AMERICAN JOURNAL OF ICT AND INNOVATION (AJICTI)

VOLUME 1 ISSUE 1 (2026)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of
ICT and Innovation (AJICTI)

Volume 1 Issue 1, Year 2026
https://journals.e-palli.com/home/index.php/ajicti

Priority of the Network Selection Based on the Rules Select Using Deep Reinforcement Learning

Anas A. Nicola[1*]

Article Information

Received: April 03, 2026

Accepted: June 16, 2026

Published: August 01, 2026

Keywords

Cognitive Radio Network, Deep Reinforcement Learning, Fuzzy logic, Heterogeneous Networks, Internet of Things, Probability Collision

ABSTRACT

The priority of the network selection based on the rules selection with specific time identified in the loop of procedure selection. Furthermore, there is several criteria of selection network, offers a network selection technique that is based on deep reinforcement learning. Therefore, Traditional algorithms for network selection make use of selection approaches are dependent on prior information about the network under consideration. Thus, the criteria of selection networks, once mobile terminal (MT), moves their location, it has gathers much higher various handoff information. However, on this situation MT spend much time for selecting suitable network in complex heterogeneous networks. However, to simplify the connection management and handoff dissection automatically is organized on this research work, as to provide the intelligent method for auto select connectivity for the best networks auto selection. Here, we describe the design of automatic intelligent hybrid connection between different radio resource; the challenge considering there based on the parameters on which candidate network discover from the list compression between others networks. Thus, during the mobile terminal (MT) moving. A number of parameters are measured scanning periodically. And, if there any of these parameters is logically exist predefined on the rule base of the network of connectivity for their auto select, then the decision is triggered for the decision of the handoff it becomes more reliability for connection. However, the contribution of this work. Researcher described the methods of to introduce a novel cooperative of proposed intelligent selection mechanism for multi-connection with hybrid connectivity.

INTRODUCTION

In a complex network environment that has numerous major networks, it is difficult to assess the statistical elements of the system without first getting insight into the system's principal users. This is because determining which users are contributing the most to the system is difficult. As a direct result of this, the vast majority of research operates under the presumption that background of the information concerning (Darabkh, 2023). The aforementioned strategy considers all user requirements regarding the service level provided (Amer, R., 2016). The methods of to introduce a novel cooperative padded mode selection mechanism for use in cognitive radio networks, (CRNs), (Wang, C., 2011). generalizes the problem to the case where the channel status is unknown and provides a novel solution under the constraint of a small collision probability of principal users. In a complex network environment that has numerous major networks, it is difficult to assess the statistical elements of the system without first getting insight into the system's principal users. This is because determining which users are contributing the most to the system is difficult. selecting the optimal network is essential for a seamless user experience. Access network selection (Bendaoud, F., 2018). Entails a sophisticated process whereby mobile devices identify ideal networks based on signal strength, bandwidth, and particularly Quality of Service (QoS). This selection gets exceedingly complicated in heterogeneous situations with dramatically variable network properties that fluctuate wildly under various propagation conditions and RAT loads. For example, the use of Markov models (Bendaoud, F., 2020), or machine learning algorithms such as KNN (K-nearest neighbors) (Bendaoud, F., 2021), allows predicting user movements and dynamically adjusting the network choice according to the anticipated conditions. Positive or negative, dependent on its choices, and with more epochs, it will be efficient, and it learns how to select excellent actions that yield positive rewards. This paper is organized as follows: in part 2, we give a review of the literature on models for the selection of the access network in a heterogeneous wireless environment; in part 3, the formulation of the problem, the presentation of the different algorithms utilized in this study, and finally, the presentation of our approach. Part 4 is dedicated to the results and their interpretation, and we conclude the work with a viewpoint conclusion.

LITRETURE REVIEW

The selection of access networks in heterogeneous wireless networks (HWN) has been extensively addressed utilizing numerous methodologies and approaches, including Multiple Attribute Decision Making (MADM), objective functions, evolutionary algorithms, fuzzy game theory, and machine learning. These techniques

[1] Engineering and Space Technology, Future University, Khartoum, Republic of the Sudan
[*] Corresponding author's email: anasnicola2018@gmail.com

examine several aspects, including user preferences, network circumstances (load and congestion), and service characteristics (Wang, L.,2012). In the following, we will present a comprehensive review of these numerous strategies employed in the situation of access network selection. The paper (Bendaoud, F., 2017), introduces a modified-SAW technique; using several Multi-Attribute Decision-Making (MADM) methodologies. The results indicate that the modified SAW outperforms the alternatives, even in the situation of rank reversal, which adversely affects all MADM approaches, but their solution circumvents this issue. Other techniques, such as game theory, were used, as referenced in (Bendaoud, F., 2015), and (Salih, Y.K., 2015). Objective functions were used, as shown in (Nguyen-Vuong, 2008) and (Yu, H.W., 2019). Moreover, fuzzy logic was utilized for this purpose, as indicated in (Evangeline, C.S., 2022). Chen at (Chen, L., 2023), developed a new method for user perceptual task offloading in the IoT, which optimizes the strategy of quantum behavior particle population for the offloading scenario of several edge center servers and smart devices. Ramya and Padmapriya (Ramya, R., & Padmapriya, K., 2023), present a fuzzy-based cluster head selection for improved routing using particle swarm optimization and the adaptive whale optimization algorithm. Kooshari *et al. .,* (Kooshari, A.,2024), presented a goal function for clustering network nodes that considers error rate, energy consumption, packet delivery ratio, and Euclidean distance, aiming to reduce energy consumption and prolong the lifespan of the wireless sensor network. Babu *et al. .,* (Babu, E. S., 2023b), suggest a technique that would allow fog, gateway, and edge nodes to register with the blockchain network. This approach would allow for identification and authentication of the connected nodes. The goal of this study (Wang *et al. .,* 2024) is to investigate and propose a network selection method that aims to reduce the interference that cognitive users cause. Although it proposes a spectrum choice technique for multi-channel selection, Zeng & Wang (Zeng, Z., & Wang, G., 2013), completely disregard the impact that sensing mistakes have on spectrum use decisions.

