Structured Cabling:
Technology that Sells Houses

You've acquired land in a growing location. You've built houses with the latest design trends, whether it is the large master bath, high-end kitchen, or the media room. Yet the customer wants more. In the 1950s it was air conditioning, then better carpeting, then a whirlpool bath. Now customers are asking for a home network to support Internet access and home entertainment systems.

Customers always seem to frustrate builders by focusing past the great looking house in a great neighborhood, and instead concentrating on peripheral items like technology. The fact is that the details sell big-ticket items. For example, a key factor is closing a car sale is the body color. Rather than dealing with technology grudgingly, builders ought to understand the options to stay ahead of customer demands and learn how to make extra income from technologically-based add-ons to a home sale.

This article explores the home network. A home network forms the basis for an emerging industry called *home systems*. The business potential for a home systems industry started to attract major manufacturers and organizations about 20 years ago. Some builders may remember that the NAHB introduced Smart House for home automation. The impetus for significant growth has been the recent proliferation of broadband access to the Internet. Once consumers pay for high-speed service via cable or DSL (high-speed data via telephone lines), they want access from more than one location in the house. The solution is a home network implemented with an organized set of cables call *structured cabling*.

Networking Alternatives

There are many options for implementing a home network including wires, wireless radio, communications over existing telephone lines in the house, and communications over electric power lines. Sales of wireless Wi-Fi are booming, but there are problems.

The materials in a house can impede wireless reception. Metal-studded walls and foil-backed wallpaper can create "dead-spots" in the house with no Wi-Fi reception. Sometimes, the only solution is to change locations of the computer, or to install an additional access point (base station). Microwave ovens and some portable telephones can interfere with Wi-Fi because they all share the same frequency band. An ideal system uses a wired network supplemented with a wireless network for portable computers and appliances.

The "gold standard" for home networks is wires. Communications via wire is the most reliable of all the media options. However, installing wires in an existing house is a challenge unless the house is undergoing extensive renovations. For this reason, wired home networks are most popular in the new home market. Buyers for more than half of the new housing starts are now offered wiring for home networks.

Standards for the components and topology of home networks were written within the past decade in the United States and Canada.

Structured Cabling Media

For simplicity and convenience it would be desirable for one wire or a uniform bundle of wires to support all home network applications. Given the investment in material and labor to install a network, it is cost-effective to support a range of applications including:

1. Broadband Internet access from multiple locations in the house.

2. Home communications such as telephone and intercom.

3. Home entertainment including broadcast, cable, and satellite TV plus in-house generated video from DVDs, VCRs, and cameras.

4. Home automation, such as lighting, comfort control, energy management, and safety / security.

It is theoretically possible to select one wire type that can carry all these signals. A fiber optic cable would do. However, nearly all networked household products have connectors for wires. These connectors include coaxial cable fittings and plugs for telephone and Ethernet. Furthermore, through advances in engineering the bandwidth of copper wires has increased and the cost has fallen, making copper still the choice over fiber.

Figure 1 shows the wires that support the applications listed above. The coaxial cables carry the TV signals, while the twisted-pair wires support all the other applications. The Telecommunications Industry Association (TIA) has issued an American National Standard called TIA-570B that defines the number and sizes of these wires. The top quality cables commonly installed are:

- CAT 6 (Category 6) for twisted-pair wires (CAT 5 and CAT 5e are still used)

- RG 6 coaxial cables with quad-shielding (4 layers of shielding)

The higher the Category of wire, the greater the data rate that can be carried over the same distance. Likewise, the construction of coaxial cables. including the shielding, affects the number of TV stations that can be carried.

Installation and Topology

The term Structured Cabling refers to an organized installation of wires in a building for network applications. The standard mandates combinations of wires for supporting common applications. These wires may be bundled into a common sheath for ease of installation. Even with good quality components, poor installation practices can degrade signals. For example, if twisted-pair wires are pulled too tightly around a corner, the twists will be deformed, reducing performance. Also, the connectors on the cabling must match the quality of the wires.

Before there were standards, the installation of wiring for services such as security, telephone, and even cable TV was not well organized. Typically, wires were run from device to device in an *ad hoc* fashion for rapid installation and minimum wire usage. This topology can deliver unequal signals to the devices resulting in degraded TV reception or high-speed data transmissions.

