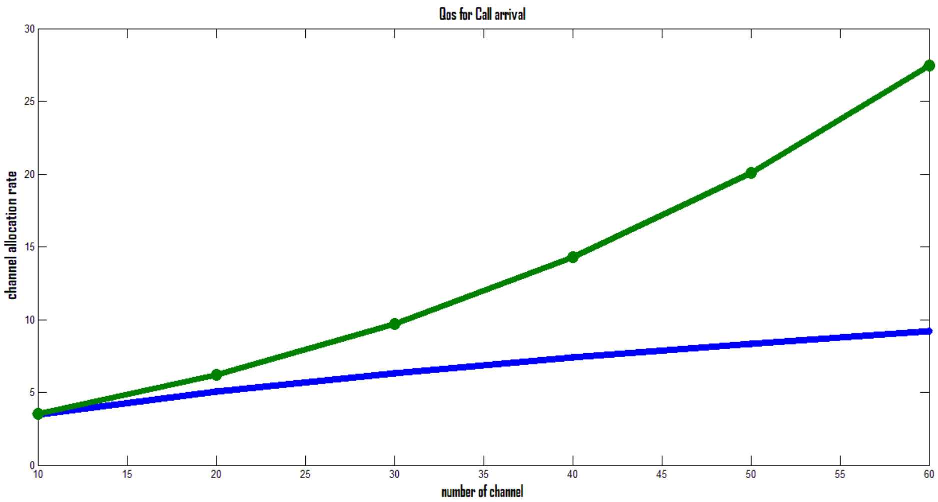

Figure 1: Number of channel vs Channel Allocation rate:

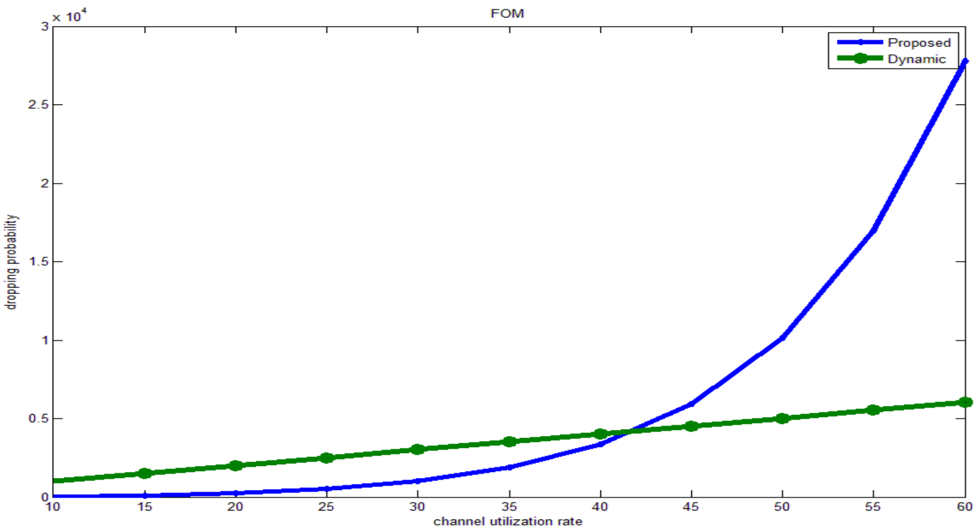

Figure 2: Channel Utilization rate vs dropping probability

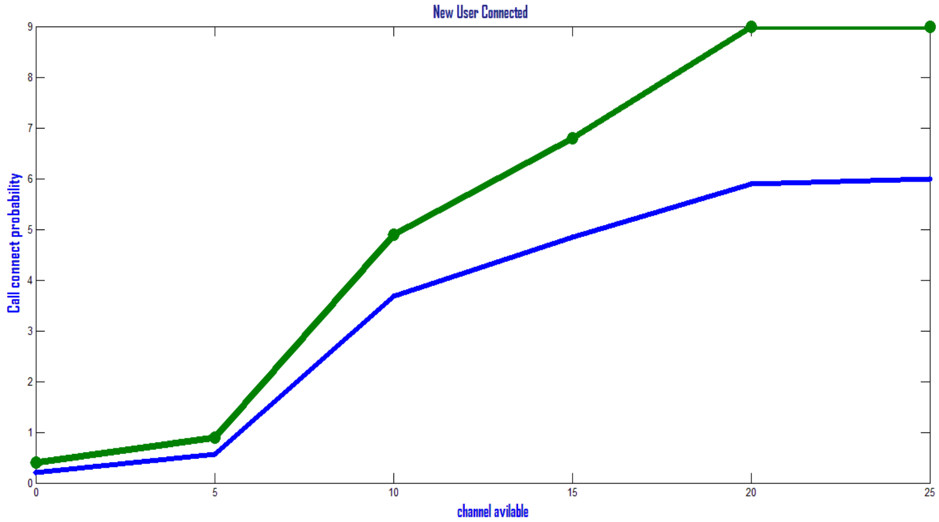

Figure 3: Channel available vs Call Connect Probability (New User)

IV. CONCLUSION

To mitigate failure costs caused by best-effort traffic depletion and maximise productivity in 5G networks, we presented a Channel allocation algorithm with efficient trade-off in this paper. This method effectively utilises network resources by admitting many mobile nodes into the network environment based on admission criteria and a threshold value. Results from a comprehensive simulation run in MATLAB's system-level simulator show that the suggested approach consistently outperforms better for channel allocation. Evidence from this study demonstrates that the proposed algorithm is a promising option for 5G networks and higher networks. Down the road. Therefore, users can be accurately predicted thanks to the crucial bandwidth's design, which distinguishes between heavy and light users and gives regulars top priority.

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