NETWORK AND TELECOMMUNICATION

ACADEMIC BACKGROUNDS:

- 1987-1993 Georgia University of Technology (Former USSR) **Specialize: Radio Transmitting Device of Satellite Telecommunication Systems** (Master of Science).
- 1997-1998 Advanced course at the Saint–Petersburg State University of Technology in computer simulation of ground stations Modem for Sputnic communication (Russia).

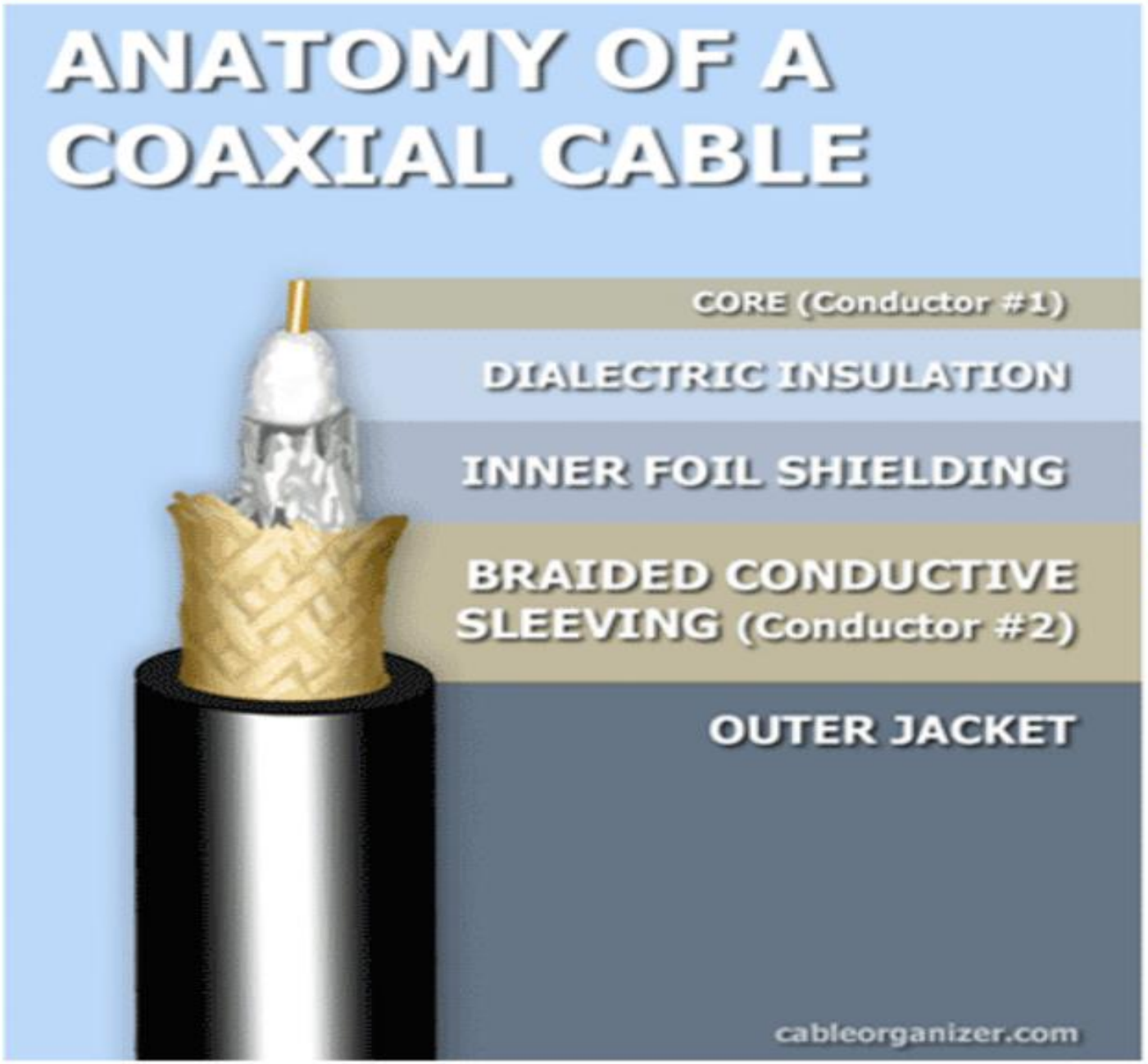
PREVIOUS EMPLOYMENT:

- 2002-2018 The World Bank Cambodia (IT Analyst, Client Services).
- 1999 -2001 Worked as Systems Engineer at VIRTU International Limited.
- 1995 -1997 Worked as assistant manager in operation and technical department at CAMINTEL.
- 1993 – 1995 Worked as engineer in Operations and Technical Department in HUB-station (ex-UNTAC Networks) at Ministry of Post and Telecommunications of Cambodia.

Teaching Experiences:

- 2000 Teaching at Royal Academy of Cambodia (MSc.IT).
- 2002 Teaching at Build Bright University (MSc.IT).
- 2019 National Polytechnic Institute of Cambodia (BSc.Telecom).
- 2020 Norton University (BSc.IT)

Cable TV Network



What is Coaxial Cable?

Everyone's heard of coaxial cable, right? Or maybe you've heard it by its hip nickname: "coax" (that's two syllables, co + ax…not the word that means “to draw forth”). It's a fairly common type of shielded data transmission cable, which is made up of two conductors that are coaxially oriented (hence the name), but separated by a layer of insulation. The make-up of your typical coax is as follows: the core consists of a metal wire (conductor #1), which is then surrounded by a layer of nonconductive dielectric insulation, which is itself covered in metallic mesh, foil and/or braid (conductor #2), and then whole shebang is wrapped in a protective outer sheathing, or jacket, which holds everything together and locks out moisture and impurities (sorry Phil Collins, a jacket is required…if you don't get that reference, ask an old person about the 80's).

What is Coaxial Cable Used For?

Good question! Coax is designed to carry high-frequency signals, and to protect those signals against electromagnetic interference (EMI) from external sources. Most people probably associate it with their cable television (CATV) service, and probably have not-so-fond memories of squeezing behind the TV to try and thread the end of the cable onto the wall outlet and/or the back of the TV set. But you'll find these cables in lots of other applications, including commercial radio communications, ham radio, undersea cable systems, closed-circuit television (CCTV), home video equipment, and broadband Ethernet application.

