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Towards a Digital Home

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Abstract – The Digital Home refers to a residence with devices that are connected through a computer network. Though Digital Home technology and standards are evolving towards an integrated electronic home system, currently the digital home consists of unconnected subsystems which conform to different standards. To facilitate accessibility to different subsystems in our home in a uniform manner we need to look at ways to integrate the different subsystems around the house. In this paper we propose using bandwidth and open standards as ways to enable integration.
Keywords- digital home, bandwidth, open standards

I. INTRODUCTION

The Digital Home refers to a residence with devices that are connected through a computer network. It is a network of consumer electronics, mobile and computer devices that co-operate transparently to simplify usability in the home [1]. The digital home technology enables the automatic or semi-automatic control of lighting, climate doors and windows, and security, surveillance systems and control of other sundry devices in the home including entertainment systems.

The current state of a digital home consists of several unconnected subsystems which conform to different standards e.g cable television, security and telecommunication subsystems are not connected and are controlled differently [2]. A digital home network often includes both wired and wireless systems that control different devices. The reason for this is because as new technologies and services emerge, no common standards are available for equipment service providers and suppliers to integrate their systems into a single uniform system.

To enable a digital house all computing, electrical and electronic devices and home appliances are expected to conform to the same standard system in a Digital Home so that everything can be controlled by a computer. In this paper we propose 2 methods to integrate unconnected subsystems so that they can conform to different standards. We firstly propose bandwidth which enables optical networking and wireless communications between different subsystems. We also propose open standards to allow the different subsystems to be integrated.

The structure of this paper is as follows: In section 2 we will propose and discuss how the digital home should be configured. In section 3 and 4 we discuss the roles of bandwidth and open standards for the implementation of our proposed digital home. Conclusions are presented in section 5.

II. THE PROPOSED DIGITAL HOME

To address the problems of the current digital home we need a single multifaceted, multi-provider network to connect the various subsystems together to make the digital home viable. Since the digital home is expected to combine different technologies for the various home applications a single agnostic platform is required that will support multiple protocols so that all traffic can be aggregated and administered by a single server [3].

An integrated digital home needs to handle information flow in any form so both unicast or multicast streaming must be supported. There is also a requirement for supporting isochronous traffic. Support of Isochronous traffic that is time bounded information that must be transferred within a specific time frame, which has a low tolerance for delay and loss, must be possible within the network given the fact that most of the information expected in the network will be real time.

We propose the digital home network to be a high-speed network capable of transporting and routing a multitude of services, including voice, data, video, and multimedia, on a common platform for applications and services that is accessible to the users across the entire home network as well as outside the network. We propose a digital home network to include various technologies which are both wired and wireless that will control numerous devices including security systems, lighting, home tele-care applications, and home entertainment systems. These networked devices will require low-power, high-performance technology platforms that should be provided by a robust and reliable solution.

