

SOFTWARE ENGINEERING



CODE REVIEW

Code Review



Coding

Good software development organizations normally require their programmers to adhere to some well-defined and standard style of coding called coding standards. Most software development organizations formulate their own coding standards that suit them most, and require their engineers to follow these standards rigorously. The purpose of requiring all engineers of an organization to adhere to a standard style of coding is the following:

- A coding standard gives a uniform appearance to the codes written by different engineers.
- It enhances code understanding.
- It encourages good programming practices.

A coding standard lists several rules to be followed during coding, such as the way variables are to be named, the way the code is to be laid out, error return conventions, etc.

Coding standards and guidelines

Good software development organizations usually develop their own coding standards and guidelines depending on what best suits their organization and the type of products they develop.

The following are some representative coding standards.

Rules for limiting the use of global: These rules list what types of data can be declared global and what cannot.

Contents of the headers preceding codes for different modules: The information contained in the headers of different modules should be standard for an organization. The exact format in which the header information is organized in the header can also be specified. The following are some standard header data:

- Name of the module.
- Date on which the module was created.
- Author's name.
- Modification history.
- Synopsis of the module.
- Different functions supported, along with their input/output parameters.
- Global variables accessed/modified by the module.

Naming conventions for global variables, local variables, and constant identifiers: A possible naming convention can be that global variable names always start with a capital letter, local variable names are made of small letters, and constant names are always capital letters.

Error return conventions and exception handling mechanisms: The way error conditions are reported by different functions in a program are handled should be standard within an organization. For example, different functions while encountering an error condition should either return a 0 or 1 consistently.

The following are some representative coding guidelines recommended by many software development organizations.

Do not use a coding style that is too clever or too difficult to understand: Code should be easy to understand. Many inexperienced engineers actually take pride in writing cryptic and incomprehensible code. Clever coding can obscure meaning of the code and hamper understanding. It also makes maintenance difficult.

Avoid obscure side effects: The side effects of a function call include modification of parameters passed by reference, modification of global variables, and I/O operations. An obscure side effect is one that is not obvious from a casual examination of the code. Obscure side effects make it difficult to understand a piece of code. For example, if a global variable is changed obscurely in a called module or some file I/O is performed which is difficult to infer from the function's name and header information, it becomes difficult for anybody trying to understand the code.

Do not use an identifier for multiple purposes: Programmers often use the same identifier to denote several temporary entities. For example, some

programmers use a temporary loop variable for computing and a storing the final result. The rationale that is usually given by these programmers for such multiple uses of variables is memory efficiency, e.g. three variables use up three memory locations, whereas the same variable used in three different ways uses just one memory location. However, there are several things wrong with this approach and hence should be avoided. Some of the problems caused by use of variables for multiple purposes as follows:

- Each variable should be given a descriptive name indicating its purpose. This is not possible if an identifier is used for multiple purposes. Use of a variable for multiple purposes can lead to confusion and make it difficult for somebody trying to read and understand the code.
- Use of variables for multiple purposes usually makes future enhancements more difficult.

The code should be well-documented: As a rule of thumb, there must be at least one comment line on the average for every three-source line.

The length of any function should not exceed 10 source lines: A function that is very lengthy is usually very difficult to understand as it probably carries out many different functions. For the same reason, lengthy functions are likely to have disproportionately larger number of bugs.

Do not use goto statements: Use of goto statements makes a program unstructured and makes it very difficult to understand.

Code review

Code review for a model is carried out after the module is successfully compiled and the all the syntax errors have been eliminated. Code reviews are extremely cost-effective strategies for reduction in coding errors and to produce high quality code. Normally, two types of reviews are carried out on the code of a module. These two types code review techniques are code inspection and code walk through.

Code Walk Throughs

Code walk through is an informal code analysis technique. In this technique, after a module has been coded, successfully compiled and all syntax errors eliminated. A few members of the development team are given the code few days before the walk through meeting to read and understand code. Each member selects some test cases and simulates execution of the code by hand (i.e. trace execution through each statement and function execution). The main objectives of the walk through are to discover the algorithmic and logical errors in the code. The members note down their findings to discuss these in a walk through meeting where the coder of the module is present.

Even though a code walk through is an informal analysis technique, several guidelines have evolved over the years for making this naïve but useful analysis technique more effective. Of course, these guidelines are based on personal experience, common sense, and several subjective factors. Therefore, these guidelines should be considered as examples rather than accepted as rules to be applied dogmatically. Some of these guidelines are the following.

- The team performing code walk through should not be either too big or too small. Ideally, it should consist of between three to seven members.
- Discussion should focus on discovery of errors and not on how to fix the discovered errors.
- In order to foster cooperation and to avoid the feeling among engineers that they are being evaluated in the code walk through meeting, managers should not attend the walk through meetings.

Code Inspection

In contrast to code walk through, the aim of code inspection is to discover some common types of errors caused due to oversight and improper programming. In other words, during code inspection the code is examined for the presence of certain kinds of errors, in contrast to the hand simulation of code execution done in code walk throughs. For instance, consider the classical error of writing a procedure that modifies a formal parameter while the calling routine calls that procedure with a constant actual parameter. It is more likely that such an error will be discovered by looking for these kinds of mistakes in the code, rather than by simply hand simulating execution of the procedure. In addition to the commonly made errors, adherence to coding standards is also checked during code inspection. Good software development companies collect statistics regarding different types of errors commonly committed by their engineers and identify the type of errors most frequently committed. Such a list of commonly committed errors can be used during code inspection to look out for possible errors.

Following is a list of some classical programming errors which can be checked during code inspection:

- Use of uninitialized variables.
- Jumps into loops.
- Nonterminating loops.
- Incompatible assignments.
- Array indices out of bounds.
- Improper storage allocation and deallocation.

- Mismatches between actual and formal parameter in procedure calls.
- Use of incorrect logical operators or incorrect precedence among operators.
- Improper modification of loop variables.
- Comparison of equally of floating point variables, etc.