EDGE COMPUTING IN 5G: COMMON NETWORK APPROACH WITH TRANSPORTATION THEORY

Introduction:

Edge computing is a distributed, open IT architecture that features decentralized processing power, enabling mobile computing and Internet of Things (IoT) technologies. In edge computing, data is processed by the device itself or by a local computer or server, rather than being transmitted to a data center. Edge computing enables data-stream acceleration, including real-time data processing without latency. It allows smart applications and devices to respond to data almost instantaneously, as its being created, eliminating lag time. This is critical for technologies such as self-driving cars, and has equally important benefits for business.

Problem Definition:

When 5G networks aim to offer data rates possibly gigabit-per-second, the main problem for a company will be to serve this service perfectly to a huge number of people alone. There will be self-driving cars which will need the service continuously rather than a user who is watching videos in YouTube. Also when the user number under a specific tower of a service provider company exceeds the maximum capacity the users will not be able to get the desired result.

Motivation:

Edge computing provides the data to be processed by the edge servers rather than transfer the data to cloud and after processing return to the device from the cloud. Data transferring and receiving from the cloud takes time which makes the process slower than normal operations.

In 5G technology, the data rate will be higher than the present time but when the service providing tower will be offline or will not be able to serve, the data will go to cloud which again will the whole process slower. That's where Edge Computing comes in 5G.

Objective:

We have proposed a common network approach where all the network providing towers of different companies in a specific area will be operated under a common station and other towers (except the one in which the user is assigned) will act like edge serves. Also to maintain the quality of the strength of the signal we are going to follow the transportation theory. The main objectives of this approach will be:

1. Finding the way to provide service without sending the data to the cloud.
2. Priority based service providing.
3. Using shortest distance tower to get the service from the towers.

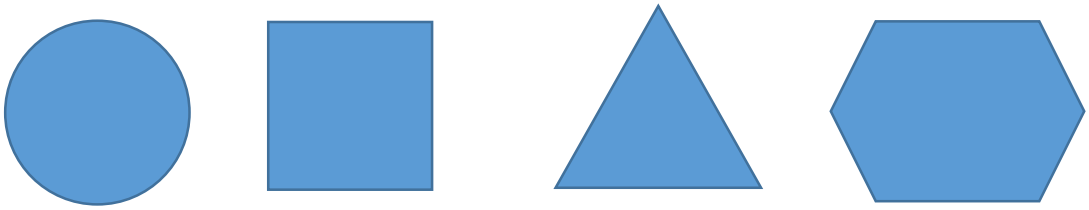
Questions About This Approach:

As our approach is not with the present structure of network towers and their working formula, there will be some questions we are going to answer in our work. They are:

1. How we are going divide the areas to plant a common station?
2. Why are we using a Common Network Approach?
3. Where are we using the Edge Computing?
4. How we are going to get better service in this approach than the previous system?
5. How we are going to give priority based service?

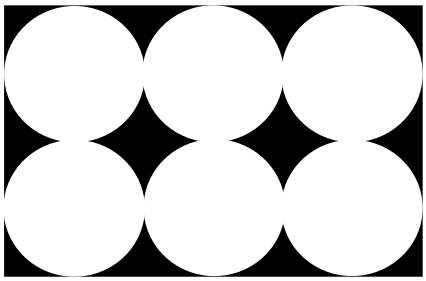
Where to Plant Common Station:

We are going to divide a specific area in a shape which will cover most of the area so we will not need too many common stations in that area. We are taking 4 shapes for testing. They are:



Circle Square Equilateral Triangle Hexagon

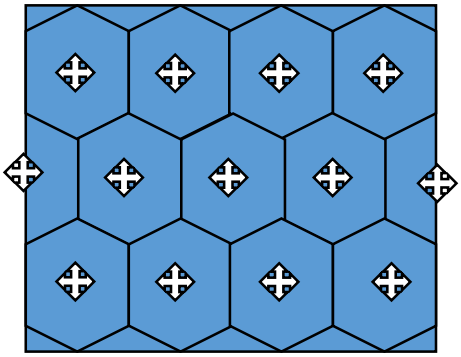
In the circle shape, the empty spaces between the circle will not get the network coverage. So the Circle shape is not the desired one for our approach.