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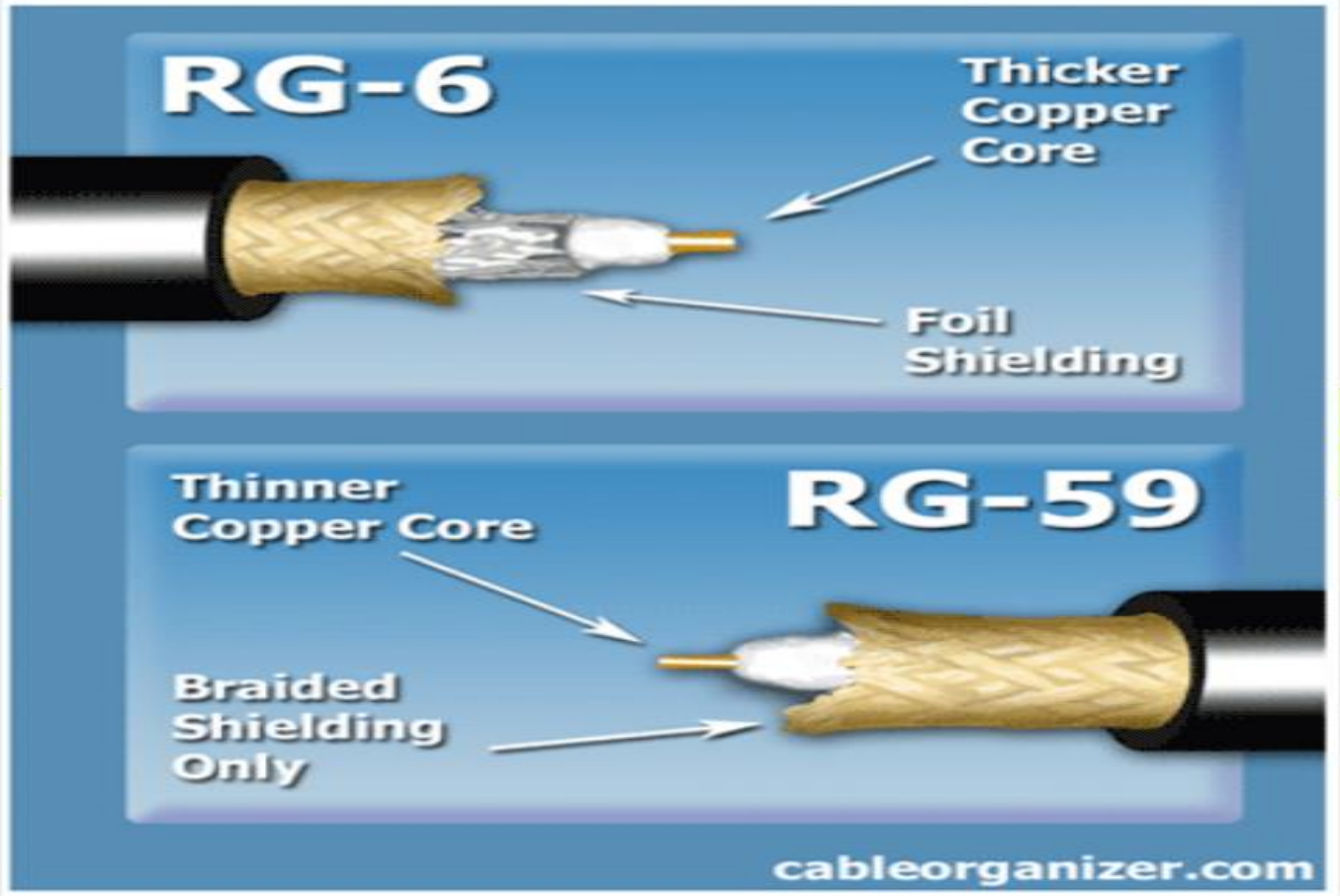
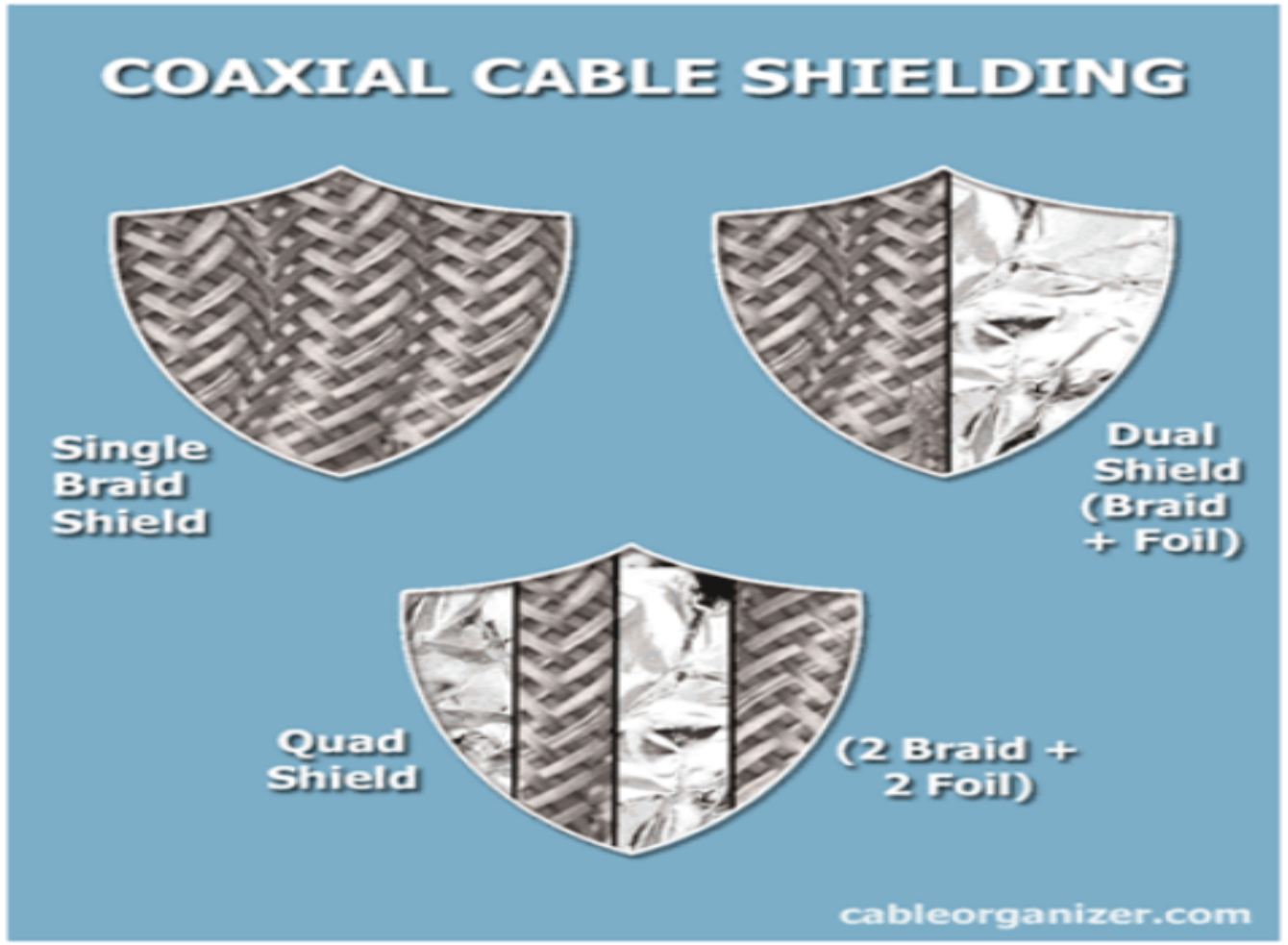


What Does the "RG" in Coaxial Cable Types Like "RG-6" and "RG-59" Stand For?

