

The Research of Software Support in Command and Control System

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Abstract. The meaning of software support and its all actions are expounded in this paper. And software support is classified to three classes. The model of software support is built. The Software Supportability and its affected factors are discussed. The software support problem and its solution methods of command and control system are discussed in this paper.

SUMMARY OF SOFTWARE SUPPORT

As an important part of information equipments, software support is very different from the traditional hardware support. Here, we give the definition of software support: software support is activities which ensure the software in using continuously and completely support performing tasks.

All activities include the technical and management activities, the technical activities mainly include fault diagnosis, software modification, software testing, installation and other activities. The management activities mainly include support planning, personnel exercitation and training, establishment of security system, setting support agency and other activities.

SOFTWARE SUPPORT CLASSIFICATION

A. Using Support

Using support, which means the support activities to ensure correctly software using, the support activities are shown in Table 1.

TABLE I. ACTIONS OF USING SUPPORT

| Activities | Detailed content |
|---|---|
| Software loading and setting | Mission data loading, parameter settings, etc. |
| Software operating environment optimization | Defragment, clean up junk files, etc. |
| Software Backup and Recovery | System Cloning, critical data backup, disaster recovery, etc. |
| Training and technical direction | Operator training, problem reports and other treatments |

B. Maintenance Support

Maintenance support, which refers to carrying out the modify activities for resolving software problems, the support activities are shown in Table 2.

TABLE II. ACTIONS OF MAINTENANCE SUPPORT

| Activities | Detailed content |
|------------------------|---|
| Fault Correction | Correction requirements, design, coding errors |
| Environment adaptation | Operation system changing, chip upgrade to modify the software |
| Software consummation | New mission requirements, performance requirements to modify the software |

C. Supply Support

Supply support, which refers to carrying out the support activities for supplying software, the support activities are shown in Table 3.

TABLE III. ACTIONS OF SUPPLY SUPPORT

| Activities | Detailed content |
|--------------|--|
| Copy | Floppy disks, CD-ROM, hard disk copy, etc. |
| Distribution | Network distribution, confidential distribution |
| Installation | Single machine installation, network installation, embedded systems installation, etc. |

SOFTWARE SUPPORT MODEL

The system theory suggests that each thing can be regarded as a system; therefore, software support can also be researched as a system. At the same time, model is an abstraction of the system, which explains the system being modeled in some level of abstraction from a certain point of view. Model may include a detailed plan or an overall plan of the system from a very high level. Model can be structural emphasizing the systematic organization and behavioral emphasizing the dynamic aspects of the system. A good model should include the main elements with widespread influence and ignore those irrelevant minor elements to facilitate the research of complex problems. The essence of software support model is the abstraction of software support process.

Reference to the "Hall model" in systems engineering, we can model the software support, as shown in Fig. 2.

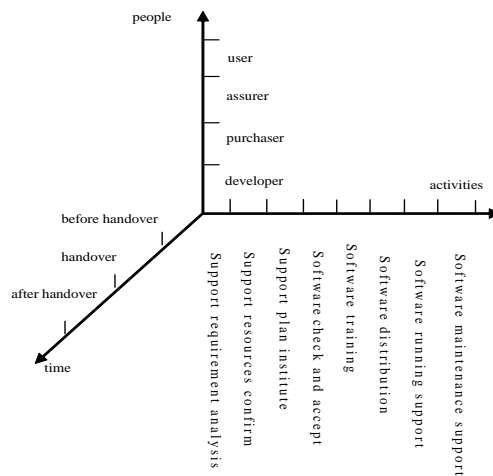


Figure 1. Three dimension structure models of software support

D. Time Dimention

The time dimension mainly related to the generated order of all types of software support activities. In the software support model, the software support activities are divided into three stages. They are before handover support, handover support, after handover support, the main activities of each stage can respectively adopt the process model, handover model, the operation and maintenance model.

E. People Dimention

The people dimension mainly describes the participants of the software support. In general, the participants of the software support include software developers, purchasers, supporters and software users. As the difference forms of software support organizations, software support can be organized by the developers or organized by an independent software support organization. In order to ensure the smooth development of software support, in a general way it needs to establish an independent software support organization. The three dimension structure model of software

support described in Fig. 2 is based on this premise Equations.

F. Activity Dimention

The activity dimension describes the support activities in the software support process. The main activities are as bellows:

Support requirements analysis; support resources confirm; support plan establish; software check and accept; software training; software distribution; software running support; software maintenance support. The sequential relationships of these support activities are shown in Fig. 3.

