APPENDIX A

Communication Skills

A.0 OBJECTIVES ■

The primary objective of this appendix is to provide the reader with guidance in becoming a better communicator using any form of communication. In particular, guidelines and suggestions are provided to help the reader in (1) structuring more effective reports and memoranda; (2) preparing more readable and less confusing specifications; (3) preparing and giving oral presentations; (4) organizing and conducting effective meetings; and (5) being a more active and effective listener. A secondary objective is to emphasize the use and advantages of having and maintaining a software engineering notebook.

A.1 INTRODUCTION ■

Several studies have shown conclusively that successful people in any field share a common trait, good communication skills. Fortunately, communication skills can be learned. The software engineer must include among his or her arsenal of skills and capabilities the ability to communicate effectively in several media. Information is disseminated among software development participants via memoranda, specifications, reports, oral presentations with flip charts or overheads, and meetings (group meetings and one-on-one meetings). Information is communicated to users, operators, maintainers, etc., via the written report, CDs or video-tapes, formal presentations, and both classroom and hands-on training sessions. How we com-

municate, our manner of communication, and what we communicate defines us to our pee our subordinates, and leaders. Just as in any communication system, we need to consider t transmitter component, the media component, and the receiver component. In human co munication we cannot ignore the receiver (listening component). Listening skills are a important acquisitions.

Three fundamental laws for effective technical communication apply to the transmitter person doing the communicating: (1) the law of the sixth grader; (2) the law of responsibili and (3) the law of the limit. The law of the sixth grader states that nothing we communic should be so sophisticated or complicated that a grammar school sixth grader, upon hear or seeing it for the first time, would not be able to understand it. The law of responsibi states that the person doing the communicating is completely responsible for making material understandable to the audience. The law of the limit states that there is a limit what can be communicated, absorbed, and digested in a given time interval. By simply tempting to satisfy these three laws, communication skills can show immediate improveme

Often, particularly among entry-level software engineers, it is felt that the more esot the presentation and presentation material, the more vague the objectives and conclusio the more ill-defined the jargon and terminology that is used, the better the presentation this approach, the audience either is intimidated into not asking questions of this appare superior being, begins to think of other things, or simply throws the report away or lea the room. The result is that no positive communication has taken place. The old saw K (Keep it simple, stupid) applies directly to human communication.

It is not always obvious to an entry-level software engineer that the major issues problems confronting software engineers are relatively straightforward, simple, and mund Software developments fail not because of major technology issues but because of the in which these simple issues and problems are handled (or not handled).

A.2 WRITTEN COMMUNICATIONS

Most of the guidelines and suggestions given with regard to written communication app other forms of communication as well. Therefore, when other forms of communication discussed in the following sections, we rely on the guidelines discussed in this section.

As we have heard over and over, a good paper, presentation, essay, etc., is the resu good planning. It has always been emphasized that a good outline is the starting point good paper or document. In preparing, reviewing, and using an outline, an effective pl needed. The outline should be of a type that has proved effective in technical communica and the planning process should go through the following steps:

Step 1. Determine the audience.
Step 2. Set goals and objectives.
Step 3. Review the results of steps 1 and 2.
Step 4. Prepare the outline and create a storyboard.*
Step 5. Review and revise the outline and the storyboard.
Step 6. Expand the storyboard.

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* Storyboards, originally used in making movies and plays, were adapted for use in technical proposals ar mately for use in preparing technical reports, presentations, and memoranda.

A.2.1 Determine the Audience

The approach to preparing the communication will be dictated by the audience (readers). The more knowledge we have about the audience, the better prepared we will be for the communication. A technical presentation given to a nontechnical audience is not effective communication. It also makes no sense to present information to an audience for the purpose of getting a decision or approval when no one in the audience has the authority to make the decision or grant the approval.

In preparing a report or memorandum the organizational level of the audience is important in sizing the document. The executive level needs to have a summary report of one to two pages. The longer the report, the less likely it will be read by the executive. More likely, a long report will be turned over to a subordinate. ''I can't boil this down to two pages; it's too complex'' is often given as an excuse for an overly long report. A good response is, ''Perhaps *you* don't understand it well enough to explain it in one or two pages.'' Similarly, middle-level executives might pay attention to a three- to five-page report while line-level supervision might read a ten- to fifteen-page report. The point is that knowing and understanding the audience is important to effective communication.

