Best strategy to control data on internet-of-robotic-things in heterogeneous networks

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ABSTRACT

The control and transmission of huge data constitute an immense challenge in various types of networks (wired and wireless). Congestion caused by the high traffic and low throughput of huge data continues to be major problems in a heterogeneous platforms such as internet of things (IoT) technology and internet-of-robotic-things (IoRT). The heterogeneous network requires new models and mechanisms to deal with the increased challenges posed by IoT and IoRT. Accordingly, eliminating the issues that emerge has compelled finding improved solutions as a new strategy. This study proposed a new strategy called routing information and distance vector (RIDV) to create the best improvement of a heterogeneous network. The RIDV strategy activates the routing information protocol (RIPv2) on a router in wire network parallel with the ad-hoc on-demand distance vector (AODV) protocol on the wireless network. The RIDV strategy is used to solve the problems of the diversity of heterogeneous networks as the basis of the infrastructure IoRT technology. Hence, this strategy can reduce or avoid congestion through the use of enhanced and effective best routing protocols. Simulation results using OPNET show that the proposed method improved the quality of service (QoS) compared with other related strategies and AODV and RIPv1 protocols in terms of data drop, traffic drop, queue delay, and throughput.

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1. INTRODUCTION

The increasing number of smart devices and robot machines is become necessary to control the influence of developments in various application fields. Robotic devices, drones and autonomous vehicles augmented are the technologies which will provide the next phase of development of IoT applications [1]. Internet of things (IoT) and Internet-of-Robotic-Things (IoRT) applications are expected to steadily grow upon networks because a substantial part of human life has become connected to the internet based on the urgent need related to the technological revolution [2, 3].The Internet is defined as a collection of wired and wireless networks described as a heterogeneous network [4-6]. The majority of the studies on heterogeneous networks have been conducted based on one type of network (i.e., either wire or wireless) [7, 8]. The traditional methods use transmission control protocol (TCP) standard with wire networks and user datagram protocol (UDP) designed to utilized with wireless networks [9-11]. The TCP and UDP protocols are mostly used for the important applications of IoT and IoRTin heterogeneous networks. The concepts of IoRT and

IoT are compatible with the same requirements of heterogeneous networks and technical protocols in IEEE 802.11 MAC and 802.16 MAC (WiMAX), as shown in Figure 1 [12].

