CABLE MODEM TUTORIAL

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This Cable Modem tutorial is designed to answer most questions about Cable Modems and the associated technology. Somehow I just got tired explaining the same stuff again and again. Now it is on-line and we can start our conversation at a level past the most basic stuff.

Assumptions - This presentation deals mainly with what I term 2nd generation Cable Modems. As from the following definition:
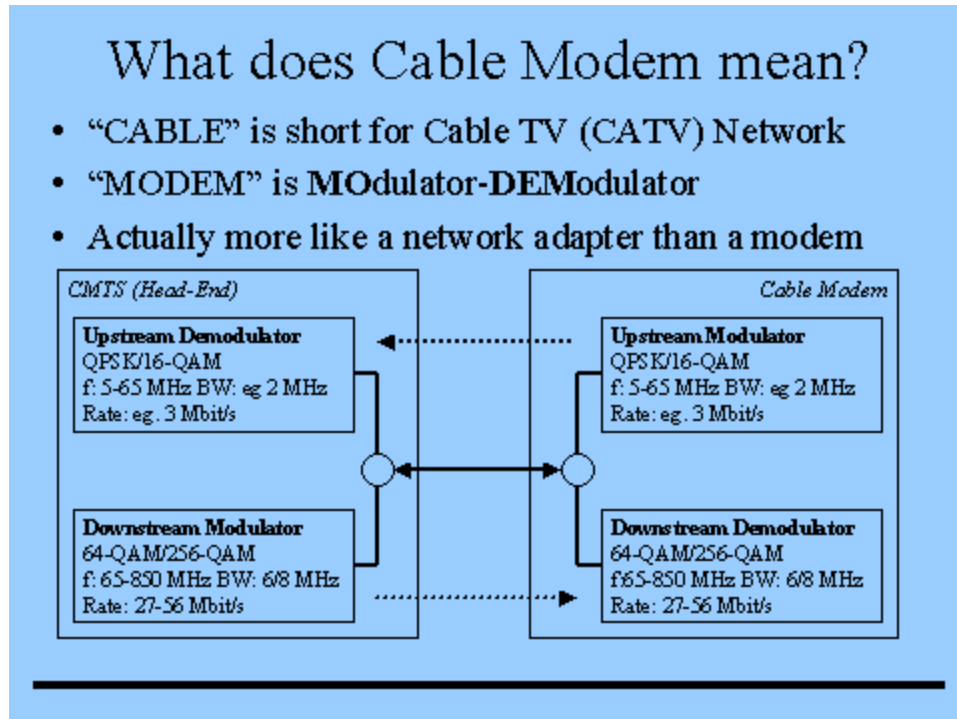
- **1st gene ration** - Proprietary systems. Not based on widely accepted standards. Cable Modems from different vendors does not work on the same CMTS/Head-End. This includes among others the first Com21 systems.

- **2nd generation** - Systems based on standards. MCNS/DOCSIS 1.0/1.1 (US etc.) and DVB/DAVIC 1.3/1.4/1.5 (Europe). Cable Modems from different vendors work together (or can be made work together). This is the systems that are shipping right now (98/99).

- **3rd generation** - Time will tell. Looks like we will see wireless modems based on the cable modem standards and some more symmetrical cable modem systems also.

Also this presentation deals only with "real" Cable Modems (as in "real men" :-), that does two-way communications on the cable. That excludes the telephone modem return systems, although most of the presentation applies to these systems as well. I do accept that telephone return systems are quite important as a step on the migration path towards "real" Cable Modem systems. But from my (very) technical viewpoint, they are not quite as interesting.

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1. What Does Cable Modem Mean?

What does Cable Modem mean?
- "CABLE" is short for Cable TV (CATV) Network
- "MODEM" is MOdulator-DEModulator
- Actually more like a network adapter than a modem

CMTS (Head-End)

Upstream Demodulator
QPSK/16-QAM
f: 5-65 MHz BW: eg 2 MHz
Rate: eg. 3 Mbit/s

Downstream Modulator
64-QAM/256-QAM
f: 65-850 MHz BW: 6/8 MHz
Rate: 27-56 Mbit/s

Cable Modem

Upstream Modulator
QPSK/16-QAM
f: 5-65 MHz BW: eg 2 MHz
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Downstream Demodulator
64-QAM/256-QAM
f 65-850 MHz BW: 6/8 MHz
Rate: 27-56 Mbit/s

The term "Cable Modem" is quite new and refers to a modem that operates over the ordinary cable TV network cables. Basically you just connect the Cable Modem to the TV outlet for your cable TV, and the cable TV operator connects a Cable Modem Termination System (CMTS) in his end (the Head-End).

Actually the term "Cable Modem" is a bit misleading, as a Cable Modem works more like a Local Area Network (LAN) interface than as a modem.

Other Terms - A short list of some of the other technical terms and acronyms that you may stumble across in trying to understand the cable modem world.

CATV: Cable TV system. Can be all coaxial or HFC (Hybrid Fiber Coax) based.

Cable Modem (CM): Client device for providing data over a cable TV network. Read all about it here.

Channel: A specific frequency and bandwidth combination. Used in this context about TV channels for television services and downstream data for cable modems.

CMTS: Cable Modem Termination System. Central device for connecting the cable TV network to a data network like the internet. Normally placed in the headend of the cable TV system.

