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RED HRS - ROBUST AND EFFICIENT DATA DISSEMINATION BASED ON HYBRID RELAY SELECTION SCHEME IN WIRELESS NETWORKS

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ABSTRACT: The concepts of cooperative relaying promise gains in robustness and energy efficiency in wireless networks. In this chapter, we focus on the relay selection aspects to improve the energy, time, and success efficiency of cooperative relaying. Proposed work used a hybrid relay selection framework, combined Cooperative, Adaptive and Multi-hop relay selection processes. We propose new methods of adaptive relay selection to increase the energy-efficiency of cooperative relaying by allowing only common neighbors with link qualities. Second, we elaborate on the time-efficiency of cooperative relaying in a multi hop communication scheme and propose a new system architecture which exploits routing information in the relay selection process. Finally, we focus on the success of the relay selection phase. This is crucial since cooperative relaying only works if a relay is available. According to those, the source selects a reliable and short path and maintains the reliability of this selected path by adjusting the incentives provided for stimulating Relay nodes under an employee incentive mechanism. The optimal incentives are determined for maintaining the reliability of the multi-service delivery under the influence of the node of the Relay nodes within the selected path.

Key terms: [Wireless networks, Adaptive and Multi-hop relay selection, Efficient Data Sharing.]

1. INTRODUCTION

In recent years, we have witnessed a drastic growth in demand for multimedia services such as different styles of media streams (i.e., video, voice and data streams) and different priority classes of one traffic streams which are referred to as multiple services having different quality of service (QoS) requirements in wireless networks. Given the proliferation of smart devices in distributed intelligent networks, each node is expected to be endowed with smart autonomic functions. By instinct, the individual network nodes would prefer to rather than altruistically in distributed network. Accordingly, each network node should establish a distributed relay -selection management for managing the aforementioned information on the relay -selection, whilst improving the network performance of delivering multiservice, i.e., the reliability of the selected path and the successful probability of delivering multi-services.

Many literatures have investigated the multi-service delivery in distributed wireless networks. A cross-layer resource allocation scheme was developed in for guaranteeing the QoS requirements of the voice and data traffic. A spatial-correlation aware QoS routing algorithm was proposed in for efficiently delivering visual service under QoS constraints.

In previous work, Deploying relays and/or base stations is a major means of extending the coverage of a wireless network. The first is where to deploy relays in order to extend the reach from a base station to the maximum; the second is where to deploy a base station and how many relays are needed to reach any point in a given area. However, this framework neglect the deep analysis of the node from the perspectives of all impact factors, i.e., the nodes' available resources, the QoS requirements of the multi-services and the factor of the employed incentive mechanism. It does not provide a specific security architecture for a network communication process.

In this proposed framework, we focus on the relay selection process which once completed, reduces the challenges of cooperative diversity to the well-studied physical aspects. More specifically, we propose and evaluate relay selection methods/options to improve the efficiency of cooperative relay selection. We first analyze cooperative diversity regarding its energy-efficiency. We consider the energy consumption for transmitting and receiving during relay selection and data transmissions in our analysis.

2. RELATED WORK

Best-effort data control and admission control are vital to guarantee quality of service for real-time (voice and video) transmissions in the IEEE 802.11e wireless LANs. In this paper, we propose and study a global data parameter control scheme integrated with a measurement-based admission control scheme for the IEEE 802.11e enhanced distributed channel access. In the proposed global data control scheme, the access point dynamically controls best-effort data parameters of stations globally based on traffic condition.

The quality-of-service (QoS) guarantees enabled by the new IEEE 802.11a/e Wireless LAN (WLAN) standard are specifically targeting the real-time transmission of multimedia content over the wireless medium. Since video data consume the largest part of the available bitrate compared to other media, optimization of video streaming for this new standard is a significant factor for the successful deployment of practical systems. The new medium access control (MAC) protocol of IEEE 802.11e is called the Hybrid Coordination Function (HCF) and, in this paper, we will specifically consider the problem of video transmission over HCF Controlled Channel Access (HCCA).

