

Challenges of the Digital Home in a Developing Economy

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Abstract

The Digital Home technology and standards are evolving towards an integrated electronic home system. This evolution will facilitate accessibility of data and information from various sources around the world to our home. The technology will also enable 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 implication of these trends to the developing country and their economies are numerous and far-reaching. This paper examines the various issues and challenges of the digital home concept in the developing economies of the world.

Keywords: digital home, development.

1. 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 cooperate transparently to simplify usability in the home.[5] The Digital Home facilitates the automatic or semi-automatic control of lighting, climate doors and windows, and security, surveillance systems and control of home entertainment systems. 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.

Currently the digital home consists of unconnected subsystems which conform to different standards. In this paper we propose and discuss how a digital home should be configured and how it will address the various challenges that come with it in a developing economy.

The structure of this paper is as follows: In section 2 we will discuss the current state of the digital home. In section 3 we will propose and discuss how the digital home should be configured. In section 4 we discuss the various challenges of implementing our proposed digital home in a developing economy. Conclusions are presented in section 5.

2. The Current Digital Home

Presently, as new technologies and services emerge, no common standards are available for equipment service providers and suppliers. Figure 1 shows the current state of a digital home. It can be seen that currently the digital home consists of several unconnected subsystems which conform to different standards. For example, there may be cable television (CATV), security and telecommunication subsystems which are not connected and are controlled differently.

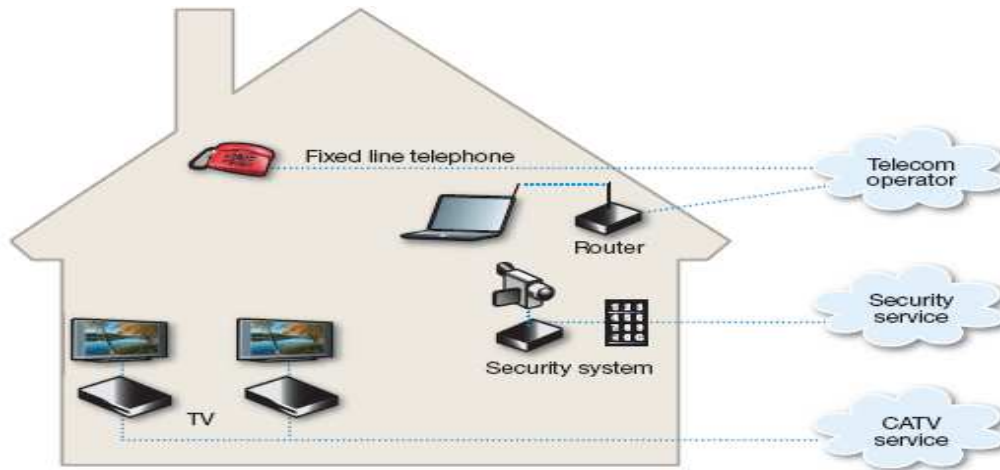


Figure 1 - The digital home as at now[4].

There is, therefore, the need for regulatory framework and business models, since we have multi-faceted, multi-provider infrastructure networks available.

To address the problems of the current digital home we need a single network to connect the various subsystems together to make the digital home viable. However, this brings its own challenges.

As personal computers and digital consumer electronics devices become increasingly interactive, the resulting “connected home” environments will enable consumers to produce, customize and share rich multimedia content with each other in a peer-to-peer mode. Ultimately, a multi-platform environment will be available to embrace different platforms and access modes.

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

3. Proposed Digital Home

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.