MATERIALS AND METHODS

The methodology adopted in this research is based on simulation and mathematical modeling of a 5G cellular network enhanced with Networks communication. The process can be summarized as follows:

System Modeling

A heterogeneous cellular network was modeled with two neighboring base stations, one congested and the other uncongested. The total available bandwidth was set to 20 MHz, and 150 users were randomly distributed in a coverage area of 100 m^2 using Poisson distribution. To evaluate the effectiveness of communication, 50 users were offloaded from the congested base station to the uncongested one using free uplink open source. This scenario enables better utilization of unused resources in the uncongested BS.

Simulation and Analysis

MATLAB simulations were conducted to compare the performance of the network before and after applying.

Validation

The results were compared with theoretical expectations and previous studies to ensure consistency and reliability.

Automatic Connection Authority Management

The analysis of automatic system proposed on this research, which has different steps combined with automatic self-learning and knowledge base. As shown in Figure 1. Consist of different level of the workflow described in the following figure "open flow service connectivity " , which is basically responsible for multi-connection with their different unit of connectivity including sensing interfaces for switching available connect ,information directly upon through knowledge base as reference of combination , on this methods of the scenario of searching we found that the parameters provided and passed from the base learning can be assist the MT handover makes seamless establish to the nearby network after getting policy handle switch from control

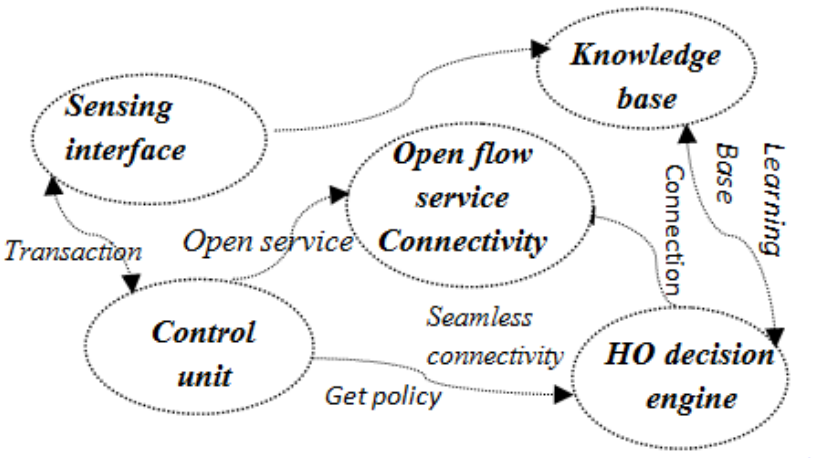

Figure 1: Open flow service connectivity

unit process (A.V. Vasilakos *et al.*, 2009) . This approach allowed by the open service transaction seamless connectivity.

Proposed Diagram of Hierarchical Connection Approach

Figure 2. Using this hierarchical approach mechanism, the network just assists the MT for decision to the seamless open flow service multi-connectivity. In their analysis diagram the integration of management consists through three steps which is construct a case model. The system collects the information from the relative transaction methods when it's activated gathering information evolving situation faced by the MT through sensing phase (Maïssa Mbaye and Francine Krief, 2009).

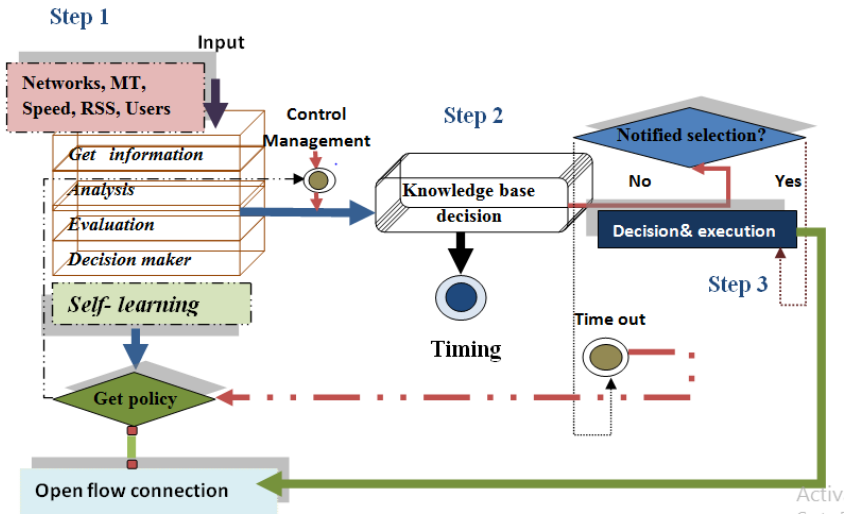

Figure 2: Propose Automatic open flow diagram

Step 1: Getting Policy Information

Context information in the terminal sensing side, recognized by many factors depends in the location, distance and speed. In the dynamic moving, availability of any service is depended for many related factors such as type of network, available of resource and other access mechanisms characteristic, also there are several capabilities of the MT include as type of mobile description, type of available interface and speed. This description is important for connectivity service. In addition, the parameters of the network are required for any network switching when MT Move from cell to cell.

Step 2: Knowledge Base Decision

The result obtained from rule matching is provided by knowledge base selection technique is based for intelligent algorithms. Any case there in the rule includes specific knowledge in particular context; they represent and provide different type of the service which is used in the procedures for selection. The time holding time selection is limited and restricted for any process as in equals.

Step 3 Decision and Execution

The appropriate choice for network selection based on multiple decisions making approach on some special goals, arranged and identified by logically heuristic equation. The priority of the network selection based on the rules selection with specific time identified in the loop of procedure selection. In this process of decision there is a need for a fast and efficient decision strategy which has minimal users is disconnect interruption for application, furthermore, sometimes the choice of users set preferences can affect the network switch may causing the network instability. So as the connection here should be more convenient for available network resource and satisfied temporary users need. The context distribution in multi choice network automatically changed selection depend in many things such environment of the network at some moment, network characteristic, location and speed to the MT required a service (Tie Qiu, 2016).

