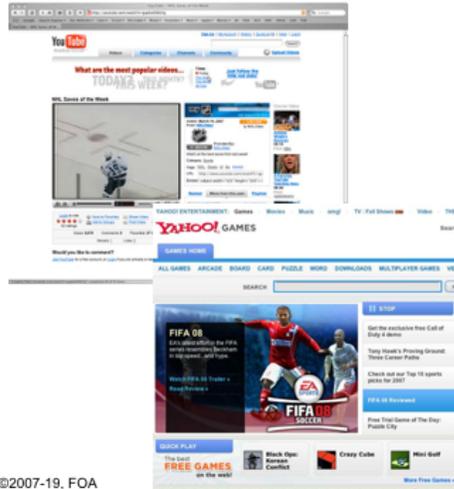


This is a program covering the basics of residential technology for voice, data and video, security, home theater and other applications. It was developed by Jim Hayes, an experienced trainer and author of two textbooks and numerous articles on cabling. This program is only an introduction, intended to be used in conjunction with complete training in the installation of cabling. It can also be used to introduce basic training in the connection and troubleshooting of telephones, PCs connected to the Internet and each other and televisions, when more in-depth information is included.

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What Is This Presentation All About?

- Broadband (fast Internet connections+) is HOT!
- Homeowners (and families) want broadband
- New applications depend on fast connections in the home
- Considering broadband when building homes makes them easier to sell and more profitable



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What Is This Presentation All About?

Broadband (fast Internet connections) is HOT! Homeowners (and families) want broadband for web browsing, viewing and downloading video, online gaming and more. New applications currently proposed like high definition IPTV depend on fast connections inside the home as well as into the home.

Considering broadband when building homes makes them easier to sell and more profitable

What Do You Need To Know To Understand This Presentation?

- Nothing special, but it helps to have a basic understanding of:
 - Telephones, etc.
 - TV
 - PC Networking
 - Structured cabling (Copper and fiber optics)
 - Wireless
 - I promise to define TLAs (three letter acronyms)



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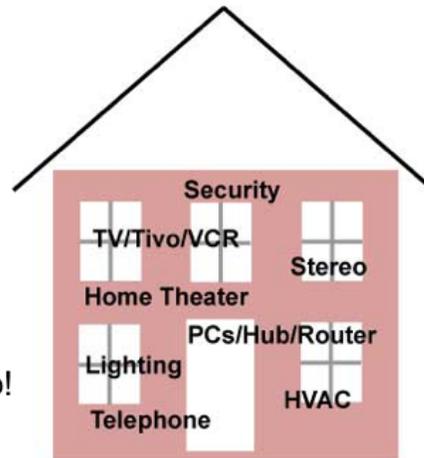
3

In order to understand residential networks, it helps if you already understand structured cabling, both fiber and copper, wireless and basic networking (e.g. Ethernet).

FOA presentations on these topics are good preparation, as are the online guides: "Lennie Lightwave's Guide To Fiber Optics" and "Uncle Ted's Guide To VDV Cabling."

Today's Home* Is Full Of Technology

- Today's home is full of new technology that requires:
 - High speed connections to the outside world
 - High speed connections to each other
 - Media centers
 - Shared mass storage
- * Condos & apartments too!



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Today's Home Is Full Of Technology

The home of today likely has multiple TVs and PCs, as well as traditional phones, plus numerous portable audio devices. Security systems may include intrusion alarms and video monitoring. Home theaters are also becoming popular in big homes. You can also get systems that control heating and AC, lighting or other electrical devices.

This new technology requires:

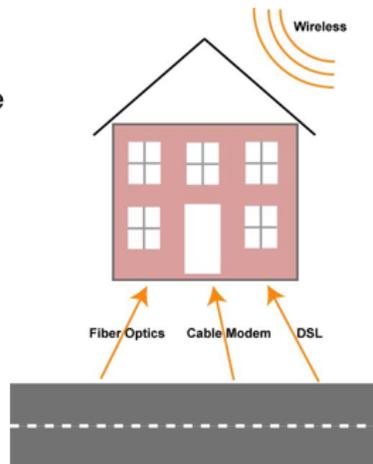
High speed connections to the outside world - over DSL, Cable modem, wireless or fiber to the home

Connections to each other - for sharing the broadband connection into the home, playing games, music, sharing files, etc.

Mass Storage - not backing up files like an office, but storing ripped or downloaded music and video.

