DOI: https://doi.org/10.46632/jeae/1/1/2

Journal on Electronic and Automation Engineering
Vol: 1(1), December 2022
REST Publisher; ISSN: 2583-6951 (Online)
Website: http://restpublisher.com/journals/jeae/

Performance evaluation of Wireless Network selection using Gray Rational Analysis (GRA) Method

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Abstract. This paper proposes a network selection solution that is user location- and knowledge-based, aiming to diversify by choosing the best value network in a wireless network environment, improving video delivery. When multi-attribute decision making (MADM) techniques are used for wireless network vertical approval, the impact of weighting techniques combined with Gray Rational Analysis (GRA) is studied. Performance analysis of the GRA algorithm is conducted for hierarchical, background, conversational, interactive, and streaming classes of services using Random Weighting (RW) and Least Square Weight (LSW) techniques. In the MCDM context, multiple alternatives (e.g., wireless networks) refer to attributes such as Network 1, Network 2, Network 3, Network 4, and Network 5. Delay (msec), Jitter (msec), BER (x 10), Throughput (kbps), and Cost (units) are used as evaluation methods. In this type of analysis, gray relational analysis (GRA) methods determine the best solution for negative short distances and very long distances to settlement, but do not consider the relative importance of these distances. As a result, Wireless Network 5 ranked first, and Wireless Network 4 ranked the lowest.

1. Introduction

With the rapid growth of 3G and 4G wireless communication technologies, various types of wireless systems have been developed. For the next generation of wireless networks, one of the most important challenges is how to integrate these heterogeneous systems and manage user traffic across different types of systems. Due to the characteristics of private wireless networks being heterogeneous, a simple approach is not sufficient for vertical handover operation, and a more complex system is needed to manage handovers across heterogeneous wireless networks. A simple policy-based handoff system is provided to allow users to express policies on the best wireless system at any time, based on network characteristics and cost, and allowing trade-offs to be made between dynamics such as performance and power consumption. The Gray Relational Analysis (GRA) algorithm belongs to structural theory and is suitable for analyzing relative quality for several unique scenarios using the Multi-Attribute Decision Making (MADM) method to choose the best sequence. The basic principle of GRA is based on the Gray Rational Coefficient (GRC), which introduces the similarity coefficient GRC for each candidate network to describe the similarity between the best reference network

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2. Wireless Network

The limited bandwidth of wireless networks is a major concern in these environments. This paper presents and analyzes free net plans for integrated wired and wireless networks, with a focus on determining packet throughput or packet delivery rate for Mobile Note Proximity to fixed nodes. To estimate the packet delivery rate, the Mobile Note periodically sends a beacon message every second, and fixed nodes within range send a beacon message to the base node via the wireless network. However, simulated wireless network conditions are often far from reality due to fixed communication thresholds between nodes or the use of random motion models. Furthermore, the fixed wireless network routing protocol cannot be used in Star BED (and thus QOMET point-to-point communication), and communication can only be accepted at calculated levels depending on the traffic sent by the test nodes. In a heterogeneous wireless environment, network selection depends on many factors, and the network selection problem can be solved using Multi-Attribute Decision Making (MADM) algorithms. Data collection and analysis related to MADM are done through the network, and the network rank is reported to the terminal only through a wireless connection, which is beneficial from a wireless bandwidth usage perspective. However, selecting networks for other services with a wireless access network may not be possible, and further study is required in these select network situations. Moreover, multiple interface terminals for heterogeneous wireless networks from different access technologies have network access, and many decision attributes are used in multimodal networks around the world, including Universal Interoperability for Microwave Access.

3. Gray Rational Analysis (GRA)

In our specific GRA MADM algorithm, we focus on combining various attribute weighting techniques, including AHP, FAHP, ANP, RW, and LSW, for wireless networks. We discuss the GRA algorithm and its application in the context of vertical handover, taking into account user preferences and proposing to select the network by creating trade-offs between service usage. However, this mechanism cannot be implemented dynamically. We also consider SINR as an important component of measurement, and as a result, the accuracy of the results is improved. GRA constructs greyscale relationships between two sets of elements, and the ranking provided by the GRA method is unusual. The objective is to provide an optimal network selection mechanism that overcomes the ping-pong effect, for which we propose a new mechanism. M-AHP is suitable for different criteria used to determine weights and to sort out alternatives, and the GRA method is used for this purpose. This paper is organized as follows: it describes multi-attribute decision-making methods (MADM), and based on two MADM methods, we provide our access network selection methodology, MAHP and GRA. The FAHP and standard deviation method are used in conjunction with the GRA method. The GRA algorithm is responsible for grading network alternatives with fast and simple calculations. GRA is based on several variables and is suitable for solving problems involving complex interactions between attributes. The GRA method is unique and widely used to solve uncertainty problems under incomplete information. The AHP method is used to determine the relative weighting of criteria for different services, and the GRA method is used to obtain the optimal access network. MCDM Algorithms AHP and GRA algorithms are presented via WiMAX Information Server (IS), which provides a form of handover to Wi-Fi [13]. Based on AHP and GRA methods, we present an evaluation of the optimal access network selection algorithm.