Selection Roaming Agreement

Network service provider agreement for establishment with other wireless services network providers, the establishment connection, users must identified register in special profile providers as it in home network (HM). However, the home network and the foreigner network must assure that its customers seamlessly be able to use the service in different domains locations. User's ID, must provider from home network to different domains for trustable policy (Junaid Qadir, 2015). The role of service agreement is to track customers into different access networks; Figure 3 explained the flow selected topology. In Figure 3, the user has already identification policy from his home domain (domain A), when a user's roams to domain B, will still be billed in his home domain and so on. However, if there is no roaming agreement in the hieratical network the seamless services may interrupted between the domains. The service of selection and distribution based on users a selection networks, aim to reduce the problems of congestion by introducing

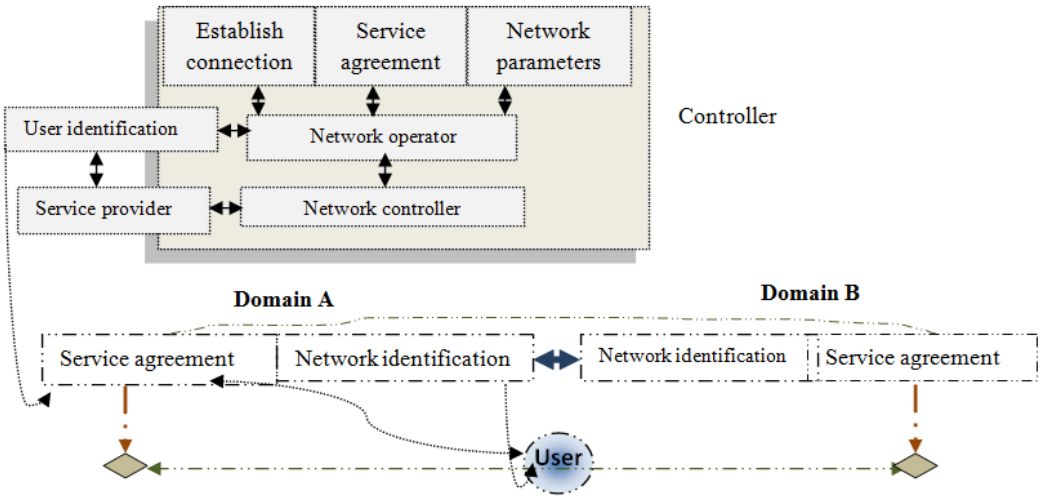

Figure 3: Represent flow selection topology

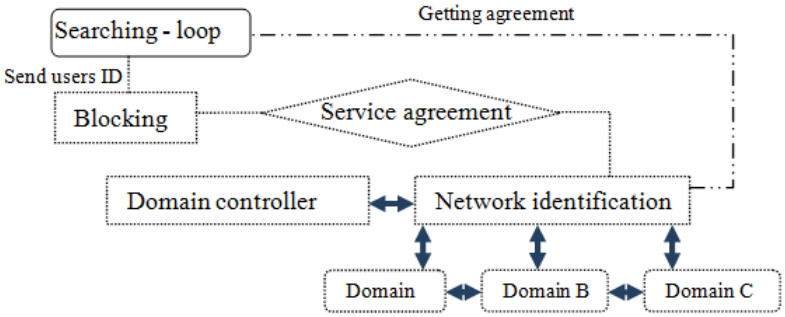

Figure 4: Executive mode of user's selection

flexible selection distribution. In the status of users moving from side to side or from domain to domain. This service provider may have different model on their own direct way of connection tracks. The following flowchart explaining in the Figure 4, describe the model of user's agreement.

The agreement of the user's selection network based on the trustable message between home domain and visiting domain based on various entries such as home domain. The domain has been connected for all others domain and has been notify all neighbor domain copy for to identity of any immigrate MT visitors, on the process of the trustable connection, MT has been decided by the user's home domain (Shanzhi Chen, 2016), see Figure 5.

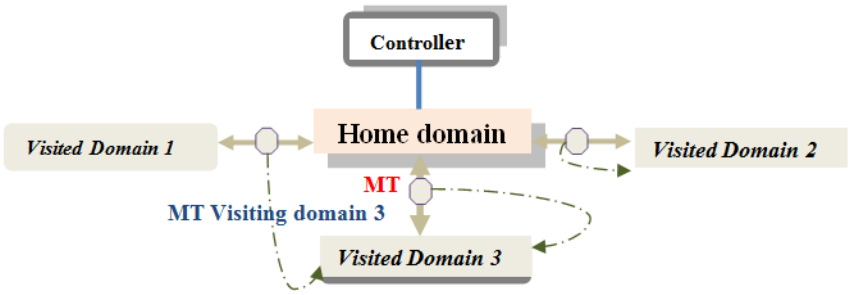

Figure 5: MT movement

Criteria of Algorithms Decision

There are several parameters identified previously in a network, the most important for seamless based on this research, based on signal strength indicator. RSS: it's directly measured of the satisfaction of users seamless between home connection and new connection, strongest signals present is an important parameter. However, the rule of selection based on the strength signals and with high bandwidth (Kui Ren , 2013). The other parameters calculated when the signals are already strongest enough in the domain of connection. For example, if RSS > RSS candidate network, then the MT keep connection in the old home connection until the singles becomes lower than before. On this situation

the decision of intelligent automatic connection method provided by fuzzy interference engine, according to the physical inputs especially in real time. The rule also can Describe and produce the final result of choosing of the network selection, on this study we represent a new fuzzy interference can describe a conceptual decision with generic algorithms which is developed in order to simplified the handoff decision. The following diagram describes the tracking connection. Figure 6 and 7.