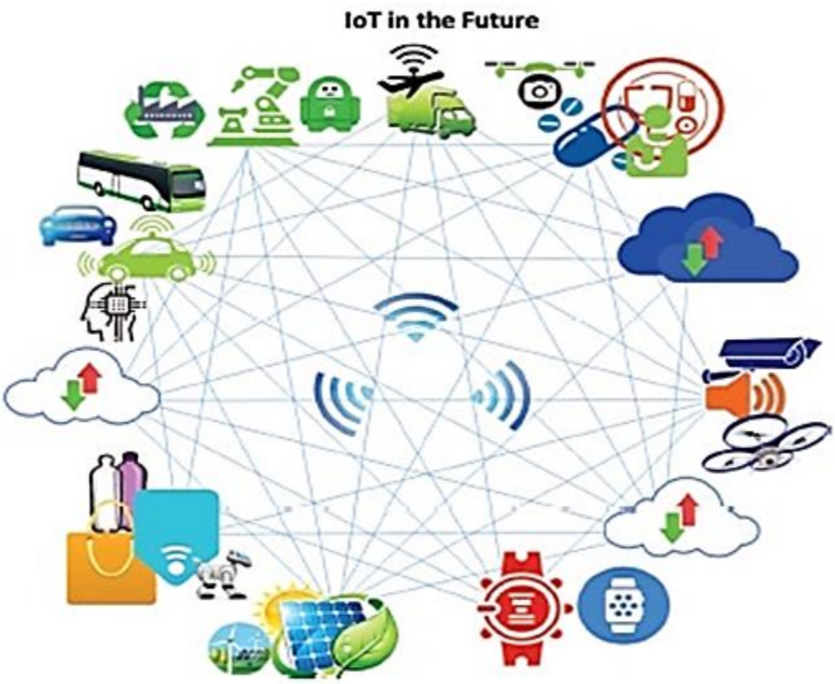

Figure 1. Internet of robotic things

The scalability router creates a smart environment based on hyperconnectivity to build an excellent IoT network and IoRT applications. The methods or strategies are necessary by selecting the only solutions to understand the high performance and meet the requirements of the good network. These aspects may be a crucial element in building a dynamic global network infrastructure. IoRT applications scenarios must be approached for real-life full-scale testbeds, models and practical systems [13]. IoRT is considered important and complex application because they contain a large amount of data. IoRT applications often suffer from not applying a dynamic style to deal with slow data transmission and congestion.The main parameters such as delay, traffic load and network throughput represent critical issues for the IoRT application [14]. Therefore, designing an effective strategy that achieves real-time data transmission control smoothly is a major challenge for IoRT applications.

The best elements of IoRT applications are the ad-hoc on-demand distance vector (AODV) and the routing information protocol (RIP) protocols [15]. The RIP and AODV protocols are mostly used separately and present best results if they are applied in wireless networks. The proposed approach aims to update and establish new dealing methods to improve IoRT applications. The proposed method uses TCP and UDP as standard protocols compatible with the properties of the data transmitted, thereby making the network organized and harmonious with the packaging type (e.g., sound,.video, .ftp). Some of the best elements of heterogeneous networks are the AODV and RIP protocols, which are used in heterogeneous network applications, such as IoRT applications [16].

The proposed method creates a new working mechanism that retuns the dynamic properties in the AODV and RIPv2 protocols. This new mechanism aims to select the best performance by obtaining new routings strategies that enhance communication. The new routing mode makes a unified path table process that distinguishes the routing and distance vector (RIDV) algorithm.

The remainder of this paper is organized as follows. Section 2 explains the features of the distance vector routing algorithm (DVRA), which demonstrates the dynamic properties of the best protocols, such as RIP and AODV. Section 3 focuses on the steps of the RIDV algorithm and its work mechanisms to choose the only performance that makes its work unrestricted. Section 4 discusses the results of the proposed strategy with important parameters. Section 5 concludes this study with an explanation of the scalable networks through the results obtained.

2. SYSTEM MODEL
2.1. DVRA

DVR is a metric use to determine the best route across a network by counts a number of hops. DVRA makes networks reliable according to what is recorded within the priority table by transferring the packet from the main node to the target. The subsequent hope (router device) should be determined in the table of priorities [17]. The RIP and AODV protocols are the most important interference and control in DVRA. These two protocols are supported in the majority of campus LAN networks [18]. The RIP protocol is a standard protocol used in routing protocol from small to medium TCP/IP networks to apply a distance-vector algorithm [19]. More than one route between two or more nodes make a router select a method to calculate the shortest path. The RIP protocol is implemented on the router to achieve the network function regularly. One of the significant features that enhance the effectiveness of routers is RIP.The RIP protocol can be classified as follows:

- RIP version 1 (RIPv1) uses broadcast UDP data packets based on a statistic routing [20].
- RIP version 2 (RIPv1) is a dynamic routing that uses multicast packets to exchange routing information with support authentication [21].

The current study discusses the RIP v2. This feature belongs to the dynamic routing protocol to reduce the network traffic that fits with the characteristics of AOVD. The software of RIP sends routing information updates every 30 seconds to create a routing table. Adevice running RIP can receive a default network via an update from another device that is also running RIP or the main device using the DVRP strategy. In both ways, the default network is advertised between at least two devices using the DVRP strategy.

2.2. Dynamic routing protocol

The dynamic algorithm is based on the counting of all possible paths that link with the source to the target [22]. The table router's information for the entire network is updated by supported information from its immediate neighbors [23]. Thereafter, the router shares the information with all network mobile nodes and exchange information between neighbours' nodes at regular intervals [24]. The AODV protocol is one of the foremost prominent reactive routing protocols and good application on the dynamic routing algorithm.

