Tech Info Library

TITLE

56Kbps Modems: Getting The Fastest Connection

Article ID: 24482
Created: 5/28/98
Modified: 11/4/99

TOPIC

My 56K modem is not connecting at the speed I expected. I understand that regulations in North America and some other countries limit connections to 53 kilobits per second, but my modem seldom connects at greater than 36 Kbps. Is it malfunctioning? Can anything be done?

DISCUSSION

A modem is unlikely to malfunction only to the extent that it is unable to achieve its top speeds. Lesser speeds are common and generally reflect limitations imposed by the operating conditions:

- Impairments in the telephone network path
- Interoperability issues between modems
- Modem settings

This article provides an overview of these conditions as they affect the connection speed and reliability of 56K modems, though much is equally relevant to other modems. It joins a large body of complementary material available online from many modem manufacturers and modem-related web pages.

But first, just how fast is that connection?

MEASURING CONNECTION SPEED

Initial connection speed. The PPP or Remote Access control panel shows the speed initially established, not the current or average connection speed, which often differs.

If operating conditions permit a faster connection, the modem will attempt to speed up (fall forward). If conditions prevent sustaining a speed without incurring excessive transmission errors, the modem will slow down (fall back). Because these adjustments are common but not reflected in the software, do not base performance measurements solely upon initial connection speed.

DTE speed (modem-to-computer speed or port speed) is generally represented by the static numbers 38400, 57600, or 115200, as configured in the software. It is not a measurement of connection speed. The ARA modem scripts (selected in the Modem control panel) for all Apple 56K modems correctly configure the DTE speed for a maximum of 115200 bps.

Determining the average Data Transfer Rate. Data Transfer Rate (DTR), or throughput, describes how fast data is being transferred, expressed in bits per second. The following method of obtaining the average DTR is a truer method of assessing modem performance than observing the initial connection speed or the fluctuating throughput indicators of web browsers or FTP clients. Because the upload (transmit) speeds of analog modems cannot exceed 33.6K, the discussion is confined to download (receive) speeds.

1. Connect to the internet and, preferably, open an FTP client application rather than a web browser. Anarchie, Fetch, NetFinder, and Vicomsoft FTP Client are popular shareware examples.

2. Log in to an FTP server. Many Internet Service Providers make local FTP servers available for their members, and most FTP clients include a selection of public FTP server bookmarks. If you know of any FTP servers that are not very busy or are geographically nearby, use them. The more frequently the modem has to wait for a busy server to respond, the less accurate the test results will be. The greater the server's distance, the more likely the connection will pass through additional line impairments that may slow the connection.

3. Download a compressed file of approximately 500K or larger. Most compressed files have a file name extension of .sit, .sea, .cpt, or .zip. Apply the formula **file size (bytes)/download time (seconds) x 9 = average DTR (bits/second)**:

Example
For a 500K file that takes 2 minutes 5 seconds to complete downloading, the equation reads:

500,000 / 125 x 9 = 36,000

The average DTR was 36K (kilobits, not kilobytes) per second, though the actual DTR at any moment may have been higher or lower.

About File Size
The file sizes shown in FTP client windows are generally approximate. Convert kilobytes to bytes using the decimal format appropriate to measuring data transfer rates, where 1K = 1,000 bytes. To convert the average DTR from bits per second to kilobits per second, always divide the result by 1,000.

About Download Time
The FTP client's download progress indicator may appear shortly before the file begins downloading. Do not begin timing until the download appears to be underway. Use your own timer instead of relying upon any download time that may be reported by the FTP client.

Why the Formula Is Not Perfect
Average DTR will be greater than calculated when transmission errors require data to be re-sent, thus increasing download time without changing file size. And if the modem negotiates a connection requiring start and stop bits (2 bits added to the baseline 8 bits per byte), DTR will be greater by an additional 1 bit per byte transferred. Because all connections require transmission of some amount of extra data, using 9 as the third variable in the formula provides a serviceable if not always entirely accurate compromise.

4. Disconnect, then repeat the procedure using different FTP servers at different times of the day, especially during the off-hours of early morning or late evening. The averaged results best represent what the modem is able to achieve under its current operating conditions, so look for improvement by making the operating conditions more suitable for faster connections.

OPERATING CONDITIONS AFFECTING CONNECTION SPEED & RELIABILITY

Impairments in the telephone network path

1. Multiple analog/digital conversions. Connections are limited to a maximum of 33.6 Kbps where more than one analog section exists in the telephone network path between modems. The first analog section begins with your modem. Internet Service Providers fully supporting 56K modem connections must provide a completely digital connection, but additional analog sections may be introduced elsewhere in the path.

What you can do
Nothing. The telephone company can confirm the presence of multiple A/D conversions in a path, but consider that no two calls are necessarily routed through the same path, even when dialing the same number. This is one reason why throughput can vary with each connection. There is always the hope that the telephone network in your area will be upgraded.