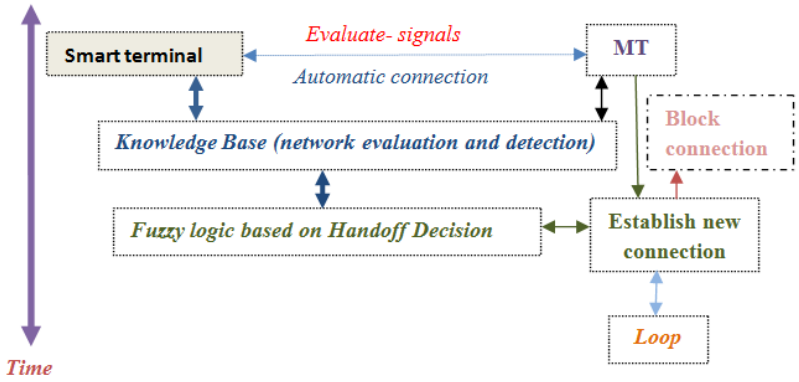

Figure 6: Diagram proposed for evaluation signal connection

Graph Based Selection
Deification 1

If we suppose the graph G = NXN is grid network, $N^{network} = \{ n^1, n^2 \ldots\ldots network^n \}$, $U^{user} \{u^1, u^2 \ldots. user^n \}$,

where $C=K \cup S$, $K = u^1, u^2 \ldots. user^n$, $S^{probability} = \{p^1, p^2 \ldots\ldots\ldots p^n \}$, $S=\{n^{k+1}, n^{n+2} \ldots\ldots\ldots n^{k+n} \}$, $K>n$, $D=$ distance $\subseteq KXN$

1- $\bigcup_{i=1}^{k} p_i = N, \quad \bigcap_{i=1}^{K} p = x_{ij} = \Phi, \quad \neq j$

2- $x_{i,j} \in \{0,1\}, S=0,1 \cap d$

3-min $\sum_{n}^{k+1} \delta(p_{x_{i,j}})$, where $\delta\ (p_{x_{i,j}})$ is the sum of the probability length from source network.

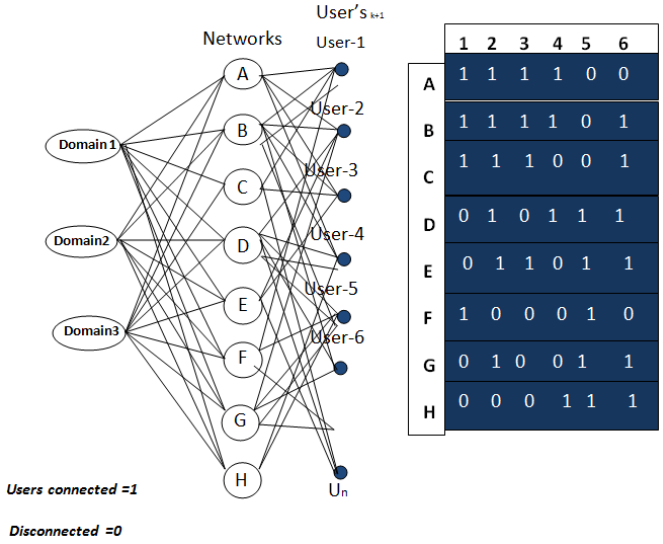

Figure 7: Graph-based node assignment selection

Table 1, explains the history records, for seamless connection between different network candidates describes path selection, shown in Figure 7, Table 1. And there, Figure 8, shows the path connection probability estimated from previous flowchart. Simulation of priority network selection.

Table 1: Describe the path connection probability

Users	History Path selection connection
User_1	A, B, C, F
USER_2	A, B, C, D, E, G
USER_3	A, B, C, E
USER_4	A, B, D, H
USER_5	D, E, F, G, H
USER_6	B, C, D, E, G, H

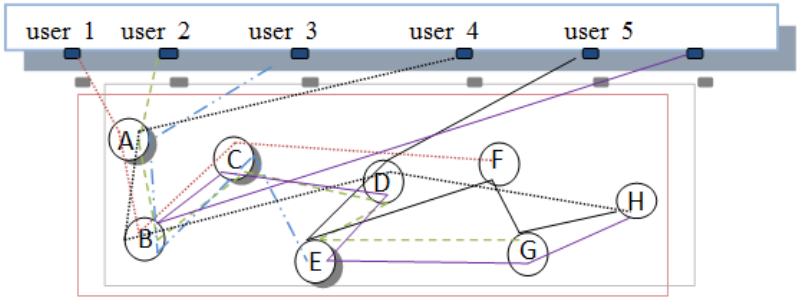

Figure 8: Simulation of graph networks selection

The transmission connection process in a logarithm's status shown in the following table 2, the table describes identification of user's connectivity from different access point. However, tracking path can be recognition in the knowledge base of the heuristic algorithm. The analyzing predictive probability explained as in, Table 2, Figure 9, and 10.

Table 2: Explain the transmission connection process

Users	Access point path selection	Access point users identification	Access point users not identification
Userl	A,B,C,D,E,F,G,H	A,B,C,F	D, E,G,H
User2	A,B,C,D,E,F,G,H	A,B,C,D,E,G	F,H
User3	A,B,C,D,E,F,G,H	A,B,C,E	D,F,G,H
User4	A,B,C,D,E,F,G,H	A,B,D,H	C,E,F,G
User5	A,B,C,D,E,F,G,H	D,E,F,G,H	A,B,C
User6	A,B,C,D,E,F,G,H	B,C,D,E,G,H	A,F

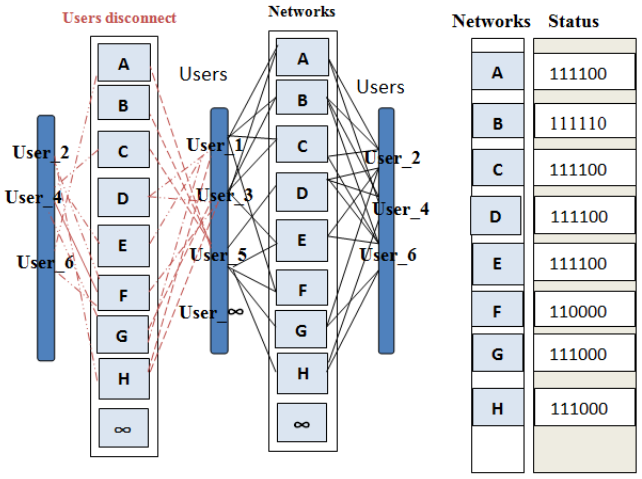

Figure 9: Transmission connection process for node connection

Then the network selection priority with circuit traffic location depends on different factors such as number of empty position location as shown as in Figure 10. And the result of the probability prediction presented in Figure 11.

