International Journal For Recent Developments in Science & Technology
2581-4575
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QOE-BASED RESOURCE ALLOCATION FOR HETEROGENEOUS TRAFFIC MULTI-RADIO COMMUNICATION BASED ON COOPERATIVE LEARNING

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Abstract: Since quality measurement of end user plays an ever increasing role in development of the wireless communications toward the 5G era, mean opinion score (MOS) has become a widely used metric, not only because it reflects the subjective quality experience of end users but it also provides a common quality assessment metric for traffic of different types. This paper presents a distributed underlay dynamic spectrum access (DSA) scheme based on MOS which performs integrated traffic management and resource allocation across traffics of dissimilar characteristics (real-time video and data traffic). The presented scheme maximizes the overall MOS through reinforcement learning for a system where primary users coexist with secondary users accessing the same frequency band of interest, while satisfying a total interference constraint to the primary users. The use of MOS as a common metric allows teaching between nodes carrying different traffic without reducing performance. As a result, the docitive paradigm is applied to the presented scheme to investigate the impact of different docition scenarios on overall MOS where a new comer node being taught by experienced peers with similar and dissimilar traffics. Simulation results show that the docition will reduce the number of iterations required for convergence by approximately 65% while preserving the overall MOS more than acceptable level (MOS >3) for different secondary network loads. In terms of applying docition between nodes with similar and dissimilar traffic, simulation results show all different diction scenarios have the same performance in terms of MOS.

1. INTRODUCTION

Wireless network design scenario is changing rapidly [1], in future wireless services will be provided through heterogeneous networks [2, 3], and customers of any subscribed network can connect to any other network when the capacity of its subscribed network goes below a certain threshold value [2]. In a cooperative network a channel sensing mechanism is used by one network to look for unused spectrum which can be borrowed from another network [4]. As various networks generate different types of traffic it is necessary for traffic controllers to deal with different type of traffic characteristics. The prediction algorithms must be able adapt to range of traffic patterns predicted and various traffic flows with best accuracy. There exist several wireless networks, such

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as Bluetooth, wireless LANs(WLANs), Universal Mobile Telecommunications System(UMTS) [5], Cellular networks, , Long Term Evaluation(LTE) etc. These networks are designed for specific service needs and vary in terms of bandwidth, cost, latency, area of coverage, and quality of service (QoS). Third-generation (3G) wireless systems like Universal Mobile Telecommunications System (UMTS) can deliver a maximum data rate of 2 Mb/s at lower cost and have wide coverage. WLANs support bandwidth up to 54 Mb/s at very low cost. The future generation of WLANs is expected to provide data rates of 100 Mb/s. WLAN can support low-mobility users and have small coverage area. None of the existing wireless systems can simultaneously satisfy the high bandwidth, low latency and coverage needs of mobile user at low cost. Here is the motivation for centralized spectrum manager.

2. RELATED WORK

There are two approaches in designing next generation cooperative networks: To develop a new wireless system with multi radio

- Interfaces and technologies that can satisfy the requirements of the services demanded by mobile users.
- To integrate the existing wireless systems [6] in between and the user will receive their services through the best available wireless network.

Developing the new wireless system is expensive and consumes more time for development and deployment. So the second option is suitable. In second approach heterogeneous wireless systems, each optimized for some specific service demands and coverage area and cooperates with each other to provide "always best connection" to end mobile users. In integrated heterogeneous network architecture, each user is always connected to the best available network. The integrated networks eliminate the weaknesses of the individual systems. The basic idea is to use the best available network at any time. The integrated networks must have the following characteristics

- Support to choose best network based on users' service needs
- High-quality security and privacy
- Protocols to guarantee seamless intersystem mobility for end user.
- Architecture should be scalable new network can be connected easily and any number of wireless systems of different service providers.

3. SYSTEM ARCHITECTURE

If any network is unable to maintain the QoS provisions due to the heavy traffic, the network can use the unused spectrum of another network using the centralized spectrum manager; simulator is designed to measure the spectrum manager's performance and to design the cooperative network using centralized spectrum manager. The proposed system consist of the centralized spectrum manager five different networks (Wifi, WiMax, Cellular, LTE and Zigbee) , nodes for different networks can be created by selecting the network type in the simulator, once the nodes are created, on running the simulator

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it calculates the network traffic on each network and display the result simultaneously and communication between nodes.