The AODV protocol uses “HELLO” messages to enhance the reliability of obtainable paths [25]. The "HELLO" messages is period local broadcasts from a source node to inform all nearby mobile nodes in a wireless network.This message may even be used to update the local network to avoid connectivity issues of the node [26]. The procedure of the "HELLO" message is organized by the knowledge table to select the path updated periodically to obviate congested or failed paths. The first request is route requests (RREQs). There after, wait to answer the second request, which is route replies (RREPs) as shown in Figure 2. If the link is interrupted or broken, then the answer will be route errors (RERRs) [27]. This dynamic protocol interacts with the wireless network environment (mobile nods). The confirmed information from the interactive commands and by investing during a positive aspect connect it with another dynamic environment represented by a wired network environment (routers) [28]. The confirmed information from the wireless network environment by interactive commands of the AODV protocol connect with another dynamic environment represented by a wire network environment using the RIPv2 protocol.

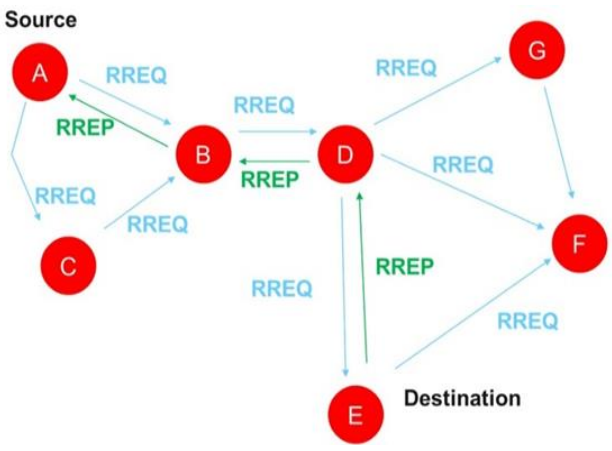

Figure 2. Dynamic performance RREQs and RREPs

3. RIDV STRATEGY

RIDV can also be a strategy generation from two algorithms to formulate a new algorithm and support the positive side and disregard or disable the negative aspects of the previous algorithms, there by forming an efficient algorithm called RIDV. Networks are treated equally (wired and wireless networks) within the primary hop count networks where a packet crosses, and route discovery with route maintenance, as shown in Figure 3.