CPE: Customer Premises Equipment. Used to describe the PC and/or other equipment, that the customer may want to connect to the cable modem.

DHCP: Dynamic Host Configuration Protocol. This protocol provides a mechanism for allocating IP addresses dynamically so that addresses can be reused. Often used for managing the IP addresses of all the cable modems in a cable plant and the PC's connected to the cable modems.

DOCSIS: Data Over Cable Service Interface Specification. The dominating cable modem standard. Defines technical specifications for both cable modem and CMTS.

Downstream: The data flowing from the CMTS to the cable modem.

Downstream Frequency: The frequency used for transmitting data from the CMTS to the cable modem. Normally in the 42/65-850 MHz range depending on the actual cable plant capabilities.

Headend: Central distribution point for a CATV system. Video signals are received here from satellites and maybe other sources, frequency converted to the appropriate channels, combined with locally originated signals, and rebroadcast onto the HFC plant. The headend is where the CMTS is normally located.

HFC: Hybrid fiber-coaxial (cable network). Older CATV systems were provisioned using only coaxial cable. Modern systems use fiber transport from the headend to an optical node located in the neighborhood to reduce system noise. Coaxial cable runs from the node to the subscriber. The fiber plant is generally a star configuration with all optical node fibers terminating at a headend. The coaxial cable part of the system is generally a trunk-and-branch configuration.

MAC Layer: Media Access Control sublayer in the network stack. Read more about that later in this presentation.

MCNS: Multimedia Cable Network System Partners Ltd. The consortium behind the DOCSIS standard for cable modems.

Minislot: Basic timeslot unit used for upstream data bursts in the DOCSIS standard.

MSO: Multiple Service Operator. A cable TV service provider that also provides other services such as data and/or voice telephony.

QAM: Quadrature Amplitude Modulation. A method of modulating digital signals using both amplitude and phase coding. Used for downstream and can be used for upstream.

QPSK: Quadrature Phase-Shift Keying. A method of modulating digital signals using four phase states to code two digital bits per phase shift.

Ranging: The process of automatically adjusting transmit levels and time offsets of individual modems, in order to make sure the bursts coming from different modems line up in the right timeslots and are received at the same power level at the CMTS.

SID (Service ID): Used in the DOCSIS standard to defines a particular mapping between a cable modem (CM) and the CMTS. The SID is used for the purpose of upstream bandwidth allocation and class-of-service management.

Subscriber Unit (SU): An alternate term for cable modem.

Upstream: The data flowing from the CM to the CMTS.

Upstream Frequency: The frequency used to transmit data from the CM to the CMTS. Normally in the 5-42 MHz range for US systems and 5-65 MHz for European systems.

2. Modem, Network and Cable Modem
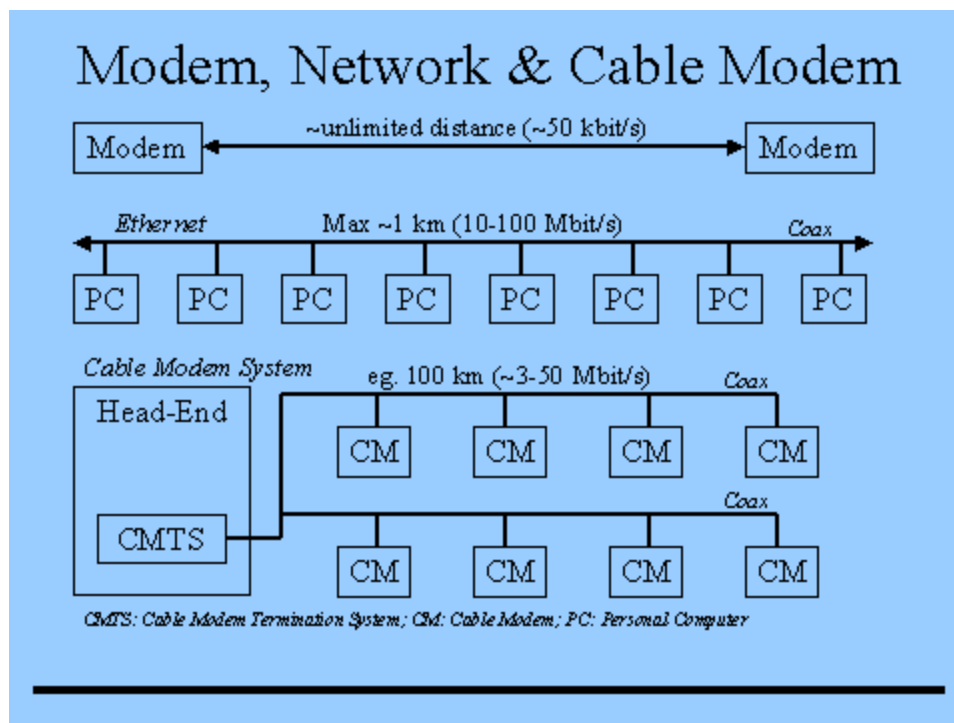
Modem - A modem connection is about 50 kbit/s, and is used point-to-point. The distance is virtually unlimited, including multiple satellite hops etc.

Ethernet - An ethernet (LAN) connection is 10 Mbit/s or 100 Mbit/s, and is used to connect many computers that can all "talk" directly to each other. Normally they will all talk with a few servers and printers, but the network is all-to-all. The distance is normally limited to below 1 km.

