Homepath
Products

Redefining the Smart Home

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There is no generally accepted definition of what a "smart home" is. Some advocates have defined the smart home broadly as a "home containing interactive technologies"[1] or as "a harmonious home, a conglomeration of devices and capabilities"[2]. Others see the smart home whenever certain types of equipment are present for controlling "[3]lamps, appliances, heater, and air conditioning and perhaps sense where in the house people are located" and which may have specialized "structured wiring" to enable the networking and remote control of such devices.[4]

For our purposes, by "smart home", we mean a home that contains an array of interactive devices and controllers networked by low voltage cabling. With today's technology, for instance, a smart home would include high speed data communications cabling (Unshielded Twisted Pair – UTP, Cat5e cable, Cat6 cable) for internet and IPTV, RG6 Coaxial cable for HDTV and video distribution, and sometimes low voltage cables distributing security signals to sensors of various types throughout the home. Increasingly, such homes would include elaborate entertainment features with systems such as home theater and whole house audio to enhance the living space and provide the convenience of entertainment throughout.

Regardless of the definition homeowners, architects, and developers, can count on the ever-increasing need for bandwidth or information carrying capacity due to the growing number of new services offered directly to the home by cable television and Internet service providers.

"We have absolutely no reason to think innovation will stop". When Thomas Edison built the world's first central-station electrical generating plants, electric lighting was the "killer app." Although Edison would later invent

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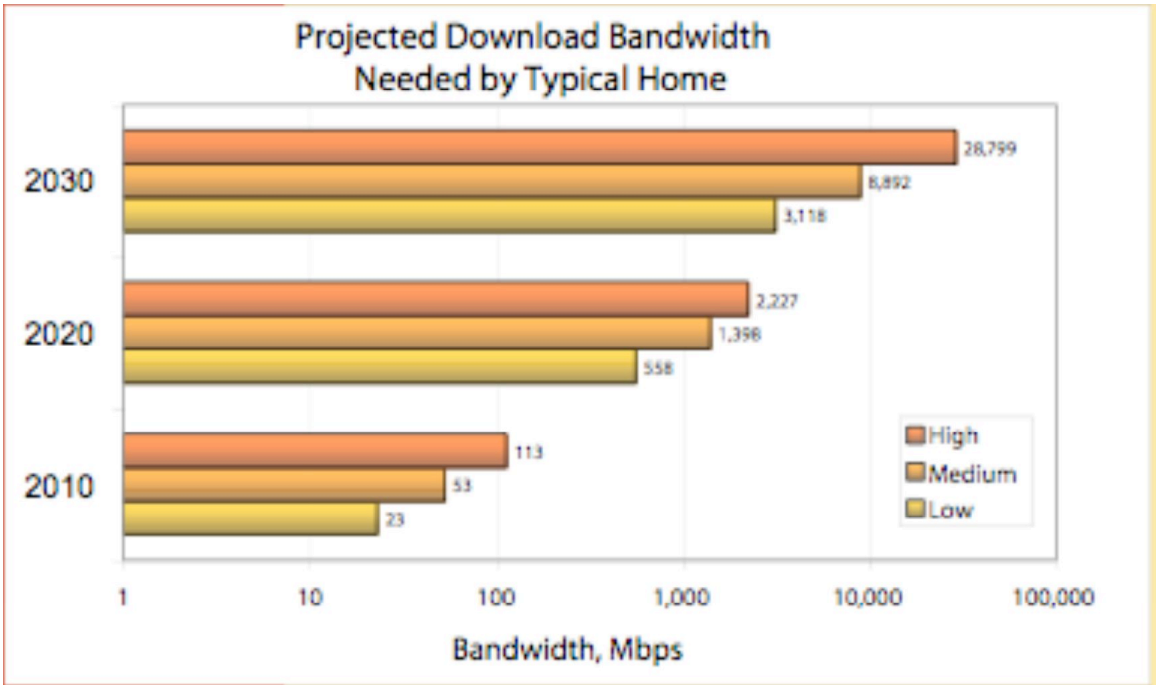
[1] R. Harper, "Inside the Smart Home" (Springer, 2003), p. 2
[2] D. Briere, et al., "Smart Homes for Dummies" (For Dummies, 2007) p. 16
[3] G. Meyer, et. al., "Smart Home Hacks" (O'Reilly 2004) p.xiv.
[4] See generally, http://searchcio-midmarket.techtarget.com/sDefinition/0,,sid183_gci540859,00.html.

