

EXAMPLE 1.1 Designing the Cell Phone of Today

As a way of understanding the engineering design algorithm, let's apply it to a piece of existing technology—the cell phone—as if we were the engineers about to begin its design process.

Step 1: *Identify the design objective.* We want to build something that will allow humans to communicate with one another between any two locations on the globe at any time.

Step 2: *Define goals and constraints.* Some of the design goals and constraints for this device include the following:

- *Movement:* The device should not be connected physically to anything else that would limit our movement when using it. For example, it shouldn't need to be plugged into a wall outlet or a network jack.
- *Size:* The device should be small and portable so that we can carry it in our hand, a pocket, a bag, or backpack.
- *Form:* It should be large enough to be easy to hold in our hand, since devices that are too small are hard to grip. It should also provide a way for us to talk into it and for us to hear the caller at the other end of the call.
- *Energy use:* It shouldn't require too much energy in its operation, or else we'll need to change or recharge its energy source too often.
- *Cost:* It should be inexpensive enough so that people will buy it.

Step 3: *Research and gather information.* Has anyone ever done something like this before? Wireless radio telephones were being researched by the American Telephone and Telegraph Company in the 1930s, but these systems were more like modern family radio systems and “walkie-talkies” than cell phones. The Citizen Band (CB) radio craze of the 1970s brought point-to-point, two-way radio communications to large numbers of automobile travelers. But neither system reaches around the globe, and neither can be used easily to contact a wide variety of individuals. It wasn't until the 1990s that a system such as the one described in Step 1 was put into widespread use.

Steps 4 to 8: *Create, analyze, choose, build, and test.* We are all fortunate that engineers at international companies such as AT&T's Bell Telephone Laboratories, Nokia, Ericsson, Qualcomm, and Motorola completed these steps and designed, built, and tested a wide variety of cell phones that meet the design goals and constraints.

Solution

How well do you think current cell phones meet the objectives specified in Step 1 and satisfy the constraints given in Step 2? Are you pleased with current cell phone technology? Would you change anything about the goals or constraints?