

A11101 564023

FIPS PUB 96



FEDERAL INFORMATION
PROCESSING STANDARDS PUBLICATION

1982 DECEMBER 6

U.S. DEPARTMENT OF COMMERCE/National Bureau of Standards



**Guideline
for
Developing and Implementing
a Charging System for
Data Processing Services**

JK
468
.A3A3
96
1982

CATEGORY: ADP Operations
CATEGORY: Computer Performance Management

Foreword

The Federal Information Processing Standards Publication Series of the National Bureau of Standards (NBS) officially publishes Federal standards and guidelines adopted and promulgated under the provision of the Public Law 89-306 (Brooks Act) under Part 6 of Title 15, Code of Federal Regulations. Under P.L. 89-306, the Secretary of Commerce has important responsibilities for improving the utilization and effectiveness of computer systems in the Federal Government. In order to carry out the Secretary's responsibilities, the NBS, through its Institute for Computer Sciences and Technology, provides leadership, technical guidance, and coordination of Government efforts in the development of technical guidelines and standards in these areas.

The complexity of managing today's computer facility is compounded by the growing technological complexity and interaction of the resources being managed. This technological complexity demands that highly specialized tools and techniques be available to ADP managers so that they may more effectively and efficiently manage their installations. This Guideline introduces the Federal Data Processing (DP) manager to a DP charging system methodology. The installation of a DP charging system is a major step toward improving the efficiency and effectiveness of DP management.

James H. Burrows, *Director*
Institute for Computer Sciences and Technology

Abstract

This Guideline describes a step-by-step methodology for developing and implementing a charging system for use in Data Processing (DP) facilities. Charging for DP services refers to distributing the costs of providing DP services to the users who receive the services. The distribution of costs requires definition of the basic DP services, the resources used to provide the services, and the costs incurred to obtain and make use of the resources. A charging system is comprised of two subsystems: the rate-setting subsystem and the billing subsystem. The rate-setting subsystem incorporates procedures for forecasting the use of each service, forecasting the costs of the resources used to provide each service, and establishing the rate to be charged for each unit of service. The billing subsystem includes procedures for monitoring the use of services, applying the billing rates to compute the total charge for the services each user receives, and reporting the charges to the user and to appropriate accounting groups.

The Federal Government has established policies through the Office of Management and Budget Circular A-121 that calls for distributing the "full cost of operating DP facilities to users according to the services they receive." This Guideline describes a charging system. Four phases and 14 steps are identified in the procedure. Major decisions are identified, recommendations are presented, and "best" practices are described.

Key words: ADP services; chargeback; charging system; computer service; cost recovery; DP service; Federal Information Processing Standards Publication; performance evaluation; performance management.

Natl. Bur. Stand. (U.S.) Fed. Info. Process. Stand. Publ. (FIPS PUB) 96, 84 pages
(1982)
CODEN:FIPPAT



**Federal Information
Processing Standards Publication 96**

1982 December 6

ANNOUNCING THE



**GUIDELINE FOR DEVELOPING AND IMPLEMENTING
A CHARGING SYSTEM FOR
DATA PROCESSING SERVICES**

Federal Information Processing Standards Publications are issued by the National Bureau of Standards pursuant to the Federal Property and Administrative Services Act of 1949, as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973), and Part 6 of Title 15 Code of Federal Regulations (CFR).

Name of Guideline: Guideline for Developing and Implementing a Charging System for DP Services.

Category of Guideline: ADP Operations

Subcategory of Guideline: Computer Performance Management.

Explanation: This Guideline describes a step-by-step methodology for the development and implementation of a charging system for data processing services. It identifies the "best" practices found within private industry and the Federal Government and is based upon numerous documents and many meetings with Government and industry representatives and upon extensive analysis of existing practices.

Approving Authority: U.S. Department of Commerce, National Bureau of Standards (Institute for Computer Sciences and Technology).

Maintenance Agency: U.S. Department of Commerce, National Bureau of Standards, Institute for Computer Sciences and Technology.

Cross Index: Federal Information Processing Standards Publications (FIPS PUBS) Numbers 38, 49, and 64. "Guidelines for Documentation of Computer Programs and Automated Data Systems," "Guideline on Computer Performance Management: An Introduction," and "Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase."

Applicability: This Guideline is intended as a basic reference guide to all Federal agencies for developing and implementing a DP charging system. It is also intended as a guide to those agencies which are required to implement a DP charging system under the Office of Management and Budget (OMB) Circular A-121.

Implementation: This Guideline represents the "best" practices for the development and implementation of a DP charging system from sources both within and outside of the Federal Government. This Guideline is consistent with the requirements of OMB Circular A-121 and with the General Accounting Office (GAO) Federal Government Accounting Pamphlet Number 4 which set forth the requirements for DP charging systems in the Federal Government.

Specifications: Federal Information Processing Standards Publication 96 (FIPS-PUB-96), Guideline for Developing and Implementing a Charging System for DP Services (affixed).

Where to Obtain Copies: Copies of this Guideline are for sale by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. When ordering, refer to Federal Information Processing Standards Publication 96 (FIPS-PUB-96) and title. When microfiche is desired, this should be specified. Payment may be made by check, money order, purchase order, or deposit account.

ACKNOWLEDGMENT

The Institute for Computer Sciences and Technology recognizes the exemplary performance of the Federal Computer Performance Evaluation and Simulation Center (FEDSIM) and acknowledges the significant contributions of the U.S. General Accounting Office, and many other Government and commercial organizations which participated in this project.



**Federal Information
Processing Standards Publication 96**

1982 December 6

Specifications for



**GUIDELINE FOR DEVELOPING AND IMPLEMENTING
A CHARGING SYSTEM FOR
DATA PROCESSING SERVICES**

Contents

	Page
EXECUTIVE SUMMARY.....	5
1. INTRODUCTION.....	7
1.1 Background and Purpose.....	7
1.2 Scope.....	7
1.3 Intended Audience.....	7
1.4 How To Use this Guideline.....	8
1.5 Guideline Structure.....	8
2. OVERVIEW OF CHARGING FOR DP SERVICES.....	8
2.1 Functional Description of a Charging System.....	8
2.2 Important Developmental Concepts.....	11
2.3 Outline of the Step-by-Step Methodology for Developing a Charging System.....	13
3. GUIDELINES FOR DEVELOPING AND IMPLEMENTING A CHARGING SYSTEM.....	16
3.1 Planning Phase.....	16
Step 1: Establish the Project Structure.....	16
Step 2: Determine Charging System Characteristics.....	17
Step 3: Prepare the Project Plan.....	20
3.2 Design Phase.....	20
Step 4: Initiate a Data Processing Cost Accounting Project.....	20
Step 5: Establish the Distribution Matrices.....	25
Step 6: Design the Charging System.....	39
3.3 Rate-Setting Phase.....	44
Step 7: Forecast Usage.....	44
Step 8: Forecast Costs.....	45
Step 9: Calculate Billing Rates.....	47
Step 10: Assist with DP Budgeting.....	62
3.4 Billing Phase.....	67
Step 11: Assist with DP Accounting.....	67
Step 12: Account for Usage.....	68
Step 13: Report Usage.....	70
Step 14: Recover Charges.....	72
4. MAINTAINING AND EVALUATING THE CHARGING SYSTEM.....	73
4.1 Routine Maintenance.....	73
4.2 Evaluating Charging System Performance.....	74
GLOSSARY.....	76
APPENDIX—Automated Reporting Package Evaluation Criteria.....	79
BIBLIOGRAPHY.....	81
INDEX.....	84

FIGURES

Page

Figure 1.	Components of a Charging System	9
Figure 2.	Relationships of Important Concepts of the Rate-Setting Subsystem.....	10
Figure 3.	Charging System Development Phases and Steps	14
Figure 4.	Sample Cost Accounting Data for the Personnel Category	22
Figure 5.	Sample Cost Accounting Data for the Equipment and Software Categories	23
Figure 6.	Sample Cost Accounting Data for the Other Resource Categories	24
Figure 7.	Sample Resource Distribution Matrix.....	26
Figure 8.	Sample Subfunction Distribution Matrix	27
Figure 9.	Sample Billing Rate Distribution Matrix	28
Figure 10.	Service Centers, Services, and Service Units for the Sample Distribution Matrices	32
Figure 11.	Sample Subfunction Distribution Matrix with Service Centers Added.....	33
Figure 12.	Sample Billing Rate Distribution Matrix with Service Centers, Services, and Service Units Added.....	34
Figure 13.	Areas of Management Responsibility, Work Functions, and Subfunctions for the Sample Distribution Matrices.....	36
Figure 14.	Sample Resource Distribution Matrix with Areas of Management Responsibility, Work Functions, and Subfunctions Added	37
Figure 15.	Sample Subfunction Distribution Matrix with Subfunctions Added.....	38
Figure 16.	Sample Resource Distribution Matrix with Resources Added	40
Figure 17.	Sample Billing Rate Distribution Matrix with Service Forecasts Added.....	46
Figure 18.	Sample Resource Distribution Matrix with Costs of Resources Added.....	48
Figure 19.	Sample Resource Distribution Matrix with Proportions and Proportion Costs for the Computer A Resource Added	50
Figure 20.	Sample Resource Distribution Matrix with Proportions and Proportion Costs for the Direct Resources Added.....	51
Figure 21.	Sample Resource Distribution Matrix with Proportions and Proportion Costs for the Space Occupancy Indirect Resource Added	53
Figure 22.	Sample Resource Distribution Matrix with Proportions and Proportion Costs for the Management Overhead Resource Added.....	54
Figure 23.	Sample Resource Distribution Matrix with Subtotals for the Work Functions and Subfunctions Added	55
Figure 24.	Sample Resource Distribution Matrix with Work Function Costs Distributed and Total Subfunction Costs Added	56
Figure 25.	Sample Subfunction Distribution Matrix with Proportions and Proportion Costs for the Product-Oriented Subfunctions Added	58
Figure 26.	Subtotals of the Product-Oriented Subfunction Proportion Costs	59
Figure 27.	Sample Subfunction Distribution Matrix with Proportions and Proportion Costs for the Support-Oriented Subfunctions Added	59
Figure 28.	Sample Subfunction Distribution Matrix with Service Center Costs Added.....	60
Figure 29.	Sample Billing Rate Distribution Matrix with Standardization Factors Added.....	63
Figure 30.	Sample Billing Rate Distribution Matrix with Standardized Forecasts Added.....	64
Figure 31.	Sample Billing Rate Distribution Matrix with Base Rates Added.....	65
Figure 32.	Sample Billing Rate Distribution Matrix with Billing Rates Added	66
Figure 33.	Sample Billing Report.....	71

EXECUTIVE SUMMARY

On September 16, 1980, the Office of Management and Budget (OMB) issued Circular A-121, "Cost Accounting, Cost Recovery, and Inter-Agency Sharing of Data Processing Facilities." This Circular states that all DP facilities which:

- are operated by, or on behalf of a Federal agency;
- provide service to more than one user;
- operate one or more general management computers; and
- exceed \$100,000 per year for the full cost of operation;

must implement policies and procedures to (a) account for the full cost of operating data processing (DP) facilities, (b) allocate and report all DP costs to users according to the services received, (c) recover DP costs from external DP users, (d) recover DP costs from internal DP users when deemed appropriate by the agency, (e) share excess DP capacity with other agencies, and (f) evaluate interagency DP sharing as a means of supporting major new DP applications.

This Guideline has been developed to provide technical guidance to Federal DP managers to assist them in their efforts to comply with Circular A-121. It describes a methodology for developing and implementing a system to charge for DP services (hereinafter referred to as a charging system). The methodology has been generalized to provide wide applicability. Users of the methodology will be required to make many design decisions to suit their specific environment.

A charging system is viewed from two perspectives, operational and developmental. The operational perspective examines the tasks required to operate a charging system that has been developed and implemented. The developmental perspective addresses the tasks required to develop and implement a charging system. The major thrust of this Guideline is developmental. Operational aspects are also briefly discussed.

In theory, an operational charging system is easily understood. It consists of two subsystems, rate-setting and billing. The rate-setting subsystem is performed only when new billing rates must be calculated and consists of the following basic tasks. First, the usage of the services during the period for which the billing rates are being set are forecast. Second, the costs of the DP facility for the same period are forecast. Third, the resource costs are distributed to each of the services. Fourth, the billing rate for each service is calculated by dividing the cost attributed to each service by its projected usage. Finally, the new rates are passed to the billing subsystem.

The billing subsystem is performed more frequently than the rate-setting subsystem and consists of the following tasks. First, the usage of the DP facility's services is recorded. Second, the billing rates are applied and the user's charges are calculated. Third, the charges for the billing period are reported to each user. Finally, the charges are either recovered from each user or not recovered, depending on the philosophy of the DP facility.

This Guideline presents a step-by-step methodology consisting of the developmental and implementation decisions that must be made, the philosophical issues affecting these decisions, and a recommended order in which to make the decisions. The step-by-step methodology has been separated into the 4 phases and 14 steps outlined below.

1. Planning Phase

The planning phase consists of preparing the agency's developmental plans for the charging system. The planning phase consists of the following steps.

- Step 1: Establish the Project Structure
- Step 2: Determine Charging System Characteristics
- Step 3: Prepare the Project Plan

2. Design Phase

During the design phase, the work performed during the planning phase is used to direct the conceptual development and general design of the charging system. The design phase consists of the following steps.

- Step 4: Initiate a Cost Accounting Project
- Step 5: Establish the Distribution Matrices
- Step 6: Design the Charging System

3. Rate-Setting Phase

The next four steps of this Guideline focus on developing and implementing the tasks of the rate-setting subsystem. The rate-setting phase consists of the following steps.

- Step 7: Forecast Usage
- Step 8: Forecast Costs
- Step 9: Calculate Billing Rates
- Step 10: Assist with DP Budgeting

4. Billing Phase

The last four steps of this Guideline focus on developing and implementing the tasks of the billing subsystem. The billing phase consists of the following steps.

- Step 11: Assist with DP Accounting
- Step 12: Account for Usage
- Step 13: Report Usage
- Step 14: Recover Charges

1. INTRODUCTION

1.1 Background and Purpose

Office of Management and Budget (OMB) Circular A-121, "Cost Accounting, Cost Recovery, and Inter-Agency Sharing of Data Processing Facilities," states the Federal policy on charging for computer services. This Circular requires Federal agencies to implement policies and procedures to (1) account for the full cost of operating data processing (DP) facilities, (2) allocate and report all DP costs to users according to the services received, (3) recover DP costs from external DP users, (4) recover DP costs from internal DP users when deemed appropriate by the agency, (5) share excess DP capacity with other agencies, and (6) evaluate interagency DP sharing as a means of supporting major new DP applications. The Circular applies to all DP facilities which:

- are operated by, or on behalf of, a Federal agency;
- provide service to more than one user;
- operate one or more general management computers; and
- exceed \$100,000 per year for the full cost of operation.

Circular A-121 also specifies that agency procedures for cost accounting and charging must be consistent with the guidance provided in the Federal Government Accounting Pamphlet Number 4, entitled "Guidelines for Accounting for Automatic Data Processing Costs." [USGAO 78]; this pamphlet is referred to as FGAP 4 throughout this Guideline.

Through Circular A-121 and FGAP 4, the Federal Government has established policies and guidelines to promote effective and efficient management in the use of certain DP facilities. The policies presented in those documents prescribe procedures designed to achieve four primary objectives:

1. to increase the accountability of the DP facility and the users to senior agency management and to the Government;
2. to keep an accurate accounting of the costs of operating the DP facility;
3. to allocate and report the costs of service utilization to the users; and
4. to facilitate better DP planning and control.

The purpose of this Guideline is to provide technical guidance to help Federal managers effectively and efficiently develop and implement a charging system that will satisfy the objectives stated above. The technical guidance presented in this Guideline incorporates the best practices that are used throughout the industry for developing and implementing charging systems. These best practices have been adapted, when necessary, to maintain consistency with existing Federal guidelines and requirements.

1.2 Scope

This Guideline provides Federal DP managers with a step-by-step methodology that will assist them to design, develop, implement, and operate a charging system. Four phases and 14 steps are identified and described in detail. Major decisions are identified, recommendations are presented, and best practices are described. Although this Guideline is primarily directed to the team that will construct the charging system, portions of it are also directed to senior management in order for them to understand the unique requirements of the development effort.

This Guideline is not intended to provide an exhaustive examination of charging or charging systems; instead, the intent is to provide one approach, based on the best practices of the DP industry, for the development and implementation of a charging system. There is no attempt in this Guideline to redefine the procedures used in standard systems development methodology. The developers of the charging system should integrate standard systems development methodology with the methodology presented in this Guideline while planning the development of the charging system.

1.3 Intended Audience

This Guideline is directed toward the individuals assigned, hereinafter referred to as the Charging Team, to develop and implement the charging system and agency senior management, who will be responsible for monitoring the development and implementation of the charging system. The Charging Team should be composed of individuals from management, DP, accounting, budgeting, and user departments of the agency. Since the Charging Team is

considered the primary audience of this Guideline, most of this Guideline is tailored toward individuals with the above backgrounds.

The agency's senior management is the secondary audience of this Guideline, since one of the main functions of a charging system is to help senior management better manage the DP facility. It is, therefore, important for senior management to take an active role in the development and implementation of the charging system. Such a role will help ensure that the charging system provides senior management the data needed to manage the DP facility and influence user behavior in appropriate ways. This Guideline assists senior management's involvement in the charging system by providing indications of important management decisions that must be made and by providing checkpoints at which progress of the development effort should be reviewed.

1.4 How To Use this Guideline

It is recommended that the Charging Team use this Guideline by, first, viewing this Guideline as a detailed outline of the Team's developmental plan for the charging system. Second, the Charging Team should obtain and read all Government documents referenced in this Guideline. Third, since this Guideline presents a general approach to developing and implementing a charging system which will cover most situations that might arise in any DP facility (without regard to specialized requirements, such as multiple, extremely large, or extremely small DP facilities), the Charging Team should tailor the tasks and decisions herein to fit its own particular DP environment. Fourth, it is important for the Charging Team to understand that the large number of tasks, which this Guideline contain, have been included so that the methodology has the widest possible applicability, and that some of the tasks will not necessarily be feasible for all agencies. Last, the Charging Team should develop the charging system according to its modified plan.