Really Good? Rapid Growth? Rockstar Groupies? No silly, none of those. It turns out, the "RG" is short for "Radio Guide", a term that dates back to the World War II era, when the military made heavy use of coax, and developed a set of standards to specify different grades and their applications. Even though us civilians still refer to coaxial cables by their original RG numbers today, these standards are now obsolete in the actual military, which now uses the umbrella specification of MIL-C-17.

There are dozens of RG specifications, but there's no real rhyme or reason to the numbers they're assigned; it's actually pretty random. When it comes to the most commonly utilized specifications, both RG-6 and RG-59 cables are widely used in residential settings, especially when it comes to TV. The difference is found in the specific signals they're used for: RG-59 is the norm for standard Cable (CATV), while RG-6 is the coax that handles digital video signals and satellite TV. When you compare the two types side by side, RG-6 has a larger core conductor, thicker dielectric insulation, and anywhere from 2 to 4 layers of shielding, versus RG-59's one. These physical differences make RG-59 best suited to low-frequency transmissions and short cable runs, and RG-6 the ideal choice to carry high frequency signals over long distances. So basically; 6 rules, 59 drools. However, the shielding used by both respective types is typically tailored to their use, which means RG-59 is better for short-range, “baseband” applications (video projectors, component video, etc.), and 6 is geared toward long-range, satellite and cable feeds.

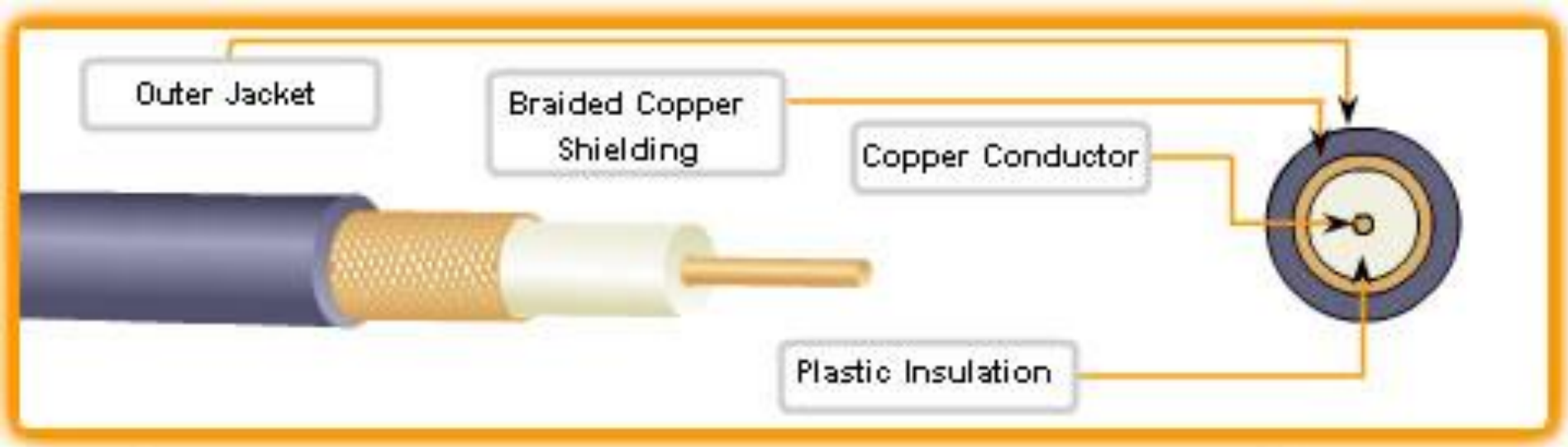


What Makes One Cable Better than Another?

In the coax world, better shielding equals less signal interference, so that's one good way to measure a cable's quality. Types of shielding can vary greatly, as can the amount present from one cable to next – coax typically has anywhere from one to four layers. The best coaxial shields are the ones that offer the highest density, or percentage of cover. Tightly-woven metal braid makes an excellent choice – not only is it highly conductive, it can provide as much as 95% coverage. To deal with that extra pesky 5%, some manufacturers combine braid with an additional layer or two of metallic foil (like a coaxial baked potato!), which helps to block small amounts of EMI that often manage to seep into the cable through tiny holes found in the braid.

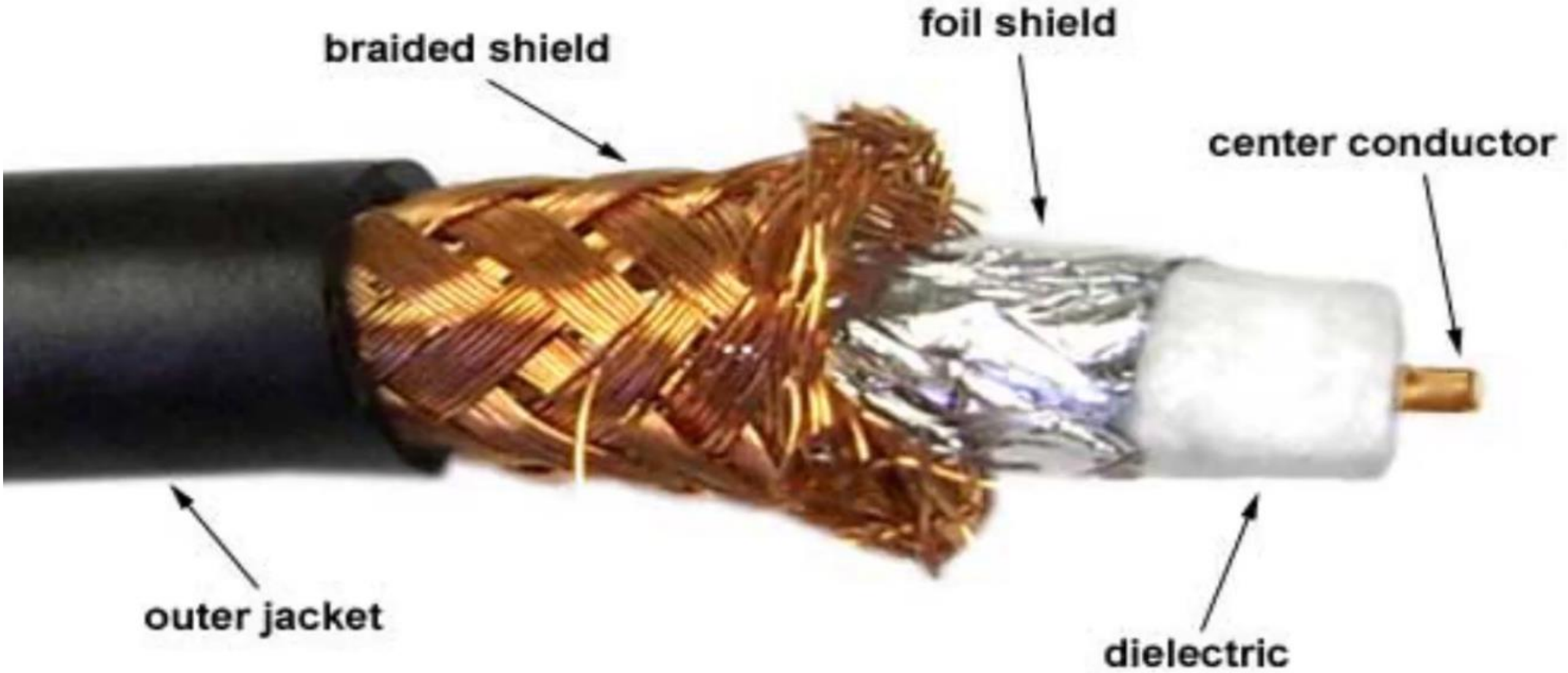
When it comes to cable quality, conductor materials can be a controversial topic that's sure to stir up debate. While some manufacturers and A/V enthusiasts will tout the benefits of silver and oxygen-free copper (OFC), the truth is that – used as core conductors – these metals generally don't perform any better than standard or tinned copper. They do, however, sound really fancy, and are often used to justify obscene price mark-ups on what is, essentially, the same cable. In the end, we'd recommend trusting a cable's specifications over hoity-toity labeling.

