International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-1, November 2019

Extended Distributed Suboptimal Channel Assignment Algorithm Based Channel Assignment for Wireless Local Area Networks in a Multi Agent Environment

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Abstract: ***Due to the universal use of IEEE 802.11 – based networks, the systematic positioned of Wireless Local Area Networks (WLANs) come to be a Challenge. With the intense admiration and stationed of WLANs, well organized administration of wireless bandwidth is elegantly a major progressive. The advanced techniques upgrade the utilization of wireless bandwidth in the factors of wireless local area networks (WLANs) employing advanced channel allocation techniques between Interfering Access Points (Aps). This work formalizes the channel assignment as a multiagent hampering optimization problem in a multi agent environment and intend a latest collective medium assignment procedure called Extended Distributed Suboptimal Channel Assignment (EDSCA), which utilizes Distributed Pseudo tree optimization (DPOP).***

Index Terms: ***Wireless local area network, multi agent, access point, distributed constraint optimization problem, Extended Distributed Suboptimal Channel Assignment.***

I. INTRODUCTION

On account of enlarged deployment and popularity of WLANs, the systematic administration of wireless scope is growing efficiently important. This work focuses on a particular resource dividing problem in the factors of 802.11 – biased WLANs – medium allocation. Examine a well-structured wireless condition in which diverse Access Points (Aps) are serviceable. Every AP function on a specific channel management. In 802.11 WLANs, the wireless identity of an agent examines the wireless channel to determine the access point with the powerful signal and connect with it. In order to lower intrusion among various APs in the identical physical area management performs elaborated Radio Frequency (RF) site values, frequently employing frequency analyzer, advanced to positioning up Aps within the fabrication and allocation of particular mediums to them. [1].

In frequency bandwidth (2.4 and 5 /GHZ) assigned by a serving body the WLANs operate in improper sections. For instance, the Federal transmission in the united states. Every standard WLAN (802.11/a/b/g) describes a fixed amount od mediums for mobile and APs users. For instance, the 802.11b pattern describes a sum of 14 spectrum mediums in which 1 between 11 are authorized in the united states. The key principle to note concerning these mediums are the mediums originally stand for the core frequency that the transceiver within the AP and radio users. There is about only 5MHz detachment among the 802.11b signal and the center frequency which engaged about 30 MHz of the spectrum bandwidth. The signal drops over 15 MHz of every surface of the frequency center. As an outcome, an 802.11b signal on any medium overlaps with various adjoining frequency medium creates intrusion. This departs only three mediums (medium1,6 and 11) that can be deployed concurrently without effecting intrusion. As a primary pattern principle, APs within radius of each other are pooled to various "non-overlapping" mediums. The capability of medium allocation utilizing non-overlapping mediums is executed by: Every AP phase examines other information transmission in the medium it is utilizing. If the magnitude of congestion in that medium is higher that a threshold, then the initial AP attempts to progress on to a smaller clogged medium. Thus, we name this method as a Least Congested Channel Search (LCCS) [1].

In various active frameworks, the WLAN is positioned in the condensed residential areas, the confusing Aps be situated to various management sectors, thus a collaborative medium allocation approach is mandatory. Some collaborative approach needs interchanging information control between a wired cluster [2], which is not attainable when comparing Aps with various management sectors. It also likely to request heavy-handed approaches [3], but it may demand direct client collaboration, which forces extra congestion handling overhead.

II. RELATED WORK

The channel allocation aims to allocate number of channels to each cell in such way that maximum frequency spectrum utilization takes place and interference is minimized.

Revised Manuscript Received on November 30, 2019.
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In this chapter various schemes that are used to allocate channels to the cells are reviewed and performance of each of these schemes is discussed.

Various medium assignment algorithms have been presented in the compositions, based on a wide range of different techniques, comprising gaming consequences [4], graph coloring [5], local bargaining [6] and auction mechanism [7]. However, these algorithms are not suitable for distributed implementation, what is a requirement when APs be-long to several management sectors. Consequently, in the following, we discuss the proposals that use distributed and cooperative approaches for channel allocation in WLANs.