TABLE 1. Data set for Wireless Network

	Delay(msec)	Jitter(msec)	BER(· 10)	Throughput(kbps)	Cost(units)
Network 1	100.00	2.00	0.20	10.00	400.00
Network 2	20.00	11.00	1.00	20.00	200.00
Network 3	10.00	54.00	2.00	20.00	100.00
Network 4	5.00	100.00	5.00	40.00	150.00
Network 5	30.00	100.00	5.00	20.00	100.00

Table 1 shows the wireless network wrt Delay (msec), Jitter (msec), BER (· 10), Throughput (kbps), Cost (units)

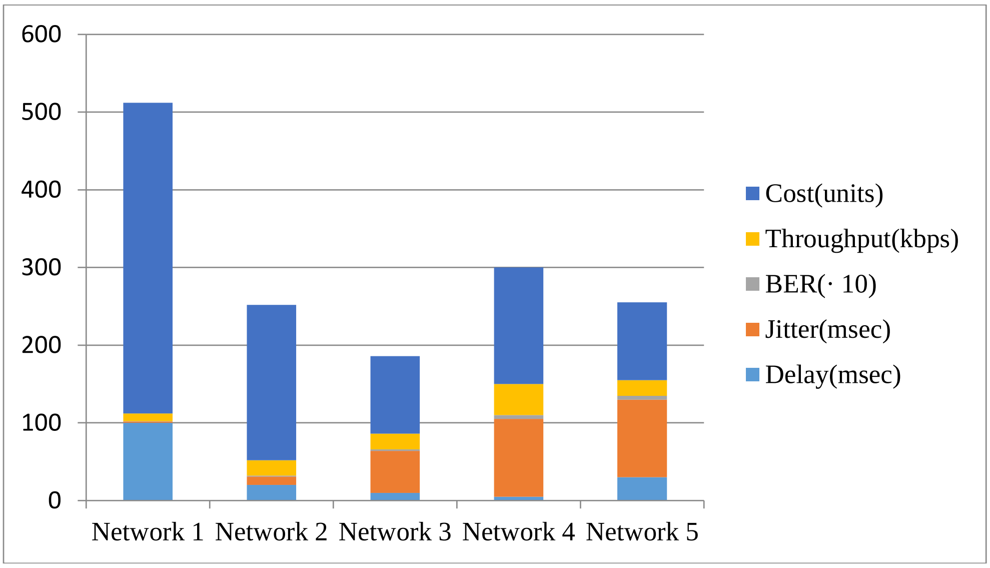

FIGURE 1. Data set for Wireless Network using GRA Method

Figure 1. Shows the data set for Network 1, Network 2, Network 3, Network 4, and Network 5.

TABLE 2. Normalized Data for Wireless Network

	Delay(msec)	Jitter(msec)	BER(· 10)	Throughput(kbps)	Cost(units)
Network 1	1.0000	0.0000	1.0000	1.0000	0.0000
Network 2	0.1579	0.0918	0.8333	0.6667	0.6667
Network 3	0.0526	0.5306	0.6250	0.6667	1.0000
Network 4	0.0000	1.0000	0.0000	0.0000	0.8333
Network 5	0.2632	1.0000	0.0000	0.6667	1.0000

Table 2 shows various normalized data for Delay (msec), Jitter (msec), BER (· 10), Throughput (kbps), Cost (units). We took normal data for all parameters for analysis.