So, now that you're up to speed, why not head over and check out our coaxial cables?


Outer Jacket
Braided Copper Shielding
Copper Conductor
Plastic Insulation


Coaxial Connectors
BNC
N type
F type

COAXIAL CABLE



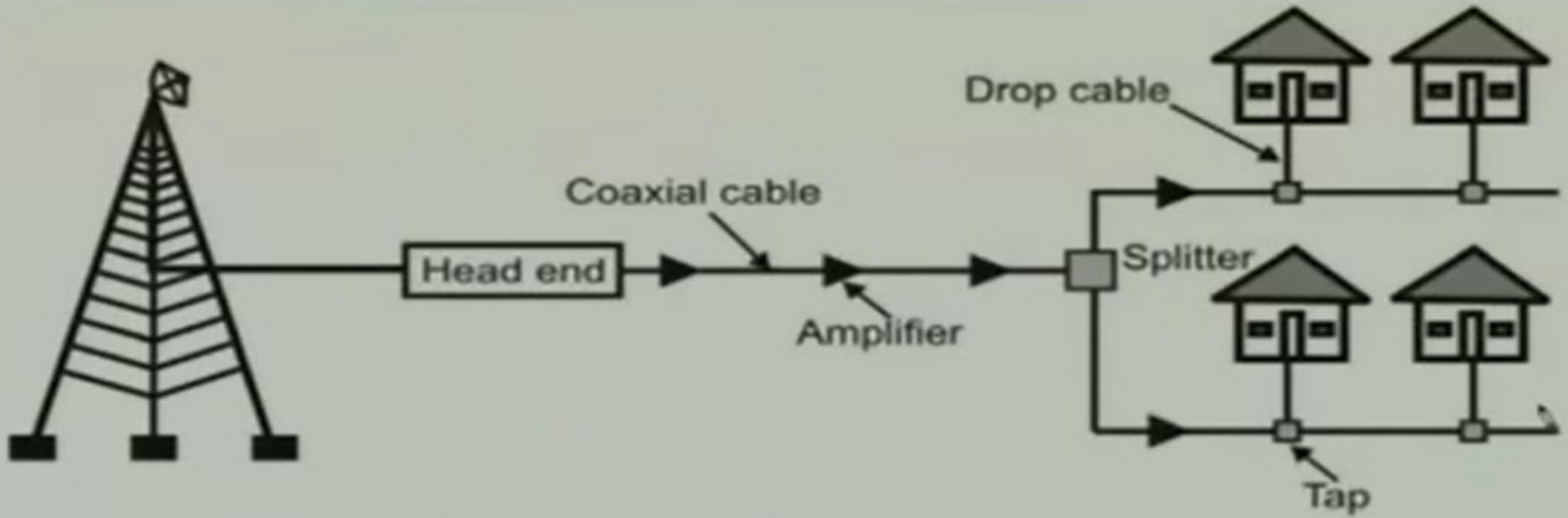
Common Applications

- Used in a variety of applications:
  - Television distribution (cable TV)
  - Long-distance telephone transmission (10,000 voice channels per cable)
  - Local Area Networks

Category	Impedance	Use
RG-59	75Ω	Cable TV
RG-58	50Ω	Thin Ethernet
RG-11	50Ω	Thick Ethernet

Cable TV System

- Traditional Community Antenna TV (CATV) distributes broadcasted video signals to residences.



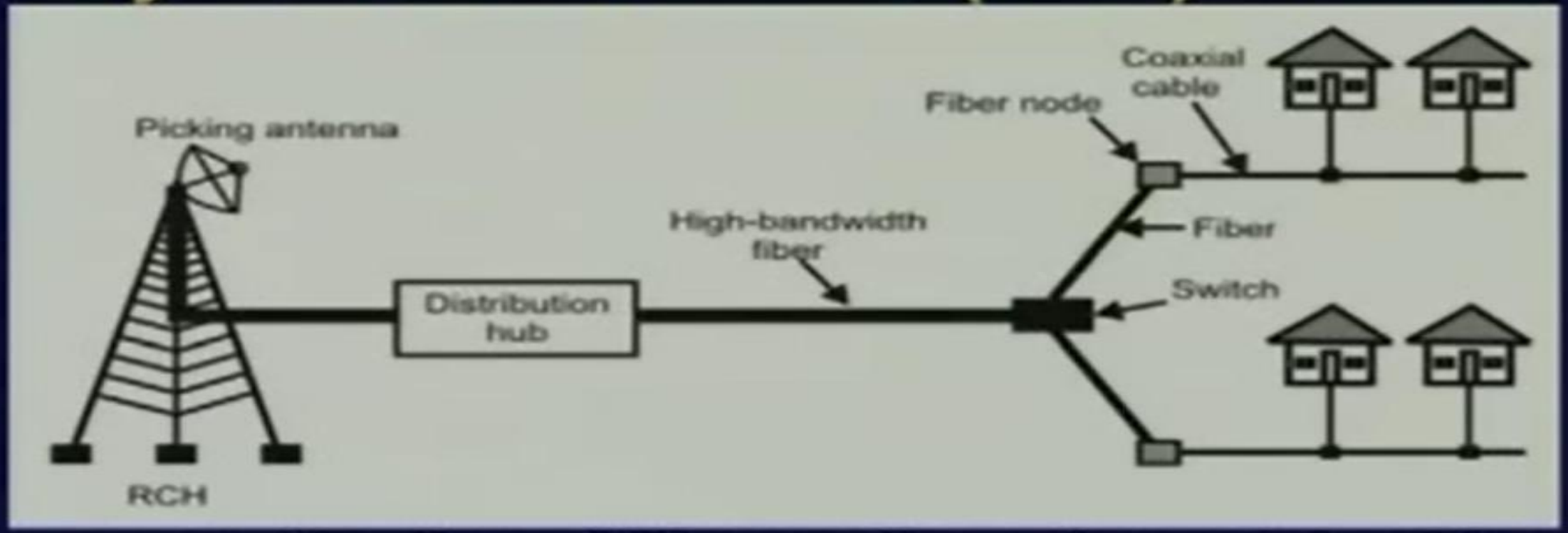
Cable TV System

- **Transmission Media**: The widest use of coaxial cable is in cable TV system. Coaxial cable provides much better immunity to interference and crosstalk compared to twisted-pair used in ~~cable modem~~ DSL Network
- **Bandwidth**: Cable TV systems use the frequency range from 54 to 500 MHz
- **NTSC** (National Television Standards Committee) and **PAL** (Phase Alteration by Line) standards use 6 MHz and 8 MHz bands, respectively to send analog TV signals, providing 50 to 70 channels.