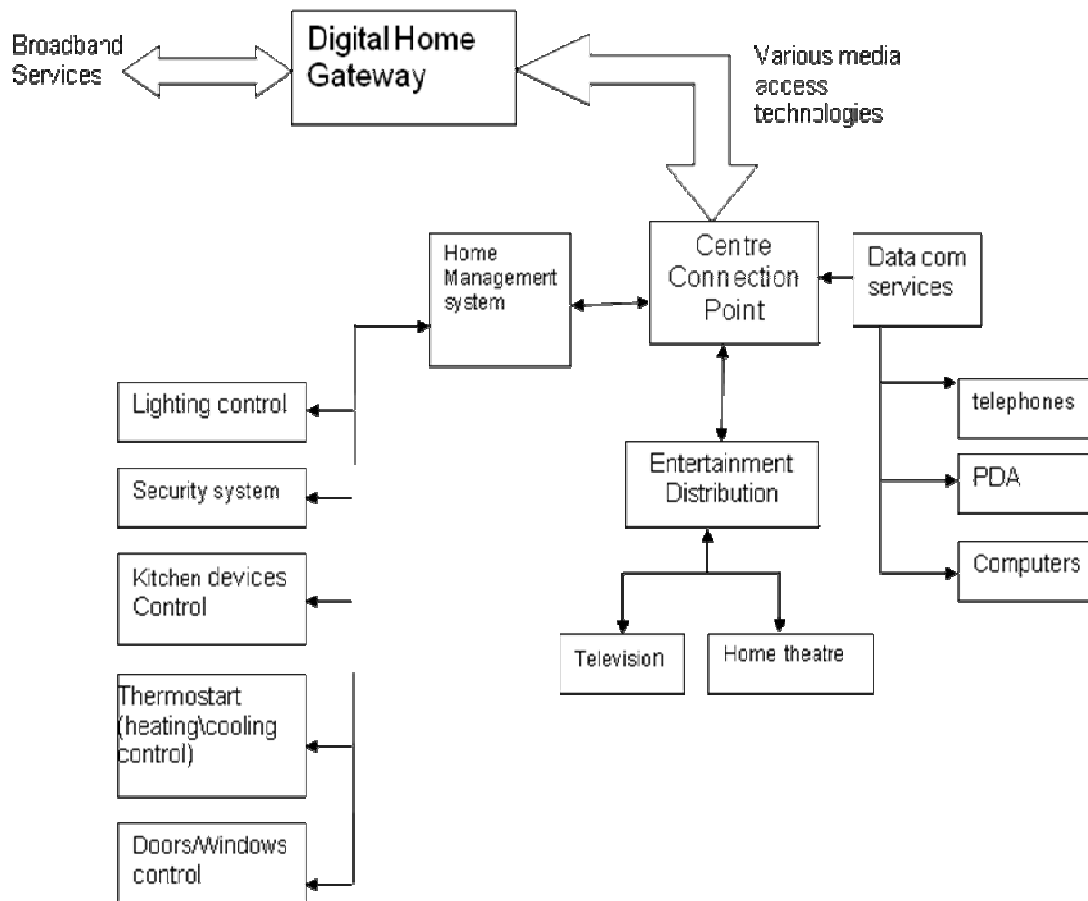


Figure 2: The Components of a Digital Home

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 2 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.

For the digital home to be viable there are a number of requirements that have to be met.

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 [5]. Each signal or stream requires full access to its required bandwidth at all times in order to maintain acceptable service levels.

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.

There is a requirement for supporting unicasting and multicasting. The seamless end-to-end services provision on a national and international scale, on multiple network platforms, must be achievable within the digital home network. Information flow in any form whether unicast stream or multicast must be supported.

There is a requirement for support for 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.

There is a requirement for an agnostic platform. Since the digital home is expected to combine different technologies for the various home applications, a single platform is required that will support multiple protocols so that all traffic can be aggregated and administered by a single server [7].

4. Challenges of the Digital Home

Digital home networks often include both wired and wireless systems that control numerous devices, including security systems, lighting, home telecare applications, and home entertainment systems. These networked devices require low-power, high-performance technology platforms which are provided by a robust and reliable solution.[4]

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.

In order to achieve the above mentioned specification and standards for the digital home network there are a lot challenges that need to be addressed - these include standardization, bandwidth, maintenance and power supply. We shall look at each in turn.

4.1 Standardization

Standards are essential for making a multifaceted multi-provider infrastructure work. They can shape the nature of the services and capabilities that are available, as well as how they are implemented.

Standardization will enable interoperability and open standards. It is a wide issue, embracing mass-market technologies that have direct impact in the technology and services competitiveness.

Standardization in the Digital home network services will ensure the following:

- Interoperability of products serving specific service markets, in order to allow diversity and innovation without confusion in the delivery of multimedia services
- Inter-changeability of products from suppliers serving the same applications, in order to promote price competition

- Interoperability within national environments between different networks comprising the multimedia platforms
- Interoperability between national networks as multimedia services develop without national boundaries
- Seamless end-to-end services provided on a national and international scale, on multiple network platforms, with fully interchangeable product elements

The standards from the likes of the Digital Living Network Alliance (DLNA) and the Universal Plug and Play Forum (UPnP Forum) that allow consumer electronics devices to share content without a complicated configuration process though noble remains far from an encompassing standards expected for the digital home networks.

Moreover, the services of many proprietary solutions are incompatible with similar service offerings from other operators. As a consequence, subscribers often cannot interact with other subscribers on other networks [3].

4.2 Bandwidth

Today's networks simply were not built for multimedia and, in particular, for applications that involve video communications, multimedia collaboration, and/or interactive-rich media

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. Video and multimedia applications require substantial bandwidth, as well as minimal latencies and losses.

The average estimated bandwidth is about 65Mbps for the digital home to averagely operate. Each signal or stream requires full access to its required bandwidth at all times in order to maintain acceptable service levels. Service operators are looking to have at least 75 Mbps of bandwidth within the home network [4].

Currently we are experiencing a wild unleashing of bandwidth, largely driven by 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.

In the developed world the issue of broadband is already being seen as an issue which is treated like public utilities such as water and electricity – this is because the present need and usage of bandwidth is similar.

In a developing world the 65Mbps bandwidth is quite high for an average home given the cost and infrastructure requirements.

4.3 Maintenance

Since the digital home is a combination of different technologies on a single platform, the network will be too complex for an average home owner/user to be able to maintain and fix any problem that may arise. Therefore there is a need for maintenance personnel that are adequately trained in the various technologies that are used. Given the shortage of inadequate technical manpower in developing countries, maintenance will be a major challenge for the deployment of the digital home.

4.4 Power Supply

The efficient functioning of the power sector has a fundamental bearing on economic development and poverty reduction. Without adequate power supply, basic services (such as piped water supply, lighting, and storage facilities for perishable goods and life-saving drugs), industrial and non-industrial operations, and access to information, communications, and

digital connectivity are likely to be adversely affected. Without access to electricity, rural areas are unlikely to maximize income-generating activities that are essential to reducing poverty.

In many developing countries creating the necessary framework to provide the basic energy needs of the population is a primary social responsibility of the state. If the digital home is to allow virtually all data and information from various sources from around the world available easily and readily accessible from home to allow for the automatic or semi-automatic control of lighting, climate doors and windows, and security, surveillance systems and control of home entertainment systems, there must be an extensive, affordable, reliable and available power supply.

5. Summary and Conclusions

Currently the digital 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. However, our proposal brings with it a number of challenges for a developing economy.

As new technologies and services emerge, common standards are important to allow interoperability between players and equipment service providers and suppliers both technical and commercial. There needs to be a regulatory framework and business models supporting new ways of cooperating.

Evolution must not inflict burdens on the users such as outages, unnecessary cost or complete change of behaviour. There is need for global standards and open interfaces to ensure a sustainable evolution path across the industry.

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