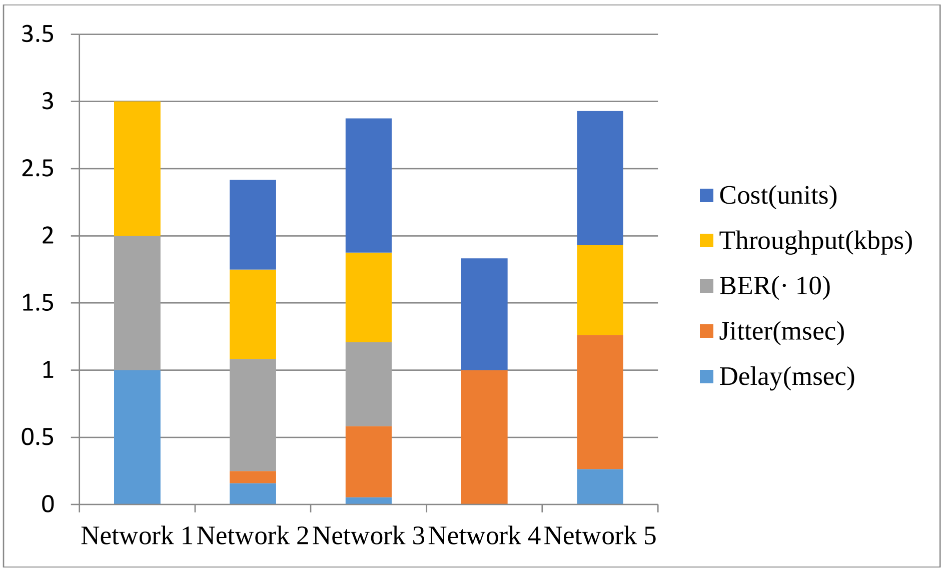

FIGURE 2. Normalized Data for Wireless Network using GRA Method

TABLE 3. Deviation sequence for Wireless Network

	Delay(msec)	**Jitter(msec)**	**BER(· 10)**	**Throughput(kbps)**	**Cost(units)**
Network 1	0.0000	1.0000	0.0000	0.0000	1.0000
Network 2	0.8421	0.9082	0.1667	0.3333	0.3333
Network 3	0.9474	0.4694	0.3750	0.3333	0.0000
Network 4	1.0000	0.0000	1.0000	1.0000	0.1667
Network 5	0.7368	0.0000	1.0000	0.3333	0.0000

Table 3 shows the deviation order for Delay (msec), Jitter (msec), BER (• 10), Throughput (kbps), Cost (units). To figure out the Deviation sequence, we used the formula (2).

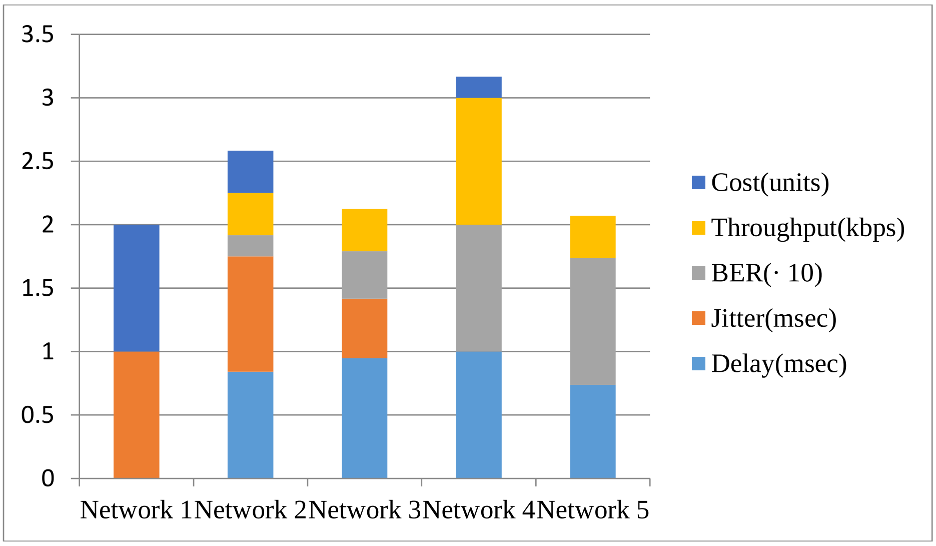

FIGURE 3. Deviation sequence for Wireless Network using GRA Method

Figure 3 shows the various Deviation sequence for Delay (msec), Jitter (msec), BER (• 10), Throughput (kbps), Cost (units). To figure out the Deviation sequence, we used the formula (2). Normalized value is obtained by using the formula (1).Table 3 shows Deviation sequence used for the analysis.

TABLE 4. Grey relation coefficient for Wireless Network

	Delay(msec)	Jitter(msec)	BER(· 10)	Throughput(kbps)	Cost(units)
Network 1	1.0000	0.3333	1.0000	1.0000	0.3333
Network 2	0.3725	0.3551	0.7500	0.6000	0.6000
Network 3	0.3455	0.5158	0.5714	0.6000	1.0000
Network 4	0.3333	1.0000	0.3333	0.3333	0.7500
Network 5	0.4043	1.0000	0.3333	0.6000	1.0000

Table 4 shows the Gray correlation coefficient for network 1, network 2, network 3, network 4 and network 5.