On the other hand, as we are searching for the most area coverage

Area (Hexagon) > Area (Square) > Area (Equilateral Triangle).

So we are taking Hexagon as our preferred shape to divide an area into parts and place the common stations in the middle of those parts.



Properties of Common Station:

As one of the most important element of our approach is The Common Stations. It should have some properties to fulfil our needs.

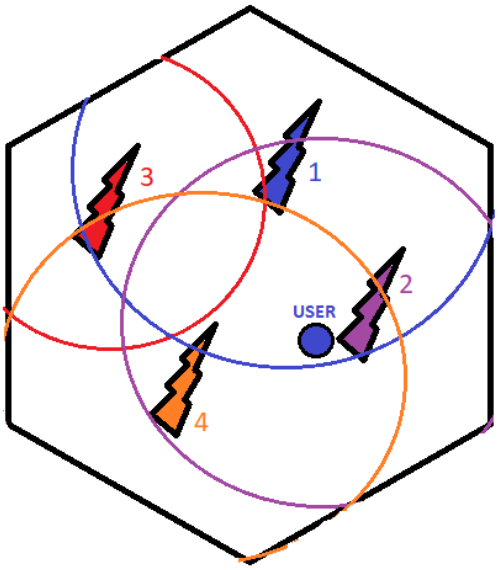
1. Able to locate user devices and network towers.
2. Maintaining the record of current status of networks towers.
3. Calculating the distance between user and the network towers.
4. Maintaining the record of remaining service port of every network tower separately.
5. Able to receive the user request and command network tower to provide the service.
6. Refresh the user location after a very short time to check if the user is moving or not.
7. Enough Number of service request acceptance port according to number of users in the area.

Common Network Approach:

The most advantage in our proposed approach is we are thinking a singular network structure. In present every network providing company has their own towers and stations to serve their customers. They are actually giving service to a part of the population while the other companies are serving the others, in our work we are thinking all those different towers will be work together under a singular station which we are calling Common Station.

In this present the towers are serving their own users. Every tower has a fixed area to cover and the strength of signal frequency drops as the distance between the tower and the user increases. So when the user is at the edge of the area, the tower will not be able to serve the best service as the distance is too much. Even though there is another tower just beside the user, the tower is not going to serve the user as the user and the tower can be from different companies.

If we assume four networks (1,2,3,4) represented by different colors with their maximum range. The user of Network 1 is at the edge of its range so the service he will get will not be the best output as the distance is too much.



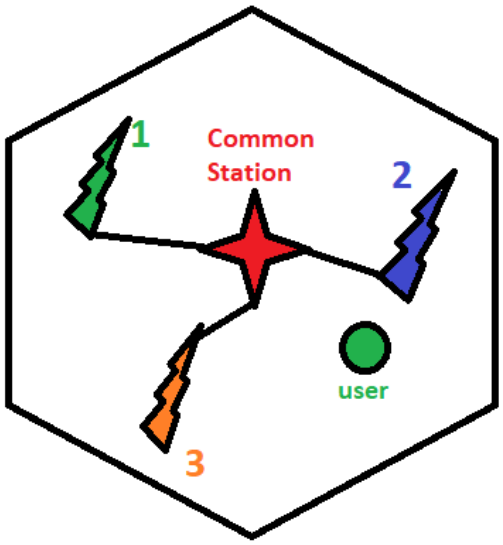
As in the figure, there is another network tower 2 just beside of the user. We can easily say if the user was served by the Network Tower 2 rather than Network Tower 1, he will get the best output.

This is where our approach holds its advantage. If a Common Network Structure is used than it will give the best service to any user of any network company.

Common Network and Station Combined with Edge Computing:

At present when a user requests for a service from its service provider network, if the tower doesn't have any empty service providing port the user will get a network error or in some case the data is send to the cloud for processing. In each case the process of getting the service takes much more time than usual. Using the Edge Computing our approach will reduce the latency.

Assume there are 3 network towers under one common station in a specific area of hexagon. If one of the users of tower 1 is requesting for a service.



Common Station will receive the user request and will perform a list of work to give the best output to the user.

The list of works Common Station will do before commanding a tower to provide the service to a user.