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Effective steps to improve QoS of wireless mobile communication system

Zalmai Zormatai | Subhanallah KhaksarT | Yousuf Hotak | Shafiullah Shinwari T

Computer Science Faculty, Hewad University, Kabul, Afghanistan.
Corresponding Author : zalmai.zormatai@afghan-wireless.com

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ABSTRACT

It is observable that since wireless mobile communication system come into era, Subscriber demands are increasing according to their requirements like messaging service, caller id service, imaging service, location area service, video service and etc. Due to mentioned demands wireless mobile communication system improve their qualities generation to generation in result nowadays 5G is going on. In this paper we will evaluate all steps which has taken place to improve QoS of wireless mobile communication system, and find out the effective solution to provide better services base on subscriber demand of current situation.

KEYWORDS: ***Wireless Mobile Communication, Effective solution, Fiber optic communication, Remote sector, Microwave communication, Satellite communication***

1. INTRODUCTION

Wireless mobile communication system is one of the interesting and more useable technology in current era due to its high mobility feature. But some limitations are available due to which subscriber demands to improve it. Related industries are trying so much to improve these limitations, which is coverage issue and capacity issue. Capacity issue has raised due to high quality of video and image processing and it requires high speed internet and this issue is little more solved due to deployment of latest technologies like fiber optic communication which is able to provide Tbps data rate. But coverage issue is still remain and industries are trying to solve it ASAP. There are so much steps which have taken place to solve mentioned issues which are describe in below sections.

The 1st step to solve capacity issue was to migrate from satellite communication system to fiber optic communication system which solved two basic issue one was delay which was observed in satellite communication and the second was capacity. Satellite communication couldn't able to provide high capacity based on current demand of customer with low rates.

The 2nd step to solve capacity and coverage issue was increment of towers and use of high frequency microwave range. Increment of tower help in coverage and capacity and high frequency microwave range help in capacity improvement.

The 3rd step to solve capacity and coverage issue is deploying of fiber optic ring between towers which is acting as protection path and also help in improvement of capacity.

The 4th step is specially design to improve coverage issue because coverage issue was not properly solved by utilizing last three steps. Last three steps mostly help in capacity improvement but not much solve coverage issue and this step is known as Remote sector installation step.

2. Migration from Satellite Communication to Fiber Optic Communication

Satellite communication is one of the best communication system in regard of coverage because it provides full coverage area to all corner of the globe, therefore GPS system and coordinate related systems refer to satellite communication system. But satellite communication system is limited in provide high capacity services which is the demand of current subscribers, and the delay is the highest limitation of satellite communication system especially in voice services. [1]

Satellite communication is worked based on C band, K band, Ka band and Ku band but the range of frequency in these band is between GHz and current required capacity through satellite communication is considered so expensive with low quality. One of the reason of low voice quality, and media quality is interference and other external affects like fog, snow rain and atmospheric effects which slow down the quality of voice and media services.

But on the other hand we have another latest technology which is fiber optic and it is laid worldwide. It provides high speed services with non-sensitive delay and another external effects like atmosphere, rain, weather, snow etc is not effected on it to degrade QoS of fiber .[2]

$$[P_R] = [EIRP] + [G_R] - [LOSSES] \quad (1)$$

$$[EIRP] = [P_t] + [G] \text{ dB W} \quad (2)$$

$$[LOSSES] = [FSL] + [RFL] + [AML] + [AA] + [PL] \quad (3)$$

Migration from Satellite communication to fiber optic communication has been started once the fiber optic network completed all around the world. Nowadays 90% of telecom network is working with high QoS based on fiber optic network. Fiber optic network is created in two ways: working and protection and the satellite communication is also considered for protection purpose because the greatest limitation in fiber optic network is its maintenance. Maintenance of fiber optic network is so time consuming and it takes days to restore back.[3]

Fiber Link Budget = [fiber length (km) × fiber attenuation per km] + [splice loss × # of splices] + [connector loss × # of connectors] (4)

Telecom network is designed based on working and protection link. First network traffic is carried on working path which is majorly underground fiber optic cable. When any fault occurred in underground cable due to flood and any other disaster happening, the protection path is activated which is generally aerial fiber optic cable and traffic is carried over areal fiber optic cable. [4]