In this letter, we investigate the dynamic packet delivery through a specific path in selfish wireless networks with cascaded selfish relay nodes (RN). A dynamic relay -selection model is designed to formulate the variation of the RN's degree of relay -selection with both its own resource and the incentive controlled by the source.

A major task in next-generation wireless cellular networks is provisioning of quality of service (QoS) over the bandwidth limited and error-prone wireless link. In this paper, we propose a cross-layer design scheme to provide QoS for voice and data traffic in wireless cellular networks with differentiated services backbone. The scheme combines the transport layer protocols and link layer resource allocation to both guarantee the QoS requirements in the transport layer and achieve efficient resource utilization in the link layer. For integrated voice/data traffic in a cell, a hybrid time-division/code-division medium access control (MAC) scheme is presented to achieve efficient multiplexing.

The spatial correlation of visual information retrieved from distributed camera sensors leads to considerable data redundancy in wireless video sensor networks, resulting in significant performance degradation in energy efficiency and quality-of-service (QoS) satisfaction. In this paper, a correlation-aware QoS routing algorithm (CAQR) is proposed to efficiently deliver visual information under QoS constraints by exploiting the correlation of visual information observed by different camera sensors.

First, a correlation-aware inter-node differential coding scheme is designed to reduce the amount of traffic in the network. Finally, the correlation-aware schemes are integrated into an optimization QoS routing framework with an objective to minimize energy consumption subject to delay and reliability constraints.

3. PROPOSED METHODOLOGY

In this chapter, we focus on the relay selection process which once completed, reduces the challenges of cooperative diversity to the well-studied physical aspects. More specifically, we propose and evaluate relay selection methods/options to improve the efficiency of cooperative relay selection.

First, we concentrate on the energy-efficiency of cooperative relaying. We consider the energy consumption for transmitting and receiving of all nodes in the network for the relay selection and data packet transmissions. We propose new methods of adaptive relay selection to increase the energy-efficiency of cooperative relaying by allowing only common neighbors with link qualities that can support the S-D pair to be relay candidates and employing relay selection on demand, where cooperation is highly likely required.

Second, we elaborate on the time-efficiency of cooperative relaying in a multi-hop communication scheme and propose a new system architecture which exploits routing information in the relay selection process.

Moreover, we investigate different selection policies regarding their end-to-end throughput.

Finally, we focus on the success of the relay selection phase. This is crucial since cooperative relaying only works if a relay is available. We focus on relay selection based on a slotted contention window and investigate two different access strategies of candidates. For those strategies we determine the optimum access probabilities that maximize their selection success.

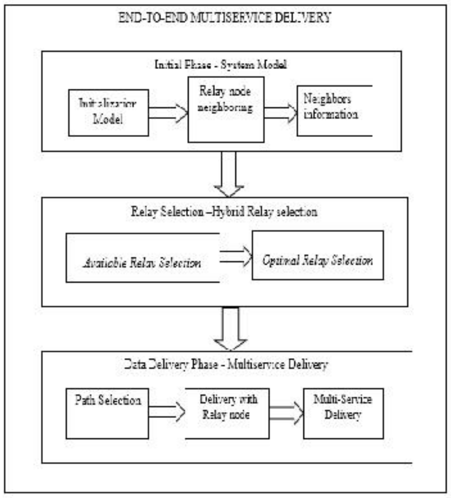


Figure 2.1 Proposed Scheme

3.1. METHODOLOGIES

In this section, we introduce the network model including source-destination pairs and some selfish RNs, and as well the profit and cost of each RN while forwarding multi-services. Finally, the RN's are defined in terms of its intrinsic and extrinsic factors.

3.1.1 Network Model

Due to the effect of the RNs' selfishness on the multiservice delivery, every source in the WNs should obtain the NSI of all RNs for determining the reliability of all path existing between this source-destination pair. Nevertheless, considering the distributed framework of WNs where no central network entity collects the NSI of all selfish RNs, every distributed source/RN should have its own relay -selection management for its selfish behavior and other RNs’ NSI. The relay -selection management at every RN obtains the NSI of the RNs around it in terms of their historical behaviors and the remote RNs’ NSI recommended by the RNs.

