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EFFICIENT RESOURCE ALLOCATION TECHNIQUES FOR MOBILE CELLULAR SYSTEMS

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Abstract- The demand of higher bandwidth and data rates has been increased substantially during recent years. This has made it important for future mobile cellular systems to implement an efficient resource allocation scheme to achieve the current demands. Radio resource involves parameter like transmit power, data rate, and time. Objective is to use radio spectrum resources s efficiently as possible to handle intercellular interference In order to achieve efficient resource utilization in all sorts of deployment scenarios and QoS requirements in the future wireless cellular systems.
Key words-

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Introduction

Objective

The demand of higher bandwidth and data rates has been increased substantially during recent years. This has made it important for future mobile cellular systems to implement an efficient resource allocation scheme to achieve the current demands. Radio resource involves parameter like transmit power, data rate, and time. Objective is to use radio spectrum resources s efficiently as possible to handle intercellular interference In order to achieve efficient resource utilization in all sorts of deployment scenarios and QoS requirements in the future wireless cellular systems, new resource allocation methods must be developed Under mixed service traffic including both real-time and non-real time services, efficient resource allocation from a shared resource pool is a challenging task due to varied and stringent QoS requirements.

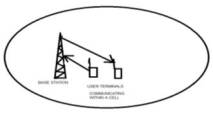

Fig. 1- communication within a cell

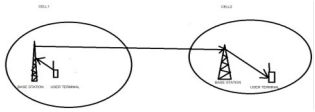

Fig. 2- Inter cellular communication

Several interference reduction techniques have been suggested in past and proved to be effective in reducing the interference to some extent and thereby increase system capacity. However, in a highly loaded system, the problem of intercellular interference remains an important issue. In this work, the intercellular interference problem of scheduling process is to be overcome by introducing a new and efficient resource allocation strategy called Load Matrix (LM). The proposed algorithm is to evaluated with existing resource allocation for performance evaluation. The suggested algorithm is to be developed on Matlab tool for its realization.

Future scope

This work focus on the development of a resource allocation algorithm for wireless channel based on the raise of thermal (RoT), this work can be incorporated with the other scheduling scheme such as frequency and time slotting for the efficient usage of the resource in the channel.

Literature Review/Survey

In order to achieve efficient resource utilization in all sorts of deployment scenarios and QoS requirements in the future wireless

cellular systems, new resource allocation methods must be developed. In other words, resource allocation has to provide optimum or near optimum, for practical reasons, utilization of the available radio spectrum in the next generation of cellular wireless systems regardless of deployment scenarios and conditions.
Under mixed service traffic including both real-time and non-real time services, efficient resource allocation from a shared resource pool is a challenging task due to varied and stringent QoS requirements. A fixed resource partitioning method in which total resource pool was partitioned between different service classes and independent resource schedulers were responsible for each resource partition. Scheduling was more unified and partitioning was dynamic to enhance spectral efficiency.
Extensive simulation results on interference outage, throughput and packet delay performance of a reference decentralized scheduling together with the proposed Load Matrix approach are provided.

Wireless Communication
Many of the current and emerging wireless communication systems make use of diversity in their design: a classic and well-known concept that has been used for the past half century to combat the detrimental effects of multipath fading.

- Space diversity- Space diversity consists of receiving the transmitted signal through L separate antennas, whose spacing is wide enough with respect to the carrier wavelength so as to obtain sufficient decorrelation. This technique can be easily implemented at the base stations, and does not require extra radio spectrum occupancy.
- Frequency diversity- This form of diversity is obtained by sending the same signal over different frequency carriers, whose separation should be larger than the coherence bandwidth of the channel. Clearly, frequency diversity is not a bandwidth efficient solution.
- Time diversity- If the same information bearing signals are transmitted in different time slots separated by an interval longer than the coherence time of the channel, time diversity can be obtained.

Overview of diversity combining techniques
As mentioned above, diversity has long been recognized as a powerful communication receiver technique for mitigating the detrimental effects of channel fading and co-channel interference. The underlying premise is that if several uncorrelated replicas of a signal are received over multiple diversity paths with comparable signal strengths, then it is improbable that these signals will experience simultaneous deep fades.