Cable Modem - A Cable Modem connection is something in-between. The speed is typically 3-50 Mbit/s and the distance can be 100 km or even more. The Cable Modem Termination System (CMTS) can talk to all the Cable Modems (CM's), but the Cable Modems can only talk to the CMTS. If two Cable Modems need to talk to each other, the CMTS will have to relay the messages.

The OSI layer stackup for a DOCSIS Cable Modem looks like this. For further explanation of the various acronyms please see the other sections of this tutorial or refer to www.whatis.com (lots of short concise explanations of especially the network terms).

OSI	DOCSIS	
Higher Layers	Applications	DOCSIS
Transport Layer	TCP/UDP	Control
Network Layer	IP	Messages
Data Link Layer	IEEE 802.2	
Physical Layer	Upstream	Downstream
	TDMA (mini-slots)	TDM (MPEG)
	5 - 42(65) MHz	42(65) - 850 MHz
	QPSK/16-QAM	64/256-QAM
		ITU-T J.83 Annex B(A)

Items in parenthesis refer to EuroDOCSIS, which is a version of DOCSIS with a modified physical layer targeted at the more DVB centric European market.

External box cable modems with ethernet interface normally acts as either MAC-layer bridges (low-end models) or as routers (high-end SOHO models).

3. What is a CATV network?

A CATV network is designed and used for cable TV distribution. With an upgrade of the system, it is normally possible to allow signals to flow in both directions. Higher frequencies flow toward the subscriber (you?) and the lower frequencies go in the other direction. This is done by upgrades to the amplifiers in the cable distribution network etc.

Most CATV networks are Hybrid Fibre-Coax (HFC) networks. The signals run in fiber-optical cables from the Head-End center to locations near the subscriber. At that point the signal is converted to coaxial cables, that run to the subscriber premises.

One CMTS will normally drive about 1-2000 simultaneous Cable Modem users on a single TV channel. If more Cable Modems are required, the number of TV channels are increased by adding more channels to the CMTS.

4. Cable Modem Types
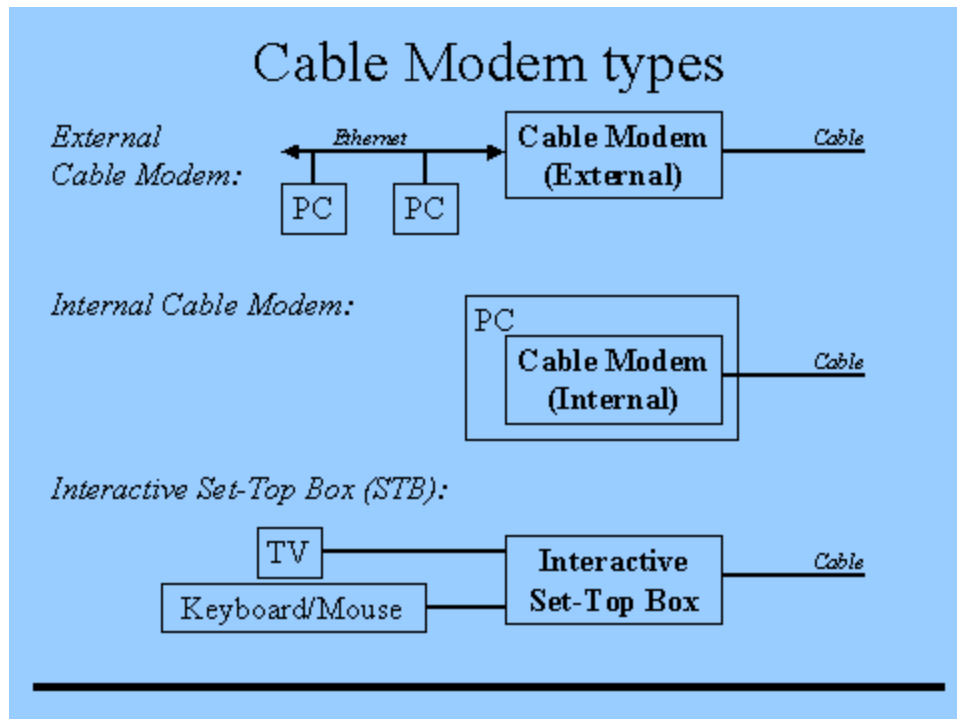
A number of different Cable Modem configurations are possible. These three configurations are the main products we see now. Over time more systems will arrive.

External Cable Modem - The external Cable Modem is the small external box that connect to your computer normally through an ordinary Ethernet connection. The downside is that you need to add a (cheap) Ethernet card to your computer before you can connect the Cable Modem. A plus is that you can connect more computers to the Ethernet. Also the Cable Modem works with most operating systems and hardware platforms, including Mac, UNIX, laptop computers etc.

Another interface for external Cable Modems is USB, which has the advantage of installing much faster (something that matters, because the cable operators are normally sending technicians out to install each and every Cable Modem). The downside is that you can only connect one PC to a USB based Cable Modem.

Internal Cable Modem - The internal Cable Modem is typically a PCI bus add-in card for a PC. That might be the cheapest implementation possible, but it has a number of drawbacks. First

problem is that it can only be used in desktop PC's. Mac's and laptops are possible, but require a different design. Second problem is that the cable connector is not galvanic isolated from AC mains. This may pose a problem in some CATV networks, requiring a more expensive upgrade of the network installations. Some countries and/or CATV networks may not be able to use internal cable modems at all for technical and/or regulatory reasons.