Lee et. al. [8] introduces a wireless network approach pointing out a set of AP locations and allocating channel problems based on the formulation of Linear Programming (LP). This principle is naturally centralized, considering a collective environment and most dominantly did not express the effective nature of the medium requirement. In cellular networks the Channel allotment is a well learned problem [9]. Cells in a mobile network has very dissimilar features when equated to IEEE 802.11 APs. Every unit cell have comparatively extreme coverage surface, and a huge power based phase is employed to interlink the mobile phones. The mobiles are also ordered in a precise systematic fashion and the surface coverage area very consistent disparate indoor surroundings. On account of these features, cases such as [10], [11], concentrate on centralized optimization strategy like a assorted linear integer model programming. These strategy functions well in mobile networks as the channel allocation is calculated once and hardly modifies. Due to such principle dissimilarities, these methods cannot be administered to the channel allocation problem in WLANs.

A. Dynamic Allocation

The allocation of channels to cells discussed so far has been based on fixed channel allocation (FCA): groups of mediums are constantly assigned to given cells corresponding to certain reutilization structure. Dynamic Channel Allocation (DCA) refers to a variety of schemes in which mediums are assigned to agents in a cell according to different congestion constrains. The two types of DCA schemes are centralized and distributed. In Centralized DCA, all the available channels are kept in a single central pool from where the central computer allocates channels to different cells on demand, and the cells return the channels to the central pool when the call is finished. In the distributed dynamic channel allocation (DDCA) scheme, the available channels are divided into multiple equal size groups. Any cell in the cluster can obtain the channel group if one of its adjacent cells is not holding the same group. The same channel group can be used by the two base stations if the distance between these two base stations is more than the minimum reuse distance. In this scheme each base station keeps the storage information table which stores information about the channels that are presently used by the cell as well as by neighboring cells.

B. Agent Architectures

Based on the goals, a number of different agent architectures have been proposed [12] –[16].

1) Reactive Architectures

In control to permit better functioning in dynamic environment, the reactive agent architecture was proposed, where the consultation mediums break to act upon. It is the simplest architecture for agents. In this, the agent has no decision-taking capability, and it only reacts to the environment in which it exists. The agent behavior in this architecture is only a mapping between stimulus and response.

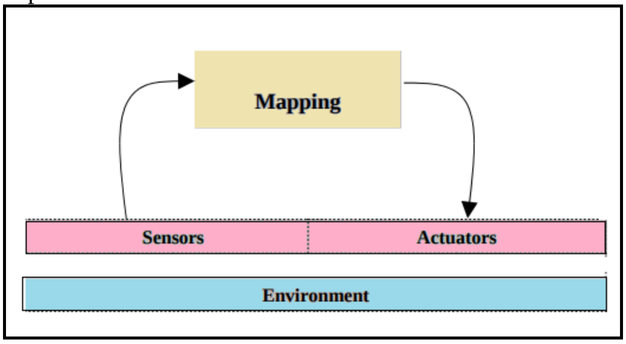

Figure 2.1: Reactive Agent Architecture

The reactive agent architectures are divided into three sub-categories i.e., entirely reactive, easily reactive design, and advanced reactive design. Entirely reactive channels take action short of organizing and did not consist of an illustrative design of the globe. The easily reactive design method comprise a illustrative design of the world and used reactive actioning to select among different possible ways at compilation time. While in sophisticated reactive planners, agents include more complex constructs to handle execution failures. Fig. 2.1 illustrates the reactive architecture.

2) Deliberative Architectures

Agent architectures that are able to maintain and maneuver representations of the world, without using stimulus-response rules are called deliberative agent architectures. A deliberative architecture is one that includes some consideration about the alternative courses of action, before an action is to be performed on a given set of inputs. Instead of mapping actuators directly with the sensors, the deliberative architecture considers the states, sensors, past results of particular actions, and additional information that is required to select the best action to perform. The deliberative architecture is shown in Fig. 2.2.

