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Technical Definition

Virtually any kind of technical writing includes one or more technical definitions. Consequently, a technical writer must be able to define terms, irrespective of whether these terms refer to mechanisms or processes.

What Is a Technical Definition?

In technical writing, definition is the process by which one assigns a precise meaning to a term. To define a term, it must be placed into a classification, then differentiated from other terms in that same classification. Technical definitions are relatively easy to write, except for some pitfalls that will be addressed later. The format for a technical definition is straightforward and works like this:

Term = Classification + Differentiation

For example, if a writer were to define the stall condition an airplane experiences when it loses lift, he or she could start with the term *stall,* then add a classification, flight condition, and then differentiate it from all other flight conditions—in this case, by a stall's unique characteristics. The definition might read something like this:

> A *stall* is a flight condition where the lift produced becomes less than the weight of the airplane, and the airplane stops flying.

That seems simple enough; but what happens when a term, like *stall,* has multiple definitions in many contexts? In such cases it may be necessary to add a qualifier in front of the definition statement to supply the necessary context. The qualifier is important when the general context for a definition needs to be established up front. If the context is known or is obvious, a qualifier is unnecessary. For example, in an aeronautics study on aircraft wing design, the context of *stall* is obvious. It is clear that *stall* in this case has to do more with the loss of lift than with, say, a single compartment for an animal in a barn.

When a context is needed, the format for the definition would be

(Qualifier +) *Term* =
<u>Classification</u> + Differentiation

By the way, the parentheses, italic font, and underscore have been added only for clarity.

Look at Figure 2.1, which provides three definitions of the same term in different contexts. Note how the term *stall* has three totally different meanings depending on the context, and how each definition begins with a qualifier that makes the context clear from the start.

In the first example, *stall* refers to what happens when an airplane does not go fast enough to stay in the air. Pilots routinely stall their airplanes right above the runway when landing them, in which case stalling is good. Sometimes they stall them inadvertently in much more precarious situations, in which case stalling is bad.

In the second example, *stall* refers to a car that has suddenly stopped running. Normally, this condition happens only in the middle of heavy traffic, in bad weather, and with a critical appointment on the route.

The third example of *stall* relates to social dating behavior. (This is the one with which I have

Qualifier **Term** **Class**

[In aeronautics], a *[stall]* is a **[flight condition]** where the lift produced is less than the weight of the airplane.

Qualifier **Term** **Class**

[In driving], a *[stall]* is an **[operating condition]** where a sudden and unexpected loss of power occurs.

Qualifier **Term** **Class**

In **[dating behavior]**, a *[stall]* is an **[interpersonal maneuver]** used by one party to discourage the unwanted advances of another.

Figure 2.1
Multiple contexts and qualifiers

had the most experience, especially back in my undergraduate years. As I remember, the typical "good night kiss" stall was for my date to fill her mouth with bubble gum and start chewing.)

Classifications and Classes

Often the most difficult part of writing a technical definition is coming up with the proper classification for the term. The class should be a general category in which the term fits, but it cannot be too general. For example, consider that 33K, one-watt carbon resistor from the abstraction ladder in Chapter 1. In the following sentence, the term is defined using the very generic classification *device.*

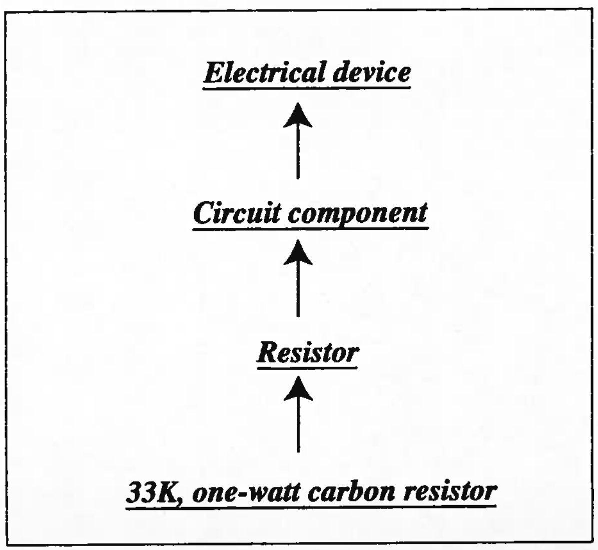
> The *33K, one-watt carbon resistor* is a <u>device</u> that impedes the flow of electrical current.