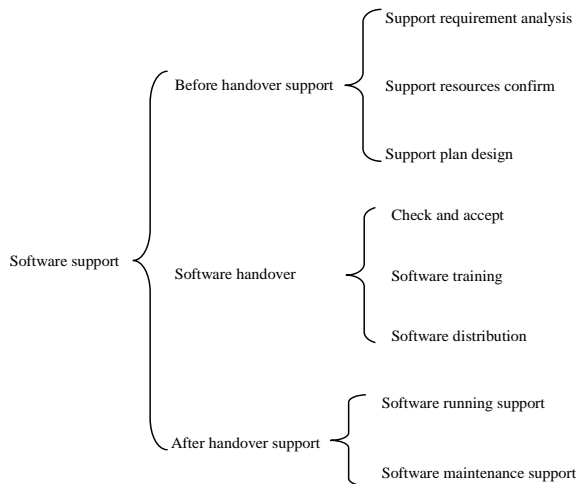


Figure 2. Software support activities

In a word, the three dimension software support model explains the phase division of software activities, participants and the activities in each stage.

SOFTWARE SUPPORTability and ITS INFLUENCE FACTORS

Software supportability is a highly integrated concept, the performance of supportability is good or not depending on composite all relevant design characteristics and all the supportability factors. When research the software supportability, the software and the support resource should not be separated. Moreover, the integrative research methods should be adopted, the difference and connection between the supportability and related factors should also be researched.

Software supportability refers to software design characteristics and the ability of arranged support resources which content the support requirements.

G. Influence Factors

Software supportability is a highly integrated concept; software supportability is influenced by multiple factors including: the software design characteristics, the software support resources, software life cycle process management etc. The analysis of specific factors is shown in Fig. 4.

The factors in figure 4 can be divided into three levels, the software supportability is the highest level, the second level are some rules of software supportability measurement which include the software design characteristics, software support resources, process of software life cycle; the third level is the main factors analysis for the second level.

External using characteristics mainly include man-machine interface friendly or not; copy distribution and installation way; the task data loading method etc.

Internal quality characteristics mainly include software modularization, complexity, expansibility, testability; integrity, consistency of document and data;

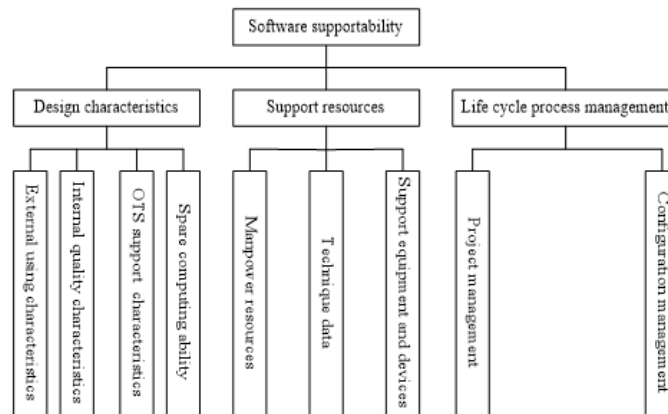


Figure 3. Influence factors of software supportability

OTS quality characteristics refer to the compatibility, authorized agreement, early support strategy which are the external interface characteristics essentially.

Spare computing ability refers to time allocation, capacity adjustment etc.

Human resources refer to the categories of personnel, technical level, responsibilities and quantity.

Technical documents refer to software development documents, maintenance manuals, demonstration and teaching software, training manuals etc.

Support equipments and establishments are divided into development tools, the supplement tools, technical support, such as configuration management tools, testing tools, diagnostic tools; the working establishments include personal living establishments, housing, water, electricity ,gas and central heating.

Software life cycle process management is a combination of related strategies, methods, processes and guides which guide software development and support in software environment. The main related management activities of software support include: software project management and software configuration management.

Project management mainly includes macro- programming, organization structure, stage partition, process implementation, checking and acceptance strategy.

Configuration management includes version control, change control, process support. It means providing the right software to the users at right time, right place. Good configuration management is an important guarantee of software supportability.

H. Software Supportability Analysis

Software supportability analysis (SSA) is application of Logistic supportability analysis (LSA) in software. SSA is an analysis technique to analyze the software supportability of equipment. As SSA is a part of supportability analysis, it is mainly used to analyze the software support significant stems (SSSI).

SSA contains all the activities which can make sure the sustainable using of system software. SSA can be divided into several major stages which is shown in Fig. 5: early activity, software supportability analysis, software support resources requirement, software support planning, these processes should be tailored to the specific circumstances.