Most Users* Have A Broadband Connection

- There are four options available for broadband connections to the home today
 - Fiber to the home
 - Cable modem
 - DSL (digital subscriber loop)
 - Wireless
- Possible future: Broadband over power lines



*60+ million households!



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Options For Broadband Connection

There are four options available for broadband connections to the home today, which we will explain in the next few slides.

Fiber to the home (FTTH or FTTP)

Cable modem over a CATV network

DSL (digital subscriber loop) connected to a fiber backbone, using Fiber To The Curb (FTTC)

Wireless using one of many options

Future: Broadband over power lines - modulating high frequency signals over power lines for digital connections. Experiments have show little promise but work continues

Homeowners Value Broadband And Are Willing To Pay For It

- Besides paying \$20-\$60 or more per month...
- Surveys show FTTH adds up to \$5500 in home value with little cost to the builder
- Home cabling adds \$3000-\$15,000 to home price with about 60-70% margin



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Homeowners Value Broadband And Are Willing To Pay For It

Besides paying \$20-\$60 per month for broadband connections, homeowners put a cash value on their connections.

Surveys show FTTH adds up to \$5500 in home value with little cost to the builder

Home cabling adds \$3000-\$15000 to home price with about 60-70% margin

Fiber To The Home (FTTH)

- Fastest Connection
 - 3-100 Mb/s
- Phone, Internet, TV over singlemode fiber
- Providers
 - Telcos (Verizon)
 - Municipalities
 - Utilities
 - Independents



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Fiber to the Home (FTTH)

Fiber to the home offers the fastest connections available, from 3-100 Mb/s depending on the system.

Phone, Internet, TV over singlemode fiber, usually using PON (passive optical network) architecture for bidirectional communications over a single fiber.

Power comes from the home and a uninterruptible power supply (UPS) is generally used to provide continuing service during power outages.

Providers of FTTH connections include:

- Telcos (e.g. Verizon)
- Municipalities
- Utilities
- Independents

You've Noticed FTTH Being Promoted?

- Verizon is promoting FTTH very aggressively
- AT&T promotes FTTC (fiber to the curb, U-verse) but is doing FTTH in some new developments
- Many communities are doing their own FTTH
- Eventually all homes may have FTTH



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You can't help but notice FTTH being promoted!

Verizon is promoting FTTH very aggressively

AT&T promotes FTTC (fiber to the curb) with DSL but is doing FTTH in new developments in NorCal

Many communities are doing their own FTTH (Loma Linda)

Eventually all homes will have FTTH - but will take decades.

Cable Modem

- Connects over CATV coax cable with HFC- hybrid fiber-coax- backbone
- Cable modem technology uses a channel frequency to transmit an Ethernet signal for Internet connection
- Standard protocol is DOCSIS (data over cable service interface spec)
- 6-16 Mb/s max downstream, 1-5 Mb/s upstream



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Cable Modem

The cable modem connects over CATV networks using a coax cable drop to the home with a fiber backbone, an architecture called "HFC" for hybrid fiber-coax network.

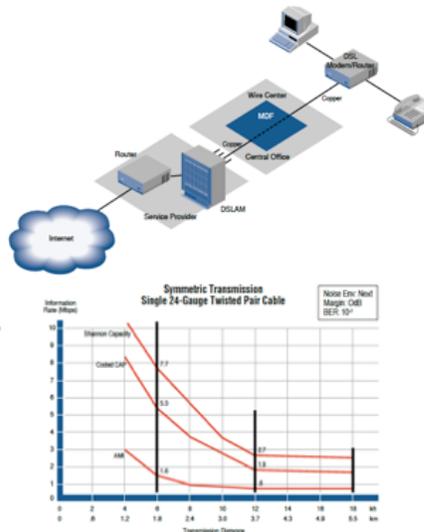
Cable modem technology uses broadband FM technology on a channel frequency to transmit an Ethernet signal for Internet connection

Standard protocol is DOCSIS (data over cable service interface spec)

Internet access speeds are 6-16 Mb/s max downstream, 1-5 Mb/s upstream is common, and the rest of the network can still offer hundreds of TV and audio channels.

Digital Subscriber Line (DSL) & Fiber To The Curb (FTTC)

- Operates over standard phone lines with fiber backbone
- xDSL covers many technologies (ADSL, HDSL, VDSL, etc.)
- At least 3 standard protocols: CAP, DMT, OFDM
- Bandwidth depends on distance, 2-25 Mb/s at 1 mile to 1-2 Mb/s at 3 miles (the max) depending on condition of the copper pairs



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Digital Subscriber Line (DSL)

DSL uses the current telco fiber backbone but completes the connection to the home over already-installed phone lines. The technology is sometimes called fiber to the curb (FTTC).

