

Study of erlang capacities for GSM and CDMA cellular networks

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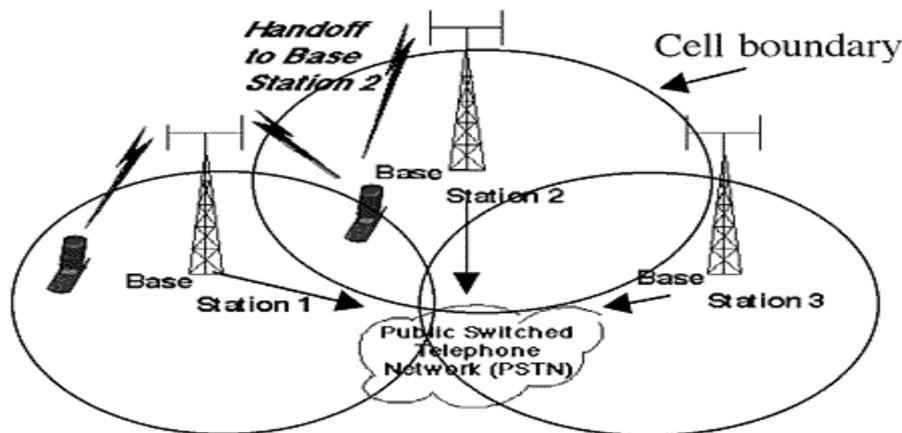
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ABSTRACT

Interference is that the vital capability limiting think about cellular systems. the most supply of interference is Co-Channel Interference (CCI) that comes from base stations operational in same waveband. In this paper a completely unique methodology is introduced to guage Erlang capacities for GSM and CDMA cellular networks. The chance of CCI is taken into account for capability analysis and physicist distributions is employed for approximating CCI chance. This analysis methodology is applied for systems wherever most number of interferers is thought. Erlang capability results square measure evaluated and compared for GSM and CDMA for different range of co-channel interferers. it's ascertained that Erlang capability per cell will increase as number of co-channel interferes decreases and contrariwise. For chance of zero.1 CCI Erlang capability per cell will increase from three.58 erlangs/cell to 12erlangs/cell in TDMA and twenty four erlangs/cell to seventy eight erlangs/cell in CDMA as range of meddling sources decreases from ten to three.

1. INTRODUCTION

The GSM makes use of narrowband Time Division Multiple Access technique (TDMA) for transmitting signals over the air interface. it absolutely was developed victimisation digital technology. the information rate carried by this technology is sixty four kbps to one hundred twenty Mbps. GSM supports several subscribers, for about 210 countries the mobile subscribers supported by this square measure quite one billion. It provides advanced voice and knowledge services together with Roaming service. the power to victimisation GSM phone number in another GSM network is named roaming, the information is digitized and compressed and then sends it down the channel with 2 further streams of user knowledge, every with individual time slot.



The GSM normal is most generally accepted normal and offers International Roaming. The method of providing multiple access capability by transmission signals at the same time in a very non overlapping time slots is named Time Division Multiple Access (TDMA). Since spectrum potency FDMA systems became scant the TDMA systems were developed. In digital systems, transmission isn't needed unceasingly since users don't use the chosen information measure all the time. It permits many users to share identical waveband by dividing the continuance into completely different time slots that square measure sporadically allotted to every mobile user for the length of a decision. TDMA systems divide the radio-frequency spectrum into time slots and every user is allowed to either transmit or receive in every time slots (i.e. completely different users will use identical frequency within the same cell however at completely different times). Digital 2G cellular systems that used the TDMA technology square measure GSM, IS-136, PDC and DECT normal for moveable phones. In this paper, the parameters of TDMA system square measure chosen in line with GSM (Global System for Mobile) normal. The spectrum allocation for GSM is 890-915MHz in transmission (mobile to base station) and 935-960 megahertz in downlink (base station to mobile).