A.2.2 Set Goals and Objectives

The second step in the planning process is to decide on objectives. Specifically, what is to be accomplished with this communication? The following are some possible objectives:

a. Inform the audience, in detail, of some event, fact, design, etc.
b. Sell a change to hardware, software, or procedures.
c. Ask for resources (people, funds, etc.).
d. Sell a new idea.
e. Ask for approval of a decision (design, purchase, etc.).
f. Explain why something happened.
g. Head off criticism.
h. Confirm understanding of an issue or problem.
i. Present trade-off study results.
j. Address concerns or rumors.

A.2.3 Review Results of Steps 1 and 2

A quick review of the objectives with an experienced colleague can often save rework, embarrassment, or even the need for producing the communication in the first place. For example, an experienced colleague may know that requests for resources are not handled in the conventional manner in this particular software development culture or that the target audience does not grant the approval that is being requested. The important point is that the audience and the communication objectives are linked and should be carefully thought through and reviewed.

A.2.4 Prepare Outline and Create Storyboard

The outline should follow a standard outlining approach. Table A.1 is a sample outline used for discussion purposes.

The construction of a storyboard is often driven by a prepared template such as the one shown in Table A.2. A filled-in example expanding the outline in Table A.1 is shown in Table A.3. Table A.4 shows the storyboard for one of the subsections (3.4.1.1) subordinate to section 3.4.1. The top of the template is reserved for the section identification, hierarchical relationship, author, section objectives, and a thematic sentence. Table A.5 shows the bottom section of the template. The bottom left-hand side is used to identify headings for subordinate subsections or text describing specific points to be made in the section. The bottom right-hand side is used to describe figures or tables that will be used to support the text. The bottom of the template is used to record the estimated number of pages, tables, figures, and photographs that will appear in the section. One storyboard is filled out for each section. By posting storyboards on a wall in sequence, the reviewer can quickly assess the flow and content of the product and make constructive comments.

Clearly this approach is useful for planning and preparing memoranda, specifications, reports, books, and other documents. The basic idea is to lay out the entire document in terms of theme sentences, important points, etc., for each section, subsection, and paragraph, following the given outline. The theme sentence is followed by a few one-line facts that will be covered in the paragraph. The idea is to make it clear to the reviewer of the storyboard just what is to be covered in each paragraph. Good theme sentences convey the critical information contained in the section or paragraph. Preferably, the sentence will contain quantitative information. Theme sentences should be designed so that, if the reader sees only the theme sentence, the reader will have gotten the main message in that section or subsection. Theme sentences should also be designed to attract the reader's interest.

Some additional theme sentences for subsections of 3.4.1 for the example are given in Table A.5 along with figure or table descriptions. The reader is encouraged to develop a storyboard for each.

An entire section, chapter, or report can be assembled at the storyboard level. The review

■ TABLE A.1   Sample Outline

3.4.1 Software Size Estimation (Two independent methods)
    3.4.1.1 Method 1 description
    3.4.1.2 Method 2 description
    3.4.1.3 Comparison of results
    3.4.1.4 Resolution of differences
    3.4.1.5 Composite estimated range and caveats
3.4.2

■ TABLE A.2   Storyboard Template

SECTION NO. ___ NAME ___ PHONE ___
SUBSECTION TITLE ___
SECTION TITLE ___
SECTION REQUIREMENT ___
THEMATIC SENTENCE ___

HEADINGS: POINTS TO BE MADE UNDER EACH HEADING	ILLUSTRATIONS: GIVE FIG.# HEADING REFERENCES

DOUBLE-SPACE PAGES OF TEXT: ___ FIGURES: ___ TABLES: ___ PHOTOS: ___

COMMENTS, REVISIONS, ETC. ___

■ TABLE A.3   Storyboard Example

SECTION NO. 3.4.1   NAME R. Luciani   PHONE X3955
SUBSECTION TITLE Software Size Estimation
SECTION TITLE Software Development Resource Estimation
SECTION REQUIREMENT Show that our resource estimation for software development is based on a thorough and professional study. Identify areas of risk and provide appropriate caveats. Give confidence limits and justify them.
THEMATIC SENTENCE The 61,000- SLOC sizing estimate (shown in Figure 3.4.1–1) is the result of two independent studies, one conducted by an independent consultant and the other performed by software engineers within our own organization.

