Software Supportability Analysis

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Abstract. In order to improve the support ability of software, we must consider the supportability of software in every stage of the whole life cycle of software, and software supportability analysis is an important means and the basis for realizing the goal of software support. It is also an important support to ensure and reduce the cost of software. This paper introduces the task, characteristics and influencing factors of software supportability analysis, and analyzes the supportability of each stage of software life cycle.

1. Introduction
Software supportability is defined as a set of software design attributes, related development tools and methods, and environmental infrastructure to enable software support activities to be completed. From the above definition of software supportability, it can be seen that software supportability is a measure of the ability of software support system to meet the needs of users[1].

Almost all software undergo varying degrees and frequencies of change after initial deployment, with the aim of correcting software errors, improving environmental adaptability or developing new features. The workload of modifying software is affected by the software development process, product characteristics and its supported resources. Software supportability should be considered throughout the software life cycle, from design to development, deployment and use.

Software supportability analysis is an important part of software life cycle and an important analytical tool to achieve the goal of software support. By using the theory and technology of comprehensive support and software engineering in the stage of software development and use, it helps to clarify the requirements of software supportability, optimize the process of software development, and determine the requirements of software support resources.

At present, most of the comprehensive support activities are aimed at hardware, and software as an important part of the whole system, software supportability analysis is also an indispensable part of the system engineering[2].

2. Process of Software Supportability Analysis
Through repeated demonstration, synthesis, trade-off, experiment and evaluation, the software supportability analysis determines the best support requirement between the software design and the support system, which helps to influence the design and development of the software, and provides the required support with the lowest cost and manpower in the use stage.
Software supportability is a multi-factor comprehensive design characteristic, and software supportability analysis is also a comprehensive analysis method. It can support the design of software supportability by integrating software maintainability and software reliability. Software supportability related auxiliary analysis includes software maintainability analysis, software failure mode and impact analysis, software maintenance support level analysis, software support cost analysis, software equipment and facility requirements analysis, etc.[3-5].

Software supportability analysis runs through every stage of software life cycle and is an effective system engineering process for software supportability design. Software supportability analysis is an iterative and orderly process adapted to the development of software. The emphasis of software supportability analysis is in the stage of software development, and the supportability analysis can be integrated into the activities of making software supportability requirements, formulating support schemes and determining software support resources.

The general process of software supportability analysis is shown in Figure 1.

![Figure 1. The general process of software supportability analysis](image)

### Tasks and Characteristics of Software Supportability Analysis

Software supportability analysis is an important part of software life cycle and an important analysis tool to achieve the goal of software support. By using the theory and technology of comprehensive support and software engineering in the stage of software development and use, it clarifies the requirements of software supportability, optimizes the process of software development, and determines the requirements of software support resources.

By analyzing the general process of software supportability in Figure 1, combined with the software development cycle, we can give the flow of software supportability analysis as shown in Figure 2.

As we can see from Figure 2, the main tasks of software supportability analysis can be summarized as follows:

- Determine the supportability requirements for each stage of the software life cycle.
- Development and optimization of software support scheme.
- Determine software support resource requirements.
- Estimation of software support costs.
- Evaluation of software supportability.

There are two essential differences between software and hardware:

- **Software won't be broken.** After the hardware is used to a certain extent, there are wear and aging problems, but the software does not exist this problem, as long as the software does not change, always maintain the state after development.
- **Software problems have a great impact.** A hardware failure affects only one unit to which it belongs, while a software problem affects all units that deploy the software.

Therefore, the supportability analysis of software should not only consider the general requirements of comprehensive support, but also consider the particularity of software. To sum up, software supportability analysis has the following characteristics:

- Software supportability analysis through planning support to optimize the software development process.
- Software supportability analysis is an iterative process.
Software supportability analysis should apply the theory and technology of comprehensive support, software engineering and software testing.

![Diagram of specific process of software supportability analysis]

**Figure 2. Specific process of software supportability analysis**

### 4. Factors Affecting Software Supportability

The main factors affecting software supportability are the characteristics of software products, that is, the properties of software itself, the development process of software and the resources of software support. Specifically, there are the following nine factors:

- **Change traffic.** Changing traffic is a complex function of requirement stability, software integrity and system usage. Changing traffic will affect the task quantity of software support, and changing traffic will require more software modification work.

- **Expansion.** Extension ability is an attribute related to system design, and insufficient extension ability may limit the scope of software modification and have an important impact on the cost of modification.

- **System number and deployment location.** The number and distribution of the system will have a great impact on the cost of support, but also affect the formulation of software support requirements and software support workload. It also affects the distribution of software support facilities.

- **Modularization.** Modularization facilitates the implementation of software support, and the poor degree of modularization usually leads to an increase in the cost of modification, as other parts of the software need to be modified accordingly.

- **Software scale.** The size of the software has an impact on change traffic, in addition to the amount of resources required to make changes.

- **Confidentiality.** The secret level of data, executable code and documents may impose restrictions and requirements on software support activities, as well as special processing requirements on the system. These effects will limit the use of software and put forward
corresponding requirements for design, thus requiring special software support tasks and equipment. For any system, high-security software should be physically isolated from other software in the system.

- Personnel skills. The software modification needs the personnel who have the corresponding software engineering skill to complete, the software personnel skill level can not reach the request will affect the software support realization, at the same time, the stipulation skill also will have the influence to the training request.

- Standardization. Software development processes and related software documentation to meet standardization requirements can reduce the variety of tools, skills and facilities required and help improve software supportability.

- Documentation. Documentation refers to all records, including electronic and paper records, i.e. requirements, design, implementation, testing and using documents related to software products. Documentation is the main factor affecting software supportability.

5. Supportability Analysis of Software Life Cycle Stages
Software supportability analysis is a iterative process. According to the main task of software supportability analysis, software supportability analysis involves all stages of software life cycle. In all stages of software life cycle, software supportability analysis should be carried out in order to achieve the goal of software support.

- Supportability analysis of software requirements analysis stage. The software requirement analysis stage mainly determines what work the system must accomplish, that is, to put forward the complete, accurate, clear and specific requirements to the target system. It is necessary to describe the function and performance of the software, determine the constraints of the software design and the interface details between the software and other system elements, and define other validity requirements of the software. At this stage, it is necessary to determine the requirements of scientific, reasonable and coordinated matching software supportability.

- Supportability analysis of software design stage. In the stage of software design, the software supportability requirement is further demonstrated from the technical feasibility to ensure the implementation of the supportability requirement.

- Supportability analysis of software implementation and testing stage. In the stage of software realization and testing, the work of supportability analysis includes the determination and optimization of software support scheme, the determination of support resource demand, the evaluation of supportability, etc. According to the clear support plan, the resources needed to implement the software support are clearly defined, including human resources, equipment and facilities, support expenses, etc.

- Supportability analysis of software deployment and operation stage. In order to truly reflect the supportability level of the software, it is necessary to evaluate the supportability in the actual use environment after the software deployment and operation.

6. Conclusion
Software support is an important stage of software life cycle, which takes a lot of time and money. In the stage of software development, improving the supportability of software will undoubtedly help to reduce the support cost and improve the support efficiency. There are many factors that affect software supportability. It is important that software development follow software engineering specifications, such as following development models, designing modules reasonably, perfecting development documents, etc., and standardizing the development process according to software engineering requirements. Naturally, the supportability of software will be improved. In addition, in different stages of the software life cycle, including requirements analysis, design, implementation and testing, and deployment and application stages, the corresponding supportability analysis can be carried out in
order to put forward appropriate supportability requirements, and to improve the software supportability as much as possible, so as to facilitate future software support.

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