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Power Control Optimization and Improving Throughput for LTE-Advanced Relay Networks

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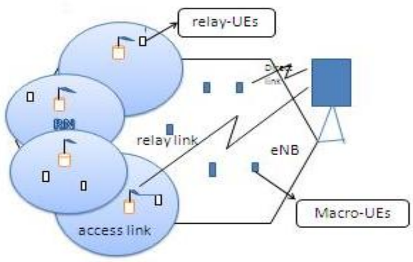
Abstract*-- Relay nodes (RNs) promise to increase the network capacity and to better distribute resources in the cell, or alternatively, extend the cell coverage area. RN-served user equipments (relay-UEs) can create severe inter-cell interference in particular when a large number of RNs are deployed in the cell with a reuse factor of power control (PC) , it becomes a vital means in the uplink (UL) scheduling and it compensate for channel variations. In LTE network the transmission is of carrier aggregation, coordinated multiple point transmission and reception, and relay. It can be seen as a kind of collaborative communications, in which a relay station (RS) helps to forward user information from neighbouring user equipment (UE)/mobile station (MS) to a local eNode-B (eNB)/base station (BS). Power adaption of high level mobile system is an advance of LTE having multihop routing. In this paper we are going to discuss the relay technique to improve the throughput of the coverage area of base station. When comparing with the WIMAX scheduling our LTE power adaption improve the high data transmission of uplink.

Key terms: **Uplink scheduling, Power adaption, relay routing, throughput, multihop, Bandwidth, LTE-Advanced, Relaying,**

I. INTRODUCTION

The present scenario suggests tremendous growth in the mobile and fixed broadband worlds. With the establishment of 3G technologies, the authorized organizations are looking to deploy 4G network worldwide. Fourth Generation calls for very high data rates with a robust relay and backhaul architecture able to support these overwhelming peak data rates such as 100 Mbps and 1Gbps for mobile and fixed environments respectively. In the paper, relay technology has been discussed, throwing light upon different types, transmission techniques, pairing schemes for WiMAX and LTE-Advanced technologies. The main objective is to build a strong interface for radio access and smooth communication among the base stations (eNB) and relay stations with the User Equipments (UE). Improvements in service coverage and system throughput are major attributes to be looked while installing the relay stations and examining its communications with eNBs and UE. International Mobile Telecommunications-Advanced (IMT-Advanced) standards are defined by the International Telecommunications Union (ITU) for the standardization of 4G technologies like LTE-Advanced and mobile WiMAX (IEEE 802.16m). Relay technology is an important aspect taken into consideration during the standardization process. Relay transmission technique involves forwarding of UE/mobile units information to the local eNBs via relay stations installed at different locations to carry out this process. Service coverage and the overall throughput can be enhanced by using this technique. There are two types relays type-I and type-II known as non-transparency and transparency respectively. Type-I will be located far away from an eNB which transmits common signal and the control information for the eNB which helps to increase the coverage. This type mainly performs IP packet forwarding in the network layer and helps in increasing system capacity by providing communication services and for remote UE units. Type-II will be located within the coverage area of an eNB and has direct communication with the eNB and does not transmit control signal. The main objective is to increase system capacity by achieving multipath diversity and transmission gains for UE units.



II. RELAY TRANSMISSION SCHEMES

Many relay transmission schemes have been proposed to establish two-hop communication between an eNB and a UE unit through an RS.

Amplify and Forward — An RS receives the signal from the eNB (or UE) at the first phase. It amplifies this received signal and forwards it to the UE (or eNB) at the second phase. This Amplify and Forward (AF) scheme is very simple and has very short delay, but it also amplifies noise.

Selective Decode and Forward — An RS decodes (channel decoding) the received signal from the eNB (UE) at the first phase. If the decoded data is correct using cyclic redundancy check (CRC), the RS will perform channel coding and forward the new signal to the UE (eNB) at the second phase. This DCF scheme can effectively avoid error propagation through the RS, but the processing delay is quite long.

Demodulation and Forward — An RS demodulates the received signal from the eNB (UE) and makes a hard decision at the first phase (without decoding the received signal). It modulates and forwards the new signal to the UE (eNB) at the second phase. This Demodulation and

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Forward (DMF) scheme has the advantages of simple operation and low processing delay, but it cannot avoid error propagation due to the hard decisions made at the symbol level in phase one.