HEADINGS: POINTS TO BE MADE UNDER EACH HEADING	ILLUSTRATIONS: GIVE FIG.# HEADING REFERENCES
3.4.1.1 One team used the function point method to make the initial estimates and then converted estimates to SLOC using a conversion factor obtained from our consultant.	Figure 3.4.1–1 SLOC Estimate Summary
3.4.1.2	Module # Low Avg High 1 xxxx xxxx xxxx 2 xxxx xxxx xxxx 3 • • • 4 • • •
3.4.1.3	Confidence Interval dd%

DOUBLE-SPACE PAGES OF TEXT: 2 FIGURES: 1 TABLES: 0 PHOTOS: 0

COMMENTS, REVISIONS, ETC.

■ TABLE A.4   Second Level Storyboard Example

SECTION NO. 3.4.1.1	NAME F. Shepherd	PHONE X3954
SUBSECTION TITLE Function Point Approach		
SECTION TITLE Software Size Estimation		
SECTION REQUIREMENT Justify the use of the function point to SLOC conversion factor. Support with references and rationale.		
THEMATIC SENTENCE Our software engineers used our own version of the function point estimation approach which has been used successfully in 6 prior projects. The conversion factors have also been used in similar estimation studies with success by our consultant.		

HEADINGS: POINTS TO BE MADE UNDER EACH HEADING	ILLUSTRATIONS: GIVE FIG.# HEADING REFERENCES	
1. Modification to function point method includes: a. b. c.	Figure 3.4.1.1-1	
2. Results shown in figure 3.4.1.1-1 are indicative of the quality of the size estimation process.	Project # Estimation Actual 2 cccc nnnn	
	n cccc nnnn Notes:	
DOUBLE-SPACE PAGES OF TEXT 3 FIGURES: 1 TABLES: 0 PHOTOS: 0		
COMMENTS, REVISIONS, ETC.		

■ TABLE A.5   Detail for Bottom Sections of Template

HEADINGS: POINTS TO BE MADE UNDER EACH HEADING	ILLUSTRATIONS:
3.4.1.2 The second team used the conventional divide-and-conquer approach to obtain 57,000 SLOC as an estimate. • Discuss table 3. • Describe touchstones used.	Table (Breakdown of estimates)
3.4.1.3 The results of the two estimates differ by 4000 source lines of code or nearly $400,000 in estimated cost. • List and describe possible reasons for difference. • Describe approach employed to resolve difference.	
3.4.1.4 The major difference was found to reside in the estimate of the size of the real-time adjunct to the operating system. • Describe process used to reestimate this function. Describe confidence limits.	Table (Final breakdown)
3.4.1.5 The estimate presented to senior management was 61,000 source lines of code with the possibility of growth to 68,000. • Explain what drives growth. • Explain how we will track the growth.	Table (Growth drivers)

process is often conducted by posting the storyboard templates on a wall in a large room in the order or sequence in which they appear in the report outline. Reviewers can walk along and review the storyboard for the following features, among others:

■ Continuity and flow
■ Organization
■ Figure significance
■ Topical sentence clarity, validity, and key points
■ Omissions
■ Errors

Reviewers of storyboards are not peers of authors. Typically, they are consultants, senior technical managers from other organizations, etc.

A.2.5   Review and Revise Outline and Storyboard

Being able to view the entire report at this level of detail and from this perspective is very useful for reviewers. Changes can be made at this level to organization, figures, topical sentences, etc., without a major rewriting effort. When the review and revise cycle is complete,

those responsible for converting the storyboards into text and figures have a good plan with which to work. Expansion of storyboards to text will flow smoothly if the storyboarding step has been effective.

The storyboard review just described has many of the attributes of a structured walk-through (discussed in Appendix D). That is, the review

- Requires established entry and exit criteria
- Requires a coordinator and a recorder
- Should not allow ego-related discussions
- Should be based on catching errors early in the development cycle
- Requires that deficiencies be identified (but not fixed) during the review
- Results in storyboard acceptance, acceptance with revision, or rejection (sending authors back to rewrite storyboards with better directions)

The reviewed and approved storyboards provide authors with a detailed plan for writing the report text and producing the figures. There is also a good estimate of the number of pages the end product will contain and the figure-to-text ratio. The value of this approach for large, important technical documents involving many authors can be easily appreciated. However, the approach is equally effective for small, one- or two-author documents and, in fact, often makes the writing process more efficient.

