

Mesleki İngilizce - Technical English

II

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• Notes:

- In the slides,
 - texts enclosed by curly parenthesis, {...}, are examples.
 - texts enclosed by square parenthesis, [...], are explanations related to examples.

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Streaming Video over a Network or the Internet

- Learning Objectives
 - to understand different kinds of transfer: radio, television, telephone, internet
 - to recognize general differences in the data transfer of radio, television, telephone and the Internet
 - to understand why internet video streaming is vulnerable to delays, and why delays do not affect radio, television and telephone
- Sub-areas covered
 - Computer networks
 - Transferring data through the Internet

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Streaming Video over a Network or the Internet

- Keywords
 - Streaming protocol
 - a set of rules to ensure that data will be supported in real time
 - Network protocol
 - a set of rules that set out how to establish communication between two or more computers over the network
 - Routing
 - the process of selecting paths in a network along which data can be sent between computers (through the router)

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Streaming Video over a Network or the Internet

- Keywords
 - Router
 - a special computer that directs communicating messages when several networks are connected together.
 - High-speed routers can serve as part of the Internet backbone.
 - Internet
 - a global network connecting millions of computers
 - Peering
 - the arrangement of traffic exchange between the Internet service providers (ISPs).
 - Internet provider
 - a company that sells bandwidth and access to the Internet

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Streaming Video over a Network or the Internet

- Keywords
 - Bandwidth
 - the amount of data that can be transferred through a specific path in the network
 - usually expressed in kb/s [kilo bits per second]
 - Circuit switching network
 - a network in which computers establish a constant bandwidth connection before they start to share any data
 - Broadcast
 - the action of sending data by one computer in the network to all the others that are available inside the network

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Streaming Video over a Network or the Internet

- [Reading text](#)
- Pre-reading questions
 - What do you know about the history of TV and radio?
 - Do you know the origins of the Internet?
 - Which kind of media do you find important and valuable?
 - Can you explain how connections are made between ‘users’ of radio, TV and the Internet?

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How Video Travels Across the Internet

- Viewing streaming video over the Internet is *hardly a seamless experience*
 - [Seamless: smooth and continuous, with no apparent gaps or spaces between one part and the next]
- Streaming video suffers from
 - hiccups, delays, drop-outs, skips, and connection loss
 - [Hiccup: 1. an involuntary spasm of the diaphragm and respiratory organs, with a sudden closure of the glottis and a characteristic gulping sound. 2. a temporary or minor problem or setback.]

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How Video Travels Across the Internet

- It is sometimes hard to understand why the Internet has trouble moving audio and video
- when radio, television, and telephones do it fairly well and have existed for almost 100 years.
- So first let us look at the mechanisms of these traditional media (radio, television, and telephones).

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Radio



- Radio means sending energy with waves.
- It is a method of transmitting electrical energy from one place to another without using any kind of direct, wired connection.
 - That's why it's often called **wireless**.
- The equipment that sends out a radio wave is known as a **transmitter**;
 - the radio wave sent by a transmitter whizzes through the air—maybe from one side of the world to the other—and completes its journey when it reaches a second piece of equipment called a **receiver**.
- When you extend the **antenna (aerial)** on a radio receiver, it snatches some of the electromagnetic energy passing by.
- Tune the radio into a station and an electronic circuit inside the radio selects only the program you want from all those that are broadcasting.

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Radio

- Radio works simply because a single tower broadcasts the same signal to many receivers.
- Everyone listens to the same thing at the same time.
- All the stations are available at any time;
 - you simply have to tune into a different frequency signal.
- The main barriers to radio transmission are
 - distance;
 - physical barriers such as hills, buildings, and tunnels that block the signal;
 - interference between two strong signals near each other on the dial.
- In terms of communication, radio is a one-way broadcast transmission.

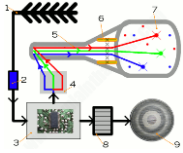
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Television

- The basic idea of television is "radio with pictures".
 - In other words, where radio transmits a sound signal (the information being broadcast) through the air, television sends a picture signal as well.
- These signals are carried by radio waves,
 - invisible patterns of electricity and magnetism that race through the air at the speed of light (300,000 km per second).
- Think of the radio waves carrying information like the waves on the sea carrying surfers:
 - the waves themselves aren't the information: the information surfs on top of the waves.