Interactive Set-Top Box - The interactive set-top box is really a cable modem in disguise. The primary function of the set-top box is to provide more TV channels on the same limited number of frequencies. This is possible with the use of digital television encoding (DVB). An interactive set-top box provides a return channel - often through the ordinary plain old telephone system (POTS) - that allows the user access to web-browsing, email etc. directly on the TV screen.

5. Typical Cable Modem installation
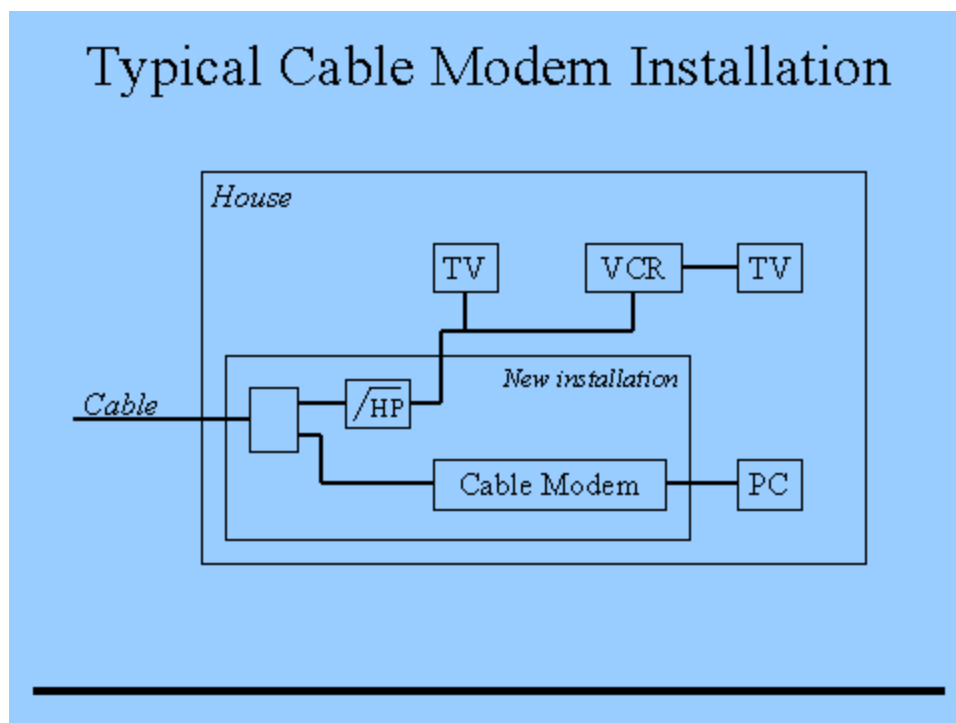
When installing a Cable Modem, a power splitter and a new cable is usually required. The splitter divides the signal for the "old" installations and the new segment that connects the Cable Modem. No TV-sets are accepted on the new string that goes to the Cable Modem.

The transmitted signal from the Cable Modem can be so strong, that any TV sets connected on the same string might be disturbed. The isolation of the splitter may not be sufficient, so an extra high-pass filter can be needed in the string that goes to the TV-sets. The high-pass filter allows only the TV-channel frequencies to pass, and blocks the upstream frequency band. The other reason for the filter is to block ingress in the low upstream frequency range from the in-house wiring. Noise injected at each individual residence accumulates in the upstream path towards the head-end, so it is essential to keep it at a minimum at every single residence that needs Cable Modem service.

Data Interface - On any kind of external cable modem (the majority of what is in use today), you obviously need some kind of data-interface to connect the computer and the cable modem.

Ethernet - On most external modems, the data-port interface is 10 Mbps Ethernet. Some might argue that you need 100 Mbps Ethernet to keep up with the max. 27-56 Mbps downstream capability of a cable modem, but this is not true. Even in a very good installation, a cable modem can not keep up with a 10 Mbps Ethernet, as the downstream is shared by many users.

The 1st version of the MCNS standard, that dominates the US market, specified 10 Mbps Ethernet as the only allowable data-interface. The DVB/DAVIC standard is totally open, allowing any type of interface. Other types of interfaces are being incorporated in the MCSN standard to allow for a wider range of cable modem configurations.

USB (Universal Serial Bus) - Among others, Intel recently announced that they are working with Broadcom on cable modems with USB interface. This is expected to bring down the installation hassle for the many users with less computer skills. Obviously you do not need to open the box to install an Ethernet card, if the computer has an USB interface. If the computer does not have an USB interface, you will need to install that (and you are back to about the same hassle-level as with the Ethernet interface).

The installation **cost** is a significant issue, as this is something that needs to be done in the house of every subscriber. The CATV operators and equipment manufactures needs to try really hard to push down the installation cost, to keep the whole operation profitable.

