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Realization of WBAN for Healthcare Monitoring by the Implementation of Route Redistribution and Border Gateway Protocol (BGP)

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Abstract: A human body implanted with biomedical sensors and running wireless protocols of variable frequency and measuring more than one physiological parameter of the body is considered for realization in this paper. A Wireless Body Area Network is a conglomeration of various nodes interconnected through links forming a network of biomedical or other sensors placed at the nodes. In our previous paper, titled "Realization of Wireless Body Area Network using GNS3 tool for Health Monitoring" bearing DOI 10.17148/IJARCCE.2018.7459, the implementation and introduction to intra-body network was expounded. In this paper route redistribution and BGP will be dealt with and efforts will be made to simulate it using GNS3 tool. The use of a routing protocol to advertise routes that are learned by some other means, such as by another routing protocol, static routes or directly connected routers can be referred to as route redistribution. The moral behind route redistribution [1] is the content of this paper and its implementation in the constitution of the Body Area Network. Border Gateway Protocol which is an Exterior Gateway Protocol is the protocol of choice of the internet. The use of BGP in simulation of the inter-body network is being propounded by us. Various BGP policies will be simulated in the paper.

Keywords:Border Gateway Protocol (BGP), realize a typical ISP network using a Network Simulation Tool, Redistribution, internal BGP, external BGP, BGP policies, variable frequency and 3-way handshaking.

I. INTRODUCTION

In case of inter-body networking, an external routing protocol is essential. Since a human body is considered to be one Autonomous System with a unique Autonomous System Number (ASN), the frequency and protocols that are running in them may differ. BGP which is subdivided into iBGP and eBGP possess that property to enable inter-body or inter-Autonomous System communication. Differences in routing protocol characteristics, such as metrics, Administrative Distance, classful and classless capabilities can effect redistribution. The above parameters must be taken into consideration while achieving route redistribution. Running different routing protocols is often part of a network design. In this case, route redistribution is a necessity.

II. SOFTWARE REQUIREMENTS SPECIFICATION

Software requirement specification performs the overall description of the Wireless Body Area Network and its applications.

A. Functional Requirements

Functional requirements define the functionality of a system to be developed.

The functional requirements of the proposed system are:

- Route redistribution between two different routing protocols in the network.
- Use of eBGP between two Autonomous Systems.
- Configuration of iBGP within the AS.
- Transmission of selected physiological parameters to another AS by handshaking and receiving desired physiological parameters.

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B. Non-functional Requirements

Non-functional requirements play the behaviour and performance of the system at its critical stages.

- Scalability

Provisions will be made to accommodate more sensors to monitor various other physiological parameters when the need arises, BGP is highly scalable.

- Security

The system will provide secured transfer of data between nodes and between Autonomous Systems (AS).

- Steps are taken to achieve immaculate response time.

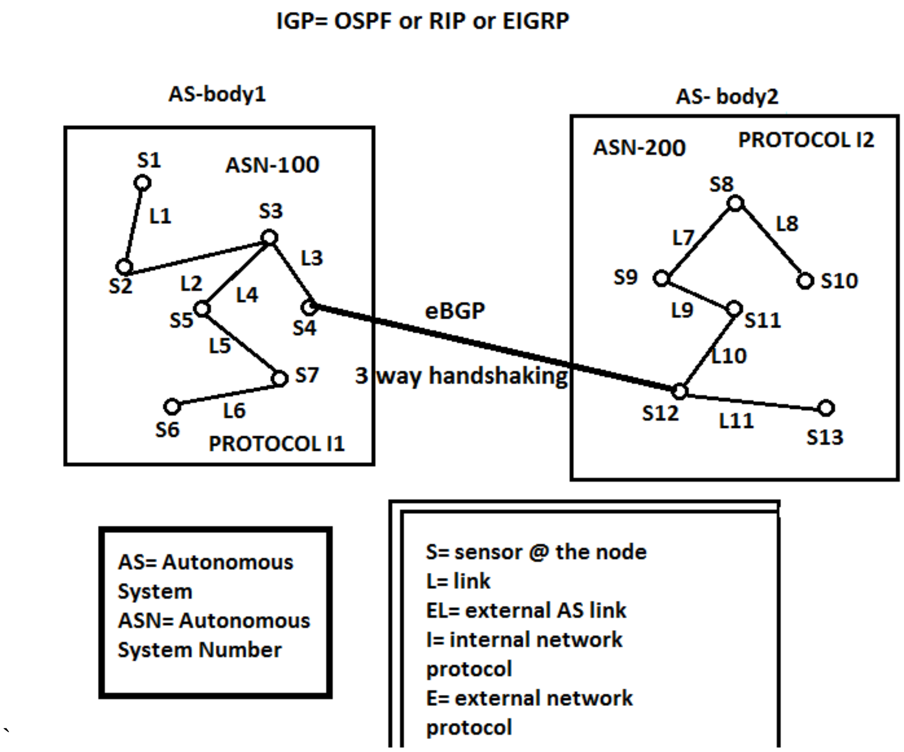

Figure 1 shows the system design of an inter-body network

III. PREREQUISITES

A. METRICS

Each protocol uses different metrics. The metrics must be defined when redistributing routes. Defining a metric that is understandable to the receiving protocol is must.