A.2.6 Expand Storyboard

The storyboard is now developed into a first draft by expanding theme sentences into paragraphs. A topical sentence conveys to the reviewer a clear sense of the context and content of the planned section or paragraph. A few points (one or two lines for each) supporting the topical sentence or perhaps referencing the figure on the facing page show the plan for expanding the paragraph. A few points are added to support the topical sentence. Such points may include the following:

- Explain consultant's approach, credentials, etc.
- Explain our approach and credibility.
- Contrast results and explain conclusions.

A.3 ORAL PRESENTATIONS ■

A slightly different approach is taken in developing storyboards for oral presentations. Topical sentences (one to a chart) are used to describe the point that must be made on each chart. For example,

Chart number 10 shows the performance results obtained in acceptance test 6. Use a table or curve to show how much performance falls short of requirements.

Or

Chart number 6 lists the six unresolved issues/problems in the software requirements specification.

In software development much of the communicating is effected by oral presentations or briefings. Advantages of an oral presentation include an immediate and spontaneous impact on the audience and immediate feedback. Questions, concerns, challenges, etc., can be surfaced and dealt with without the delay associated with other communication media. The communicator can use inflection, emphasis, dramatic pauses, asides, and body language to get points across. An oral presentation makes a greater impression than a written report or memorandum. A question-and-answer discussion period allows for immediate feedback. A well-designed and well-delivered presentation results in quicker response to issues, questions, and requests. An oral presentation is often the only contact that junior personnel have with senior technical and management personnel.

A simple time distribution template for a general oral presentation is shown in Table A.6. This template is generally applicable and will fit almost any presentation objective. A planned oral presentation should not exceed an hour. Experience has shown that about 3 minutes, on the average, is spent on each chart. Therefore, a one-hour oral presentation with a 10-minute discussion period should include fifteen or sixteen charts or overheads.

It is important to emphasize that you have asked for an hour of your audience's time. They have planned to give it to you. You have one hour to make your case and get what you want. You cannot rely on the force of your own personality or the efficacy of what you are saying to hold your audience beyond the one hour you asked for.

A.3.1 Making Oral Presentation

One very useful tool in the preparation of an oral presentation is the dry run. A dry run is a rehearsal of the oral presentation before an audience that simulates the real audience. The benefits of the dry run are as follows: (1) the presenter builds confidence in the presentation

■ TABLE A.6   Time Distribution Template for Oral Presentation

1/6 of the presentation should be devoted to the problem statement and work performed to date, if any.

2/3 of the presentation should be devoted to the following:
  a. Summary of an existing system, problem, limitation, etc.
  b. Summary of proposed solutions
  c. Feasibility of proposed solution. Justification, qualification, etc.
  d. Proposed schedule for effecting solution
  e. Questions/discussion

1/6 of the presentation should be devoted to concluding remarks such as the following:
  a. Summary of proposal, request, etc.
  b. Specifically what is requested—dollar amount, schedule relief, approval, etc.

material; (2) many of the questions that are likely to arise in the actual presentation are surfaced in the dry run; (3) annoying presenter mannerisms can be identified and corrected; (4) errors of omission and commission can be corrected; (5) charts can be modified as needed; and (6) the general quality of the presentation can be improved substantially. The dry run is especially important to those who do not make oral presentations frequently or who are newcomers to the field. The dry run is equivalent to the formal review of a report.

The mechanics for developing an oral presentation are similar to those used in preparing any other communication. In particular,

■ Plan the presentation flow carefully to assure that goals and objectives are met.
■ Storyboard the presentation. Try to maintain a 50/50 mix of word charts and graphics.
■ On word charts limit items to six per chart.
■ Use stand-alone phrases on word charts. Design phrases so that they are difficult for the presenter to read to the audience during the actual presentation. The reason is to discourage the presenter from reading the chart to the audience.
■ One item on each chart should be the key point you want the audience to remember. Dwell on this item and allow the audience to read the other items for themselves.

Often the objectives in oral presentations are the same as those for written reports and memoranda. These objectives include the following: (1) to clarify facts, (2) to address concerns or rumors, (3) to sell ideas, (4) to verify conclusions, (5) to sell changes, (6) to ask for approval, (7) to head off criticism, and (8) to report progress.

In conducting the presentation, it is appropriate to dress somewhat formally in suit and tie, etc., even if the dress code in the work place is informal. This attire shows a certain respect for the audience and calls attention to the fact that you view the presentation as a little more important than the normal work activity.