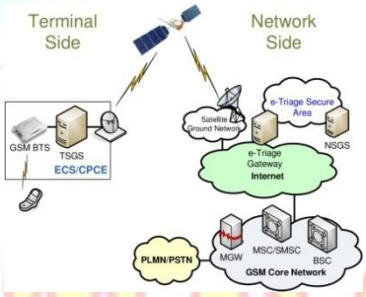

Fig.1a. Cellular system via Satellite communication

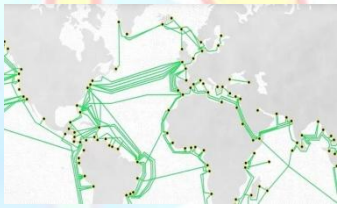

Fig.1b. Fiber optic worldwide network

3. Tower Increment And Use of High Frequency Microwave Range

The 2nd solution which aim to cover coverage and capacity issue is increment of tower and use of high frequency microwave range. Microwave range is started from 3GHz to 30GHz and it is the rule that high frequency is directly proportional to provide high capacity but inversely proportional towards distance of propagation. Proportional towards distance of propagation. Therefore network operators need to increase number of tower when intend to operate network on high frequency range of microwave. Because high frequency microwave range is travel shorter distance. [6]

Received Power (dB) = EIPR (dB) − Losses (dB) (5)

FSPL (dB) = 20log10 (d) +20log10 (f) +20log10 (4π/c)-Gt-Gr (6)

But this techniques also have some limitation like external interference, free space loss, rain, fog, snow, and obstacle among line of sight.

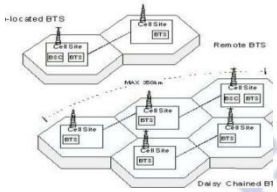

Fig. 2. Tower increment

4. Deployment of Fiber Optic Ring Between Towers

As we mentioned in above portion that microwave communication is faced with external interference and other factors like fog, rain, snow, storm, and earth quick which effects services are carrying via microwave link. But latest techniques are considered by network operators which prevent tower or transmission portion of the network from external disaster. These technique is deployment of fiber optic link between towers which help in improvement of capacity and high QoS. [5]

Network operators are utilizing fiber optic ring between telecom towers and create mesh topology of fiber optic ring. Network operators prefer to deliver all traffic via fiber optic ring as working path and microwave link is only use for protection purpose. Current 4G and 5G network is based on this technique and able to provide highest data rate of multimedia services. Network operators can provide service via fiber optic about 10Gbps but microwave technology provide maximum service about 2.5Gbps. [7]

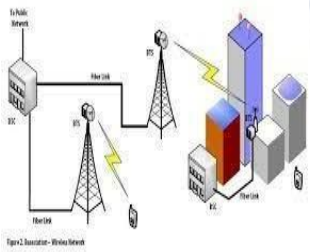

Fig.3. Fiber to the BTS

5. Remote Sector Installation Technique

The major issue in urban or dense urban area is coverage issue. Subscriber submit more complain in this regard. But the only possible way to solve this issue is installation of remote sector sites.

Remote sector is describe as mini pole tower which is installed in area or above building where coverage is low. These mini poles are directly connected with major poles or tower via fiber optic network. There are two advantages of Remote sector sites. One is providing high coverage area and second is providing high capacity due to connectivity with fiber optic network. [6]

Remote sector sites also use fiber optic as working path and microwave link as protection path, and in customer side remote sector sites provide service with high quality using non ionized electromagnetic radio frequencies to cover whole building or area. [8] Some dense urban area contain high floor buildings and remote sector sites installation is able to solve coverage issue in mentioned areas.

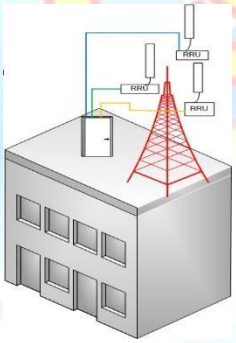

Fig. 4. Remote sector site

6. Conclusion

In this paper we evaluated different techniques to recover coverage and capacity issue and we figure out 4 techniques which help to recover QoS. But we concluded that the major part which help to solve capacity issue is deployment of fiber optic network and remote sector sites installation to recover coverage issue. Remote sector sites use non ionized electromagnetic radio waves which is not seriously health side effect.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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