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Power Management for Transmission of Data in Rayleigh Fading Wireless Networks

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Abstract: **Power management is used in networking devices in order to prevent too much unwanted interference between different wireless networks. When the powers are fixed for data transmission it takes more power to send fewer amounts of data which increases the interference. To reduce the noise during data transmission the data divided and send through various nodes. Data transmission is based on the bandwidth of every node. Reduce the workload and analyze the minimum power consumption node based on random order value by bandwidth of every node. Optimal resource allocation is important to enhance energy efficiency. Dynamic algorithm is proposed to minimize the total energy consumption of the network by adapting the outage probability specification and it provide worst outage probability guarantees.**

Keywords: **Adaptive outage power control, energy efficiency, interference, outage probability, power management, power minimization.**

I. INTRODUCTION

Wireless networks are computer networks that are not connected by cables. The use of a wireless network enables enterprises to avoid the costly process of introducing cables. Outage denotes a period in which power supply is unavailable. Outage probability is the probability that an outage occur within a specified time period. Rayleigh fading is a statistical model for the effect of a propagation environment on a radio signal. Rayleigh fading models assume that the magnitude of a signal that has passed through a transmission medium will vary randomly or fade. Power control refers to the strategies required to adjust, correct and manage the power in both uplink and downlink directions in an efficient manner.

In a general sense, wireless networks offer a vast variety of uses by both business and home users. Now, the industry accepts a handful of different wireless technologies. Each wireless technology is defined by a standard that describes unique functions at both the Physical and the Data Link layers of the OSI model. These standards differ in their specified signaling methods, geographic ranges, and frequency usages, among other things. Such differences can make certain technologies better suited to home networks and others better suited to network larger organizations.

Each standard varies in geographical range, thus making one standard more ideal than the next depending on what it is one is trying to accomplish with a wireless network. The performance of wireless networks satisfies a variety of applications such as voice and video. The use of this technology also gives room for expansions, such as from 2G to 3G and, most recently, 4G technology, which stands for the fourth generation of cell phone mobile communications standards. As wireless networking has become commonplace, sophistication increases through configuration of network hardware and software, and greater capacity to send and receive larger amounts of data, faster, is achieved.

Space is another characteristic of wireless networking. Wireless networks offer many advantages when it comes to difficult-to-wire areas trying to communicate such as across a street or river, a warehouse on the other side of the premises or buildings that are physically separated but operate as one. Wireless networks allow for users to designate a certain space which the network will be able to communicate with other devices through that network.

For homeowners, wireless technology is an effective option compared to Ethernet for sharing printers, scanners, and high-speed Internet connections. WLANs help save the cost of installation of cable mediums, save time from physical installation, and also create mobility for devices connected to the network. Wireless networks are simple and require as few as one single wireless access point connected directly to the Internet via a router.

System performance is improved by using a mix of higher-tier macrocells and lower-tier small cells to enhance performance and network coverage. As small cells utilize spectrum currently employed by macro-cellular networks and due to the broadcast nature of the wireless medium, interference is a major source of performance impairment. Also, small cells are deployed in an ad-hoc manner, and this can lead to undesirable interference between cells. Wireless resources thus need to be shared fairly in a collaborative and distributed manner. Wireless resource sharing under interference is however far from perfect.

Maintaining a balanced operation in the macro-small cell heterogeneous wireless network is difficult, because interference rises rapidly with increasing small cell density. Without appropriate resource control, the network can become unstable or operate in a highly inefficient and unfair manner. Wireless transmission depends on other factors such as statistical channel fading that is typically modeled by a Rayleigh, a Ricean or a Nakagami distribution depending on the wireless environment.