There are numerous versions of DSL as the technology develops to try to go further and faster. However the copper wire limits the distance as a function of speed - faster means shorter - plus degradation of the installed cable plant may limit usage. Bandwidth depends on distance, 2-25 Mb/s at 1 mile to 1-2 Mb/s at 3 miles (the max) depending on condition of the copper pairs

Many experts question whether DSL can meet needs for digital HD TV - around 45 Mb/s?

Example DSL technologies (sometimes called xDSL) include:

High Data Rate Digital Subscriber Line (HDSL)

Symmetric Digital Subscriber Line (SDSL), a standardized version of HDSL

Asymmetric Digital Subscriber Line (ADSL), a version of DSL with a slower upload speed

ISDN Digital Subscriber Line (IDSL)

Rate-Adaptive Digital Subscriber Line (RADSL)

Very-high-bit-rate Digital Subscriber Line (VDSL)

Very-high-bit-rate Digital Subscriber Line 2 (VDSL2), an improved version of VDSL

Symmetric High-speed Digital Subscriber Line (G.SHDSL), a standardized

replacement for early proprietary SDSL by the International Telecommunication Union
Telecommunication Standardization Sector

Transmission methods vary by market, region, carrier, and equipment.

CAP: Carrierless Amplitude Phase Modulation

DMT: Discrete Multitone Modulation, otherwise known as OFDM

OFDM: Orthogonal Frequency-Division Multiplexing

Wireless

- Wireless uses radio frequency transmission to connect to the user - in effect replacing cables
- Easy connection but limited bandwidth, subject to interference
- Constantly changing standards
- Options
 - Cell phone wireless
 - Satellite
 - WiFi wireless
 - WiMAX broadband wireless
 - Broadcast TV

Cellular







Municipal Wi-Fi





WiMax



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What Is “Wireless”?

Wireless offers the greatest number of options, the most development activity and the hardest standards to keep up with!

Wireless uses radio frequency transmission to connect to the user - in effect replacing cables, allowing the final connection to be done over the radio link

Wireless allows the user to roam unencumbered by cabling within the service area covered.

Wireless is generally limited by distance and number of users. The frequencies used are shared with other services, including door openers, so interference has been a problem.

Wireless is also undergoing constantly changing standards to make it faster and have longer distance reach. That makes it hard to sell as hardware is constantly becoming obsolete.

Examples of wireless networks serving residential communities are:

Cell phones use one standard for voice another for data. Standards differ per cell phone technology, require a adapter in the computer to match the network and may be the most expensive connection. Some cellular data networks have the broadest coverage-not only usable in the home but many areas where the company offers cell phone service.

Satellite - downloads from satellite but require dial up for upstream, generally tied to satellite TV.

WiFi wireless networks, popular in cities to offer wide Internet access using the same standards used in coffeshops. Requires lots of antennas like those

shown above on a street light -look closely two systems are there!

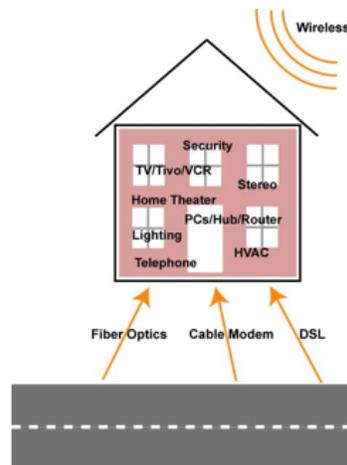
WiMax broadband wireless - still being developed, but like WiFi with a longer range (miles) using higher power.

Don't forget broadcast TV. The first use of digital TV was using broadcast stations, where digital produced much better signals. But this method of wireless is limited to the receipt of TV signals - no upstream requests for pay-per-view or Internet access.

WiFi is probably most important to the typical cable installer and is used in many municipal networks to create home connections. Few believe wireless will be able to supply the bandwidth needed for typical home use - especially with the rollout of IPTV in high definition.

What Is Connected Inside The Home?

- Telephones
- PCs sharing the Internet connection through a Router
- TVs or Home Theater
- Audio/Stereo/Intercoms
- Security Systems
- Lighting controls
- Environmental (HVAC)
- Appliances



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What Is Connected Inside The Home?

Much of what is connected inside the home is obvious, but there are some new options and future possibilities.

Telephones: Phones are currently wired serially from a bridge at the entrance, but can just as easily use a star-wired structured cabling system.