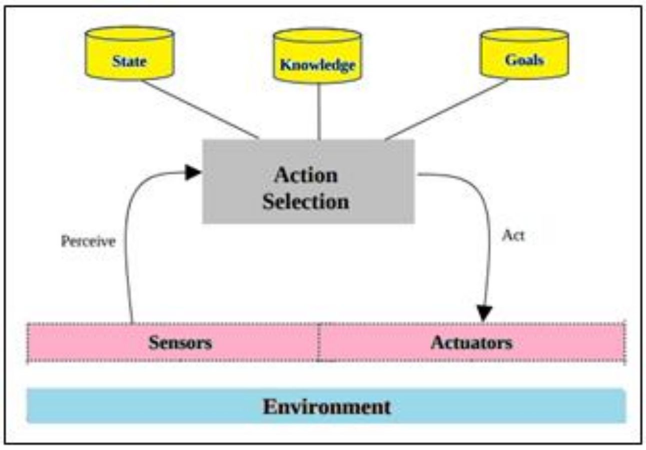

Figure 2.2: Deliberative Agent Architecture

3) Blackboard Architectures

The blackboard architecture is extremely common architecture and is also very interesting.

HEARSAY-II was the first blackboard architecture, and it was a speech understanding system. This architecture works around a global work area called the blackboard. The blackboard is a universal work area for a number of agents that operate cooperatively to solve a particular problem. Therefore, the blackboard consists of information about the environment, but the cooperative agents produce intermediate work results. Fig. 2.3 shows an example blackboard architecture that could be applied to an agent system.

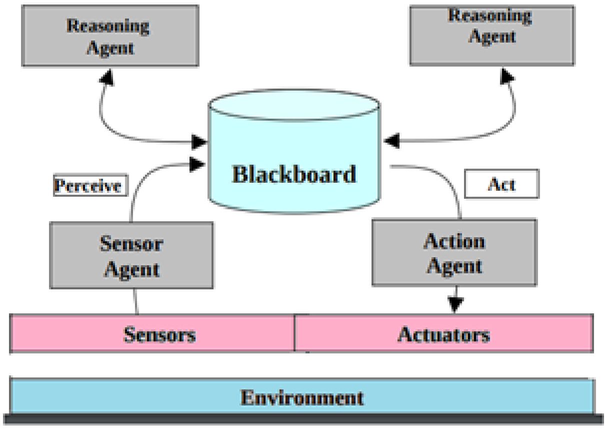

Figure 2.3: Blackboard Agent Architecture

III. PROBLEM FORMULATION

The mail goal of a WLAN [17] – [21] is to deliver wireless interconnectivity for a positive exploration region adjoining the AP. In implementation an extensive number of APs may be functioning on the identical area. In this framework, the administration of wireless medium is exceptionally a key due to the interferences of adjoining and adjacent channels.

The objective is to deliver a disseminate process established on Multi channel conception [21], authorizing various group of AP for inquiring the better resolution for the medium assignment problem. Thus the collaboration of DCOP and DPOP process [22], [23] encounter these specifications.

A. Multi Agent Systems (MAS)

MAS Systems composed of multiple entities that can interact among them (i.e. it is hard to define precisely). The main features are: relevant degree of autonomy, interaction with the environment, and Sensing and modeling of the environment.

Agents can execute actions (e.g., turn on the sensor to acquire data). Utility function values each action (e.g., value of acquired data minus cost to obtain it). Utility of each agent depends on actions of other agents (e.g., value of data depends on whether other agents acquired that data already). Agents choose actions to maximize the social welfare (sum of agent's individual utilities).