Factor affecting wireless communication
Schemes to improve the reliability of wireless channels range from innovative transport-layer protocols to robust physical-layer schemes, including better modulation and coding. The development and selection of the schemes are based on the understanding of the statistical nature of errors. Some of the main causes of bit errors, and consequently packet losses, in the widely deployed in wireless channel as described below.

- Attenuation: This is due to a decrease in the intensity of electromagnetic energy at the receiver (e.g., due to long distance), which leads to low signal-to-noise ratio (SNR).
- Intersymbol interference (ISI): This is caused by delay spread (the arrival of a transmitted symbol is delayed), resulting in partial cancellation of the current symbol.
- Doppler shift: This is due to the relative velocities of the transmitter and the receiver.
- Multipath fading: Caused by multipath propagation of radio frequency (RF) signals between a transmitter and a receiver.

The fading effect
The information theoretic analysis of fading channel is one of the major considerations in wireless communication. This interest is motivated by the rapid advances in wireless technology and the need to use scarce resources such as bandwidth and power as efficiently as possible under severe fading conditions.
The physical parameters like Walls and floors reflect the signal under transmission and tend to decrease the signal strength, and background noises make it more difficult to demodulate the received message to retrieve back the original message. The channel quality also varies quite a lot over the time as the environment is not static.

Transmitted power
The transmitted power is the strength of the transmissions measured in Watts (or milliWatts). System having a high transmit power consumes more power and demands for a higher rate of power supply. High usage of transmitting power also effects on frequency reuse. Different networks in areas close to each other, tends to affect each other due to high power usage.

Sensitivity
The sensitivity is the measure of the weakest signal that may be reliably heard on the channel by the receiver (it is able to read the bits from the antenna with a low error probability).

Attenuation
The attenuation is the decrease of signal strength between the transmitter and the receiver. In air medium, the attenuation is simply proportional to the square of the distance.

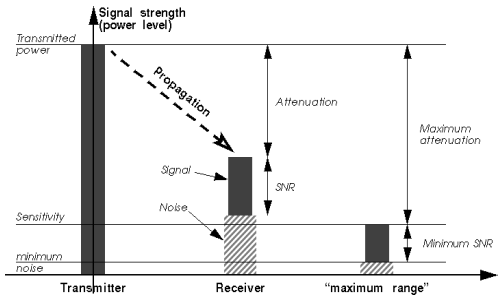

Fig. 2.1- Propagation and Range in a wireless communication system

Signal to noise ratio (SNR)
In the case of multi-rate systems, Signal to Noise ratio (SNR) plays an important role. The sensitivity of the system mainly depends upon the minimum SNR The signal to noise ratio (SNR) defines the difference of power in between a valid signal and a noise in the receiver system. The SNR should be Minimum to decode successfully the received signal.

Multi-rate systems
Today's communication system demands for very high precession systems which work more efficiently under extreme conditions. To overcome the external interference and for a better throughput, the most simple way is to use more bandwidth. But the amount of bandwidth usable for a particular application is limited, and also, in most hardware the filters used to recover the signal are fixed, so the channel width is fixed. This limit the rate of symbols that can be used. So, to overcome this limitation a more complex modulation schemes are used.

The wireless communication system
The wireless communications system is responsible for the transmission of information from the sender to the recipient through wireless channel. Generally a wireless communication system consists of;

- A modulator that modulates the source signal to be transmitted, so that it is physically suitable for the transmission channel.
- A transmitter that transmits the modulated signal into the channel, usually amplifying the signal as it does so.
- A transmission channel that gives a physical link between the transmitter and the receiver system. Fig. 3.1 shows the functional block diagram of a wireless communication system. The wireless communication Systems are generally distinguished by the type of signal presented to the modulator.

Wireless channel
The wireless channel is defined as the medium through which the data get transmitted from the transmitter to the receiver system. There are various factors affecting these transmitted data. The main effecting parameters are the wireless noises and the channel fading which results in losing the transmitted data.

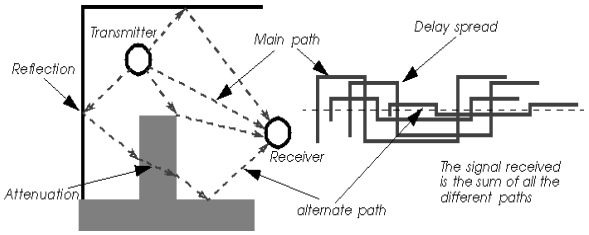

Fig. 2.2- Multipath and Delay Spread

Multipath and delay spread
Radio waves reflect or diffract on obstacles, and are attenuated differently by different materials. This is exactly like light, which goes through glass, is reflected by mirrors and stop by most obstacles, except that much more materials are transparent or reflector to radio than to light.
Most of the time, multipath is good, because the addition of all the reflections of the signal increase its strength. Fig 3.6 shows the multipath and delays observed for the signal transmitted in a wireless communication system.

