Efficient Scheduling For D2D Communication in 5g Networks

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Abstract – *With the introduction of smart phones and new user registrations, the existing network faced vicious problems in fulfilling user requirements. Congestion, spectrum efficiency, and delay throughput became common problems in those networks so new advanced methods were introduced in new generations to reduce these problems.D2D communication is also a model by which we can give boost the existing resources of the cellular network in order to overcome these limitations. The D2D helps us to improve network capacity, data delivery latency, individual user throughput, and energy efficiency in a cellular network. Current mobile networks are facing data tsunami and this can be drastically reduced by implementing and enhancing D2D communication in current mobile networks. By using D2D methodology higher gains can be obtained by redefining the existing resources with efficient scheduling methods. Existing techniques used in D2D provide solution to above problems but still they are not so efficient when number of users increases significantly. So, in this article Round-Robin algorithm is used to enhance channel efficiency and in turn we can achieve higher transmission rates. Channel efficiency is boosting parameter in D2D networks because bandwidth limitation gives us Goosebumps for higher date rate transmission.*

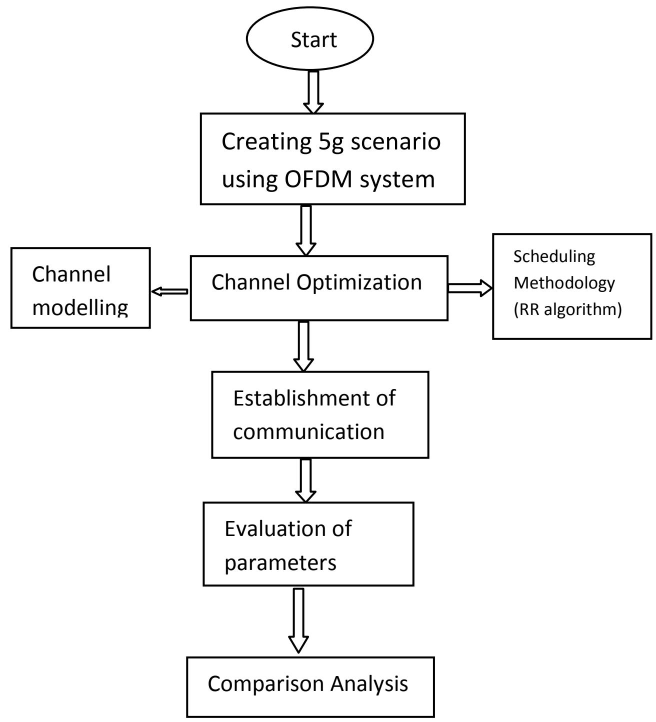
Keywords– Cellular Networks, 5G, D2D, Proactive, Reactive.

1.INTRODUCTION:-

With the introduction of smart phones , user demands increased drastically for mobile broadband. Smart phones has considerably enriched the mobile user expertise, resulting in a huge array of recent wireless services, as well as transmission streaming, web-browsing applications and socially networks. This development has been more fueled by mobile video streaming, which presently accounts for nearly 50% of mobile information traffic, with a projection of 500-fold increase over future ten years [1]. At the same time, social networking is also the second largest traffic volume contributor in the current networks. This new development has urged mobile operators to revamp their existing networks and get a lot of advanced and complicated techniques to extend coverage, boost network capability, and cost-effectively bring contents nearer to users. With more new mobile users day by day and the ever growing demand for higher data rates there is a need of new methods where we can reuse the existing resources with more efficient methods[2].D2D communications have such a promise! Together with enhancements in network capability, information delivery latency, individual user output, and energy efficiency, D2D additionally brings on engaging fresh business cases for network and service providers.The term device here refers to a transportable device with cellular property (tablet, laptop,) that a user owns. Device relaying makes it possible for devices throughout a network to perform as transmission relays for each totally different and spot a huge spontaneous mesh network. This, of course, is possible with device-to-device (D2D) communication utility, that allows a pair close devices to talk with each other inside the licensed cellular system of measurement whereas not a base station (BS) involved or with restricted involvement for authentication and authorization[9]. In D2D communications, devices don't directly communicate with one another within the authorized cellular system but every communication occur through the nearest base stations. During this article, we tend to predict two-tier cellular networks that involve a macro cell tier (i.e., BS-to-device communications) and a tool tier (i.e., device-to-device communications. With the preliminary research, various benefits can be achieved if a network assisted D2D technology will be deployed by network service providers. By proactive caching model, numerical results demonstrate that essential gains can be obtained for each case study, with backhaul savings and a better ratio of pleased users of up to 22% and 26%, respectively. Higher gains can be further obtained by escalating the storage capability at the network edge [2].Ejder Bastug in his research journal "Living on the Edge" mentioned that we can use a procedure that exploits the social structure of any cellular network by predicting a set of influential users in the network via D2D communications.Arghir-Nicolae Moldovan says that As mobile devices are becoming extra powerful and inexpensive they are more and more used for mobile learning activities. By enabling learners' mobile education has the potential to offer online learners with new opportunities and to reach fewer privileged categories of learners that require access to traditional e-learning service. Shahid Mumtaz mentioned that direct communication can make a comeback spectrum potency, on the entire system output, and energy potency, and reduce the delay between devices[5].

