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ANALYSIS OF LINK EFFICIENCY AND HANDOFF WITH MOBILITY MANAGEMENT IN COGNITIVE RADIO

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Abstract— Cognitive radio cellular network has been proposed as a solution to spectrum scarcity and spectrum inefficiency problems. However, they face challenges based on the opportunistic communication of secondary user, making it more difficult to support seamless communications especially when user moves out of the serving cell. In this paper, a novel architecture is constructed to aggravate spectrum availability. Based on this architecture, a management framework is developed to support mobility events which consist of user spectrum mobility management and user mobility management. Spectrum mobility management defines spectrum band for opportunistically communication secondary users. User mobility management defines selection of handoff so as to banish call dropping by considering an extended area QoS analysis is performed based on blocking probability, dropping probability, failure probability. Simulation results show that proposed system achieves better performance in terms of mobility support in CR cellular communication.
Keywords— Cognitive radio, spectrum pool, handoff, intercell resource allocation, spectrum mobility management, user mobility management.

I. INTRODUCTION

Wireless spectrum is assigned to license holders, by governmental agencies, on long term basis. Research has shown that in frequent use of allocated spectrum leads to wastage of frequency resources [1]. To address above problem Federal communication commission (FCC) has approved the use of unlicensed devices to share license spectrum [2] -cognitive network operated on interweave paradigm. The basic idea of cognitive network is CR user uses the licensed spectrum of PU user in its absence. The concept has been investigated to solve exponential growth on data traffic in cellular network [3], [4]

The difference between current cellular network and cognitive cellular network lies in spectrum handoff. In [6] a proactive spectrum handoff scheme is proposed where cognitive user predict spectrum availability based on past channel histories and intelligently switches between license bands prior to the appearance of primary/license users, which minimize interference to primary users and maintains reliable opportunistic communication of unlicensed users. Spectrum handoff scheme is developed based on discrete Markov chain to reduce call dropping probability[7].In [2] schemes has been proposed to analysis QoS based of three parameters say blocking, dropping and failure probability. To address the challenge - reliable communication in opportunistic spectrum availability and user mobility in cognitive network, First we propose a novel CR cellular network based on the spectrum pooling concept, which mitigates heterogeneous spectrum availability, based on this architecture a unified framework is defined so as to support spectrum mobility and user mobility. To support spectrum mobility, to maximize cell capacity, spectrum mobility management functions defines spectrum bands for CR users experiencing PU activity. User mobility management, for PU, mainly focuses on spectrum heterogeneity in space and offers a switching cost based handoff decision mechanism to minimize quality degradation and user mobility management, for CR, defines spectrum availability for CR in area out of cell boundary called extended area so as to minimize service quality degradation due to forced termination.

The rest of the paper is organized as follows: Section II presents the proposed network architecture. Performance Evaluation and simulation results are presented in section VII. Finally conclusions are presented in section VIII.

II. PROPOSED NEWTORK ARCHITECTURE

With proliferate of smart -phones there is an exponential growth in data traffic. The CR technology is considered as a promising solution to this data explosion problem on the current cellular network. Cognitive radio enables bandwidth aggregation by sharing spectrum with licensed users [8].The classical cellular network has significant switching latency-as the RF frontend frequency needs to be reconfigured whenever a PU activity is detected in current band. In proposed architecture spectrum pools are assigned to each cell exclusively with its neighbor cells with a predetermined reuse factor. Although the proposed architecture provides seamless communication between bands within the pool, it was still difficult to provide seamless communication to CR users moving across different cells. To address this problem we define to types to cell coverage as depicted in figure 1.

1. SPECTRUM MOBILITY MANAGEMENT

The difference between classical cellular network and proposed network is spectrum handoff. When licensed user appears in spectrum band CR users generally changes its spectrum without switching base station. Since CR users have time varying spectrum, each cell may not have enough bands to serve current users, the admission control scheme proposed in defines solution for this problem. When PU activity is detected in basic area, the BS performs intracell/intrapool handoff for all users requesting for new spectral band. If PU is detected in extended area, the BS performs intercell/interpoll handoff as it cannot find other available spectral bands for switching in that area

2. USER MOBILITY MANAGEMENT

Handoff is also initiated by user mobility in CR network, which happens at the BA boundary or EA boundary. When CR users reach the boundary of EA, they check the feasibility of intercell/intrapool handoff first.CR user can measure the signal strength from other BS directly, which is same as classical handoff. If CR user cannot find proper cell for intercell/intrapool handoff, they need to perform the intercell/interpool handoff to find a cell having different spectral pool. For classical cellular users, a large cell is advantageous as it reduces no. of handoffs [9].However large cell is not desirable in CR network as it increases the PU activity.

