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WG 1 ([Berlin](#)~~Cancun~~, Wacks) 44

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**ISO/IEC JTC 1 SC 25 WG 1
Interconnection of Information Technology Equipment
Home Electronic System**

Title: Linking HES Devices to the Internet, [revision 1](#)

Source: United States

Project: Working Group 1, HES Architecture
(Specific project to be determined)

Requested Action: For consideration by WG 1

Reason: Respond to industry requests for linking home products to the Internet for remote control

Distribution: All WG 1 members

Notes:

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FOREWORD

ISO (the International Organization for Standardization) and the IEC (the International Electrotechnical Commission) form the specialized system for world-wide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

This proposal was prepared by the U.S. Technical Advisory Group to ISO/IEC JTC 1/SC 25/WG 1, *Interconnection of Information Technology Equipment / Home Electronic System*.

INTRODUCTION

The development of most home automation infrastructures is based on applications of local area network technology to the home. The anticipated applications have involved interconnecting appliances, sensors, switches, and control panels within the home. Growing interest by electric and gas utilities prompted WG 1 to focus on HomeGate. HomeGate provides a link between an external utility wide area network and the Home Electronic System, the standard being written by WG 1.

Current applications of the Internet involve primarily E-mail and transmission of World Wide Web pages for viewing. Various trade groups are starting to examine the transmission of command and control over the Internet between user and device, and device-to-device.

This paper discusses how the HES architecture could be modified to accommodate remote control via the Internet. It is expected the WG 1 will decide where in the Program of Work this project should reside. Follow-on work and technical assignments can then be determined.

1. Scope

The ideas presented here are intended to facilitate extensions of the HES architecture to accommodate access to the Internet. It is expected that remote control via the Internet would be useful both for home and building automation applications.

The rapid growth of the Internet has resulted in much engineering resources devoted to Internet research. Therefore, investigation of this topic by WG 1 may draw attention to the potential importance of HES in extending the Internet to home appliances and building system components. Liaisons with Internet standards groups and trade associations may be worthwhile for WG 1.

2. Interface to the Internet

2.1 Network Access Unit for the Internet

The HES Universal Interface (UI) allows home and building components to connect to a variety of communications infrastructures. The design principle for the UI is that adaptation to a specific network is done outside the device via a Network Access Unit (NAU), as shown in Figure 1.