1.5 Guideline Structure

This Guideline is divided into four sections. Section 1 provides an introduction to both charging systems and to this Guideline. Section 2 provides an overview of an operational charging system, discusses concepts which are fundamental to charging systems, and summarizes the step-by-step methodology for developing and implementing a charging system. Section 3 provides the step-by-step methodology. Section 4 contains information on the maintenance and evaluation of charging systems. A glossary of important terms used throughout this document, an extensive bibliography of recommended articles on charging systems, and an index of important concepts are provided at the end of this Guideline.

2. OVERVIEW OF CHARGING FOR DP SERVICES

This section provides the background necessary for understanding the methodology presented in section 3. Section 2.1 provides a brief functional description of an operational charging system. Section 2.2 discusses some important developmental concepts for a charging system. Section 2.3 summarizes the step-by-step methodology for the development and implementation of a charging system.

2.1 Functional Description of a Charging System

As used in this Guideline, a charging system is the work activities used to calculate billing rates, to monitor the use of DP services, and to report to or bill users according to their utilization. Related work activities have been grouped into procedures, and the procedures have been separated into two subsystems—rate-setting and billing. Figure 1 illustrates the procedures contained in each of the subsystems. The billing rates that are charged for DP services are established during the rate-setting subsystem and are then fed into the billing subsystem. The billing subsystem monitors service utilization and applies the billing rates to compute the amount that should be reported or charged to a user. When viewed operationally, the rate-setting and billing subsystems are cyclical; that is, the work activities of each subsystem are repeated on a regular basis. The rate-setting subsystem is used whenever billing rates need to be changed. In most DP facilities, this will occur on an annual basis. The billing subsystem operates almost continually when the DP facility is offering services, because service usage must be monitored whenever a service is utilized.

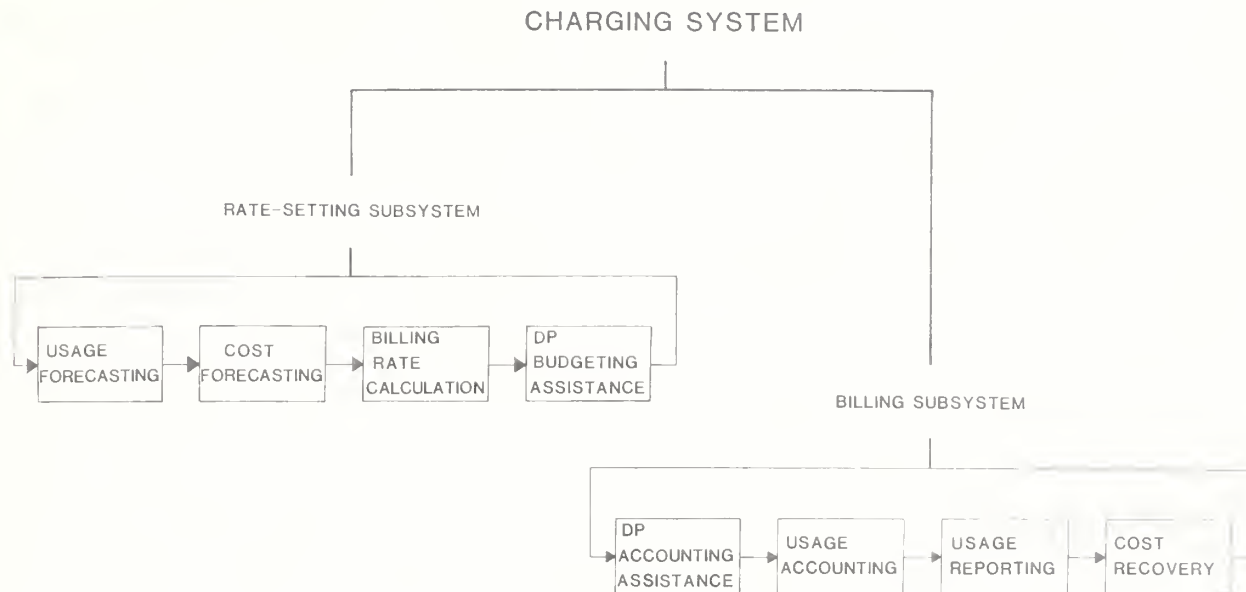


FIGURE 1. Components of a charging system.

Each of the work activities of the rate-setting and billing subsystems is included in this Guideline in order to satisfy one or more of the four primary objectives for promoting efficient and effective management of DP facilities. (See sec. 1.1.) A more detailed discussion of the work activities of the subsystems and the relationship of those work activities to the four primary objectives is presented below. Terms used in the following discussions which have specialized meanings within the context of charging systems have been underlined. Each underlined term is defined in the glossary at the end of this document.

1. Rate-Setting Subsystem

The ultimate objectives of the rate-setting subsystem are to identify and group the resources, and their associated costs, that are used to support particular work areas of the DP facility; to identify and group the work areas, and their associated costs, that are associated with each DP service; and to develop a billing rate for each service that reflects the cost to the DP facility of providing that service.

Figure 2 illustrates the relationships among important concepts involved in the rate-setting subsystem. The rate-setting subsystem is the most difficult and time consuming part of a charging system to develop. It involves (1) identifying the resources to be included in the charging system, (2) forecasting the cost of these resources, and (3) distributing the costs of the resources to the subfunctions, and, subsequently, to the service centers.

a. *Work Activities.* The first step in the rate-setting subsystem is to forecast the volume of usage of each DP service. These usage forecasts will normally be in terms of the number of service units (CPU seconds, checks printed, analyst hours, e.g.) of each DP service that will be used for a given rate period. Next, the costs of all of the various resources (hardware, software, personnel, e.g.) used to provide the services are forecasted. These individual resource costs are then distributed into DP facility work areas, called subfunctions, according to a predetermined formula. A subfunction is the bottom level of a DP facility's work area hierarchy, which consists of areas of management responsibility (AMR) at the top, work functions in the middle, and subfunctions on the lower level. This work area hierarchy is used for the purpose of categorizing costs in terms more relevant to the DP facility. An example of a work area hierarchy is an area of management responsibility (computer processing operations) with three work functions (computer operations, reporting, and technical support) each containing two subfunctions (CPU and storage devices for computer operations, microfiche and printing for reporting, and data base management and equipment maintenance for technical support). Another way of viewing the work area hierarchy of a DP facility is to think in terms of cost centers. Each AMR, work function, or subfunction can be viewed as a cost center for some part of the DP facility specifically and for the whole DP facility generally. The total cost of each subfunction is calculated and then distributed into individual service centers (groupings of related services) according to a predetermined formula. The total cost of each service center

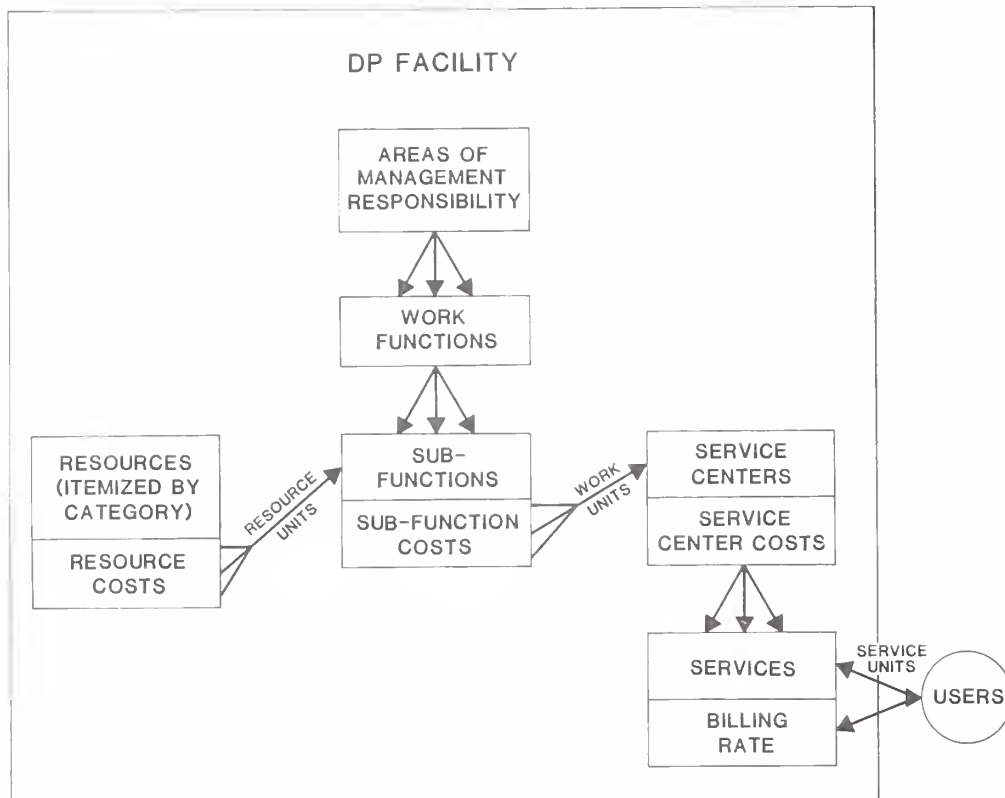


FIGURE 2. Relationships of important concepts of the rate-setting subsystem.

is calculated and then, based upon individual service forecasts and certain other factors, the billing rate for each service is calculated. The billing rates are then distributed to the users and fed into the billing subsystem where they replace the current rates.

b. Objectives of Work Activities. Each of the work activities in the rate-setting subsystem is performed to achieve one or more of the four primary objectives discussed in section 1.1. Forecasting resource costs helps allocate and report the costs of service utilization to the users, keep an accurate accounting of the costs of operating the DP facility, and improve DP planning and control. Distributing the resource costs into subfunctions, before distributing the costs to service centers, provides senior management with information on the cost that the DP facility incurs for performing particular areas of work; i.e., the subfunctions, work functions, and areas of management responsibility. Consequently, providing senior management with cost information facilitates better DP planning and control and increases the accountability of the DP facility to the senior management of the agency and Government. The work activities of the "Assist with DP Budgeting" procedure facilitate the interface between the DP facility and the budgeting department of the agency. The remaining work activities of the rate-setting subsystem help allocate and report the costs of service utilization to the users.

2. Billing Subsystem

The objective of the billing subsystem is to inform users of, and/or bill users for, the services that they have utilized during a particular billing period. When a charging system is being developed, the billing subsystem's development is relatively straightforward, as opposed to the rate-setting subsystem. It is assumed that the development of the billing subsystem will be less difficult to users of this Guideline. Therefore, the billing subsystem is discussed at a general level and the rate-setting subsystem is described in more detail in this Guideline.

a. Work Activities. The first work activity that is performed in this subsystem is to monitor the usage of services. This monitoring is performed with manual and automated techniques, according to the type of services being monitored. The data collected on service usage are stored in service logs. Next, these service logs are analyzed and reduced to obtain service usage figures by user. The service usage figures are then multiplied by

the billing rates for the services used in order to calculate the charges for each user. Service usage and charges are then reported to the users. If the DP facility is recovering its costs, users are billed the amount reported.

b. Objectives of Work Activities. Each of the work activities of the billing subsystem, like the work activities of the rate-setting subsystem, is performed to achieve one or more of the four primary objectives discussed in section 1.1. The work activities of the "Assist with DP Accounting" procedure facilitate the interface between the DP facility and the accounting department in the agency. The remaining work activities of the billing subsystem help allocate and report the costs of service usage to the users.

2.2 Important Developmental Concepts

This section discusses six concepts that are important to the development of the charging system:

1. senior management involvement;
2. incremental development and implementation;
3. resource charging algorithms;
4. user's DP budgets;
5. documentation of the charging system development; and
6. developmental cost/benefit tradeoffs.

The Charging Team should review and consider the following discussions on each of the concepts when developing its charging system.

1. Senior Management Involvement

Senior management involvement refers to the degree of participation by the agency's senior management in the planning, design, development, and implementation of the charging system.

The degree of senior management involvement is important to the charging system project for three reasons. First, senior management involvement provides the Charging Team with the authority to implement all aspects of the charging system. This authority is extremely important, since a charging system may require changes in agency policies or practices and may result in additional work by the involved groups.

Second, through its involvement, senior management will be able to identify to the Charging Team the type of information that management needs from the charging system. Identification of management's information needs is important since the main purpose of a charging system is to enable senior management to better manage the DP facility.

Third, senior management's involvement will ensure that any changes to the agency's work environment caused by the charging system will be under their control. When implemented in an agency for the first time, charging systems can cause extensive changes to work environments and budgeting processes; thus, senior management should be able to control any disruption of the agency's working environment.

2. Incremental Development and Implementation

DP facilities, especially those that have been providing services free to their users, should consider an incremental development and implementation of the charging system. It is not always possible, or desirable, to develop and implement all parts of a charging system at once. Rather, it may be better to implement parts of the system as developed, instead of waiting for the entire system to be developed. Incremental development and implementation will also enable the users and the DP facility to better plan and budget for the new charging environment.

Although there are many different ways to separate the development and implementation of a charging system, some of the more common methods are listed below.

- Develop and implement the manual procedures first and then the automated procedures;
- Develop and implement a system that charges for the most frequently used services first, and which later charges for the remaining services provided by the DP facility;
- Develop the entire charging system and stage implementation of the various procedures; and
- Develop and implement a charging system that only monitors and reports the use of services, and later develop the procedures for budgeting and transferring funds.

Each agency must determine the best approach to be used for its particular environment.

3. Resource Charging Algorithms

Resource charging algorithms refer to the equations often employed to aggregate the use of computer-related resources into a single artificial service with a single service unit. An example of this type of service is a DP facility that charges its users only according to the number of Computer Accounting Units (CAU's) utilized. In the past, this method has been one of the most common methods of billing users of DP facilities. Recently, a number of deficiencies in this charging method have become generally recognized, some of which are listed below.

- The artificial billing units (e.g., CAU's) have little real or intuitive meaning for most users. Thus, users have little incentive and virtually no information with which to plan for future DP usage or to improve the efficiency of DP usage.
- The algorithms are often so complex that even sophisticated users have difficulty understanding the actual amount of resources utilized.
- The algorithms can become extremely expensive to develop and maintain both in terms of dollars and the amount of time expended.

The current trend in state-of-the-art charging systems has been away from the artificial resource charging algorithms, and toward the techniques that are more understandable by the users, such as transaction or output charging. It is recommended that the Charging Team not select a resource charging algorithm as the basis for its charging system. Of course, it is recognized that there are a limited number of situations that encourage the use of this charging method. And, if the Charging Team determines that it must use a resource charging algorithm, then it should make certain that all formulas, loading factors, and billing rates for the formula variables be made public. Making this information available to the users will enable them to determine for what and how they are being charged.

FGAP 4 states that the use of artificial resource charging algorithms with artificial accounting units is "a less preferred alternative" for reporting DP charges to users. Therefore, detailed information on constructing a resource charging algorithm will not be provided in this Guideline. If necessary, the Charging Team can obtain additional information on resource charging algorithms from the charging literature (see Bibliography).

4. User DP Budgets

User DP budgets refer to the amount of services each user is authorized during a rate period. After an agency has implemented a charging system, it is important that it enforce the DP budgets allocated to users. Adherence to DP budgets can be enforced in one of several ways, depending on whether or not funds are being transferred. One frequently used technique is to authorize users a set dollar or "pseudo" dollar amount for a rate period and allow them to exceed that amount only by obtaining approval from senior agency management. An agency should require users to justify all major expenditures over or under their limit, regardless of the technique selected.

5. Document Charging System Development

Although the development of a charging system is essentially a one-time activity, a number of development tasks will be repeated during the operation of the charging system. Therefore, it is important for the Charging Team to produce good documentation for the procedures developed. Whenever feasible, this documentation should meet the standards set forth in the Federal Information Processing Standards Publication (FIPS PUB) 38, "Guidelines for Documentation of Computer Programs and Automated Data Systems" [NBS 76]. This Guideline recommends that the Charging Team produce thorough documentation for at least the following tasks and procedures:

- the development of the distribution matrices;
- the charging system general design;
- usage forecasting procedure;
- cost forecasting procedure;
- billing rate calculation procedure;
- usage accounting procedure; and
- reporting procedure.

6. Developmental Cost/Benefit Tradeoffs

Determining the appropriate size and complexity of the charging system will be an important and ongoing task of the Charging Team during its developmental efforts. It is important that the Charging Team keep the cost of developing the charging system in line with the overall budget and size of the DP facility. Unfortunately, there are no good metrics that the Charging Team can use to determine the proper ratio of the charging system cost to the size and budget of the DP facility. Therefore, the Charging Team will have to analyze the costs and benefits of each decision that concerns the structure of the charging system. The Charging Team should adjust its level of effort for analyzing each decision to the potential additional cost of the decision. Some of the major decisions that the Charging Team will have to analyze have been identified and listed below.

- Size of the Charging Team
- Quantity and level of detail of the costing data
- Level of detail of the distribution matrices
- Quantity and level of detail of the usage data
- Proper mixture of the charging system characteristics
- Sophistication and expense of the billing package
- Level of detail for reporting charges

2.3 Outline of the Step-by-Step Methodology for Developing a Charging System

As discussed in section 2.1 of this Guideline, the charging system contains two subsystems: rate-setting and billing. The step-by-step methodology presented in section 3 of this Guideline has been organized around the procedures of each subsystem. The methodology consists of 14 steps separated into 4 phases. Figure 3 illustrates the separation of the steps into the 4 phases. This section provides a brief discussion of each phase and a summary of the tasks involved in each step.

