A Review of OFDM-Based Multihop Cellular Networks

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Abstract:- **MRCC (Multiple relay co-operative communication) is known to improve remote (wireless) network performance. OFDM (Orthogonal Frequency Division Multiplexing) in system of remote communication is the transmission technique which is the dominating one. In particular paper we have given reviews for the methodologies of different number of issues which need to design carefully for implementing successfully of MULTI-HOP CELLULAR NETWORK (OFDMA-based). It requires to incorporation with relay type terminals.**

Keyword :- *Cooperative communication, orthogonal frequency division multiplex (OFDM), resource allocation.*

I. INTRODUCTION

Co-operative wireless (remote) communication systems needs in-corporation of the relay terminals into the conventional type cellular-networks and further requires multi-hop transmission because of half-duplex nature of remote (wireless) terminals. And these types of systems are considered to be MHCN (multi-hop cellular networks). It needs to design carefully for perfect implementation. The schemes co-operative communication may provide improvements in terms of point-to-point (end-end) output. Though they need additional expenditure of the radio resources which have been arise from multi-hop transmission need.

And all of these schemes require two phased (that is two hop) communications. The RS (relay station) requires being signals which are transmitted because of source terminal. Particular study in this thesis show that downlink type transmission which then assisted by RS (given) is considered to be deployed by system operator.
The adapted co-operative scheme in MHCN (Multi-Hop Cellular Network) includes:

A. Cooperative multiple-input multiple-output (MIMO)

The MS (mobile station) and RS (radio station) is used to listen of transmission of BS (base station) in between first phase. In second phase- BS & RS transmit simultaneously by utilizing give radio resource. So because of that co-operative space time coding may used. MS can benefited by co-operative diversity if it combines first and second stage received signals appropriately with STD (space-time decoding).

B. Cooperative multiple-input single-output (MISO)

In first stage RS is listen BS transmission. In second stage both of RS & BS simultaneously transmit by utilizing given radio resource. So only because of that co-operative space time coding is used. MS can benefited by transmit co-operative diversity, if it combines received signal appropriately from RS & BS for an example STD.

C. *Cooperative single-input multiple-output (SIMO)*

In first stage RS & MS listen to BS transmission. In second stage only RS transmits (relays signal which have been received in first phase) by utilizing given radio resource.MS is used combine receiving signal appropriately in first & second stage. It is noted as MRC- maximum-radio combining can benefit co-operative receive diversity.In conventional relaying of 1st phase, RS receives BS- transmission which destined to MS (given). In second phase, the RS forwards MS-signals which received during 1st phase. This particular scheme gives path loss saving whereas co-operative schemes are providing the diversity gain. Robustness and spectral efficiency are against multi-path impairments. When it is applied in OFDM-based remote-network, co-operative scheme may be at each sub-channel with comparison to frequency diverse sub-channel.

DC (Direct Communication) without the relay intervention is further referred to as without relay scheme. In the environment (frequency selective), subcarriers experience fiat fading at the different amplitude where subcarriers are of properly designed OFDM-network. And hence it is beneficial for the relay terminals which are operating in OFDM-based network. In order to use the best forwarding and relying scheme at each subcarriers. The best scheme Identification may based on CSI (channel state information). In-corporation of the OFDM into remote (wireless) relaying with following benefits:

1) To relay/ not relay will be decided for every sub-channel.
2) Best relaying and forwarding scheme may choose for every sub-channel and such scheme is then referred as adaptive-relaying. The Multi-hop networks, referred as wireless (remote) relay networks. It involves three of main links which constitutes E-TO-E (end to-end) path: relay to- destination (*R--->D*), source to- destination (*S--->D*) and source to- relay (*S--->R*). Therefore, end to- end performance may be key criterion which considered in design of remote or wireless relay-networks.

Relaying will be used on improve of end to- end output. An adaptive relaying may improve performance of the conventional-cellular & multi-hop cellular type networks, where the relaying scheme is used always.