hundreds of products that use electricity, he was not thinking about air conditioning for private homes when he built the first electricity distribution network. He did not consider dishwashers, refrigerators, computers, or those rechargeable batteries for your iPod, mobile phones and cameras. "We have every reason to think the innovation will continue and that our need for ever more bandwidth will grow."[5]

Since Edison's time, traditional home construction evolved to accommodate electrical appliances through the permanent installation of electrical wiring. Standards were created to ensure that the wiring remained useful for the life of the home. Traditional construction didn't anticipate Internet enabled appliances . With the advent of Fiber-To-The-Home (sometimes referred to as FTTH), the Internet and bandwidth hungry applications are poised to accelerate. [6] These impending changes will drive the development and adoption of new consumer electronics that in turn fuel the need for low voltage cable upgrades within the home. Unlike electrical wiring which have stable standards amd methods, voice/video/audio/data cabling changes with time. Today many builders of "smart homes" attempt to anticipate consumer electronics advancements by permanently installing today's best low voltage cables during construction. These cables, while currently adequate, will obsolesce as consumer electronics evolve.

As a gauge, one can see today's download rates range from:
Dial Up: 54 Kilo (thousand) bits per second - Kbps
DSL: 1.5 Mega (million) bits per second - Mbps
Cable Modem: 3.0 Mega (million) bits per second - Mbps

As this paper is being written, major service providers such as Verizon and Comcast are selling Internet subscriptions with data rates of 50 Mbps and in beta tests with rates as high as 150 and 175 Mbps.



[5] The Advantages of Fiber, FTTH Council, 2007
[6] The Advantages of Fiber, FTTH Council, 2007

By the year 2020, broadband homes are projected to require a download capacity of 2.227 Giga (billion bits per second) or Gb/s. To keep pace this means that in only eleven years, data rates directly to the home are expected to be approximately one-thousand times faster than today's DSL speeds. It is also worth noting that chip manufacturers such as Intel and IBM have already developed working prototype chips destined for computer servers that are capable of sending data at speeds above 100 Gb/s. "Scientists from IBM have developed a prototype optical transceiver chipset capable of reaching speeds of 160 Gb/s. Theoretically, that rate would be fast enough to reduce the internet download time for a typical high-definition feature-length film to just one second, compared with the usual half an hour or more for the best connectivity available today (first phase FTTH). IBM says that the development will transform how data is accessed, shared and used across the web."[7]. It's not unrealistic to expect that these or similar microprocessors will find their way into consumer electronics at some point in the future.

"...it would be fast enough to reduce the internet download time for a typical high-definition feature-length film to just one second..."

According to a recent press announcement, new standards for much higher speed Ethernet data transmission rates (40 and 100Gb/s) are targeted for completion in 2010. Based around the ubiquitous Ethernet transmission protocol, these new standards will first be deployed in Optical Transport Networks, in part to support the growth in consumption of video-on-demand services. "The entire industry is committed to creating the best standard possible for 40Gb/s and 100Gb/s Ethernet to enable its rapid adoption to alleviate the bandwidth crunch being experienced by many."[8]

Redefining the smart home

Given the constantly changing environment architects, developers, and homeowners cannot predict with any accuracy which cable types to install during construction and where to optimally locate media outlets to serve a resident's future needs. As a result, common practice currently is to install expensive cable everywhere it might *possibly* be needed based on today's best guess of what and where that may be. Doing so offers no assurance that the cables installed will be suitable to support the eventual applications and devices.