The problem with this classification is that *device* could mean all kinds of different things, most of which have nothing to do with circuit components; consequently, its inclusion does not really help specify the meaning of the term. By changing *device* to *circuit component,* however, the meaning can be narrowed considerably for the reader even before it is differentiated.

One trick for classifying a term is to build an abstraction ladder for the term, then move up one or two "rungs" above the term. In the original abstraction ladder, the movement was as shown in Figure 2.2. In this case, moving up one rung—from the term "33K, one-watt carbon resistor" to the term "resistor"—is not an option because the classification would be derived from the original term. That would yield the following circular definition:

> The *33K, one-watt carbon resistor* is a resistor that impedes the flow of electrical current.

.2
n ladder



Because the 33K, one-watt resistor is obviously a resistor, this classification does not help define the term. In fact, it contributes nothing other than useless circularity. If possible, try to find a classification that is not derived from the term. In this case, the easiest solution is to just move up the abstraction ladder one more rung. *Circuit component* helps to define the term and has no circularity with the term.

Differentiation

The next step in defining the term is to differentiate it from all the other members of the class. Differentiation involves narrowing the meaning of the term to just one possibility within the class. Clearly, it would be easier to narrow the class of "circuit components" to a particular resistor than it would be to narrow "device" to a particular resistor. There are all kinds of devices in the world and relatively few circuit components.

The class "circuit components," however, still contains many possibilities: capacitors, diodes, switches, potentiometers, inductors, transistors, and IC chips, for example. In this case, a good approach is to focus on the function of a resistor, which is to impede the flow of electric current, and to use that function to differentiate the class. Doing so yields the following definition:

> The *33K, one-watt resistor* is a circuit component that impedes the flow of electric current.

Avoiding Mistakes

In writing technical definitions, it is easy to do something bad. For example, define the common computer term *hard drive.* It is probably a good idea to qualify the definition unless the context of computing is obvious. (There are other kinds of hard drives, such as one through the Mojave Desert without air conditioning.)

So how about this definition?

> In computing, a *hard drive* is an input/output device for the nonvolatile storage and retrieval of data.

Think about this one for a minute. If the reader does not know what a "hard drive" is, what is the likelihood that the reader is going to know what an "input/output device" is, much less the meaning of "nonvolatile storage and retrieval"? As mentioned earlier, an important rule of writing definitions is never to define a term with the same term. Sometimes, however, an even more important rule is never to define a term with another term that itself needs defining. Consider the reader's knowledge and skill level. In this case, the term was defined with terms that need even more defining.

Extensions

As with many rules, there are times when you may have no choice but to violate the principle to achieve the goal. Sometimes a simple term that the audience will understand is just not available. In fact, sometimes the only thing to do is to define the term with undefined terms, then extend the definition immediately by explaining the undefined terms. For example:

> In computing, a *hard drive* is an input/output device for the nonvolatile storage and retrieval of data. *Input/output devices* move information into and out of the computer. The computer writes (or *outputs*) data to the hard drive and reads (or *inputs*) data from the hard drive. *Nonvolatile storage* means that when data is written to the hard drive, it remains there even when the power is turned off.

The two sentences added in this definition are called *extensions*. Extensions are sentences that follow up a definition statement with additional

information the reader needs. Often a single-sentence definition will not be adequate. In such cases, you will have to extend the definition in a way that communicates to the audience and serves the purpose at hand.

Extensions can take many forms. In the example just given, the extensions further define the terms used to define the original term. But extensions can do far more than provide further definition. Here are a few of the most common types of extensions you can use, along with examples that relate to our hard drive:

Common Extensions

- Use *comparison and contrast* when you need to show differences or similarities.