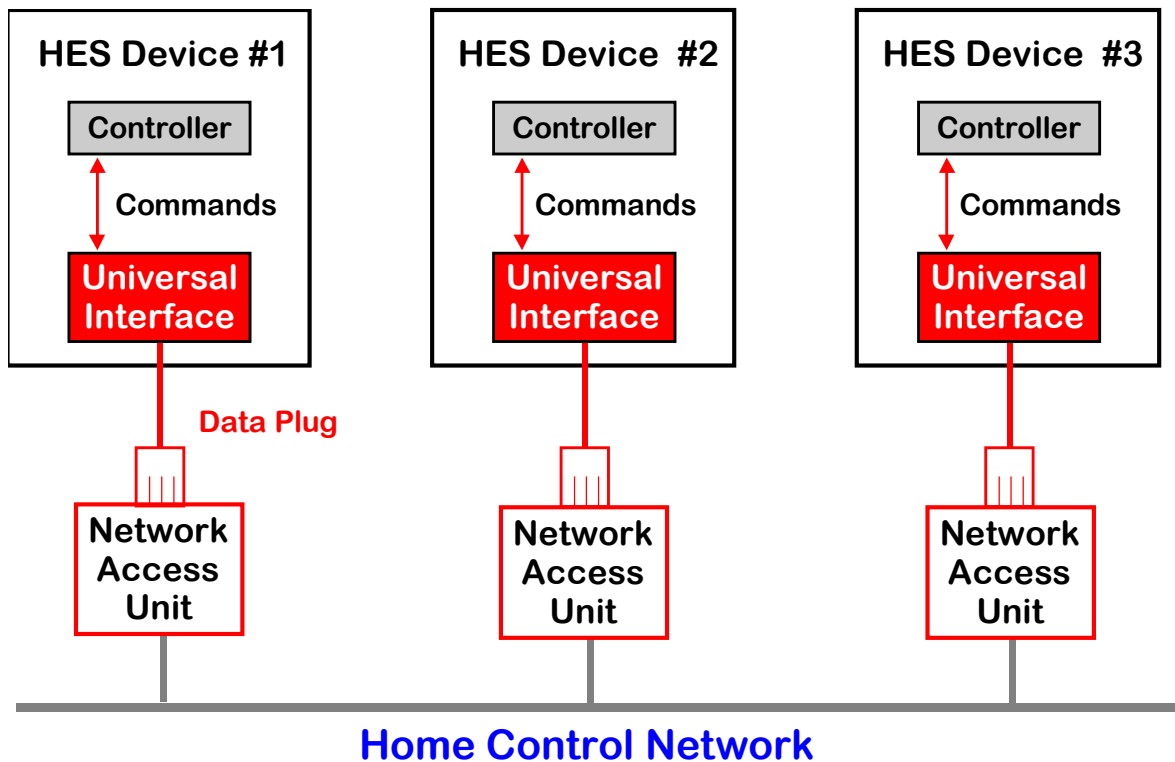


Figure 1 – The Role of the HES Universal Interface and Network Access Unit

The specifications for the UI have already been decided by WG 1 using a serial data stream. The communications protocol was derived from IEC 870 and EIA-232. It does not use any Internet protocol.

For consistency with HES, it is proposed that the UI remain unchanged. Instead, the NAU would be designed for the Internet. This means that a special Internet NAU would be specified that includes the UI interface on the device side and the Internet protocol TCP/IP on the network side. [Alternatively, UDP/IP may be used on the network side.](#) This is illustrated in Figure 2.