Cooperation Model:-Introducing device-to-device (D2D) communications in well-planned cellular networks can potentially improve spectrum utilization, boost energy efficiency and capacity, and reduce communication delays. However, this integration requires careful radio resource management in order to guarantee the aforementioned gains resulting from such hybrid networks**.**One of the challenging communication scenarios involves the crowded environments where there are many users in close proximity to one another in a small area. In such environments, the cellular network can easily become congested due to the high number of connections. Therefore, it is desirable to increase the area spectral efficiency and the number of connected devices per shared resources (time/frequency). In order to minimize interference among users, interactions and cooperation between users are beneficial. Cooperation requires that the cooperative entities follow the same protocol and have some common knowledge, or that they are willing to sacrifice some of their resources, such as power and time, in order to improve each other's performance. Cooperative D2D communications can be a solution to the above scenario by allowing spectrum sharing between cellular links and direct D2D links. Cooperative D2D communications make use of the broadcast nature of the wireless channel in which users in close proximity can overhear each other's broadcasted information. In this scenario, we assume that the D2D transmitter can act as a relay to assist CUE's transmission, while at the same time having the opportunity to transmit to its own receiver.

PROPOSED METHODOLOGY:



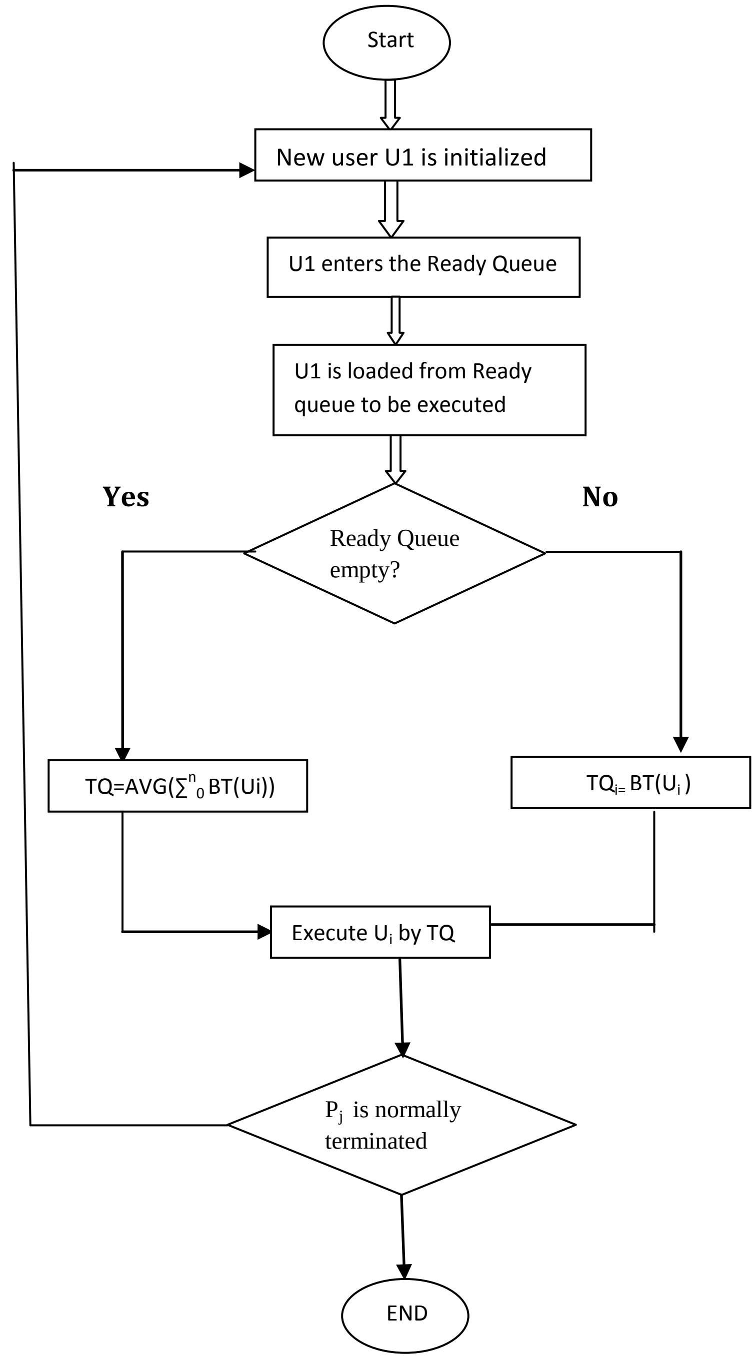
Channel Scheduling In D2D:-

- In our proposed method we use Round-Robin scheduling algorithm for D2D communication. Round Robin uses time slice method to each user in equal portions in a circular manner without priority. This scheduling is simple and easy to implement in our communication networks. To schedule a users request cleanly, round-robin scheduler employs time-sharing methodology, that is scheduler assigns each user a definite time slot and interrupts the user after the specified time slot. The interrupted users request is resumed again in next time slot. Scheduler creates a table where it maintains the status of all the users request and updates the contents of all users after the allocated timeslot. Let me explain by example if there are three user requests and the time slot is 50 milliseconds, and if the user1 takes 100 ms to complete. The round-robin scheduler will suspend the job1 after 50 ms and will attend other two jobs for their allotted time slot. Once the other two jobs have had their allotted time slot then job1 will be given another time slot and the cycle will repeat until the users request is processed and needs no more processing.