1. Planning Phase

The planning phase consists of preparing the agency's developmental plans for the charging system and is the most important of the four phases.

a. *Step 1: Establish the Project Structure.*

- Establish the management structure for the charging system project.
- Establish a Charging Team.

b. *Step 2: Determine Charging System Characteristics.*

- Clarify the characteristics of the DP facility in order to determine the type of DP facility that exists within the agency.
- Clarify the agency's reasons for charging for its DP services.
- Decide on the desired mixture of the major characteristics of the charging system.
- Reconcile the charging system characteristics with the characteristics of the DP facility and the agency's reasons for charging for its DP services.

c. *Step 3: Prepare Project Plan.*

- Prepare a formal project plan for the design, development and implementation of the charging system.

2. Design Phase

During the design phase, the characteristics and reasons for charging set forth in the planning phase are used to direct the conceptual development and general design of the charging system. During this phase, the requirements for the charging system must be identified and the alternative techniques to be used to satisfy the requirements explored.

PLANNING PHASE

1. ESTABLISH THE PROJECT STRUCTURE
2. DETERMINE CHARGING SYSTEM CHARACTERISTICS
3. PREPARE THE PROJECT PLAN

DESIGN PHASE

4. INITIATE A COST ACCOUNTING PROJECT
5. ESTABLISH THE DISTRIBUTION MATRICES
6. DESIGN THE CHARGING SYSTEM

RATE-SETTING PHASE

7. FORECAST USAGE
8. FORECAST COSTS
9. CALCULATE BILLING RATES
10. ASSIST WITH DP BUDGETING

BILLING PHASE

11. ASSIST WITH DP ACCOUNTING
12. ACCOUNT FOR USAGE
13. REPORT USAGE
14. RECOVER CHARGES

FIGURE 3. *Charging system development phases and steps.*

The cost accounting system, distribution matrices, and general design of the charging system provide a starting point for the detailed design, development, implementation, and operation of the rate-setting and billing subsystems. The general design of the charging system also serves to coordinate the individual steps and tasks of subsequent phases.

- a. *Step 4: Initiate a Cost Accounting Project.*
 - Initiate a project that will design and develop a DP cost accounting system to complement the chargeback system.
- b. *Step 5: Establish the Distribution Matrices.*
 - Determine the services, service units, and service centers.
 - Determine the areas of management responsibility, work functions, subfunctions, and work units.
 - Itemize the resources and define the resource units.
 - Test and adjust the distribution matrices.
- c. *Step 6: Design the Charging System.*
 - Define the functional requirements of the charging system.
 - Use the functional requirements to define and document the data requirements of the charging system.
 - Explore the alternative techniques that can be used to satisfy the functional and data requirements of the charging system.
 - Compile, review, and approve/disapprove a general design document based on the decisions made in the first three tasks.

3. Rate-Setting Phase

During the rate-setting phase, the four procedures of the rate-setting subsystem are developed and implemented. The agency's standard DP systems development techniques should be used in conjunction with the steps in this phase to structure the detailed design, development, implementation, and operation of the rate-setting subsystem.

- a. *Step 7: Forecast Usage.*
 - Collect and analyze usage forecasting data for services, subfunctions, and resources.
 - Determine and resolve any discrepancies that may exist between the forecasted service usage and the current resource capacity.
 - Re-evaluate the distribution matrices and, if necessary, restructure them to incorporate the resolutions between the users' forecasts and available capacity.
- b. *Step 8: Forecast Costs.*
 - Obtain or establish the trial budget that will be proposed for the DP facility for the rate period.
 - Collect and analyze cost forecasting data.
 - Re-evaluate and update the distribution matrices.
- c. *Step 9: Calculate Billing Rates.*
 - Determine the proportion of each resource that supports each subfunction and the cost of that proportion.
 - Determine the proportion of each subfunction that supports each service center and the cost of that proportion.
 - Calculate the base rates.
 - Calculate the billing rates.
- d. *Step 10: Assist with DP Budgeting.*
 - Develop techniques that will instruct the users in how to use the data from the charging system to develop their DP budgets.

- Develop techniques that will provide to the DP facility the data from the charging system that will facilitate the preparation of its budget.
- Develop techniques that will provide to the agency the data from the charging system that will facilitate the preparation of its budget.

1. Billing Phase

During the billing phase, the four procedures of the billing subsystem are developed and implemented. These procedures directly affect the users, the DP facility, and the agency's accounting activities. The agency's standard DP systems development techniques should be used in conjunction with the steps in this phase to structure the detailed design, development, implementation, and operation of the billing subsystem.

- a. *Step 11: Assist With DP Accounting.*
 - Develop techniques for establishing and maintaining user DP accounts.
 - Develop the techniques for providing billing data to the agency's accounting department.
 - Develop techniques for assisting in the maintenance of accounting information.
 - Establish billing techniques for handling aborted work.
- b. *Step 12: Account for Usage.*
 - Design the DP usage accounting procedure.
 - Develop and implement the usage accounting procedure.
- c. *Step 13: Report Usage.*
 - Design the user/billing reporting procedure.
 - Develop and implement the reporting procedure.
- d. *Step 14: Recover Charges.*
 - Design, develop, and implement the cost recovery procedure.

3. GUIDELINES FOR DEVELOPING AND IMPLEMENTING A CHARGING SYSTEM

This section is a discussion of the recommended steps for developing and implementing a charging system. The steps are grouped into four phases and should be followed in sequence to the extent that they are relevant to a particular DP environment.

3.1 Planning Phase

The planning phase consists of preparing the agency's developmental plans for the charging system. The preparation of the developmental plans consists of establishing the project structure, determining the charging system characteristics, and preparing the project plan. This phase is the most important of the four phases, because (1) the agency will be establishing the general structure of the charging system and (2) the decisions made will guide the work during the remaining three phases. Representatives of the Charging Team and senior agency management should be responsible for the work during this phase. The three steps of the planning phase are discussed below.

1. Step 1: Establish the Project Structure

The objectives of the tasks performed during this step are to establish the management structure for the charging system project and to select the Charging Team.

- a. *Establish the Management Structure.* The management structure refers to the relationship between the individuals who must perform, manage, and oversee the charging system project. Senior agency management

should start the charging system project by appointing a Project Manager and an Oversight Official. The Project Manager should come from either the DP or accounting departments and the Oversight Official should be a member of senior management. *This Guideline recommends that the Project Manager of the charging system be responsible for performing the following functions.*

- The Project Manager will need to interface with senior agency management (Oversight Official) on a regular basis. This interface is important since senior management will be one of the primary users and beneficiaries of the charging system and the charging system project may need the authority of senior management to implement certain aspects of the charging system.
- The Project Manager will need to review all of the relevant literature on charging systems in order to make the many decisions that will be required when developing the charging system.
- The Project Manager will be responsible for the overall management of the project. Such management will include dealing with the day-to-day problems that normally arise during projects of this magnitude.
- The Project Manager should be somewhat familiar with the agency groups that will be most affected by a charging system; i.e., senior management, data processing, accounting, budgeting, and the users.

b. Establish the Charging Team. The second task that must be performed for Step 1 is for the Project Manager to establish a Charging Team. The purposes of the Charging Team are to (1) design, develop, and implement the charging system and (2) provide a forum where problems that arise can be resolved, and information and decisions from the involved groups can be easily requested and obtained. The Charging Team should consist of at least one representative from each of the agency's major groups that will be most affected by a charging system. Typically, the Charging Team members should come from the following groups: management, data processing, accounting, budgeting, and the users. The Charging Team's work will be made less complicated if the accounting member has a strong background in cost accounting. The Project Manager should be included as a member of the Charging Team. For some agencies with small DP facilities, costs can be conserved by limiting the Charging Team to one or two part-time members from one or two of the groups. When this situation arises, the members should be from data processing and accounting.

As a group, the Charging Team is responsible for designing the charging system, for organizing the charging system project to satisfy the design, and for determining the organizational approach to be used to develop the charging system. When work is assigned to individual Charging Team members, the DP and accounting representatives typically will receive responsibility for most of the work. The Charging Team collectively should have the authority, expertise, and experience to plan and execute the design, development, implementation, and operation of the charging system.

2. Step 2: Determine Charging System Characteristics

This step of the planning phase sets the direction of the work that will be performed during the subsequent steps of the project. During this step, the first attempt at determining the desired mixture of charging system characteristics will be performed. Use of the term "first attempt" implies the continuing modification throughout the project of the degree that each characteristic will influence the charging system. The proper mixture of the charging system characteristics can only be determined after study of certain DP facility characteristics, related to charging systems, and after study of the reasons the agency is charging for DP services.

This step will also indicate how the charging system can provide senior management with some of the potential benefits expected. For example, the allocation of scarce resources, a potential benefit of charging systems, can only be obtained if the proper mixture of charging system characteristics is selected.

a. Clarify DP Facility Characteristics. The first task of Step 2 is to clarify the DP facility characteristics. The major DP facility characteristics that relate to charging systems are the stage of maturity that the DP facility has achieved, the role of the DP facility in the agency, and the degree of decentralization of the DP budgeting and funding processes. Each of these characteristics is briefly discussed below with a reference from the bibliography where more information can be found concerning the characteristic. The Charging Team is encouraged to obtain and review each of these references.

(1) DP Facility Stage of Maturity. DP facilities can be viewed as being in one of four stages of maturity: initiation, contagion, control, or integration. The stage that a DP facility is in and is moving toward will dictate a certain mixture of characteristics that should be selected for the charging system. For example, a DP facility at the contagion level of maturity would be viewed as a minor part of an agency and, therefore,

may not need a highly sophisticated charging system. Conversely, a DP facility at the integration level of maturity would be viewed as a major part of an agency and, therefore, would need a highly sophisticated charging system. A detailed discussion of the four stages of maturity and the interaction they have with charging systems can be found in [NOLAR 77].

(2) *Role of the DP Facility in the Agency.* The DP facility's role in an agency is that of either providing support, providing service, or making a profit. The role of the DP facility will dictate a certain mixture of characteristics that should be selected for the charging system. A support center provides services free of charge to the agency and is not directly related to any specific department. A service center operates on the concept that those who use computer services should pay for them and should, subsequently, be charged on a cost reimbursable basis. A profit center operates as an independent business, and the user is charged at the market rate for the computer services supplied. A detailed discussion of each of the three roles can be found in [SCHAC 74].

(3) *Degree of Decentralization of DP Budgeting and Funding.* Most Federal agencies currently have a centralized approach for DP budgeting and funding. This centralization is accomplished by senior management's approval of DP usage through the DP facility's budget. DP budgeting and funding can be decentralized by approving DP usage via the users' budgets. The degree of decentralization that the agency currently has, or plans to have, will dictate a certain mixture of characteristics that should be selected for the charging system. A detailed discussion of the issue of decentralized DP budgeting and funding can be found in [BERND 77].

b. *Clarify Reasons for Charging.* Since the agency's reasons for developing and implementing a charging system are primarily the responsibility of senior management, they should be clarified by both the Charging Team and senior management. Aside from Government regulations, there are many interrelated reasons why an agency would want to charge for DP services. Some of the major reasons are briefly discussed below.

(1) *Encourage Efficiency.* An agency may wish to charge for DP services in order to encourage its users to utilize the DP facility more efficiently. Users can utilize the DP facility more efficiently if they are able to determine, in a timely manner, the volume and cost of each specific service they utilize and, thereby, can modify their use of those services. Additionally, the agency can charge for DP services to encourage DP managers to be more efficient and accountable in managing the DP facility. A charging system can lead to more efficient and accountable DP management because the system often increases dramatically the visibility of many DP managers' decisions.

(2) *Allocate Scarce Resources.* An agency may wish to charge for DP services in order to allocate services according to organizational priorities. This influence can entail the use of premiums or discounts to either balance the workload, encourage or discourage the use of particular services at a particular time, or control system performance. Any charging system will implicitly, if not explicitly, influence user behavior; therefore, care must be taken to avoid any presumptuous or inappropriate control over resource allocation which may result in a net loss to the organization as a whole.

(3) *Recover Costs.* An agency may wish to charge for DP services in order to recover the costs of operating the facility. Decisions will eventually have to be made concerning from which users to recover costs, which costs are to be recovered, the method used to account for costs, and the method used to recover the costs.

(4) *Report Usage and Costs.* An agency may wish to charge for DP services in order to report only DP usage and the costs of operating the facility. The charges that are reported to the users are never recovered.

(5) *Encourage Competition.* An agency may wish to charge for DP services in order to provide its users the opportunity to compare its billing rates with those of other DP facilities. This enables the users to obtain the most economical price available to support their applications. An additional benefit is that competition encourages the DP facility to operate as efficiently as it can in order to retain its users.

c. *Determine Mixture of Charging System Characteristics.* The third task of Step 2 is to determine the desired mixture of the major charging system characteristics. Charging system characteristics deal primarily with the particular features that the charging system should have. It is important that a first attempt at determining the desired mixture of characteristics be performed prior to designing the charging system, because attempting to

completely redesign a charging system to satisfy a completely different mixture of characteristics is costly and time consuming. When determining characteristics for the charging system, the following should be considered:

- Characteristics can be emphasized in the charging system to varying degrees;
- Some of the characteristics may conflict; thus, trade-offs between conflicting characteristics must be considered; and
- Whenever possible, it is best to minimize the complexity of the charging system; i.e., "keep it simple".

Twelve major charging system characteristics need to be determined. Each is briefly discussed below.

(1) *Repeatability.* When a given DP service is utilized more than once without changes being made either to the number of service units or to the billing rate, then the usage charge should be the same. The charging system should be able to keep track of the service units utilized by each user, regardless of the number of other users currently utilizing the same service. Repeatable charges enable users to make better plans and increase their trust in the functionality of the charging system.

(2) *Understandability.* Whenever possible, reports of service usage and charges which are supplied to the users should be in terms that they understand. If the users cannot understand the information, they will not be able to improve their efficiency or make adequate plans/budgets concerning future use. The type of information that is supplied to the users on usage reports should conform to their background and level of DP knowledge.

(3) *Equitability.* Users should be charged only for the services they actually receive. The techniques selected to measure the use of services should provide accurate and consistent data. Equitable charges will help prevent users from becoming disgruntled at having to pay more than their fair share.

(4) *Auditability.* An audit trail should be available to determine the type and quantity of the services which generated the charges. An audit trail enables the user, the DP facility, and senior management to evaluate the charging system and determine if it is calculating accurate charges.

(5) *Adaptability.* The charging system must be flexible enough to respond to the constant changes typical of the environments of most DP facilities. Changes often occur in most DP facilities due to hardware, software, and other technical advances. To minimize problems when changes do occur, the charging system should be capable of responding to these changes.

(6) *Cost to Operate.* Because the charging system is an important and potentially costly activity for the DP facility, the Charging Team should attempt to keep the cost of efficiently operating the charging system in line with the overall cost of operating the DP facility.

(7) *Implementation.* Whenever possible and despite their complexity, charging systems should be designed and developed so that their implementation, operation, and maintenance are relatively simple. This characteristic is closely related to characteristic (6) above, since the more difficult a charging system is to implement and maintain, the more expensive its operation is likely to be.

(8) *Controllability.* Controllability refers to the charging system producing charges that can be controlled by the user. If users attempt to make a program or application more efficient, then their charges should reflect their actions in a predictable manner. Variations in charges over which users have no control soon lead to frustration and prevent effective planning.

(9) *Stability.* The procedures and billing rates of the charging system should be changed as infrequently as possible. When users budget for DP services, they do so based on the projected billing rates provided by the DP facility. If the DP facility changes its rates after the users' budgets have been approved, the users may not be able to complete their work within their prescribed budget limits. One approach for preventing unexpected rate changes is to set the billing rates only once during the users' budgeting period; i.e., the rate period should match the budgeting period. The rates should be kept stable during this period, unless there is a major and unexpected change in resources or services of the DP facility. Users should be adequately forewarned and encouraged to participate in decisions regarding the charging system and procedural changes via a steering committee.

(10) *Simplicity.* Complexity in the method of calculating charges can confuse users, thereby causing frustration and an unwillingness to use the charging system as an aid to planning or achieving efficiency. A simple method of calculating charges will also enable the charging system to be more flexible to changes in resources and services.

(11) *Easy to Use.* The charging system should be easy enough to use so that extensive training and technical knowledge are not required. A charging system that is easy to use will encourage users to participate in decisions regarding modifications and enhancements to the charging system.

(12) *Provide Valuable Information.* The reports provided by the charging system should be sufficiently informative to enable users to improve their efficiency, control their costs, and determine the status of their accounts in a timely manner.

d. *Reconcile the Charging System Characteristics.* The fourth task of Step 2 is to reconcile the charging system characteristics with the DP facility characteristics and the agency's reasons for charging. The purpose of this reconciliation is to identify conflicting characteristics, characteristics that will be too expensive to incorporate, and any additional characteristics that should have been determined but were overlooked.

3. Step 3: Prepare the Project Plan

The final step of the planning phase is the preparation of a formal Project Plan to guide the design, development, and implementation of the charging system. Special attention should be given to the Project Plan by the Charging Team. The Plan should include (a) the decisions made on the project structure in Step 1, (b) the characteristics that were determined in Step 2, and (c) budget and work schedules for each phase, step, and task described in this Guideline and for any additional tasks added by the Charging Team.

After the Charging Team has completed the Planning Phase, senior agency management should review the Charging Team's results. This is the first of several major checkpoints that should be utilized by senior agency management to make certain that the charging system project is progressing satisfactorily.

3.2 Design Phase

During the design phase, the work performed during the planning phase is used to direct the conceptual development and general design of the charging system. The objectives of the design phase are to begin developing/modifying a DP cost accounting system to complement the charging system; establish cost distribution matrices (i.e., matrices to be used to proportion the costs of the resources to the services); and to prepare the functional requirements, data requirements, and general design documents for the charging system. These documents, along with the DP cost accounting system and the cost distribution matrices, will be used during subsequent phases to guide the detailed design, development, implementation, and operation of the rate-setting and billing subsystems. The Charging Team should perform the work during this phase. The three steps of the design phase are discussed below.

