

**PLANNING COMPUTER MAINTENANCE PROGRAM  
TO MEET YOUR NEEDS**

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**INTRODUCTION**

Today, computers touch nearly every aspect of our business. It is increasingly important that we safeguard the data contained in them. Loss of a single file can mean thousands of wasted dollars spent on recovery, not to mention the priceless nature of data that might be lost forever.

If you own or manage a computer center, you or your company would have already spent thousands of dollars on hardware equipment, data storage media and systems or applications software. However, to ensure a successful operation, one very important step must be taken. That step is the development of a comprehensive computer maintenance program for your facility.

This paper covers various aspects of computer maintenance that every systems manager should know about.

I will first outline the various maintenance requirements throughout the "life cycle" of a computer system and the cost implications of these components. I will discuss how to choose a computer systems maintenance program for both ongoing hardware and software support. I will also cover the financial analysis for computer maintenance. Lastly, I will discuss some future trends in computer maintenance systems.

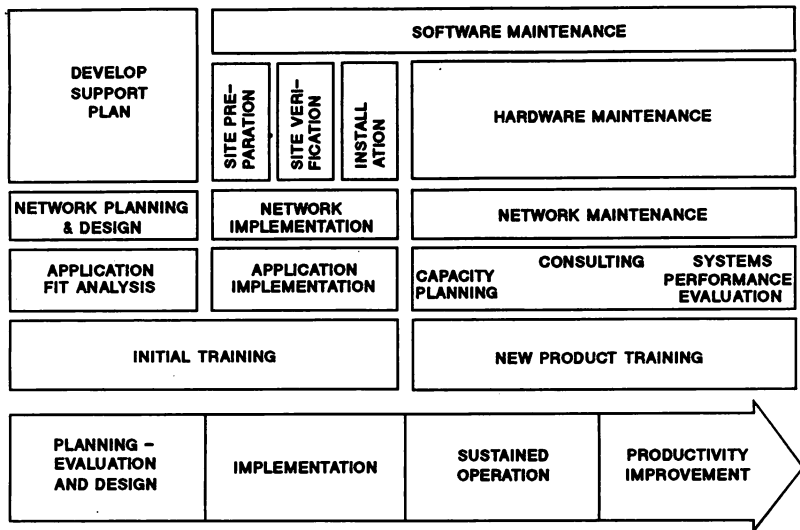
**SYSTEM SUPPORT LIFE CYCLE**

When one talks about computer maintenance, the first thing that comes to mind is hardware or software maintenance. In actual fact, there are other maintenance needs throughout the life cycle of a computer system implementation.

First, let's look at the process of implementing solutions for an organization. There are three phases involved:

- 1 Planning,
- 2 Implementing and
- 3 Operating.

# PLANNING FOR YOUR SUCCESS: LAYING THE GROUND WORK



The planning phase entails designing and evaluating end-user systems needs, training, manpower planning and developing a system support maintenance plan, among others.

In the implementation phase, some of the key activities include system implementation and installation and end-user training.

On an ongoing basis, the operation would have to be maintained, fine-tuned and, in many cases, expanded to cater for changing business needs.

In each of these phases, there are associated maintenance requirements.

## \* Evaluation and Design Phase

During the initial phase of analysis and recommendation, you may want to rely on the training programs or consulting services to select the type of system that best suit your needs. These consulting services may also help define system requirements and software needs. They will facilitate the transition to a new system.

In the area of application, time may be needed to perform application fit analysis. At this stage, a decision would have to be made to determine whether the application requirements are going to be satisfied with an off-the-shelf package or in-house development. If the solution is in the application software package, the level of extra development effort required will have to be determined.

In the area of networks, planning and design take place. You need to select the best network strategy to support your business objectives. All data flow across multiple systems are analyzed and a detailed network design plan could then be determined. This early planning in your network life cycle ensures future flexibility, cost savings and a higher probability of success in implementing the network within your organization.