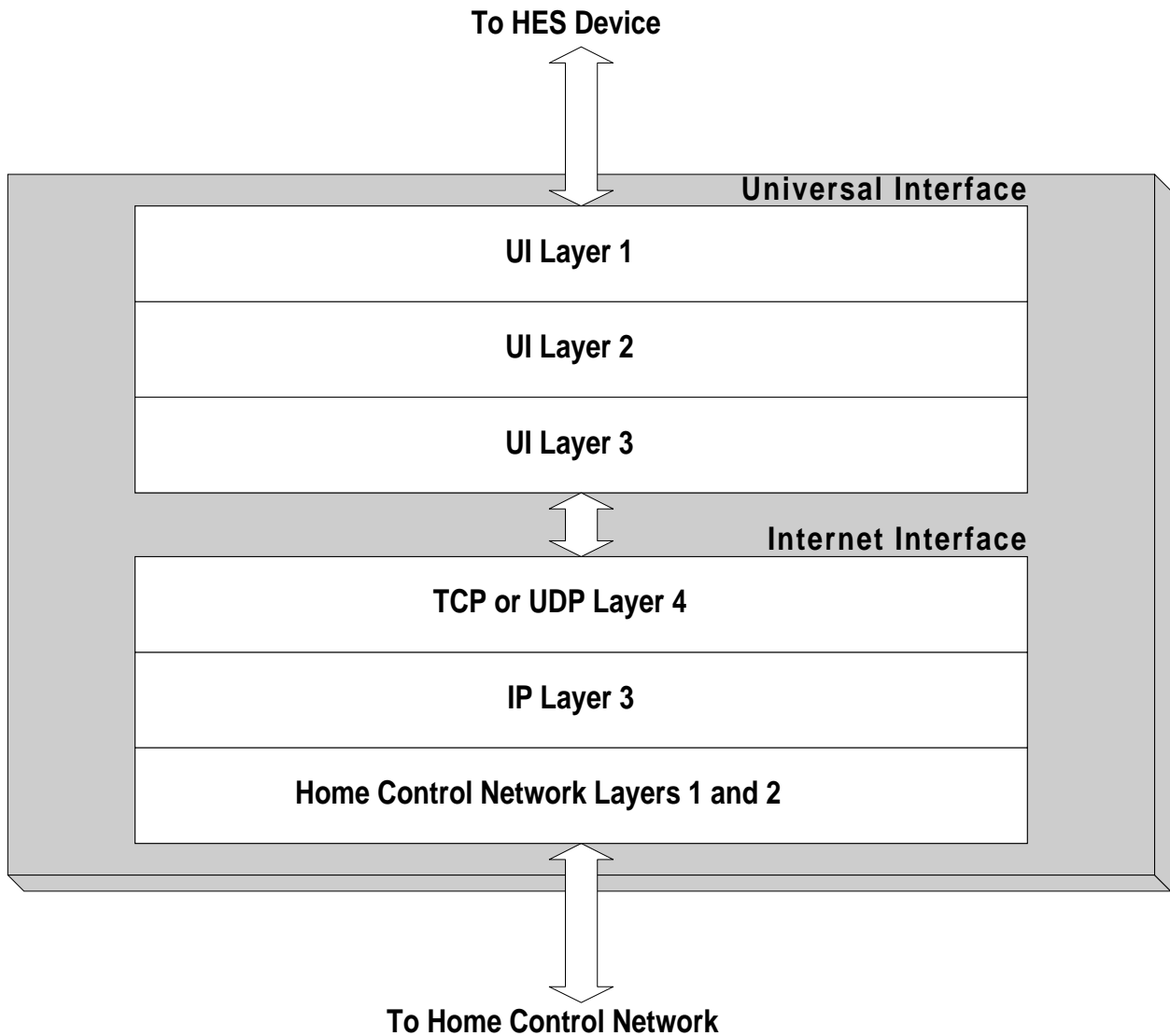


Figure 2 – Network Access Unit for the Internet

2.2 Integrated NAU

The concept of a UI-equipped HES device and an external NAU constitutes HES Type A Conformance. This is illustrated in Figure 3. HES also accommodates devices specifically designed for the underlying network with HES Type B Conformance, as shown in Figure 4.

