

Normally the first step in debugging is to attempt to reproduce the problem. Programmable devices have existed for centuries. Many programmers use forms of Agile software development where the various stages of formal software development are more integrated together into short cycles that take a few weeks rather than years. Scripting and breakpointing is also part of this process. The following properties are among the most important: In computer programming, readability refers to the ease with which a human reader can comprehend the purpose, control flow, and operation of source code. Programs were mostly entered using punched cards or paper tape. Proficient programming usually requires expertise in several different subjects, including knowledge of the application domain, details of programming languages and generic code libraries, specialized algorithms, and formal logic. Expert programmers are familiar with a variety of well-established algorithms and their respective complexities and use this knowledge to choose algorithms that are best suited to the circumstances. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability. FORTRAN, the first widely used high-level language to have a functional implementation, came out in 1957, and many other languages were soon developed—in particular, COBOL aimed at commercial data processing, and Lisp for computer research. Also, specific user environment and usage history can make it difficult to reproduce the problem. A study found that a few simple readability transformations made code shorter and drastically reduced the time to understand it. High-level languages made the process of developing a program simpler and more understandable, and less bound to the underlying hardware. Assembly languages were soon developed that let the programmer specify instruction in a text format (e.g., ADD X, TOTAL), with abbreviations for each operation code and meaningful names for specifying addresses. Sometimes software development is known as software engineering, especially when it employs formal methods or follows an engineering design process. Popular modeling techniques include Object-Oriented Analysis and Design (OOAD) and Model-Driven Architecture (MDA). They are the building blocks for all software, from the simplest applications to the most sophisticated ones. Debugging is often done with IDEs. Standalone debuggers like GDB are also used, and these often provide less of a visual environment, usually using a command line. Assembly languages were soon developed that let the programmer specify instruction in a text format (e.g., ADD X, TOTAL), with abbreviations for each operation code and meaningful names for specifying addresses. Integrated development environments (IDEs) aim to integrate all such help. Techniques like Code refactoring can enhance readability. Machine code was the language of early programs, written in the instruction set of the particular machine, often in binary notation. Expert programmers are familiar with a variety of well-established algorithms and their respective complexities and use this knowledge to choose algorithms that are best suited to the circumstances. Integrated development environments (IDEs) aim to integrate all such help. Many factors, having little or nothing to do with the ability of the computer to efficiently compile and execute the code, contribute to readability.