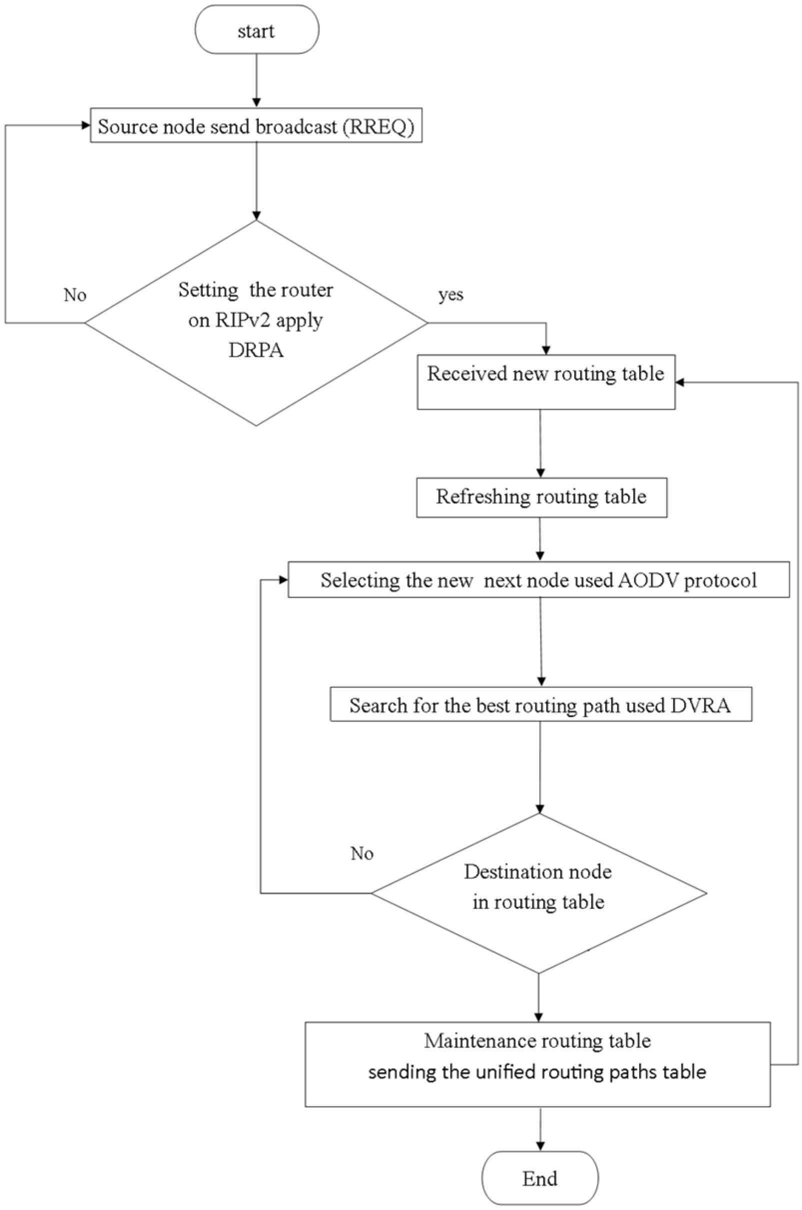

Figure 3. Flowcherat of RIDV strategy

The RIDV algorithm can be explained through the following steps:

Step 1: Source node sends broadcast request to RREQ.
Step 2: If node is a router - Setting the router on RIPv2
Step 3: Else go to step 1 //the source node.
Step 4: Receive a message including the route table with new information.
Step 5: Update the routing table by refreshing to add one hop for each advertised.
Step 6: Selecting the new next node using the AODVprotocol.
Step 7: Search for the best routing path using DVRA.

Step 8: If (destination node within the routing table), then go to step 10.
Step 9: Else (go to step 6).
Step 10: Maintenance routing table shown in Figure 4.
Step 11: Return the result go to step 4 //sending the unified routing paths table to the router because of the implementation of the same path routing map algorithm (DVR with DRP).