6. Who buys a Cable Modem?
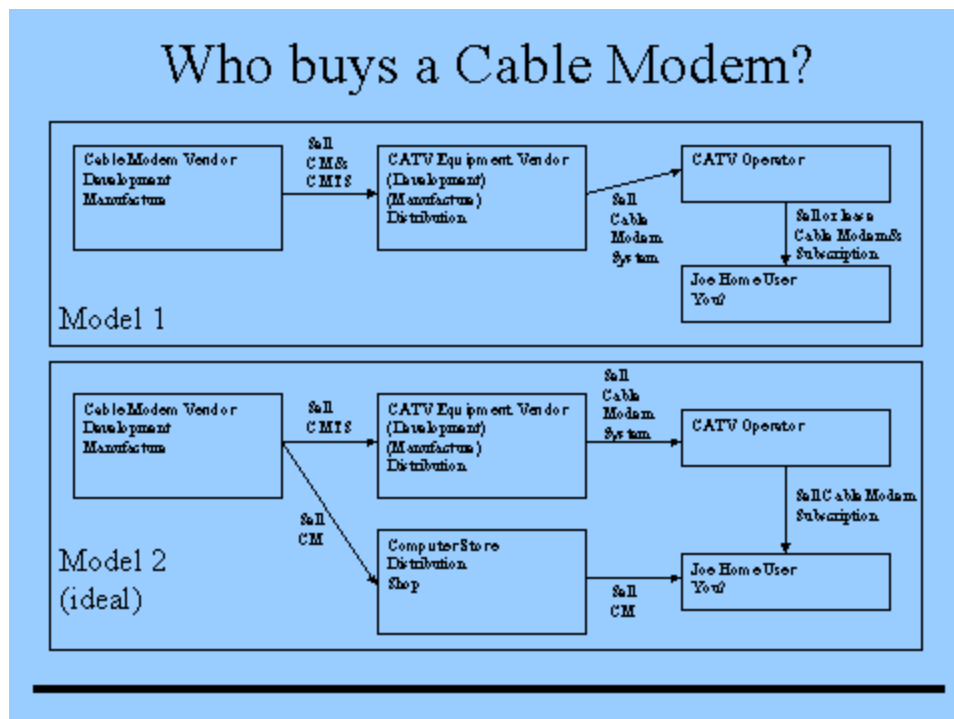
Basically Cable Modems are for ordinary people, just like analog modems and ISDN. Two different models exist for the actual buy/sell situations. In both cases the CATV operator sells the Cable Modem access subscription, and takes the role as Internet Service Provider (ISP).

Model 1 - The 1st model is what we see now. The Cable Modem vendor normally provides both CMTS and Cable Modem for the system integrator (here called CATV vendor, but this could even be a division of the cable operator). The system integrator provides a complete Cable Modem system to the cable operator. This might include the necessary return channel amplifiers etc. The subscriber leases (or buys) the Cable Modem from the CATV operator, much like the model normally used for set-top boxes.

Model 2 - The 2nd model is the ideal model from many viewpoints, but can not be implemented before the Cable Modem standards are firm enough to guarantee Cable Modems from various vendors to work smoothly together on the same Cable Modem system. The difference here is that the subscriber buys the Cable Modem in a computer store as he would buy any other modem. The CATV operator only provides the Cable Modem service.

Cable modems for sale in the retail stores is actually a reality now, in some areas of the US (start of 1999). That simply proves that it can be done, but from what I can tell, the lease-model (Model 1) is still by far the most common approach.

CM Vendors - For DOCSIS modems, the following is an (probably soon incomplete) list of vendors with actual DOCSIS certified products (accurate august 1999):

- Toshiba
- Thomson Consumer Electronics
- 3Com
- General Instrument
- Arris Interactive
- Askey Computer Corp. (partnering with Cisco for the reference design)
- Cisco Systems
- Philips Electronics (partnering with Cisco for the reference design)
- Samsung Information Systems of America (partnering with Cisco for the reference design)
- Sony Corp (partnering with Cisco for the reference design)

Other companies are known to have un-certified cable modems and/or cable modems that are either proprietary or conforming to other standards like DVB/DAVIC (very incomplete list, august 1999):

- COM21 (Proprietary ATM based system. Also a shipping, but un-certified DOCSIS cable modem).
- Zenith (Proprietary system)
- LanCity/Bay Network (Proprietary system)
- NetGame (Proprietary system, working on DOCSIS system also)
- COCOM (DVB-RCC/DAVIC based system)
- DeltaKabel (Proprietary system. Also a EuroDOCSIS based system).

Gallery

A picture gallery with most of the DOCSIS certified modems along with various other information is available here!