An OFDMA (orthogonal frequency-division multiple access) - based IEEE-802.16e standard have developed for the providing broad-band coverage for the mobile users in the single-hop wireless (remote) MAN (metropolitan area networks). Particular standard is then considered to a mobile Wi-MAX. Which is an emerging IEEE-802.16j standard may extend IEEE-802.16e standard by enabling multi-hop transmissions. In particular study a critical-design issues for a successful extension of IEEE-802.16e to IEEE-802.16j are then presented.

The issues of these designs are:

A. Synchronization

To achieve systems potential output this issue has become critical.

B. Adaptive relaying: radio resource in the system

In order to use effective radio resource in system the proposed design of adaptive relying is important. Outputs delivered by the system get optimized by properly designed adaptive relaying.

C. Aspects of Hardware Implementation

Particular issue becomes important for hardware requirement and operability of terminal which have been served by MHCN (Multi-Hope Cellular Network). For adaptive relying design hardware related matter is considered.

D. LR-ARQ (Local Re-Transmission Automatic-Repeat Request)

The LR-ARQ design is important to take an advantage of multi-hop nature of cellular type network. Once it designed properly, it will enhance the performance over which of single hop counterparts which in terms of good put, cell latency and throughput.

II. CHRONOLOGICAL REVIEW

In 2004 Ralf Pabst[et.al] presented a paper for the different type approaches to an exploiting benefits of the multi-hop communications namely relays, like solutions for the radio with range of an extension in the wireless and mobile broadband cellular-networks (trading-range for capacity), & solutions to that combat shadowing on HRF (high radio frequencies). In order to reduce infrastur deployment cost relaying is there all the time. Also the relying will improve in cellular network through spatial diversity exploitation.

In 2009 Yiqun Wu[et.al] presented a paper at Multi-hop cellular networks. It employs to relay stations to improve end to- end quality of link in terms of the reliability, coverage an capacity. The techniques such as co-operative spatial and relaying re-use will enhance further a network performance. An efficient resource-allocation algorithm is then required to exploit potential advantages. In particular research paper, there have been introduced three- relaying schemes and further show which there's a trade-off in between spatial and co-operative diversity re-use. Here proposes an efficient algorithm of resource allocation which allocates resource among the user the multi-hop cellular networks. The algorithm further exploits both co-operative diversity and spatial re-use.

In 2011 Kianoush Hosseini[et.al] presented a paper in which the resource-allocation to acquire a max- min fairness in selection -based OFDM (orthogonal frequency division multiplexing)- network. In OFDM- network source nodes assisted by the fixed decode and-forward relays. And relay assignment, power allocation and transmission strategy selection (joint problem) are combinatorial problem with an exponential-complexity. In order to create an effective solution for such questions, they approached this problem in two stages. 1st set of problem aims ideal source relay channels. Particular simplification helps to illustrate common method and wy the solution provides tight-bounds. And then formulate a common problem for selection of transmission strategy, power allocation and relay assignment at relays and sources by considering all the communication channels, that is source-relay channels of finite power. In all two sets, the transmissions over the sub-carriers are then assumed to be an independent. Given, that an attendant problem implementation and synchronization by utilizing a FFT/ IFFT –pair. Resource allocations at the level of sub-carriers pretend to be impractical. Hence, we considered a resource -allocation at level of entire OFDM- block. The optimal type resource management needs exhaustive search. Here develop lower complexity tight bounds.

In 2011 Gurpreet Kaur[et.al] presented a paper for a co-operative diversity that technique is for the numerous relay signals of radio terminals for each-other. The co-operative diversity results in when the co-operative communications is utilized primarily in order to leverage spatial-diversity which available among all distributed radios. Research paper focuses on different co-operative diversity schemes & such applications in numerous wireless (remote) networks which are discussed. And impact of co-operative diversity on consumption of energy, sensor network of lifetime and co-operation impact in cognitive-radio are discussed. Here are user is scheduling and the radio-resource allocation techniques are discussed that developed efficiently to integrate numerous co-operative schemes of diversity for an emerging IEEE-802.16j -based systems.