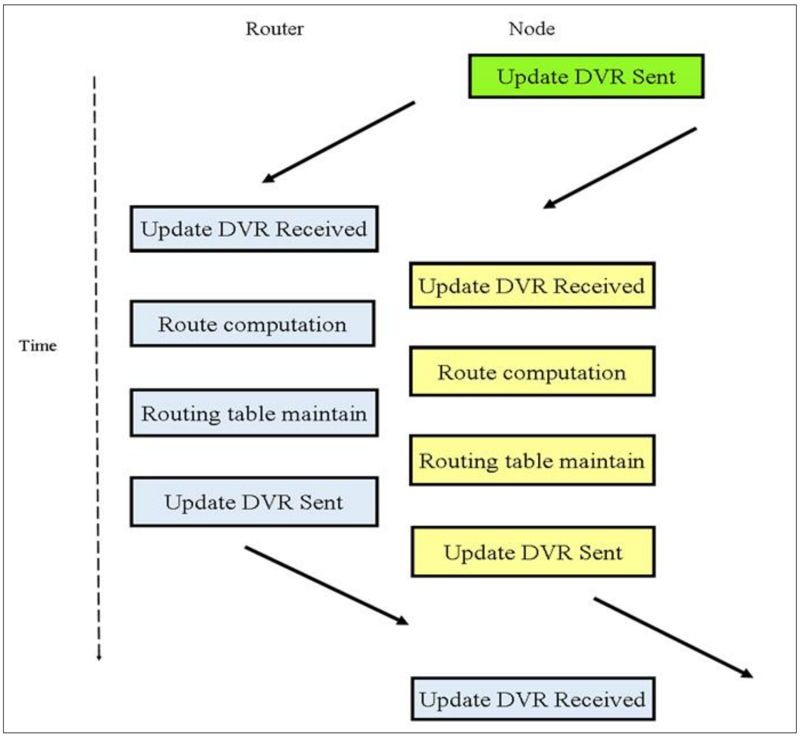

Figure 4. Route maintenance with time

4. SIMMULATION RESULTS AND ANALYSIS

The following results are presented within the factors applied in a heterogeneous network that is work on IoRT environment as shown in Table 1. Figure 5 shows the dynamic mobility of the IoRT systems and data management represented by the source node m25. The mobile device sends different instructions to other nodes from m1 to m15. These nodes (e.g., robot or smart mobiles nodes) may be connected with an access point (i.e., node 3, node 2) through two routers in OPNET. The simulation is used to perform and analyze different routing protocols, such as RIPv2 and RIPv1 with AODV, to generate a new RIVD strategy by applying 15 mobile nodes and by having three different scenarios in an area of 2000×1500 m. In the results between the first scenarios, the RIPv2 protocol is activated only in routers. In the second scenario, protocols (RIPv1 default protocol in router) are not activated with the proposed new RIVD strategy to measure the different factors.

Table 1. Elements of the network

Environment	Details	type
Mobile node	16	source & destination
Router	2	Wire
Access point	2	Wired& wireless
Maximum packet in queue	50 packets	size
Network interface type	IoRT application	
Topographical area	2000X 1500	sq.m
Routing protocol	RIPv2&AODV	RIDV
Number of scenarios	3	With the same conditions
Simulation time	20	Mints
Packet Size	260	MB
Simulator	OPNET	14.5