Cable TV Devices

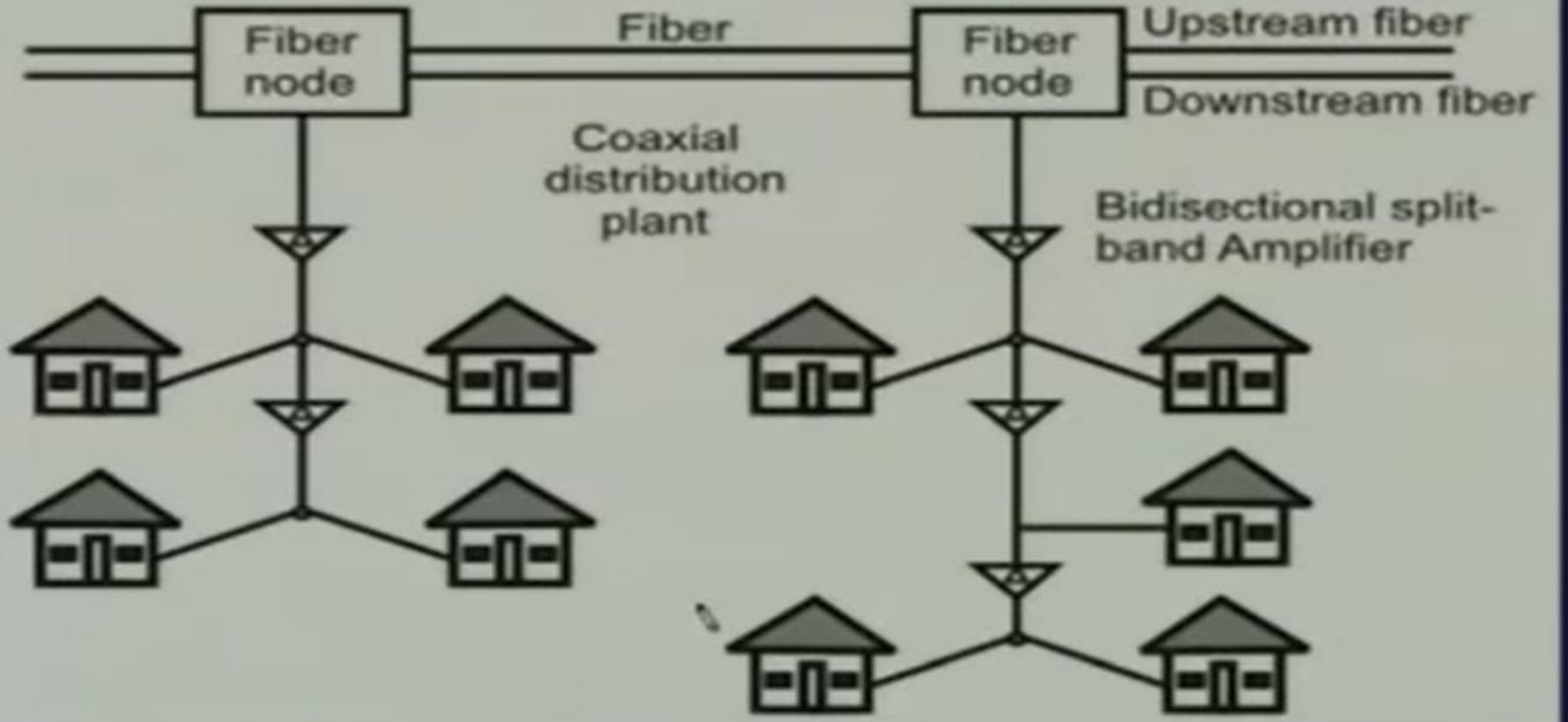
- **Head end**: The head end receives video signals from broadcasting stations with the help of an antenna installed at the top of a tall building
- **Amplifiers**: Amplifiers are used to boost the signal levels. Up to 35 amplifiers may be used between the head end and subscriber premises
- **Splitters**: Splitters are used to split distribution of signals into branches and **drop cables** are used to take signal to subscriber premises
- Because of large attenuation and the use of large number of amplifiers, the communication is **unidirectional** (downstream) in nature