When making the presentation or talk, avoid using ''I'' as much as possible. Maintain eye contact with the audience. Find someone in the audience, preferably at the rear, who seems to respond positively to the presentation; that is a good person with whom to maintain eye contact.

Many people become intimidated when standing before an audience. In the theater it is called stage fright. Some of the best professional actors experience it. One trick that can help to get the presenter off to a good start is to memorize the opening remarks and what is to be said about the first one or two charts. This approach often gets the presenter into the presentation flow. Another artifice is to imagine that everyone in the room is naked except you. However, there is nothing like being thoroughly prepared, knowing what you want to say, having a couple of dry runs under your belt, and believing in what you are doing to overcome stage fright.

The presenter should exhibit confidence and, if he or she does not have the answer to a question, say so and promise to get an answer (and keep the promise). As the advertisement says, ''Never let them see you sweat.'' The presenter is often unaware that little personal mannerisms can detract from the presentation. Dry runs should reduce or eliminate most of these mannerisms. The presenter, however, should become aware of these mannerisms and over time eliminate them. The presenter should anticipate questions and prepare answers. All of us have a tendency to overlook or miss certain things in preparing reports or presentations. Dry runs and reviews help to cover these blind spots. However, it is better that we learn about them ourselves and build a personal checklist that forces us to cover these blind spots ourselves.

A.4   MEETINGS   ■

Meetings consume resources. If eight or ten people spend an hour in a meeting without accomplishing anything, then eight to ten potentially productive labor hours have been lost. Overall, software development productivity can be improved greatly by improving the quality of meetings. Some of the common objectives for calling a meeting are the following:

To solve problems, clarify issues, etc.
To brainstorm solutions to problems
To resolve conflicts
To conduct reviews
To collect and merge facts and data
To report progress
To assign actions
To communicate

The first step in planning a meeting is to define clearly the expected results or outcomes of the meeting. Unless we go into the meeting with a clear idea of what we want to accomplish, it is unlikely that we will accidentally stumble onto anything of value during the course of the meeting.

Once we know the expected outcome of the meeting, the second step in planning a meeting is to find a way to eliminate the need for the meeting. This step may be accomplished by answering the following two questions:

1. Do we really need the outcome of this meeting at this moment?
2. Is there another more efficient and more effective way to accomplish what is to be accomplished by holding this meeting?

If the answer to question 1 is yes and the answer to question 2 is no, then preparation for the meeting should proceed.

The third step in planning a meeting (if it can't be avoided) is to prepare the agenda for the meeting. With a clear idea of meeting objectives in hand, an agenda can now be created. The agenda should have reasonable time allocations for each topic. The agenda should be circulated at least two days before the meeting, if possible. Two days is enough time to allow attendees to prepare for the meeting, comment on the agenda, and make schedule arrangements.

Before distributing the agenda, required meeting attendees should be identified and notified. It is important to have the right people at the meeting. The right people include those with the following:

■ The appropriate information and knowledge to support meeting goals and objectives
■ The authority (direct or delegated) to make decisions and commitments if required by the meeting's goals and objectives
■ The inclination or power to obstruct any decisions or commitments that might be made at the meeting
■ The need to understand what is going on and the rationale behind any decisions or commitments made during the meeting

The fourth step in planning a meeting is to consider meeting location. Meeting quality can be impacted by the physical environment. Room size, lighting, noise, temperature, and humidity can offer distractions. A room too small or a room too large is sometimes a distraction. A noisy meeting environment can distract meeting attendees; a noisy meeting can distract those in the vicinity of the meeting room. A room too hot and humid or too cold can be a further distraction. All of these factors can be overcome by finding a suitable location before the day of the meeting. It is very annoying to spend the first 20 minutes of a meeting correcting meeting environment problems, changing rooms, or making excuses. Similarly, it is important to have considered the need for audio or visual aids or audio and video teleconferencing and to have taken steps to assure that they are there, connected, tested, and in working order before the meeting.