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Television



- Television is really a three-part invention:
 - the TV camera that turns a picture and sound into a signal;
 - the TV transmitter that sends the signal through the air;
 - the TV receiver that captures the signal and turns it back into picture and sound.
- TV creates moving pictures by repeatedly capturing still pictures and presenting these frames to your eyes so quickly that they seem to be moving.
- Think of TV as an electronic flick-book.
 - The images are flickering on the screen so fast that they fuse together in your brain to make a moving picture.

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Television

- Television works much like radio, except that television broadcasting is organized into national networks.
- The same program is delivered to television receivers around the country by broadcasting the originating signal to branch offices,
- which broadcasts it out from towers,
 - out through cable companies, or to people with satellite dishes.
- In any case, the same signal is sent to everyone at the same time
 - a one-way broadcast.

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Television

- All the channels are available at any time;
 - there is no noticeable delay caused by changing channels.
- The main barriers to television reception are
 - bent or frayed cables,
 - badly aimed antennas or dishes,
 - physical barriers as in radio,
 - interference of stations with each other.

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Telephone

- Telephone calls use many of the same wires used by the Internet.
- The telephone central office maintains devices called switches
 - that are used to connect the call to the next location.
- Telephone calls create a two-way circuit all the way from caller to receiver.
 - The message “All circuits are busy” (usually heard only during disasters or radio call-in concert ticket giveaways) means the switch does not have any more slots in which to carry this call.

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Telephone

- The main barriers to telephone transmission are found at the beginning of the call
 - if there are not enough circuits to place the call.
- While a call is in progress, the entire route between the caller and recipient is reserved for their use only,
 - even if there is silence and no one is talking.
- Telephones use what is called a circuit-switched connection.

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Internet Basics

- The path from a website to a web browser is different than these other systems.
- Conceptually, it is similar to the telephone conversation:
 - It's a two-way conversation in which the browser asks for a document and the server sends it.
- Unlike the telephone call, however, there is no reserved circuit.
 - Data, in the form of requests and responses, are organized into chunks called packets and sent between the requesting web browser and the web server.

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Internet Basics

- In between the requester and the server is a series of routers.
- These machines route traffic between different smaller networks.
- Each time a packet crosses the boundary from one ISP to another, or from one kind of network to another, it goes through a router.
 - [ISP: Internet Service Provider, a company that provides Internet services, including personal and business access to the Internet]

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Internet Basics

- The packets “hop” from router to router like a bucket brigade.
- This type of data transmission is called packet switching, instead of circuit switching.
- Internet packet switching has some attributes that make it reliable and unreliable at the same time.
 - [A bucket brigade device is a discrete-time analogue delay line, developed in 1969 by F. Sangster and K. Teer of the Philips Research Labs. It consists of a series of capacitance sections C0 to Cn. The stored analogue signal is moved along the line of capacitors, one step at each clock cycle]

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The Internet Backbone

- The Internet is an extremely heterogeneous network,
 - consisting of several different kinds of networks and ways of connecting networks to the Internet
- The Internet backbone (as much as a large, shapeless and ever-shifting cloud of networks can have a backbone!) consists of long-haul connections that carry large volumes of Internet traffic (packets) across and between continents.

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Public Exchange Points

- Public exchange points exist at various points on continents and are the major nerve centers
 - where many regional private networks, Internet providers, corporations, schools, and government divisions converge to exchange traffic destined for other points on the Internet.
- You can compare these centers to major public airports,
 - where international and domestic flights arrive 24 hours a day and trade passengers from different airlines.

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Peering

- The process of connecting a network to the Internet at one of these exchange points is called peering,
 - connecting to the backbone this way makes one a Tier-1 Internet provider.
- ISPs that rent their connection from a Tier-1 provider are called Tier-2 providers, and so on.
- The policies, prices, and agreements that cover how data is treated on these connections are as numerous as there are companies involved.
- This is the first source of variability for our packet switching.