Meanwhile, since the multi-services have different impact factors, the RNs have different resource consumption amounts for satisfying their QoS requirements, which may lead to different selfish behaviors of these RNs. Nevertheless, for successfully delivering multi-services, the source employs an incentive mechanism to depress the relay -selection of these RNs, and different incentives have different stimulating levels for the selfish behaviors of these RNs.

Nevertheless, considering the distributed framework of WNs where no central network entity collects the NSI of all selfish RNs, every distributed source/RN should have its own relay -selection management for its selfish behavior and other RNs’ NSI. The relay -selection management at every RN obtains the NSI of the RNs around it in terms of their historical behaviors and the remote RNs’ NSI recommended by the RNs around it, referred to as the recommended NSI.

Determines the effects of the intrinsic and extrinsic factors on its relay -selection of forwarding multi-services. For the multi-service delivery, every source in such WN may obtain some paths of delivering multi services, denoted by, by using a traditional routing protocol, e.g., the dynamic source routing (DSR) in.

Nevertheless, since the relay -selection of the RNs within these paths degrades the reliability of these paths, each source selects the most reliable and shortest one of these obtained paths, denoted of the RNs’ NSI under this distributed framework of the relay -selection management.

Additionally since each time of the path selection introduces a large signaling overhead in distributed the source should reduce the selection frequency and maintain the reliability of the selected path. Nevertheless, the relay -selection of the RNs within the selected path varies with the aforementioned factors, thus leading to the variation of the path reliability. Accordingly, every source may adjust the incentives to depress the relay -selection of the RNs within the selected path and to maintain the reliability of this path for delivering multi-services. Here, the network model of the distributed including a distributed framework of the relay -selection management and the multi-service delivery of the sources is shown in

3.1.2 Relay nodes forwarding services

When the multi-services are successfully forwarded, RN i (i ∈V) obtains the revenue of forwarding multi-services, denoted by Pi. Since the multi-services have different bit-error rate (BER) requirements, via the adaptive modulation, the transmission rate of RNi to RN j for service his expressed as.

where Pi,h is the transmit power of RNi for service h, N0is the thermal noise power, gi,j is the channel gain from RNi to RN j, Wi is the available bandwidth possessed by RNi, ηhis the target BER of forwarding service h. The transmission time of RN i for service his expressed as Lh Ri,h, where L his the service length. The resource consumption of RNi for service h with target BER ηh is given by Accordingly, the resource cost of RNi for forwarding service h depends on the corresponding resource consumption Ei, h, expressed as

$$R_{i,h} = W_i \log_2\left(1 - \frac{1.5}{\ln(5\eta_h)} \frac{P_{i,h}|g_{i,j}|^2}{N_0 W_i}\right)$$

Where, π is the energy price, which is a constant and is the same for all RNs.

3.1.3Relay Node Information

Note that the RN’s intrinsic and extrinsic factors affect its relay -selection. The intrinsic factors of the RN are its residual energy and available bandwidth, while its extrinsic factors are the employed incentives and the impact factors of the multi-service.

The degree reflecting the effects of intrinsic factors on its selfish behavior, while the RN's is defined as the degree reflecting the effects of extrinsic factors on its selfish behavior. The RN's NS is defined as the degree reflecting the effects of all impact factors on its selfish behavior, denoted by S., which are referred to as the RN's NSI, vary from 0 (altruistic) to 1 (completely selfish) via a normalization.

$$S = f(S^I, S^E),$$

Which is a non-decreasing function with respect to (w.r.t.) it. When the RN's SI =0 or its S=0, meaning that the RN having either the infinite available resources or the infinite incentive is altruistic. While the RN's =1, meaning that this RN of no available resources and no incentive for the service of the high impact factor is completely selfish. Naturally, it is more common than 0<S I <1 and 0<S E<1, yielding the RN's De NS 0<S<1.