The TIA standard requires “star wiring.” Star wiring consists of many wires emanating from a single distribution panel called the Home Distributor to each room regardless of the application. Star wiring in general uses more cabling material than bus or device-to-device wiring. However, signal quality is better controlled with star wiring. Also, less drilling though wood studs in the wall is required when installing star wiring.

Typical Installations

Star wiring for structured cabling can use a lot of wire. Figure 2 shows the cabling being installed in an apartment. The total quantity of wiring depends on the number of outlets. TIA-570B mandates data

outlet installations to minimize extension cord lengths that could create safety hazards from tripping over cords. Outlets are required:

- Every 12 feet along any continuous unbroken wall.
- So that no point along the floor by the walls is more than 25 feet, measured horizontally, from an outlet.

Coaxial cables are terminated with F-connectors, while twisted-pair wires use RJ-45 plugs. Many manufacturers sell combination outlets, as illustrated in Figure 3. This figure also shows an example of a Home Distributor from which the cables emanate. Some companies are offering communications equipment such as modems and Internet routers within the Home Distributor. Others include Wi-Fi access points to supplement the wired network with wireless, as illustrated in Figure 4.

Recommendation

All builders should plan for the installation of structured cabling. The standard mentioned in this article is voluntary now, but is likely to be included in state and local regulations. For example, a few years ago, the U.S. Federal Communications Commission (FCC) mandated a minimum quality of wiring for all telephones.

An investment in structured cabling will enable the house to accommodate data communications and multi-media applications. Also, the value of the house is likely to be enhanced by a well-planned and carefully-installed structured cabling network. Most important to the builder, the installation of structured cabling removes an impediment to closing a sale.

Dr. Kenneth Wacks has been a pioneer in establishing the home systems industry. He advises manufacturers and utilities worldwide on business opportunities, network alternatives, and product development in home and building systems. The NAHB retained Ken to develop the original system architecture for Smart House. For further information, please contact Ken at +1 781 662-6211, Fax: +1 781 665-4311, E-mail: kenn@alum.mit.edu, Website: www.kenwacks.com.

Figure 1 – Wiring for a Home Network
(Photo courtesy of UStec)

