Using Direct Seek First Algorithm With Ability and Optimal Rule Allocation for Fading Relay Network

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Abstract
Wireless telecommunications is the transfer of information between two or more points that are not physically connected. Distances can be short, such as a few meters for television remote control, or as far as thousands or even millions of kilometres for deep-space radio communications. In the existing system we developed, and implemented a compromised router Detection Protocol (DP) that dynamically infers, the number of congestive packet losses (CPL) that will occur. Each and every packet is encrypted so that to prevent the data from eavesdropping. So the data is much secured. We derive the ability and optimal rule allocation scheme for a multi-user fading relay channel in which minimum rates must be maintained for each user in all fading states, assuming perfect channel state information at the transmitter and at all receivers. We first allocate the minimum rule required to achieve the minimum rates in all fading states, and we then optimally allocate the excess rule to maximize rates averaged over all fading states in excess of the minimum rate requirements. The optimal allocation of the excess rule is a multi-level water-filling relative to effective noise that incorporates the minimum rate constraints.

Keywords
Wireless Relay Network Model, Detection Protocol, Congestive Packet Losses Proposing, Direct Seek First Algorithm (SSFA), Secrecy Ability Region, Stability, Utility Maximization

I. Introduction
The ability of fading relay channels determines the maximum average rates achievable in the downlink of a single cell. An unfortunate consequence of the optimal rule allocation scheme is that users with poor channels may receive no data for large periods of time, depending on the duration of channel fades. Such a situation may be unacceptable in applications such as video transmission. We will show that the optimal rule allocation scheme with minimum rates reduces to first allocating the minimum rule required to meet the minimum rates and then allocating the excess rule according to a multi-level water-filling scheme relative to effective noise. Some rules are used to maintain the minimum rates in all fading states, similar to outage ability with zero-outage probability, while the remaining rule is used to maximize the average rates in excess of the minimum rates.

As wireless networks evolve, it is apparent that multi-cast (i.e. sending a common message to all users on a downlink channel) is an important mode of communication that systems will require in the future. In cellular networks, for example, multicast information could be common information such as news updates or location-based information. It is reasonable to assume that networks will want to transmit a mixture of common information to all users and independent information to each of the users. With this in mind, we consider relay channels with both common and independent information.

We consider parallel two-user Gaussian relay channels, where the transmitter wants to send independent information to users 1 and 2 at rates R1 and R2, respectively, and common information (decodable by both users) at rate R0. For degraded relay channels, the common information rate and the independent information rate to the degraded user are interchangeable, because the strongest user can decode anything that the degraded user can. However, we consider parallel channels where in some channels User 1 is the degraded user, but in other channels User 2 is the degraded user.

We first derive an equivalent expression for this ability region that is more amenable to optimization techniques. We then pose the problem of characterizing the optimal rule and rate allocation schemes that achieve the boundary of the three-dimensional region. We then apply the utility function approach used for the relay channel without common information, but we find that this approach does not work in general. We use a more direct approach to maximize the function and obtain the ability region with common information using this approach. Using this method, the optimal allocation is found by performing a finite maximization in each channel.

We propose an achievable region based on dirty paper coding. We also consider the maximum common rate achievable on these channels, i.e. the common information ability. The remainder of this paper is organized as follows. Wireless operations permit services, such as long range communications, that are impossible or impractical to implement with the use of wires. The term is commonly used in the telecommunications industry to refer to telecommunications systems (e.g. radio transmitters and receivers, remote controls, computer networks, network terminals, etc.) which use some form of energy (e.g. radio frequency (RF), acoustic energy, etc.) to transfer information without the use of wires. Another common use is for mobile networks that connect via satellite. A wireless transmission method is a logical choice to network a LAN segment that must frequently change locations.

The following situations justify the use of wireless technology:
- To span a distance beyond the capabilities of typical cabling,
- To provide a backup communications link in case of normal network failure,
- To link portable or temporary workstations,
- To overcome situations where normal cabling is difficult or financially impractical, or
- To remotely connect mobile users or networks

Wireless relay networks constitute one class of basic and important wireless networks, in which a source node simultaneously transmits a number of information flows (messages) to different destinations. However, relay communications make use of the open nature of the wireless medium, which presents a great challenge to achieve secure communication for individual users. This is because information for all users is contained in one transmitted signal, and hence information destined for one user may be obtained by non-intended users unless special coding is used. Physical layer security, which uses randomness of a physical communication channel to provide security for messages transmitted through the channel, opens a promising new direction toward solving wireless networking security problems.