III. CENTRALIZED PAIRING SCHEME

In a centralized pairing scheme, each RS identifies a set of UE units it can serve in its vicinity and checks the channel condition (service quality) for the links between the RS and the eNB and between the RS and every UE unit in this service set. This information needs to be periodically updated and reported to the local eNB to capture dynamic changes of neighbourhood and channel conditions at each RS. the condition that each RS can serve only one UE unit at a time, the optimization objective of a centralized pairing scheme is to maximize the number of served UE units.

IV. DISTRIBUTED PAIRING SCHEME

To reduce periodic information exchange and signalling overhead in the centralized pairing scheme, a simple distributed pairing scheme based on a contention-based MAC mechanism. Specifically, a common slotted communication channel is shared by all the RSs in the same cell. Every N slot is grouped into a pairing section, and a complete pairing procedure contains M pairing sections. In practice, these parameters N and M can be tuned according to the densities of RSs and UE units in each cell, thus to achieve a better performance trade off between collisions and delay.

V. RELAY ROUTING SELECTION

Routing is thus a key issue of networks that support multihop relaying through the deployment of dedicated relays, users' cooperative relaying, or protocols incorporating both. Routing can be viewed as the process of establishing efficient connectivity between nodes over multihop links allowing coverage extension, throughput, and fairness improvement. Since different routing schemes are expected to differently affect the system performance in terms of throughput, delays, and signalling overhead, several relay selection strategies and relaying criterion. More importantly, while relays are deployed with the potential of improving coverage and assisting users having unfavourable channel conditions.

VI. POWER MODEL

Power shaping over time slots within the frame, on–off power shaping over the cell sectors in time, fixing the sequence of resource allocation to users, or limited exchange of interference information discrimination of the quantities involved in the resource allocation, such as transmit power levels, steering coefficients of the directional antennas, and transmission rates. Signals at source nodes have multiple potential recipients, among which, the routing algorithm selects the appropriate receiving nodes.

The combination of multi antenna systems in the form of MIMO and OFDMA has been shown to yield a rich performance.

Table 1: Simulation Parameter

Parameter	Value
Simulator	Ns2 - 2.29
Number of nodes	50
Simulation Time	20 min
Packet Interval	0.01 sec
Simulation Landscape	1000 x 1000
Background Data Traffic	CBR
Packet Size	1000 bytes
Queue Length	50
Initial Energy	10 Joules
Transmission Range	100 Kbytes
Node Transmission range	250 m
Antenna Type	Omni directional
Mobility Models	Random-waypoint (0-30 m/s)
Routing Protocol	AODV
MAC Protocol	IEEE 802.16

The relay's transmit power per subcarrier is fixed, maintaining almost even distribution of subcarriers among relays limits the relay's total transmit power and, thus, its power-amplifier rating and the consumption of its battery energy for battery-operated relays. In addition, a balanced traffic load reduces the packet processing delays at the regenerative relays. The link between eNB and RN is expected to be 3dB better than the link between eNB and UE due to the RN height that is assumed to be 5m (hRN). We have adopted the suburban macro-cell model (C1) of with non line-of-sight, i.e. PL PL -3dB.

eNB-RN eNB-UE ------------------ (1)

The path-loss for the RN to UE link is based on an urban micro cell model in non line-of-sight situations:

$PL_{LOS\,/\,RN\text{-}UE}$ = max(22.7 log $_{10}$ (d $_1$) 41.0 + 20 log (f/5.0), PL_{FREE})

for *d* 1 □ □*d BP* with

$$\text{for } d_1 < d_{BP} \text{ with } d_{BP} \leq 4 \cdot (h_{RN} - 1.0) \cdot (h_{UE} - 1.0) f/c,$$

$$d_1 \geq d_{BP}:$$

------------------- (2)

In above equations notation dBP refers to the break point distance between LOS and NLOS propagations and we have assumed a geometry where RN is located in one street and the UE is in the perpendicular street. The distance d1 is from the RN to the middle point of the crossing and d2 is the distance apart from the middle point of shall be assumed 2 1 2 *d* □ □*d* □ □*d* , see . Since indoor users are considered, a penetration loss of 20 dB has been applied to the direct and access link but not to the relay link because relays are expected to be deployed outdoor. The eNB/RN selection is performed by UEs on the basis of highest received signal power.

VII. EXPERIMENTAL RESULTS

We conduct an adaptive signal processing , the joint routing and scheduling problem challenges as well the multihop cooperative schemes in relay networks. Power shaping over time slots within the frame, on–off power shaping over the cell sectors in time, fixing the sequence of resource allocation to users, or limited exchange of interference information between neighboring BSs, discretization of the quantities involved in the resource allocation, such as transmit power levels, steering coefficients of the directional antennas, and transmission rates. By comparing the result with the existing scheme to select the power conception in network.