B. DCOP Definition:

The method of discovering a resolution to an amount of limitations that charge orders over a group of variable is symmetrically mentioned as limitation contentment. When the interpretation entails a level of standard, the issue is structured as a Constraint Optimization Problem. A dispensed COP comprise of a group of variables that are dispensed over a pool of cooperated medium as constraint principles: rewarding parameters then repay values in a particular span. The main objective is to maximize overall unbiased process, neglecting the value of pleased limitations.

DCOP is a combination of Cost network with Agents.

DCOP is a tuple {A, X, D, Ch, Cs}

Where,

A = {A1, . . . , Ak } is a set of agents

X = {X1, . . . , Xn} is a set of variables,

D = {D1, · · · , Dn} is a set of variable domains

Ch and Cs represent hard and soft constraints

Cs = F = {F1, . . . , Fm} is a set of constraint functions.

Each function

$$F_i: D_{i_1} \times \ldots \times D_{i_{r_i}} \rightarrow \Re \text{ depends on a set of variable } X_i \subseteq \mathcal{X}$$

C. Multiagent constraint optimization problem (MCOP)

A separate multiagent constraint optimization problem (MCOP) is an order of records <X, D, R> such that:

X = {X1, ..., Xm} is the pair of agents/variables;

• D = {d1, ..., dm} is a pair of variables field, each specific as a limited pair of set of potential principles.

• R = {r1, ..., rp} is a pair of connections,

where a connection ri is a parameter di1 × .. × dik ⟶ $\Re_+$ which indicates how much value is allocated to every potential concert of principles of the complicated inconstant.

D. The DPOP algorithm

The DPOP algorithm has three stages. Initially, the medium set up the pseudotree formation that to be employed in other two stages. The following stages are the UTIL and VALUE generations.

```
DPOP(X , D, R)
Each agent Xi executes:
Phase 1: pseudotree creation
     elect leader from all Xj ∈ X
     elected leader initiates pseudotree creation
     afterwards, Xi knows P(Xi), PP(Xi), C(Xi) and PC(Xi)
Phase 2: UTIL message propagation
      if |Children(Xi)| == 0 (i.e. Xi is a leaf node) then
          UTILXi (P(Xi)) ← Compute utils(P(Xi), PP(Xi))
          Send message(P(Xi), UTILXi (P(Xi)))
     activate UTIL Message handler()
Phase 3: VALUE message propagation
      activate VALUE Message handler()
END ALGORITHM
```

Algorithm 1: DPOP Algorithm

IV. EXTENDED DISTRIBUTED SUBOPTIMAL CHANNEL ASSIGNMENT (EDSCA) ALGORITHM

The proposed algorithm is presented in Algorithm 2. It has 3 phases namely: DFS arrangement, UTIL propagation and VALUE propagation.

```
Procedure Initialization
     PHASE 1: DFS Arrangement;
D* = Ø;
Rj = null;
Utildim = n;
LocalViewj = null;
end

Procedure DSCAMain
      PHASE 2: UTIL Propagation;
          Compute Rj;
           LocalViewj = Rj ;
          For all the ak ∈ Cj do
              Receive UTIL (UTILk) from ak;
              LocalViewj = LocalViewj ⊕ UTILk;
          End
          D* = SELECT(LocalViewj, min(x2))⊥x2;
          if (Pj ≠ Ø) then
              UTILj = SELECT(LocalViewj , criterium);
              UTILj = CUT(UTILj, maxLines);
              UTILj = SELECTMin(UTILj )⊥x1;
              Send UTIL (UTILj) to Pj ;
         else ;
               VALUEj = D*;
                For all the ak ∈ Cj do
                     Send VALUE (VALUEj ) to ak;
          end
 end
  PHASE 3: VALUE Propagation
     Receive VALUE (VALUEj) from Pj ;
     D* = D* ∪ BestValue(LocalViewj, VALUEj );
     VALUE j = D*;
      For all the ak ∈ Cj do
          Send VALUE (VALUEj ) to ak;
     end
end
```