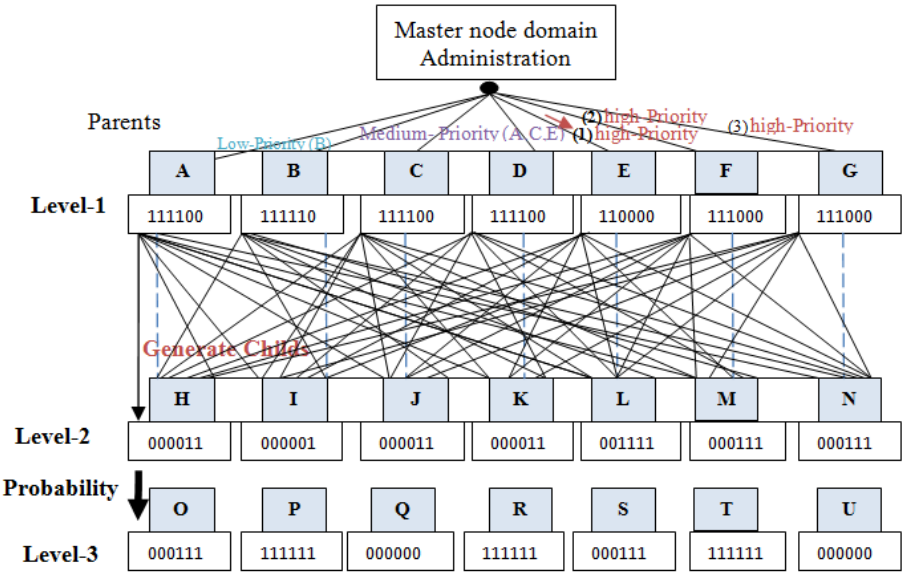

Figure 10: Simulation transmission connection process for node connection

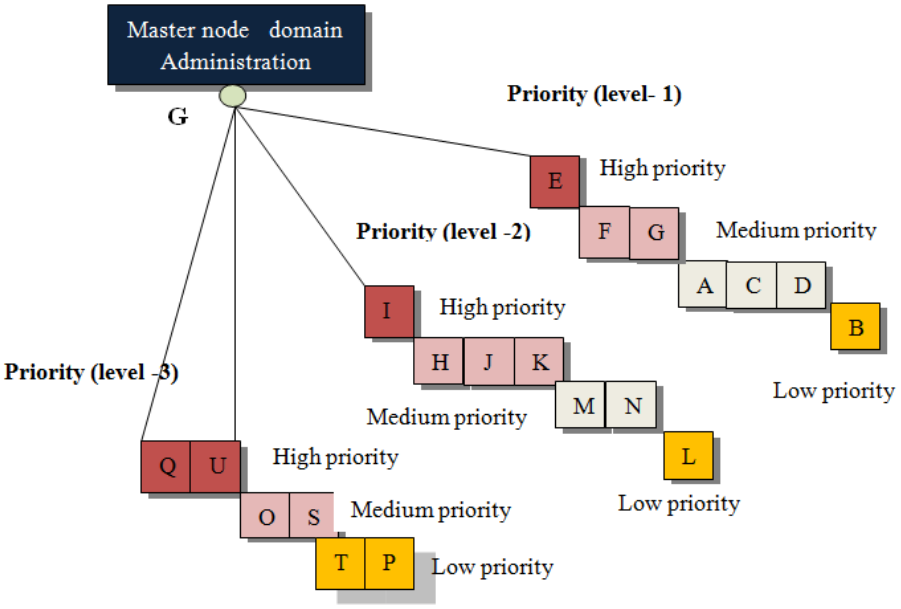

Figure 11: Simulation of priority network selection for node connection

The graph represents examples of a hierarchical node sorting under priority value tree, is represent the optimistic connectivity node classified with three level (level -1 is shown as parent queue), the graph give a number of highest priority to the node which is the number of empty location present by number of zero (0), medium priority represent the second choice and the last choosing is node is the node labeling by low priority. The second level is called leaf of the tree or Childs generated from the first queue (parent), and finally is the probability nodes see Figure 12.

Probability Identifies

$$P(G)\prod_{n=\infty}^{N} p\left(N_x \mid A, B, C, D, E, F, G\right)$$

Where G represent grid network, N is number of networks, (p) is probability.

$$p(G/N)=\sum_{G}\sum_{N} P(A, B, C, D, E, F, G)$$

$$P(G \mid N_X)\alpha \sum_{G}\sum_{N} P(N_x)^{highpiority}\, p(N_x)^{lesshigher\ piority}\, p(N_x)_{lowpiority}$$

Analysis Approved of Graph Connection

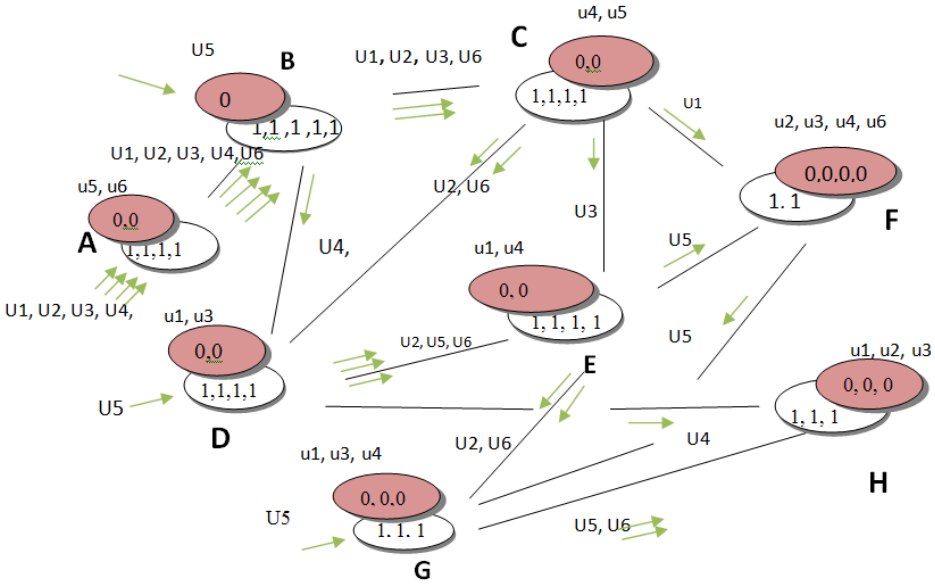

Figure 12: Graph connection explanation

The heuristic research algorithms in a graph presented in Figure 12, identified from path location in which point the users has located as shown in this target searching of the searching plan, in this figure, if we suppose that the current point of users is located in track node, then the track position of the users has been proposed work through intelligent optimized networks selection. Described in the flowchart Figure 13 and 14.