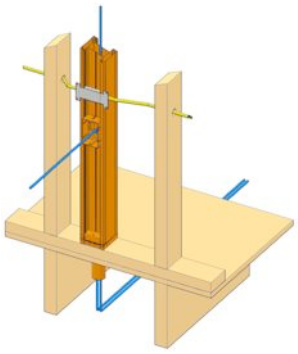
Building the smart home of tomorrow using the eXapath™ system

Preinstalling cable pathways to prepare a home for future cabling moves, additions and changes provides unsurpassed flexibility for the homeowner and installer. The benefits of doing so include:

* Deferment of cabling decisions until furniture and electronics placement are known
* Minimized as-built changes, call backs
* Reduced trade boundary conflicts
* Improved construction scheduling
* Reduced consumption of underutilized low voltage cables
* Convenience in adding media outlets before or after expensive wall treatments are in place
* Flexibility to provide media outlets at any point from floor to ceiling

[7] IBM team reveals 'world's fastest' optical chipset, Compound Semiconductor Net, 7http://compoundsemiconductor.net/articles/news/11/3/26/1
[8] 3/19/09, "40Gb/s And 100Gb/s Ethernet Project Reaches Milestone Vote", Fiber Optics Online

The eXapath system from Homepath Products grants tremendous flexibility to the builder and homeowner by preparing the living space to change as electronics related needs and desires change. Decisions regarding cable type and location of media outlets for computer networking, home theater, security, home automation, whole house audio, and home theater can be made when needed, not by guessing during the construction process. That's smart building and a very smart home!



In our view, the smart home of tomorrow looks much like the traditional wood frame home but with one out of sight and distinct difference: in tomorrow's smart home, for each room being framed with traditional 2x4 and 2x6 lumber, every third or fourth stud cavity is complemented by geometrically optimized eXapath conduits. These pathways are installed before electrical rough in, doing so accommodates traditional line voltage wires and installation practices while providing ready access to add or upgrade low voltage cables at any time, before or after wall treatments are in place.

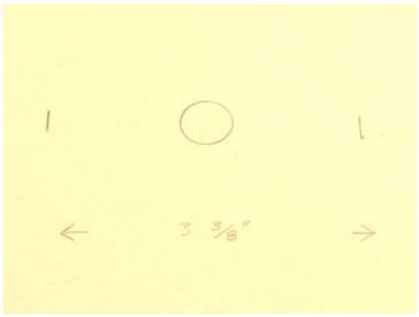
The cable routes for most low voltage systems use a "home run" or star topology where each outlet is connected directly to a patch panel or consumer electronics device. When the first floor of a building is outfitted, cables run from outlets, downward, through the shoe and subfloor, into the basement or crawl space, and then under floor joists to a main distribution panel. When installing on a second floor, the cables often run through the plate of the wall into the attic. Once in the attic, the cables are gathered and run through a main chase to the basement and finally to a distribution panel.

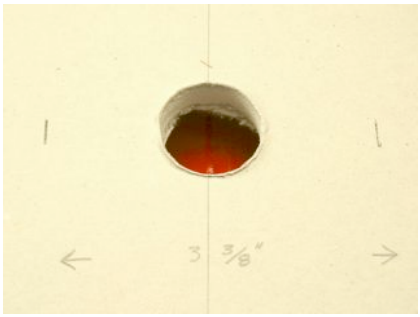
The eXapath system supports the efficient installation of low voltage wiring by providing a pathway within the wall to enable the creation of outlet positions anywhere along the vertical axis from floor to ceiling. In addition, the eXapath system allows convenient transition and cable passage between floors. The eXapath solution also offers performance benefits by separating line voltage and low voltage cables and ensuring that, whenever they are near each other, they cross at ninety degrees, systematically minimizing data transmission interference.