This measure of security level also makes a unified security design across networking layers possible. The goal of such a design is
to maximize network utility (i.e., to maximize overall users’ satisfaction of the service rate in a certain fair manner among users) under security, reliability, and stability constraints. This motivates a joint design of rate control at the transport layer, rate scheduling at the medium access control layer, and rule control and secure coding at the physical layer. Without security constraints, the above issues have been separately studied for wireless relay networks in previous work.

We consider two eavesdropping models. The first one is referred to as a collaborative eavesdropping model, in which the eavesdroppers can exchange their outputs to interpret the message. The second one is referred to as a non-collaborative eavesdropping model, in which eavesdroppers do not exchange their outputs. We assume that the source node maintains a queue for each message flow if it is not served immediately. Each queue needs to remain stochastically stable so that no queue length builds up to infinity. As the measure of users’ satisfaction about network transmission services, a utility function is associated with each user. As the measure of the overall performance, the sum of all users’ utility functions needs to be maximized given that transmission of all information flows over the network is secret, reliable, and stable.

In this paper, stability means queue stability, i.e., the queues do not build up to infinity. We assume that the channel from the source to the users is a fading relay channel, in which the channel outputs at each user are corrupted by a multiplicative fading gain process in addition to an additive white Gaussian noise process. We assume that the channel state information (channel gain realization) is known to the source node and to the corresponding receiver. This assumption is justified in the relay scenario considered here, because all users receive information from the source node and hence it is reasonable for them to feed their channel states back to the source node to obtain better service rates from this node.

It is clear that this user must have the best channel gain at this state. The rule control among the channel states thus determines the rate allocation among users, i.e., rate allocation among components of a rate vector. We further show that all arrival rate vectors contained in this region can be stabilized by a throughput optimal queue-length-based scheduling scheme at the packet time level, where queue length determines the service rate allocation among users, and hence determines the corresponding rule control to achieve this service rate vector at the symbol time level.

II. Related Works

A. Modes

Wireless communications can be via: radio frequency communication, microwave communication, for example long-range line-of-sight via highly directional antennas, or short-range communication, Infrared (IR) short-range communication, for example from consumer IR devices such as remote controls or via Infrared Data Association (IrDA). Applications may involve communication, point, relaying, cellular networks and other wireless networks.

B. Cordless

The term “wireless” should not be confused with the term “cordless”, which is generally used to refer to ruled electrical or electronic devices that are able to operate from a portable rule source (e.g. a battery pack) without any cable or cord to limit the mobility of the cordless device through a connection to the mains rule supply. Some cordless devices, such as cordless telephones, are also wireless in the sense that information is transferred from the cordless telephone to the telephone’s base unit via some type of wireless communications link. This has caused some disparity in the usage of the term “cordless”, for example in Digital Enhanced Cordless Telecommunications cordless telephone to the telephone’s base unit via some type of wireless communications link. This has caused some disparity in the usage of the term “cordless”, for example in Digital Enhanced Cordless Telecommunications.

C. Uses Of Wireless Technology

1. Mobile Telephones

One of the best-known examples of wireless technology is the mobile phone, also known as a cellular phone, with more than 4.6 billion mobile cellular subscriptions worldwide as of the end of 2010. These wireless phones use radio waves to enable their users to make phone calls from many locations worldwide. They can be used within range of the mobile telephone site used to house the equipment required to transmit and receive the radio signals from these instruments.

2. Wireless Data Communications

Wireless data communications are an essential component of mobile computing. The various available technologies differ in local availability, coverage range and performance, and in some circumstances, users must be able to employ multiple connection types and switch between them. To simplify the experience for the user, connection manager software can be used, or a mobile VPN deployed to handle the multiple connections as a secure, single virtual network.