  > Hard drives differ from optical drives in that hard drives store data as magnetic patterns read by a read/write head, whereas optical drives store data as pits and lands read by a laser.

- Use *classification* when you need to organize information into categories.

  > Hard drives are categorized by the size of their storage capacity, the speed at which data can be accessed, and the type of computer interface they employ.

- Use *cause and effect* when you need to demonstrate why something happens or when you need to trace results.

  > Hard drives write information by passing electric currents representing data through a coil wound on a highly permeable material called a *head*. The resulting electromagnetic pulses cause magnetic patterns to be recorded on the surface medium of a spinning disk.

- Use *process* when you need to list the steps of a procedure.

> To select Drive D in Windows, first double-click the "My Computer" icon on the desktop, and then, in the resulting window, double-click the "Drive D" icon.

- Use *exemplification* when you need to give real or analogous examples.

> Hard drives have evolved rapidly in terms of storage capacity and speed. For example, the Finkel-DRIVE 1000 provides 1,000 gigabytes of storage with access times less than 10 nanoseconds. (I made this up, of course.)

- Use *etymology* to show the linguistic genesis of the term.

> The term *magnetic disk drive* comes from the ancient Latin *magneticus,* meaning "mysterious flux"; *diskae,* meaning "shaped like a plate"; and *drivum,* meaning "to rotate with torsion." (If you believe any of this is true, I have a Finkel-DRIVE you can buy at a bargain.)

Remember, the choice of which extensions you use should be governed by the purpose of your paper and the knowledge requirements of your audience. In other words, if you are writing a set of instructions for a novice operator on how to use a hard drive, extensions that involve the basic use of the hard drive would be more appropriate than extensions that address the theoretical basis for the hard drive's operation.

Required Imprecision

In some situations you will need to trade off desired precision in your definition to achieve the

required level of communication. At times it is foolish to attempt to achieve expert-level precision with an uninformed audience.

Consider the following two definitions of a *black hole*—the astrophysical phenomenon that is supposed to exist somewhere in space.

> In astrophysics, a *black hole* is a set of events from which it was not possible to escape to a large distance. A black hole gets its name from its boundary, called an event horizon, which is formed by the paths in space-time of rays of light that just fail to get away, hovering instead forever on the edge and, consequently, moving on paths parallel to or away from one another.

> In astrophysics, a *black hole* is a collapsed neutron star whose gravity is so great that even light cannot escape. Although fusion reactions within this collapsed star still may emit brilliant rays of light, viewed from the outside, the black hole appears to be a totally dark void in space.

The first definition functions at the expert level. For theoretical physicists, it provides a precise and accurate description of a black hole and thus is appropriate for their needs. But for the less informed, reading it represents a mind-twisting experience that, in many cases, can leave readers more confused regarding the term than they were before they read it.

The second definition functions at the level of the average reader. It is not nearly as precise or accurate as the first definition, but it communicates the basic gist of what constitutes a black hole in space.

The problem is that to be precisely correct and absolutely accurate, you would have to function at a level where you cannot effectively communicate to the average reader. If you were a technical writer writing for the average reader, you would have to make a tough decision here: either be absolutely correct and communicate less effectively, or be less than absolutely correct and communicate more effectively. If your goal is effective communication, then your decision is obvious.

Word about Defining cifications Standards

Defining specifications and standards is a specialized activity. Such documents can take many different forms, depending on what areas of engineering and science are involved and whether the documents are designed to meet commercial, industrial, or government standards. Writing these kinds of definitions is far more complex than simply defining terms.

Specification documents precisely state particulars, including requirements, designs, implementations, and testing. In engineering and science, specifications normally involve goods and services being developed under some type of contractual obligation. The specification precisely defines the quality of work and performance standards required by the contract.