2. Signal interference & distortion. The telephone network path between modems must be sufficiently free of noise and frequency distortion to permit the desired speed. The modem analyzes these line impairments as they affect the quality of the transmission signal. Poor signal quality causes transmission errors, reduced throughput, reduced connection speed, and even dropped connections.

What you can do
a. Experiment with eliminating potential sources of line impairments in the home:

- Any device connected to any telephone outlet, especially if used by the modem, and even if on a different line: telephones, including cordless telephones and their base stations, answering machines, fax machines, caller ID boxes, and other modems
- Telephone line splitters, cable extenders, faulty or overly long telephone cables (shorter is better)
- Surge protectors, including those that offer telephone line protection
- Alarm systems, especially those that are connected to the telephone system
- Computer equipment, including speakers
- Fluorescent light fixtures and light dimmers
- Satellite dish receivers
- Appliances such as air conditioners, refrigerators, dryers, microwave ovens, and televisions
- Any AC power source and related cabling
- All other things electrical, including issues with the premises wiring: loose or corroded connections, too many splices or bridges, insulation deterioration and exposed wiring, non-twisted pair telephone wiring

Start with a direct, unobstructed, modem-to-outlet connection using a short, high-quality telephone cable. As a way of confirming the issue

prior to isolating it any further, there is the option of testing with a direct connection to the external telephone box located at the back or side walls of the residence. It provides one or more standard telephone jacks supplying the home telephone connections but bypassing most impairments inside.

b. Listen for noise. Because the telephone company is only obligated to provide voice-quality phone lines, it is unlikely to address the many and varied off-premises sources of line impairments that can affect connection speed but don't cause audible noise. Connect a telephone to the wall jack used by the modem, then pick up the line, dial the number 1 to stop the dial tone, and listen. Contact the telephone company if the line is not quiet (loud hiss, pops, static, voices), but first disconnect other telephone devices and check again.

c. Use a local dial-in number to your Internet Service Provider. Long distance and 800 numbers aren't typically a concern, but may cause the call to be routed through more facilities, indirect paths, and different carriers with different types of equipment and lines. Local calls may be auto-forwarded in the same manner, but most reputable ISP's don't engage in this practice. Finally, note that if you are dialing 9 to get an outside line, you are probably using a phone system that will limit throughput to around 33.6K or less.

Interoperability issues between modems

1. The modems on both the client and server side must support the same protocol. Apple 56K modems support K56flex and V.90, but not X2. Apple/GV 56K modems that have been flash-ROM updated support either K56flex or V.90, depending upon the modem updater used.

What you can do
Confirm with your ISP that you are dialing in to a number answered by a modem of the same 56K protocol as yours.

2. Where modems of different makes, models, firmware/flash-ROM revisions, and chipsets are concerned, one modem may have an incompatible method of implementing a connection that it has negotiated with the other modem, or the negotiation itself may fail. For example, if a modem cannot sustain the current connection speed but is unable to successfully negotiate a slower connection with the other modem, the connection will incur excessive transmission errors, decreasing throughput and potentially forcing a disconnect.

What you can do
a. If your modem can be flash-ROM upgraded via software, apply the most recent modem update available. Apple 56K modem updates are available online. The latest firmware code may make the two modems more compatible--or less.

b. Force a slower connection from the very start, such as by disabling 56K protocols in favor of V.34. This change is incorporated into the "V.34 Only" modem scripts available for some Apple 56K modems. A variety of other modem manufacturers supply similar ARA modem scripts for their modems. If you are connecting to the internet using software that does not use modem scripts, supply the software with a custom initialization string for your modem. Your ISP may be able to assist you, or you can teach yourself the proper initialization string by studying the AT command guide provided with your modem or available online from the manufacturer.

c. Ask your existing Internet Service Provider whether different modems are available via an alternate dial-in number, or switch to an ISP that provides different modems (call them first, as they may already know of issues they are having supporting the modem you are using). If all else fails, you may wish to go so far as to try a different modem yourself--one that your ISP recommends for best compatibility.

The settings of either modem

The default configuration of either modem may be altered to enforce one type of modulation over another (Apple's V.34 modem scripts enforce V.34, for example); disable or change the type of compression, error correction, and flow control; change the maximum and minimum speeds allowed, and respond differently when, for example, error correction fails. These settings are changed from their defaults--the factory settings--by the modem initialization string. Depending upon the connectivity software used, the modem initialization string is either entered manually into the software or is part of an Apple Remote Access modem script.