3. Supporting Technologies Include

Wi-Fi is a wireless local area network that enables portable computing devices to connect easily to the Internet. Wi-Fi has become the de facto standard for access in private homes, within offices, and at public hotspots. Cellular data service offers coverage within a range of 10-15 miles from the nearest cell site. Speeds have increased as technologies have evolved, from earlier technologies such as GSM, CDMA and GPRS, to 3G networks such as W-CDMA, EDGE or CDMA2000.

Mobile Satellite Communications may be used where other wireless connections are unavailable, such as in largely rural areas or remote locations. Satellite communications are especially important for transportation, aviation, maritime and military use.

4. Wireless Energy Transfer

Wireless energy transfer is a process whereby electrical energy is transmitted from a rule source to an electrical load that does not have a built-in rule source, without the use of interconnecting wires.

5. Computer Interface Devices

Answering the call of customers frustrated with cord clutter, many manufactures of computer peripherals turned to wireless technology to satisfy their consumer base. Originally these units used bulky, highly limited transceivers to mediate between a computer and a keyboard and mouse, however more recent generations have used small, high quality devices, some even incorporating Bluetooth. These systems have become so ubiquitous that some users have begun complaining about a lack of wired peripherals. Wireless devices tend to have a slightly slower response time than their wired counterparts, however the gap is decreasing.
D. Types of Wireless Networks

1. Wireless PAN
Wireless personal area networks (WPANs) interconnect devices within a relatively small area that is generally within a person’s reach. For example, both Bluetooth radio and invisible infrared light provides a WPAN for interconnecting a headset to a laptop. ZigBee also supports WPAN applications. Wi-Fi PANs are becoming commonplace (2010) as equipment designers start to integrate Wi-Fi into a variety of consumer electronic devices. Intel “My Wi-Fi” and Windows 7 “virtual Wi-Fi” capabilities have made Wi-Fi PANs simpler and easier to set up and configure.

2. Wireless LAN
A wireless local area network (WLAN) links two or more devices over a short distance using a wireless distribution method, usually providing a connection through an access point for Internet access. The use of spread-spectrum or OFDM technologies may allow users to move around within a local coverage area, and still remain connected to the network.

3. Wireless Mesh Network
A wireless mesh network is a wireless network made up of radio nodes organized in a mesh topology. Each node forwards messages on behalf of the other nodes. Mesh networks can “self heal”, automatically re-routing around a node that has lost rule.

4. Wireless MAN
Wireless metropolitan area networks are a type of wireless network that connects several wireless LANs. WiMAX is a type of Wireless MAN and is described by the IEEE 802.16 standard.

5. Wireless WAN
Wireless wide area networks are wireless networks that typically cover large areas, such as between neighbouring towns and cities, or city and suburb. These networks can be used to connect branch offices of business or as a public internet access system. The wireless connections between access points are usually point to point microwave links using parabolic dishes on the 2.4 GHz band, rather than unidirectional antennas used with smaller networks. A typical system contains base station gateways, access points and wireless bridging relays. Other configurations are mesh systems where each access point acts as a relay also. When combined with renewable energy systems such as photo-voltaic solar panels or wind systems they can be stand alone systems.

III. Existing System
Although jointly considering secrecy, reliability, and stability for network utility maximization has the potential for significant impact in improving network performance and resource efficiency, this perspective has not been examined before. One reason is because the physical layer approach to achieve security, which quantifies the measure of secrecy and greatly facilitates this joint design, has attracted considerable attention only recently. However, relay communications make use of the open nature of the wireless medium, which presents a great challenge to achieve secure communication for individual users.

IV. Proposed System
Our proposed model is direct seek first algorithm it scans the request queue for the request that is nearest the head and serves that request first. This algorithm minimizes the total seeking that the head must perform this algorithm can allow requests to starve. If new requests keep coming in that are near the current position of the head at a sufficient rate, the disk head will never move near enough to other requests to service them.
This is a direct improvement upon a first-come first-served (FIFO) algorithm. The drive maintains an incoming buffer of requests, and tied with each request is a cylinder number of the request. Lower cylinder numbers indicate that the cylinder is closer to the spindle, while higher numbers indicate the cylinder is farther away. The direct seek first algorithm determines which request is closest to the current position of the head, and then services that request next. We consider the -user fading relay network (see Fig. 1), in which a source node transmits confidential messages to user nodes. Each message is intended for one user and needs to be kept secret from all other nodes. Hence, with regard to one message, all users other than its intended receiver are considered to be eavesdroppers. We assume that the channel from the source node to the users is a fading relay channel, in which the channel outputs at each user are corrupted by a multiplicative fading gain process in addition to an additive white Gaussian noise process.