Algorithm 2: Extended Distributed Suboptimal Channel Assignment (EDSCA) Algorithm

V. EXPERIMENTAL RESULT

The DSCA algorithm is estimated by counterfeit, and when contrasted with the standard algorithm LO-! [22] and Hsum [23]. Also we incorporates in the differentiation approach utilizing the DPOP procedure, since it looks for the optimal resolution and the Random technique, which casually assigns channel. The dimensions of multi agent network with the amount of nodes vary from 10 to 100 and various network frequencies with the median degree of nodes vary from 3 to 6. While performing these operations there metrics are considered, the amount of messages controlled, the global resolution cost and the congestion load of the information control.

The diagram 5.1 differentiate the proportion of controlled messages exchanged as a operation of the group of nodes, for network structure with AD=6. The average amount of information interchanged by EDSCA is a magnitude control lesser than LO-A. From both such instances, it can be noticed nearly untwisted amount of increasing information with the group of nodes.

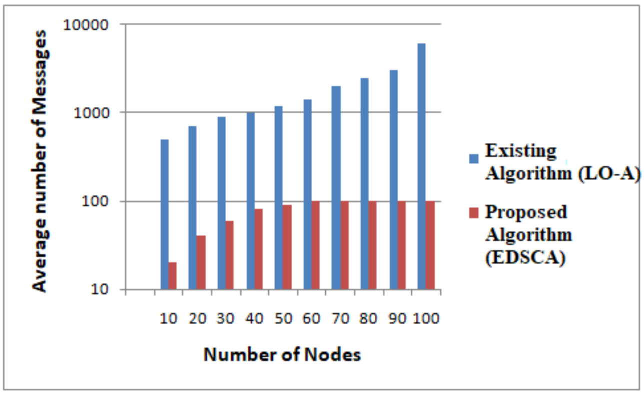

Figure 5.1: Number of exchanged control messages (AD=6).

VI. CONCLUSION

This work integrates disseminate artificial intelligence exploration techniques with wireless optimization network complications. The medium assignment complication is represented as a DCOP, which utilizes multi agent method. We investigate and proposed a current collective medium assignment method employing DPOP. Our solution consequently enlarges the computing while safeguarding a better resolution standard.