PCs sharing the Internet connection through a Router: a star-wired structured cabling system or wireless access point is needed to connect PCs in the home so they can share the broadband Internet connection, share printers or files, and play multi-user games.

TVs or Home Theater: Now we use coax for TV, but that TV is analog. When TV is digital, the same cable that is used for PCs may be appropriate for TVs. If we have a media center, a star-wired structured cabling system is a perfect solution.

Audio/Stereo/Intercoms: Many homes have intercoms and some use the same wiring for music. If the home has a central media server, it can be handled over a home cabling system that also connects PCs and maybe TVs.

Security Systems: Most home security systems already are connected to the phone to call to report situations requiring intervention, but if they were on a broadband network, they could email also and be controlled remotely.

Lighting controls: light switches can be installed to turn off when people leave the room or on when they enter, or controlled remotely using some home master controller. This seems a logical use of power line communication technology. As with much of this technology in the home, the questions are who wants to pay what it costs and can they easily learn to use it?

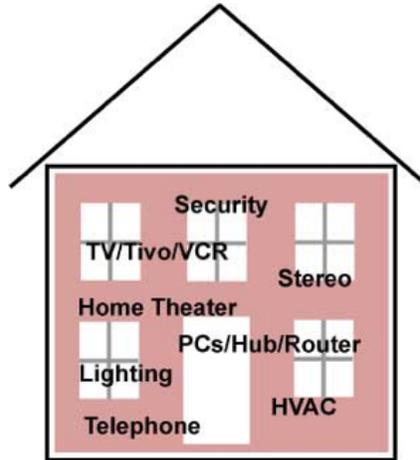
Environmental (HVAC) - today's furnace has a wired thermostat and power. But it

could be controlled locally from a control center for the home or remotely over the web or phone, even be programmed to warn you of problems.

Appliances - imagine a refrigerator that warns the user of power outages or could use RFI tags to know it needs to call you on your cell phone and tell you you need more milk. Do consumers want this enough to pay for it?

How Are They Connected Inside The Home?

- Phones: wires, cordless or cell
- PCs: cable or wireless
- TV: Coax or broadcast
- Audio: wired, wireless, broadcast
- Security: wired or wireless
- HVAC controls: wired
- Lighting controls: wired or wireless
- **Let's look at each in more detail**



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How Are They Connected Inside The Home?

All these devices require some kind of connection in order to function properly.

Phones can connect on copper wires, have a cordless handset to a wired base station or have a purely wireless connection like a cell phone.

PCs can connect to each other over unshielded twisted pair cable (commonly called "Cat 5") or use WiFi wireless connections to a WiFi router connected to the home Internet connection.

TVs can receive broadcast signals using an antenna attached to the set or the roof of the home or using coax cable with a coax feed coming into the house from a CATV company or signals coming from a satellite dish mounted outdoors.

Audio: wired, wireless, broadcast

Security: wired or wireless

HVAC controls: wired

Lighting controls: wired or wireless

How Are Phones Connected Inside The Home?

- POTS (Plain Old Telephone Service)
 - Traditional 2 pair phone wire
 - Cat 3 UTP mandated by FCC
 - Any category-rated UTP cable
 - Cordless
- VoIP (Voice over Internet Protocol)
 - VoIP modem uses network cabling and POTS phones
 - VoIP phones on network cables
 - Software VoIP works through PC
 - May offer cordless handsets



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How Are Phones Connected Inside The Home?

Plain old telephone service -POTS - uses a two wire current loop connection. This same method works for short links inside the home to longer links to a phone company central office. Connections are over:

Traditional 2 pair phone wire. Two pairs were originally used when AT&T offered the "Princess" phone with lighted dial. The second pair carried power for the light. Eventually, the second pair was used for a second line.

Cat 3 UTP was mandated by FCC in 2000, replacing phone wire, which was unrated. Any category-rated UTP cable can be used today - and although outside the standards, you can use a 4-pair Cat 5 cable for both phone and computer connections by using a splitter that connects two jacks to two separate pairs each.

Cordless phones have a wired (POTS) base station and a cordless handset that works with that base station over a short range.

Many millions of homes now use some form of VoIP, with from their Cable TV company or through another operator. VoIP digitizes and mixes voice data with IP data, using the broadband connection to transport the call over the Internet and connect to the phone network on a local switch at the destination. There are three options in using VoIP:

Using a special VoIP modem. The VoIP modem uses network cabling and POTS phones plugged into the modem.