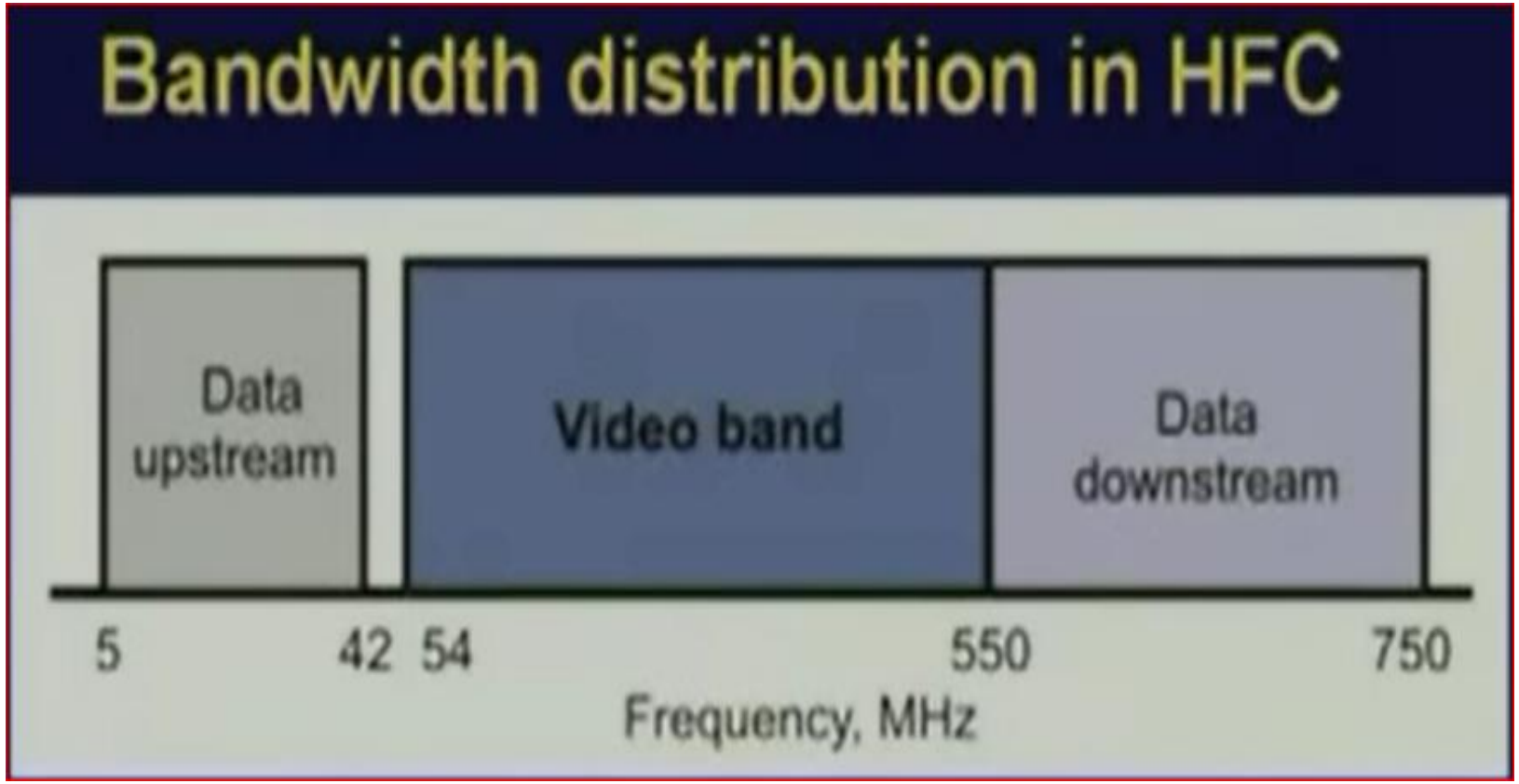
Hybrid Fiber-Coaxial (HFC) network



- Uses a combination of fiber-optic and coaxial cable
- HFC network facilitates bidirectional communication
- RCH can serve as many as 400,000 users, distribution hubs can serve 40, 000 users, each coaxial cable can serve 1000 users

Hybrid Fiber-Coaxial (HFC) network




Bandwidth distribution in HFC
Data upstream
Video band
Data downstream
5
42
54
550
750
Frequency, MHz

Bandwidth distribution in HFC

- **Upstream data band:** Occupies the lower band from 5 to 42 MHz, divided into 6-MHz channels.
  - As it is more susceptible to noise, **QPSK** is used instead of QAM
  - Theoretical data rate is **12 Mbps**
- **Video band:** Downstream only
  From 54 to 550 MHz, accommodates 80 channels
- **Downstream data band:** Occupies the band from 550 to 750 MHz, divided into 6-MHz channels. Can support up to ~~80~~ channels
  - **64-QAM** is used for modulation
  - As one bit is used for upward error detection, theoretical data rate is **30 Mbps** (actual 10Mbps)

6 channels

6 MHz

33 channels

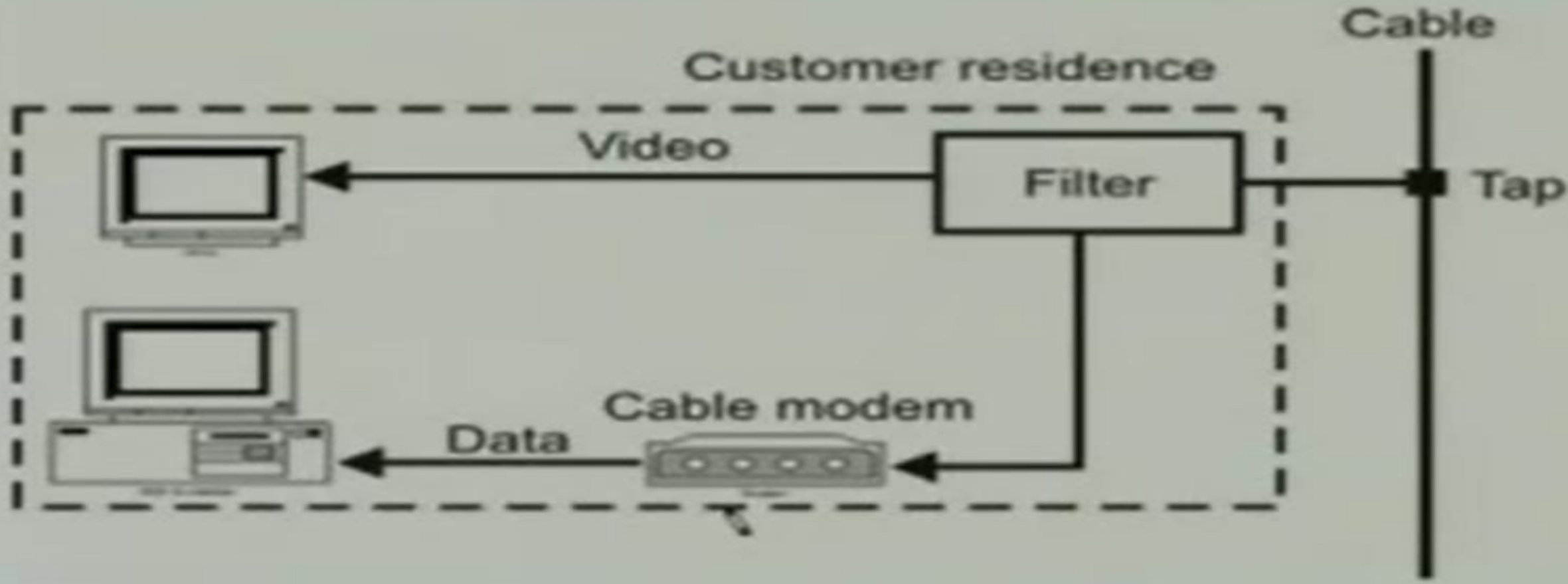
Sharing of Bandwidth

- The subscribers share both upstream and downstream bandwidths.

Upstream sharing: As the upstream bandwidth is only 37 MHz, these are divided in to six 6-MHz channels using FDM, which are shared by users. One channel is allocated to a group of users statically or dynamically.

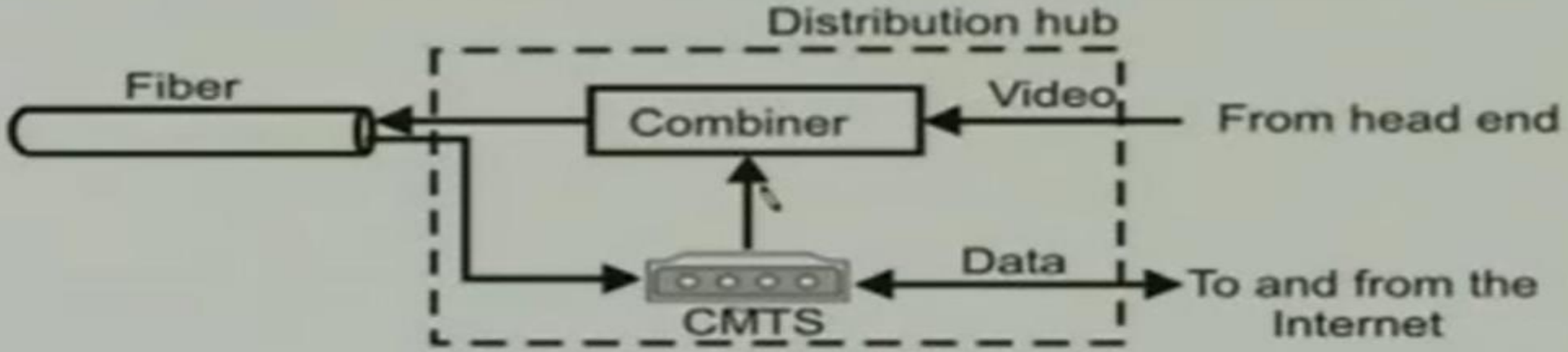
Downstream sharing: Downstream band has 33 channels of 6 MHz each, which are shared by all the users. Here multicasting is done based on matching of address.