The channel input–output relationship is given by

$$y[n] = h[n] \cdot x[n] + w[n] \quad \text{for} \quad 1 \leq l \leq k$$

(1)

Where $y[n]$ denotes the user, and denotes the nth symbol time instant. At the symbol time instant, is the channel input from the source, is the channel output at user, is the source-to-user channel gain coefficient, and is the noise term at user. We define, and assume is a stationary and periodic vectoring proper complex random process. We assume that the channel state information (i.e., the realization of $\mathbf{S}$) is known at both the source node and the corresponding receivers. Here, the fading coefficients across users are not necessarily independent, and nor are they necessarily identically distributed. It will be as long as the channel state information is known, only the marginal channel distributions to individual users affect the performance of the network.

$$1/N \leq \sum_{n=1}^{N} E(2X[n]) \leq P$$

(2)

The secrecy ability region is defined to be the set that includes all achievable rate vectors such that perfect secrecy can be achieved. Since the source node has access to the channel state information, the source can dynamically change its transmission rule as the channel state varies at the symbol time level. Each rate vector in the secrecy ability region is a service rate allocation among users and is achieved by a corresponding rule control policy at the source node. We assume that the source node maintains one queue for each message flow if it is not served immediately. We first consider the case in which the arrivals of the message flows are on the packet time scale, and are assumed to be random and independent of each other. We use to denote an arrival rate vector at packet time slot, with each component representing the arrival rate of one queue at packet time slot. The system is stochastically stable if no queue builds to infinity. We use the vector to denote the queue length vector at packet time slot, with each component denoting the queue length for the th queue.

In the second case, we assume that associated with each user, a standard -fair utility function is given by

$$U_i(x_i) = \frac{x_i^\lambda}{\alpha_i}$$

Where denotes the rate at which the source node generates the messages for user. The objective is to control arrival rate vectors for users properly so that the following network utility function is maximized, i.e.,

$$\max_{\mathbf{x}} \sum_{i} U_i(x_i)$$

A. Single User Fading Channel

Before analyzing the relay channel, we first find the ability-achieving scheme for a single user fading channel subject to minimum rate constraints.

$$\max_{P(n)} \mathbb{E}_n \left[ \log(1 + \frac{P(n)}{\eta}) \right]$$

subject to: \( \mathbb{E}_n [P(n)] \leq \overline{P}, \quad R(n) \geq R^* \quad \forall n \)

We denote the minimum rule required to achieve the minimum rate standard techniques, the optimal allocation of excess rule is modified water-filling

$$\hat{P}(n) = \left( \frac{1}{\lambda} \right) \begin{cases} 1 & P^*(n) \leq \frac{1}{\lambda} \\{n \mid P^*(n) \} \\ 0 & \{n \mid P^*(n) > \frac{1}{\lambda} \} \end{cases}$$

The special structure of the ability formula for Gaussian channels allows us to treat rule allocated to a channel as an additional source of noise. Therefore, the interpretation of this scheme is very simple.

B. Two-User Fading Relay Channel

Now consider a multi-user fading relay channel as described how our results extend to the general case where the ordering of noises differs from state to state. Before we find the optimal rule allocation scheme, let us first prove that superposition coding achieves ability for the relay channel with minimum rates. Consider a two-user, constant relay channel with minimum rates. The rate pairs satisfying the minimum rates are simply a subset of all rate pairs without minimum rates, and are therefore achievable by superposition coding.

Because the fading relay channel can be equivalently viewed as a set of parallel constant relay channels, one for each fading state, superposition coding can be used in each of these parallel channels to achieve ability. Using the time-sharing argument, we also can show that the ability region is convex.