1. Step 4: Initiate a Data Processing Cost Accounting Project

The objective of this step is to initiate a project that will develop a new DP cost accounting system or modify the existing DP cost accounting system to provide the charging system with appropriate DP cost data. It is important for the Charging Team to understand that unless there is a good DP cost accounting system in place, it will have difficulty obtaining the cost data needed for the charging system. In many agencies the cost data, mechanisms to obtain the cost data, or both just do not exist. Therefore, without a DP cost accounting system designed specifically to collect the cost data for a charging system, the Charging Team could have great difficulty obtaining any sort of useful cost data. Consequently, the DP cost accounting system should be developed/improved prior to, or in parallel, with the charging system. This step consists of one task, to initiate a project that will design and develop a new or improved DP cost accounting system.

a. *Fundamental Concepts.* Before initiating the project to develop or modify a DP cost accounting system, the Charging Team should understand some general concepts about DP cost accounting and related design and developmental issues.

(1) *DP Cost Accounting.* Cost accounting is that method of accounting which provides for the assembling and recording of all the elements of cost incurred to accomplish a purpose, to carry on an activity or operation, or to complete a unit of work or a specific job. A DP cost accounting system is a system by

which the costs incurred by a DP facility for providing its services are monitored and recorded. When the DP facility is using a charging system, the DP cost accounting system is typically the source of the historical cost data used to forecast DP costs. The cost data forecasted for the rate period are used to determine the billing rates for the services provided by the DP facility. Figures 4 through 6 provide examples of some of the data that might be kept by a DP cost accounting system. Cost accounting and accounting techniques are not necessarily as straightforward and simple as might be assumed from reading this Guideline. There are a variety of accounting techniques that could be used when accounting for DP costs. For more information on cost accounting, accounting techniques, and DP cost accounting systems, the Charging Team should obtain the help of a cost accountant and read the documents listed in the following section.

(2) *Design and Developmental Issues for a DP Cost Accounting System.* First, since the DP cost accounting system needs to be developed prior to or in parallel with the charging system, the Charging Team should read this entire Guideline in detail prior to designing the DP cost accounting system. This will enable the Charging Team to determine more easily the exact data that the DP cost accounting system will have to provide for the charging system.

Second, the Charging Team should read the following documents prior to designing the DP cost accounting system: FGAP 4: "Guidelines for Accounting for Automated Data Processing Costs" [USGAO 78]; "Guidelines for Cost Accounting Practices for Data Processing" [STATN 77]; and "Management Guidelines for Cost Accounting and Costs Control for Automatic Data Processing Activities and Systems" [USGAO 75]. These documents and the assistance of a cost accountant should more than adequately help the Charging Team determine the specifications for the design of the DP cost accounting system.

Third, DP cost accounting systems can be designed to maintain cost data at varying levels of detail. The Charging Team needs to make certain that the DP cost accounting system maintains data at the level of detail needed by the charging system. This means that the Charging Team will need to anticipate the level of detail of charging system cost data.

Fourth, the Charging Team should survey the agency's current cost accounting capabilities and budget submission process. Most agencies have a cost accounting system that can probably be used by the DP facility with minor modifications. All possibilities should be explored prior to designing and developing a new DP cost accounting system.

Fifth, the Charging Team should strongly consider an evolutionary approach to its DP cost accounting system design, because the charging system will need accurate cost data with which to forecast costs before it can be implemented. It will probably take several years before the DP cost accounting system will be able to provide cost data with the desired accuracy. Therefore, the DP cost accounting system should be designed to provide the best data currently available. This will enable the charging system to be implemented earlier, although the charges and data provided by the charging system will only be as accurate as those provided by the DP cost accounting system.

Finally, one area of cost forecasting that often proves to be cumbersome is calculating the depreciation costs. According to Circular A-121, depreciation costs for both hardware and software must be incorporated into the costs to be charged out to the users. There are a number of different ways to calculate depreciation for hardware and software. The Charging Team should obtain further guidance from FGAP 4 and other Federal and agency guidelines. *This Guideline generally recommends straight-line depreciation over the management-defined useful life of the original investment.*

b. *Initiate Project to Design and Develop a DP Cost Accounting System.* The purpose of this task is for the Charging Team to begin a separate project to design and develop a DP cost accounting system. This project should be managed by an accountant with some DP cost accounting experience, possibly the accounting representative on the Charging Team. It is important that there be a constant flow of information between the cost accounting and charging system projects because data from the DP cost accounting system will be needed for the charging system.

It is not within the scope of this Guideline to provide detailed direction concerning the design and development of the DP cost accounting system. The Charging Team should obtain the direction that they need from the Government documentation cited earlier in this step and from the accounting department within the agency.

COST ELEMENTS	TOTAL ANNUAL COST ESTIMATE							TOTALS		
	FUNDED COSTS				UNFUNDED COSTS			FUNDED	UNFUNDED	TOTAL
	DIRECT		INDIRECT		MISC. COSTS	RETIREMENT ETC.				
	REGULAR WAGES	OVERTIME WAGES	OTHER EXPENSES (TRAINING, TRAVEL, ETC.)	FRINGE BENEFITS						
PERSONNEL										
<u>MIS OFFICE</u>										
<u>DATA CENTER PERSONNEL</u>										
<u>SYSTEMS ANALYSIS AND PROGRAMMING BRANCH</u>										
TOTAL										

FIGURE 4. Sample cost accounting data for the personnel category.

COST ELEMENTS	FUNDED COSTS				TOTAL	UNFUNDED COSTS (DEPRECIATION)	TOTAL
	LEASE	RENTAL	MAINTENANCE	TOTAL			
<u>EQUIPMENT</u>							
1. PROCESSORS							
2. CORE MEMORY							
3. I/O MULTIPLEXOR							
4. DATA COMMUNICATIONS GEAR							
5. DISK DRIVES							
6. TAPE DRIVES							
7. UNIT RECORD CONT.							
8. PRINTER							
9. CARD READER/PUNCH							
10. TERMINALS							
EQUIPMENT SUBTOTAL							
<u>SOFTWARE</u>							
1. OPERATING SYSTEM, LANGUAGE PROCESSORS, UTILITIES, ETC.							
2. DATA BASE SOFTWARE							
3. APPLICATIONS SOFTWARE							
SOFTWARE SUBTOTAL							
TOTAL							

FIGURE 5. Sample cost accounting data for the equipment and software categories.

COST ELEMENTS	FUNDED			UNFUNDED (DEPRECIATION)	TOTAL
	LEASE	RENT	MAINTENANCE		
OTHER					
<u>SUPPLIES</u>					
1. OFFICE SUPPLIES					
2. DATA PROCESSING SUPPLIES					
3. MISCELLANEOUS EXPENSES					
<u>CONTRACTED SERVICES</u>					
1. TECHNICAL AND CONSULTING SERVICES					
2. EQUIPMENT MAINTENANCE					
3. OPERATIONS SUPPORT					
4. TELECOMMUNICATIONS NETWORK SERVICES					
<u>SPACE OCCUPANCY</u>					
1. MIS FLOOR SPACE					
2. MIS OFFICE FURNITURE					
3. UTILITIES AND MAINTENANCE					
<u>INTRA-AGENCY SERVICES AND OVERHEAD</u>					
TOTAL					

FIGURE 6. Sample cost accounting data for the other resource categories.

2. Step 5: Establish the Distribution Matrices

The objective of the tasks performed during this step is to develop the cost distribution matrices. The distribution matrices, which can be viewed as the nuclei of the rate-setting subsystem, are the mechanisms by which the costs of the resources are proportioned to the services. Depending on the level of detail desired, establishing the distribution matrices can be an extremely complex and time-consuming process because of the variety and number of decisions that must be made. Consequently, it is important for the Charging Team to expend considerable effort on the tasks in this step. This step consists of the following four tasks:

- Define the services, service units, and service centers for the DP facility;
- Define the areas of management responsibility, work functions, subfunctions, and work units;
- Itemize resources and define the resource units; and
- Test and adjust the distribution matrices.

a. *Fundamental Concepts.* Before attempting to establish the distribution matrices, it is important for the Charging Team to understand

- the concepts of full and partial cost allocation;
- billing rates based on expected usage; and
- the purposes and content of the distribution matrices.

A discussion of each of these concepts follows.

(1) *Full and Partial Cost Allocation.* Full cost allocation means that all of the DP facility's costs are incorporated into the distribution matrices and charged out to the users of the DP facility. Partial cost allocation means that only a predetermined subset of the DP facility's total costs are incorporated into the distribution matrices; such as only the costs for hardware, software, and personnel. It is important that the Charging Team understand the difference between full and partial cost allocation. Circular A-121 states that agencies must account for and allocate the full cost of operation. The only reason partial cost allocation might be justifiable under the requirements of Circular A-121 may be the difficulty, due to a lack of data, of using full cost allocation during the first several times the billing rates are calculated. Thus, agencies could begin with partial cost allocation in order to speed up the implementation of the charging system. As more complete data become available, agencies could begin to use full cost allocation.

(2) *Billing Rates Based on Usage.* It is possible to base service billing rates on either expected service usage or service capacity. Expected usage refers to the total number of service units, for a particular service, that the Charging Team expects to be used during the rate period. Capacity refers to the total number of service units, for a particular service, available during the rate period. Based on the direction set forth in Circular A-121 and FGAP 4, *this Guideline recommends that the Charging Team base its billing rates on expected usage.*

(3) *Distribution Matrices.* The purposes of the distribution matrices are to provide a mechanism that can be used (a) to proportion the costs of the resources to the subfunctions, (b) to proportion the costs of the subfunctions to the service centers, and (c) to develop a billing rate for each service of the service centers. The use of a series of matrices, instead of some other allocating mechanism, is recommended by this Guideline, because matrices provide the clearest, easiest technique for tracking the large volume of information required to calculate the billing rates. Figures 7 through 9 are examples of the distribution matrices and show the major categories of information needed. Completing the three matrices is the major objective of the work that will be performed during the rate-setting phase.

The resource, subfunction, and billing rate distribution matrices contain 19 categories of information. A brief discussion of each type of information is presented below, along with the appropriate section in this Guideline where the information is either discussed more fully, collected, or calculated.

- *Area of Management Responsibility (AMR).* Name of a DP facility department, managed by one individual, with responsibility for one or more work areas. (See sec. 3.2.2.c. of this Guideline.)
- *Work Function (WF).* The name of a work area performed by the DP facility. The work function consists of one or more subfunctions. (See sec. 3.2.2.c.)

AREA OF MANAGEMENT RESPONSIBILITY	AMR1			AMR2						AMR3																																		
	WORK FUNCTION		WF1	WF2		WF3		WF4		WF5			WF6																															
SUB-FUNCTION	SF1		SF2		SF3		SF4		SF5		SF6		SF7		SF8			SF9			SF10			SF11																				
RESOURCE COST	R1		C1		R2		C2		R3		C3		R4		C4		R5		C5		R6		C6		R7		C7		R8		C8		R9		C9		R10		C10		R11		C11	
SUBTOTAL					TC2		TC3		TC4		TC5		TC6		TC7		TC8			TC9			TC10			TC11																		
WORK FUNCTION COSTS																																												
TOTAL					TC1																																							

FIGURE 7. Sample resource distribution matrix.

SERVICE CENTER SUBFUNCTION TOTAL COST	SC1	SC2	SC3	SC4	SC5	SC6
SF1 TC1						
SF2 TC2						
SF3 TC3		SP _{3,2} SPC _{3,2}				
SF4 TC4						
SF5 TC5						
SF6 TC6						
SF7 TC7						
SF8 TC8						
SF9 TC9						
SF10 TC10						
SF11 TC11						
TOTAL	CSC1	CSC2	CSC3	CSC4	CSC5	CSC6

FIGURE 8. Sample subfunction distribution matrix.

SERVICE CENTER	SC1						SC2		SC3			SC4		SC5	SC6	
SERVICE	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16
SERVICE UNIT	SU1	SU2	SU3	SU4	SU5	SU6	SU7	SU8	SU9	SU10	SU11	SU12	SU13	SU14	SU15	SU16
COST OF SERVICE CENTER	CSC1						CSC2		CSC3			CSC4		CSC5	CSC6	
SERVICE FORECAST	SF1	SF2	SF3	SF4	SF5	SF6	SF7	SF8	SF9	SF10	SF11	SF12	SF13	SF14	SF15	SF16
STANDARDIZATION FACTORS	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16
STANDARDIZED FORECAST	STF1						STF2		STF3			STF4		STF5	STF6	
BASE RATE	B1						B2		B3			B4		B5	B6	
BILLING RATE	BR1	BR2	BR3	BR4	BR5	BR6	BR7	BR8	BR9	BR10	BR11	BR12	BR13	BR14	BR15	BR16

FIGURE 9. Sample billing rate distribution matrix.

- *Subfunction (SF)*. The name of an area of work that is more specific than that characterized by its corresponding work function. (See sec. 3.2.2.c.)
- *Resource (R)*. The name of the resource that will be used as the lowest level of detail to collect cost data. (See sec. 3.2.2.d.)
- *Cost (C)*. The dollar value that the agency incurs for each itemized resource. (See sec. 3.3.2.)
- *Resource Proportion (RP)*. The proportion of a resource used to support a particular subfunction. (See sec. 3.3.3.)
- *Resource Proportion Cost (RPC)*. The proportionate cost of a resource used to support a particular subfunction. The resource proportion cost is calculated by multiplying the cost of a particular resource by the resource proportion for a particular subfunction; e.g.,

$$RPC_{N,M} = C_N * RP_{N,M}$$

where:

- N = a particular resource
- M = a particular subfunction.

(See sec. 3.3.3.)

- *Total Cost of Subfunction (TC)*. The total cost of performing a subfunction, calculated by summing all of the resource proportion costs; e.g.,

$$TC_1 = \sum_{i=1}^N RPC_{i,1}$$

where:

- N = number of resources.

(See sec. 3.3.3.)

- *Service Center (SC)*. The name of a group of services that have been grouped for a particular purpose. (See sec. 3.2.2.b.)
- *Subfunction Proportion (SP)*. The proportion of a subfunction used to support a particular service center. (See sec. 3.3.3.)
- *Subfunction Proportion Cost (SPC)*. The proportionate cost of a subfunction used to support a particular service center. The subfunction proportion cost is calculated by multiplying the cost of a particular subfunction by the subfunction proportion for a particular service; e.g.,

$$SPC_{M,L} = TC_M * SP_{M,L}$$

where:

- M = a particular subfunction
- L = a particular service center.

(See sec. 3.3.3.)

- *Cost of Service Center (CSC)*. The cost of providing a service center, calculated by summing all of the subfunction proportion costs; e.g.,

$$CSC_1 = \sum_{i=1}^M SPC_{i,1}$$

where:

- M = number of subfunctions.

(See sec. 3.3.3.)

- *Service (S)*. Commonly used name for each service that will be offered by the DP facility. (See sec. 3.2.2.b)
- *Service Unit (SU)*. The name of the unit that will be used to report and bill users for utilizing a given service. (See sec. 3.2.2.b.)
- *Service Forecast (SF)*. The number of service units projected to be used for the planning period. (See sec. 3.3.1.)
- *Standardization Factor (F)*. A number chosen for a particular service such that, when it is multiplied by the service forecast, the result is a forecast expressed in standardized units. (See sec. 3.3.3.)
- *Standardized Forecast (STF)*. For each Service Center, the standardized forecast is the sum of the service forecasts multiplied by their respective standardization factors; e.g.,

$$STF_1 = \sum_{i=1}^N SF_i * F_i$$

where:

N = number of services in Service Center 1.

(See sec. 3.3.3.)

- *Base Rate (B)*. The amount that represents the cost of providing each unit of the standardized forecast. The base rate for a service center is calculated by dividing the cost of a service center by its standardized forecast; e.g.,

$$B_1 = \frac{CSC_1}{STF_1}$$

(See sec. 3.3.3.)

- *Billing Rate (BR)*. The dollar amount charged to the users for each service unit. The billing rate for a service is calculated by multiplying the base rate of its service center by its standardized factor; e.g.,

$$BR_1 = B_1 * F_1$$

(See sec. 3.3.3.)

To illustrate the manner in which distribution matrices should be completed, sample distribution matrices will be completed in succeeding sections of this Guideline to provide the Charging Team with concrete examples of the approaches recommended in the text. As direction is provided on how to complete a specific section of the distribution matrices, the corresponding completed section of the sample distribution matrices will be illustrated. Sample distribution matrices are intended for *illustrative purposes only*; they are not recommendations for using particular resources, areas of management responsibility, work functions, subfunctions, service centers or services.

b. Determine Services, Service Units, and Service Centers. The first task in Step 5 is to determine the services and service units that the DP facility will provide to its users. The Charging Team should then group the services into service centers.

(1) *Determine Services.* Determining the DP facility's services will probably be one of the most difficult tasks for the Charging Team to perform; it is also among the most important tasks, since the services form the foundation of the entire charging system. The Charging Team should remember the following principles when determining the DP facility's services.

- It is best to have only one measure, one service unit, for each service.
- Services and service units should be easily understood by the users.
- The services should represent a significant portion of the DP facility's work.

- The services should not be limited only to hardware services. Other DP services, especially personnel-based services, are often very costly and should be explicitly charged for whenever possible.
- Whenever possible, services that are transaction or output based should be selected. A transaction or output based service is one which has a service unit that users can easily understand and that is closely related to the work that the user is performing. Examples of transaction or output based services are payroll, with the service unit being the number of checks printed; catalogue orders, with the service unit being the number of orders processed; and literature search, with the service unit being the number of documents searched.
- The services chosen will be the basis for charging the users and are the most visible aspect of the charging system to users; therefore, they should be chosen with care. Examples of typical services are presented in the sample distribution matrices presented later in this section.

(2) *Determine Service Units.* The Charging Team should consider the following when determining the service unit for each service.