When arranging or conducting a meeting, the proper attitude is always to keep in mind the dollar cost of the meeting. The dollar cost of a meeting is the number of attendees times the length of the meeting in hours times the average labor rate. It is the responsibility of the meeting organizer and conductor to assure that the money is well spent. Meeting conductors may benefit from many personal styles and approaches. Some of the most effective ones are as follows:

1. Start on time. If participants are more than a few minutes late without informing the meeting organizer, cancel the meeting and reschedule. This approach may seem extreme, but it is effective, particularly when the meeting organizer reports that the meeting was canceled and meeting objectives were not met because certain attendees did not appear on time.
2. Record and publish minutes. Emphasis in the minutes should be on decisions made, concurrences and nonconcurrences, action assignments and dates committed for completion, schedule for follow-up meeting, etc.
3. Have handouts ready for distribution at the meeting. Some presenters prefer to withhold presentation material until after the presentation, and some place the handouts on the table before the meeting starts. In any case, it is not a good practice to distribute handouts during the meeting.
4. Review the agenda, meeting goals, and objectives first. Be sure attendees understand where the meeting leader is taking them and what they must accomplish.
5. Discourage interruptions and deflections from the topic at hand. Keep the meeting focused on the agenda and on the goals and objectives. At the same time, allow for free discussion within the framework of the agenda.
6. Follow the agenda schedule as closely as possible. If, because of unforseen issues, problems, etc., it is not possible to follow the agenda schedule, then schedule another meeting to complete the agenda.
7. End the meeting on time. Some attendees may have already scheduled themselves for the time following the meeting.

This approach may seem like a harsh discipline, but to conserve resources and hold high-quality, productive meetings, it is essential. A social scientist might argue that a great deal more goes on in meetings than simply following the agenda and accomplishing meeting objectives. Crisply run disciplined meetings do not preclude normal group dynamics. Technical meetings are not social events. There are meetings whose primary objective is to air grievances, express opinions, exchange views, make announcements, discuss policy, etc. However, these kinds of meetings are not of primary concern in the software development environment. Meetings are essential but very expensive ways to conduct software develop-

ment. The efficiency and quality of meetings can have a very important impact on the cost and quality of the software product.

A.4.1 Brainstorming

A very important meeting type is the brainstorming session. Often a design issue or problem seems insurmountable. No fresh ideas or thoughts have come to the fore. What is needed is some fresh thinking, some creative approaches, something new. Faced with this situation, a brainstorming session often provides the creative impulse to produce some new avenues or solutions.

The brainstorming meeting is unstructured with no apparent agenda. The objective is the production of ideas unfettered by criticism in an unconstrained environment. A moderator creates a relaxed environment conducive to freewheeling idea generation. The brainstorming session moderator is expected to enforce the following rules:

1. No criticism, challenges, evaluations, or judgments are allowed to any of the ideas generated. Only questions of clarification are permitted.
2. Quantity of ideas rather than quality is stressed. The moderator discourages any evaluations, challenges, judgments, etc., that would negate the idea.
3. For each idea generated, the moderator attempts to get the group to suggest improvements and use combinations of different ideas to synthesize additional ideas.
4. The moderator records the ideas on a blackboard, flip chart, or on blank overhead foil. In recording each idea, the moderator asks the group to assist in describing the idea. The group attempts to clarify the idea description and often, as a result, generates new ideas.

It often takes a while to get participants into the spirit of the session. A skilled moderator can often see a linkage between two different ideas that together can offer a fundamentally different and unconventional approach to a knotty problem. The duration of a brainstorming session is usually longer than the duration of a regular meeting. Therefore, the format for a brainstorming session should allow for breaks as mandated by the meeting duration.

A.5 SOFTWARE ENGINEERING NOTEBOOK ■

A good habit for a software engineer to establish is to carry a software engineering notebook. Many organizations make the notebook mandatory for software engineers. The notebook is essentially a technical diary of the software engineer's daily activities. The notebook documents the following:

1. Meetings attended, date, start and stop time, attendees, decisions, actions assigned, dates committed, etc.
2. Important results of studies performed, reviewed, or read about germane to the project or to professional growth including sizing estimates, cost and schedule estimates, new methods or techniques for performing tasks, references, etc. Often pertinent memos, tables, or graphics are stapled to the notebook pages.

3. Assignments along with any dates committed to for completion and the task schedule for carrying out the assignment.
4. The results of any technical work, the rationale behind certain decisions or designs, information collected as part of tasks and sources.
5. Hours worked on a particular task or spent in traveling or training, etc.