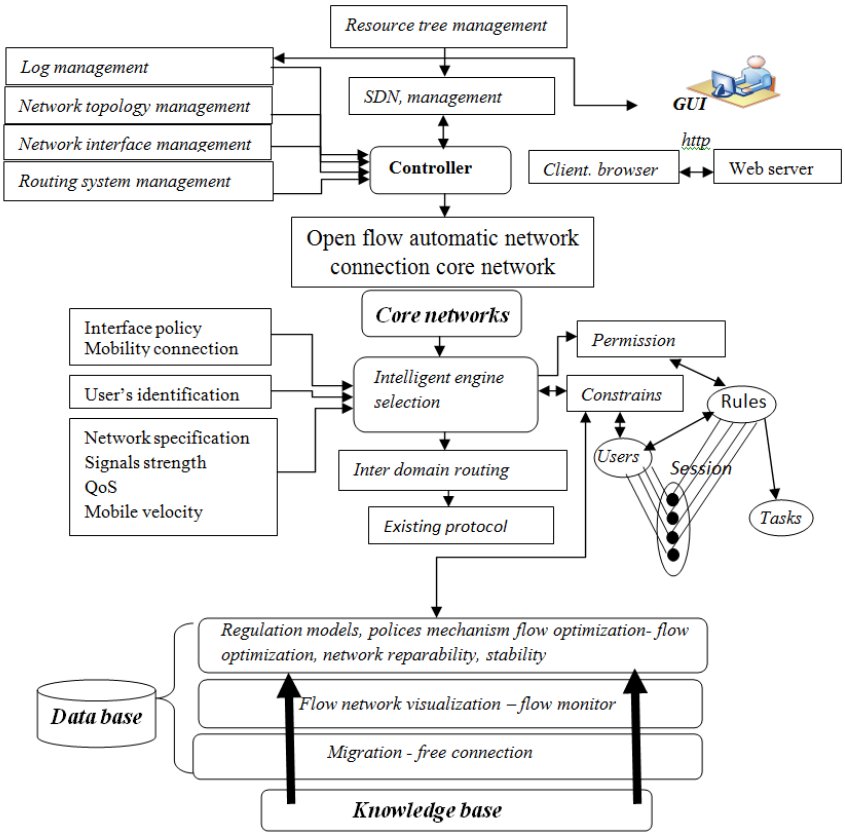

Figure 13: Propose the process of optimality network selection

The following flowchart Figure 14. Algorithm explains the optimization process for auto selection network.

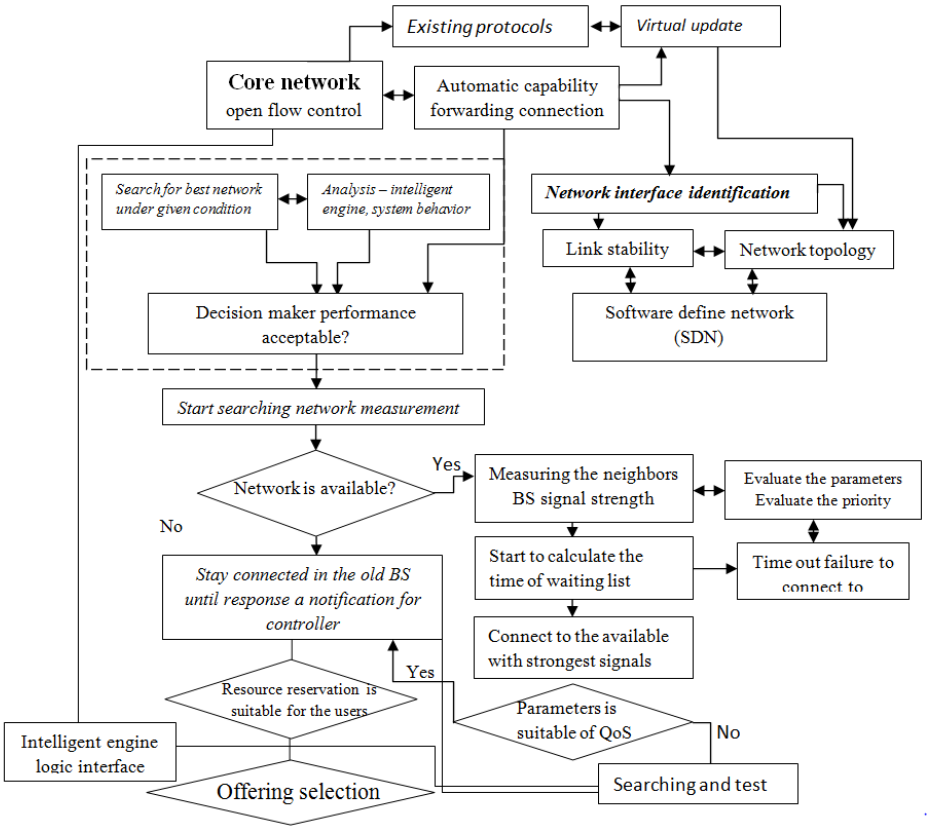

Figure 14: Propose optimization decision algorithms for network selection

Mathematical Explanations

Let N= {1… N} be set of indexes classes of domain nodes, X is target of classes index, k is set of users generated from network resources. Let x, y is parameters of networks x_i, $y_i \in$, N p is present the probability of user's selection ., Pij, N (C) is the neighbors (setoff)

$$K^{select} = \sum_{x=1}^{n}\sum_{x=0}^{n} N(x,y)_{n_i} \rightarrow f(\pi) \approx \sum_{i=1}^{n} p_{ij}.d\pi(i)\pi(j)$$

π is represent the assignment of facility of location, the element (i, j) is represented the facility of the position of the location user's movement.

