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A Study on Next Generation Networks with Li-Fi Technology

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Abstract—This article is presented in a three-part series describing next-generation networks (NGNs). This first part examines the significantly different properties of packet-based NGNs and legacy circuit-based networks. These differences will determine the new trends of usage and characteristics of NGNs. Part 2 will present a set of graphical paradigms to illustrate the dramatic effects that NGNs will have on the communications environment. Part 3 will identify the effects Li-fi technology in NGN network service providers, and the communications industry in general.

Keywords: Next Generation Networks (NGN), Li-Fi

I. INTRODUCTION

Classic telecommunication networks were implemented for the transfer of data such as telephone calls or data packages. Recent growth and new requirements for the market and technological developments improvements have fundamentally changed the traditional approach of telecommunications industry. now a days, broadband connections the convergence processes of various network technologies and the coming out of a uniform Internet protocol (IP) standard for individual and mass communications. Traditionally market boundaries between fixed networks, mobile telephony and data networks are fading more and more quickly. Customer will take the advantage that he can call on an extremely broad range of services, apart from of his access technology. This development requires a meta-infrastructure further than the existing, and other networks – a major network for all the access networks. This new network is named as Next Generation Network. The Internet Protocol is the most important integration factor because it is accessible globally at least in principle, it can use almost all the services in all the networks.

II. NEED AND IMPORTANCE:

- *In the core network, NGN implies a consolidation of several (dedicated or overlay) transport networks each historically built for a different service into one core transport network (often based on IP and Ethernet). It implies amongst others the migration of voice from a circuit-switched architecture (PSTN) to VoIP.*
- *In the wired access network, NGN implies the migration from the dual system of legacy voice next to DSL setup in local exchanges to a converged setup in which the DSLAMs integrate voice ports or VoIP, making it possible to remove the voice switching infrastructure from the exchange.*
- *In the cable access network, NGN convergence implies migration of constant bit rate voice to CableLabs PacketCablestandards that provide VoIP and SIP services. Both services ride over DOCSIS as the cable data layer standard.*

In an NGN, there is a more defined separation between the transport (connectivity) portion of the network and the services that run on top of that transport. This means that whenever a provider wants to enable a new service, they can do so by defining it directly at the service layer without considering the transport layer – i.e. services are independent of transport details. Increasingly applications, including voice, tend to be independent of the access network (de-layering of network and applications) and will reside more on end-user devices (phone, PC, set-top box).

III. MAJOR DRIVERS TO NEXT GENERATION NETWORKS

Recognized network operators are finding themselves forced to about turn their business models and to convert their communications IP based platform to Next Generation Network. The main aim is to decrease costs and to create latest sources of income, as displayed in Figure 1.1.

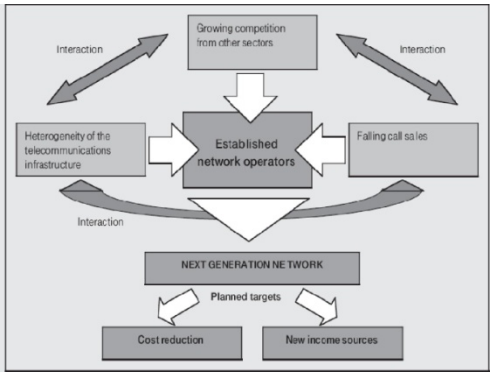

Figure 1.1 Reasons for the migration to the Next Generation Networks

3.1 HETEROGENEITY OF THE TELECOMMUNICATIONS INFRASTRUCTURE.

The present telecommunications networks consist of a variety of wired and wireless technologies: satellite and cell phone networks such as GSM/UMTS, phone networks, wireless local networks like wireless LAN and Bluetooth networks, fixed networks like Ethernet and fiber-optic networks.

Increasing number of services has led to an addition in the platforms essential to provide them, which in turn has augmented the complexity of the overall infrastructure. The problems of interoperability between the a variety of systems are becoming more serious, and this rising the complexity is also placing greater stress on staff. Maintaining these platforms involves increase annual operating costs for the network operators. Recognized network operators often maintain 15 to 20 dissimilar platforms with hundreds of central switches, which is without doubt leads to extremely high staffing costs.