- There should be no more than one service unit per service. Having only one unit per service facilitates cost distribution and billing rate calculation and helps keep the charging system simple.
- The service unit, like the service it measures, should be selected so that it can be easily understood by the users.
- The service unit should be a good measure of the work that is supplied by the service.
- The service unit should be as easy to measure accurately as possible. If the number of units consumed cannot be easily and accurately measured, then the utility of that particular unit is significantly decreased.

(3) *Group Services into Service Centers.* After determining the services and service units, the Charging Team should then group the services into service centers to facilitate the distribution of costs and the calculation of billing rates. Costs are distributed only to the level of the service center, not the service, in the distribution matrices. Consequently, revenues should be required only to balance at the service center level, not at the service level.

The Charging Team should consider the following concepts when grouping the services into service centers.

- The purpose of grouping services into service centers is (a) to permit greater management flexibility in calculating the services' billing rates and (b) to balance costs and revenues at a level more general than services. This greater management flexibility allows the Charging Team to more easily incorporate such features as priorities, normalization factors, surcharges, and discounts. Balancing costs at a higher level allows senior management to more easily manage the DP facility.
- The services grouped within one service center should be related in some reasonable manner. The relationship can be logical or physical. An example of a physical relationship is grouping CPU services with different priorities into a service center. These services are physically related in that they have the same type of service unit, CPU seconds. An example of a logical relationship is grouping a microfiche service and a printing service into a service center. These services are logically related in that they are both output devices, but there is no direct relationship.
- The relationship between services should not be forced; there should be a rational reason for grouping them. For example, it is rational for the Charging Team to group two services, place a surcharge on one and a discount on the other, in order to encourage the users to use more of one than the other. But it is not rational for the Charging Team to group two services because neither can be grouped under any other service center. If services cannot be grouped rationally under any other service center, they should be treated as a service center with one service.
- The magnitude of the service's billing rates can be adjusted from service to service within the same service center. But Government policies require that the Charging Team must have a rational, defensible reason for doing so, and the total cost of the service center should not be over- or under-charged.
- The grouping of services into service centers is one area of the charging system where management can exert significant influence over the allocation of scarce resources.

(4) *Review Selections.* Upon completing this task, the Charging Team should review all of the services identified in order to ensure that no services have been inadvertently omitted or unnecessarily included. The service units should also be reviewed to ensure that they satisfy all of the suggestions set forth in this document. Finally, the groupings of the services into service centers should be reviewed and validated. After reviewing the services, service units, and service centers, the Charging Team should complete the corresponding parts of the subfunction and billing rate distribution matrices.

(5) *Sample Distribution Matrices.* Sixteen sample services have been chosen and grouped into six service centers for inclusion in the sample distribution matrices. The services, their respective service units, and service centers are listed in figure 10. The services, service units, and service centers have been included in the sample subfunction and billing rate distribution matrices and are presented in figures 11 and 12.

<i>Service Center</i>	<i>Service</i>	<i>Service Unit</i>
Processing A	CPU prime shift high priority	CPU second
	CPU prime shift normal priority	CPU second
	CPU prime shift low priority	CPU second
	CPU non-prime shift high priority	CPU second
	CPU non-prime shift normal priority	CPU second
	CPU non-prime shift low priority	CPU second
Processing B	High-speed CPU	CPU second
	Low-speed CPU	CPU second
Applications Programming	Senior Analyst Support	Analyst Hour
	Analyst Support	Analyst Hour
	Junior Analyst Support	Analyst Hour
	Apprentice Analyst Support	Analyst Hour
Reporting	Microfiche	Fiche
	Printing	Lines
DBMS	DBMS	Users
Payroll	Payroll	Checks

FIGURE 10. *Service centers, services, and service units for the sample distribution matrices.*

SERVICE CENTER	PROCESSING A						PROCESSING B		APPLICATIONS PROGRAMMING				REPORTING		DBMS	PAY-ROLL		
	PRIME HIGH	PRIME NORMAL	PRIME LOW	NON-PRIME HIGH	NON-PRIME NORMAL	NON-PRIME LOW	HIGH SPEED	LOW SPEED	SENIOR ANALYST	JUNIOR ANALYST	APPREN. ANALYST	MICRO-FICHE	PRINTING	FICHE			1000 LINES	USERS
SERVICE UNIT	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	HOUR	HOUR	HOUR	HOUR	HOUR					
COST OF SERVICE CENTER																		
SERVICE FORECAST																		
STANDARDIZATION FACTORS																		
STANDARDIZED FORECAST																		
BASE RATE																		
BILLING RATE																		

FIGURE 12. Sample billing rate distribution matrix with service centers, services, and service units added.

c. *Determine Areas of Management Responsibility, Work Functions, Subfunctions, and Work Units.* The second task of Step 5 is to determine the areas of management responsibility (AMR's) within the DP facility, the distinct work functions within each AMR, the various subfunctions within each work function, and the work unit that is the measure of work for each subfunction.

The AMR's, work functions, and subfunctions are incorporated into a charging system in order to provide senior and DP management more information on the costs and revenues of the DP facility so that they can better manage. Therefore, it is extremely important that the Charging Team include these three work categories as part of the charging system. Senior and DP management should take an active role in determining the AMR's, work functions, and the subfunctions in order to obtain the types of information that they need.

(1) *Determine Areas of Management Responsibility.* The Charging Team should consider the following concepts when determining the areas of management responsibility for the charging system.

- An AMR should be an area of work in the DP facility that is managed by one individual.
- To ensure that the individual in charge of an AMR is conscious of and responsible for the costs incurred within his/her area of control, costs should be accounted for and reported by the AMR.
- The individual in charge of an AMR will need to be provided information for planning and control, so that costs can, where possible, be related to decisions.
- Revenue from billing for service usage may be calculated for each AMR and compared to the AMR's cost in order to help evaluate management performance.
- Whenever possible, AMR's should be selected to correspond to the existing management structure within the DP facility.

(2) *Determine Work Functions.* After determining the AMR's for the charging system, the Charging Team should determine the work functions performed by the DP facility in each AMR. Several reasons require that costs be grouped by work functions.

- To permit an evaluation of the efficiency of performing specific operations and a comparison of the costs of functions that can be accomplished in more than one way or by more than one source;
- To provide a means of isolating costs for similar activities and work processes which have a common unit for measuring resource consumption; and
- To segregate the costs of the DP facility into different work functions for effective management of the DP facility.

The Charging Team should consider the following when determining work functions.

- Work functions can be either product-oriented or support-oriented. Product-oriented work functions are those for which the output can be traced directly to the services offered to the DP facility's users. Support-oriented work functions are those upon which product-oriented work functions rely for certain services and skills. For example, I/O is a product-oriented work function if the DP facility provides various I/O services to its users, while administration is a support-oriented work function.
- Work functions should be established both for computer processing and for software activities. Software work functions should include maintenance and development activities.
- A work function should not be spread between two AMR's. If the Charging Team determines that one or more work functions are spread between two AMR's and cannot be logically separated into two work functions, then the Charging Team should consider restructuring the AMR's to encompass distinct work functions.

(3) *Determine Subfunctions.* Once the Charging Team has determined the work functions of the charging system, it should next determine whether or not each work function can be further divided into subfunctions. The reasons for dividing work functions into subfunctions are

- to provide an additional level of cost information to senior and DP management, and
- to facilitate distribution of the costs of the work functions to the services provided by the DP facility.

The Charging Team should consider the following concepts when dividing the work functions into subfunctions.

- Each subfunction should be chosen so that a single measure can be used to represent the work of the subfunction.
- There should be a rational reason for dividing the work functions into subfunctions.
- If a work function cannot be divided into two or more subfunctions, it should be treated as having only one subfunction.

(4) *Determine Work Units.* The last thing that the Charging Team should do in this task is to determine a work unit for each subfunction. These work units will be used by the Charging Team to facilitate distribution of the costs of the subfunctions to the service centers in the distribution matrices. The Charging Team should consider the following concepts when determining the work units.

- Each subfunction should have only one work unit.
- The work unit should be a good measure of the major type of work performed in the subfunction.
- The work unit should be easy to measure accurately. If the number of work units performed cannot be easily and accurately measured, the utility of that particular unit is significantly decreased.

(5) *Review Selections.* Upon completing this task, the Charging Team should review all of the AMR's, work functions, and subfunctions previously determined in order to ensure that no work area has been inadvertently omitted or unnecessarily included. The work units should also be reviewed to ensure that they satisfy all of the suggestions set forth in this Guideline. After reviewing the AMR's, work functions, subfunctions, and work units, the Charging Team should complete the corresponding parts of the resource and subfunction distribution matrices.

(6) *Sample Distribution Matrices.* For illustrative purposes, three AMR's, six work functions, and 11 subfunctions have been chosen and are listed in figure 13. The sample resource and subfunction distribution matrices have been completed with these AMR's, work functions, and subfunctions and are presented in figures 14 and 15.

<i>Area of Management Responsibility</i>	<i>Work Function</i>	<i>Subfunction</i>
ADMINISTRATION	DP ADMINISTRATION	DP ADMINISTRATION
COMPUTER PROCESSING OPERATIONS	COMPUTER OPERATIONS	CPU
	REPORTING	STORAGE DEVICES MICROFICHE PRINTING
	TECHNICAL SUPPORT	DATA BASE MANAGEMENT EQUIPMENT MANAGEMENT
	SOFTWARE DEVELOPMENT MAINTENANCE	SOFTWARE DEVELOPMENT
	USER LIAISON	APPLICATIONS SOFTWARE ANALYSIS AND DESIGN CODING AND TESTING USER LIAISON

FIGURE 13. *Areas of management responsibility, work functions, and subfunctions for the sample distribution matrices.*

SERVICE CENTER SUBFUNCTION TOTAL COST	PROCESSING A	PROCESSING B	APPLICATIONS PROGRAMMING	REPORTING	DBMS	PAYROLL
ADMINISTRATION						
C. P. U.						
STORAGE DEVICES						
MICROFICHE						
PRINTING						
DATA BASE MANAGEMENT						
EQUIPMENT MAINTENANCE						
APPLICATIONS SOFTWARE						
ANALYSIS AND DESIGN						
CODING AND TESTING						
USER LIAISON						
TOTAL						

FIGURE 15. Sample subfunction distribution matrix with subfunctions added.

d. *Itemize Resources and Determine Resource Units.* The third task of Step 5 is to list in detail the resources that the DP facility uses to provide its services and to determine the resource units that can be used to facilitate distribution of the costs of the resources to the work functions and subfunctions.

(1) *Itemize Resources.* The Charging Team should consider the following concepts when itemizing the resources.

- The resources should be listed by the specific categories presented in Circular A-121 and FGAP 4.
- The resources should be as detailed as possible, since a cost will have to be forecast for each resource listed. For example, when a computer system is leased, the various components (e.g., tape and disk drives) should be listed separately if the cost for each can be forecasted. If the costs for the various components cannot be forecasted separately, the computer system should be listed as one resource.
- For every resource listed, a corresponding entry should appear in the new/modified DP cost accounting system discussed in Step 4.

(2) *Determine Resource Units.* After the Charging Team has itemized the resources of the DP facility, it should determine a resource unit for each resource. These resource units will be used by the Charging Team to facilitate distribution of the costs of the resources to the work functions and subfunctions. The Charging Team should consider the following concepts when determining the resource units.

- Each resource should have only one unit associated with it.
- The resource unit should be a good measure of the work performed by the resource.
- The resource unit should be easy to measure accurately. If the number of resource units consumed cannot be easily and accurately measured, the utility of that unit is significantly decreased.

(3) *Review Selections.* Upon completing this task, the Charging Team should review all of the resources that have been listed to ensure that all resources have been included at the appropriate level of detail. After completing this review, the Charging Team should list the resources in the resource distribution matrix.

(4) *Sample Distribution Matrices.* Eleven resources have been selected for illustration and included in the sample resource distribution matrix, as shown in figure 16.

e. *Test and Adjust the Distribution Matrices.* The fourth task of Step 5 is to test and adjust the distribution matrices. When the actual resource and subfunction proportions are determined during the rate-setting phase, the Charging Team's work will be facilitated if the resources have a clear relationship to the subfunctions and the subfunctions have a clear relationship to the service centers. These relationships consist of being able to identify how much of each resource is used to support each subfunction and how much of each subfunction is used to provide each service center. The purposes of this task are (1) to identify any vague relationships between the resources and subfunctions or the subfunctions and service centers and (2) to attempt to clarify the relationships, if possible.

The best technique to use in identifying vague relationships is to estimate (1) the resource proportions for each resource across subfunctions and (2) subfunction proportions for each subfunction across service centers. These estimates should be performed mentally with the objective of identifying obvious vague relationships. Once the vague relationships have been identified, they should be clarified by redefining the particular resources or subfunctions. Resources can be bundled together or unbundled into more detailed resources. Subfunctions can be grouped back into work functions or separated.

The testing and adjusting of the distribution matrices should not be a time-consuming process but should serve as a checkpoint for the Charging Team to identify and correct potential problems. The Charging Team should view this task as such and realize that problems that are missed now can be corrected later.

3. Step 6: Design the Charging System

The distribution matrices established in Step 5 provide the framework for designing the charging system. During Step 6, the distribution matrices are used to define the charging system's functional and data requirements, to explore alternative techniques for satisfying these requirements, and to prepare the charging system's general design. The tasks in Step 6 may result in the need to re-evaluate and revise the distribution matrices and the characteristics and objectives established in earlier tasks.

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.		COMPUTER PROCESSING OPERATIONS				SOFTWARE DEVELOPMENT AND MAINTENANCE		
	WORK FUNCTION	DP ADMIN.	COMPUTER OPERATIONS	REPORTING	TECHNICAL SUPPORT	SOFTWARE DEVELOPMENT	USER LIAISON		
RESOURCE COST			C. P. U. STORAGE DEVICES	MICROFICHE PRINTING	DATA BASE MANAGEMENT EQUIPMENT MAINTENANCE	APPLICATIONS ANALYSIS AND DESIGN CODING AND TESTING			
MANAGEMENT									
ANALYSTS									
COMPUTER A									
COMPUTER B									
PRINTERS									
MICROFICHE CAMERA									
DBMS									
PAYROLL SOFTWARE									
MICROFICHE									
COMPUTER PAPER									
SPACE OCCUPANCY									
SUBTOTAL									
WORK FUNCTION COSTS									
TOTAL									

FIGURE 16. Sample resource distribution matrix with resources added.

Three documents are produced during Step 6: the Functional Requirements, the Data Requirements, and the General System Design. Most agencies have guidelines or standards which prescribe the format, content, and approach to be used to prepare this Guideline. Additional guidance is contained in FIPS Publications (FIPS PUBS) 38 [NBS 76] and 64 [NBS 79], as well as in numerous other industry publications. Because of the availability of guidance in these areas, the discussion in this step will focus on the underlying charging system concepts that the Charging Team should address while preparing this Guideline.

The documents which will be produced during this step should be viewed as undergoing an evolutionary process of refinement during subsequent steps. The Charging Team should produce the documents after considering the needs and expertise of the intended audiences and the flexibility needed for revisions. These documents will provide the blueprint for the detailed design and development of the charging system. This step consists of four tasks:

- Define functional requirements.
- Define data requirements.
- Explore alternative techniques for satisfying the requirements.
- Prepare the charging system's general design.

a. *Fundamental Concepts.* Prior to producing the design documents, the Charging Team needs to understand the difference between the methods of actual and standard cost distribution and to incorporate one of the two into the charging system's general design.

(1) *Actual Cost Distribution.* The actual cost distribution method attempts to reduce the chance of over- or under-distributing costs to users by periodically adjusting billing rates. This periodic adjustment is performed as often as necessary to reflect both the actual cost of providing services and the actual usage levels. When the recalculations are performed, they are based upon the last rate period's usage and costs, as well as on the projected usage and costs for the upcoming rate period. These adjustments allow the DP facility to report (i.e., bill) all of its actual costs. Since this method provides billing rates that more accurately reflect costs, it can supply valuable information for accurate project costing, cost-benefit analyses, and management/project efficiency evaluation.

The major disadvantage to the actual cost method is that the billing rates change frequently. This constant fluctuation in the billing rates can cause budgeting problems for users. Another disadvantage is the tendency for under-utilization of the DP facility. If utilization falls off, billing rates will increase to compensate. As the billing rates increase, utilization often may decrease further, precipitating a vicious circle of decreasing utilization and increasing billing rates. Still another disadvantage is the problem of implementing new resources. For example, initial usage of new hardware is typically low, necessitating high billing rates. High billing rates may prevent increased utilization. When utilization does increase, the billing rates decrease, resulting in higher demand when least needed. One solution to these disadvantages is to increase the time between billing rate adjustments. When billing rates are held constant for a long period of time, the distribution method is referred to as standard cost distribution.

(2) *Standard Cost Distribution.* Standard cost distribution calls for the development of a set of billing rates for a fixed (reasonably long) period of time (rate period). During this period, billing rates do not fluctuate unless there is a major, unexpected change in the DP facility and/or the level of service utilization. The major advantages of the standard cost distribution are that

- variances between actual and recovered costs can be analyzed at the end of the rate period;
- rates will not rise during short periods of low utilization; and
- the fixed billing rates enable users to plan better and adhere to their DP budgets.

The disadvantages are that

- billing rates will not always reflect the current cost of providing service;
- fewer opportunities exist to effect resource utilization via the billing rates, especially if demand exceeds available capacity; and
- users of the DP facility may be over- or under-charged.

The Charging Team's decision on which allocation method to use will have the primary effect of determining the frequency with which billing rates will be recalculated. *This Guideline strongly recommends*

that the Charging Team select the standard cost, versus the actual cost, distribution method unless extenuating circumstances dictate otherwise. The primary reason for this strong recommendation is that standard cost distribution will make the charging system easier to operate and more helpful to both management and users. It is important that the Charging Team make its final decision before completing the design documents discussed in this step.

b. Define the Functional Requirements. The first task in Step 6 is to define the functional requirements of the charging system. The definition of the charging system's functional requirements began in Steps 4 and 5 with the establishment of the DP cost accounting system and the distribution matrices. The functional requirements document is a description of proposed methods for operating the charging system. The requirements which must be analyzed and specified include:

- the desired performance criteria of the subsystem procedures;
- the inputs, processes, and outputs for each procedure; and
- the operating environment.