7. What is Inside a Cable Modem?
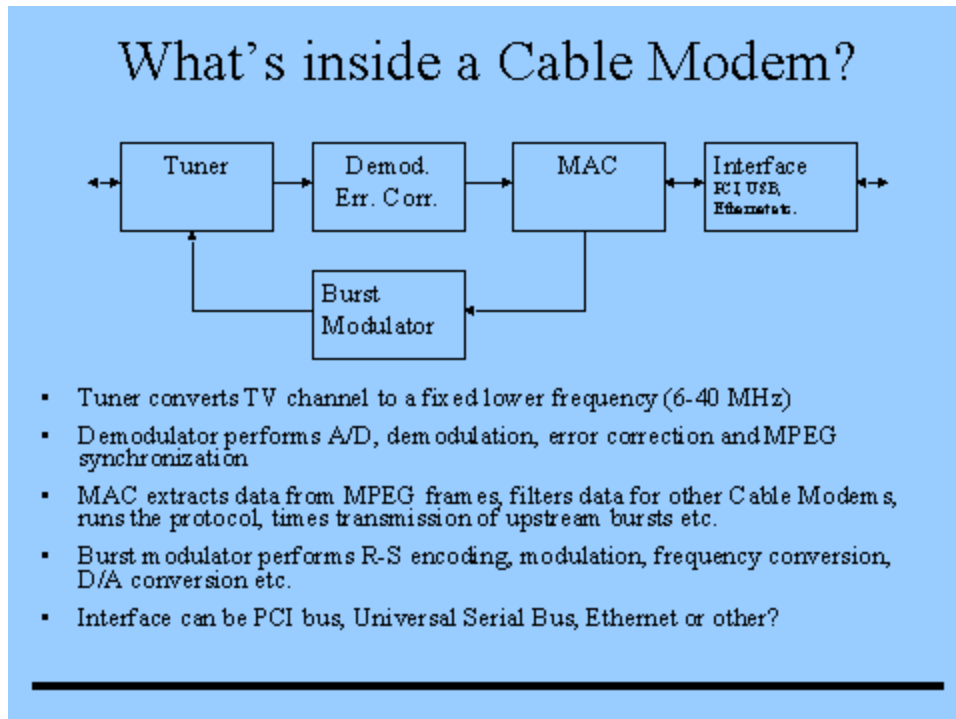
Cable Modems are different, but the basic architecture is more or less the same as shown above. The major components are outlined below, along with an indication of some companies that are know to deliver products to the open market. Many other companies are working in the field, but may not be so well known to me - or may only produce components for their own use.

Tuner - The tuner connects directly to the CATV outlet. Normally a tuner with build-in diplexer is used, to provide both upstream and downstream signals through the same tuner. The tuner must be of sufficiently good quality to be able to receive the digitally modulated QAM signals. Companies like ALPS, Sharp, Temic and Panasonic are strong suppliers here.

A new concept of a silicon tuner is in the works. This is basically a tuner on a chip, and is expected to cut the cost down quite a bit compared to a more conventional tuner module.

Demodulator - In the receive direction, the IF signal feeds a demodulator. The demodulator normally consists of A/D converter, QAM-64/256 demodulator, MPEG frame synchronization, Reed Solomon error correction.

The clear leader here is Broadcom, with a single chip demodulator. Other companies are Stanford Telecom wit a combined demodulator and burst modulator, but also companies like SGS Thomson, VLSI Technologies, LSI Logic and Fujitsu play a role here. The demodulator

component is required both in a cable modem and in the more mature product, the digital (receive-only) set-top box, so many companies have developed products for this part of the game.

Burst Modulator - In the transmit direction, a burst modulator feeds the tuner. The burst modulator does Reed Solomon encoding of each burst, modulation of the QPSK/QAM-16 on the selected frequency and D/A conversion. The output signal is feed though a driver with variable output level, so the signal level can be adjusted to compensate for the unknown cable loss.

The burst modulator is unique to the cable modem (and some two-way set-top boxes), so less component are available here. Broadcom leads the pack, with Stanford Telecom, Analog Devices, SGS Thomson and others playing catch-up. Combined demodulator and burst modulator chips are also available as the integration race drives more and more functions into a single chip..

MAC - A Media Access Control mechanism sits between the receive and transmit paths. This can be implemented in hardware or split between hardware and software. The MAC is pretty complex compared to an ethernet MAC, and in reality no MAC's are able to handle all of the MAC layer function without some microprocessor "help".

For DOCSIS cable modems, Broadcom and Libit (now Texas Instruments) are known to have MAC ASIC's available as standard products. Connexant is also in the market with a MAC that rely more on software to handle the various functions, supposedly giving more flexibility. Other companies are known to be working on various MAC chips for both DOCSIS and DVB/DAVIC, with different partitions of what goes in software and hardware. Some cable modem manufacturers even develop their own MAC apparently in an attempt to be more competitive or to differentiate their products.

Interface - The data that pass through the MAC goes into the computer interface of the Cable Modem, be it Ethernet, USB, PCI bus or whatever.

CPU - The microprocessor is not explicitly shown on the diagram, but for external cable modems a CPU is required. Some work is being done on host based processing cable modems, that uses the processor in the host (PC or Mac) to do all (or almost all) processing. Much like how analog telephony modems (WinModem) rely on the PC processor to do the processing.

For external cable modems with Ethernet interface, the Motorola embedded PowerPC series of microprocessors are popular, but other RISC based architectures are also used.

Single devices combining MAC, demodulator, burst modulator, processor, ethernet/PCI/USB interfaces and more are emerging, in effect integration the guts of a cable modem in a single chip. There will still be some additional parts for memory, tuner, analog stuff, power supply etc. so we are still no-where near the true single-chip cable modem - even though that is what the marketing guys tout.

8. What is Downstream?

Downstream is the term used for the signal received by the Cable Modem. The electrical characteristics are outlined in the below table. Notice that most CATV networks in Europe allows 8 MHz bandwidth TV channels, whereas the US CATV networks allows only 6 MHz. Again Europe runs a little faster...