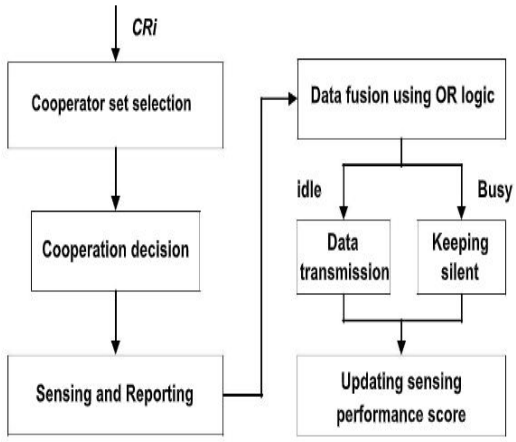

Fig 1: procedure of SBC

4. TRAFFIC MODEL

The traffic model is use to calculate the traffic load on the several heterogeneous networks. To generate predictions, information about past events, time-series data, is collected. 1), ... , y(1)–Time series is a sequence of observations y(t), y(t of a random process Y at discrete time intervals, where an observation at time t is given by y(t)The traffic model finds the traffic load on the network, by using heuristic approach

$$y(t)=\Psi^{T}(t)\theta+e(t)$$

Parameter estimation after the traffic load is found the parameters are estimated for handover. For parameter estimation here we use RLS (Recursive Least Square) technique. RLS (Recursive Least Square) algorithm recursively finds the filter coefficients that minimize a weighted linear least squares cost function relating to the input signals.

5. EXISTING SYSTEM

Network selection schemes can be categorized into two types, i.e., distributed or hybrid schemes, in both types of schemes, it is assumed that, there is a central network entity like the network interoperating agent (NIA) in the backbone, broadcasting system information periodically to all the MHs (Mobile Hosts) in the heterogeneous networks. In distributed schemes the MH periodically updates the cost functions of its reachable networks, using the broadcasted system information and by the user preference of itself. The network with the minimum cost function is selected and a vertical handoff will be triggered if it is different from the current serving network. The end users care about the sharing of the radio spectrum and system is interested in the optimization in global spectrum efficiency, and this conflict is influenced by the increasing freedom given to the end users.

Therefore, network selection based on distributed schemes cannot result in optimal use of the global radio spectrum, and the advantages in the target network may get destroyed due to handoff and load unbalance. A hybrid network selection scheme is used, the basis of which is a two-level cost function model. First, the optimal distribution of user number throughout the whole heterogeneous system is determined according to the systemlevel cost function, and then, an adjustment value of user number distribution in each network is

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calculated and passed to all the MHs, together with the broadcasting information. Then the MHs update their user-level cost functions and make network selection, just like the processes in, except that the adjustment value is added to the user-levelcost function as a special parameter. This scheme tries to influence the individual decision with system optimization advice, hoping that the actual user distribution can converge to the optimal distribution. The end users' desire for bandwidth and their personal preferences still place a decisive role in network selection. In addition, the assumption of identical service request of each MH limits the practicability of the scheme. In this paper we are proposing a centralized spectrum manager scenario which will communicate with all the other networks which are connected to it and have the state information such as traffic on the network, future traffic requirement predicted by the network etc. After having the state information of the network, the centralized spectrum manager chooses the network for vertical handover [9] having the less traffic flow on it. As different networks generate different types of traffic it is necessary for traffic controller module to deal with variety of traffic characteristics. The prediction algorithms must be able adapt the range of traffic patterns predict various traffic flows with best accuracy.

6. PROPOSED SYSTEM

In cooperative networks users move between different networks. They want to maintain their ongoing communications while moving from one network to another. These heterogeneous networks may or may not belong to the same service provider. Hence, support for inter-system movement between networks of different service providers is required in cooperative networks. One way of achieving roaming among networks of different service providers is to have SLAs (service level agreements) among them. This approach is not feasible due to the following reasons:

First, operators have reservations for the technologies they are using for their communication (which is required for authentication, billing, and service provisioning when an SLA [5] is established between operators) to all other operators.