Table 1: list of Abbreviation

AOPC	Adaptive Optimized Proportional Controller
OPCS	Optimum Power Control Scheme
SINR	Signal to Interference Noise Ratio

II. RELATED WORK

The existing system work on power control with Rayleigh fading mainly fall into two categories. The first category assumes that transmitters have perfect knowledge of the channel state information and can track the Rayleigh fading states over time in order to allocate power for each state realization. For example, tracking Rayleigh-fading fluctuation to reduce outage in a macrocell network [3]. The second category assumes that transmitters have only channel distribution information since instantaneous state information may not be practically available.

Once optimized using the distribution information, powers are fixed regardless of the fading states. Total power minimization problem under a more general setting. Optimal wireless resource sharing requires that the performance gain is not outweighed by interference and unfairness [2], [3]. Power control problems to minimize the worst-case outage probability and the total power consumption in an interference-limited system that is without background noise using geometric programming [5]. There are extensions to other power control problems with outage constraints, but the geometric programming approach may not be scalable in practice as it requires a centralized solver to solve the geometric programs.

The total power minimization problem under a more general setting with background noise and individual power constraints, but the feasibility issue of this problem is left open. Once optimized using the distribution information, powers are fixed regardless of the fading states which leads to more power consumption in case of sending less amount of data.

A distributed power control algorithm that adapts the outage probability specification to minimize the total energy consumption and to simultaneously guarantee fairness in terms of the worst-case outage probability. Once optimized using the distribution information, powers are fixed regardless of the fading states. Geometric programming approach may not be scalable in practice as it requires a centralized solver to solve the geometric programs [5], [6].

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III. PROPOSED SYSTEM

A dynamic algorithm that adapts the outage probability specification in a heterogeneous wireless network to minimize the total energy consumption and to simultaneously provide fairness guarantees in terms of the worst outage probability. A numerical evaluation on the performance of the algorithms and the effectiveness of deploying closed-access small cells in heterogeneous wireless networks to address the tradeoff between energy saving and feasibility of users satisfying their outage probability specifications.

The proposed system minimizes the power consumption in the context of outage probabilities. The power consumption of all nodes in the network is not fixed and varies randomly which leads to the data transmission by using minimum power. First study the feasibility condition of a total power minimization problem, and propose a dynamic power control algorithm that adapts the outage probability specification to minimize the total energy. The geometrically fast convergent algorithm, free of parameter tuning. It solves an open problem of convergence in the interference-limited case.

Wireless resource sharing under interference is however far from perfect. Maintaining a balanced operation in the macro-small cell heterogeneous wireless network is difficult, because interference rises rapidly with increasing small cell density. Without appropriate resource control, the network can become unstable or operate in a highly inefficient and unfair manner. In addition, wireless transmission depends on other factors such as statistical channel fading that is typically modeled by a Rayleigh, a Ricean or a Nakagami distribution depending on the wireless environment.

Optimal power control for wireless resource sharing under Rayleigh fading that is relevant to in-building coverage model and urban environments where small cells are mostly deployed. Optimal wireless resource sharing requires that the performance gain is not outweighed by interference and unfairness.

Power control problems to minimize the worst case outage probability and the total power consumption in interference limited system. As a by-product, resolve an open issue of convergence for a previously proposed algorithm and its fixed-point existence in for the interference-limited special case. Wireless networks have to be adaptive in order to be spectral and energy efficient.

When the system is infeasible, resource allocation has to be adapted to resolve the infeasibility issue. Tight relationship between the worst outage probability problem and its certainty-equivalent margin counterpart, and utilize the connection to find useful bounds and insights. A by-product of analysis resolves an open issue of convergence for a previously proposed algorithm in for a max-min weighted SINR problem without fading.

The feasibility condition of the total power minimization problem with both outage specification and individual power constraints, and provide useful feasibility bounds. Based on the established feasibility conditions, a dynamic algorithm is proposed for the graceful handling of infeasibility in the network. In particular, the algorithm optimizes the overall energy consumption by adapting the outage probability specification based on our proposed worst outage probability algorithm. The total power minimization problem subject to both outage specification and individual power constraints, and address its feasibility conditions.