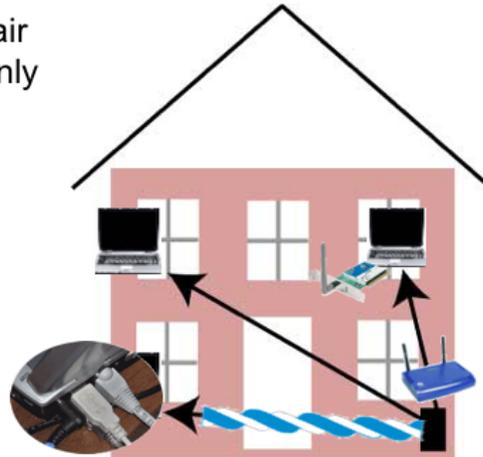
Special VoIP phones have both the VoIP modem and a phone set connected on network cables.

Some links use a PC with special software, so VoIP works through the PC using a headset.

VoIP phones are available with cordless handsets, and, of course, a regular cordless set can be used with a VoIP modem.

How Are PCs Connected Inside The Home?

- Unshielded twisted pair cables (UTP) commonly called “Cat 5”
- Wireless using WiFi
- Power line networks
- Phone line networks
- Fiber optics



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How Are PCs Connected Inside The Home?

There are several methods but two are most commonly used, UTP cables and wireless.

Unshielded twisted pair cables (UTP), commonly called “Cat 5,” can be installed in the walls in a “star” architecture, connected to one point in the home. All PCs have an Ethernet connection compatible to this cable.

Wireless using WiFi connects a wireless router to the broadband connection and every PC has a wireless adapter.

Power line networks use the home’s power lines but can have interference and bandwidth problems.

Phone line networks are slow but can work in some homes where other alternatives are not feasible.

Fiber optics are the fastest connections, but also more expensive, and rarely used in the home today.

How Are TVs Connected Inside The Home?

- Today's TVs can connect to an antenna, CATV input, CATV desktop box, satellite controller, VCR, DVD player or media PC
- F connector on RG-6 coax (75Ω) is most popular for in-wall cabling
- From video electronics, depends on format:
 - F connector on coax
 - RCA plugs/coax
 - HDMI
- New generation of wireless boxes coming, some using WiFi, some UWB



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How Are TVs Connected Inside The Home?

Televisions offer numerous ways of connecting to signals. All TVs can be connected to an antenna, where you can receive signals broadcast from local stations in both analog and digital format. Tuners in the TV select the stations.

Many people connect by CATV - which actually means "community antenna television," not cable TV, which comes into the house over coaxial cable connected to a box usually called a "set top box" that selects the channels, sends them to the TV over coax (RG-6 or RCA) or for newer TVs, HDMI cables and communicates with the CATV operator for pay-per-view or to download guides. Some set top boxes now also include video recorders (like TiVO) or even DVD players. New TVs have provision for a "Cable Card" which provides the functions of a set top box with a plug in for the TV itself.

Satellite TV inside the home works like CATV on coax.

You can get devices called "baluns" that adapt coax networks to work on UTP copper. However Coax has much higher bandwidth than UTP, so if such a solution is used, the highest performance UTP (Cat 6 or above) is recommended.

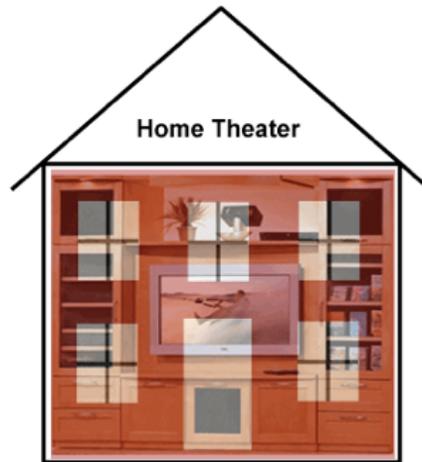
The movement toward replacing the cable set top box with a media server like a PC is changing the way TV is used. A media server offers the ability to watch cable or satellite TV, download video from the Internet, or search the Internet just like a PC, but using a TV as the display. Most solutions will offer the ability to do all three simultaneously.

Some of these devices are connecting to TVs wirelessly, some over UTP, some coax, some HDMI. From the box to the TV is currently not standardized. Wireless is using WiFi and a new variation of Bluetooth called UWB or Ultrawideband, touted as a

wireless version of USB. Even fiber optics is being used as HDMI is limited to 5 meters (about 16 feet) while fiber offers much longer distances.

What About Home Theater?

