An Efficient Data Link Protocol for Integrated Wireless Networks: Next Generation Networks (NGN)

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***Abstract*— The seamless integrated communication has a vital role in pervasive communication. It has implemented on next generation networking. There is various integration issues: coupling, decoupling, mobility, IP etc. In this paper we propose an efficient protocol for the hybrid network and it covers the basic terminology as: syntax, semantic and timing properties and narrow the dilemma of above issues. It provides the embedment of all different isolated heterogynous networks for seamless integration.**

Keywords- Wireless Networks, Hybrid Internetworking, Wireless Communication Technologies, Next-Generation Network.

I. INTRODUCTION

The reliable and mobile communication is a fundamental necessity of this era. For effective communication many architectures has been developed few of them are wireless asynchronous transfer mode (WATM), Cellular network, Ad-hoc network, Wireless sensor networks, satellite communication device etc and it has numerous application in real life [4]. The generic communication between these networks called next generation communication. Now a day the next generation communications have gain more attention for seamless communications because it provides integration of all different kinds of networks. The need of this kind of communication technology is very crucial. It provides least cost, and reliable communication.

The traditional circuit-based networks are being replaced by packet-switched ‘‘next-generation networks’’ (NGN) which will operate alongside the public Internet [9]. The NGN are an aspect of technological evolution which might change how consumers access telecommunication services, and could therefore change the nature and significance of termination of old technologies. The Next Generation Communication Networks employ the idea of convergence, where heterogeneous access technologies may coexist and a user may be served by anyone of the participating access networks and motivating the emergence of a Network Selection mechanism. The NGN are designed to support a wide range of applications with various service classes guaranteeing the respective Quality of Service (QoS) levels [8]. In this paper, we have proposed a new protocol for NGN to enhance the QoS of networks.

This paper is organized as follows, the related work and motivation to propose a new protocol is presented in the section II. The section III, will demonstrate the proposed protocol. How much our proposed protocol is efficient is illustrated in section IV. The section V concludes the paper and followed by references.

II. RELATED WORKS AND MOTIVATION

The next generation communication has unique properties to embedment of heterogeneous networks. Towards narrowing the integration issue many research work is going on [6]. In [1], the authors propose towards cross layer mobility support in metropolitan networks and works as a glue of all different kind of heterogeneous networks. In [1, 2], the author proposes a hybrid inter-networking architecture (HIA) for metropolitan area networking. The working domain of HIA is inter-networking cooperation server and local inter-networking cooperation server with this, HIA working properly. In [7], author proposes outline architectural guidelines and design strategies for ITU-T RACF employment across GMPLS-controlled networks while providing a variable solution for dynamic resource control that takes into account operational issues for the integration of GMPLS capabilities within NGN architecture. Thus, an NGN prototype implementing the proposed architectural, the enhancement is also presented as a proof of concept. The implementation of NGN is expensive. The NGN has many issues of billing and economics interfaces. In [9], author proposes cost estimation with the following conclusions. The intervention should be limited to situations of demonstrable market failure, and be undertaken only where benefits of intervention outweigh its costs. Second, to enhance economic efficiency regulators should intervene at the network layer that is closest to the market failure.

The wireless technologies are producing the unique results, when they are as an isolated network. Now days, next generation networking (NGN) puts together several wireless networks. A NGN is a packet-based network able to provide telecommunication services to users and able to make use of multiple broadband, QoS-enabled transport technologies and

in which service-related functions are independent of the underlying transport-related technologies. It enables unfettered access for users to networks and to competing service providers and services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users. [ITU-T Recommendation Y.2001 (12/2004) - General overview of NGN] and it should be scalable [2, 7].

The integrated architecture of wireless system is available in the figure 1. In this the backbone of all kind of networks is IP network. The IP provides the glue of all isolated wireless networks [3, 5]. The figure 1 has four different kinds of wireless technologies (WLAN, PSTN, Ad-Hoc, and WSN) and all of them are connected to the IP network. Whenever a node of any network communicates within the intra domain, they can communicate without any complication. The inter domain communication (different technologies) has a several issue as each network has it own protocol and communication strategies.