VIII. CONCLUSION AND FUTURE WORK

It is shown that relay technologies can effectively improve service coverage and system delivery ratio, especially when multiple RSs are deployed. With additional complexity and processing delay, Under different radio channel conditions, UE units as possible in a realistic multiple-RS-multiple-UE scenario, we have compared the result with both centralized and distributed pairing schemes, which can achieve maximal numbers of served UE units and compared with power metric proposed

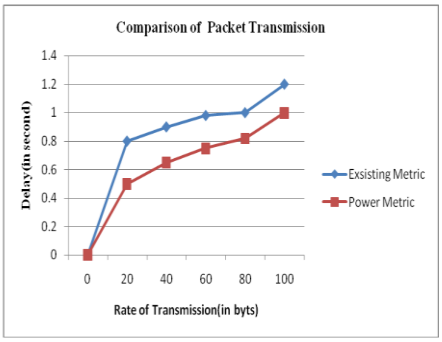

Fig 2 : Comparison Of Packet Transmission

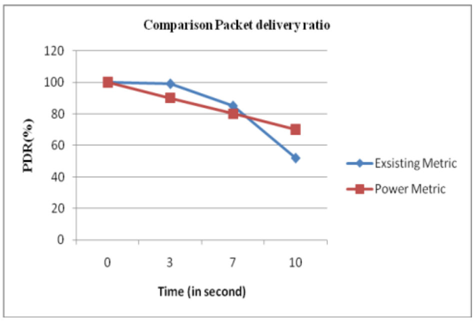

Fig 3: Comparison of Packet delivery ratio

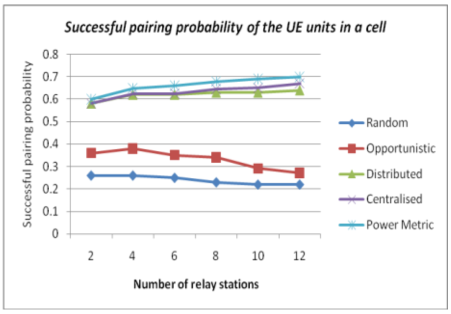

Fig 4 : Successful pairing probability of the UE units in a cell.

REFERENCES

[1] ITU-R Rep. M.2134, “Requirements Related to Technical Performance for IMT-Advanced Radio Interface(s),” 2008.

[2] 3GPP TR 36.814 V1.2.1, “Further Advancements for EUTRA: Physical Layer Aspects,” Tech. Spec.n Group Radio Access Network Rel. 9, June 2009.

[3] IEEE P802.16j/D9, “Draft Amendment to IEEE Standard for Local and Metropolitan Area Networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems: Multihop Relay Specification,” Feb. 2009.

[4] S. W. Peters and R. W. Heath Jr., “The Future of WiMAX: Multihop Relaying with IEEE 802.16j,” IEEE Commun. Mag., vol. 47, no. 1, Jan. 2009, pp. 104–11.

[5] V. Genc et al., “IEEE 802.16j Relay-Based Wireless Access Networks: An Overview,” IEEE Trans. Wireless Commun. vol. 15, no. 5, Oct. 2008, pp. 56–63.

[6] A. Nosratinia and T. E. Hunter, “Grouping and Partner Selection in Cooperative Wireless Networks,” IEEE JSAC, Feb. 2007, pp. 369–78.

[7] G. Li and H. Liu, “Resource allocation for OFDMA relay networks with fairness constraints,” IEEE J. Sel. Areas Commun., vol. 24, no. 11, pp. 2061–2069, Nov. 2006.

[8] J. Lee, H. Wang, S. Lim, and D. Hong, “A multi-hop user admission algorithm for fixed relay stations with limited capabilities in OFDMA cellular networks,” in Proc. IEEE 18th Int. Symp. Pers., Indoor, Mobile Radio Commun., Sep. 2007, pp. 1–5.

[9] T. Kim, T.-Y. Min, and C. Kang, “Opportunistic packet scheduling algorithm for load balancing in a multi-hop relay-enhanced cellular OFDMA-TDD system,” in Proc. IEEE 14th Asia-Pacific Conf. Commun., Oct. 2008, pp. 1–5.

[10] Mobile Multihop Relay Study Group Recommendations for the Scope and Purpose of the Mobile Multihop Relay Task Group, IEEE Std. 802.16, Nov. 11, 2005. [Online].

[11] Network Simulation tutorial is refered by http://ns2rock.wordpress.com/