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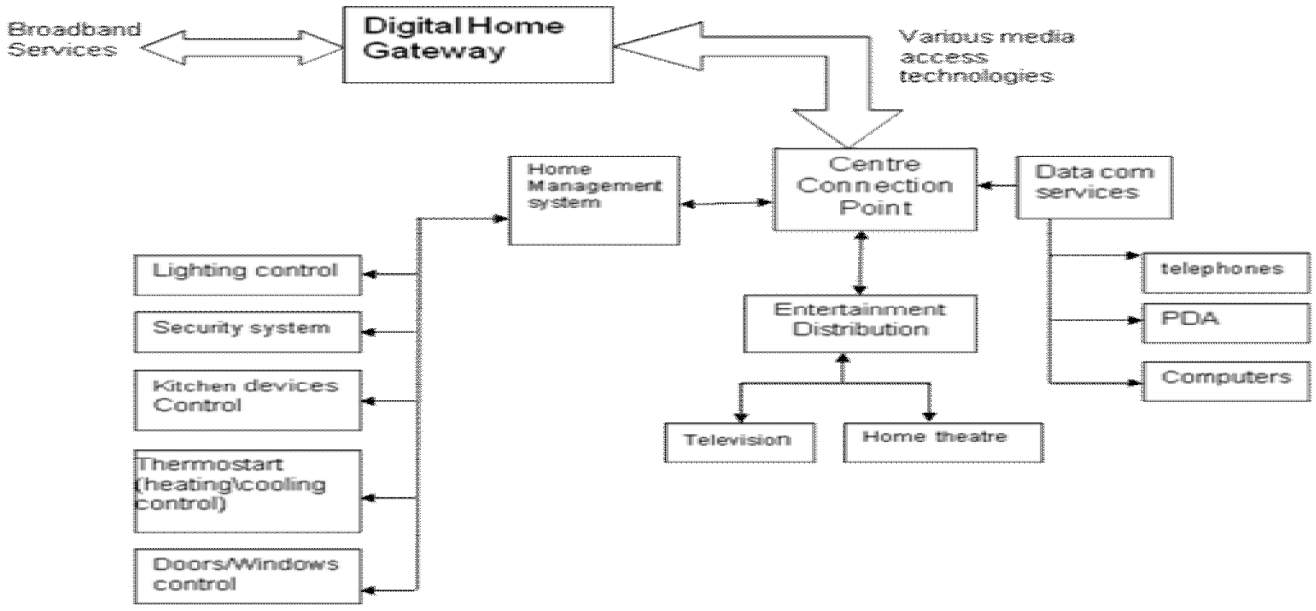

Fig 1: The Components of a Digital Home

Our proposed digital home is expected to be a converged home network, where interoperability of various media management and control between different types of multimedia devices and services is applicable. The Quality of Service issues for multimedia services need to be addressed in order to satisfy users' quality expectation because multimedia applications such as Audio/Video (AV) streams, voice and games are bandwidth and delay sensitive cannot be overemphasized.

Figure 1 shows the various connected components to make the digital home operational. It can be seen that all subsystems are connected together using a single network. The Digital Home gateway is the interface of the digital home network with external broadband services such as PSTN (Public Switch Telephone Network) network. A Centre Connection Point integrates all the various subsystems such as the home management system which controls various household appliances, the entertainment distribution system which controls entertainment appliances and a data communication services system which control data communication appliances. Other subsystems can also be plugged into the digital home in the same way. The external broadband services allow the various subsystems to be controlled within or out of the digital home.

Our proposed digital home is expected to be a converged home network, where interoperability of various media management and control between different types of multimedia devices and services is applicable.

For the digital home to be viable we need to consider bandwidth as the form of communication and open standards to facilitate inter-operability between devices.

III. BANDWIDTH

A broadband access medium can be defined as a high-speed and high-capacity transmission medium that is capable of conveying signals from a wide range of independent network carriers. Broadband technology can support a wide range of frequencies and is used to transmit data, voice and video over long distances simultaneously [4]

Availability of bandwidth has increased in recent years mainly due to developments in both optical networking and wireless communications. The requirements of digital network applications which generally include high degrees of visualization as well as sensory streams is driving the move for such a large amount of bandwidth,

Broadband technologies will play a key role in the digital home as it is presently providing. Indeed the telecommunications industry has an opportunity to create a world in which all people can have affordable access to basic services that can improve lives, enable access to healthcare and to provide education services. Broadband also facilitates the provision of information, entertainment, and also a world in which everyone can take part in a borderless and global information society.

There is a requirement for data high speed and capacity. The average estimated bandwidth of more than 65Mbps is required for the digital home to operate [1]. Each signal or stream requires full access to its required bandwidth at all times in order to maintain acceptable service levels.

