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iHOMESand BUILDINGS

THE MAGAZINE OF THE CONTINENTAL AUTOMATED BUILDINGS ASSOCIATION

CABA Board meets at IBM Labs during CABA's Intelligent Buildings & Digital Home Forum 2015

Do You Prefer A Traditional or a Contemporary Electrical Installation?

Guy Kasier notes that homes offer more individualized options for electrical installation.

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KEN WACKS' PERSPECTIVES

Multimedia Networks in Buildings

By Ken Wacks

Multimedia is being integrated into a diversity of commercial settings, ranging from corporate offices to educational facilities to transportation to government operations. These applications require an integrated infrastructure for distributing audio, video, and control from sources such as videodiscs, media servers, broadcasts, and Internet streams to displays. A high-quality multimedia experience is essential for conveying messages and information effectively to employees, business associates, and customers.

The CABA Intelligent & Integrated Buildings Council (IIBC) White Papers Subcommittee that I chair has issued a paper on multimedia distribution networks in buildings. The paper is entitled, *High-Quality Multimedia Distribution in Commercial Buildings*. This article is a summary of the paper, which is available on the CABA Web site.

Evolution of building cabling

"Building infrastructure cabling" has traditionally meant power wiring and support for building automation services such as environmental control, lighting, and communications. These core-building functions are usually included in the domain of the building management organization. Cabling for telephone and computer networks have traditionally been the responsibility of the tenants.

The term structured cabling refers to an organized installation of wires in a building for data network applications. These wires may be bundled into a common sheath for ease of installation. National and international standards specify the topology and performance requirements of such cabling systems.

Before there were standards, the installation of wiring for services such as telephone, data networks, and 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 might deliver unequal signals to the devices, which would result in a degradation of data transmissions and video reception.

The structured cabling standards require "star wiring." Star wiring consists of many wires emanating from a single distribution point in the building to each floor in a hierarchy. The elements of this hierarchy are the campus, the building, the floor, a possible distribution point on a floor to support an open-office plan, and finally the outlet where computer and audio/video (A/V) equipment are connected. Figure 1, adapted from the international standard ISO/IEC 11801, *Generic cabling for customer premises*, shows the topology of structured cabling for commercial buildings.

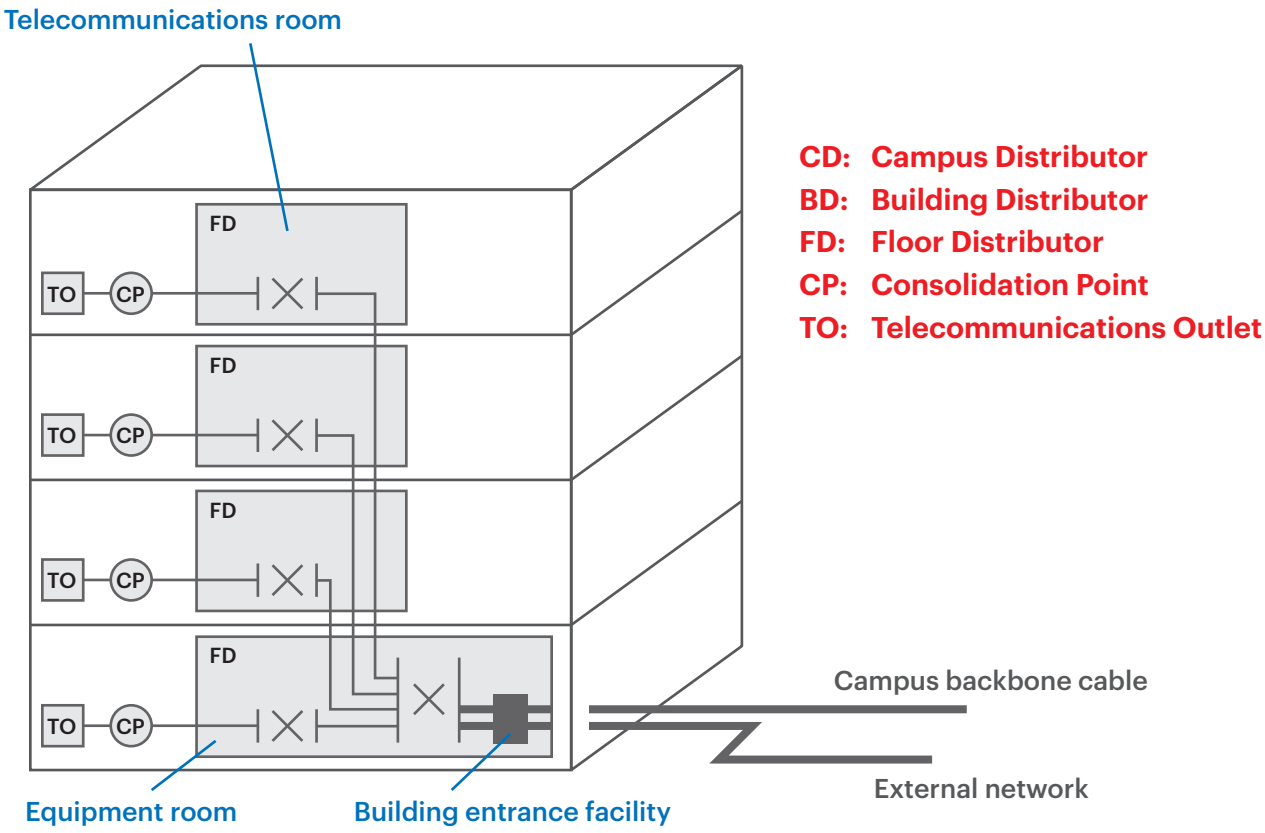
Star wiring, in general, uses more cabling material than bus or device-to-device wiring. However, signal quality is controlled better with star wiring. Also, less drilling through wood studs in the wall is required when installing star wiring. The international standard specifies signal quality for the entire communications channel, which includes the wires, connectors, and any patch cords.