In 2012 Seh Chun Ng[et.al] presented a paper for study properties of the 1-D (single dimensional) infrastructure- based multi- hop networks. Especially, they considered networks with the two-types of nodes, that is, powerful nodes and ordinary nodes. With the unit interval, ordinary nodes are distributed commonly. The powerful-nodes are an arbitrarily distributed with unit-interval. Such powerful nodes are interconnected through backbone infrastructure. Network said to be connected if and only if every ordinary node connected to one of powerful node (which through multi-hop path). Analytical result has been obtained by them. This analytical result was for average number of clusters and connectivity probability in network. We proved for first time which the distribution of optimum powerful-node minimizes average number of maximizes clusters and asymptotic-connectivity-probability. In order to deploy such powerful node is in the fashion of equidistant.

In 2013 Tzu-Ming Lin[et.al] presented a paper at a Relay-Technology, which has been then adopted to improve a performance and coverage of remote (wireless) networks like LTE-A (Long-Term Evolution-Advanced) and Microwave Access of a Worldwide Interoperability. As well by utilizing relays to the forward packets can induce the more number of packet-losses than the traditional SHWN (single hop wireless networks). And multiple radio links conduct such transmissions. When there're lost-packets, RSs (relay stations) decide whether to re-transmit such packets with ARQ (automatic repeat request)- strategies. They are observing which impracticable ARQ-strategy workloads, blocked packets and increases latency on MHRN (multi-hop relay network). Particular paper is proposing new-relay ARQ (R-ARQ) scheme. It is providing an efficient acknowledgement

in order to reduce the packet latency. And further number of the blocked-packets with all small workloads.

In 2013 K. J. A. Chisty[et.al] presented a paper at a Multiple-relay co-operative communication that is well-known to improve performance of remote networks. OFDM (Orthogonal frequency division multiplexing) is one of dominating-transmission techniques in remote-communication systems. Co-operative communication development with the (MIMO) OFDM (multiple input-multiple outputs) systems has then promised a significant enhancement in an output and reliability for the remote (wireless) networks by using multiple-relays in between destination and source. Co-operative MIMO-OFDM systems mathematical model are under-AF (amplify & forward) multiple relays implemented and developed in order to evaluate performance of system. Under such scenario of audio frequency and text message signal transmission, it's observable which multiple-relay co-operative MIMO- OFDM system with the MMSE-SIC (minimum mean-square error- successive-interference cancellation) detection of signal and the BPSK digital-modulation schemes which outperforms as compared with single relay co-operative system of MIMO-OFDM.

In 2014 Lin Dai, Bo Gui[et.al] presented a paper for the growing interest in an integration of the multi-hop (or-relaying) capability into the conventional remote networks. Particular paper proposed an OFDM- based scheme of selective relaying, where relay-selection at every hop is then performed on per-sub carrier basis. And then by joint-selection which is adopted at last-two-hops. Analysis outage clearly shows which full spatial-diversity gain may achieved with particular planned Selective-OFDMA Relaying. In mean time, no diversity-gain may obtain. If the entire OFDM-block, chooses same-relay with largest combined-SNR. It's also then demonstrated which with the coding among sub-carriers. A superior performance will be achieved by a Selective-OFDMA Relaying. It is with only the symbol of detection at every relay. Particular is highly-attractive as processing decoding and complexity delay obtained are so small.

In 2016 S.P.Porkodi[et.al] presented a paper for co-operative SISO, that has an emerged as promising technique in order to improve reliability, performances, and system capacity in the resource-limited (remote) environment. And with help of co-operative users (or the relays) the multiple copies of source's data are transmitted from- source to- destination & DS (direct signal) is then transmitted from the source to- destination in co-operative communication. In order to minimize fading diversity techniques are used at destination. Particular paper deals with maximum similar detection. And performance of system of a conventional-communication & co-operative communication system can be analyzed by utilizing forward and decode protocol.

