Chapter 38 of the Society of Broadcast Engineers
SBE
EL PASO - LAS CRUCES - JUAREZ

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NEWS

What's the difference between Cable and DSL broadband access ? Part 1

Major technological differences produce roughly equivalent Internet performance

Feb.2013/ Lou Frenzel/ *Electronic design*

Most people use cable TV or digital subscriber line (DSL) for high-speed Internet access at home. In fact, 50% of all broadband customers use cable, 42% use DSL, and 8% use fiber-optic cable, satellite, or a wireless system. However, DSL dominates in Europe and the rest of the world. Cable and DSL both have been around for years with steady upgrades and improvements, though their methods for delivering high-speed data are very different.

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Cable TV Systems

Cable TV systems were developed to provide reliable TV service to local communities. Along with the hundreds of TV channels available, cable companies offer services such as high-speed Internet access. Some even offer voice over IP (VoIP) telephone service. Cable companies usually offer a "triple-play" package that bundles TV, phone, and Internet services.

Systems have been upgraded from pure analog transmission to digital. Early systems were based on coax cable, but today the most common configuration is fiber-optic cable and coax. Hybrid fiber coax is one of the most common configurations *(Fig. 1)*.

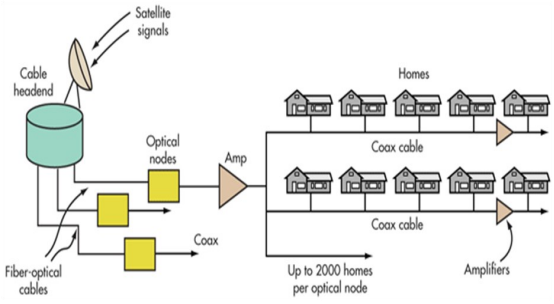


Fig 1 *The typical hybrid fiber coax (HFC) cable TV distribution system used throughout the U.S. consists of fiber-optic cable to neighborhood nodes that then distribute the signals to homes with RG-6/U coax.*

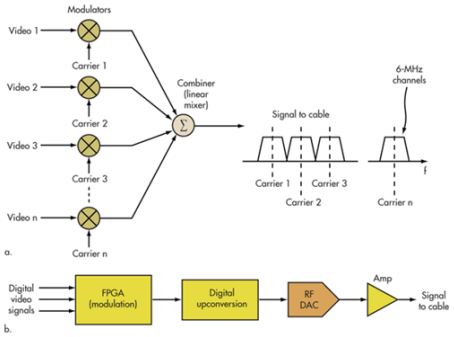
All of the services originate from the cable company's facilities, known as the headend, where the company collects the video from local TV stations and cable TV programming suppliers via satellite. The company then packages multiple channels into bundles for basic cable as well as two or three other options of premium movie and/or sports channels. The headend also has an interconnection to the Internet, where it can supply Internet services or connect to a separate Internet service provider.

The headend connects to the end user via a network of fiber-optic and coax cables. The TV channels and Internet channels are frequency multiplexed and modulated on to the main fiber-optic cable for transport out to distribution hubs that rejuvenate the signals over longer cable runs. From the one or more distribution hubs, the signal travels to multiple optical nodes located in various city or suburban neighborhoods. In a typical configuration, a single fiber is split to serve four fiber optical nodes. Most fiber nodes serve up to 500 homes. With this arrangement, each fiber serves up to 2000 homes, although not all homes passed have a cable modem or service.

The optical nodes convert the optical signals into electrical signals for the final distribution via coax cable. The most common cable is RG-6/U 75-ohm coax using F-type connectors. All of the homes receive the same signal, just like a bus network topology. In some areas with longer distances, amplifiers are added along the way to mitigate the large cable losses that are common.