A. Signal-to-Interference-Noise Ratio (SINR):

Signal-to-Interference-Noise Ratio is a way to measure the quality of wireless connections. Energy of a signal fades based on the distance. Power control is important to resource allocation as it determines the appropriate SINR at the receiver to meet the performance requirement. SINR is a nonlinear function of powers, couples the transmit powers of all the users together. The interference can be minimized by sending the data through low power consumption node. SINR fluctuates due to the statistical channel fading.

B. Worst outage probability minimization:

The transmitters have perfect knowledge of the channel state information and can track the Rayleigh Fading states over time in order to allocate power for each state realization. Transmitters have only channel distribution information since instant state information may not be available. Power control problems to minimize the worst case outage probability and the total power consumption in interference limited system.

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C. Total power minimization and adaptive outage power control:

The total power minimization problem subject to both outage specification and individual power constraints and address its feasibility conditions. An adaptive algorithm is then proposed to minimize the total power consumption and simultaneously guarantee min-max fairness in terms of worst outage probability. The distributed power control algorithm that adapts the outage probability specification to minimize the total energy consumption and to simultaneously guarantee fairness in case of outage probability. This leads to a decentralized dynamic algorithm without the need of centralized admission controller.

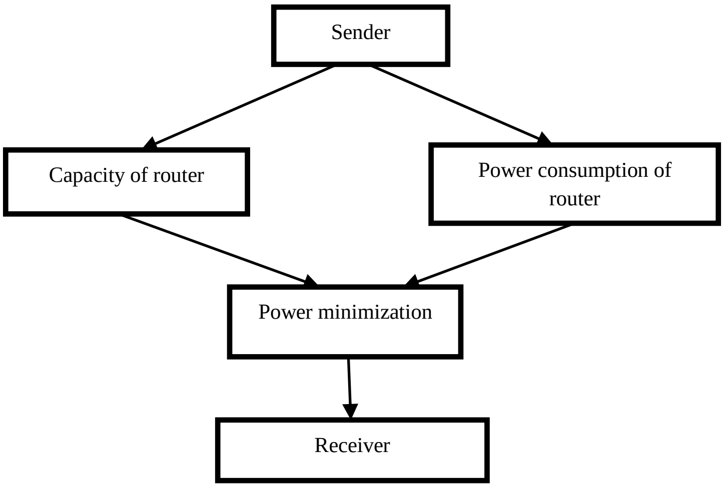

Fig 1: Architecture diagram

The Fig.1 shows that, the sender sends data to the receiver, several routers present between them. Each router has sub routers and its own power consumption to send data. The worst outage probability is minimized by finding the adaptable node that is the node which has low power consumption and maximum capacity to send data is done by random order value which is depend on the bandwidth of every node that are participant in data transmission.

IV. CONCLUSION

The worst outage probability problem that have power constraints in a multiuser Rayleigh-faded network using tools from the nonnegative matrix theory. The optimal value and solution can be characterized by the spectral property of matrices induced by a particular positive mapping. Proposed a geometrically fast convergent algorithm, free of parameter tuning, to solve it optimally in a distributed manner. As a by-product, we solved an open problem of convergence for a previously proposed algorithm in the interference-limited case. Established a tight relationship between the worst outage probability problem and its certainty-equivalent margin counterpart, and utilized the connection to find useful bounds and to evaluate the fairness of resource allocation. Address a total power minimization problem with outage specification constraints and its feasibility condition. A dynamic algorithm is proposed that adapt its outage probability specification to minimize the total power in a heterogeneous wireless network. Numerical results showed that the dynamic algorithm can be effective for deploying closed-access small cells in a macrocell in terms of total power consumption and the percentage of users satisfying their outage probability specification.

Advantages:

- Optimal power is used for data transmission.
- It solves an open problem of convergence in the interference-limited case.

Disadvantages:

- Design is quite complicated.
- It exhibited poor transient behavior.

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