Video distribution

Video distribution cabling has usually been limited to point-to-point solutions such as coaxial cables and specialty cables for projectors. Extending coaxial cables throughout a commercial building for high-quality multimedia distribution is not a practical option because of costs and content-protection agreements.

The media industry has selected the High-Definition Multimedia Interface (HDMI) as the primary suitable interface between video players of commercial content on media (such as Blu-ray discs) and video displays (monitors, televisions, and projectors). This interface was designed for the transmission of uncompressed data carrying high-definition video. HDMI includes data encryption and a control

Figure 1: Physical Arrangement of Structured Cabling



channel to protect the distribution of content considered high value.

HDMI has been implemented in specialized cables that are typically 10 feet in length (with a limit of 50 feet). A plenum-rated 50-foot HDMI cable costs about $200-300 compared to less than $20 for a comparable Category 6 (Cat 6) Ethernet cable. Furthermore:

- A 50-foot HDMI cable weighs about four pounds.
- An HDMI cable is almost a half-inch thick.
- An HDMI cable has a limited bend radius.
- The HDMI connector assembly is large compared to other connectors.
- HDMI connectors are complex and expensive, as are field termination tools and kits.

Thus, HDMI is not practical for a building infrastructure. To address this distance limitation and yet provide all the features supported by HDMI, a new technology was developed called HDBaseT™.

HDBaseT technology

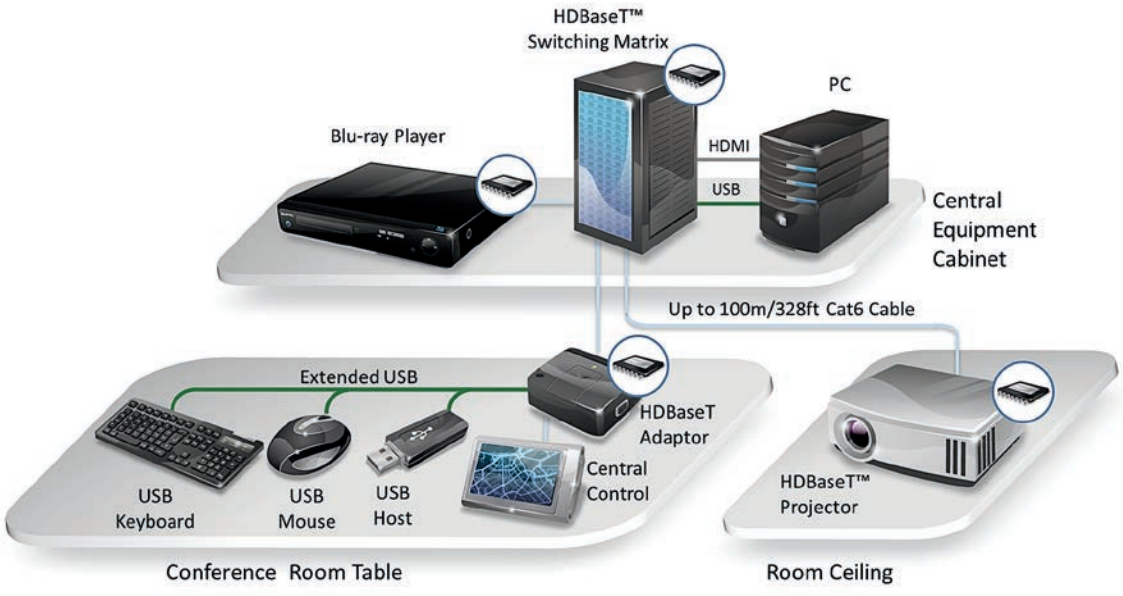
HDBaseT converts signals passed via an HDMI interface into a format suitable for transmission via the same type of local area network (LAN) cabling as used for Ethernet data communications. Transmission distances can span hundreds of feet while maintaining the quality of the source material.