Due to the convexity of the region, the boundary of the ability region can be found by the following maximization:

$$\max_{P(n)} \mathbb{E}_n \left[ \mu_1 R_1(n) + \mu_2 R_2(n) \right]$$

subject to: \( \mathbb{E}_n [P_1(n) + P_2(n)] \leq \overline{P}, \quad R_1(n) \geq R_1^*, \quad R_2(n) \geq R_2^* \quad \forall n \)

over \( 0 \leq \mu_1 \leq 1 \) and \( \mu_2 = 1 - \mu_1 \).

Let us now introduce notation similar to that used in Section Defining minimum rules \( R_1^*(n) = n_1 \Omega_1 \) and \( P_2(n) = (P_1(n) + \eta) \Omega_2 - 1 \).
Subject to: $E_n[\hat{P}(n)] \leq P^*$, $0 \leq \hat{P}(n) \leq \hat{P}(n)e^{-R_2^*}$

Though the minimum rate ability of the single-user channel was found rather easily, the relay channel problem is considerably more difficult because stronger users interfere with weaker users. The additional interference. As a result, user 1 cannot be allocated ball of the excess rule in a state and is constrained to

$$0 \leq \hat{P}_1(n) \leq \hat{P}(n)e^{-R_2^*}$$

In order to solve (5), we decompose the maximization into two steps

Given $P(n)$ for all 5, we must optimally distribute the excess rule between the users in each state:

$$F_n(\hat{P}(n)) \triangleq \max_{\hat{P}(n)} \mu_1 \log \left(1 + \frac{\hat{P}_1(n) + P^*_1(n)}{n_1}\right) + \mu_2 \log \left(1 + \frac{\hat{P}(n) - \hat{P}_1(n) + P^*_1(n)}{\hat{P}_1(n) + P^*_1(n) + n_2}\right)$$

subject to: $0 \leq \hat{P}_1(n) \leq \hat{P}(n)e^{-R_2^*}$.

After we find $F_n(\hat{P}(n))$ for each 5, we must optimally allocate the excess rule $\mu_1, n_1, \mu_2, n_2$ subject to $E_n[\hat{P}(n)] \leq P^*$.

Equation (6) is a one-dimensional optimization over and is therefore easily solved. is achieved by Following rule distribution:

1) If $\frac{\mu_2}{\mu_1} \leq 1$, then $\hat{P}_1(n) = \hat{P}(n)e^{-R_2^*}$ and $P_2(n) = \hat{P}(n)(1 - e^{-R_2^*})$.
2) If $\frac{\mu_2}{\mu_1} \geq \frac{n_1 + P^*_1(n)}{n_1 + P^*_1(n)}$, then $\hat{P}_1(n) = \hat{P}(n)$ and $\hat{P}_1(n) = 0$.
3a) If $1 < \frac{\mu_2}{\mu_1} < \frac{n_1 + P^*_1(n)}{n_1 + P^*_1(n)}$ and $\hat{P}(n) \leq \hat{P}(n)$, then $\hat{P}_1(n) = \hat{P}(n)(1 - e^{-R_2^*})$ and $\hat{P}_2(n) = \hat{P}_2(n)(1 - e^{-R_2^*})$.
3b) If $1 \leq \frac{\mu_2}{\mu_1} \leq \frac{n_1 + P^*_1(n)}{n_1 + P^*_1(n)}$ and $\hat{P}(n) > \hat{P}(n)$, then $\hat{P}_1(n) = 0$.

Now that is known, we must solve we introduce a Lagrangian multiplier $\lambda$ to get:

$$\max_{\hat{P}(n)} E_n[\hat{P}(n)] - \lambda E_n[\hat{P}(n)] = \max_{\hat{P}(n)}$$

The standard solution to such a problem satisfies $1/2$ similar to single user water-filling. The optimal rule allocation scheme is a two-level water-filling scheme is chosen to satisfy excess rule constraint

1) If $\mu_2 \leq \mu_1$, then

$$\hat{P}_1(n) = \frac{\mu_1}{\lambda} e^{-R_2^*} - (P^*_1(n) + n_1)$$
$$\hat{P}_2(n) = \frac{\mu_2}{\lambda}(1 - e^{-R_2^*}) - (P^*_1(n) + n_1)(e^{-R_2^*} - 1)$$