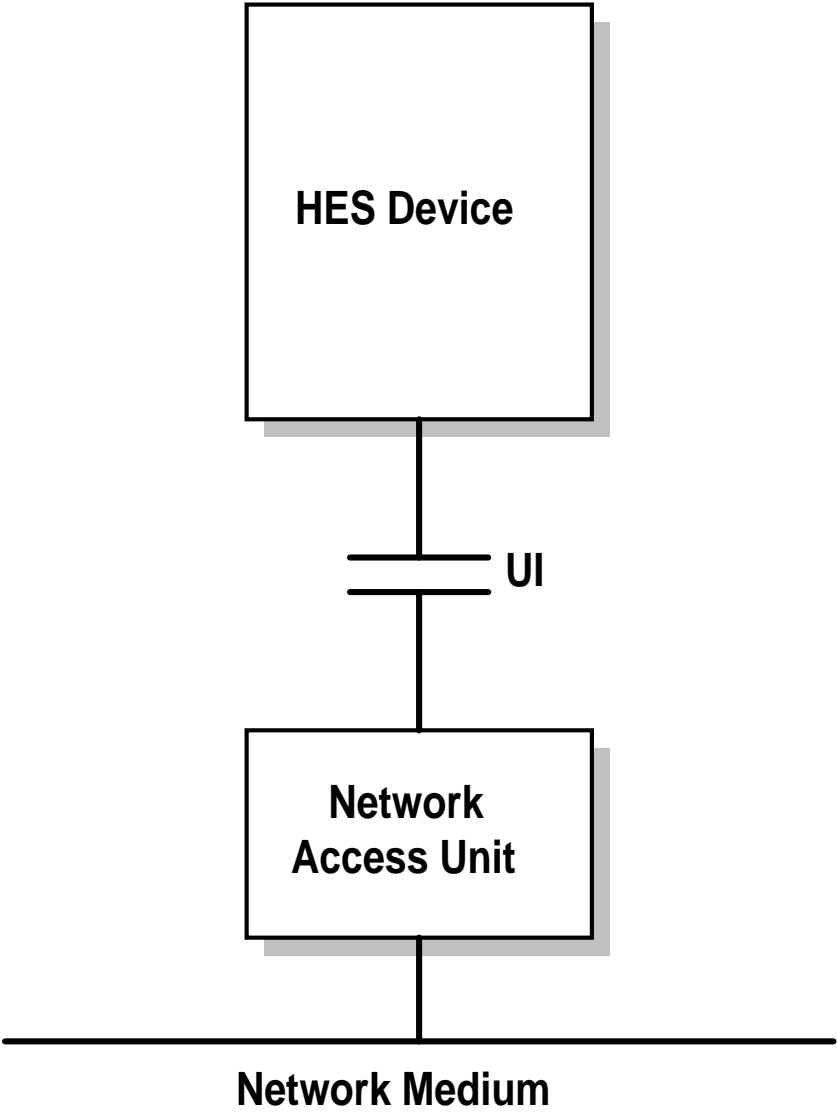


Figure 3 – HES Type A Conformance

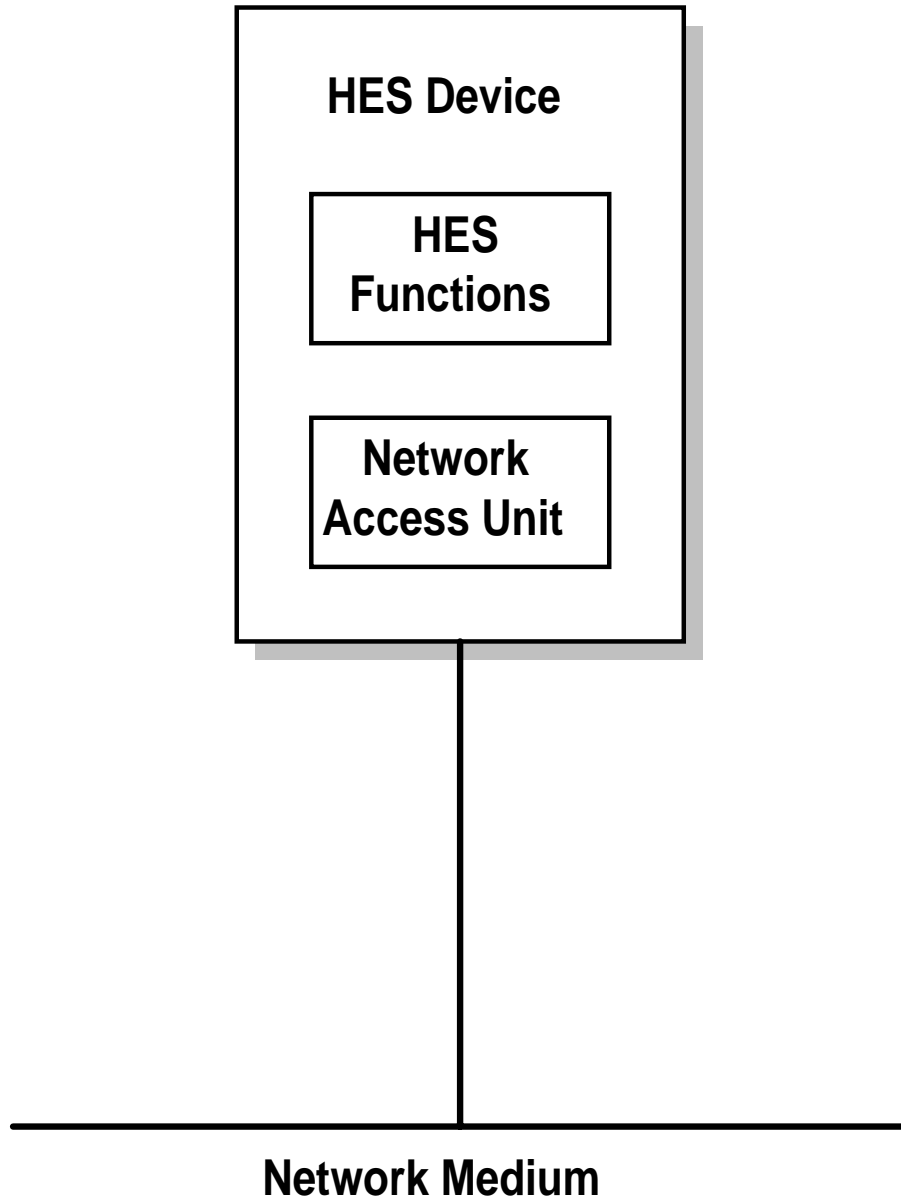


Figure 4 – HES Type B Conformance

HES Type B Conformance could be applied to devices intended for connection to the Internet. Such devices no longer meet the HES principle that they can operate on a wide variety of home or building control networks. However, if the home and building control industries eventually adopt one network, then all devices could be HES Type B Conformant.

3. Internet Functions in Devices

3.1 Separate Control and Internet Networks

The previous section explained how HES devices might be equipped for connection to the Internet. In practice, the addition of the Internet interface protocols, TCP/IP or UDP/IP, and Internet applications may be too costly for simple devices. It may be practical to retain a home or building network specialized for command and control distinct from the Internet.

Thus, only selected devices in a premises network might be equipped for Internet access. The logical relationship among home automation appliances and controllers is illustrated in Figure 5. Likely candidates to support the extra cost of Internet access are the application-specific cluster controllers and a whole house or building coordinator. Figure 6 shows a connection to the Internet limited to these controllers. Note that the application-specific controllers and the coordinator might be distributed among the appliances. In that case, selected appliances would link to the Internet.