- Refers to a “integrated entertainment system”
- TV
- Cable/Satellite
- DVD/TiVO/media server
- Stereo
- Speakers
- Mostly high-end custom systems



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What About Home Theater?

Home theater refers to a “integrated entertainment system” in a room that includes a TV, usually with Cable/Satellite connection (and an Internet connection), a DVD/TiVO/media server, a stereo system for sound and music, and speakers. Needless to say, it needs lots of connections and plenty of power. Home theater is usually installed by an integrator who takes system responsibility.

How Are Other Devices Connected In The Home?

- What devices?
 - Thermostats
 - Speakers/Intercoms
 - Security/Alarm systems
 - Lighting control
- Most devices have some wiring or wireless connection
- Some use power lines



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How Are Other Devices Connected In The Home?

What kinds of devices inside the home require connections and what do they use?

Thermostats that control the heating and AC generally use a simple 2-6 wire connection using large 18Ga thermostat wire.

Speakers/Intercoms need two wires, but analog speaker drives may carry large currents, so larger gage wires are needed. Some speakers are digital with internal amplifiers, which can use any kind of wire, but require AC power for the amplifier. Wireless speakers also require power, but no signal cables, simplifying their installation.

Security and/or alarm systems are hard to generalize. Most have a central system box with one or more remote keypads. Some are wired, some wireless; some are monitored and require a outside phone or Internet connection to the alarm service; some include video, some include intrusion/door/window alarms, some include smoke/fire detectors, and so on. Most comprehensive systems are installed during construction, as the wiring can be so complex as to be prohibitively difficult to retrofit.

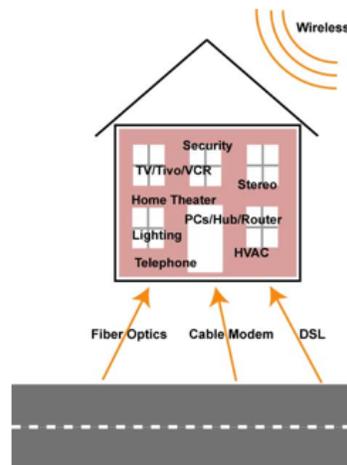
Lighting control is one item that should be easier to install, since it controls electricity to a bulb, it offers the possibility of using power line transmission, and many systems do.

Most devices mentioned have some unique wiring connection scheme and a unique cable. Some can use wireless. Some use power lines. Many have been designed to operate over Cat 5 UTP cable, making it possible to include their cables in a structured cabling system. For whatever is considered, check with manufacturers for the proper

connection scheme.

How Do You Cable A Home?

- Depends on:
 - New construction or renovation
 - Buyer's or owner's needs and desires
 - Technology status
 - Price point
 - Future proofing



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How Do You Cable A Home?

How you design and install cabling in a home depends on a number of factors, but all assume the building has or will have a broadband connection.

Is the building a single family home or multi-dwelling unit (MDU)? Single family homes will have a “nerve center” that acts as the interface between the broadband connections and the internal cabling. MDUs will generally have a central facility serving each unit and a smaller facility in each unit. Internally the needs are similar, differing in scale. Is it a condo or apartment? If it's a condo, each unit owner may have inputs into the design and installation, while apartments will be a fixed design, flexible in use but simple to understand and connect to.

Is the residence new construction or renovation? Obviously, new construction is easier to plan and install, while renovation will require flexibility as to where cables can be run and hardware installed.

Buyer's or owner's needs and desires. They are unlikely to understand the cabling issues, but they probably will have strong opinions as to where hardware will be installed, e.g. dens,

bedrooms, etc. That will determine the locations of cable connections for entertainment and communications, as well as security systems, lighting controls, etc.

Every installation must use available technology, the status of which changes daily, especially in entertainment options. Installing outlets for dual Cat 5 and coax connections will cover most current and future options.

The price is always going to be an issue, so the installation must fit the owner's budget. Market price is determined by the level of desire to have certain options, and in areas where broadband access is competitive and highly advertised, the buyer's willingness to pay for comprehensive cabling options is going to be higher.

Future proofing is a bad joke. Technology changes so fast that any predictions of the future are wrong by the time they are made! However installing adequate cabling will make it more likely the home will be able to support future equipment options.

Bringing Connections To The Home

- Most new construction puts cables underground
 - Trenching or directional boring
 - Usually install conduit or innerduct
- Aerial is used in many overbuilds
 - Drop from street uses current cable for messenger



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Bringing Connections To The Home

Codes require most new construction places cables underground, which can be done by trenching or directional boring, with cables usually installed in conduit or innerduct.