Cable Modem Devices



CM is similar to ADSL modem

Cable Modem Devices

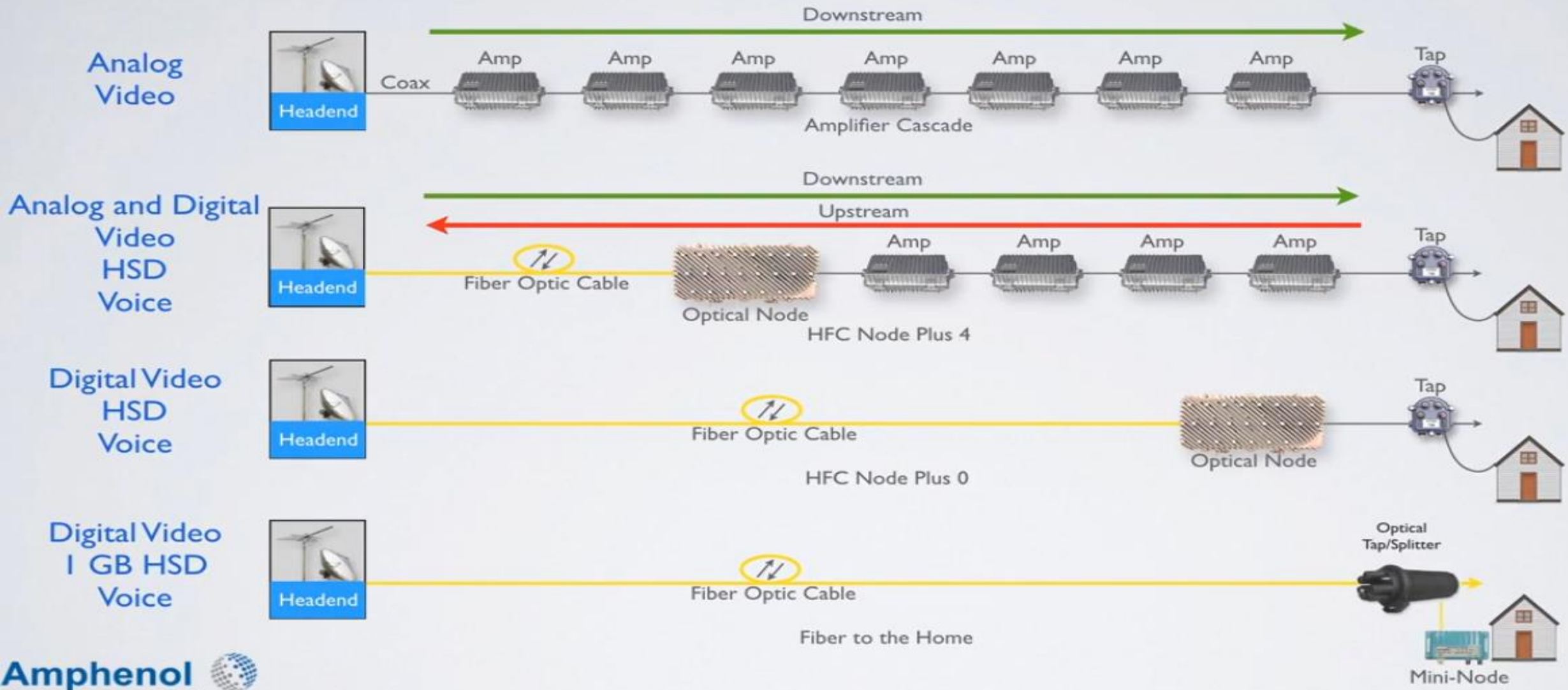


- Cable Modem Transmission System (CMTS) is installed in the distribution hub of the cable company.
- CMTS receives data from the internet and sends them to the combiner. It also receives data from the subscriber and passes them to the internet

Data Transmission Schemes

- Data Over Cable System Interface Specification (DOCSIS) devised by Multimedia Cable Network Systems (MCNS)
- DOCSIS defines all the protocol necessary to transport data from a CMTS to a CM. Timesharing is allowed for upstream data
- A CM must listen for packets destined to it on an assigned downstream channel
- The CMs must contend to obtain time slots to transmit their information in an assigned channel in the upstream direction
- The CMTS sends packet with the address of the receiving CM in the downstream direction without contention

Fiber Evolution



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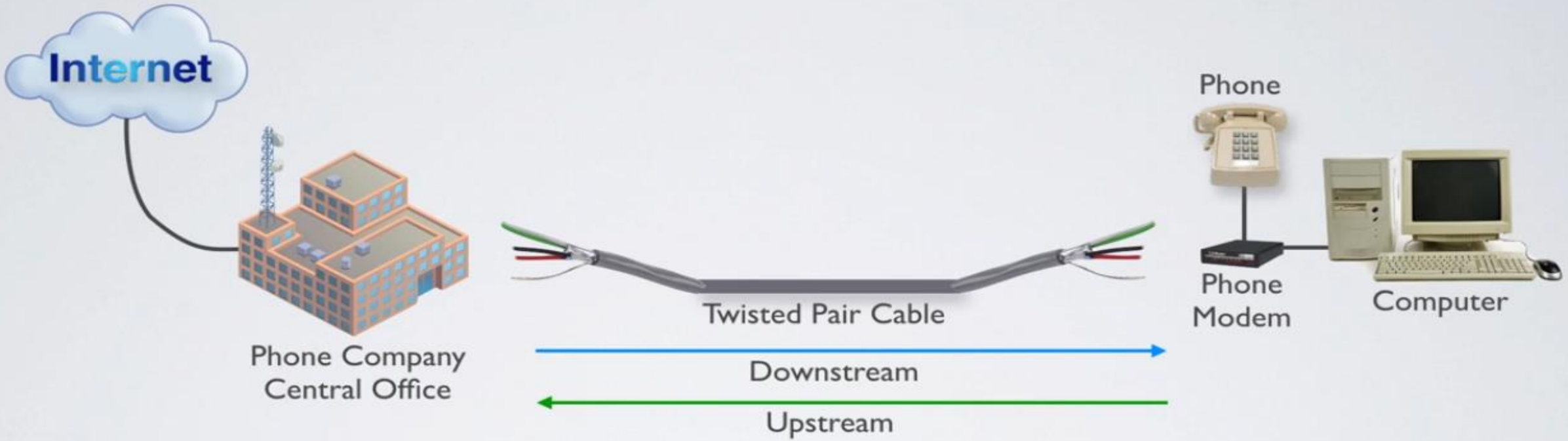
First Internet



Internet through the phone company used twisted pair cables which don't allow for high data speeds