3.1.4 Relay Selection –Hybrid Relay selection

Under the distributed framework of the relay -selection management, the relay -selection management of each RN consists of two parts: the management of its NSI and the management of the other RNs' NSI. For the management of the RN's relay -selection, the models of the intrinsic and extrinsic selfishness are designed for computing its terms of its intrinsic and extrinsic factors, respectively. Additionally, for the management of the other RNs' NSI, their obtained in terms of their historical behaviors and the SI of these RNs recommended by the RNs around it.

A. Available Relay selection

Owing to the effects of the RN's intrinsic and extrinsic factors on its relay -selection of forwarding multi-services, it should quantify these effects, thus the models of the intrinsic and extrinsic selfishness are designed to obtain its, respectively.

1) Model of Intrinsic: Owing to the effects of both the RN's residual energy and its available bandwidth on it IS, the model of intrinsic is divided into two parts: the effect of its residual energy on it IS, denoted as SIE (0≤SIE≤1), and the effect of its available bandwidth on it IS, denoted as SIF (0≤SIF≤1).

2) Model of Extrinsic Selfishness: Owing to the effects of both the service impact factor and the incentive on the RN's this factor is formulated including two parts: the effect of the service impact factor on it's, denoted as S (0≤S≤1), and the effect of the incentive on its denoted as SI (0≤S I ≤1).

From the residual-energy point of view, the RN's willingness of forwarding multi-services decreases as its residual energy is depleted. Correspondingly, its IS increases as its residual energy decreases. From the available bandwidth point of view, the RN has the low willingness of forwarding multi-service if the available bandwidth is insufficient and vice versa. Hence, in order to balance the effects of both its residual energy and available bandwidth on its IS, the RN's IS is developed as

$$S^I = \omega^I S_F^I + (1 - \omega^I) S_E^I,$$

Here, we analyze the influence of the RN's available bandwidth on it IS. In the presence of large available bandwidth, the RN has high willingness of forwarding multi-services, and thus exposing low IS. In the presence of mediocre available bandwidth, its willingness of forwarding multi-services slowly decreases. Extremely, in the presence of the null available bandwidth, this RN may drop multi-services, thus exposing high IS. The RN's IS may exponentially increase as its available bandwidth decreases.

B. Optimal Relay Selection

In distribute WNs, besides managing the RN's own NSI, its relay -selection management also acquires the other RNs' NSI, including their multiservice delivery.

1) Extraction: The RN's relay -selection management extracts the other RNs' in terms of their historical behaviors, i.e., forwarding and dropping multi-services, which are referred to as the binary events. Within the time window with lengthT, the historical behaviors of RNi are expressed asBi ={Bi,t |0≤t ≤T−1}, where Bi,t ∈{0,1}is the behavior information of RNi at timet, and Tis properly set in terms of the time-correlation of its behaviors. The behavior information Bi,t =1 represents that RNi forwards multi-services at time t, while Bi ,t =0 represents that it drops multi-services at time t. The behavior information Bi,0 is the latest action information of RNi, while Bi,T−1is its earliest behavior information. Additionally, the forgetting factor τi (0≤τi ≤1)is used to weight the historical behaviors of RN i within the time window, and(τi) t is used to weight on the behavior information ti . Accordingly, the extracted of RNi is expressed as

2) Parameters Extraction: For further analyzing the effect of each impact factor on the other RNs' relay -selection, the RN's relay -selection management also needs to evaluate the parameters of the other RNsωI, IF, IE, ωE, ES andEI for effectively optimizing the network performance.

The kernel methods in regression and the neural network have been employed to evaluate the parameters of a nonlinear function and a video transmission. Hence, these methods may also be employed for the RN's parameter extraction, which will not be studied in this paper due to the limited space of this paper.

3.1.5 Multiservice Delivery

In this section, in terms of the obtained NSI under the distributed framework of the relay -selection management, every source selects the most reliable and shortest path and provides the optimal incentives to the RNs within the selected path for the multi-service delivery.