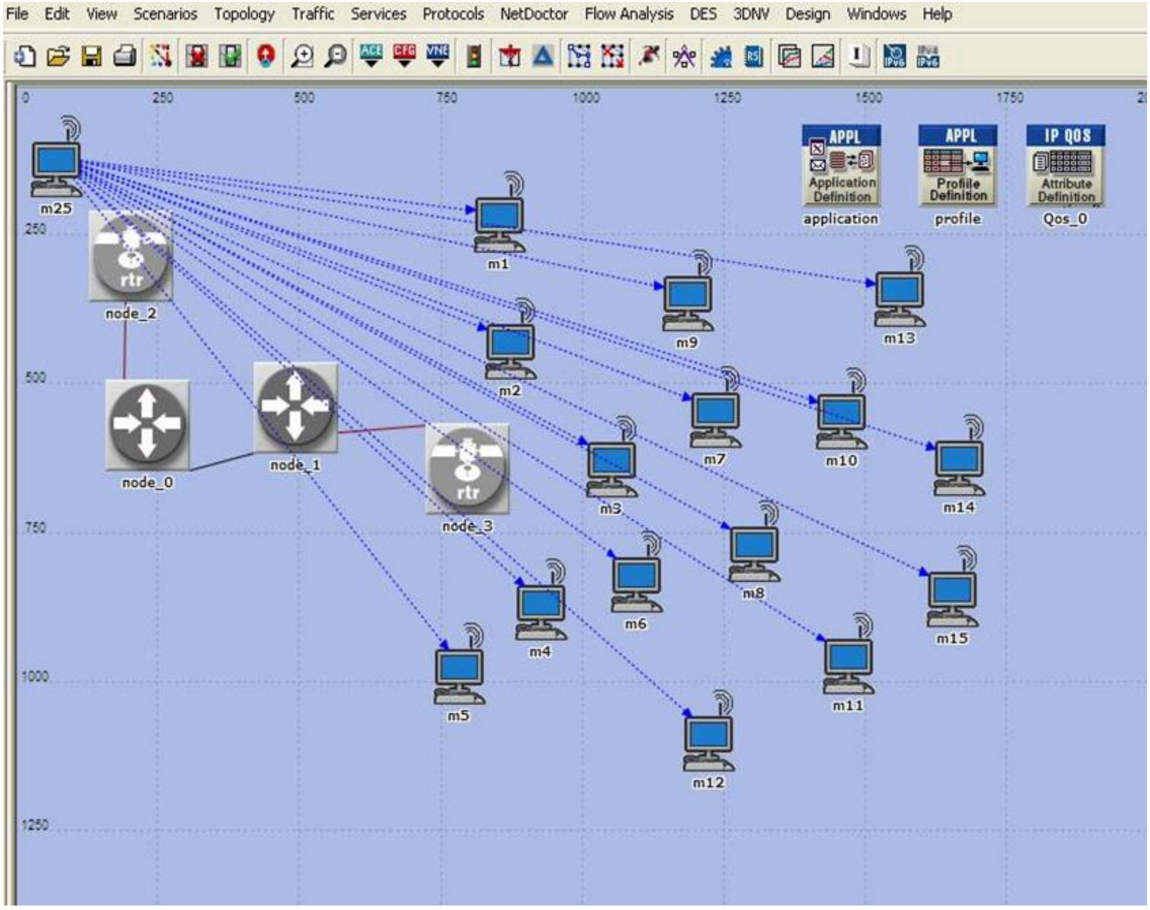

Figure 5. IoRT environment

4.1. Data drop in LAN

Figure 6 shows that RIDV (blue line) is equal to zero compared with other scenarios that did not lose any packets through the process by time average. The new result from the new proposed strategy led to the disposal of the loss data.

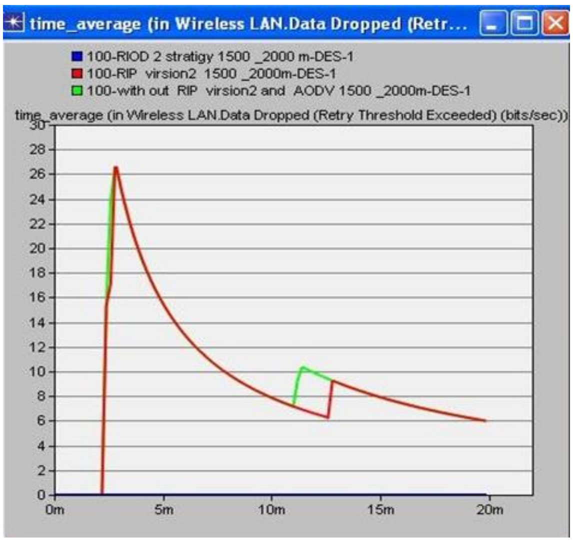

Figure 6. Data drop in LAN

4.2. Traffic drop IP

Figure 7 evidently shows that the RIDV strategy curves the lowest. The focus on the blue curves with other curves means its best result as the packets'/sec less loss achieved in the RIDV strategy in the properties of IP traffic. By achieving this factor, network congestion is avoided.

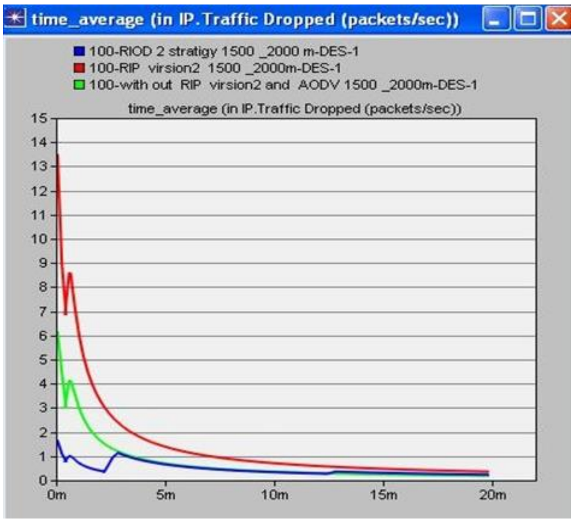

Figure 7. Traffic drop IP

4.3. Queue delay

Queue is an important parameter in measuring the delay in any network and congestion pointer. Moreover, achieving the speed of the network depends on the lowest delay and network stability. Figure 8 shows that the blue line is the best one to determine the speed and slowness of communication by measuring the accumulated load on point to point in the queue.