IV. IMPLEMENTING LI-FI TO NEXT GENERATION NETWORKS

4.1 HYBRID LI-FI SYSTEM ARCHITECTURE

The planned hybrid Li-Fi network is exposed in figure 2. The whole system is composed of multiple compact wireless energy harvest sensor nodes, one Li-Fi access point, and a central control computer. The LED provides ambient lighting energy to sustain the operation of energy harvest sensors. In addition, the central control computer sends control signals (e.g., a command to start temperature sensing operation) through the Li-Fi communication mechanism. On the other hand, through a wireless uplink link, these temperature values or other environmental parameters were transmitted to the access point and then display in the central control computer for inspection and testing.

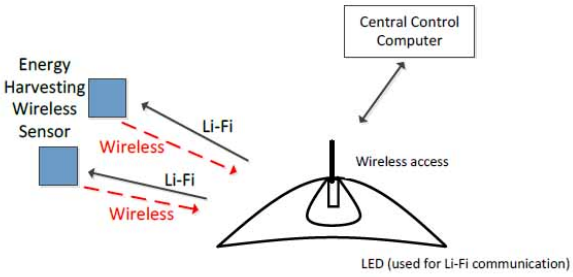

Figure 2: Li-Fi Architecture

4.2 WORKING PROCEDURE

It is implemented by using a light bulb at the downlink transmitter. Normally the light bulb glows at a constant current supply however fast and subtle variations in current can be made to produce the optical outputs since it just uses the light, hence can be easily applied in aircrafts or hospitals or any such area where radio frequency communication is often problematic. The operation procedure is very simple-, if the LED is on you transmit a digital 1, if it is off you transmit a 0. The LED can be switched on and off very quickly henceproviding nice opportunities to transmit data. Hence all that is required id some LED and a controller that code data into those LEDs flicker depending upon the data we want to encode. The more LEDs in your lamp, the more data it can process. To further get an clear idea of what is said above let us consider a IR remote which sends data stream at rate of 10000-20000 bps. Now replace the IR LED with a light box containing a large LED array which is capable of sending thousands of such streams at very fast rate. LEDs are found in traffic and street lights, car brake lights, remote control units and countless other applications.

So visible light communication not only solves the problem related to lack of spectrum space but also enable novel application because this spectrum is unused and not regulated thus can be used for communication at very high speeds. This method of using rapid pulses of light to transmit information wirelessly, technically referred to as visible light communication (VLC) has a potential to compete with Wi-Fi and hence inspired the characterization of Li-Fi.

4.3 TRANSFER MEDIUM (FIBER OPTIC)

Generally, fiber optic cables are wires that transmit data through a extremely thin layer of glass or plastic fiber threads. The relation between fiber optic thread and LiFi is that light signals travel through these fibers in form of light and then translated to 1's and 0's, the data part. However fiber optics are extremely expensive but massive bandwidth availability can do away with that and hence may soon replace most existing wired cables and the change has already started initiating.

4.4 ADVANTAGES OF Li-Fi:

High speed connectivity of the rate of 500mbps.

1) *Li- Fi uses light rather than radio frequency signals so are intolerant todisturbances.*
2) *VLC could be used safely in aircraft without affecting airlines signals*
3) *Integrated into medical devices and in hospitals as this technology doesn'tdeal with radio waves, so it can easily be used in all such places where Bluetooth, infrared, Wi-Fi and internet are broadly in use.*
4) *Under water in sea Li-Fi work at all but light can be used and hence undersea explorations are good to go now with much ease.*
5) *There are billions of bulbs worldwide which just need to be replaced withLED's to transmit data.*
6) *Security is a side benefit of using light for data transfer as it does not penetrate through walls.*
7) *On highways for traffic control applications like where Cars can have LED based headlights, LED based backlights, and they can communicate with each other and prevent accidents.*

Using this Technology worldwide every street lamp would be a free data access point. The issues of the shortage of radio frequency bandwidth may be sorted out by Li-Fi.

CONCLUSION

This paper has presented a model for an improve NGNs. The proposed model has the potential to mitigate the problem of NGNs and can satisfy our identified requirements for NGN. The model is independent of any service or environment and general enough to accommodate any type of existing or future service. The model is still in its infancy and necessitates more research. Future work would consist on testing the viability of such a model through the implementation and testing of an appropriate prototype.

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