Steps 7 through 14 of this Guideline describe many of the performance criteria, inputs, processes, and outputs for each procedure of the rate-setting and billing subsystems. The operating environment, the DP facility's organizational and operational structure, should be described by listing such things as the administrative structure, security and privacy requirements, and backup and operational controls.

c. Define the Data Requirements. The second task in Step 6 is to define the data requirements of the charging system. There are two categories of data in any system, static data and dynamic data (see [NBS 76]). Static data refers to data used during the operation of the system but updated or maintained independently of the system's operation schedule. Dynamic data refers to data which are updated during the system's normal operation. The Charging Team should identify all of the static and dynamic data of the charging system and list them in the Data Requirements document.

Static data are important to the charging system in that they form the basis upon which the dynamic data are monitored, collected, and used to operate the charging system. Examples of static data in a charging system are the lists of user identifiers and the accounting codes which are used to track costs.

It is important for the Charging Team to consider all types of dynamic data when defining the data requirements of the charging system, because the charging system's operation revolves around the monitoring and collection of the different types of data. There are four main types of dynamic data for a charging system: cost, resource unit, work unit, and service unit data.

The Charging Team should attempt to "look ahead" in the developmental process, as well as "look behind", when producing the Data Requirements document, since existing technical and operational constraints can limit the ability to collect certain types of data. These constraints need to be identified so that the techniques requiring the respective data can be modified. For example, if the Charging Team desired to charge users based on the length of time their programs were in real memory, but that data could not presently be monitored and collected, a different service unit would have to be selected or new monitoring techniques established.

d. Explore Alternative Techniques for Satisfying Requirements. The third task of Step 6 is to explore alternative techniques for satisfying the functional and data requirements of the charging system. The general design of the charging system should be based on an analysis of alternative techniques for satisfying these requirements. The four major decisions that the Charging Team will have to make during this task are whether to:

- use existing techniques or new techniques;
- centralize or decentralize the charging system;
- use manual techniques or automated techniques; and
- purchase needed software or develop it in-house.

The Charging Team will have to make these four decisions for each procedure in the rate-setting and billing subsystems.

The discussion below provides examples of the issues that must be considered for each of the four decisions. Evaluation of which decision is best should include brief feasibility and cost-benefit analyses. The choices made while exploring the alternatives of each decision may affect the requirements and objectives defined earlier. The Project Plan, the Functional Requirements document, and the Data Requirements document

should be modified or refined, as appropriate, to reflect the choices made for each decision. Also, the choices made for each decision will seldom be limited to the extremes presented below; instead, most requirements will probably be satisfied by using a combination of the alternatives.

(1) *Existing Versus New Techniques.* Most agencies have existing techniques capable of satisfying many requirements for the charging system. Even if the DP facility has never charged for its services, many data requirements could be satisfied by using existing cost accounting systems, usage accounting techniques, and historical data routinely collected for accounting, budgeting, and capacity planning purposes. Most computers have measurement software which can be used for monitoring machine-based resource, subfunction, and service usage. Existing techniques and data should be used when appropriate, although many procedures will require that new techniques be developed. For example, usage accounting systems are frequently inadequate for personnel-based systems if the DP facility has not previously charged for its services. Time sheets may have to be modified to allow personnel to associate the work they do with a particular user, user account, or project.

(2) *Centralized Versus Decentralized Charging System.* The second decision the Charging Team should make is the choice between a centralized or decentralized charging system. An agency may operate numerous DP facilities or have remote processing or job entry stations which link to a central facility. For example, an agency may operate two DP facilities and permit users in many locations to employ either facility via remote job entry. The agency may prefer to centralize the rate-setting procedures of the charging system by establishing an agency-wide billing rate schedule which is applied to the DP services at both facilities. In this example, usage accounting could be decentralized and all other procedures centralized. If the two DP facilities operate different types of computer equipment, billing rates may have to be normalized so that charges for a job run at either facility would be equal. Conversely, the agency may prefer to use different charging systems and billing rates for each DP facility and decentralize all of the procedures. The choices between centralized and decentralized procedures and subsystems are heavily influenced by the DP facility's mode of operations and agency management policies.

(3) *Manual Versus Automated Techniques.* The procedures of the charging system can be manual, automated, or a combination of both. Typically, the rate-setting procedures are manual and the billing procedures (except cost recovery) are automated. For example, the usage forecasting procedure may incorporate manual user surveys and data from automated systems, such as measurement software, both of which can be analyzed using an automated statistical package. Each procedure should be evaluated to determine the degree of automation required to satisfy the objectives and requirements established earlier.

(4) *Purchased Software Versus In-house Developed.* The fourth decision to be made is whether to develop needed software in-house or to purchase the software from commercial sources. Most agencies will find it feasible to adapt software provided by vendors or other DP facilities, if available, to avoid the costs and risks of in-house development. Usage accounting for machine-based resources, subfunctions, or services is the best example of the potential risks, complexity, and expense of in-house development. Most computer operating systems have measurement software which is used for capacity planning and performance measurement. These capabilities are difficult to develop in-house because of the need to modify operating systems. Another example is the reporting procedure, which requires software that is typically available from vendors or other sources.

e. *Prepare the General Design Document for the Charging System.* The fourth task of Step 6 is to prepare the charging system's general design. Once the alternative techniques have been explored and the choices for the four decisions selected, the charging system requirements should be refined. The refined requirements are then used to prepare the charging system General Design document. Federal and agency guidelines prescribe the format and content of this Guideline. The general design should include a description of the flow of information among procedures and a definition of the individual who is responsible for each procedure. The General Design document is used as a blueprint by the Charging Team for the detailed design, development, and implementation of each procedure during subsequent phases.

The General Design document should be used as a second major checkpoint by senior management to determine the progress of the charging system development project. It is important that senior management ensure that their objectives for the charging system are satisfied before permitting the project to proceed to the next phase.

3.3 Rate-Setting Phase

The next four steps of this Guideline focus on developing and implementing the procedures of the rate-setting subsystem. These procedures will need to be performed each time the billing rates are (re)set; i.e., at the end of every rate period. The Charging Team should remember the following points as it develops the four steps of this phase.

- This Guideline assumes that most of the techniques developed in this phase are not new to the Charging Team; however, it may be the first time that the Charging Team has encountered these techniques in the context of DP charging.
- Many of the techniques may already be in place.
- Each agency should expand or modify the steps and tasks in this phase in order to meet its own particular charging system objectives and requirements.

1. Step 7: Forecast Usage

This step discusses usage forecasting techniques as they relate to the charging system and is concerned with the usage of services, subfunctions, and resources. The Charging Team will need to forecast the usage of services, subfunctions, and resources in order to calculate the billing rates. The tasks in this step will show the Charging Team how to develop and implement the usage forecasting procedure. Each task is structured around the following four assumptions:

- The Charging Team is familiar with the DP facility's current forecasting techniques and has access to historical usage forecasts and data.
- Expertise in usage forecasting techniques is available or can be acquired.
- The expertise is available to translate the forecasted service usage into forecasted subfunction and resource usage.
- The values for the resource units, work units, and service units that are needed throughout the rate-setting phase are typically obtained from the usage accounting procedure. When developing the charging system for the first time the Charging Team should obtain the values from whatever data it has available.

This step consists of three tasks:

- collecting and analyzing usage forecasting data for services, subfunctions, and resources;
- determining and resolving discrepancies between the forecasted service usage and the current resource capacity; and
- re-evaluating the distribution matrices.

a. Collect and Analyze Usage Forecasting Data. The first task in Step 7 is to collect and analyze service, subfunction, and resource usage data. Collecting the data entails surveying the users, validating the users' responses, collecting the current rate period's usage accounting data, retrieving all pertinent historical usage accounting data, and readying the data for analysis. Whenever possible, the data should be collected in terms of the service, work, and resource units defined in the distribution matrices. After the Charging Team has collected the data, the data should be analyzed using regression and trend analysis techniques, and the results described in terms of the service, work, and resource units. The results should provide a projection of the amount of usage for each service in the distribution matrices, the data needed to determine the resource proportions for each subfunction, and the data needed to determine the subfunction proportions for each service center. It is not within the scope of this Guideline to present a thorough description of workload forecasting techniques; therefore, the reader is encouraged to consult the relevant literature, agency capacity planners, and/or outside experts, as appropriate, to obtain an understanding of how to forecast and how to use the forecasts once they are available.

b. Determine and Resolve Discrepancies Between Capacity and Usage. The second task in Step 7 is to determine and resolve discrepancies between available capacity and forecasted usage. After the Charging Team has analyzed the usage data, it should work with the DP facility's capacity planner(s) to compare forecasted usage with available service and resource capacity. It is possible that the usage forecasts will have to be re-analyzed or

translated into units that can be used to plan capacity. Discrepancies occur if the forecasted usage exceeds available service, subfunction, or resource capacity.

If the Charging Team determines that there are discrepancies between the forecasted usage and available capacity, then it must resolve the discrepancies. There are three possible resolutions if the forecasted usage exceeds the capacity:

- More resources can be acquired to increase the capacity of the DP facility.
- The extra work can be sent to another DP facility.
- The projected usage can be cut back.

If projected usage is below available capacity, there are three possible resolutions:

- Reduce capacity of the services and resources for which usage is unacceptably low. This should only be done if a trend of declining usage has continued for a long period and if the DP facility is incurring a substantial cost for the excess capacity.
- Assume that usage has temporarily declined and will pick up later, and leave capacity unchanged.
- Share the excess capacity with other agencies.

Regardless of the actions taken, declining usage should be monitored very closely, because it could indicate an operating deficiency in the DP facility. Operating deficiencies can range from not offering competitive rates to providing unacceptable levels of services. The decisions required to resolve discrepancies may require extensive interaction with, and compromises among, all of the DP facility's users. The Charging Team should be responsible for organizing meetings where the proper interactions can take place.

c. Re-Evaluate the Distribution Matrix. The third task in Step 7 is to re-evaluate the distribution matrices. The Charging Team should re-evaluate the distribution matrices at this point if services, subfunctions, or resources are to be added or removed as a result of the capacity planning and resolution efforts. If new services are to be offered, new subfunctions created, or new resources acquired, they will have to be incorporated into the distribution matrices, necessitating a restructuring of the matrices. If any of the three are added, it is very likely that additional usage forecasting will be needed. The removal or elimination of existing services, subfunctions, or resources could also necessitate a similar restructuring. If services, subfunctions, or resources are removed from the distribution matrices, usage forecasts may need to be modified to reflect both the loss of the services, subfunctions, or resources as well as any resulting increase in other services, subfunctions, or resources.

Once the Charging Team has re-evaluated the distribution matrices, it should complete the row for service forecasts of the billing rate distribution matrix.

d. Sample Distribution Matrices. The service forecast row has been completed for the sample billing rate distribution matrix and is presented in figure 17.

2. Step 8: Forecast Costs

This step discusses cost forecasting techniques as they relate to the charging system and involves projecting the costs of the resources for the rate period. The Charging Team will be developing and implementing the cost forecasting procedure of the rate-setting subsystem in this step. It is important that the Charging Team forecast the costs of the resources for the same time period for which usage was forecast, otherwise, the base rates will be inequitable. Cost forecasts are used in conjunction with usage forecasts to calculate the base rates. The discussion in this step assumes that the DP cost accounting system discussed in Step 4 has been designed and developed.

Prior to performing the tasks in this step, the Charging Team must determine whether or not military salaries should be included as part of the costs of operating the DP facility. There are certain limitations on the transferral of military salaries and the Charging Team should determine what its agency's policies are. This step consists of three tasks:

- Obtain or establish a trial budget for the DP facility.
- Collect and analyze the cost forecasting data.
- Re-evaluate and update the distribution matrices.

a. Obtain or Establish a Trial Budget. The first task in Step 8 is to obtain or establish a trial budget for the DP facility. The trial budget is generally available and can be used to offset deficiencies in the DP cost data when

SERVICE CENTER	PROCESSING A						PROCESSING B		APPLICATIONS PROGRAMMING				REPORTING		DBMS	PAY-ROLL						
	PRIME HIGH	PRIME NORMAL	PRIME LOW	NON-PRIME HIGH	NON-PRIME NORMAL	NON-PRIME LOW	HIGH SPEED	LOW SPEED	SENIOR ANALYST	ANALYST	JUNIOR ANALYST	APPREN. ANALYST	MICRO-FICHE	PRINTING			HOUR	HOUR	HOUR	FICHE	1000 LINES	USERS
SERVICE UNIT	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	HOUR	HOUR	HOUR	HOUR	HOUR	HOUR	HOUR	FICHE	1000 LINES	USERS	CHECKS	
COST OF SERVICE CENTER																						
SERVICE FORECAST	500,000	6,000,000	25,000,000	1,500,000	1,000,000	500,000	4,000,000	4,000,000	9,000	15,000	3,000	3,000	80,000	30,000	3,000	100						70,000
STANDARDIZATION FACTORS																						
STANDARDIZED FORECAST																						
BASE RATE																						
BILLING RATE																						

FIGURE 17. Sample billing rate distribution matrix with service forecasts added.

first calculating the billing rates. As a basis for forecasting costs, the Charging Team can obtain estimates of resource costs for the rate period from the trial budget and can use these estimates to supplement the data from the DP cost accounting system. The data obtained from the trial budget will have to be adjusted to reflect any changes resulting from resolving the discrepancies between capacity and usage in Step 7. The adjusted data should form the basis for both the DP facility's budget request and for cost forecasting. It is very important for senior management and the budget representative of the Charging Team to be involved if a trial budget needs to be established.

b. Collect and Analyze Cost Forecasting Data. The second task in Step 8 is to collect and analyze cost forecasting data. The Charging Team should collect the data needed for cost forecasting, including the trial budget, the usage forecasts, and the DP cost accounting system data. Whenever possible, the data should be collected at the same level of detail as used in the distribution matrices and for the same rate period for which usage forecasts were prepared. After the Charging Team has collected the cost data, it must analyze the data either manually or by using automated statistical analysis techniques. The analysis should include itemizing and categorizing the data for the appropriate resources. The results of the analysis should provide estimates of the costs for each resource listed in the distribution matrices. The next task will discuss what the Charging Team should do if costs cannot be calculated for some of the resources.

c. Re-evaluate and Update the Distribution Matrices. The third task in Step 8 is to re-evaluate and update the distribution matrices. Once the Charging Team has analyzed the cost data, the resources for which costs could not be calculated must be re-evaluated or removed from the distribution matrices. A problem which typically occurs is the inability to reduce the cost data to the appropriate level of detail. When this occurs, the distribution matrices should be restructured by grouping the resources, whose costs are difficult to itemize, with other related resources.

Once the Charging Team has re-evaluated the distribution matrices, it should complete the section for resource costs in the resource distribution matrix.

d. Sample Distribution Matrices. The resource cost section has been completed for the sample resource distribution matrix and is presented in figure 18.

3. Step 9: Calculate Billing Rates

This step discusses calculating the billing rates for the charging system. Billing rates are one of the most visible parts of the charging system to the users and can have a profound influence on them. Thus, the Charging Team should ensure that all of the information obtained from prior steps is as accurate as possible before beginning this step. The objective of the tasks in this step is to calculate the billing rates by using the cost and usage forecasts collected in Steps 7 and 8. This step consists of four tasks:

- Determine the resource proportions and resource proportion costs.
- Determine the subfunction proportions and proportion costs.
- Calculate the base rates.
- Calculate the billing rates.

a. Determine the Resource Proportions and Proportion Costs. A resource proportion is the percentage of a resource that is used to support a particular subfunction. A resource proportion cost is that cost that the DP facility incurs for utilizing a resource to support a particular subfunction. The resource proportion cost is calculated by multiplying the cost of the resource by the resource proportion. It is important that the Charging Team use care in determining the resource proportions, since they will form the basis for distributing the cost of each resource to each subfunction and, ultimately, to each service center. To determine the resource proportions and proportion costs, the Charging Team must:

- separate the resources into three categories, direct, indirect, and overhead, as specified in FGAP 4;
- use the resource usage data to determine the proportions and proportion costs for the resources in the direct category;
- determine the proportions and proportion costs for the resources in the indirect category;

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.	COMPUTER PROCESSING OPERATIONS						SOFTWARE DEVELOPMENT AND MAINTENANCE				
		COMPUTER OPERATIONS		REPORTING		TECHNICAL SUPPORT		SOFTWARE DEVELOPMENT			USER LIAISON	
WORK FUNCTION SUB- FUNCTION	DP ADMIN.	C. P. U.	STORAGE DEVICES	MICROFICHE	PRINTING	DATA BASE MANAGEMENT	EQUIPMENT MAINTENANCE	APPLICATIONS	ANALYSIS AND DESIGN	TESTING		
RESOURCE COST												
MANAGEMENT \$300,000												
ANALYSTS												
COMPUTER A \$150,000												
COMPUTER B \$100,000												
PRINTERS												
\$40,000												
MICROFICHE CAMERA												
\$10,000												
DEMS												
\$15,000												
PAYROLL SOFTWARE												
\$10,000												
MICROFICHE												
\$20,000												
COMPUTER PAPER												
\$25,000												
SPACE OCCUPANCY												
\$150,000												
SUBTOTAL												
WORK FUNCTION COSTS												
TOTAL												

FIGURE 18. Sample resource distribution matrix with costs of resources added.

- determine the proportions and proportion costs for the resources in the overhead category; and
- determine the subfunction costs.