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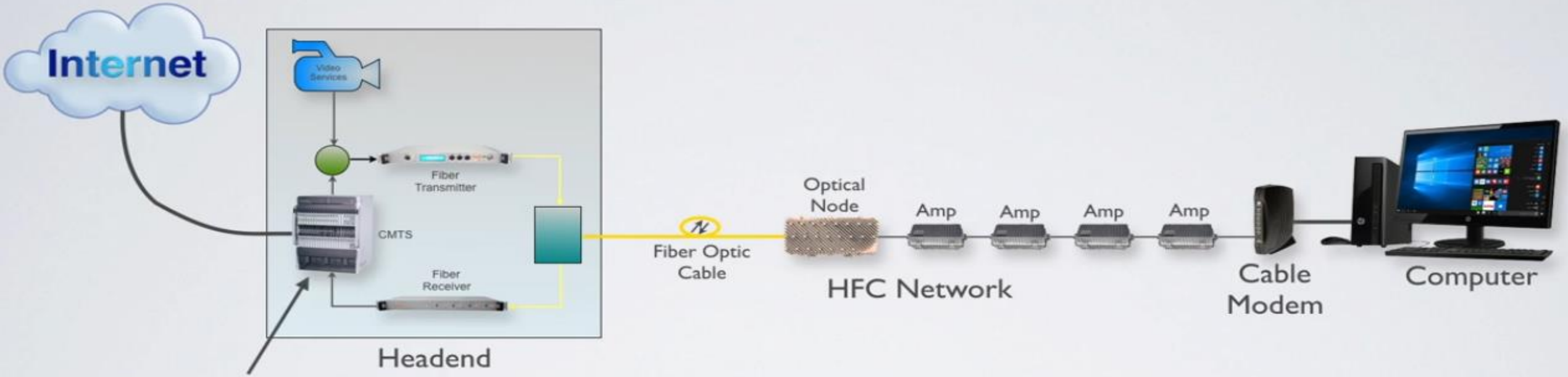
HSD Internet



Cable Modem Termination System (CMTS) Modulates and demodulates the signal and routes the digital signal to the internet

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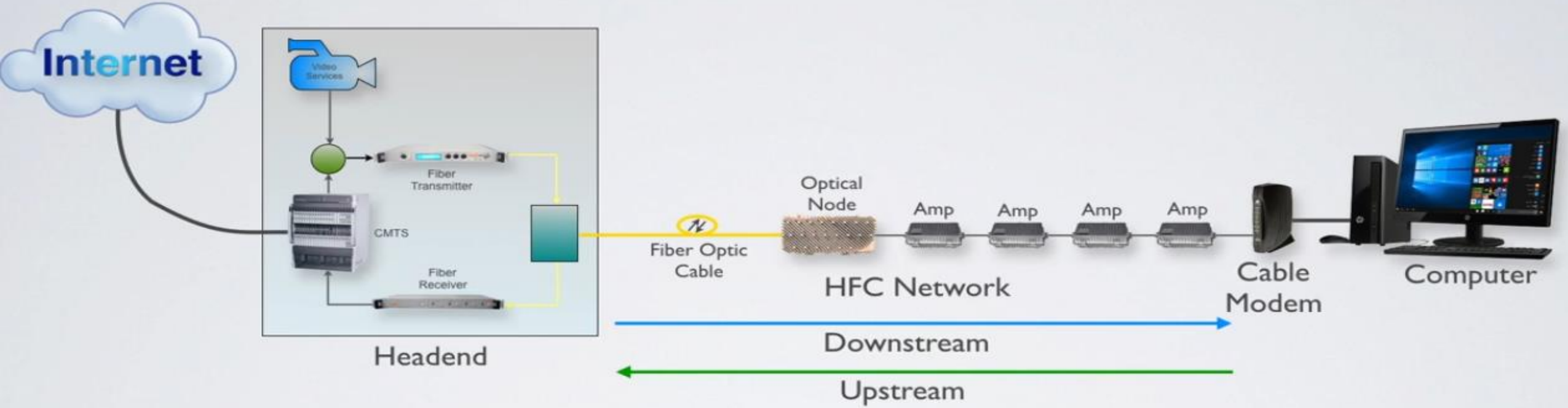
HSD Internet



Cable High Speed Data uses a HFC network which allows for high data speeds

Amphenol Broadband Solutions

DOCSIS

Data Over Cable Service Interface Specification

- Telecommunications standard that allows for the addition of high-bandwidth data transfer to an existing coaxial cable TV system
- Provides modem manufacturers and network service providers a common method for products to work together in a predictable manner
- A cable modem located at the user's premises, as well as a cable modem termination system (CMTS)located at the headend
- Provides for Quality of Service (QoS)
- Provides security

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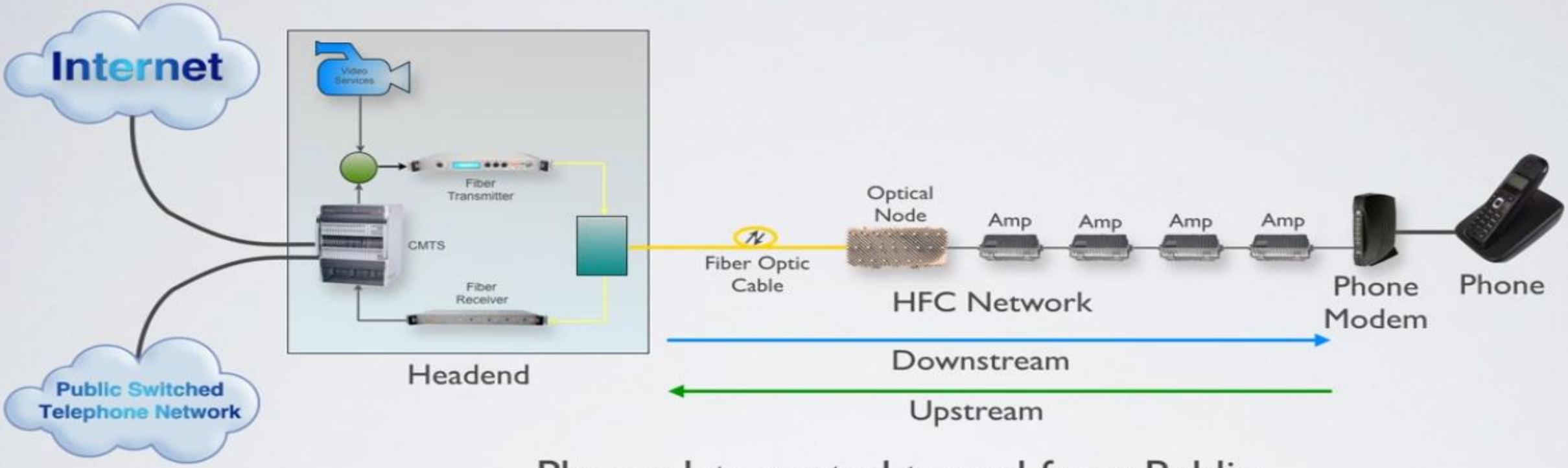
VoIP



Phone data routed to and from Public Switched Phone Network (PSPN) through the CMTS

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