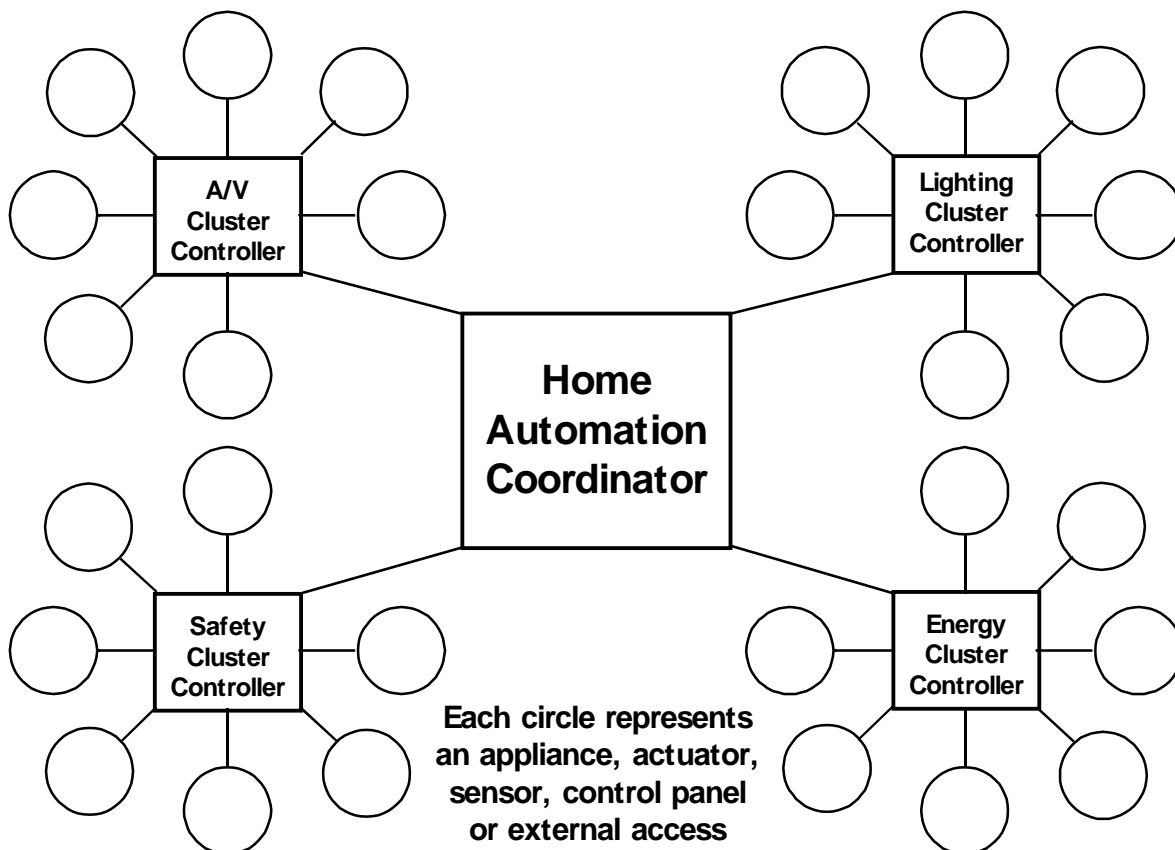


Figure 5 – Integrated Home Automation

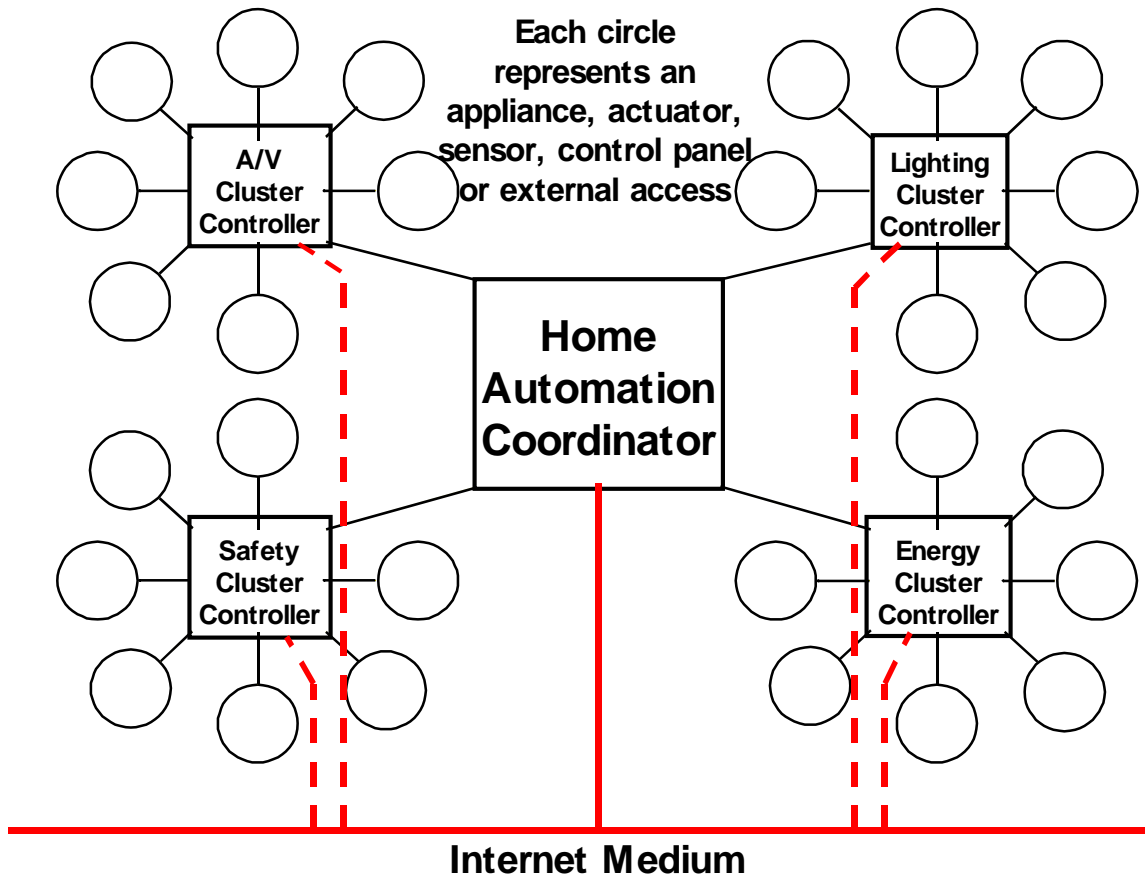


Figure 6 – Linking Home Automation to the Internet

3.2 Internet Applications

The Internet originated in the United States as a defense project to create a nation-wide data communications network that could continue to function if portions were destroyed. The key elements of the communications protocol are connectionless packets that are routed dynamically from sender to receiver via intermediate points. The route from city to city taken by each packet in a message may differ. IP (Internet Protocol), Layer 3 of the protocol, manages the dynamic routing, while TCP (Transmission Control Protocol), Layer 4 of the protocol, assembles the packets into a message. [UDP \(Unacknowledged Datagram Protocol\) is a subset of TCP that may be appropriate for simple devices.](#)

Originally applications of the Internet were electronic mail, file transfers, and remote access to computers. The Internet remained in government and academia until the introduction of the World Wide Web, invented by Tim Berners-Lee of the Massachusetts Institute of Technology (MIT). The World Wide Web transformed the Internet into a vehicle for the dissemination of information and for commerce.

Recent developments in Internet applications have been directed toward using the network for sending command, control, and status reports between humans and devices and between devices. In a home automation application, a user might call the house via the Internet and be presented with a web page illustrating the status of the home lighting, heating, or security system. The user could then click on designated “hot spots” on the screen to cause actions in the house. For example, the heat could be turned up in the house before leaving work, or a service person could be allowed in for appliance repairs. The home coordinator in Figure 6 could be a repository of web pages for the various home automation applications. Commands resulting