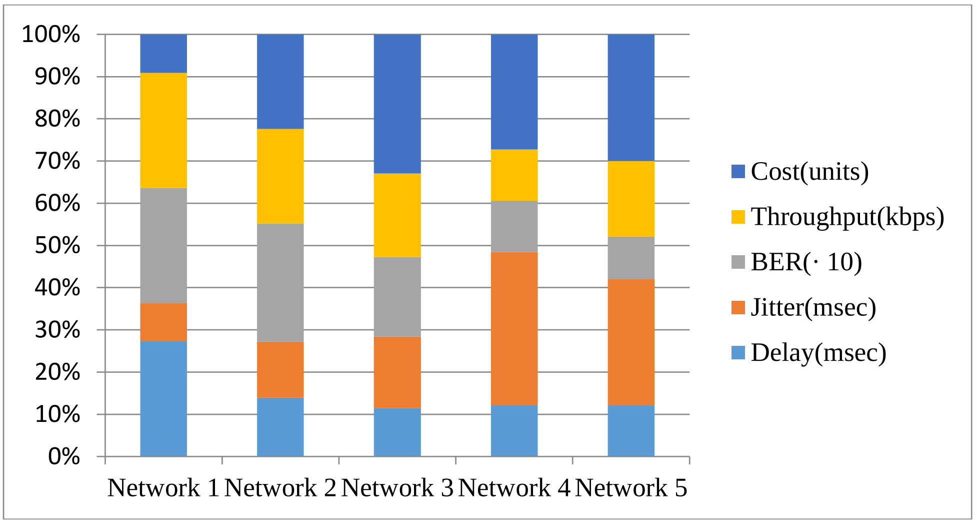

FIGURE 4. Grey relation coefficient for Wireless Network using GRA Method

TABLE 5. GRG and Rank for Wireless Network

	GRG	Rank
Network 1	0.7333	1
Network 2	0.5355	5
Network 3	0.6065	3
Network 4	0.5500	4
Network 5	0.6675	2

Table 5 shows the final result of GRA for Application of Wireless Network. Figure 5 shows the GRA Analysis Rank and GRG of Wireless Network. Wireless Network 5 is having is Higher Value and Wireless Network 4 is having Lower value.

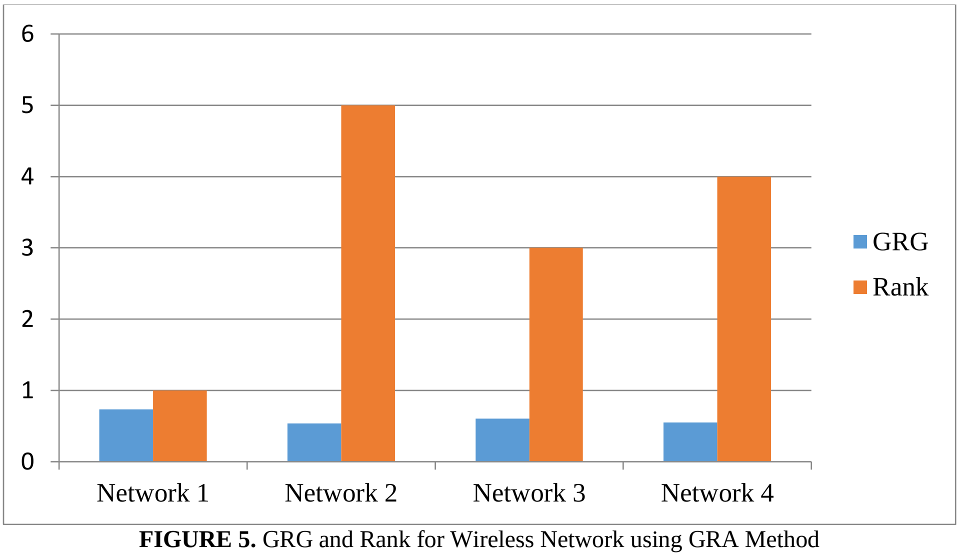

FIGURE 5. GRG and Rank for Wireless Network using GRA Method

Figure 5 Shows Ranking of Wireless Network. Network 1 is got the first rank whereas is the Network 2 is having the Lowest rank.

4. Conclusion

Selecting an optimal access network for service delivery in a heterogeneous wireless system is an important feature, as the outcome is influenced by many factors. This paper proposes a decision-making process for a network-assisted network selection mechanism that combines non-compensatory and compensatory MADM algorithms for Fourth Generation Wireless Communications (4G) systems. Such 4G systems include Wireless Local Area Networks (WLAN/Wi-Fi), 3G Universal Mobile Telecommunications System (UMTS), and Wireless Metropolitan Area Networks (WMAN/WiMAX), which can be integrated with other networks. To select the optimal network, we combine optimal weights obtained by the correlation matrix obtained by GRA. GRA is based on a cumulative function representing "closeness to ideal" generated by a compromise programming system. However, the simulation results show that the FAHPE-GRA algorithm alone does not reduce GRA. As a result, network 1 has the highest ranking, while network 2 has the lowest ranking.

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