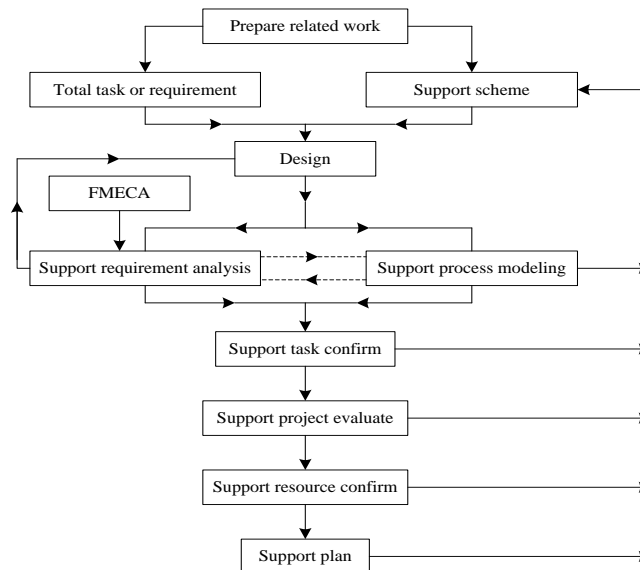


Figure 4. Ordinary process of SSA

Implement of Software Support in Command and Control system

As the Command and Control system are informational equipments with dense soft wares, the core functions of the Command and Control system are based on many application soft wares. During the process of software support, the problem of the system such as operation characteristic, security characteristic, the organization forms of software modules, implementation characteristic, configuration flexibility and rational conflicts should be fully considered.

I. Auto Configuration and TestingTools for Station Software

The automatic configuration contents of the computer software for each seat include environment variables, network configuration, environment (including the aerial defense components installation, integrated components installation, MO environment installation, WEB environment installation, OFFICE installation, database configuration, etc.), such as: IP address configuration, the environment variable configuration, integration component module system configuration; deployment package configuration, seat and its unit locations and other configurations.

For all devices such as the gateways of the system, their configurations are stored in a database or the configuration files. The address of gateway is automatically detected, then user can configure the gateway according to the suggestive information.

The gateway configuration includes the configurations of network ports, IP addresses, serial port rates, serial port number information. As software is the friendly interface of man-machine, it automatically sends the stored configuration file of the gateway to the gateway according to site of the gateway.

The site configuration checking tool checks all the configurations of the system. If the configuration is incorrect or conflicting, then suggestive information will be provided for the user.

J. Automatically Checking and Recovery Tools for Site Software

Firstly, check the installation of all the modules of the general information processing platform according to the pre-stored correct configuration. Secondly, check the correctness and completeness of the files in each module.

For each detected file, its corresponding profile information is the stored information which stores its correct attributes of the file. The completeness and correctness of the document were detected mainly based on the information of stored files which includes: file creation date, file size, file version number, MD5 value. In order to make good use of the checking time, the checking is divided into primary checking and advanced checking. The primary checking mainly checks simple properties such as: date, size, versions. The advanced checking uses the MD5 algorithm or Diff

algorithm for further examination.

The automatic checking and recovery contents of site software mainly include the correctness and completeness checking of software on each site, the correctness checking of database, routine maintenance of the site such as log file maintenance.

K. Environment of Software Running Simulation and Software Function Verification

The environment of software running simulation provides input and output information of software components and site. User can verify and debug the functions of the components and site in the software environment. The simulation environment can be divided into integrated software running simulation environment, simulation environment for specific system software components running, site software running simulation environment based on the software structure of command system.

The software running simulation environment provides a friendly man-machine interface. The interface is convenient to verification and testing all of the functions of each software module for software support people.

The single device software function verification tool mainly provides input and output signals for single device. The control and function of single device are verified in accordance with its software interface and communication protocols, and find the fault location in the hardware or software systems.

L. Special programmer

The basic components of special programmer include: the CPU control panel, the programming control panel, the programming interface board, LCD display, keyboard / mouse.

The programming control panel not only meets the need of offline programming the programmable chip, but also provides the programming interfaces and connects the programming control panel via interface and programming interface board.

Each programmable chip has its own programming algorithms; there are some differences among different programming algorithms. The programming control panel energized the chip pin of programming panel according to the microcontroller. According to the information of programming algorithm and programming data, the microcontroller produces the sequence of programming instruction and controls its external circuit to generate working sequence of the programming algorithm, and then complete the chip programming, reading, erasing and other operations.

With flexible PIN driver, we can get accurate waveforms and achieve speed programming, over current protection, anti-plug detection and the function of self-test by connecting the USB interface to the CPU control board.

Acknowledgment

With the development of command information systems, not only the size of software is increasing, but also the structure of software is become more and more complex. So software flaws and imperfections are increasingly difficult to avoid. How to find and solve these flaws and imperfect factors with maximum efficiency during the command information system performs its tasks is an important factor that affects the command information systems performing its combat effects.

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