(1) *Separate the Resources into Direct, Indirect, and Overhead Categories.* The differentiation between direct, indirect, and overhead resources is an important distinction that the Charging Team must make. A direct resource is one that is associated with one or more subfunctions because of a distinct logical and measurable relationship between them. Computer equipment and applications programmers are typically categorized as direct resources. An indirect resource is one that is associated with one or more subfunctions because there is a logical, but not readily measurable, relationship between them. Space is typically categorized as an indirect resource. An overhead resource is one that is associated with all of the subfunctions by management fiat because there is neither a logical nor measurable relationship between them. Management personnel are typically categorized as overhead resources. The Charging Team should categorize every resource as either direct, indirect, or overhead. This process is not as easy as it may seem at first glance, so the Charging Team should proceed with caution and allow sufficient time to perform it.

(2) *Determine the Resource Proportions for the Direct Resources.* The Charging Team should determine the proportions and proportion costs of the resources in the direct category prior to those in the indirect and overhead categories.

To determine the resource proportions, the Charging Team should use the resource usage data forecast in Step 7 and its own experience and judgment. The value of resource proportions can vary from 0.00 to 1.00, but the sum of the proportions across subfunctions should never exceed 1.00. For example, consider the Computer A resource in the sample distribution matrices. Assume that the resource usage data and the Charging Team's experience indicates that this resource is used approximately 80 percent of the time to support the CPU subfunction, approximately 10 percent of the time to support the Storage Device subfunction, approximately 10 percent of the time to support the Microfiche subfunction, and is never used to support any of the other subfunctions. Then the resource proportions for this resource would be 0.80, 0.10, and 0.10 for the three subfunctions mentioned, and 0.00 for the rest of the subfunctions.

The above example illustrates an important concept that the Charging Team should remember when determining the resource proportions: when a resource is used to support more than one subfunction, excessive cost and time should not be expended trying to determine the exact value of the resource proportion. If the data are available to determine the proportions exactly, then the Charging Team should calculate them. But, if the data are not available, then the Charging Team must use its experience and judgment to determine the proportions. The Charging Team should take steps to collect additional resource usage data, for calculating the resource proportions more exactly, only if it feels the added information is worth the cost of collecting the data.

After determining the resource proportions, the Charging Team should next calculate the resource proportion costs. Continuing with the above example, the Charging Team should multiply each resource proportion by the cost of the Computer A resource, \$150,000, to find its proportionate cost. This calculation would yield \$120,000, \$15,000, and \$15,000 for the CPU, Storage Device, and Microfiche subfunctions, respectively.

After determining all of the resource proportions and calculating the resource proportion costs for the resources in the direct category, the Charging Team should complete the appropriate parts of the resource distribution matrix.

The sample resource distribution matrix with the above example completed is presented in figure 19, while figure 20 illustrates the sample resource distribution matrix with all of the resource proportions and proportion costs completed for the direct resources.

(3) *Determine the Resource Proportions for the Indirect Resources.* The Charging Team should next determine the proportions and proportion costs for the resources in the indirect category. When determining the resource proportions for the indirect category, the Charging Team should use whatever resource usage data are available and its experience and judgment to assist in the process. One problem that the Charging Team may have in this process is that it is often difficult to determine a resource proportion value for a small subfunction. *When this situation arises, this Guideline recommends grouping the appropriate cost under the parent work function.* The work function's costs can then be distributed to its subfunctions later, after all of the resource costs have been distributed.

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.	COMPUTER PROCESSING OPERATIONS						SOFTWARE DEVELOPMENT AND MAINTENANCE			
		COMPUTER OPERATIONS		REPORTING		TECHNICAL SUPPORT		SOFTWARE DEVELOPMENT			USER LIAISON
WORK FUNCTION	DP ADMIN.	C. P. U.	STORAGE DEVICES	MICROFICHE	PRINTING	DATA BASE MANAGEMENT	EQUIPMENT MAINTENANCE	APPLICATIONS	ANALYSIS AND DESIGN	TESTING	
SUB-FUNCTION											
RESOURCE COST											
MANAGEMENT \$300,000											
ANALYSTS \$600,000											
COMPUTER A \$150,000		.80 120,000	.10 15,000								
COMPUTER B \$100,000											
PRINTERS \$40,000											
MICROFICHE CAMERA \$10,000											
DBMS \$15,000											
PAYROLL SOFTWARE \$10,000											
MICROFICHE \$20,000											
COMPUTER PAPER \$25,000											
SPACE OCCUPANCY \$150,000											
SUBTOTAL											
WORK FUNCTION COSTS											
TOTAL											

FIGURE 19. Sample resource distribution matrix with proportions and proportion costs for the computer a resource added.

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.		COMPUTER PROCESSING OPERATIONS				SOFTWARE DEVELOPMENT AND MAINTENANCE		
	WORK FUNCTION	DP ADMIN.	COMPUTER OPERATIONS	REPORTING	TECHNICAL SUPPORT	SOFTWARE DEVELOPMENT	USER LIAISON		
RESOURCE COST									
MANAGEMENT \$300,000									
ANALYSTS \$600,000									
COMPUTER A \$150,000									
COMPUTER B \$100,000									
PRINTERS \$40,000									
MICROFICHE CAMERA \$10,000									
DBMS \$15,000									
PAYROLL SOFTWARE \$10,000									
MICROFICHE \$20,000									
COMPUTER PAPER \$25,000									
SPACE OCCUPANCY \$150,000									
SUBTOTAL									
WORK FUNCTION COSTS									
TOTAL									

FIGURE 20. Sample resource distribution matrix with proportions and proportion costs for the direct resources added.

The following example from the sample distribution matrices should help clarify the above process. Of the 11 resources in the sample distribution matrices, only Space Occupancy has been categorized as an indirect resource. It has been determined, based on square foot measurements, that the space is used by the work functions and subfunctions according to the following percentages:

- 5 percent by the DP Administration work function;
- 30 percent by the CPU subfunction;
- 10 percent by the Storage Devices subfunction;
- 10 percent by the Microfiche and Printing subfunctions (The actual breakdown could not be determined, therefore the percentage was grouped under the Reporting work function.);
- 5 percent by the Equipment Maintenance subfunction;
- 5 percent by the Technical Support work function (The proportion could not be divided between the Data Base Management and Equipment Maintenance subfunctions.);
- 30 percent by the Software Development work function (The proportion could not be divided between the Application Software, Analysis and Design, and Coding and Testing subfunctions.); and
- 5 percent by the User Liaison work function.

The resource proportion costs have been calculated for the Space Occupancy resource proportions and both are listed in the sample resource distribution matrix in figure 21. The distribution of the work function costs to their subfunctions will be discussed after the overhead resource proportions have been calculated.

(4) *Determine the Resource Proportions for the Overhead Resources.* The next part of determining the resource proportions is for the Charging Team to determine the proportions and proportion costs for the resources in the overhead category. The Charging Team should use the same techniques for the overhead resources as it used for the indirect resources.

Of the resources in the sample distribution matrices, only the Management resource has been categorized as overhead. The sample resource distribution matrix in figure 22 shows the resource proportions and resource proportion costs for the Management resource.

(5) *Determine the Subfunction Costs.* The last part of determining the resource proportions is for the Charging Team to calculate the subfunction costs. To do this, the Charging Team should first begin to distribute the work function costs to their subfunctions by summing all of the resource proportion costs for each work function and subfunction. Figure 23 shows what the totals are for the sample distribution matrices.

Second, for every work function that meets the following criteria, its undivided cost should be distributed to its subfunctions.

- The work function has more than two subfunctions.
- The work function has an undivided cost greater than zero.

This Guideline recommends distributing the work function cost based on the percentage of each subfunction's costs to the total of all of the subfunction costs of that particular work function. Working through an example from the sample distribution matrices should help clarify this process. The Reporting work function has a \$15,000 cost and has two subfunctions, so it meets both criteria. The total of both subfunction costs is \$116,000 and the percentage of each subfunction cost to this total is 41 percent and 59 percent for the Microfiche and Printing subfunctions, respectively. Thus, 41 percent (\$6,200) of the Reporting work function cost is distributed to the Microfiche subfunction and 59 percent (\$8,800) of the cost is distributed to the Printing subfunction.

Third, the new totals for all of the affected work functions and subfunctions should be calculated. Figure 24 shows the results of the above calculations for the work functions and subfunctions of the sample distribution matrices.

b. *Determine the Subfunction Proportions and Proportion Costs.* The second task of Step 9 is to determine the subfunction proportions and proportion costs. A subfunction proportion is the percentage of a subfunction that is used to support a particular service center. A subfunction proportion cost is that cost that the DP facility incurs

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.		COMPUTER PROCESSING OPERATIONS						SOFTWARE DEVELOPMENT AND MAINTENANCE		
	WORK FUNCTION	SUB-FUNCTION	COMPUTER OPERATIONS	REPORTING		TECHNICAL SUPPORT		SOFTWARE DEVELOPMENT			USER LIAISON
RESOURCE COST				MICROFICHE	PRINTING	DATA BASE MANAGEMENT	EQUIPMENT MAINTENANCE	APPLICATIONS	ANALYSIS AND DESIGN	TESTING	
MANAGEMENT \$300,000											
ANALYSTS \$600,000											
COMPUTER A \$150,000			.80 120,000	.10 15,000			.10 60,000	.25 150,000	.25 150,000	.20 120,000	.10 60,000
COMPUTER B \$100,000			.90 90,000	.03 3,000	.03 3,000						
PRINTERS \$40,000											
MICROFICHE CAMERA \$10,000											
DBMS \$15,000											
PAYROLL SOFTWARE \$10,000											
MICROFICHE \$20,000											
COMPUTER PAPER \$25,000											
SPACE OCCUPANCY \$150,000	.05 7,500		.30 45,000	.10 15,000			.05 7,500		.30 45,000		.05 7,500
SUBTOTAL											
WORK FUNCTION COSTS											
TOTAL											

FIGURE 21. Sample resource distribution matrix with proportions and proportion costs for the space occupancy, indirect resource added.

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.	COMPUTER PROCESSING OPERATIONS						SOFTWARE DEVELOPMENT AND MAINTENANCE			
		COMPUTER OPERATIONS		REPORTING		TECHNICAL SUPPORT		SOFTWARE DEVELOPMENT			USER LIAISON
WORK FUNCTION SUB-FUNCTION	DP ADMIN.	C. P. U.	STORAGE DEVICES	MICROFICHE	PRINTING	DATA BASE MANAGEMENT	EQUIPMENT MAINTENANCE	APPLICATIONS SOFTWARE	ANALYSIS AND DESIGN	CODING AND TESTING	
MANAGEMENT \$300,000	1.00 300,000										
ANALYSTS \$600,000								.25 150,000	.25 150,000	.20 120,000	.10 60,000
COMPUTER A \$150,000		.80 120,000	.10 15,000	.10 15,000							
COMPUTER B \$100,000		.90 90,000	.04 4,000	.03 3,000	.03 3,000						
PRINTERS \$40,000					1.00 40,000						
MICROFICHE CAMERA \$10,000					1.00 10,000						
DBMS \$15,000						1.00 15,000					
PAYROLL SOFTWARE \$10,000								1.00 10,000			
MICROFICHE \$20,000					1.00 20,000						
COMPUTER PAPER \$25,000					1.00 25,000						
SPACE OCCUPANCY \$150,000	.05 7,500	.30 45,000	.10 15,000	.10 15,000	.05 7,500	.05 7,500	.05 7,500	.30 45,000			.05 7,500
SUBTOTAL											
WORK FUNCTION COSTS											
TOTAL											

FIGURE 22. Sample resource distribution matrix with proportions and proportion costs for the management overhead resource added.

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.		COMPUTER PROCESSING OPERATIONS				SOFTWARE DEVELOPMENT AND MAINTENANCE		
	WORK FUNCTION	SUB-FUNCTION	COMPUTER OPERATIONS	REPORTING	TECHNICAL SUPPORT	SOFTWARE DEVELOPMENT	SOFTWARE DEVELOPMENT	SOFTWARE DEVELOPMENT	USER LIAISON
RESOURCE COST									
MANAGEMENT \$300,000	1.00	300,000							
ANALYSTS \$600,000									
COMPUTER A \$150,000			.80 120,000	.10 15,000					
COMPUTER B \$100,000			.90 90,000	.03 3,000					
PRINTERS \$40,000				1.00 40,000					
MICROFICHE CAMERA \$10,000				1.00 10,000					
DBMS \$15,000					1.00 15,000				
PAYROLL SOFTWARE \$10,000							1.00 10,000		
MICROFICHE \$20,000				1.00 20,000					
COMPUTER PAPER \$25,000									
SPACE OCCUPANCY \$150,000	.05 7,500		.30 45,000	.10 15,000	.05 7,500	.30 45,000			.10 60,000
SUBTOTAL	307,500	0	255,000	34,000	15,000	48,000	68,000	75,000	67,500
WORK FUNCTION COSTS									
TOTAL									

FIGURE 23. Sample resource distribution matrix with subtotals for the work functions and subfunctions added.

AREA OF MANAGEMENT RESPONSIBILITY	ADMIN.	COMPUTER PROCESSING OPERATIONS				SOFTWARE DEVELOPMENT AND MAINTENANCE									
		COMPUTER OPERATIONS		REPORTING		TECHNICAL SUPPORT		USER LIAISON							
		C. P. U.	STORAGE DEVICES	MICROFICHE	PRINTING	DATA BASE MANAGEMENT	EQUIPMENT MAINTENANCE		APPLICATIONS	ANALYSIS AND DESIGN	TESTING				
WORK FUNCTION SUB-FUNCTION	DP ADMIN.														
RESOURCE COST															
MANAGEMENT \$300,000	1.00 300,000														
ANALYSTS \$600,000															
COMPUTER A \$150,000		.80 120,000	.10 15,000												
COMPUTER B \$100,000		.90 90,000	.04 4,000	.03 3,000	.03 3,000										
PRINTERS \$40,000															
MICROFICHE CAMERA \$10,000															
DBMS \$15,000															
PAYROLL SOFTWARE \$10,000															
MICROFICHE \$20,000															
COMPUTER PAPER \$25,000															
SPACE OCCUPANCY \$150,000	.05 7,500	.30 45,000	.10 15,000												
SUBTOTAL	307,500	0	255,000	34,000	15,000	48,000	68,000	7,500	75,000	67,500	45,000	160,000	150,000	120,000	67,500
WORK FUNCTION COSTS	0		0	0		6,200	8,800		3,900	3,600		16,700	15,700	12,600	0
TOTAL	307,500		255,000	34,000		54,200	76,800		78,900	71,100		176,700	165,700	132,600	67,500

FIGURE 24. Sample resource distribution matrix with work function costs distributed and total subfunction costs added.

for performing that subfunction in support of a particular service center. The subfunction proportion cost is calculated by multiplying the cost of the subfunction by the subfunction proportion. It is important that the Charging Team uses care in determining the subfunction proportions, because they will form the basis for distributing the cost of each subfunction to each service center. To determine the subfunction proportions and subfunction proportion costs, the Charging Team must

- determine the proportions and proportion costs for the subfunctions of the product-oriented work functions;
- determine the proportions and proportion costs for the subfunctions of the support-oriented work functions; and
- calculate the service center costs.

(1) *Determine the Proportions and Proportion Costs for the Product-Oriented Subfunctions.* The Charging Team should determine the proportions and proportion costs for the subfunctions of the product-oriented work functions prior to those of the support-oriented work functions. To determine the subfunction proportions, the Charging Team should use the work usage data forecast in Step 7 and its own experience and judgment. The same principles and techniques that were used to determine the resource proportions should be used to determine the subfunction proportions.

It is important that the Charging Team not be overly constrained by the distribution matrices. Instead, it should learn to use the matrices to accomplish certain objectives. For example, figure 25 shows the sample subfunction distribution matrix with the proportions and proportion costs for the subfunctions of the product-oriented work functions. The Charging Team should note how the cost of the Payroll Software resource was passed to the service center Payroll via the subfunction Application Software. The main point for the Charging Team to remember is that it has a certain degree of flexibility in working with the matrices, as long as the decisions made are defensible.

(2) *Determine the Proportions and Proportions Costs for the Support-Oriented Subfunctions.* The Charging Team should next determine the proportions and proportion costs for the subfunctions of the support-oriented work functions. There are two methods that the Charging Team can use to determine the proportions for the support-oriented subfunctions:

- by management fiat, or, in other words, a reasonable proportion in the considered judgment of the Charging Team; or
- by a function of the costs of the product-oriented subfunctions that have already been distributed.

This Guideline recommends the latter method, since it can be more easily justified. To determine the proportion for the support-oriented subfunctions as a function of the costs of the product-oriented subfunctions, the Charging Team should do the following:

- Sum all of the product-oriented subfunction proportion costs for each service center. (Figure 26 shows the results of this summation for the sample distribution matrices.)
- Calculate the ratio for the cost of each service center to the cost of all service centers.
- Use these ratios as the proportions for the support-oriented subfunctions.

The proportion costs for the support-oriented subfunctions can now be easily calculated. Figure 27 shows the proportions and proportion costs for both the support-oriented and product-oriented subfunctions for the sample distribution matrices.

(3) *Calculate the Service Center Costs.* The last part of this task is for the Charging Team to calculate the costs of the service centers. This calculation can be easily performed by summing the subfunction proportion costs for each service center. Figure 28 shows the service center costs for the sample distribution matrices.

c. *Calculate the Base Rates.* The third tasks of Step 9 is to calculate the base rates. To do this, the Charging Team must:

- determine the standardization factors for each service;
- calculate the standardized forecasts for each service center; and
- divide the total cost of each service center by the standardized forecast for that service center.