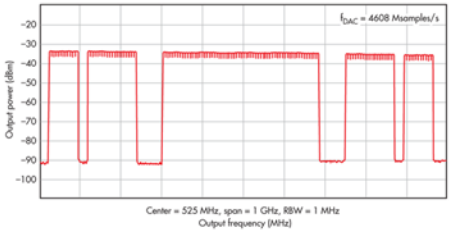
All of the TV signals and Internet data are transmitted in a spectrum of 6-MHz wide channels. Since a coax cable has a bandwidth as wide as 850 MHz to 1 GHz, the system can accommodate from 140 to 170 downstream channels of 6 MHz each. The TV signals or Internet data are modulated on to carriers in each channel. There are also upstream channels that allow the consumer to transmit data back to the headend. This communication takes places in 6-MHz channels as well that occupy the cable spectrum from 5 MHz to 40 MHz or in some systems up to 65 MHz.

The composite video signal is developed in equipment called the cable modem termination system (CMTS). In older systems, the video information is modulated on to the 6-MHz channel carriers and then all channels are combined or linearly mixed to form the composited cable signal *(Fig. 2a)*. However, today it's possible to synthesize a full block of modulated channels digitally. The digitized video is sent to an ASIC or FPGA programmed to produce the desired quadrature amplitude modulation (QAM) for each channel *(Fig. 2b)*. The signals are then digitally upconverted to the final frequency and sent to a wideband digital-to-analog converter (DAC) that produces the composite multi-channel signal to be sent to the cable.



2. In older cable TV systems, individual modulators add the video to the channel carriers that are linearly mixed to form the composite signal for transmission over the cable (a). Modern cable TV systems are beginning to use direct digital synthesis of the composite signal for transmission (b). The digital video signals are fed to an ASIC or FPGA, where an inverse FFT and other techniques implement the QAM modulation and upconversion. A fast RF DAC develops the final composite analog signal for transmission on the cable..

Maxim Integrated's MAX5880 modulator/digital upconverter (DUC) can generate from eight to 128 QAM modulated channels. It is a 14-bit RF DAC with a 4.6-Gsample/s rate that produces the final signal. Figure 3 shows what the output signal looks like in the frequency domain.



3. This illustration shows a spectrum analyzer output display of 128 QAM channels generated by the MAX5882 and MAX5880 combination. The full bandwidth is 1 GHz with a center frequency of 525 MHz. The resolution bandwidth is 1 MHz. You can just make out the 6-MHz channels, 16 per 100-MHz segment.

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EL PASO, TX SBE CHAPTER 38 MEETING MINUTE

DATE 10/10/2017 LOCATION: iHearthRadio, El Paso, TX.

MEETING CALLED TO ORDER: 18:11 PM, BY ANTONIO CASTRO. THERE WERE 8 ATTENDANTS.

REPORT OF THE SECRETARY: MINUTES IN THE AUGUST NEWSLETTER. ACCEPTED BY MARIO JIMENEZ, SECONDED BY NORBERT MILES.

REPORT OF THE TREASURER: $ 3,016.76 IN THE BANK. ACCEPTED BY DAVID GRICE, SECONDED BY MARIO TELLEZ.

REPORT OF THE CERTIFICATION COMMITTEE: NO REPORT .

REPORT OF THE MEMBERSHIP COMMITTEE: NO REPORT.

REPORT OF THE FREQUENCY COORDINATOR COMMITTEE: NO REPORT.

REPORT OF THE SCHOLARSHIP COMMITTEE: TO VISIT AVX FOR INTRODUCTION AND INVITATION.

REPORT OF THE WEBSITE COMMITTEE: 2247 HITS LAST TIME, NOW 2258. (11). TO UPDATE PICTURES FROM **EARS** MEETING

REPORT OF THE EAS CHAIRMAN: MONTHLY TEST FOR TX & NM WERE FINE. SUGESTED THAT KROD TO BE BACK UP FOR MONTHLY TEST BECAUSE THEY HAVE BK-UP GENERADOR FROM FEMA. LP-1S SPANISH RELAY IN SEARCH OF AN OWNER.