REFERENCES

1. Jim Geier, “Assigning 802.11b access point channels,” Wi-Fi Planet.
2. Chen, J. K., de Veciana, G. and Rappaport, T. S. (2009). Site-Specific Knowledge and Interference Measurement for Improving Frequency Allocations in Wireless Networks. IEEE Transactions on Vehicular Technology, vol. 58, no. 5, 2366-2377.
3. Yue, X., Wong, C.-F. and Chan, S.-H.G. (2011). CACAO: Distributed Client-Assisted Channel Assignment Optimization for Uncoordinated WLANs. IEEE Transactions on Parallel and Distributed Systems, vol. 22, no. 9, 1433-1440.
4. Nie, N. and Comaniciu, C. (2006). Adaptive channel allocation spectrum etiquette for cognitive radio networks. Journal of Mobile Networks and Applications, vol. 11, no. 6,779-797.
5. Huang, J., Berry, R. A. and Honig, M. L. (2006).Auction-based spectrum sharing. Journal of Mobile Networks and Applications, vol. 11, no. 3, 405-418.
6. Cao, L. and Zheng, H. (2005). Distributed spectrum allocation via local bargaining. 2nd Annual IEEE Communications Society Conference on Sensor and Ad Hoc Communications and Networks, 475-486.
7. Peng, C., Zheng, H. and Zhao, B. Y. (2006). Utilization and fairness in spectrum assignment for opportunistic spectrum access, Journal of Mobile Networks and Applications, vol.11, 555-576.
8. Youngseok Lee, Kyoungae Kim, and Yanghee Choi, “Optimization of ap placement and channel assignment in wireless lans,” in Proceedings of 27th Annual IEEE Conference on Local Computer Networks (LCN), 2002.
9. T. Rappaport, Wireless Communications: Principle and Practice, Prentice Hall, 1996.
10. Bhaskar Krishnamachari, Stephen Wicker, Ramon Bejar, and Cesar Fernandez, “On the complexity of distributed selfconfiguration in wireless networks,” Journal of Telecommunication Systems, 2003.
11. Filipe Mazzini, Geraldo Mateus, and James Macgregor Smith, “Lagrangean based methods for solving large-scale cellular network design problems,” Journal of Wireless Networks, 2003.
12. Balakrishnan. S and K L Shunmuganathan. Article: A JADE Implementation of Integrated Agent System for E-Mail Coordination (IASEC). International Journal of Computer Applications 58(5): 5-9, November 2012.
13. P.Arivazhagan, Balakrishnan. S and K L Shunmuganathan. “An Agent Based Centralized Router with Dynamic Connection Management Scheme Using JADE”, International Journal of Applied Engineering Research, ISSN 0973-4562, Volume 11, Number 3 (2016) pp 2036-2041.
14. Balakrishnan. S and K L Shunmuganathan, R. Sreenevasan, “Amelioration of Artificial Intelligence using Game Techniques for an Imperfect Information Board Game Geister” International Journal of Applied Engineering Research (IJAER). ISSN 0973-4562. Vol 9, Number 22 (2014) pp. 11849-11860.
15. Balakrishnan. S and K L Shunmuganathan, An Agent Based Collaborative Spam Filtering Assistance Using JADE”, International Journal of Applied Engineering Research, ISSN 0973-4562, Volume 10, Number 21 (2015) pp 42476-42479.
16. S.Balakrishnan, “An Overview of Agent Based Intelligent Systems and Its Tools”, CSI Communications magazine, Volume No. 42, Issue No. 10, January 2019, pp. 15-17.
17. S. Balakrishnan, B. Persis Urbana Ivy and S. Sudhakar Ilango, “A Novel And Secured Intrusion Detection System For Wireless Sensor Networks Using Identity Based Online/Offline Signature”, ARPN Journal of Engineering and Applied Sciences. November 2018, Vol. 13 No. 21, pp. 8544-8547.
18. S.Balakrishnan, Vinod K, B. Shaji. (2018). “Secured and Energy Efficient AODV Routing Protocol For Wireless Sensor Network”, International Journal of Pure and Applied Mathematics, Vol. 119, No. 10c, 2018, pp. 563-570.
19. S.Balakrishnan, J.P.Ananth, L.Ramanathan, S.P.Premnath, (2018). “An Adaptive Energy Efficient Data Gathering In Wireless Sensor Networks”, International Journal of Pure and Applied Mathematics, Volume 118 No. 21, 2018, pp. 2501-2510.
20. J.P.Ananth, S.Balakrishnan, S.P.Premnath, (2018). “Logo Based Pattern Matching Algorithm for Intrusion Detection System in Wireless Sensor Network”, International Journal of Pure and Applied Mathematics, Volume 119, No. 12, 2018, pp. 753-762.
21. Ranjeethapriya K, Susila N, Granty Regina Elwin, Balakrishnan S, “Raspberry Pi Based Intrusion Detection System”, International Journal of Pure and Applied Mathematics, Volume 119, No. 12, 2018, pp.1197-1205.
22. Chen, J. K., de Veciana, G. and Rappaport, T. S. (2009). Site-Specific Knowledge and Interference Measurement for Improving Frequency Allocations in Wireless Networks. IEEE Transactions on Vehicular Technology, vol. 58, no. 5, 2366-2377.
23. Mishra, A., Banerjee, S. and Arbaugh, W. (2005). Weighted coloring based channel assignment for WLANs, ACM SIGMOBILE Mob. Comput. Commun. Rev., vol. 9, no. 3, 19-31.

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