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Realization of Wireless Body Area Network Using GNS3 tool for Health Monitoring

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Abstract: A wireless Body Area Network (WBAN) is a BAN using wireless protocols to interconnect nodes and to enable packet communication between them. WBAN is so handy that the medical fraternity is craving for its swift customization; as a result the growth in R&D in the field of WBAN is increasing expeditiously. The major objective of this research project is to create a wireless intra-body network of sensors interconnecting and sharing data, thereby eliminating the old-school wired interconnection of sensors and the use of high impedance shoe. The sensors attached at the nodes, representing the epicentres of the human body, may be attached on clothing, on the body or implanted under the skin to monitor various physiological parameters. Iterative and incremental product development approach is followed. Each succeeding development efforts build on the preceding one.

Keywords: Wireless intra-body network of sensors interconnecting and sharing data, iterative and incremental product development approach, GNS3 tool to simulate the foundation network and 24/7 monitoring of the patient.

I. INTRODUCTION

There is a need for a vibrant and a robust health monitoring system on-the-go. The demand is for a wireless and low power data interexchange system [1]. The major challenges confronted are the exchange of data between various physiological parameters and to calibrate the sensors for proper parameter passing.

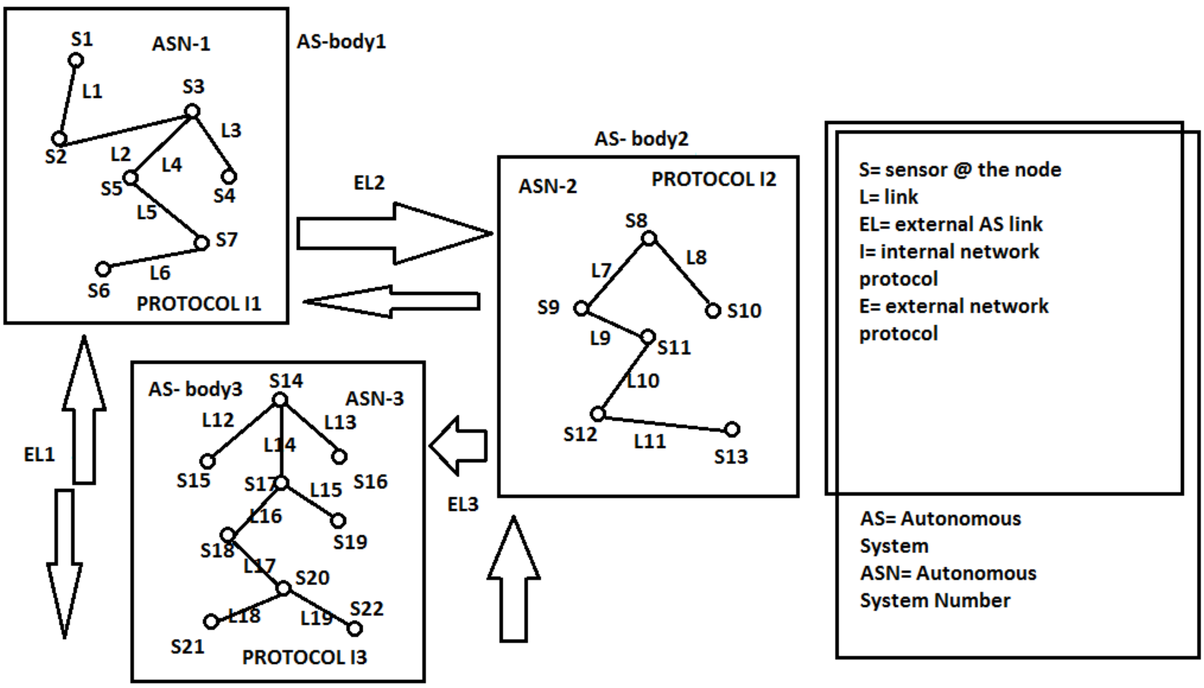

Figure 1 shows the conceptual diagram of the network to me analysed and simulated

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II. FEASIBILITY STUDY

Feasibility study is a signified process carried out over various aspects of a research project. It determines whether the technical feasibility, financial affordability etc. are meeting the expected requirement of the project. Here in wireless BAN, we use the GNS3 tool [2] to simulate the foundation network which will be used by various sensors present in the WBAN network. The simulated routers have been observed to exchange data with the other routers without any discrepancies.

```
router ospf 100
 log-adjacency-changes
 network 10.1.12.1 0.0.0.0 area 0
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
!
control-plane
!
mgcp fax t38 ecm
!
gatekeeper
 shutdown
!
!
line con 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line aux 0
 exec-timeout 0 0
 privilege level 15
 logging synchronous
 stopbits 1
line vty 0 4
 login
!
end

R1#ping 10.1.23.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.23.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 72/89/108 ms
```

Figure 2 shows OSPF protocol being configured on the network and 5 ICMP packets being echoed.