Where their neighborhood N it can be mathematically expressed as follows:

$$N_{networks} \in Map\ (Nodes\ , Sub\ (nodes\ )).$$

$$N_{K\in Nodes} \approx \{X, Y \in Nodes | p_{ij}\ , x_i\ , y_i\}$$

$$N(C) \subset Nodes \approx \{X, Y\} | x_i, y_i (\exists_x \in N(c)\}$$

Where the neighbors (setoff) = $\{ {}^{N_{x_i,y_i}} | p_{ij\in 1,0,I\in 1,0} \}$

$$(\forall_{x_i} \in 1,0)(N_i \neq 0) \vee \bigcup N_i = Nodes$$

$$\left(p\prod_{x,y}^{n} N \xrightarrow{nodes} (\exists^{\max_{i,j}} \in 1,0 | i \neq j)(N_i \cap N_j \neq 0, N(C) \in N \subset N(K)) \right.$$

The selection process of the resource to manage resource utilization in wireless heterogeneous network, selection algorithm it can be represented as follow in Figure 15. And the result shown in Figure 16, presented master domain auto select networks connectivity. Figure 16, explained the Node priority auto selects of radio resource algorithms.

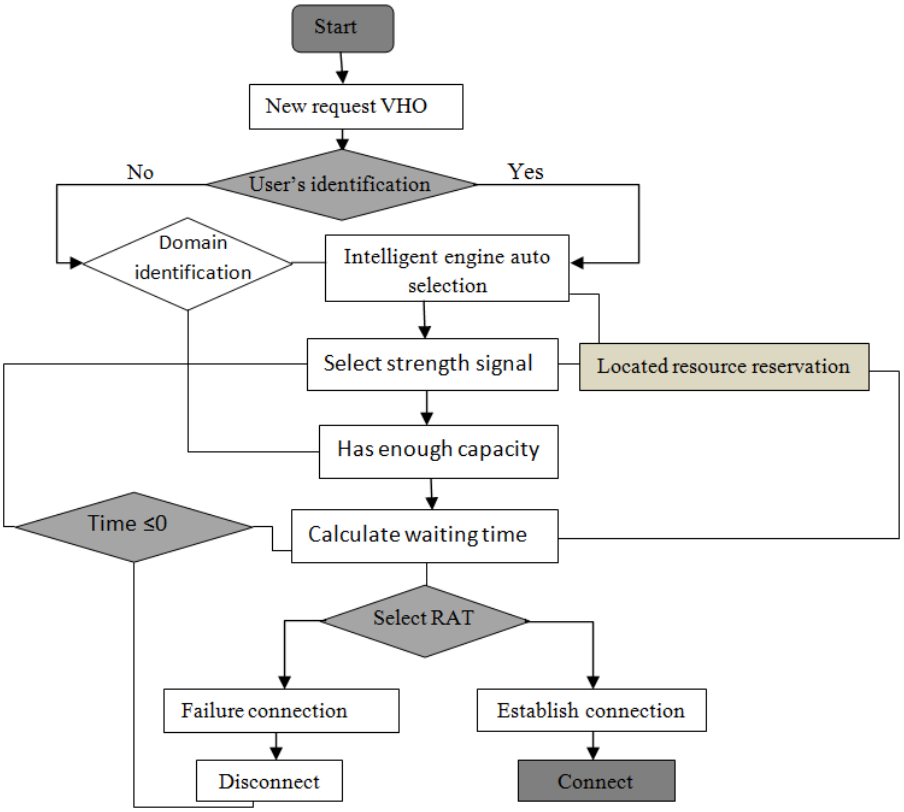

Figure 15: Propose selection process of radio resource algorithms

RESULTS AND DISCUSSION

The distribution of 150 users is shown in Fig 16. Using poison distribution function, in the area of 100$m2$. The base station in the center and users is surrounding base station; this is the first scenario. However, the number of users calculated connected from the specific BS station shown the numbers of higher spectrum data rate can also been provider to SNR, to others neighbored users disconnect.

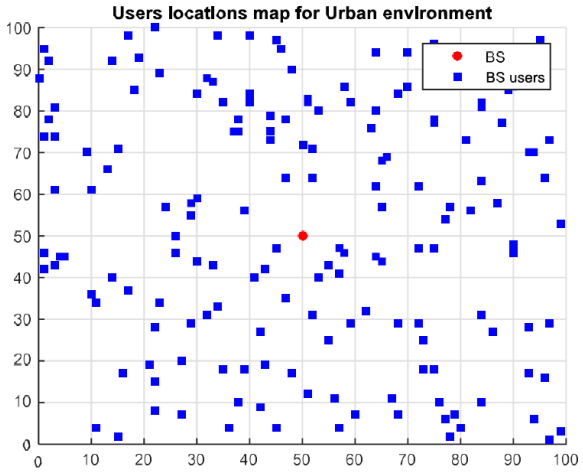

Figure 16: Distribution of users

Masters' Node Priority

The simulation in Figure 17, describe the highest priority of the master node presented in figure 11. That level 1 and 2, provided high prediction portability wireless networks auto connected registered 0.5 percentage of users auto connect.

Figure 17. shows the throughput of Master node base station (BS), simulation which is the accumulation of the data rate taking an ascending path, with 30 % enhanced in Throughput after offloading. Higher network throughput means large numbers of successful message delivery more data rates are being delivered to terminals and better reliable user experience is achieved. Therefore, THE Performance simulations evaluated shown that the priority schedule within level 1, level 2, and level 3. with Master node recognized higher priority and medium priority and low priority simulated in previous figures mention.

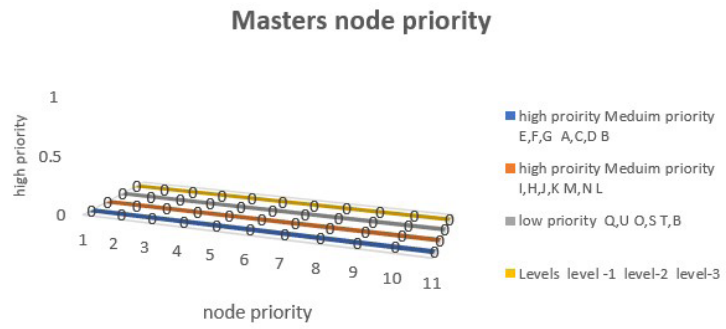

Figure 17: Node priority auto selects

CONCLUSION

This paper investigates the challenge of selecting a network in situations where there is more than one primary network available. It discovers performance. The authors propose, in different cases. Search for and acquire new knowledge forms the foundation of this mechanism. Researcher taken special scenario for seamless connectivity when the users try to make or to establish connect to the networks. On this situation the network parameters select. In addition, also on this research the facility provided by algorithms, that make users more convenient and safety tracking in the whole process of seamless connectivity. Furthermore, the heuristic algorithms applied using smart terminal makes seamless moving easier and simpler. The analysis process of search strategy using specific intelligent knowledge that informed users, for a heuristic search technique such as best first search and deep first search including hierarchical tree combined with multi greedy nodes.