RJ-45 Plug

HDBaseT technology consists of electronics that convert A/V and control signals, including uncompressed high-definition (HD) and ultra-high-definition (UHD) video, into a format suitable for transmission on standard local area networks via RJ 45 connectors as illustrated. HDBaseT electronics may be externally attached to or embedded inside A/V sources and displays.

Since HDBaseT uses the same type of infrastructure as data LANs, once cable installers are trained for LAN installations, they will have the skills to install high-quality A/V

Figure 2: Multimedia Conference Room



networks with HDBaseT technology. HDBaseT carries all the HDMI signals (audio, video, and control) plus Ethernet, USB, and up to 100 Watts of direct current (DC) power, called Power over HDBaseT (PoH).

Power over HDBaseT

A new technology for delivering power to office equipment over local area network cabling was introduced in 2001. This power delivery system is called Power over Ethernet (PoE). DC power is delivered using the same wires that carry data. Two standards have been issued for PoE to supply about 13 Watts and PoE+ to supply 25 Watts via office network cabling.

HDBaseT extends PoE to 100 Watts with a feature called PoH using four pairs of local area network wires. If PoH equipment is connected to a PoE line, the maximum common power will be passed between them, i.e., according to whether PoE or PoE+ devices are installed.

The higher power of PoH compared to PoE is applicable to video equipment in the office such as:

- Digital signage displays
- Displays for local video sources and streaming (Internet) TV
- TVs (displays with tuners) for high-definition broadcasts
- Video switching units
- HDBaseT extenders

PoH at 100 Watts is enough power for operating most TVs up to 60 inches (diagonal measure). The U.S. EPA (Environmental Protection Agency) Energy Star program for TVs requires consumption for a 60-inch TV to be no more than 98.7 Watts, down to 21.9 Watts for a 20-inch TV.

HDBaseT applications and venues

Static message boards are giving way to dynamic presentations with graphics and video using high-definition displays. The phenomenal market growth of LCD (liquid crystal display) high-definition and ultra-high-definition displays has resulted in low-cost, high-quality large-format displays for commercial applications. These video displays offer the opportunity for visual information presentation and corporate messaging in public spaces, company lobbies, conference rooms, and even office areas.

Our increasing expectations for higher quality multimedia pose challenges for developing technology that can adapt to higher resolutions and faster data-distribution rates with lower latency (delay). The technology for high-quality multi-media distribution requires high-resolution source material, high-resolution displays, and a distribution network that can stream high-data-rate audio and video.

HDBaseT achieves these performance goals to support a variety of applications in a variety of commercial buildings, as listed in the following table.

Multimedia Applications in Commercial Facilities

Multimedia Applications in Commercial Facilities
Corporate information networks for building visitors and employees
Hospitality, such as hotels and cruise ships
In-flight entertainment systems
Fitness centers
Education applications
Conference rooms
Public displays with multiple screens
Government agencies
Power system operators
Healthcare
Digital signage
Interactive kiosks
Commercial showrooms
Movie theaters for digital cinema

HDBaseT equipment

The equipment to enable HDBaseT is available from multiple vendors in the form of:

- Integrated circuits and modules
- Matrix switches
- HDMI
- HDBaseT converters
- Projectors with HDBaseT ports
- Displays with HDBaseT ports

These components and products fulfill the requirements outlined by the HDBaseT Certification Program (http://hdbaset.org/certification). This program verifies that products comply with the HDBaseT specifications to promote interoperability among vendors of current and future HDBaseT products. Figure 2 illustrates a multi-media conference room designed with such equipment.

Thus, high-quality multimedia can be distributed on a network that parallels a building data network and uses the same types of cables, connectors, and topology. Multimedia distribution in commercial buildings is now feasible, cost-effective, and easily installed without special cables, connectors, or additional training. ●

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. In 2008, the United States Department of Energy appointed him to the GridWise Architecture Council. For further information, please contact Dr. Wacks at 781.662.6211; kenn@alum.mit.edu; www.kenwacks.com.