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Private Peering

- Peering is simply two networks connecting to each other with routers.
- Public peering occurs at large exchange points,
 - but any two networks that find a lot of traffic flowing between them can choose to create a direct private link between the networks (called private peering).
- This reduces the cost of access through a public exchange point or other provider for all the bandwidth that travels between these two networks.
- It also decreases the number of intermediate connections between the networks.

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Private Peering

- For instance, when several schools in the same organization link together, their inter-campus network traffic does not have to go out to the Internet at large, and is often more reliable as a result.
 - In this scenario, though, each school has its own connection to the Internet.
- What if one of the school's Internet connections went down?
 - Would it be fair to send its traffic through the private peering connection and use another school's Internet connection?
- The way these kinds of questions are answered and the internal policies in this regard are another contributing factor to the variability of Internet packet switching.

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Internet Complexity

- As everything “goes digital,” the distinction between cable TV wires, telephone wires, radio waves, and satellite transmission blurs.
- However, there are many ways to send data over these media.
- Internet data transmission can be complicated, leading to a variety of undesirable transmission characteristics.

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Packet Loss

- Circuit switching on the Internet is described as “best-effort,”
- meaning that one of the routers along the way can lose a packet before it reaches its destination.
- In this case, the sender or receiver must somehow note that the packet was lost (perhaps by receiving the next packet and noting that it is out of context) and re-requesting the lost packet.
- This mechanism is fairly reliable in that two machines will usually (and eventually) figure out what went wrong and resend the missing packets.

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Packet Loss

- Packet loss causes audio and video to pause if the packets are eventually resent, and it causes video to pause, drop out, and skip if the packets are not resent at all.
- In our analogy of a public exchange point being a major airport, if it's a “foggy day” at that exchange, the part of the Internet that goes through that exchange can be slowed down (called a brownout) by the data that can't “take off.”

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Different Routes

- Not all packets in a file follow the same route to the destination computer.
- This is not unlike the airline's hub and spoke system:
 - One packet might go “direct” from İstanbul to Van; others might “transfer” in Ankara or Antalya to get to Van.
- Contributing to this issue is private peering and the variable rules and costs associated with all the choices to be made.
- Alternate routes can be excellent when one path between two machines goes down and a packet can use another path.

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Different Routes

- It can also cause strange effects, such as when a packet is sent down a slow route, is assumed lost, is resent - and then later reappears as a duplicate packet!
- Audio can **stutter** and skip if duplicate packets are not detected and discarded.
 - [stutter : talk with continued involuntary repetition of sounds, especially initial consonants]
- Also, some paths travel far out of the way, hopping through many more routers than necessary and causing large delays.
- The more “hops” or routers between two machines, the higher the chance of unexpected delays.

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Delay (Latency)

- Because of the many different routers a packet has to go through to get from sender to receiver and because there are no reserved circuits on the Internet like there are for telephones,
 - the delay of any given packet can be high or low, or change unexpectedly.
- This can be caused by a variety of factors such as:
 - A router is too busy and can't keep up with traffic.
 - A particular link between sender and receiver becomes saturated.
 - A link goes down, causing traffic to be rerouted to a different link.
 - One or more routers in between can't think fast enough.

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Delay (Latency)

- A firewall looks at all the packets for viruses.
- Delay is added due to the use of older technology, such as modems.
- Other downloads on a pipe cause it to delay.
 - [pipe: In computer programming, a pipe is a technique for passing information from one program process to another. A pipe is one-way communication only. Basically, a pipe passes a parameter such as the output of one process to another process which accepts it as input. The system temporarily holds the piped information until it is read by the receiving process]
- Packets are lost, resulting in resends, and other packets get bunched up behind them.

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Delay (Latency)

- These factors make predicting how long it will take to get packets back from a server difficult.
- Because of varying latency, video can take a long time to start playing;
 - fast-forward and rewind features can be slow and clunky;
 - video can pause, stutter, skip, and stop altogether.
 - [clunky: clumsy in style, form, or execution; solid, heavy, and old-fashioned]

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Bandwidth Variation

- Another factor on the Internet is the variability of bandwidth.
- With broadcast media, such as radio or television, as well as telephones, the bandwidth is always the same
 - just enough to carry the channel or the conversation.
- There is no wasted bandwidth; the size of the channel is just enough to carry the data.
 - It was designed to be that way.