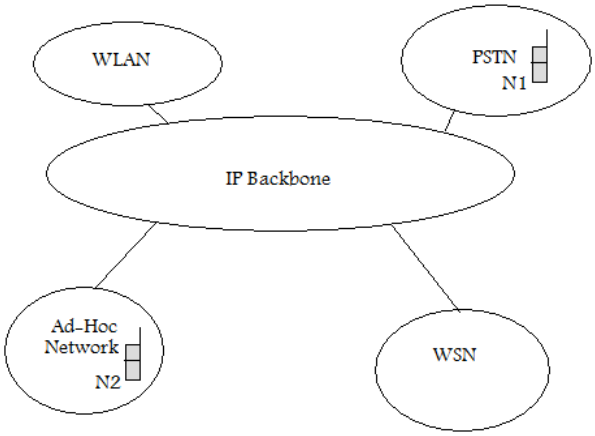

Figure 1: Integrated wireless networks architectures

Now, the motivation to introduce the seamless network to encapsulate the different protocols to a generic protocol and passes it over the IP network. There is a big dilemma when various wireless communication technologies are integrated together. The main issue is how to link different kinds of wireless technologies.

III. PROPOSED PROTOCOL

In this we have proposed a wireless protocol which is capable to integrate all kind of wireless networks and fulfill the above requirement. All transmissions are in the form of frames and the single frame format (as shown in Figure 2) is sufficient for data and control exchange.

Figure 2: Proposed Protocol Frame Format

The main attribute of this protocol, it is capable to communicate different kinds of isolate networks. This procedure will be performing with the following technique. Whenever, a source has the data to sends, the data is forwarded to the Access Router (AR). The AR will determine the destination address and destination type (e.g WLAN, WSN, Ad hoc.) of its with the help of address specification. The AR of the source network will convert that frame to destination compatible network frame. For this purpose the frame uses the control field.

The length of flag is 8 bits; it has a unique bit pattern of 01111110, so it is helpful to understand the in starting and ending of the frame. There may be any co-incident that, the flag bit sequence is present in the data. This may lead to the end of frame. To avoid this, the protocol will follow the bit stuffing technique [10]. The address field is 8 bit and has two types: Source address and destination address, they maintain the address of source and destination respectively.

The most important field is control field, it provides the control mechanism over the communication network and it has 16 bit length, each bit of it has unique functionality as shown in figure 3. The specification of bit pattern of control is describe as follows, two bit for bearer capabilities, if the first bit is set as 0(e.g. 00, 01) then communication is possible with in home network else(10, 11) they support communication over the global environment. It defines the accessibility of frame over the networks, only incoming (half duplex) from sender, sending to other network but can not receive, full duplex control mechanism respectively.One bit for call session, the call session bit is for the call initiative, if it is 1 then node can setup the connection else waiting for connection request of other nodes. The application/service is also one bit field. This bit shows the applicability and service, the value 1 for encapsulation with other frames and 0 for isolated frame. The mobility field is for the mobility purpose and it is one bit for support the mobility, it has two values: 1 for static, 0 for mobile network. One bit is assigned unfettered access by users to different service providers (scalability), and it is for the uniform access of data over the networks and it is always 1. Next four bit for network compatibility for this the network will set the bit pattern according to the user requirements. For example: if the data is sends from a WLAN to PSTN then bit pattern of the PSTN will be filled in these bit fields. So , the data frame will convert PSTN based frame.

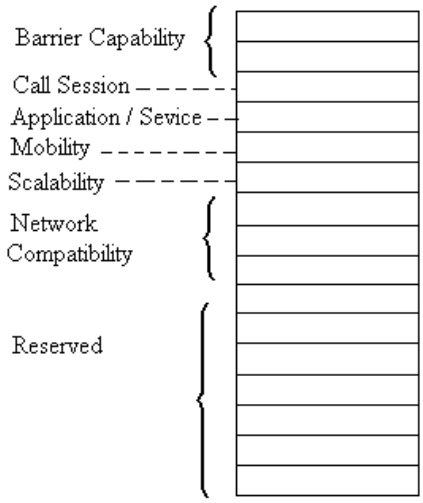

Figure 3: Control field specifications

The information field consists of data information or sequence of bits and it is variable by nature. It has properties of the variety of identification schemes, for the congestion management. For congestion management the information has size zero but other fields are to be define to identify the status of the networks. So, it can be resolved to IP addresses for the purposes of routing in IP backbone networks and converging services between fixed and mobile networks. It accommodating with all regulatory requirements, for example concerning emergency communications and security/privacy, etc.

The frame check sequence (FCS) has the size of 16 or 23 bit. It is for error detection purpose and follows the cyclic redundancy check (CRC).Finally the complete frame is embedded with the IPV_4 frame. This process called IP encapsulation.

IV. Analytical Modeling And Efficiency

To calculate the efficiency of the proposed protocol we should introduce some notations.