Frequency	42-850 MHz in USA and 65-850 MHz in Europe
Bandwidth	6 MHz in USA and 8 MHz in Europe
Modulation	64-QAM with 6 bits per symbol (normal)
	256-QAM with 8 bits per symbol (faster, but more sensitive to noise)

The raw data-rate depends on the modulation and bandwidth as shown below:

	64-QAM	256-QAM
6 MHz	31.2 Mbit/s	41.6 Mbit/s
8 MHz	41.4 Mbit/s	55.2 Mbit/s

Note: A symbol rate of 6.9 Msym/s is used for 8 MHz bandwidth and 5.2 Msym/s is used for 6 MHz bandwidth in the above calculations. Raw bit-rate is somewhat higher than the effective data-rate due to error-correction, framing and other overhead.

Since the downstream data are received by all Cable Modems, the total bandwidth is shared between all active Cable Modems on the system. This is similar to an Ethernet, only the wasted bandwidth on an Ethernet is much higher. Each Cable Modem filters out the data it needs from the stream of data.

9. What is Upstream?

Upstream is the term used for the signal transmitted by the Cable Modem. Upstream is always bursts, so many modems can transmit on the same frequency. The frequency range is typically 5-65 MHz or 5-42 MHz. The bandwidth per channel may be e.g. 2 MHz for a 3 MBit/s QPSK channel.

The modulation forms are QPSK (2 bits per symbol) and 16-QAM (4 bits per symbol), with the later being the fastest, but also most sensitive to ingress. One downstream is normally paired with a number of upstream channels to achieve the balance in data bandwidths required.

Each modem transmits bursts in time slots, that might be either marked as reserved, contention or ranging.

Reserved Slots - A reserved slot is a time slot that is reserved to a particular Cable Modem. No other Cable Modem is allowed to transmit in that time slot. The CMTS (Head-End) allocates the time slots to the various Cable Modems through a bandwidth allocation algorithm (notice: this algorithm is vendor specific, and may differentiate vendors considerably). Reserved slots are normally used for longer data transmissions.

Contention Slots - Time slots marked as contention slots are open for all Cable Modems to transmit in. If two Cable Modems decide to transmit in the same time slot, the packets collide and the data is lost. The CMTS (Head-End) will then signal that no data was received, to make the Cable Modems try again at some other (random) time. Contention slots are normally used for very short data transmissions (such as a request for a number of reserved slots to transmit more data in).

Ranging Slots- Due to the physical distance between the CMTS (Head-End) and the Cable Modem, the time delay vary quite a lot and can be in the milliseconds range. To compensate for this all Cable Modems employ a ranging protocol, that effectively moves the "clock" of the individual Cable Modem forth or back to compensate for the delay.

To do this a number (normally 3) of consecutive time-slots are set aside for ranging every now and then. The Cable Modem is commanded to try transmitting in the 2nd time-slot. The CMTS (Head-End) measures this, and tells the Cable Modem a small positive or negative correction value for its local clock. The two time slots before and after are the "gap" required to insure that the ranging burst does not collide with other traffic.

The other purpose of the ranging is to make all Cable Modems transmit at a power level that makes all upstream bursts from all Cable Modems arrive at the CMTS at the same level. This is essential for detecting collisions, but also required for optimum performance of the upstream demodulator in the CMTS. The variation in attenuation from the Cable Modem to the CMTS can vary more than 15dB.

10. Downstream Data Format

Downstream data is framed according to the MPEG-TS (transport stream) specification. This is a simple 188/204 byte block format with a single fixed sync byte in front of each block. The Reed-Solomon error correction algorithm reduces the block size from 204 bytes to 188 bytes, leaving 187 for MPEG header and payload.

This is where the various standards differ quite a lot. Some standards even allow various formatting of data within the MPEG-TS payload.

For the DVB/DAVIC standard, the framing inside the MPEG-TS payload is simply a stream of ATM cells.

11. Upstream Data Format

Upstream data is arranged in short bursts. The DAVIC/DVB standard requires a fixed length burst, whereas the MCNS standard specifies variable length bursts.

Since the upstream data is just a short burst of data, the demodulator needs something to trigger on. That is the unique word, that is prepended to the data. For DVB/DAVIC the unique word is 32 bit of data that triggers the demodulator to demodulate the burst.

Without the unique word, the demodulator could easily start to demodulate various noise signals etc. And then be all busy doing that when the real data arrives. Also the unique word provides resynchronization at every burst.

12. What is MAC?

The Media Access Control mechanism is normally implemented in hardware or in a combination of hardware and software. The primary purpose of the MAC is to share the media in a reasonable way. Both the CMTS and the Cable Modem implements protocols to do:

- Ranging to compensate for different cable losses. It is essential that the upstream bursts from all Cable Modems are received in the Head-End at the same level. If two Cable Modems transmit at the same time, but one is much weaker than the other one, the CMTS will only hear the strong signal and assume everything is okay. If the two signals are same strength, the signal will garble and the CMTS will know a collision occurred.

- Ranging to compensate for the different cable delays. The size of a CATV network calls for fairly large delays in the millisecond range.

- Assigns frequencies etc. to the Cable Modems. The Cable Modem first listens to the downstream to collect information about where and how to answer. The it signs on to the system using the assigned upstream frequency etc.

- Allocate the time-slots for the upstream.

It is impossible to give more detailed information about the MAC, without going into the specific standards. This is one of the areas that are most closely tied to the specific standard.

13. What Standards?

What standards?