Developing a support plan for hardware and software maintenance is necessary to ensure that financial resources are dedicated for the right purpose. This support plan should reflect the organizational support needs in the areas of software and hardware maintenance. The criteria should also be made clear to facilitate the objective in selecting a system maintenance contract.

#### \* Implementation Phase

Here, there are several specialized services to help put your implementation plan into action. Some of these services include site planning and preparation, verification and system installation.

In network implementation, the site preparation includes the installation, verification and testing of the necessary data communications and line equipment. This is followed by the execution of the network implementation plan devised in the design phase.

#### \* The Operating Phase

Hardware and software maintenance services provided by the vendor are necessary to ensure the continued and smooth operation of the system. The user can be classified into two categories. In one category, the user essentially maintains status quo after installation. In the other category, the user will plan for expansion. The latter, of course, requires more effort. New product training would be desirable to keep up with the latest technology of the vendor

or vendors. It is essential in the planning for expansion. Capacity planning is usually a good practice to manage the system requirements on a pro-active basis.

The overall picture we are seeing is a complex one. Overall system maintenance requires careful planning. Not only must the support requirements be taken into consideration, so must the cost be evaluated. The trade-off between cost and support level will have to be managed.

#### COMPONENTS OF COMPUTER SYSTEM MAINTENANCE COSTS

In looking at the maintenance costs for a computer system, there are several components. System costs are usually the most visible of the capital costs. This is only but the tip the iceberg. Some of the other costs are hidden which should be clearly spelled out. The user should be aware of them. The "hidden costs" usually represent between 50% to 130% of the total hardware costs. These "hidden costs" may include:

- 1 Software costs,
- 2 Training costs,
- 3 Site Installation and Preparation costs and
- 4 System Maintenance costs.

Consultancy services may not necessarily be included as part of the system acquisition costs.

The details of the cost components are as follows:

##### 1 Software Costs

Software costs vary immensely with the system type and application. Mainframe applications software tend to be more costly than those on minicomputers, for example. Software costs can sometimes range up to 100% of the total system cost. There are two categories of software cost:

- a) Application development cost and
- b) Maintenance costs.

Application development software can be further divided into two types. They are off-the-shelf packages or in-house developed software. What is hidden in off-the-shelf packages may include the programmers' time to customize them to suit the end-user requirements. In-house software development involves the purchase of

compilers and time to develop the applications. There is the additional factor of system analysis time which is not included anywhere else in the costing exercise. This cost can usually be fairly substantial.

Application maintenance is usually required from software supplier to cater for upgrades and enhancements. Program maintenance would be needed for customized packages and the software developed in-house. An additional item which can contribute to higher costs is the maintenance of the operating system.

## 2 Training Costs

Training is essential for the successful implementation of a computer system. This usually accounts for 5 to 10% of the total system cost. Initial training comes in the form of new product training to familiarize the users with the features of the new software and hardware. Only with a clear understanding of the system capabilities and limitations could one exploit the system to its fullest. In HP's terms, this would be translated into courses like Programmers' Introduction, Systems Manager and Operation.

On an ongoing basis, further education increases the productivity of the MIS staff. This usually comes in the form of more advanced courses. What in-depth knowledge really means is that the system can be further exploited to service the end-users. In addition, an MIS department should always cater for attrition.

## 3 Site Preparation and Installation Costs

In many cases, one factor which is often forgotten is the site preparation cost. Site preparation costs include the time your hardware engineer spends verifying and planning for your machine. It may in some cases include a designer fee to plan for the computer space, air-conditioning, electrical and other environmental requirements. Site preparation costs are borne by the customers to ensure that the specifications are met to cater for the computer system. With many vendors, site planning, verification and installation are usually included in the system cost. Site preparation costs typically run between 2 to 10 % of the total system costs.