The purpose of the notebook, in general, is to keep a record of the technical activities of a software engineer. The notebook is a portable personal file for the software engineer. The notebook can be used when memory fails to pinpoint the when, where, why, and what of a specific meeting held in the past or the results of a study that perhaps was not documented elsewhere. Often this notebook provides a means for a software engineer to record his or her own rules of thumb for estimation factors for development tasks, etc. The greatest value of this notebook, however, is as a source of information when it comes time to prepare formal documents. It is often the only source of information for justifying an approach or solution or a study result. When it is known that the software engineer is using an engineering notebook, those with whom he or she comes into contact will be less likely to be careless with information and data; they know the information and the source are going into a notebook.

A.6 LEARNING HOW TO LISTEN ■

Learning how to be an effective listener can also improve the efficiency of information transfer in personal communication settings. We can all remember the game we played as children in which a message is passed around a circle by initially whispering the message into the ear of the first player just once. The first player then whispers the message they thought they heard into the ear of the next player just once. The message is passed around the circle of players in this fashion until it reaches the last player. Usually there is absolutely no correspondence between the initial message and the final message. The game is an excellent illustration of the problem of verbal communication.

In one-on-one conversations we often have a dynamic in action that involves biases, preconceived notions, prejudices, personal agendas, power, etc. Focusing on the topic and its related facts can reduce or eliminate many of the subliminal effects that often impede good communication. However, even when focusing on just the facts, any or all of the following questions may transpire when a speaker makes a statement to a listener:

What did the speaker mean to say?
What did the speaker actually say?
What did the listener think the speaker said?
What did the listener actually hear the speaker say?
What did the listener think the speaker meant by what he or she said?
What did the speaker think the listener understood?

Clearly, under these circumstances we have what communication engineers would call a noisy channel.

To get the most out of what an individual is saying, one must become an active listener. The objective is to make what the speaker meant to say equivalent to what the listener thought

the speaker meant to say. The following guidelines will help to define an active listener, and following these rules should help to make everyone a more active, attentive listener.

1. An active listener clears his or her mind of everything except the speaker, the topic, and what the speaker is actually saying. The objective is to try to prevent reading more into what the speaker is saying than the speaker is actually saying.
2. An active listener captures, as accurately as possible, the information that the speaker is conveying.
3. An active listener lets the speaker know by actions that he or she is interested in what is being said.
4. An active listener should help the speaker communicate by being sensitive to other communication channels being used by the speaker, such as body language and other cues that support information being communicated.
5. An active listener should ask questions as they arise to clarify points, indicate understanding, and provide feedback to the speaker.
6. An active listener should ask that central ideas, themes, and summaries be repeated to assure complete understanding.
7. An active listener should repeat what he or she understood to be the theme of the speech so that the speaker can critique the understanding of what was said and correct any misunderstandings.
8. An active listener should not attempt to formulate replies, rebuttals, or counterexamples while the speaker is talking.
9. An active listener should focus completely on understanding what the speaker is saying.
10. An active listener shouldn't draw conclusions until he or she has heard the speaker's whole story.
11. An active listener shouldn't be judgmental.
12. An active listener should encourage the speaker to be open and complete.
13. An active listener should provide a nonthreatening environment that makes both speaker and listener comfortable.
14. An active listener shouldn't be afraid to ask if there is anything that he or she hasn't been told, especially when bad news is being communicated.
15. Both parties, the active listener and the effective speaker, should appreciate that understanding is not equivalent to agreeing.

Only after the listener has a clear understanding of what was said and has confirmed that understanding with the speaker is it time for the listener to weave what was said into the fabric of what he or she knows. The objective is to decide if what has been heard is consistent with what the listener already knows and to determine how it fits into his or her existing knowledge structure. If there is a contradiction, it is important to focus on answering the following questions:

Why is there an inconsistency?
Where is the inconsistency, precisely?
When did the inconsistency emerge?
How is the inconsistency manifested?
Who is involved in the inconsistency?
Who may have caused the inconsistency?

It is important at this point to examine what was heard from different perspectives. For example, a software designer might view and interpret a set of facts in a way that is markedly different from the way an analyst might view the same set of facts. It is also important now to examine critically what was heard and, if warranted, develop rebuttles, opposing views, etc. It is also useful to extend what was heard to other situations or environments to see if what was heard still holds.

Being a good listener is a valuable asset. One can learn more efficiently, reduce rework, and become more productive in virtually everything one does by being a good listener. One's own views are better supported because of having a better understanding of the views of others. And finally, one learns how to be a better overall communicator by being a good listener.