- In this method we need two registers to be identified: SR; Register to store the addition of the remaining burst times in the complete queue. AR; Register to store the average of the burst times by dividing the value found in the SR by the count of users found in the ready queue. When a user in execution finishes its time slice or its burst time, the ready queue and its registers will be updated to store the fresh data values. If the user finishes its burst time, then it will be removed from the ready queue. Else, it will move to the end of the ready queue. SR register will be updated by subtracting the time consumed by the current user.AR register will be updated according to the new data. When a new users request arrives to the ready queue, and will operated as per the rules discussed above in addition to updating the ready queue and its registers.
- **Pseudo code and Flow Chart:-**

The various steps of algorithm are as:-

New user U arrives
U enters ready queue
Update SR and AR
User U is loaded from ready queue into the channel to be executed
IF (Ready queue is Empty)
TQ←BT (U)
Update SR and AR
End IF
IF (Ready queue is not Empty)
TQ←AVG (Sum BT of users in ready queue)
Update SR and AR
End IF
Channel executes U by TQ time
IF (U is terminated)
Update SR and AR
End IF
IF (U is not terminated)
Return U to the ready queue with its updated burst time
Update SR and AR
End IF



Numerical Results and Discussion:-

In our setup we take 'N' users connected to 'M' cells ,each user is connected to its SCBS via wireless communication in a definite time slot 'T' and its neighbors are connected via D2D links. Let the total link capacity of SCBS is 'C_w' and total D2D link capacity of the system is 'C_d'. The other parameters include length of file ‘L’, bit rate of each file ‘B’, number of files ‘F’, number of user terminals ‘N’, number of communities connected ‘K’. Also ‘R’ is the number of requests by the users, R* is the maximum number of requests during peak hours .After we understand and determine the influential users in the given community we want to spread this data to the nearby devices through a model known as CRP parameter (Chinese Restaurant Parameter) which is also known by Stochastic Dirichlet Process and is represented by ‘B’ .The total D2D cache size is represented by ‘S’.

Parameter	Description	Value
T	Time slots	1024
M	Number of small cells	4
K	Number of communities	3
N	Number of user terminals	32
F	Number of files	128
L	Length of each file	1 Mbit
B	Bit rate of each file	1 Mbit/s
C_w	Total SBS link capacity	32 Mbit/s
C_b	Total D2D link capacity	64 Mbit/s
R^*	Maximum number of requests	9464
R	Number of requests	0~9464
S	Total D2D cache size	0~128Mbit
B	CRP parameter	0~128