III. IMPLEMENTATION STEPS

The implementation of the proposed system is done in five steps.

STEP 1: Cellular network has been defined based on PU activity in basic area. Then the unallocated spectral bands are allocated to CR users governed by each cells spectrum configuration.

STEP 2: Step two includes calculations for performance. Performance of the system is evaluated in three classical QoS metrics: blocking probability (Pb), dropping probability (Pd) and failure probability (Pf). Calculation is based on state and transition probability.

1(a). Blocking probability for PU: Pb(i,PU), gives blocking probability for classical flow belonging to network ' i '.

A flow is blocked if it arrives while cell is already using more resources than service threshold (i.e. $n(i) \geq Thi$)

$$P_B(i,CR) = \sum_{s \in S} 1\Big|_{\sum_{j=1}^{N} n(j)=M} \times 1\Big|_{n(i) \geq K_i} \times \pi_s$$

$$P_B(i,CL) = \sum_{s \in S} 1\Big|_{n(i) \geq Th_i} \times \pi_s$$

1(b). Blocking probability for CR: In order for a flow to be blocked two conditions must be satisfies:
i. All resources must be occupied (∑ n(j) = M) and,

ii. Network i already used all of its resources (n(i) ≥ Ki) 2. Dropping probability: Classic flow ' f ' is never dropped. Therefore Pd(i,CR) is only considered, dropping probability of flow ' f ' belonging to network ' j '. For a flow to be blocked following two conditions must be satisfied

i. All channels (M) must be occupied (∑ n(k) = M)
ii. Network ' i ' using more resources than its physical processes (n(i) > Ki)

3. Failure probability: CR user experiences more of dropping and reduced blocking compared to classic traffic (Pd(i,PU) = 0).Therefore the overall performance is compared by Pf, where Pf is probability the arrived flow will not receive required service

$$P_F(i,CR) = P_B(i,CR) + (1 - P_B(i,CR)) \times P_D(i,CR)$$

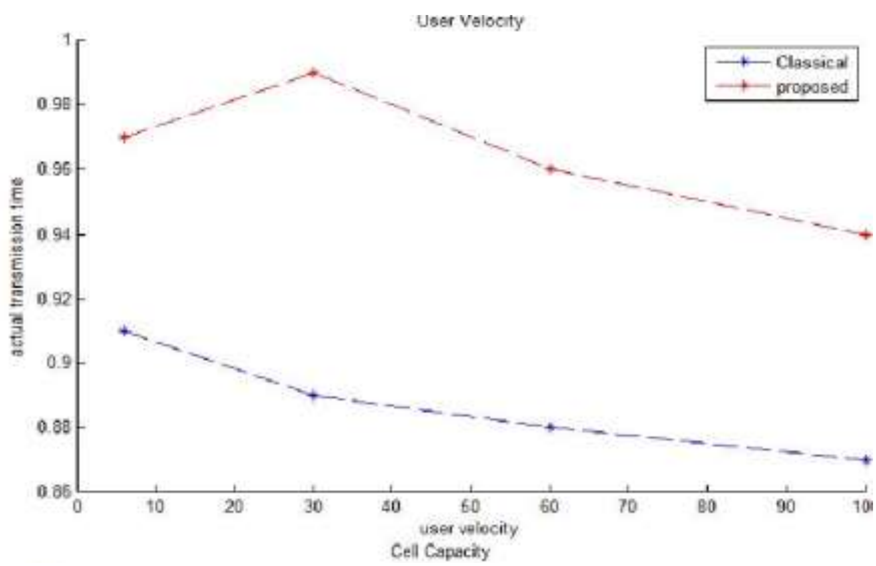
STEP 3: The unlicensed devices which are using the license spectrum are observed with user mobility where the user activity in EA is guided with EA configuration for CR users.