Aerial cables are allowed in older areas where poles are used for electrical, CATV and phone now, so aerial cable is used in many overbuilds in current neighborhoods.

Aerial cables drop from street using the current cable for support (messenger.)

Structured Cabling Inside The Home

- Each home needs a cabling center, where the outside and inside meet
 - Holds network electronics
 - Uninterruptible power
 - Patch panels
- Cable to outlets can be bundled, 2-Cat 5, 2-coax
- Outlet has PC, phone, TV jacks
- Standard: TIA-570



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Structured Cabling Inside The Home

By structured cabling, we're referring to a standardized cabling system designed to allow many types of communications systems to be used on the same infrastructure.

Each home needs a cabling center, where the outside connections and inside cabling meet. The panel or box holds network electronics such as cable modem, DSL modem or even FTTH converter and a cable amplifier.

Most panels or boxes have provision for multiple outlets, since several powered devices must be accommodated, and uninterruptible power, since all communications will be lost if power fails at the home. The box will also have patch panels which neatly connect to individual outlets in the home.

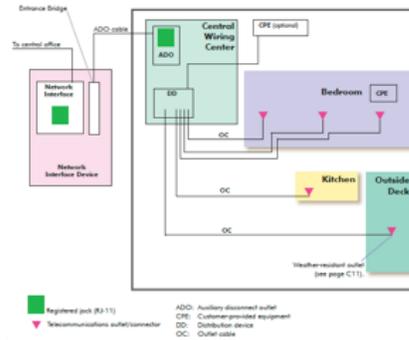
The cable pulled to every outlet can be bundled, to include 2-Cat 5 and 2-coax cables in one jacket, so only one cable is pulled, saving lots of installation time.

Practically every room will have a media outlet which has PC, phone, TV jacks, and maybe separate jacks for cable and satellite TV.

There is an industry standard to follow for cabling homes, TIA-570, written by manufacturers who are members of the Telecommunications Industry Association, to ensure compatibility between all cables and electronics.

Residential Cabling - *TIA-570

- Basic structured cabling: UTP and coax, star cabling
- 2 Grades
 - Grade 1: 1-Cat 3, 1-coax
 - Grade 2: 2-Cat 5e, 2-coax, optional optical fiber
- Addenda
 - TIA-570A-1: Security
 - TIA-570A-2: Control
 - TIA-570A-3: Audio



*Telecommunications Industry Assoc.



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Residential Cabling - TIA-570

When it comes to understanding residential cable, the TIA-570 standard covers most of the bases and gives guidelines for designing cabling layouts and choosing products. Wired to a central point - called star cabling architecture - where everything that connects to the devices in each room are located.

TIA-570 covers basic structured cabling: UTP and coax with 2 Grades:

Grade 1: 1-Cat 3, 1-coax

Grade 2: 2-Cat 5e, 2-coax, optional fiber

In addenda, it offers guidelines for other types of cabling:

TIA-570A-1: Security

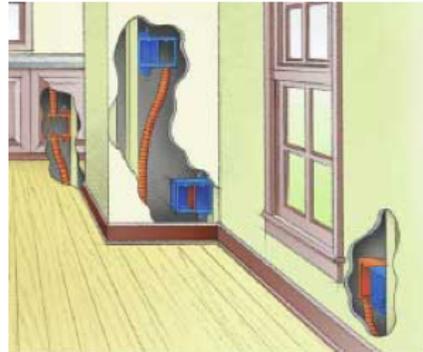
TIA-570A-2: Control

TIA-570A-3: Audio

TIA-570 was written by vendors for vendors - it's a set of specifications they can use to develop products that will work together and provide a baseline for cabling performance that electronics manufacturers can use to develop their products that will use the cabling. It's not a document that is easily understood by most users. However, the Structured Cabling Association (<http://www.scausa.org/>) and many cabling vendors offer their summary of these specifications in their catalogs and websites - which is where you can go for more understandable details!

Residential Cabling - Planning For The Future

- Who knows what will be needed in the future?
- Gigabit networks
- Optical fibers
- Homes are hard to update
- Install flexible conduit or raceways to allow recabling



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Residential Cabling - Planning For The Future

Who knows what will be needed in the future?

Gigabit networks

Optical fibers

Unfortunately, homes are not like offices, where spaces are available above ceilings or below floors to place updated cabling and most work areas are based on modular office furniture not studs and drywall!

The best bet is to install flexible conduit or raceways in addition to cables to allow recabling as needed in the future.