#### 4 System Maintenance Costs

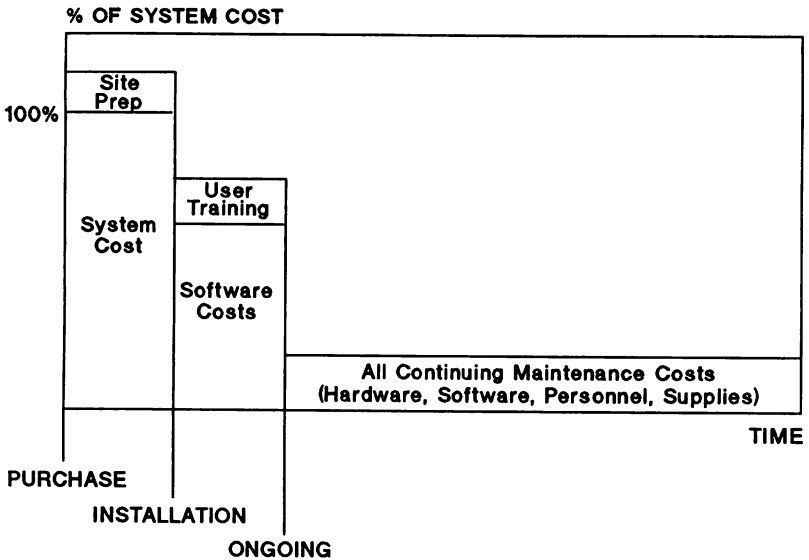
System maintenance costs, however, run between 10% to 20% of the system costs per year. It is a recurring cost necessary to maintain a highly available system. System maintenance can be broken into three components, i.e. hardware and software maintenance and consumables. Hardware maintenance costs typically ranges from 5% to 9% per annum. This, of course, is dependent on the system availability requirements and hardware configuration. Software maintenance costs also vary with the software type and level of support service. Computer consumables cost depends on the usage of the peripherals like magnetic tape, disc drives and printer.

On an overall basis, one can see that the cost components of the total system vary greatly. The total solution cost in the first year, if we include all the hidden costs, would be about 37% to 140% more than the system cost. The total costs can be broken down into capital expenses and recurring expenses:

<u>Category</u>	<u>% of Total System Cost</u>	<u>Cost Type</u>	
		<u>Capital</u>	<u>Recurring</u>
System costs	100	X	
Software Costs	20 - 100	X	X
User Training Costs	5 - 10		X
Site Preparation Cost	2 - 10	X	
System Maintenance Costs	10 - 20		X
<hr/>			
Total Solution Cost	137 - 240% (of system cost).		

Obviously, not all the total solution costs are incurred at the same time. Typically, the organization will incur the system costs and site preparation cost at the point of purchase, and software and user training costs during installation. All maintenance for hardware, system and application software, personnel and consumables are incurred on an ongoing basis.

# COST FLOW TIMING ANALYSIS



To summarize what we have discussed so far, good planning and a balanced investment are needed to ensure that the system is utilized optimally with well-trained MIS staff and satisfied users.

## COMPUTER SYSTEM MAINTENANCE PROGRAM SELECTION CRITERIA

Selecting a maintenance program requires some careful thoughts in order to ensure the right support services meet the needs of the organization. The bottom line, of course, is price/performance.

Before we delve into the selection criteria, it is necessary to understand the hardware and software maintenance needs of a computer system.

## **Hardware Maintenance Needs**

There are several features in a hardware maintenance service that the user will require. One of the key features is system availability. To achieve this, the maintenance service must be able to provide a mechanism whereby the user can obtain quick resolution to systems problems which may impair their operation.

At the same time, some hardware components are expected to be upgraded to improve the system performance or have bugs removed. It is also expected that such engineering changes and improvements will maintain system compatibility. Engineering changes are also needed to increase the system functionality. It is desirable to have further enhancements to the system so that the capabilities can be increased over the years.

The ability to predict system or component failures before they occur is a highly desired feature. This allows the user and engineers to take pro-active measures to alleviate any potential problems. What this means is that system availability would increase if these steps are taken.

## **Software Maintenance Needs**

The software maintenance needs are no different in that system availability would still be prime on the user's mind. When the user requires assistance, he would like to have the facility to call through the telephone to obtain quick resolution to his problem. However, if the problem cannot be resolved through the telephone, on-site assistance would be required.