from clicks by the user on the web page could be directed to an appliance via the appropriate application-specific controller. The application-specific controller would transmit the command or status request to the appliance over the local home control network. Thus, the appliance does not need the additional cost of Internet access.

4. Transmitting HES via the Internet

Web pages on the Internet are transmitted using the application layer protocol called HTTP, Hypertext Transfer Protocol. HTTP accesses and delivers data from a file identified by a Uniform Resource Identifier, URI. A URI may provide the name or location of the data to be sent via HTTP. The most common method of identifying the data is with the Uniform Resource Locator (URL). This is the familiar web location string such as `http://www.bt.labs.com`. Web pages are usually maintained in web servers, which send the data to clients, such as customers' personal computers.

In HTTP the user requests a web page by entering a URL. The HTTP protocol issues a GET command. If the web page requests data from the user, these data are passed up to the web server in an HTTP POST command. The format of the data describing a web page is defined by HTML, Hypertext Markup Language. HTML contains text and graphics to be displayed, plus tags that describe the data by size, position, color, etc. A web browser, such as Netscape or the Internet Explorer, is responsible for interpreting the HTML tags to create the display.

The Internet Engineering Task Force, the organization that maintains the Internet protocols, is specifying XML (Extensible Markup Language) to expand the HTML language for applications beyond web pages. XML is a meta-language for creating applications. Like HTML, XML is based on embedded tags that describe the data.

HES or other home automation commands could be carried via XML. Here is a simple example of a possible version of XML for HES:

```
<HES>
```

```
[HES command]
```

```
</HES>
```

The XML tags are contained within angle brackets.