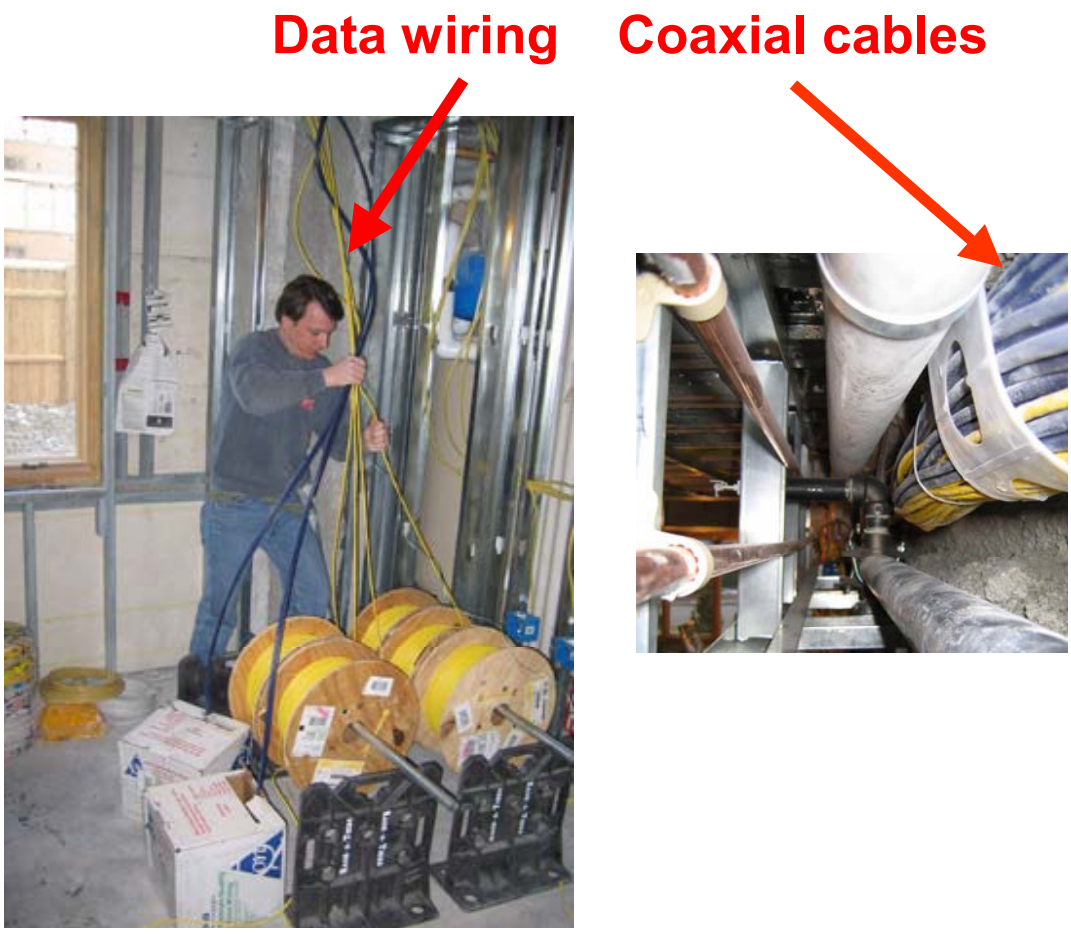

Figure 2 – Installation of Structured Cabling

Figure 3 – Data Outlet and Home Distributor
(Photos courtesy of UStec)

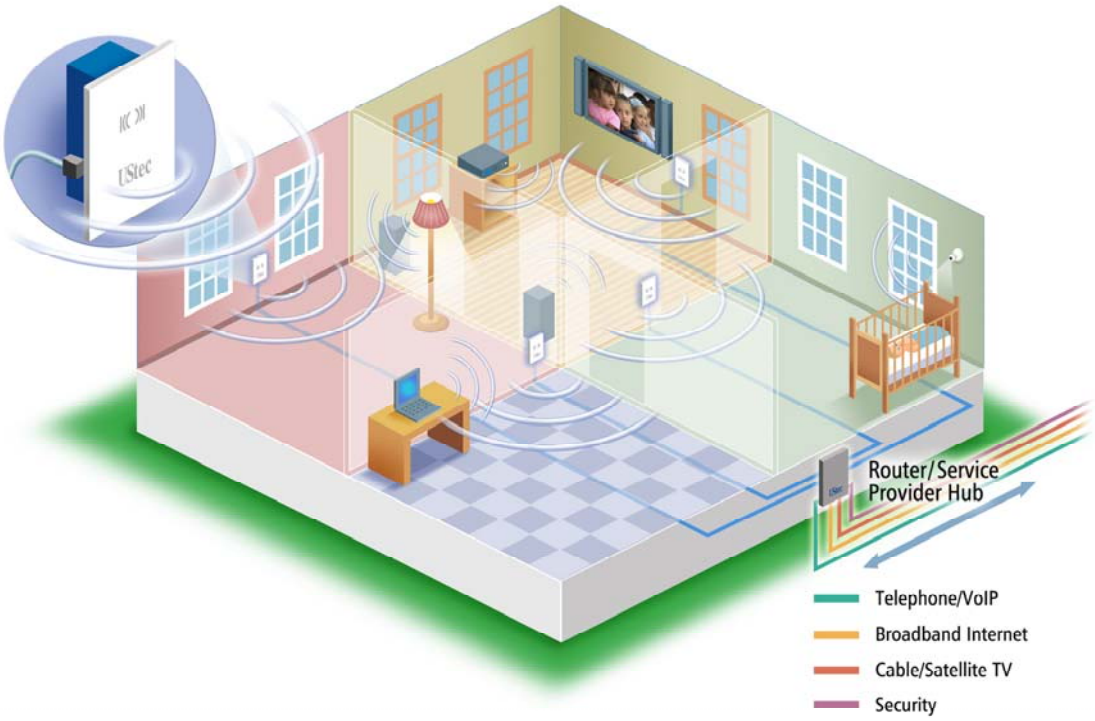

Figure 4 – Combined Wired and Wireless Network
(Illustration courtesy of UStec)