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Bandwidth Variation

- Because the Internet is designed to allow different computers of different speeds and different channel sizes communicate,
 - it is possible to have bottlenecks,
 - not just due to traffic that the size of the channel varies from sender to receiver.
- The Internet link for a major website's hosting provider might be excellent.
- The links between the host's ISP and its branch in a particular city might be high-capacity.

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Bandwidth Variation

- However, the Internet link provided by a small ISP to the end user might be very small due to oversubscription.
- If that Internet provider has incurred a good deal of customer growth without upgrading its own connection to the Internet backbone,
 - the potentially high-bandwidth connection from the website host is lowered to the slowest intermediate link in the chain.
 - In other words, the bandwidth between a website and a client is no faster than its slowest link.

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Grammar revision

- Fundamentally, the Internet is far better suited for sending web pages than real-time media
 - because web pages are far smaller and far less sensitive to delays.
 - There is not much difference between a one- and two-second delay in getting a web page.
- However, a one-second pause in real-time video is unacceptable.
- The brute-force approach of keeping the bit rate of the video far below the maximum bandwidth of the Internet connection can be effective in getting Internet video to perform predictably.

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Grammar revision

- **Relativative clauses with a participle**
- Relative clauses with a participle are often used in technical descriptions.
- They allow you to provide a lot of information about a noun using as few words as possible.
- For example:
 - {The technology *needed to set up a home network.*}
 - {PCs *equipped with Ethernet adapters.*}
 - {Network modem *allowing clients to access the Internet simultaneously.*}
 - {Data line *linking client to server.*}

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Grammar revision

- **We can use the passive participle as in 1st and 2nd examples.**
 - {The technology *needed to set up a home network*}
 - {The technology *which is needed to set up a home network*}
 - {PCs *equipped with Ethernet adapters.*}
 - {PCs *which are equipped with Ethernet adapters.*}

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Grammar revision

- **We can use an active participle as in 3rd and 4th examples.**
 - {Network modem *allowing clients to access the Internet simultaneously.*}
 - {Network modem *which allows clients to access the Internet simultaneously.*}
 - {Data line *linking client to server.*}
 - {Data line *which links client to server.*}

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THE CLAUSE

- a syntactic construction/group of words that
 - contains a subject and a predicate
 - functions as a sentence or as part of a sentence.
- Every subject predicate word group in a sentence is a clause
- Every sentence must contain at least one independent clause;
 - otherwise, it is a sentence fragment.

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THE CLAUSE

- Subordination is a technique that writers use to show, by the structure of a sentence,
 - the appropriate relationship of ideas of unequal importance
 - by subordinating the less important ideas to the more important ideas.
- When you first begin to write, you use simple sentences.
 - Later you write more complicated sentences, in order to express your thoughts more effectively.
- One sign of maturity in writing is the use of subordination.

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THE CLAUSE

- {The essay, **which was chosen by the committee**, is on power electronics.}
 - [An adjective clause modifies the noun *essay*.]
- {Ali hopes **that it will be published**.}
 - [The original sentence has become a noun clause used as a direct object of the verb *hope*.]
- {Tomorrow he will call the publisher **because he wants to know his decision**.}
 - [An adverbial clause shows the reason for doing something.]

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THE CLAUSE

- Effective subordination can be used to achieve
 - sentence variety,
 - conciseness,
 - emphasis.
- For example, consider the sentence,
 - “The researcher’s report was carefully illustrated, and it covered five pages.”
- It can be rewritten, using **subordination**, in any of the following ways:

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THE CLAUSE

- DEPENDENT CLAUSE
 - {The researcher’s report, **which covered five pages**, was carefully illustrated.}
- PHRASE
 - {The researcher’s report, **covering five pages**, was carefully illustrated.}
- SINGLE MODIFIER
 - {The researcher’s **five-page** report was carefully illustrated.}

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INDEPENDENT CLAUSES

- When an independent clause stands alone, it is called a simple sentence.
 - {On Friday Ali bought a new computer.}
- It is called an independent clause only when it is combined with one or more additional clauses in a sentence.
 - {On Friday Ali bought a new computer, **but** he hasn’t paid for it yet.}
 - [The conjunction **but** joins two independent clauses.]
 - {It is a good computer **because** he needs it for his work.}
 - [In this sentence the independent clause **it is a good computer** is combined with a subordinate clause.]