2) If $\frac{\mu_2}{\mu_1} \geq \frac{n_1 + P^*_1(n)}{n_1 + P^*_1(n)}$, then

$$\hat{P}_1(n) = 0$$
$$\hat{P}_2(n) = \frac{\mu_2}{\lambda} - (P^*_1(n) + n_2)e^{-R_2^*}$$

3a) If $1 \geq \frac{\mu_2}{\mu_1} \leq \frac{n_1 + P^*_1(n)}{n_1 + P^*_1(n)}$ and $\lambda \leq \frac{\mu_2 - \mu_1}{n_2 - \mu_1} e^{-R_2^*}$ then

$$\hat{P}_1(n) = \frac{\mu_1}{\lambda} e^{-R_2^*} - (P^*_1(n) + n_1)$$
$$\hat{P}_2(n) = \frac{\mu_2}{\lambda}(1 - e^{-R_2^*}) - (P^*_1(n) + n_1)(e^{-R_2^*} - 1)$$

3b) If $1 \leq \frac{\mu_2}{\mu_1} \leq \frac{n_1 + P^*_1(n)}{n_1 + P^*_1(n)}$ and $\lambda \geq \frac{\mu_2 - \mu_1}{n_2 - \mu_1} e^{-R_2^*}$ then

$$\hat{P}_1(n) = P_{thrresh} e^{-R_2^*}$$
$$\hat{P}_2(n) = \frac{\mu_2}{\lambda} - (P^*_1(n) + n_2)e^{-R_2^*} - P_{thrresh}e^{-R_2^*}$$

After some algebraic manipulation, the state-by-state power allocation simplifies to:

$$\hat{P}(n) = \max \left(\frac{\mu_1}{\lambda} - (P^*_1(n) + n_1)e^{-R_2^*}, \frac{\mu_2}{\lambda} - (P^*_1(n) + n_2)e^{-R_2^*}, 0\right)$$

To simplify this solution, let us first define effective noises

$$\hat{n}_1 = \left(P^*_1(n) + n_1\right)e^{-R_2^*}, \hat{n}_2 = \left(P^*_1(n) + n_2\right)e^{-R_2^*}$$

Let us examine equations more carefully. we saw that the effective noise in a single-user channel is the sum of the actual noise and rule already used in the channel Using the effective noises, the optimal scheme is water filling with two water-levels scaled by weights.

$$\hat{P}(n) = \max \left(\frac{\mu_1}{\lambda} - \hat{n}_1, \frac{\mu_2}{\lambda} - \hat{n}_2, 0\right)$$

The allocation of excess rule to each fading state is identical to the optimal rule allocation [1-2] used to achieve ability of the relay channel with effective noises. The allocation of the excess rule between users, however, is not necessarily the same as under ability maximization because under minimum rate constraints all excess rule in a fading state cannot be allocated to the stronger user due to the interference it causes on the weaker user. Nonetheless, the state-by-state rates achieved by each user, and therefore the average rates, are equal to the ability maximization rates. The minimum rate ability is therefore equal to the ability of the relay channel minimum rates.

We have obtained the ability region of a multi-user fading relay channel with minimum rates. We found that the minimum-rate ability region is achievable by superposition coding with successive decoding and we derived the optimal rule allocation scheme. By using minimum rule and effective noise terms, channels with wide-ranging noise levels, incur a large ability
reduction due to minimum rate constraints, while benign fading environments are able to support large minimum rates with little ability reduction.

V. Conclusion
In this paper, P2P collaborative applications in which shared data are distributed across peers in the network. Since these peers can join and leave at any time, data duplication is required to provide high availability and we analyzed a combined approach for file duplication and regularity protection. In this paper we considered Gaussian relay channels with both independent and common information rate. We first recast the expression for the ability region in a more traditional manner, and found the optimal rate and rule allocation policies that achieve the boundary of the ability region. Interestingly, the simple approaches that worked in the absence of common information no longer work in general when common information is added to the picture. However, some intuition can still be gleaned from the optimal rule allocation policy. This approach also allows the incorporation of public and common message flows for users in the system as well.

References

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