REPORT OF THE PROGRAM COMMITTEE: WARREN REEVES INTRODUCED HIS VECTOR NETWORK ANALYZER. VERY GOOD DEMO.

UNFINISHED BUSINESS: NONE.

NEW BUSINESS OR ANY ITEMS FOR THE CHAPTER INTERES: DAVID GRICE TO TAKE OVER OWNERSHIP OF TNT AS ABS.

NEXT MEETING DATE AND LOCATION: NOVEMBER 14, 2017, TIME: 12:00 PM. COMO'S ITALIAN RESTAURANT

MEETING ADJOURNED: AT 19:10 PM.

CONGRATULATIONS TO
DAVID GRICE
FOR HIS NEW ADVENTURE.

WE WISH YOU THE BEST !!!!-

NOVEMBER PROGRAM

OCTOBER MEETING WAS SIMPLY A GOOD ONE, BASIC ATTEDANCE OF EIGHT, BUT THE BEST OF ALL WAS THE PRESENTATION MADE BY WARREN REEVES INTRODUCING HIS RUSIAN SPECTRUM VECTOR ANALIZER.
THANK YOU WARREN

AND THANKS TO DAVID GRICE FOR PERMITING THE USE OF THE iHearthRadio CONFERENCE ROOM .

WE HAD PLENTY OF PIZZA !!

FOR NOVEMBER, WE ARE GOING TO MEET ON THE SECOND TUESDAY THE FOURTEEN AT THE
COMO'S ITALIAN RESTAURANT

TIME: 12:00 PM SHARP.

SEE YOU THERE !!

In older analog systems, each TV signal occupied one 6-MHz channel. Modern digital signals may have one TV signal per channel or more. Digital TV signals can be compressed using MPEG compression algorithms to reduce the amount of channel space required for transmission, allowing multiple signals per channel. Downstream modulation is usually 64-state QAM (64QAM) or 256-state QAM (256QAM), meaning each channel can deliver a data rate up to 38 Mbits/s. Higher speeds can be achieved by using channel bonding, which transmits the data stream in two or more 6-MHz channels.

Users do not usually get the full download speeds mentioned above. Because the coax line is a bus shared by many homes, the data speed is divided up amongst those who are using the connection. A single user will get the full speed but with multiple users each will get a proportionally slower connection.

Upstream modulation is quadrature phase-shift keying (QPSK) or one of several variations of 16/32/64/128QAM. Upstream rates are typically less than 27 Mbits/s.

The downstream data is routed through the cable wiring in the home through splitters that divide the signal for multiple room connections. One or two devices then recover the signals. A cable box or set-top box (STB) selects the desired television channel with a tuner and directs the signals to the TV set for presentation. In some cases, a cable-ready TV can recover the signals without the STB.

Internet service and VoIP telephone service use a cable modem, which connects to the Ethernet port on a PC or laptop. In many homes today the cable modem connects to a wireless router that distributes the service by Wi-Fi to PCs, laptops, tablets, or cell phones.

Most cable modems also have a telephone option where the digital VoIP is converted to be compatible with the standard telephone wiring in the home so standard phones can be used. A standard RJ-11 connector connects the cable modem to the home wiring.

Most cable systems are based on the Data Over Cable Service Interface Specification (DOCSIS). Developed by CableLabs in cooperation with the industry, DOCSIS defines the operating system and the hardware specifications. Version 1.0 was introduced in 1997. DOCSIS 2.0 came along in 2001, and DOCSIS 3.0 was released in 2006. Most systems use the latest version, which is IPv6 capable.

DOCSIS also provides multiple security options including a Baseline Privacy Interface (BPI) or security (SEC) option. The 56-bit DES and AES 128 encryption methods are available, as is public key infrastructure (PKI) authentication .

In PART 2, the DSL will be explained. Look for the December newsletter.