TIA-570 was written by vendors for vendors - it's a set of specifications they can use to develop products that will work together and provide a baseline for cabling performance that electronics manufacturers can use to develop their products that will use the cabling. It's not a document that is easily understood by most users. However, the Structured Cabling Association (<http://www.scausa.org/>) and many cabling vendors offer their summary of these specifications in their catalogs and websites - which is where you can go for more understandable details!

For the future, only singlemode optical fiber is a sure bet to have the bandwidth

capability, but few homes have singlemode fiber installed today. Installing a ducting system is a better bet. It allows easy upgrades when necessary.

AC Power Issues

- Location - near data/video outlets
- Quantity-adequate for equipment
- Quality-filtered and protected for delicate electronic gear
- Uninterruptible: UPS for must-have services



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Power Issues In The Home

This may sound more like a commercial installation, but in many ways the same issues apply:

Location - power must be provided near data/video outlets

Quantity-the power available must be adequate for the equipment being connected. Media servers, large plasma TVs and the like consume lots of power.

Quality-like every other outlet used for computers or electronics, the power should be filtered and protected for delicate electronic gear. This can be done locally or centrally.

Uninterruptible- a uninterruptible power supply (UPS) will be required for mass storage devices, either part of or connected to media servers, and “must-have” services, so if you use VoIP phones and want continuous service during a power outage, you need a UPS for both the VoIP modem and the Cable/DSL modem, plus any other phone gear.

Installers Of Cabling Inside The Home

- Installers should be familiar with the application, not just the cabling type.
 - Electrical
 - HVAC
 - Security
 - Entertainment
 - PC Network
- Credentials may include licenses, training and certification, references
- NEC covers everything!
- Cabling should be tested and verified for proper performance



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Cabling Inside The Home

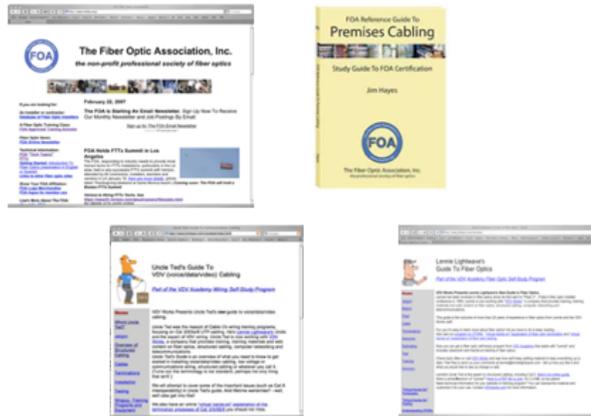
Installers should be familiar with the application, not just the cabling type. Obviously the electrical contractor will have training, experience and a license. Likewise, HVAC, security, entertainment and PC networking are different enough that the installation of both cabling and the equipment should be done by specialists to make certain it's done correctly and the systems will work properly.

Certifications can come from professional societies like the Structured Cabling Association (<http://www.scausa.org/>) or FOA (<http://www.thefoa.org/>) or commercial suppliers who train their own installers.

For electrical work, proper installation and safety is covered by the National Electrical Code. But every cable, HVAC, security, entertainment and network, is also covered under the NEC. Industry standards exist for virtually any types of cables (TIA-570 covers video and networks, for example), but all are also covered under various provisions of the NEC, and of course, all these systems require proper AC power.

All cabling should be tested and verified for proper performance. Improperly installed cabling may be unsafe and provide substandard performance, so installers should test every run and verify its performance to industry standards or operation with installed devices.

Learn More About Cabling



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More information on cabling is in the textbook *The FOA Reference Guide to Premises Cabling* by Jim Hayes.

For more information on fiber to the home, see the FOA site for an online tutorial and links to references: <http://www.thefoa.org/>

A good tutorial on structured cabling is *Uncle Ted's Guide to VDV Cabling*. You can see it on the web at <http://www.vdvworks.com/LennieLw/> and a printable version in PDF format is linked from the site.

Another reference is *Lennie Lightwave's Guide to Fiber Optics*. You can see it on the web at www.LennieLightwave.com and a printable version in PDF format is linked from the site.

Questions?

- Where do I go to learn more?
- Do architects know about home cabling?
- How do I find qualified installers?
- How should I market high-tech homes?
- Do I cable MDUs like homes?
- Do I need to get involved with content providers?
- Do all VDV cabling installers do everything?



Now it's your turn.

For more information, see:
The Fiber Optic Association, Inc. - www.foa.org