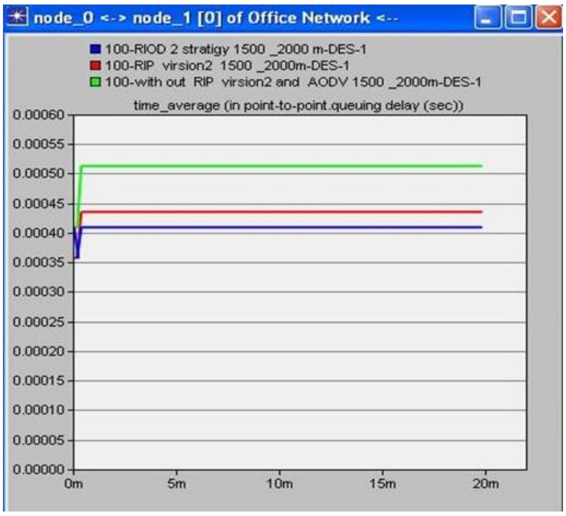

Figure 8. Queue delay

4.4. Throughput in the wireless LAN

The second best pointer in the network is the throughput. Figure 9 shows that the blue line is the highest one compared with the others. That is, the processes work with excellent output. Increased network productivity indicates its strength and effectiveness, particularly with wireless networks because it is more vulnerable to noise.

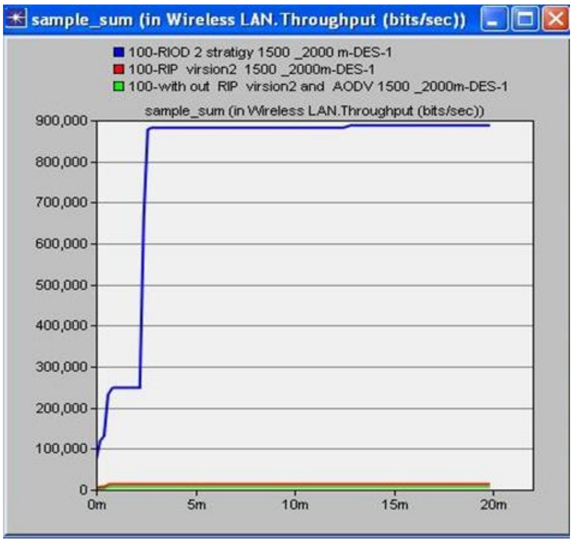

Figure 9. Throughput in the wireless LAN

The above results imply the dynamic mobility of RIDV algorithm gives high flexibility to the IoRT enviroment.The RIP and AODV protocol tables were united into one table if these protocols were activated concurrently. Accordingly, they will end with diminishing time and reduced congestion, thereby resulting avoid a collision in the passage of information from the mobile source (user) to the mobile destination (robot) using the available dynamic property.

5. CONCLUSION

The internet of robotic things (IoRT) requires research into the area of seamless heterogeneous platform integration, things identification (addressing and naming in IoT) and dynamic-things. The current research is focused on IoT heterogeneous parallel processing and dynamic systems based on parallelism and concurrency. The dynamic maintain is changing the re-configuration IoT systems in the heterogeneous network for integration with IoRT service and composition.The problem of control in terms of avoiding congestion and slow data transmission results from high traffic with the effect of queue delay on network productivity. Note that the configuration required by the proposed RIDV strategy is better than RIP and AODV that works separately. The reason is that the AODV protocol has considerable interaction with the RIPv2 protocol owing to similar properties. The dynamic compatibility features in the RIDV strategy provide sobriety and reliability to transmit data. In this context, RIDV strategy could be considered maintaining a path table needed to address scalability and reliability concerns with respect to IoT technologies and IoRT applications. The high efficiency of the new RIDV strategy makes the heterogeneous network interact with the surroundings by controlling and transmitting information toward its targets. The implementation of the same path map algorithm by maintaining a path table periodically gives the RIDV strategy a distinct method of control and preference, thereby shortening the time and unified path routing table. Future studies should activate a new RIDV strategy in different independent networks by selecting a rapid means to connect with mobile devices in wide areas.

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