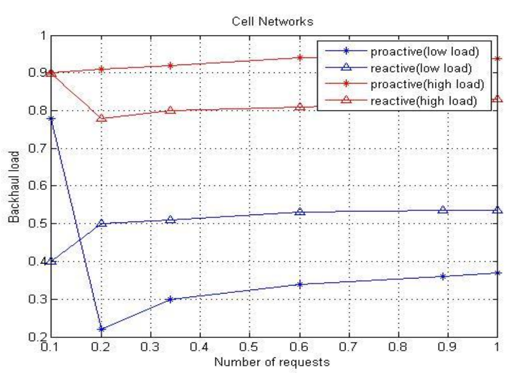


Figure 1

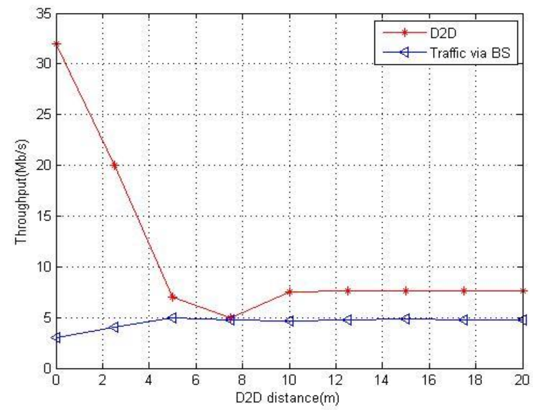


Figure 2

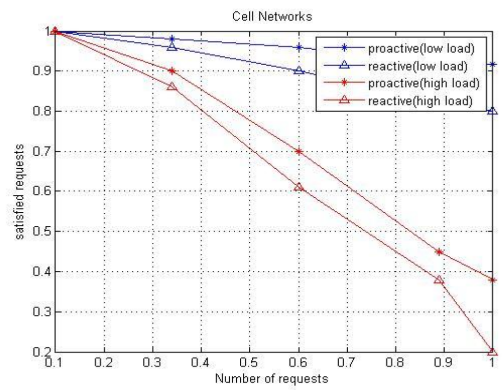


Figure 3

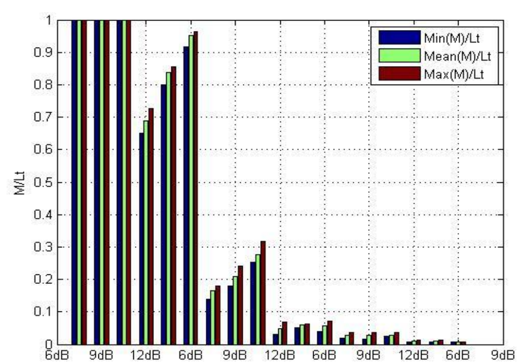


Figure 4

After the simulation results it can said the proactive paradigm outplays the reactive paradigm in all the parameters like throughput, mean and max peak data traffic and backhaul congestion. But also one should keep in mind that the high data rates are achieved in nearby devices as compared to the farther devices. So it can be said that link distance also plays a crucial role in data trafficking. When the number of devices increases to larger extent D2D also needs good traffic management strategies.

Impact of number of requests: As shown in figure 3, as the number of users' requests increases, the amount of satisfied requests starts decreasing due to the limited resource constraints. However, the proactive caching approach outperforms the reactive one in terms of satisfied requests.

Impact of cache size: As S increases; the number of satisfactions approaches 1 and the backhaul load becomes 0. This reflects the unrealistic case where all requested files can be cached. Assuming this is not the case in reality and checking for intermediate values of cache sizes, it can be seen that proactive caching outperforms the reactive case from the above results. Hence D2D outplays the existing reactive methods by using proactive caching.

Impact of Throughput: Figure 2 shows the throughput of the D2D system in terms of different distances between several D2D devices. As far as the short-range distance is concerned, direct D2D's throughput outperforms the throughput by a big margin when exclusively passing D2D traffic on via the eNB. Moreover, for link distance of 5 m, the average D2D throughput is 15 Mb/s in comparison to 3.5 Mb/s when all D2D traffic is passed along (relayed) by the eNB. In other words, D2D communication enhances the energy efficiency of the network in distinction to the relayed link because of high throughput and lower trans- mission power. As a result, the energy efficiency decreases along with increased distance between the D2D pair.

Conclusion:

In this article we discussed the limitations of existing cellular networks and proposed a new proactive caching paradigm which overcomes the limitations of existing cellular networks to larger extent. By using proactive model in 5G networks we can reduce the peak data traffic demands to greater extent through D2D communication methodology. By D2D communication we can solve the data storage capabilities and transmission rate to the extreme in current networks. D2D holds the promise of aiding cellular networks by using latest scheduling methods for betterment. In this article we used the used Round-Robin algorithm for channel scheduling for better and efficient results.

D2D methodology although very helpful for data traffic management but still is a new concept and has been investigated on upper layers. For future work we can use latest algorithm like Condor or Haze for more efficient results. Other parameters we can boost for betterment are interference management, joint optimization of proactive content caching. Also smarter mechanisms can used for load balancing among the SBSs for coordination so that frequent data can be cached 100 percent while low frequent data can be requested from the core network.

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