After installation of eXapath cable pathways, drywall is applied normally. With the eXapath system, cables can be installed or removed in minutes by inserting the cable into the conduit that penetrates between floors and then pushing or pulling the cables to the outlets. This is made easier because all of the cable pathways are straight, generally less than six feet in length and provide more than three square inches of cable capacity. This simplifies and speeds up the process of moving cables within the conduits. There are no sharp bends to contend with, no fish tapes are required, no frame drilling required and never a need to pull cables through fiberglass or expanded foam insulation. Quick, clean, simple and reusable pathways revolutionize cabling within the home.

Accessing cable pathways after the drywall is up

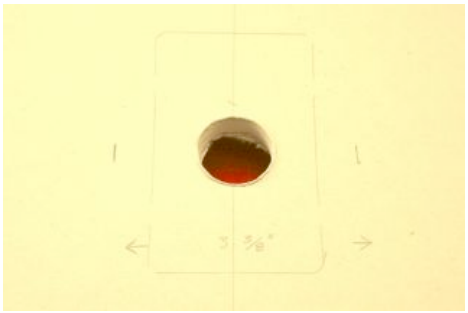
The eXapath cabling system makes it much easier than traditional methods to install new cables; no more blindly drilling holes, probing around through insulation to find the cable you're installing, and then pulling the cable along with a fish tape. The eXapath cable pathways can be found behind the walls using common density based stud finders and can be distinguished through drywall from wooden studs by their consistent 3 3/8" width. Once the pathways are located, the installer simply marks the limits of the eXapath conduit and bores a small (1") hole through the drywall to reveal the recessed cable channel of the conduit. At this point the installer verifies that the center of the eXapath conduit is exposed by looking for the longitudinal v-groove in the wall of the conduit. This centerline v-groove also serves as a useful pilot point for the next installation steps.



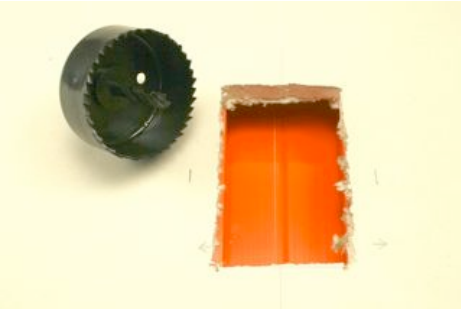


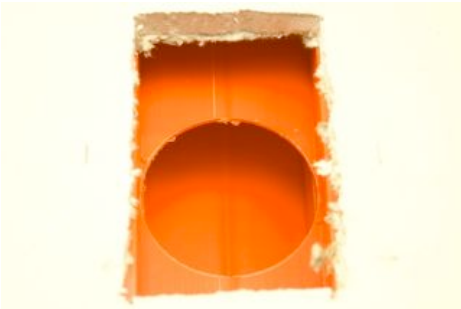
Tapping into the eXapath conduits behind the drywall

Using the small hole shown above, the installer positions the eXapath outlet as a template to mark the drywall for enlargement prior to creating the snap-in outlet port.



Once the drywall opening is enlarged the v-groove piloting mark will become more obvious. Using a common 2 1/8" hole saw, the installer can create a port centered in the drywall opening as shown below.





Once the hole has been created it's simply a matter of snapping the eXapath outlet in place and installing cables.

Utilizing products such as eXapath cable pathways is a low cost, revolutionary way to add value to any traditionally framed home.

With the eXapath system a smart home can be designed to accommodate the homeowners desire to keep pace with advancements in consumer electronics. In most cases, the expense of adding the eXapath system is offset by reducing the costs of installing underutilized cables. Furthermore, the investment in using the system is often recouped with the first few cable changes. The eXapath system eliminates the need to blindly drill holes between floors, fish cables through insulation, and damage large portions of drywall when creating new outlets leaving a home that is well prepared for years of future enjoyment. Pretty smart.