A. Path Selection

For delivering multi-services, the sources find some paths by virtue of the traditional routing protocol. Nevertheless, these paths may not be all reliable for successfully forwarding multi services due to the relay -selection of the RNs within this paths. Although the RN's NS represents its behavior of forwarding multi-services, the NS information is not the best option to select the most reliable path. When the RNs of a few available resources have high IS, their historical behaviors may be the ones of forwarding the multi-services owing to the large incentives, thus leading to their low NSs. If these RNs of high ISs are selected within the path of delivering multi-services in terms of the RNs' NSs, the sources should provide large incentives for stimulating the multi-service forwarding of these RNs and maintaining the reliability of the selected path.

B. Multi-Service Delivery with Relay nodes

After selecting the shortest and most reliable path θ∗={θ∗1,...,θ∗|θ∗|}for the multi-service delivery by using the path selection criterion, the source should maintain the reliability of path θ∗ for delivering multi-services by adjusting the incentives for depressing the RNs' relay -selection. Nevertheless, the incentives provided by the source are the cost of delivering multi-services, thus the source should minimize such incentive costs. Therefore, for maintaining the path reliability, the source should minimize the incentive costs subject to the successful multi-service forwarding of each RN within the selected path θ∗.

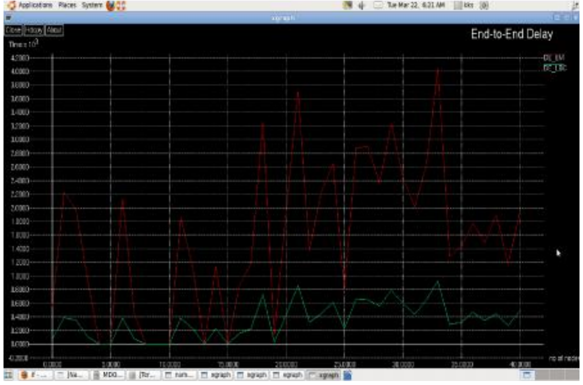
The RN of high IS cares its lack available resource and conserve its available resource, thus the resource cost of forwarding multi-services is regarded as a large value. In contrast, the RN of low IS does not care the resource consumption of forwarding multi services and has high willingness of forwarding multi-services, thus the resource consumption cost is regarded as a small value. Here, the expected resource cost of each RN within path θ∗ for forwarding multi-services.

In this section, our simulation results are provided for characterizing the RN's relay -selection management and effectively demonstrating both the path selection and the path reliability of delivering multi-services.

4. EXPERIMENTAL RESULT AND DISCUSSION

PERFORMANCE ANALYSIS:

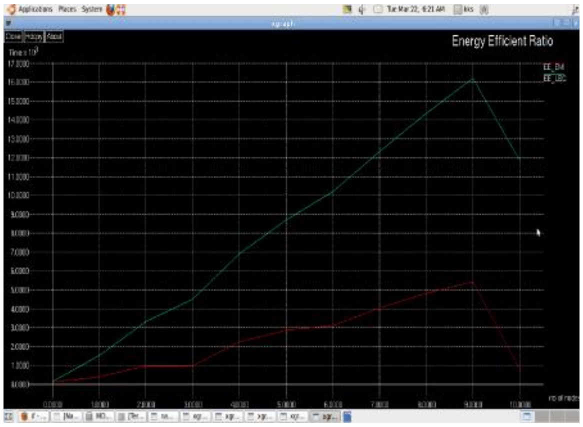
4.1. Delay ratio:



Above figure mention delay ratio of our proposed and existing comparison.

Here, we distinguish the current and proposed delay ratio, the red line indicates the proposed delay ratio and green line is existing delay ratio, as a result, the proposed work minimizes the delay when distinguished with the current process.