T = Transmission time of the frame.

P = Propagation time of the frame.

f = Frame length.

r = Rate (bit/sec).

l = Length of the medium.

v = Traveling velocity of the frame.

In general efficiency (E) can be computed as:

$$\text{Efficiency} = \frac{\text{Transsmission time}}{\text{Transmission time} + \text{Propagation time}}$$

$$T = \frac{f}{r},\ P = \frac{l}{v}$$

$$E = \frac{T}{P+T}$$

$$= \frac{(f/r)}{\left[(f/r)+(l/v)\right]}$$

$$= \frac{v\ r\ f}{vf + rl}$$

For a particular medium, rate and velocity is constant so the efficiency is depends on frame length, and length of the medium. The important factor is, the back bone of network is IP protocol service. So, it will provide best effort delivery of data packets. Then there will be a probability of success towards delivering the data packets. The probability of successful transmission is P_0 , and failure transmission is $(1-P_0)$ and n stations are trying to communicate to corresponding nodes. Then actual transmission (A) will be:

$$A = \sum_{n=1}^{\infty} n E . P_0 (1-P_0)^{n-1}$$

The maximum value of A is depends on the P_0, n . The value n = 4 and P_0 = 0.25 gives the maximum results. For the error free condition the efficiency of actual transmission is $A \approx 400\%.$. For the numerical analysis we set the following parameter.

$f = 1500\ -\ 5500\ bits, r = 25 bit/\sec.$

$l = 1000\, meters, v = 45 m/\sec.$

In the figure 4 the range of velocity is 45 m/sec to 85 m/sec.

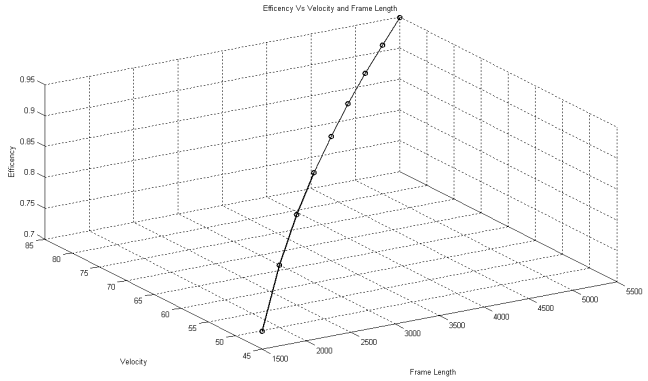

Figure 4: Efficiency Vs Velocity and Frame length.

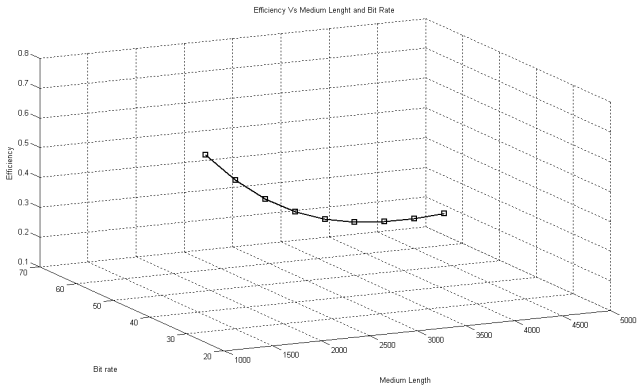

Figure 5: Efficiency Vs Bit rate and medium Length.

The figure 5 shows the effect of bit rate and medium length over efficiency. The variations bit rate is from 25 to 65 bits/sec and medium length from 1000 to 5000 meter.

V. CONCLUSIONS

In this paper, we proposed a simple next generation protocol for integrated wireless networks. It covers the properties of mobility, robustness, syntax, and it capable to communicate over the isolate heterogynous network. In the idle condition it has unique results. Thus, the propose protocol of NGN will helpful for the seamless integrations of networks to enhance the QoS of communication networks.

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Sanjay Kumar Biswash received B.I.T and M.C.A from School of Computer and Information Science, Indira Gandhi National Open University (I.G.N.O.U) in 2004, 2007 respectively. Now he is a Ph.D candidate in Department of Computer Science and Engineering, Indian School of Mines Dhanbad (I.S.M). His research interest includes Mobility management, Wireless Communication, Computer Networks and Ad-Hoc networks. He served as a reviewer of Journal of Network and Computer Application (Elsevier publication) in 2009, 2010 and Journal of Computer Systems, Networks, and Communications, (Hindawi publication), 2010.

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