REFRENCES

Amer, R., El-Sherif, A. A., Ebrahim, H., & Mokhtar, A. (2016). Cooperation and underlay mode selection in cognitive radio network. In *Proceedings of the 2016 Fifth International Conference on Future Generation Communication Technologies (FGCT)*. IEEE. https://doi.org/10.1109/FGCT.2016.7605066

Babu, E. S., Barthwal, A., & Kaluri, R. (2023b). Sec-edge: Trusted blockchain system for enabling the identification and authentication of edge-based 5G networks. *Computer Communications, 199,* 10–29. https://doi.org/10.1016/j.comcom.2022.12.001

Bendaoud, F. (2017). A modified-SAW for network selection in heterogeneous wireless networks. *ECTI Transactions on Electrical Engineering, Electronics, and Communications, 15*(2), 8–17.

Bendaoud, F. (2018). *Management of joint radio resources in heterogeneous networks beyond 3G* (Doctoral dissertation, University of Tlemcen).

Bendaoud, F. (2021). Adaptive KNN-based algorithm for network selection in next generation networks. *Journal of High-Speed Networks, (4),* 1–14.

Bendaoud, F., Abdennebi, M., & Didi, F. (2015). Network selection using game theory. In *Proceedings of the 2015 3rd International Conference on Control, Engineering & Information Technology (CEIT)* (pp. 1–6). IEEE.

Bendaoud, F., Abdennebi, M., & Didi, F. (2020). Mobility aware network selection in a heterogeneous wireless environment. *Transport and Telecommunication Journal, 21*(1).

Chen, L., Zhang, D. G., Zhang, J., Zhang, T., Wang, W. J., & Cao, Y. H. (2023). A novel offloading approach of IoT user perception task based on quantum behavior particle swarm optimization. *Future Generation Computer Systems, 141,* 577–594. https://doi.org/10.1016/j.future.2022.12.016

Chen, S., Shi, Y., Hu, B., & Ai, M. (2016). *Mobility management: Principle, technology and applications*. Springer-Verlag.

Darabkh, K. A., Al-Khazaleh, H. F., Al-Zubi, R. T., Alnabelsi, S. H., & Salameh, H. B. (2023). Efficient routing protocol for optimal route selection in cognitive radio networks over IoT environment. *Wireless Personal Communications, 129*(1), 209–253. https://doi.org/10.1007/s11277-022-10093-6

Evangeline, C. S., & Kumaravelu, V. B. (2022). A two-phase fuzzy-based access network selection scheme for vehicular ad hoc networks. *Peer-to-Peer Networking and Applications, 15*(1), 107–133.

Kooshari, A., Fartash, M., Mihannezhad, P., Chahardoli, M., AkbariTorkestani, J., & Nazari, S. (2024). An optimization method in wireless sensor network routing and IoT with water strider algorithm and ant colony optimization algorithm. *Evolutionary Intelligence, 17*(3), 1527–1545. https://doi.org/10.1007/s12065-023-00847-x

Mbaye, M., & Krief, F. (2009). *A collaborative knowledge plane for autonomic networks.*

Nguyen-Vuong, Q. T., Ghamri-Doudane, Y., & Agoulmine, N. (2008). On utility models for access network selection in wireless heterogeneous networks. In *Proceedings of the IEEE Network Operations and Management Symposium (NOMS 2008)* (pp. 144–151). IEEE.

Qadir, J. (2015, September 3). *Artificial intelligence based cognitive routing for cognitive radio networks.*

Qiu, T., Chen, N., Li, K., Qiao, D., & Fu, Z. (2016). Heterogeneous ad hoc networks: Architectures, advances and challenges.

Ramya, R., & Padmapriya, K. (2023). An implementation

of energy-efficient fuzzy-optimized routing in wireless sensor networks using particle swarm optimization (PSO) and whale optimization algorithm (WOA). *Journal of Intelligent & Fuzzy Systems, 44*(1), 595–610. https://doi.org/10.3233/JIFS-220963

Ren, K., Liu, X., Liang, W., Xu, M., Jia, X., & Xing, K. (Eds.). (2013). *Wireless algorithms, systems, and applications*. Springer-Verlag.

Salih, Y. K., Hang See, O., Ibrahim, R. W., Yussof, S., & Iqbal, A. (2015). A novel noncooperative game competing model using generalized simple additive weighting method to perform network selection in heterogeneous wireless networks. *International Journal of Communication Systems, 28*(6), 1112–1125.

Vasilakos, A. V., *et al.*. (Eds.). (2009). *Autonomic communication: Autonomic networks*. Springer Science+Business Media. https://doi.org/10.1007/978-0-387-09753-4_3

Wang, C., Sohraby, K., Jana, R., Ji, L., & Daneshmand, M. (2011). Network selection for secondary users in cognitive radio systems. In *Proceedings of IEEE INFOCOM 2011*. IEEE. https://doi.org/10.1109/INFCOM.2011.5935106

Wang, J., Pei, H., Wang, R., Lin, R., Fang, Z., & Shu, F. (2024). Defense management mechanism for primary user emulation attack based on evolutionary game in energy harvesting cognitive industrial Internet of Things. *IEEE Transactions on Network and Service Management*.

Wang, L., & Kuo, G. S. G. (2012). Mathematical modeling for network selection in heterogeneous wireless networks—A tutorial. *IEEE Communications Surveys & Tutorials, 15*(1), 271–292.

Yu, H. W., & Zhang, B. (2019). A hybrid MADM algorithm based on attribute weight and utility value for heterogeneous network selection. *Journal of Network and Systems Management, 27*(3), 756–783.

Zeng, Z., & Wang, G. (2013). Dynamic spectrum access strategy for multi-channel cognitive radio networks. *International Journal of Future Generation Communication and Networking, 6*(4), 157–166.