Second, each time a new operator implements itswireless network, a SLA has to be created with every other operator separately. The number of operators of wireless networks is very large; there are a large number of operators for several wireless networks. Given the large number of operators, it is almost impractical for network operators to create direct SLAs with every other operator. Therefore, there is a need for a new architecture to achieve roaming among heterogeneous. Heterogeneous wireless networks should have the following characteristics:

In case of a contention based allocation, the SM advertises available resources and its parameters to all requesting networks. A number of requesting networks sends requests to the SM using a contention mode. The SM will allocate the resource to the first successfully received request. In an auction based approach each channel is advertised

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with a minimum price and then kept resource open for certain duration so that requesting networks can bid for the resource. The highest bidder from the list is allocated the resource. Traditionally, frequency-division has been adopted to divide the electromagnetic spectrum between different wireless technologies. In frequency-division, portions of the spectrum are statically assigned to particular wireless technology to support their transmissions. This assignment has some inherent disadvantages with respect to spectral efficiency. For example, consider two operators operating on their licensed bands. It is possible that the one wireless network operating in a particular frequency band is fully loaded, while the second may have unused resources. It would be profitable for both wireless network technologies, if these unused resources were shared to allow more capacity for the fully loaded operator. This form of spectral sharing is much easier to accomplish if the underlying access technique in the two operators is multicarrier-based.

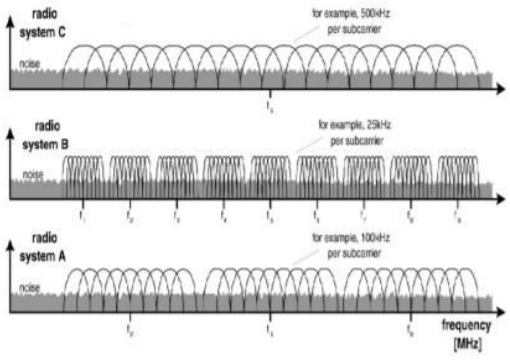

Fig 2: Different frequency channels used by different radio systems

In order to allow different wireless technologies to borrow/lend spectral bands from/to different wireless networks residing in the same or different spectral region, we could conceive of a simple ad hoc strategy for selecting the frequency among carriers

7. RESULT

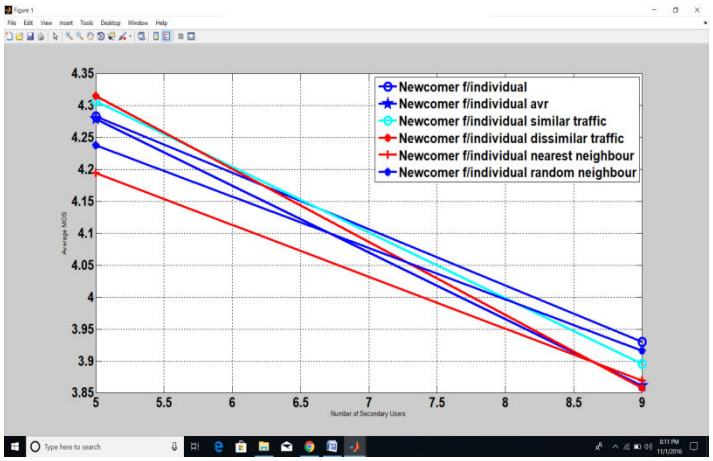

Fig: Average MOS in SN.

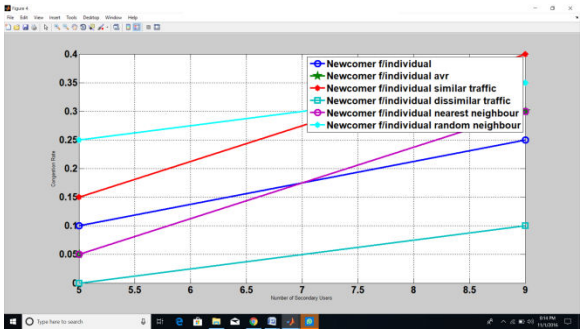

Fig 3: Congestion rate

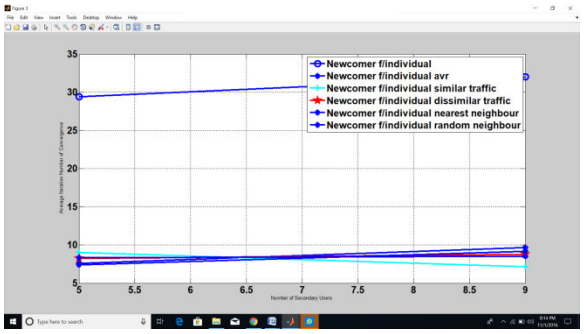

Fig 4: Average number of cycles at the convergence point.

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CONCLUSION

The proposed system architecture for cooperative networks consisting of the low complexity centralized spectrum manager which is the heart of the system, aiming to optimally connect the end users to the network selected for handoff using ANSM in heterogeneous wireless networks, aiming to maximizing the global spectrum efficiency, and try to remove the load unbalancing problems occurred in cooperative networks. The future work would be to implement this method and compare with existing one.

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