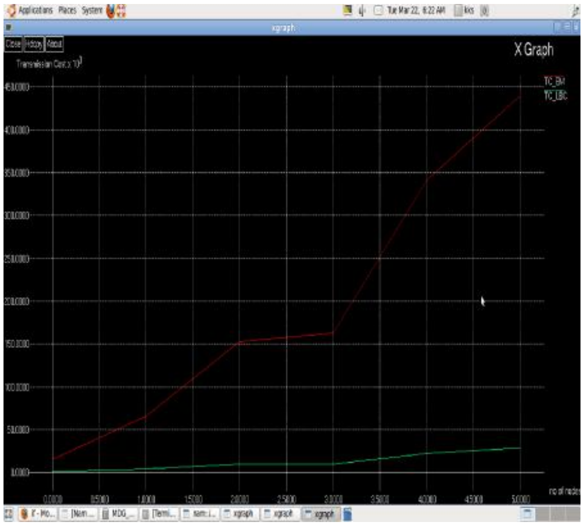
4.2. Energy efficiency rate:



Above figure mention energy efficiency ratio of our proposed and existing comparison.

Here, we distinguish the current and proposed energy efficiency rate, here green line indicates the proposed efficiency rate and red line is existing efficiency rate, as a result, the proposed work enhances the efficiency of energy distinguished with the current process.

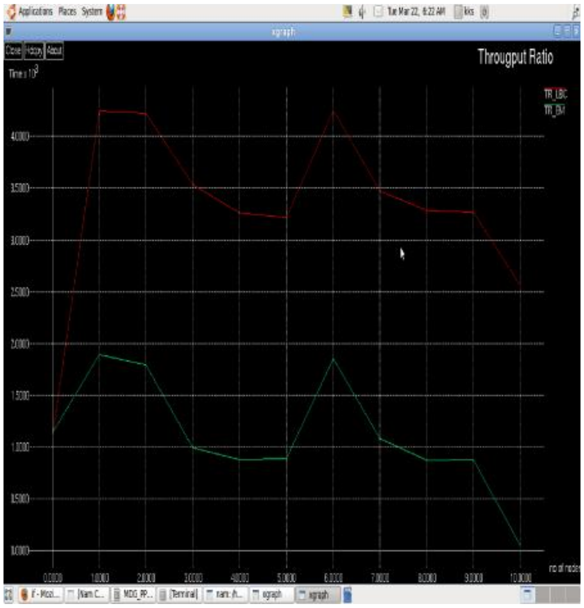
4.3. Transmission cost:



Above figure mention Transmission cost of our proposed and existing comparison.

Here, we distinguish the current and proposed Transmission cost rate, here red line indicates the proposed transmission rate and green line is existing transmission rate, as a result, the proposed work minimizes the Transmission cost when distinguished with the current process.

4.4. Throughput ratio:



Above figure mention Throughput ratio of our proposed and existing comparison.

Throughput ratio, as a result, the proposed work enhances efficiency of Throughput ratio t when distinguished with the current process.

Parameters	Correlation	DSR	Optimal Deployment	Hybrid relay
Life Time	6,445s	7,250s	7,450s	8,150s
TS Speed	Light high	Light high	high	Very high
Throughput	250 pkts	295 pkts	300 pkts	340 pkts
Delay	0.047s	0.045s	0.044s	0.042s
Packet Ratio (25 sec)	65	70	78	96

Parameters comparison Table with previous frameworks

CONCLUSION

In this paper, we have constructed a distributed framework of the relay -selection management, where every RN manages its NSI and other nodes' NSI and every source manages the RNs' NSI in distributed WNs. In this framework, the RN's models of intrinsic and extrinsic have been developed to manage IS, and the other RNs' NSI has been obtained in terms of the RNs' historical behaviors and their recommended NSI. Under this distributed framework of the relay -selection management, the path selection criterion has been designed to select the most reliable and shortest path for the multi-service delivery. Additionally, the optimal incentives have been adjusted by the source for maintaining the path reliability of the multi-service delivery.

Finally, we would like to point out that there are some interesting problems that may be studied in our future work. The first problem is how to find transmission and compatible pairs for each node. A scheme should be developed to partition the continuous space to locate the optimal delivery for each cluster. Then finding the compatible pairs becomes a matching problem to achieve optimal overall spatial diversity. The second problem is how to schedule end-to-end delivery from multiple clusters. An algorithm that adapts to the current system-based transmission scheduling algorithms should be studied in future.

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