The channel fading
Radio-wave propagation through wireless channels is a complicated phenomenon characterized by various effects, such as multipath and shadowing. A precise mathematical description of this phenomenon is either unknown or too complex for tractable communication systems analyses. However, considerable efforts have been devoted to the statistical modeling and characterization of these different effects. The result is a range of relatively simple and accurate statistical models for fading channels which depend on the particular propagation environment and the underlying communication scenario.

The Receiver System
Receiver system receives the transmitted data from the transmitter with the noise interferences and receives the bit stream at fluctuated signal's amplitude, phase, and angle due to fading. The receiver job is to retrieve the original message back by removing the external interferences induced during the transmission. The system uses a matched filter, a Down sampler, and a Demodulator Block to retrieve the message back.

Proposed system architecture Design
Load matrix concept
One of the main challenges in resource allocation in multicell system is the control of intercell interference. In uplink scheduling, the basic problem is to assign appropriate transmission rate and time to all active users in such a way that result in maximum radio resource utilization across the network whilst satisfying the QoS requirements of all the users. Amongst other constraints, another important factor in the resource allocation is the user's transmit power. For network of M users and N cells the constraints to be satisfied are Cnst1: For each active user i in the network, its transmit power Pi must be maintained in an acceptable region defined.Cnst2: Rise over Thermal must be below Rise over Thermal Target.

a. All LM elements are set to zero.
b. Users in each cell are sorted as per their priority.
c. LM allocation process simultaneously increases allocated resources in each cell to avoid interference imbalance amongst the cell.
d. This process consists of number of assignment (allocation) round which is equal to maximum number of users per cell.

Design approach
We will consider several users communicating with the base station. The base station transmitter receives the digital message data of all the users asynchronously and process it for transmission. After this block, the message data will be transferred to the channel. We will consider this channel as an AWGN. At the receiver end the data will be processed through demodulator and MUD blocks and the actual message data will be retrieved at the end of the receiver.

PN Generators
PN generators are at the heart of every spread spectrum system, and are a good example for demonstrating how we can dramatically reduce FPGA utilization by exploiting the target device. In a CDMA system, many PN generators are needed to distinguish channels, base stations, and handsets. We are using three pairs of PN Generators in the transmitter and the same number in the receiver side. Finding a way to improve the FPGA implementation efficiency of a circuit that is copied many times in a system (such as a PN generator), will obviously provide a huge savings.

Linear Feedback Shift Register

Though the mathematics behind a PN code can be extremely complicated, the LFSR implementation can be relatively simple. A typical LFSR consists of a chain of registers and a modulo-2 adder (XOR gate). Predefined registers are "tapped" and fed to the XOR gate, and the XOR output is fed back to the first register in the chain. In a CDMA system, the predefined registers taps are carefully determined to provided good auto correlation and cross correlation, and are often expressed as a polynomial.

Feasibility Study

Load Matrix (LM) concept operates on Rot, Channel gain and specified constraints such as user power and available rates. These parameters are common in CDMA mobile systems. Load Matrix Concept is feasible in CDMA mobile systems.

Requirements and Input Output Specifications

Hardware- Intel Pentium IV processor, 1GB RAM, 10 GB Hard Disk

Software- Windows XP/ MATLAB

Performance evaluation

Simulation will be performed for different case study. The result for different load will be observed. The quality matrix such as throughput, communication delay and power allocation will be evaluated .For performance evaluation of load matrix concept parameters like cell throughput and packet delay will be used. Data set from any telecommunication company (if available) will be used along Load matrix algorithm for performance evaluation of packet delay, then LM may experiences a packet delay of 20 TTI .This delay will be less than existing method's.

Conclusion

For the proposed design the simulation will be performed for different case study. The result for different offered load at different channel characteristic need to observe. The proposed methodology for resource allocation based on the channel raise of thermal can improve the performance of the suggested system as compared to the existing method.

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