The channel information measure is two hundred KHz; rate is 270.8333 Kb/s and mathematician minimum shift keying (GMSK) is employed in knowledge modulation. The co-channel protection magnitude relation a is mounted to minimum $(C/I)_s=9\text{dB}$. The method of providing multiple access capability supported an expansion spectrum system is named Code Division Multiple Access (CDMA). All users share same frequency and at identical time, but every user has own spreading code to encrypt knowledge. The spectrum potency in CDMA is increases by victimisation unfold spectrum technique [1, 2, and 3]. The 2G CDMA cellular technology is also called IS-95, this competes with the GSM technology. CDMA cellular systems operate in the 800 megahertz and one.9 gigacycle per second PCS bands. In this paper IS-95 is chosen for CDMA system. The parameters of IS-95 square measure, spectrum allocation for transmission is 824-849MHz and down link is 869-894MHz. The information measure is one.23MHz; chip rate is 1.228Mc/s, modulation chosen for digital knowledge is either QPSK (quadrature section shift keying) or OQPSK (offset construction section shift keying). The multiple access theme used is CDMA, FDD. The CDMA mobile phones and Base Stations (BS) use minimum quantity of power to communicate with one another. They use correct power management to cut back users' transmission power. By decreasing a user's transmission power, the movable has accessorial battery life, increased speak time, and smaller batteries. There square measure 3 kinds of codes usually used, Walsh code, Short PRN code and Long PRN codes. ·

Walsh codes square measure orthogonal codes. The Spreading on forward link is one.2288Mbps and on reverse link is 307.2kbps. sixty four bit Walsh codes square measure utilized in IS 95A and IS 95B. 128 bit Walsh codes square measure utilized in CDMA2000. · Short PRN code (16 bit) is employed to spot the BS and therefore the cell. · Long PRN code (42 bit code) square measure wont to determine mobile station on reverse link. This paper chiefly describes associate analysis procedure for the capability in GSM and CDMA systems with the thought of co-channel interference. The chance of co-channel interference is taken into account for the capability analysis. physicist distribution is taken into account for the analysis of chance of CCI in a very given cellular network. The capability results evaluated and compared for various range of active co channel interferers for GSM and CDMA systems. It is observed that the Erlang capability of a CDMA system is additional as that of a GSM system.

2. CO-CHANNEL INTERFERENCE AND ITS CHANCE

The noise from 2 completely different radio transmitters victimisation identical frequency is named Co-channel interference or CCI. The CCI is major supply of interference that limits the standard and capability (number of users) of wireless networks. It arises owing to frequency utilize construct i.e. using the same set of carrier frequencies in numerous cells [4]. the majority co-channel interference originates network designing. If the amount of CCI is high, the cluster size is augmented but this might limit the capability. This inevitable trade-off between system capability and quality of service is always gift. In cellular CDMA systems, the bulk of co-channel interference comes from the specified cell (intra-cell interference) and a part of the interference comes from the near cells (inter-cell interference). Intra-cell and inter-cell interferences may be referred to as multiple access interference (MAI) as a result of they carries with it the cross-correlation merchandise of at the same time active users' spreading codes. The capability of a CDMA system is interference restricted and therefore the range of cochannel interferers is usually terribly massive. The CDMA system applies to universal one-cell frequency utilize pattern [3], as a result of the utilize factor is sometimes one. The frequency utilize issue is larger than one in GSM (TDMA) cellular networks. this suggests that CCI comes from adjacent utilize cells. Also, the numbers of effective CCI sources square measure usually quite little. in a very cellular system, the signal to-noise magnitude relation (S/N) could be a significant think about determinant the standard of service tough by the user.

3. RESULTS AND DISCUSSION

The Erlang capability is evaluated from for GSM (TDMA) and CDMA systems with the subsequent assumptions, radio capability is restricted by co-channel interference solely (adjacent channel interference and thermal noise neglected), 3 leaf herb hexangular layout is employed for every cell, Rayleigh distribution is taken into account and range of active co-channel interferers ($N=3, 5, 7$ and 10) square measure thought of for Erlang capability comparison for GSM (TDMA) and CDMA.

4. CONCLUSIONS

Co-channel interference (CCI) is that the major supply of noise that limits capability of wireless networks. during this paper associate analytical methodology is given for the analysis of Erlang capability of GSM and CDMA systems owing to the CCI. This methodology is appropriate for the cellular network wherever the number of active interferes is low. The chance of CCI is assumed to follow a physicist distribution. The Erlang capability is evaluated and compared for each GSM and CDMA systems with completely different range of active interferers. it's ascertained that the Erlang



capability per cell increases because the range of co-channel interferers decreases for a given CCI chance. In GSM, it is ascertained that for zero.1 CCI chance, Erlang capability will increase from four erlangs/cell to 12erlangs/cell because the range of interferers decreases from ten to three and in CDMA Erlang capability increases from twenty four erlangs/cell to seventy eight erlangs/cell. The results showed that best Erlang capability is achieved by reducing range of active interferers

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