- Proprietary systems (1st generation systems).
- MCNS (USA mainly). Developed for Cable Modem only. Specifies external Cable Modem only, but may add internal Cable Modem also.
- DAVIC/DVB (Europe mainly). Used for set-top box and now also Cable Modem.
- IEEE 802.14 lost 1st round, but tries to leapfrog and be the standard of the future (3rd generation systems).

Three major standards exist for Cable Modems! Guess how many we need?

First generation Cable Modems uses various proprietary protocols etc. making it impossible for the CATV network operators to use multiple vendors Cable Modems on the same system.

Around 1997 three standards emerged. DAVIC/DVB were first with a European standard, closely followed by MCSN with a US standard (DOCSIS). IEEE came last with 802.14, and clearly lost the 1st round. IEEE is now trying to leap-frog the two other standards by focusing on the next generation standards.

DVB/DAVIC

This standard is also known as DVB-RCC and as ETS 300 800. Initially run by DAVIC, but now the work has moved to DVB. Very few vendors develop for this standard, but enough that it does play a role. This standard is fighting the EuroDOCSIS standard for the European market (see below).

This standard is based on fixed cell size (ATM) and includes all the standard ways of doing quality of service (QoS) that ATM is known for. In that way, the standard is very well suited to both data i.e. TCP/IP (using AAL5) and telephony as pure ATM. VoIP to the cable modem may not be the best solution, although technically feasible.

Initially the standard lacked security (encryption), but that was added as an option in version 1.4.

Open to both internal and external implementations, and also covering Set-Top Box implementations with an additional out-of-band receive data channel.

Some of the European cable operators joined forces and made a request for proposals for a EuroModem. The specification is available to the public from EuroCableLabs for free, and even though it does not seem very big, it does refer to other standards including ETS 300 800 for the details.

MCNS/DOCSIS

The dominant US standard - even though it has not gone through any formal/independent standards body yet. This standard is very much driven by the wish of the large cable operators to have cable modems sold through the retail channel. Initially the chip manufacturer Broadcom played an important role, by pushing the standard and the level of chip integration at a very fast pace. As a result, the complexity of the standard is generally agreed to be much higher than what is strictly required, and is even growing.

Initially the standard did not support QoS which is required for telephony applications (VoIP) and other applications as well, but this has been added in version 1.1.

Initially open to only external box solutions with Ethernet interface, but now also allows internal modems and USB modems. Host based processing solutions is still debated (start 1999).

While originally targeted at the US domestic market, an off-spring named EuroDOCSIS is being pushed as the solution to the DVB centric European market. EuroDOCSIS is essentially the same as DOCSIS apart from the physical layer, which is DVB compliant in EuroDOCSIS.

IEEE

Lost the 1st round of the Cable Modem standards battle. What happens down the road remains to be seen. It looks like part of the IEEE group is working with Broadcom and Terayon on the next generation physical layer with increased (30 Mbps) upstream bitrate. This has also been termed DOCSIS 1.2, even though that does not seem to be official, and is certainly not approved by the DOCSIS vendor community yet.

The DVB-RCC vs. EuroDOCSIS Fight

The battle for the US domestic market is clearly won by the DOCSIS standard, but the battle for the European market is still going on. It does not seem like at very fair match, but nevertheless quite interesting. The following somewhat biased "whitepapers" are among the most visible parts of the fight.

October 1998: Gregers Kronborg who is Chairman DVB/DAVIC Interoperability Consortium but also co-founder of DVB cable modem manufacturer COCOM writes this: Comparing DVB RCC / DAVIC with OpenCable MCNS (PDF file - also available on the DVB website www.dvb.org).

May 1999: Tom Quigley from Broadcom Corporation presents his "whitepaper" Euro-DOCSIS/DVB-RC Comparison (PDF file - also available on the CableLabs website www.cablemodem.com) on a EuroDOCSIS promotion tour of some European countries (Stockholm, Vienna, Paris, Zeist and London).

May 1999: Henry Barton who is MD for Broadcentric Ltd. publishes another similar but much more detailed "whitepaper" titled DOCSIS MCNS vs. DVB/DAVIC DVB-RCC - The Case For DOCSIS in Europe: A Cable Operator & Industry Perspective (PDF file) to complement the above Broadcom presentation.

14. Why is this so cool?

So what will the cable modem give you, that you don't already have with your analog or ISDN modem connection?

Speed

Cable Modems are much faster. Speeds from x25 to x1000 are possible today, and we are now only at the beginning of the Cable Modem era! Remember 1200 baud analog modems?

Compare the speed you get to that of E1/T1 or ethernet. Notice: This is the speed from you to the CATV operator (ISP). Provided he do not sell too many Cable Modems in your area and/or upgrade his equipment to keep up with the number of Cable Modems.

To provide high speed access to other sites the internet, the CATV operator also needs fairly large proxy cache servers and a very fast connection to the net. We will see the CATV operators put a lot of (local) content, to which you will have very fast access.

On-Line

Cable Modems are on-line whenever you turn on your computer. Just like the network (LAN) used in most offices etc.

This allows a whole new range of applications - just start to think about it.

Some cable operators do not like you to run web servers or FTP servers through your Cable Modem, but that may change over time when they realize that they are selling bandwidth.

Competition

The phone company will now have serious competition. You actually do have an alternative to connection through the phone lines.

Note: Some systems actually do provide telephony through the CATV network also.