Temporary work-arounds would be required if no resolution is forthcoming. In the situation when problems are "grey", assistance should be made available to aid the user in determining the cause of the problem. Other forms of assistance include providing emergency patches and escalating the problem for the vendor to muster more resources.

Software installation activities, software and manual updates are some of the other software maintenance needs which a user may require.



There are essentially five main criteria for choosing a computer maintenance service. They are:

- 1 Criticality of the application systems,
- 2 Multiple systems and sites,
- 3 Security and geographic considerations,
- 4 Level of in-house expertise and
- 5 Price/Performance.

#### 1 Criticality of the Application Systems

The criticality of the application systems is the primary determinant for the hours of coverage and response time required for your computer maintenance service. If the production environment does not permit a prolonged period of down-time, then the hours of coverage required would have to be extended. The longer the coverage hours, the higher the cost.

In the same vein, the response time would also be a point of consideration in order to ensure that the system availability is maintained. The shorter the expected response time is, the higher the cost. This should of course result in higher system availability.

#### 2 Multiple Systems and Sites

Sites with multiple systems would require different level of system maintenance service compared to those with single computers. In a single site, multiple system environment, the configuration in the computer room can be arranged to ensure that some peripherals can be shared to increase the system availability. If such arrangement is possible, the criticality of having shorter response time and longer hours of coverage is reduced.

In the situation where multiple systems are located at different sites, the level of system maintenance depends on whether the system management of such operations is centralized or decentralized. This determines the type and level of service expected from the vendors.

Generally, operations which choose to manage the systems in a centralized fashion are those with centralized application development and technical support teams. The remote sites are usually run-only environments with minimal operator intervention.

A centralized system management strategy can affect the way manual and software updates are co-ordinated. Similarly, telephone assistance can be co-ordinated from one technical focal point. It also determines how the application and system software are distributed. Such an environment usually requires system compatibility across the various operations. This can be ensured with proper co-ordination between multiple sites. It is desirable in this environment to have software maintenance co-ordinated at the central site.

The hours of coverage and response times required for hardware maintenance at different sites will depend on the needs. However, the maintenance planning activities can still be co-ordinated from the central site.

### 3 Security and Geographical Considerations

In some operations, the consideration could be one of security and/or geography. This point of consideration usually leads you to examine the viability of self-maintenance. Some of the activities which users can undertake include workstation maintenance, first line system diagnostic, memory dump analysis, board-level changes, system performance tuning, etc.

Users may want systems to be self-maintained instead of depending on vendors for security reasons. Security requirements may make it impossible to allow engineers to troubleshoot freely and expeditiously. Similarly, if there are sites which are remotely located away from the nearest vendor service center, then it may necessary to think about some form of self-sufficiency so that the system availability will not be affected by the long time it takes for an engineer to be on-site. The user, however, would have to think about the burden of attending specialist courses on an ongoing basis. On top of that, the user is also expected to carry the cost of spare parts inventory. There is the consideration about product obsolescence and users may be required to carry this burden too.

### 4 Level of in-house expertise

The degree of in-house expertise of the MIS staff and the size of operation are also points for consideration in determining the level of maintenance service. Generally, a higher technically competent team supporting a large

operation requires a different set of features in the service compared to a less knowledgeable user. They would have a more sophisticated set of requirements like advanced education courses, in-house performance tuning capability, first-line hardware and system software troubleshooting, etc. They too would have the critical mass in work and personnel to justify for this level of service than a smaller operation.

## 5 Price/Performance

In the final analysis, the cost factor would be heavily featured. This determines the price-performance of the maintenance service. The above discussion shows that the higher the level of service, the higher the costs. However, if cost is a concern, then the user must be prepared to accept a lower level of system availability and set of services from the maintenance program.

In HP, it is recommended that users take a Standard Systems Maintenance Service if he has a application critical environment or Basic Systems Maintenance Service for cost sensitive applications and when some system down-time can be tolerated.