III. CONCLUSION

In given paper, we have given the different techniques review for implementing successfully an OFDM- based MHCN (Multi-Hop Cellular Networks). These techniques are development of an efficient link-layer, evaluation of hardware complexity, adaptive relaying design, frame structure, adaptive algorithms, synchronization and end to- end evaluation of output with an efficient link.

REFERENCES

[1] R. U. Nabar, H. Bölcskei, and F. W. Kneubühler, "Fading Relay Channels: Performance Limits and Space-Time Signal Design," IEEE JSAC, vol. 22, no. 6, Aug. 2004, pp. 1099–1109.
[2] R. U. Nabar and H. Bölcksei, "Space-Time Signal Design for Fading Relay Channels," IEEE GLOBECOM, vol. 4, 1- 5 Dec. 2003, pp. 1952–56.
[3] Z. Lin, E. Erkip, and M. Ghosh, "Adaptive Modulation for Coded Cooperative Systems," IEEE 6th Wksp. Sig. Proc. Advances in Wireless Commun., June 2005, pp. 615–19.
[4] WiMAX Forum, "Mobile WiMAX-Part I: A Technical Overview and Performance Evaluation," June 2006.
[5] B. Can, H. Yomo, and E. De Carvalho, "Hybrid Forwarding Scheme for Cooperative Relaying in OFDM Based Networks," Proc. IEEE ICC, June 2006, Istanbul, Turkey,pp. 4520–25.
[6] M. Herdin, "Chunk Based OFDM Amplify-and-Forward Relaying Scheme for 4G Mobile Radio Systems," Proc. IEEE ICC, June 2006, Istanbul, Turkey, pp. 4507–12.
[7] M. Kuhn et al., "Two-way Communication for IEEE802.11n WLANs Using Decode and Forward Relays," Asilomar Conf. Sig., Sys., and Comp., Pacific Grove, CA, Nov. 2006.
[8] H. Mheidat, M. Uysal, and N. Al-Dhahir, "Equalization Techniques for Distributed Space-Time Block Codes with Amplify-and-Forward Relaying," IEEE Trans. Sig. Process, http://bbcr.uwaterloo.ca/~muysal/Publications.html
[9] R. Van Nee and R. Prasad, OFDM Wireless Multimedia Communications, Artech House, 2000.
[10] A. Bletsas and A. Lippman, "Implementing Cooperative Diversity Antenna Arrays with Commodity Hardware," IEEE Commun. Mag., vol. 44, Dec. 2006, pp. 33–40.
[11] IEEE 802.16's Relay Task Group, http://www.ieee802.org/16/relay/
[12] Y. M. Ki, E. S. Kim, and D. K. Kim, "Downlink Scheduling and Resource Management for Best Effort Service in TDD-OFDMA Cellular Networks," LNCS, vol. 3260, 2004, pp. 315–29.
[13] G. Senarath et al., "Preliminary Performance Benefit of Single-Hop OFDMA Relay in IEEE802.16," Tech. rep. IEEE C802.16mmr-05/010r1, Sept. 2005.
[14] C. Hoymann, "Analysis and Performance Evaluation of the OFDM-based Metropolitan Area Network IEEE 802.16," Comp.r Networks, Oct. 2005, pp. 341–63.
[15] I. K. Fu et al., "Reverse Link Performance of Relay based Cellular Systems in Manhattan-Like Scenario."
[16] D.S. Baum et al., "Final Report on Link Level and System Level Channel Models," Tech. rep. IST-2003- 507581 WINNER D5.4 v. 1.4, Nov. 2005.
[17] D. S. Baum et al., "An Interim Channel Model for Beyond-3G Systems: Extending the 3GPP Spatial Channel Model (SCM)," Proc. IEEE VTC Spring, Stockholm, Sweden, June 2005, pp. 3132–36.