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There is a requirement for bandwidth on demand for each application. Digital-rich media, in every conceivable sort of format including audio, animation, graphic, full-motion video, application, whiteboards, and communities will increasingly depend on multimedia. Information will have to be available on the network and each application will require a unique bandwidth.
High speed and capacity, bandwidth-on-demand are provisions which the home networks must be able to provide when it is needed. Support of Isochronous traffic that is time bounded information that must be transferred within a specific time frame, which has a low tolerance for delay and loss

IV. OPEN STANDARDS

Since the services of many proprietary solutions are incompatible with similar service offerings from other operators, subscribers often cannot interact with other subscribers on other networks [6]. One way to overcome this problem is to use open standards.

Open Standards are a set of rules and specifications which collectively describe the design or operating characteristics of a program or device that is published and made freely available to the technical community [6]. Such standards can contribute to rapid market growth if they encourage interoperability. Currently, businesses around the world are beginning to adopt open standards which could be used in the digital home [7].
The digital home must adopt open standards because of the improved interoperability, organizational flexibility and responsiveness that such an initiative would generate for consumers. In particular, it provides the opportunity to avoid middle men and diminishes vendor relevance. The advancement of information technology makes it an integral part of other disciplines and this new-found preference for open standards is driving innovation in government, academia, medical services, emergency services, businesses and other sectors [8].
The digital home's ability to keep up with new technologies and general trends towards open standards has prompted digital home technologies to have unwritten software procurement policies which specify that products and solutions should support and implement open standards before they can be deployed. However, digital home technologies must overcome several challenges before they can be put into practice e.g open standards may not be available for a particular product or it may not be useful for a required technology. Also, in many cases, the usage of a genuine standard is so well-established by consumers that it is not practical to ignore it.
By adopting open standards, digital home consumers would achieve and gain the following [9]:

A. Introduction of interchangeable components into their technology peripherals and surroundings
B. Augment portability and scalability of technology use
C. Decrease total cost of ownership
D. Improve and increase interoperability of other digital home items
E. Access to expanded software products
F. Decrease switching and transferring of data costs to different programs
G. Increase security methods to safeguard data for a long time
H. Reduction in the potential for unfair contract terms
I. Reduction in the need to lock in to one system or one vendor for a long time.
J. Increase vendor choice, reduce vendor independence and decrease cost

Open Standards are the backbone of a service-based approach where organizations not only acquire new customers but try to retain its current customers with up-selling, cross-selling, loyalty etc. The goal of a service-based approach is to eliminate or, at least, minimise product incompatibility and inoperability for customers. In particular, a service based approach would increase flexibility, modularity and choices for consumers since open standards would create a fairer and more competitive market for the implementation of interoperability standards and does not tie the customer into a particular vendor. Moreover, consumer choices will become service-oriented based and technology-neutral.
Applications that use open standards would enable consumer and technology managers to integrate, mix and match, and change components without the cost and expense of expertise to customise coding and integration between service components. Open standards will enable businesses and consumers to expand their choices of products and services which results in increased competition among technology companies which will, in turn, assist related businesses and increase returns on investments [10].

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Using open standards on consumer's technological products and services and the creation of internal harmony between gadgets in the digital home can reduce unnecessary stress, decrease costs, save shopping time looking for compatible products, and gives the consumer wider choices. Indeed, since vendors come and go and open standards remain durable, there will be greater vendor independence – this will decrease the cost of changing vendors by decreasing the costly components of change, and, in turn, reduce the risk of incompatibility and dependency on and support for a particular technology.

V. SUMMARY AND CONCLUSIONS

Currently the digital home consists of various unconnected subsystems which cannot communicate with each other. In this paper we proposed that the digital home must consist of a single network of connected subsystems facilitated by broadband and open standards – this will allow the integration of unconnected subsystems so that they can conform to different standards.

Bandwidth enables optical networking and wireless communications between different subsystems. Broadband technology can support a wide range of frequencies to transmit data, voice and video in the digital home and can improve lives by enabling access to healthcare and education services.

Open standards allow the different unconnected subsystems to be integrated. Using open standards on products and services will enable new components to be easily integrated and will lead to the creation of internal harmony and compatibility between products in the digital home.