III. SOFTWARE REQUIREMENTS SPECIFICATION

Software requirement specification performs the overall description of the Wireless Body Area Network and the major people involved in its usage and/or application.

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A. Functional Requirements

Functional requirements define the functionality of a system to be developed. It also reflects each functionality of the user in the system.
The functional requirements of the proposed system are:

- Connecting different sensors at the nodes in various topology best suited for a particular situation.
- Providing proper addressing scheme for the packets to traverse through various elements/components in the network. [3]
- Use of proper dynamic or static routing principles/protocols to guide the packets in the network.
- To enable handshaking between two autonomous bodies running WBAN.
- To develop a robust system for the doctor or specialist technician to view numerous collected/recorded data or images.

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.

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

- Immaculate response time.

```
router ospf 100
 log-adjacency-changes
 redistribute rip
 network 10.1.46.6 0.0.0.0 area 0
 network 10.1.67.6 0.0.0.0 area 0
!
router rip
 version 2
 network 10.0.0.0
 no auto-summary
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
```

Figure 3 shows redistribution being carried out.

```
router ospf 100
 log-adjacency-changes
 area 1 virtual-link 3.3.3.3
 network 2.2.2.2 0.0.0.0 area 1
 network 10.1.12.2 0.0.0.0 area 0
 network 10.1.23.2 0.0.0.0 area 1
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
```

```
!
router ospf 100
 log-adjacency-changes
 area 1 virtual-link 3.3.3.3
 network 2.2.2.2 0.0.0.0 area 1
 network 10.1.12.2 0.0.0.0 area 0
 network 10.1.23.2 0.0.0.0 area 1
!
ip forward-protocol nd
no ip http server
no ip http secure-server
!
```

Figure 4 is a collage of two different network router configurations containing virtual-link.

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IV. SYSTEM DESIGN

Consider figure 1. We have considered 3 Autonomous Systems AS- body 1, body 2 and body 3, with Autonomous System Numbers (ASN) - ASN 1, ASN 2 and ASN 3 respectively. ASN-1 consists of several nodes consisting of sensors, each measuring same/different physiological parameters of that human body. Similarly, ASN-2 and ASN-3 also consists of various sensor nodes and link LN, N = 1, 2, 3… interconnecting the above sensor nodes. AS-body 1, AS-body 2 and AS-body 3 run internal network protocols I1, I2 and I3 respectively. These network protocols may be static or dynamic routing protocols. External routing protocol EL1, EL2 and EL3 runs between ASN1 and ASN3, ASN1 and ASN2; and ASN2 and ASN3 respectively.

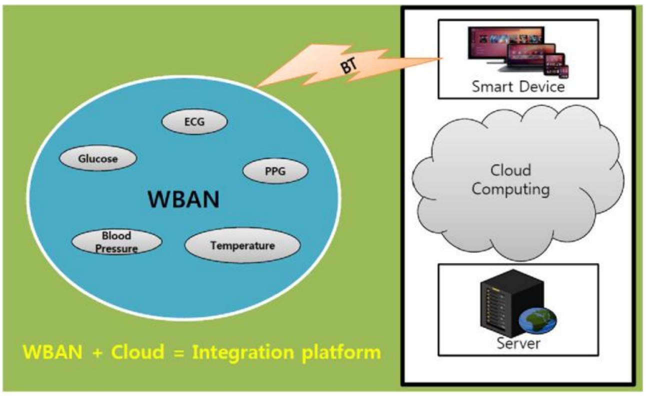

Figure 5 shows the data being moved to the cloud

V. SIMULATION AND RESULT

Figure 2 shows OSPF protocol being configured on the network and 5 ICMP packets being echoed. Figure 3 shows redistribution being carried out. Figure 4 is a collage of two different network router configurations containing virtual-link. The results of the system can also be moved to the cloud [4] as shown in figure 5.

VI. CONCLUSIONS

Hospitals have health monitoring equipment with wires. Wired health equipment restricts the mobility of the patient. Patients are also compelled to visit health centres frequently. In this research work a complete solution to the above problem is simulated and will be built in the coming days. WBAN is so handy and 24/7 monitoring of the patient is possible.

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BIOGRAPHY

VISHESH S born on 13th June 1992, hails from Bangalore (Karnataka) and has completed B.E in Telecommunication Engineering from VTU, Belgaum, Karnataka in 2015. He also worked as an intern under Dr. Shivananju BN, former Research Scholar, Department of Instrumentation, IISc, Bangalore. His research interests include Embedded Systems, Wireless Communication, BAN and Medical Electronics. He is also the Founder and Managing Director of the corporate company Konigtronics Private Limited. He has guided over a hundred students/interns/professionals in their research work and projects. He is also the co-author of many International Research Papers. He is currently pursuing his MBA in e-Business and PG Diploma in International Business. Presently Konigtronics Private Limited has extended its services in the field of Software Engineering and Webpage Designing. Konigtronics also conducts technical and non-technical workshops on various topics.