Software support offered by HP varies in the level of service and cost. For very experienced users who may be in a static and/or run-only environment, it is recommended that they opt for a Response Center Support service. In most cases where users are still in development and may have networked systems, Account Management Support service is recommended.

## FINANCIAL ANALYSIS FOR COMPUTER SYSTEM MAINTENANCE

Now that we have covered the features and examined the cost factors involved in the planning for maintenance, the next key issue of the exercise is the justification of the investment.

The methodology to justify the maintenance service from the cost point of view is indeed a very simple one. It involves costing the MIS operation and determining how much it would affect the operation if the system is down.

Assuming that it costs US\$190,000 to run a small MIS operation. The US\$190,000 can be broken down into three main components - salary for system manager/analyst, programmer/operator accounts for US\$60,000; operational overheads takes up US\$120,000 and consumables US\$10,000. Operational overheads typically comprise communications, occupancy, training, expense equipment, hardware maintenance, etc. Assuming that there are 250 working days in a year, this is translated to be US\$760 per day. In other words, it would cost \$760 per day to run an MIS operation. A typical Account Management Support contract for a Micro 3000/XE system from HP costs about US\$5,000 per annum or translated into MIS operational costs, it is equivalent to 7 (5000/760) production days.

Translating 7 days into actual work done at the MIS department, this value can be quite significant. Viewed from a different perspective, for an additional US\$5000 annual cost incurred in software support, the MIS department may gain up to 7 days worth of production time. There are other associated benefits which the software maintenance program offers but cannot be easily quantified here. The figures would be more if the end-user operations are taken into consideration, and of course this is dependent on the kind of business the company is in. The figures would be easier to justify if the end-user impact is taken into consideration. These will far exceed the cost of the software contract.

The above argument also holds for hardware maintenance. We could put in the numbers for both hardware and software maintenance and go through the same exercise. It would arrive at the equivalent production days. This would form the basis for your justification.

#### **TRENDS IN THE COMPUTER SYSTEM MAINTENANCE**

Trends in the computer industry have changed over the years from one of reactive in nature to being more pro-active and preventive. There is a very noticeable trend to move towards remote electronic support. Problems are beginning to be solved more through the public telecommunications network. There frequently is now lesser dependence on on-site visits by the engineers. With prior diagnosis through remote electronic support, the engineers, during on-site visit, will be better prepared with the right tools and spare parts thus shortening the problem resolution time. Besides, there is a larger source of information to help in the troubleshooting process if the engineer analyzes and researches the problem from the office.

*Planning Computer Maintenance.....*

Temporary work-arounds can then be implemented quicker because there is a clearer understanding of the problem at the engineer's office. Not only would users be able to receive temporary solutions faster, the service cost is also expected to drop too.

There is also a trend of centralizing information for access by both customers and engineers alike. Such kind of service is beginning to be introduced in the computer industry by hardware vendors. This service enables the MIS staff to provide first-line troubleshooting by researching into a large centralized knowledge database. This is going to be the key to help bring down the cost of servicing users and at the same time, increase the technical competence of the technical people in the user base.

Predictive support capabilities of computer hardware are proliferating in many areas. This capability allows built-in software to predict potential failures and alarms the engineers and users on the impending problems. Action steps can then be taken to avert potential down-time. Disruption to the system can thus be minimized and planned. This helps to increase user productivity. With this mode of operation, active steps can be planned and manpower needs lowered, thus lowering service costs.

The advances in artificial intelligence have made it possible to think about the possibility of applying it in the field of service maintenance. Memory dump analysis is one area of application. Built-in diagnostic is another area which can be incorporated in the system hardware.

#### CONCLUSION

There is always a cost and performance trade-off. Usually the higher and more urgent the need, the higher would be the cost of the maintenance program.

It is not difficult to select the right level of computer system maintenance service if you can systematically list down the maintenance needs of your operation. A list of selection criteria can then be designed to meet the organization's maintenance needs. Cost and benefit analysis is then conducted to justify your selection of a particular maintenance program.