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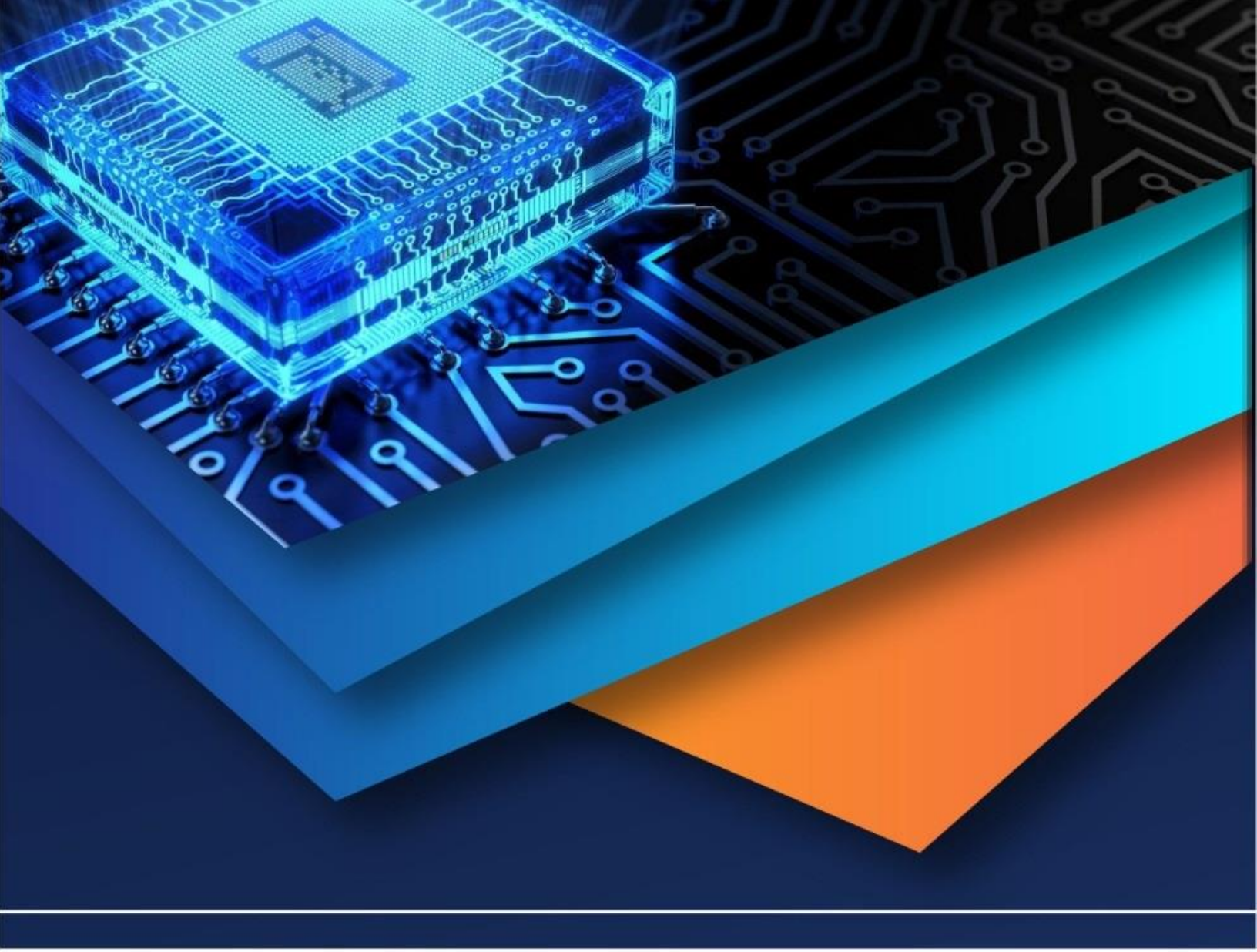

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