What you can do
a. Be certain that you are using the correct modem script for your modem. Macintosh computers that ship with internal modems already include the necessary modem script, and many manufacturers also provide them online separately or with modem firmware updates.

b. Try an alternate modem script if the software or the modem manufacturer provides one. A different modem script may contain an initialization string more suitable to your operating conditions. Externally contributed modem scripts may also be found in the Communications directory of Info-Mac FTP servers and elsewhere on the Internet.

c. Edit the initialization string contained in your modem script or use software that provides the option of entering an initialization string directly, such as FreePPP or MacPPP. Your Internet Service Provider may be able to tell you what initialization string, if any, they recommend for best compatibility with their modems. They may require that you fax them the AT and S-register command set from the modem's documentation, as these can vary among modems. Don't expect too much: the modem's default settings and those defined in the modem script typically place the modem into its most robust and flexible configuration, so changes often amount to turning off features that

are beneficial in most circumstances. That is why Apple does not provide end-user instruction in modifying ARA modem scripts, other than to make an unsupported tool, the Modem Script Generator, available online.

A failed modem

Again, a modem is unlikely to malfunction only to the extent that it is unable to achieve its top speeds, but it's a possibility that cannot be discounted outright. To find out, use your modem in place of another **identical** modem that is able to attain higher speeds. Conversely, use an **identical** modem that is able to attain higher speeds in place of your own modem.

If you don't see similar results using the formula provided above, and both modems are using the same modem cable and power supply (if present), and both have been updated to the same firmware revision, there may be a hardware issue with the slower modem.

FREQUENTLY ASKED QUESTIONS:

Q. I found a new ARA modem script on the Internet that claims to make my modem faster, and sure enough, I'm now connecting at 48000 bps every time.

A. Be wary of modem scripts that always report the same initial connection speed or that claim to exploit supposedly hidden features in the modem. When evaluating a new modem script or modem initialization string, base your judgement upon the modem's stability and apply the formula for obtaining the average DTR. A modem script can force a high initial connection speed (or lie about it), but cannot force the modem to sustain that speed without dropping the connection. It is of little benefit to have a fast but unreliable connection, or one that always starts fast before slowing down dramatically.

Q. My Internet Service Provider advised me to disable error correction and compression in order to boost my connection speed. Is this advisable?

A. Rarely. That advice is grounded in the notion that, over heavily impaired lines, the overall throughput of the modem may decrease when the error-correction protocol is forced to retransmit data to correct the errors. But without error correction and compression, the integrity of the data being transferred cannot be maintained. The Remote Access control panel provides an "allow error correction and compression in modem" checkbox that may be disabled if you wish to experiment.

Q. Would it help to connect with something else besides Remote Access or Open Transport/PPP?

A. Probably not, but feel free to experiment. Examples of other connectivity software are FreePPP, MacPPP, LinkUPPP!, and SonicPPP. The first two do provide a more convenient method of changing the modem initialization string than software that uses Apple Remote Access modem scripts.

Q: I'm making a connection between my home and office 56K modems using Apple Remote Access Personal Server, but I cannot exceed 33.6 Kbps, despite achieving faster rates when connecting to my ISP. Is this normal?

A. Yes. In order to provide the fully digital server-side connection required to exceed 33.6 Kbps (see part 1 of "Impairments in the telephone network path"), an Internet Service Provider uses high speed digital servers and modem racks quite unlike the consumer modem setup. The home-to-office scenario described not only introduces an additional analog segment to the network path, but cannot avoid the 33.6K upload (transmit) limit now affecting both sides of the connection instead of just the client side. Note that the connectivity software (ARA, Timbuktu, a terminal application) is not relevant to these limitations.

Q. Is it possible to determine the highest connection speed attained during a connection, instead of just the average DTR?

A. After terminating the connection, issue an AT&F and AT&V1 command from a terminal program. This works for most modems. The results will look something like this:

```
AT&F
OK

AT&V1
TERMINATION REASON..... LOCAL REQUEST
LAST TX rate..... 21600 BPS
HIGHEST TX rate..... 21600 BPS
LAST RX rate..... 24000 BPS
HIGHEST RX rate..... 24000 BPS
PROTOCOL..... LAPM
COMPRESSION..... V42Bis
Line QUALITY..... 035
Rx LEVEL..... 023
Highest Rx State..... 67
Highest TX State..... 67
```

```
EQM Sum..................... 00C3
Min Distance................ N/A
RBS Pattern................. FF
Rate Drop................... FF
Digital Loss................ None
Local Rtrn Count............ 00
Remote Rtrn Count........... 00
Flex fail
```

HIGHEST RX rate (or MAX RX and similar) represents the highest connection speed attained. Note also the line QUALITY entry: values greater than approximately 020 suggest a line quality that is unlikely to permit connections greater than 33.6K, but results may vary.

Useful Links:

TIL article 24775: "**Remote Access: Using the Terminal Window to Send AT Commands**"
TIL article 17931: "**Modem AT Command Set: Description**"
Apple Software Updates: **http://www.apple.com/swupdates**

EXTENDED Information - Apple Internal Use - Service Providers and Support Professional

---

Document Information
Product Area: Communications-Networking; Peripherals
Category: Modems & Fax Modems
Sub Category: General Topics