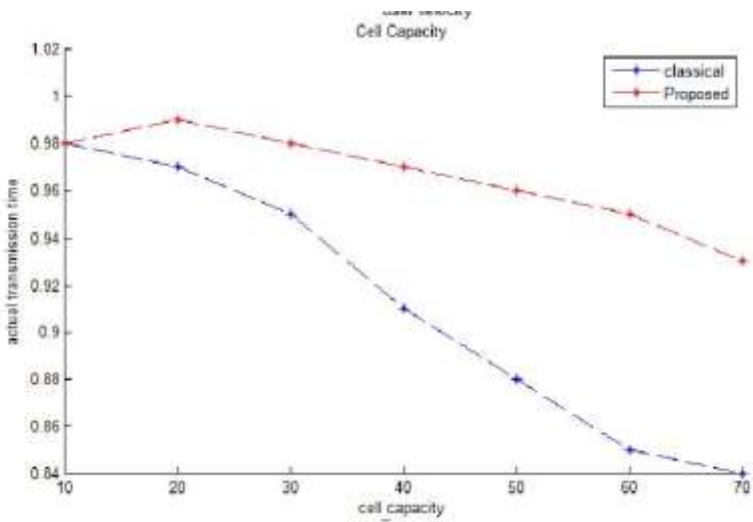
STEP 4: The calculations for QoS for CR users in extended area is done as defined in STEP 2.
STEP 5: Comparison of QoS in EA with that of BA is made graphically and valuation of performance of proposed system is done.

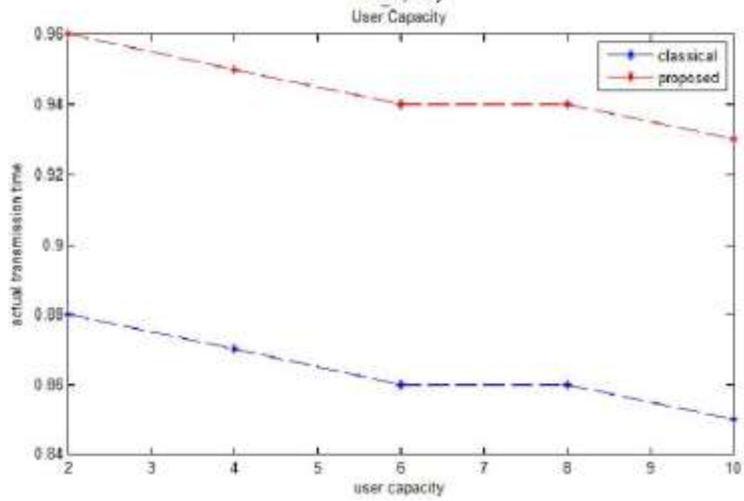
IV. RESULTS AND ANALYSIS

Figure below shows the link efficiency, which is the ratio of real transmission time over an entire simulation time. From the simulations the proposed system shows higher link efficiency over classical system, low link efficiency do to quality degradation caused by intercell/interpool handoffs. Furthermore when current cell users all of its resources then some mobile users cannot use spectrum resources until they move into new target cell or the spectrum availability changes, which also decreases link efficiency.

From these simulations, we can see that the proposed method achieves more transmission opportunities in a opportunistically communication environment regardless of users and network conditions







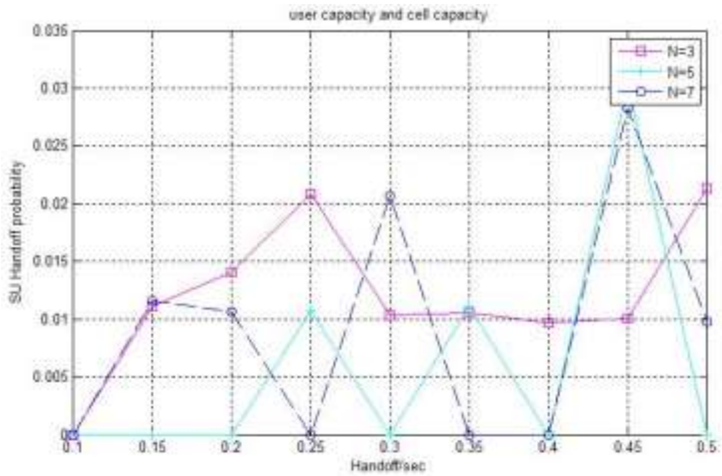


TABLE:

1)User Velocity vs Link Efficiency:

Sr no	User Velocity	Link Efficiency (Classical)	Link Efficiency (Proposed)
1	5	0.91	0.97
2	30	0.89	0.99
3	60	0.88	0.96
4	100	0.87	0.94

2)Cell Capacity vs Link Efficiency:

Sr no	Cell Capacity	Link Efficiency (Classical)	Link Efficiency (Proposed)
1	10	0.98	0.98
2	20	0.97	0.99
3	30	0.95	0.98
4	40	0.91	0.97
5	50	0.88	0.96
6	60	0.85	0.95
7	70	0.84	0.94

3)User Capacity vs Link Efficiency:

Sr no	User Capacity	Link Efficiency (Classical)	Link Efficiency (Proposed)
1	2	0.88	0.96
2	4	0.87	0.95
3	6	0.86	0.94
4	8	0.86	0.94
5	10	0.85	0.93

V. CONCLUSION

In this paper we present a mobility management scheme for CR cellular network. Availability of spectral bands varies over time and space, in CR network, and are distributed over a wide frequency range. First we proposed a pool based architecture which mitigates heterogeneous spectrum availability. Based on this proposed architecture diverse mobility events, consisting of spectrum and user mobility management is defined to minimize quality degradation and maximize cell capacity. Spectrum mobility management is developed for PU activity which defined proper spectrum band for CR based on current network load and stochastic connectivity model. In user mobility management the switching cost based handoff is
defined for PU and unallocated spectrum bands are defined for CR in extended area .Simulation results show that the proposed system shows maximum cell capacity and minimized quality degradation.

REFERENCES

1. Federal Communications Commission, “Spectrum Policy Task Force Report,” ET Docket No. 02-135, Nov. 2002.
2. Federal Communications Commission, “In the Matter of Unlicensed Operation in the TV Broadcast Bands: Second Report and Order and Memorandum Opinion and Order,” FCC 08-260, Nov. 2008.
3. M.M. Buddhikot, “Cognitive Radio, DSA and Self- X: Towards Next Transformation in Cellular Networks,” Proc. IEEE Symp. New Frontiers in Dynamic Spectrum (DySPAN ’10), Apr. 2010.
4. J. Sachs, I. Maric, and A. Goldsmith, “Cognitive Cellular Systems within the TV Spectrum,” Proc. IEEE Symp. New Frontiers in Dynamic Spectrum (DySPAN ’10), Apr. 2010.
5. L. Yang, L. Cao, and H. Zheng, “Proactive Channel Access in Dynamic Spectrum Network,” Proc. Int’lICST Conf. Cognitive Radio Oriented Wireless Networks (CROWNCOM ’07), July 2007.
6. X. Zhu, L. Shen, and T.P. Yum, “Analysis of Cognitive Radio Spectrum Access with Optimal Channel Reservation,” IEEE Comm. Letters, vol. 11, no. 4, pp. 304-306, Apr. 2007.
7. I.F. Akyildiz,W.Y.Lee, M.C. Vuran, and S. Mohanty,”Next Generation /Dynamic Spectrum Access/Cognitive Radio Wireless Network: A survey ,”Computer Network ,vol. 50, pp. 2127-2159,Sept. 2006
8. M.M. Buddhikot, I. Kennedy, F. Mullany, and H.Viswanathan,“Ultrabroadband Femtocells via Opportunistic Reuse of Multi-Operator and Multi-Service Spectrum,” Bell Labs Technical J.
9. P.A. Ramsdale and W.B. Harrold, “Techniques for Cellular Networks Incorporating Microcells,” Proc. IEEE Int’l Symp. Personal, Indoor and Mobile Radio Comm. (PIMRC ’92), pp. 169-173, Oct. 1992.