B. ADMINISTRATIVE DISTANCE (AD)

A router running more than one routing protocol and learns a route to the same destination using both routing protocols, then AD must be considered.

C. eBGP and iBGP

BGP is an Exterior Gateway Protocol. BGP is subdivided into external BGP and internal BGP. External BGP is configured at the Autonomous Border Routers (ABR). Internal BGP is configured within the AS.

IV. SYSTEM DESIGN

The system design of aninter-body network is as shown in figure 1. Autonomous System with ASN = 100 consists of several nodes and links which form the intra-body network. IGP like RIP, OSPF [2] or/and EIGRP runs in the AS. The requirement of a static route is also not ruled out. Similarly AS with ASN=200 is also shown in the figure. eBGP is configured between the two Autonomous Systems to enable inter-body communication. Figure 2 shows the process of 3-way handshaking. This ensures controlled transfer of data between the two ASs. The established connection must be terminated. Figure 3 shows the connection termination by one side.

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The steps involve:
1. The left side transmits a FIN message to the right.
2. The right side responds with an ACK message.
3. Right side sends FIN message to left.
4. The left side waitsfor 120 seconds and then enters the closed state.

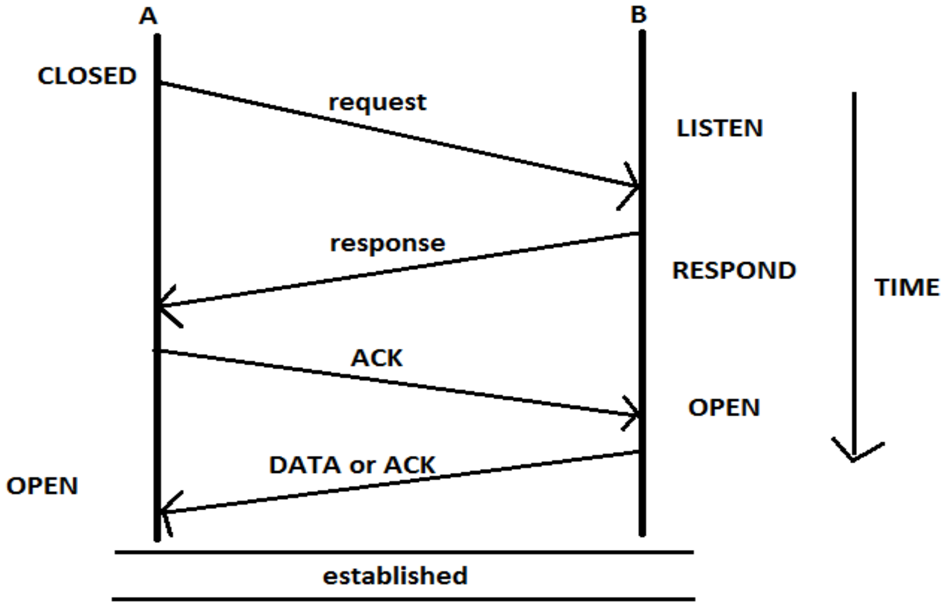

Figure 2 shows the process of the 3-way handshaking

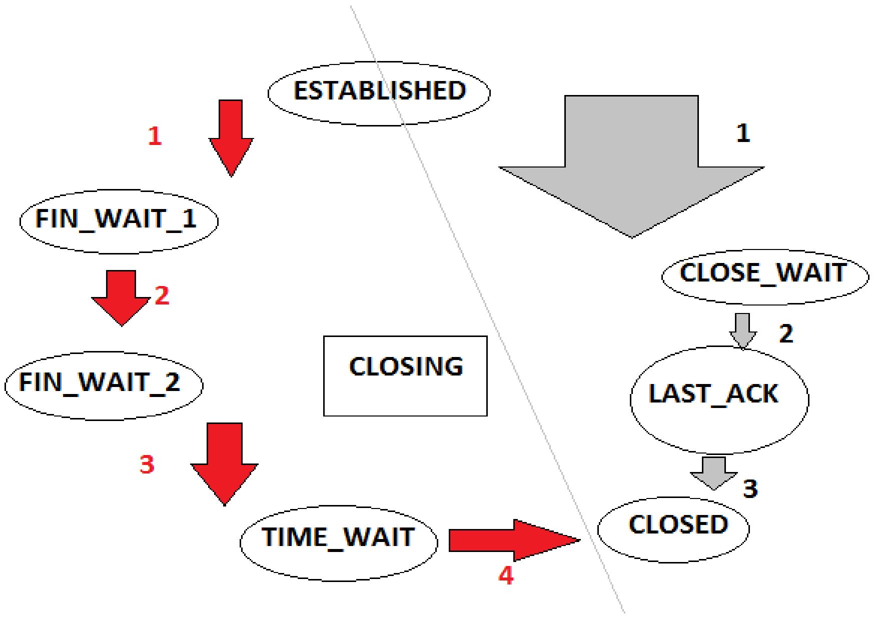

Figure 3 shows the connection termination by one side.

V. SIMULATIONS AND RESULTS

Figure 4 and 5 shows the simulation result when the router at S4 tried to ping S12 and when S4 tried to ping S8 respectively. This shows the external body or inter-body communication [3] between ASN=100 and ASN=200. Figure 6 shows the redistribution between OSPF and RIP. Figure 7 shows the effort to ping after route-redistribution.

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```
R1
*Jan  6 22:56:04.723: %LINK-5-CHANGED: Interface Serial1/5, changed state to administratively down