Specifications are also what technical standards are made of. Standards are accepted or established methods, measures, or designs for accomplishing specific tasks. Many standards exist for everything from data transfer protocols and cable connectors to air conditioning coolants and drinking water.[1] Specifications used in standards are detailed and exacting. The following excerpt from the IEEE 1394 Open Host Controller Interface Specification is a good example:

> 1394 requires certain 1394 bus management resource registers be accessible only via "quadlet read" and "quadlet lock" (compare-and-swap_ transactions), otherwise ack_type_error shall be sent. Those special bus management resource registers are implemented internal to the 1394 Open Host Controller to allow atomic compare-and-swap access from either the host system or from the 1394 bus.[2]

If the specification is required under U.S. government contract, it must contain certain information about the goods and services involved and the various standards that apply. Government specifications often require the following:

- Precise definitions and descriptions of the scope of the project.
- Any documentation the contractor must furnish, along with the formats for those documents.
- Specific performance characteristics of any required product, along with necessary testing, including procedures and equipment, to verify that the goods or services meet the specified requirement.
- Exact descriptions of the deliverables of the contract, including all goods and services, and the dates and times by which these products will be provided.
- Contractor notes, records, and other research and production materials.

Writing specifications is a demanding task normally accomplished by experienced engineers, scientists, and project managers with a solid knowledge of all applicable standards. Standards are often developed by committees composed of legal, managerial, and technical experts.

Definition Checklist

- Have I fully analyzed the purpose of my report, and do I understand the skill and knowledge level of the audience?
- Have I defined the term by first classifying it in a way that adds precision and understanding for my audience and serves my purpose?

- Have I differentiated this classification to distinguish this term from other members of its class?
- Have I determined whether the context is clear and, if not, whether it is critical to the definition? If the context is unclear and critical, have I used a qualifier before the term?
- Have I avoided defining a term with the same term?
- Have I avoided using terms that themselves need to be defined? If not, have I explained these terms?
- Have I chosen extensions to my definitions that are appropriate for my audience and purpose?
- Have I compromised my fundamental purpose (communicating with my reader) by including inappropriate or irrelevant information or precision?

Exercise

Read each of the following definitions and try to determine the context, audience level, accuracy, and purpose for which they were written.

- A *resistor* is a small electronic part that reduces the amount of electricity flowing through a circuit.
- A *resistor* is a circuit component that converts electrical energy into thermal energy and, in the process, determines the current produced by a given difference of potential.
- *Resonance* is a systemic condition where small amplitudes of a periodic agent produce large amplitudes of oscillation or vibration.
- *Resonance* is a natural means of amplification that makes a musician's horn sound louder.
- *Ionization* is the electrostatic process by which a neutral atom or molecule loses or gains electrons, thereby acquiring a net charge.
- *Ionization* is the phenomenon that creates lightning in thunderstorms.

- *Ergonomics* is the field of study by which we make machines easier to use.
- *Ergonomics* is the systematic consideration of physical, psychological, and social characteristics of human beings in the design of tools and equipment, the workplace, and the job itself.

Notes

1. For an updated, comprehensive listing of standards, see "CFS Standards Document Library on the World Wide Web." Internet: http://www-library.itsi.disa.mil/by_org.html, March 23, 1999. Some of the more commonly used standards on this Web site include American National Standards Institute (ANSI) http://www-library.itsi.disa.mil/org/ansi_std.html; Department of Defense Standards (DOD-STD) http://www-library.itsi.disa.mil/org/dod_std.html; Institute of Electrical and Electronic Engineers (IEEE) http://www-library.itsi.disa.mil/org/ieee_std.html; International Organization for Standards (ISO) http://www-library.itsi.disa.mil/org/iso_std.html; Military Standard (MIL-STD below 2045) http://www-library.itsi.disa.mil/org/mil_stdb.html; Military Standard (MIL-STD 2045 and up) http://www-library.itsi.disa.mil/org/mil_std.html; and Telecommunications Industry/Electronic Industries Association (TIA/EIA) http://www-library.itsi.disa.mil/org/tia_eia.html.
2. Apple Computer, Inc., Compaq Computer Corporation, Intel Corporation, Microsoft Corporation, National Semiconductor Corporation, Sun Microsystems, Inc., and Texas Instruments, Inc., "1394 Open Host Controller Interface Specification," Release 1.00, p. 38. Internet: http://1394ohci-l@austin.ibm.com.