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SUBORDINATE CLAUSES

- cannot stand alone as sentences.
 - They are always joined in some way to an independent clause.
 - {that you bought}
 - {who the lecturer is}
 - {when they started}
- Combined with an independent clause, each of these subordinate clauses plays a part in completing the meaning of the sentence.
 - {The best computer was the computer **that you bought**.}
 - {Ali knows **who the lecturer is**.}
 - {**When they started**, Veli was tired.}

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The Adjective Clause

- a subordinate clause that, like an adjective, modifies a noun or a pronoun.
 - {The paper **that you are writing** is an interesting work of research.}
 - {The room **where the equipment is kept** is air-conditioned.}
 - {The first student **who won the Science and Technology Award** was Ali.}
 - [The subordinate clause **who won the Science and Technology Award** modifies the noun *Ali*.]
- often begin with the pronouns **who**, **whom**, **whose**, **which**, **that**

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Relative Pronouns

- a pronoun that begins a subordinate clause and is related to another word or idea.
- It may be the subject of the clause it begins.
 - {The principal awarded the student **who had won the contest.**}
 - [The relative pronoun *who* is the subject of the verb *had won.*]
- A relative pronoun may be the object of the verb in the clause it begins.
 - {The book **that** you want is from Oxford University.}
 - [The relative pronoun *that* is the object of the verb *want.*]

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The Noun Clause

- a subordinate clause used as a noun.
 - {We understood **what the lecturer explained.**}
 - [The entire clause *what the lecturer explained* is the direct object of the verb *understood.*]
- Examples show how a noun clause may be
 - the subject of the verb,
 - a predicate nominative,
 - a direct object,
 - an indirect object,
 - the object of a preposition.

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The Noun Clause

- {His interest was evident.}
 - [Interest is a noun used as the subject of the verb *was.*]
- {That he was interested was evident.
 - [*That he was interested* is a noun clause used as the subject of the verb *was.*]
- {This is his article.}
 - [*Article* is a noun used as a predicate nominative.]
- {This is what he wrote.}
 - [*What he wrote* is a noun clause used as a predicate nominative]
- {They like your article.}
 - [*Article* is a noun used as a direct object.]

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The Noun Clause

- {They think that you wrote well.}
 - [*That you wrote well* is a noun clause used as direct object.]
- {The committee will give the best researcher the job.
 - [*Researcher* is a noun used as an indirect object.]
- {The committee will give whoever performs the best the job.}
 - [*Whoever performs the best* is a noun clause used as an indirect object.]
- {The efficiency of his projects helped him a lot.}
 - [*Projects* is a noun used as the object of the preposition *of.*]
- {The efficiency of what he had done helped him a lot.}
 - [*What he had done* is a noun clause used as the object of the preposition *of.*]

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The Adverb Clause

- a subordinate clause that, like an adverb, modifies a verb, an adjective, or an adverb.
- In the following examples, the adverb clauses modify the verb by telling
 - *how, when, where, why, to what extent, or under what conditions.*
- {Ali felt as though he already had the job.}
 - [*how* he felt]
- {Before he left, he said good-bye.}
 - [*when* he left]

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The Adverb Clause

- {They sat down wherever they could find seats.}
 - [*where* they sat down]
- {Since the office was closed, we left.}
 - [*why* we left]
- {He understands mathematics better than I do.}
 - [*how much* or *to what extent* he understands mathematics]
- {Will you apply for the scholarship if you have to go to England?}
 - [*under what conditions* you will apply]

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The Adverb Clause

- ADVERB CLAUSE MODIFYING AN ADJECTIVE
 - {Ali was **sure** that he would obtain the scholarship.}
 - [The adverb clause *that he would obtain the scholarship* modifies the adverb *sure*.]
- ADVERB CLAUSE MODIFYING AN ADVERB
 - {Veli arrived **earlier** than I did.}
 - [The adverb clause *than I did* modifies the adverb *earlier*.]

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