*Jan  6 22:56:04.723: %LINK-5-CHANGED: Interface Serial1/6, changed state to administratively down
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#pi
*Jan  6 22:56:19.031: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.1.2 on OSPF_VL0 from LOADING to FULL, Loading Done
R1#ping 10.1.12.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/18/28 ms
R1#
```

Figure 4 shows the simulation result when the router at S4 tried to ping S12

```
R1
R1#
R1#pi
*Jan  6 22:56:19.031: %OSPF-5-ADJCHG: Process 1, Nbr 2.2.1.2 on OSPF_VL0 from LOADING to FULL, Loading Done
R1#ping 10.1.12.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.12.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/18/28 ms
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#
R1#ping 10.1.34.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.34.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/52/72 ms
R1#
```

Figure 5 shows the simulation result when the router at S4 tried to ping S8

```
router ospf 2
 log-adjacency-changes
 redistribute rip subnets
 network 10.1.54.5 0.0.0.0 area 0
!
router rip
 version 2
 redistribute ospf 2 metric 2
 network 10.0.0.0
 no auto-summary
!
ip forward-protocol nd
no ip http server
no ip http secure-server
```

Figure 6 shows the redistribution between OSPF and RIP.

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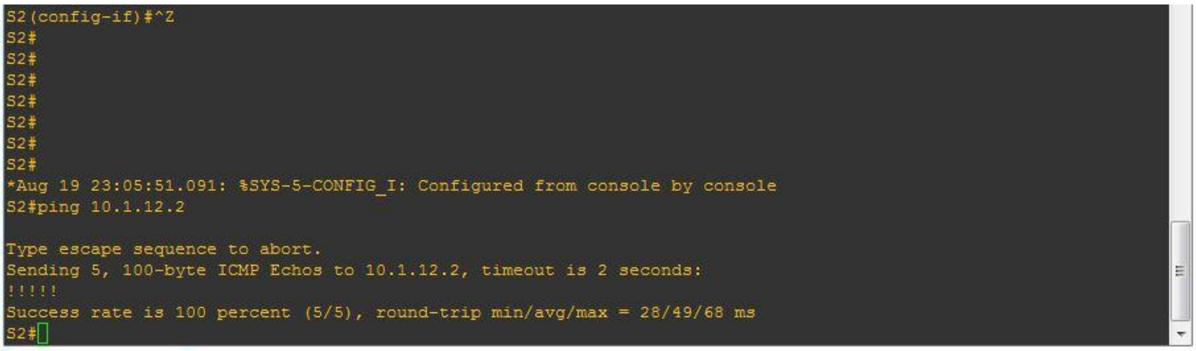

Figure 7 shows the effort to ping after route-redistribution.

VI. CONCLUSIONS

Inter-body area network is the communication between two autonomous bodies having their own internal routing policies and frequencies. In this paper we have configured IGP [4] inside the Autonomous System (AS) and eBGP between the ASs.Route redistribution is essential here because of the use of a routing protocol to advertise routes that are learnt by some other means, such as by another routing protocol, static routes or directly connected routes.

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BIOGRAPHY

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