SERVICE CENTER SUBFUNCTION TOTAL COST	PROCESSING A	PROCESSING B	APPLICATIONS PROGRAMMING	REPORTING	DBMS	PAYROLL
ADMINISTRATION \$307,500						
C. P. U. \$255,000	.40 102,000	.30 76,500		.10 25,500	.05 12,750	.15 38,250
STORAGE DEVICES \$34,000	.45 15,300	.35 11,900			.10 3,400	.10 3,400
MICROFICHE \$54,200				1.00 54,200		
PRINTING \$76,800				.90 69,120		.10 7,680
DATA BASE MANAGEMENT \$78,900					1.00 78,900	
EQUIPMENT MAINTENANCE \$71,100	.50 35,550	.40 28,440		.10 7,110		
APPLICATIONS SOFTWARE \$176,700			.85 150,195			.15 26,505
ANALYSIS AND DESIGN \$165,700			1.00 165,700			
CODING AND TESTING \$132,600			.85 112,710		.10 13,260	.05 6,630
USER LIAISON \$67,500						
TOTAL						

FIGURE 25. Sample subfunction distribution matrix with proportions and proportion costs for the product-oriented subfunctions added.

<i>Processing A</i>	<i>Processing B</i>	<i>Applications Programming</i>	<i>Reporting</i>	<i>DBMS</i>	<i>Payroll</i>
152,840	116,840	428,605	155,930	108,310	82,465
TOTAL					
1,045,000					

FIGURE 26. Subtotals of the product-oriented subfunction proportion costs.

SERVICE CENTER SUBFUNCTION TOTAL COST	PROCESSING A	PROCESSING B	APPLICATIONS PROGRAMMING	REPORTING	DBMS	PAYROLL
ADMINISTRATION \$307,500	.15 46,125	.11 33,825	.41 126,075	.15 46,125	.10 30,750	.08 24,600
C. P. U. \$255,000	.40 102,000	.30 76,500		.10 25,500	.05 12,750	.15 38,250
STORAGE DEVICES \$34,000	.45 15,300	.35 11,900			.10 3,400	.10 3,400
MICROFICHE \$54,200				1.00 54,200		
PRINTING \$76,800				.90 69,120		.10 7,680
DATA BASE MANAGEMENT \$78,900					1.00 78,900	
EQUIPMENT MAINTENANCE \$71,100	.50 35,550	.40 28,440		.10 7,110		
APPLICATIONS SOFTWARE \$176,700			.85 150,195			.15 26,505
ANALYSIS AND DESIGN \$165,700			1.00 165,700			
CODING AND TESTING \$132,600			.85 112,710		.10 13,260	.05 6,630
USER LIAISON \$67,500	.15 10,125	.11 7,425	.41 27,675	.15 10,125	.10 6,750	.08 5,400
TOTAL						

FIGURE 27. Sample subfunction distribution matrix with proportions and proportion costs for the support-oriented subfunctions added.

SERVICE CENTER SUBFUNCTION TOTAL COST	PROCESSING A	PROCESSING B	APPLICATIONS PROGRAMMING	REPORTING	DEMS	PAYROLL
	ADMINISTRATION \$307,500	.15 46,125	.11 33,825	.41 126,075	.15 46,125	.10 30,750
C. P. U. \$255,000	.40 102,000	.30 76,500		.10 25,500	.05 12,750	.15 38,250
STORAGE DEVICES \$34,000	.45 15,300	.35 11,900			.10 3,400	.10 3,400
MICROFICHE \$54,200				1.00 54,200		
PRINTING \$76,800				.90 69,120		.10 7,680
DATA BASE MANAGEMENT \$78,900					1.00 78,900	
EQUIPMENT MAINTENANCE \$71,100	.50 35,550	.40 28,440		.10 7,110		
APPLICATIONS SOFTWARE \$176,700			.85 150,195			.15 26,505
ANALYSIS AND DESIGN \$165,700			1.00 165,700			
CODING AND TESTING \$132,600			.85 112,710		.10 13,260	.05 6,630
USER LIAISON \$67,500	.15 10,125	.11 7,425	.41 27,675	.15 10,125	.10 6,750	.08 5,400
TOTAL	209,100	158,090	582,355	212,180	145,810	112,465

FIGURE 28. Sample subfunction distribution matrix with service center costs added.

(1) *Determine the Standardization Factors.* The first thing that the Charging Team must do to calculate the base rates is to determine the standardization factors. Standardization factors are important parts of the rate-setting process, and the Charging Team should spend considerable time and effort in determining them. The importance of standardization factors can be more easily comprehended once their function is understood. Standardization factors are used to convert to a common unit the service units of the services within one service center; the common unit is then used to calculate the standardized forecast. The standardized forecast, in turn, is used to calculate the base rates, which are subsequently multiplied by the standardization factors to calculate the billing rates.

Although no set procedures exist for determining the standardization factors, there are a number of concepts that the Charging Team should remember.

Determining the standardization factors can be either a quantitative or a subjective process. The process can be quantitative because the standardization factors are often based on numerical measures of the service units, the cost of the services, or measures of the resources which are used to provide the services. The process can be subjective because the standardization factors are often based on particular management objectives that the Charging Team and/or senior management want to achieve with the charging system. Priority charging and the use of surcharges and discounts to allocate scarce resources are examples of approaches to achieve management objectives. Typically, the Charging Team will use both quantitative and subjective bases in determining the standardization factors for services within the same service center.

Whichever basis (i.e., quantitative or subjective) is used in determining the standardization factors, the Charging Team should be able to justify the values determined. The Charging Team must have clear and defensible reasons for each factor chosen. Essentially, the Charging Team must leave an audit trail so that the rationale for calculating the value of each standardization factor can be determined.

The total amount charged out for each service center should equal the cost of the service center. Therefore, the standardization factor must always be 1.0 for a service in a service center that contains just the one service. Otherwise, the amount charged out will not equal the cost of the service center.

The use of standardization factors is the mechanism by which the Charging Team can incorporate the concepts of priority charging and shift differentials. Priority charging and/or shift differentials should be incorporated by (a) determining the number of priorities and/or shifts, letting each priority and/or shift equal a unique service, and then grouping these services under one service center; (b) determining the relative values of a unit of each priority and/or shift (e.g., high priority might be twice as expensive as normal priority); and (c) assigning the relative values of the priorities and/or shifts as the standardization factors.

Working through an example from the sample distribution matrices should help clarify this process. The Processing A service center contains six services, each representing a different priority for one of two shifts. There are high, normal, and low priorities for prime and non-prime shifts. It has been determined, based on judgement and past experience with processing usage, that the relative values of the high, normal, and low priorities for both prime and non-prime shifts should be 2.0, 1.0, 0.75, 0.60, 0.50, and 0.25, respectively. These values have been used as the standardization factors for the Processing A service center in the sample distribution matrices.

Two things should be noted at this point. First, when determining the standardization factors for priority services, the proper value of the factors should be whatever it will take to shift users from using one priority to another. Second, many Federal DP facilities have eliminated priority charging because it had not leveled out the workload as desired and caused user animosity toward the DP facility. This animosity was developed because the users tried to use the highest priority all of the time; this resulted in the high priority providing no better turn around than normal priority but at a higher cost. The use of priority charging as an example in this Guideline is for illustrative purposes only and should not be construed as a recommendation for its use.

The use of standardization factors is the mechanism by which the Charging Team can incorporate the concept of normalization between two or more services. In the context of charging systems, normalization between services refers to charging the same price for performing a quantity of work, regardless of which service performs the work. The concept of normalization is most often seen used with two computers of different speeds so that a job costs the same when run on either computer. Normalization can be accomplished by (a) determining the services that are to be normalized, then grouping them under one service center; (b) determining the relative weight of a unit of each service (e.g., processing on the high-

speed computer is twice as fast as processing on the low-speed computer); and (c) assigning the relative weights of the service units as the standardization factors.

An example from the sample distribution matrices should help clarify this process. The Processing B service center contains two CPU services. One service is provided by a computer significantly faster than the computer that provides the second service. It has been determined, based on performance measures of the two computers, that the high-speed computer is twice as fast as the low-speed computer. The values of 2.0 and 1.0 have been used as the standardization factors for the high-speed and low-speed services, respectively.

Standardization factors are also the mechanism by which the Charging Team can incorporate the concept of surcharges and discounts. This can be accomplished in a manner similar to that used for the concepts of priorities and normalization: (a) determining the services to which the surcharges and discounts will be applied and grouping them under one service center; (b) determining the relative weight of a unit of each service (e.g., it should cost three times as much to use a unit of a Printing service than it does to use a unit of a Microfiche service); and (c) assigning the relative weights of the service units as the standardization factors.

Again, an example from the sample distribution matrices should help clarify the above. The Reporting service center contains two services, Printing and Microfiche. Agency Management desired to place a surcharge on the Printing service and a discount on the Microfiche service in order to encourage users to use the Microfiche service. It has been determined, based on experience and judgment, that if the printing unit is three times more expensive than the microfiche unit, then the users will use the Microfiche service more often. The values of 1.0 and 3.0 have been used as the standardization factors for the Microfiche and Printing services, respectively.

Figure 29 shows the standardization factors for the services in the sample distribution matrices. The standardization factors for the four services in the Applications Programming service center were based on the salary levels of the four categories of analysts.

(2) *Calculate the Standardized Forecasts.* After the Charging Team has calculated the standardization factors, it should next calculate the standardized forecasts for each service center. A standardized forecast represents the projected number of standardized service units to be used for an entire service center. Determining the standard forecast is relatively easy and is calculated by multiplying each service forecast by its standardization factor and summing the result for all services within one service center. Figure 30 shows the standardized forecasts for the service centers in the sample distribution matrices.

(3) *Calculate the Base Rates.* The last part of this task is for the Charging Team to calculate the base rate of each service center. A base rate is the amount that must be charged by the DP facility in order to recover the projected cost of providing a standardized service unit. A service center's base rate may or may not be the same as its service's billing rates. The base rates are easily calculated by dividing the cost of the service center by the standardized forecast. Figure 31 shows the base rates for the service centers in the sample distribution matrices.

d. *Calculate the Billing Rates.* The last task in Step 9 is to calculate the billing rates. To do this, the Charging Team need only multiply the base rate of a service center by the standardization factor for each service in that service center. At this time, the Charging Team should ensure that within each service center, the sum of the products of each service's forecast and billing rate is equal to, with error allowed for rounding, the cost of the service center. Figure 32 shows the billing rates for the services in the sample distribution matrices.

4. Step 10: Assist with DP Budgeting

This step discusses areas in the DP budgeting process where information obtained from the charging system can be of assistance to the agency budgeting process. Certain data need to flow between the DP facility and the agency budgeting group; providing this data is a tertiary objective of the charging system.

The three tasks in this step consist of developing techniques to:

- assist users in generating their DP budgets;
- provide input to the DP facility budgeting process; and
- provide input to the agency budgeting process.

SERVICE CENTER	PROCESSING A						PROCESSING B		APPLICATIONS PROGRAMMING				REPORTING		DBMS	PAY-ROLL		
	PRIME HIGH	PRIME NORMAL	PRIME LOW	NON-PRIME HIGH	NON-PRIME NORMAL	NON-PRIME LOW	HIGH SPEED	LOW SPEED	SENIOR ANALYST	ANALYST	JUNIOR ANALYST	APPREN. ANALYST	MICRO-FICHE	PRINTING			FICHE	1000 LINES
COST OF SERVICE CENTER	209,100						158,090		582,355				212,180		145,810		12,465	
SERVICE FORECAST	500,000	6,000,000	25,000,000	1,500,000	1,000,000	500,000	4,000,000	4,000,000	9,000	15,000	3,000	3,000	80,000	30,000	100	70,000		
STANDARDIZATION FACTORS	2.0	1.0	.75	.60	.50	.25	2.0	1.0	1.2	1.0	.75	.50	1.0	3.0	1.0	1.0	1.0	1.0
STANDARDIZED FORECAST																		
BASE RATE																		
BILLING RATE																		

FIGURE 29. Sample billing rate distribution matrix with standardization factors added.

SERVICE CENTER	PROCESSING A						PROCESSING B		APPLICATIONS PROGRAMMING				REPORTING		DBMS	PAY-ROLL
	PRIME HIGH	PRIME NORMAL	PRIME LOW	NON-PRIME HIGH	NON-PRIME NORMAL	NON-PRIME LOW	HIGH SPEED	LOW SPEED	SENIOR ANALYST	JUNIOR ANALYST	APPREN. ANALYST	MICRO-FICHE	PRINTING	FICHE		
SERVICE UNIT	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	HOUR	HOUR	HOUR	HOUR	HOUR	USERS	CHECKS	
COST OF SERVICE CENTER	209,100						158,090		582,355				212,180		145,810	112,465
SERVICE FORECAST	500,000	6000000	2500000	1500000	1000000	500,000	4000000	4000000	9,000	15,000	3,000	3,000	80,000	30,000	100	70,000
STANDARDIZATION FACTORS	2.0	1.0	.75	.60	.50	.25	2.0	1.0	1.2	1.0	.75	.50	1.0	3.0	1.0	1.0
STANDARDIZED FORECAST	10,400,000						12,000,000		29,550				170,000		100	70,000
EASL RATE																
BILLING RATE																

FIGURE 30. Sample billing rate distribution matrix with standardized forecasts added.

SERVICE CENTER	PROCESSING A						PROCESSING B		APPLICATIONS PROGRAMMING				REPORTING		DBMS	PAY-ROLL	
	PRIME HIGH	PRIME NORMAL	PRIME LOW	NON-PRIME HIGH	NON-PRIME NORMAL	NON-PRIME LOW	HIGH SPEED	LOW SPEED	SENIOR ANALYST	ANALYST	JUNIOR ANALYST	APPREN. ANALYST	MICRO-FICHE	PRINTING			FICHE
SERVICE UNIT	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	HOUR	HOUR	HOUR	HOUR	HOUR	1000 LINES	USERS	CHECKS	
COST OF SERVICE CENTER	209,100						158,090		582,355				212,180		145,810		12,465
SERVICE FORECAST	500,000	6,000,000	2,500,000	1,500,000	1,000,000	500,000	400,000	4,000,000	9,000	15,000	3,000	3,000	80,000	30,000	100	70,000	
STANDARDIZATION FACTORS	2.0	1.0	.75	.60	.50	.25	2.0	1.0	1.2	1.0	.75	.50	1.0	3.0	1.0	1.0	
STANDARDIZED FORECAST	10,400,000						12,000,000		29,550				170,000		100		70,000
BASE RATE	.0201						.0131		19.70				1.25		1458		1.61
BILLING RATE																	

FIGURE 31. Sample billing rate distribution matrix with base rates added.

SERVICE CENTER	PROCESSING A						PROCESSING B		APPLICATIONS PROGRAMMING				REPORTING	DBMS	PAY-ROLL	
	PRIME HIGH	PRIME NORMAL	PRIME LOW	NON-PRIME HIGH	NON-PRIME NORMAL	NON-PRIME LOW	HIGH SPEED	LOW SPEED	SENIOR ANALYST	ANALYST	JUNIOR ANALYST	APPREN. ANALYST				MICRO-FICHE
SERVICE UNIT	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	SECONDS	HOUR	HOUR	HOUR	HOUR	FICHE	1000 LINES	USERS	CHECKS
COST OF SERVICE CENTER	209,100						158,090		582,355				212,180	145,810	12,465	
SERVICE FORECAST	500,000	6,000,000	250,000	1,500,000	1,000,000	500,000	4,000,000	4,000,000	9,000	15,000	3,000	3,000	80,000	30,000	100	70,000
STANDARDIZATION FACTORS	2.0	1.0	.75	.60	.50	.25	2.0	1.0	1.2	1.0	.75	.50	1.0	3.0	1.0	1.0
STANDARDIZED FORECAST	10,400,000						12,000,000		29,550				170,000	100	70,000	
BASE RATE	.0201						.0131		19.70				1.25	1458	1.61	
BILLING RATE	.0402	.0201	.015	.012	.01	.005	.0263	.0131	23.64	19.70	14.78	9.85	1.25	3.75	1458	1.61

FIGURE 32. Sample billing rate distribution matrix with billing rates added.

a. Assist Users in Generating Their DP Budgets. Once implemented, the charging system will provide users with the data needed to forecast their DP budgets. The first task in Step 10 is for the Charging Team to develop techniques that will instruct the users in how to employ the data from the charging system to forecast their DP budgets. Users will probably need assistance in understanding how to better forecast their own usage, how to utilize the rate schedule, and how to budget for their DP funds. Such assistance to users can result in an added benefit for the DP facility; once users become more proficient and accurate in forecasting their usage, the Charging Team's work during the rate-setting phase will become simpler.

b. Provide Input to the DP Facility Budgeting Process. Certain data from the charging system may be used by the DP facility to develop its budget requests. These data include, but are not limited to:

- forecasted cost of service centers and subfunctions;
- funds charged out;
- funds recovered; and
- prior year costs.

The second task in Step 10 is for the Charging Team to develop techniques that will provide the necessary data to the DP facility to facilitate its budgeting process.

c. Provide Input to the Agency Budgeting Process. Certain data from the charging system may also be used by the agency in its budget process. Examples include:

- forecasted cost of the DP facility, obtained by summing the costs of the subfunctions;
- funds charged out;
- funds recovered; and
- prior year costs.

The third task of Step 10 is for the Charging Team to develop techniques that will provide the necessary data to the agency to facilitate its budgeting process.

The completion of this step should be used as the third major checkpoint by senior management to evaluate the progress of the Charging Team. It is important for senior management to ensure that their objectives for the charging system are being met.

3.4 Billing Phase

The last four steps of this Guideline will focus on developing and implementing the procedures of the billing subsystem. When developing these procedures, the Charging Team must remember that the billing subsystem will be used almost continuously. Thus, each of the procedures must be well designed and, where applicable, developed according to standard systems development methodology. After completing the four steps in this phase, the Charging Team will have incorporated all of the work completed during the planning, design, and rate-setting phases and will have developed any automated parts of the charging system.

1. Step 11: Assist with DP Accounting

During this step, the Charging Team will be developing and implementing the procedure that will assist with the accounting activities related to the charging system. This step discusses techniques that provide the interface between (a) the agency's accounting department and the charging system and (b) the various types of accounting activities, internal to the DP facility, required because of the charging system.

The four tasks in this step consist of developing techniques for:

- establishing and maintaining user accounts;
- providing data to the agency's accounting department;
- assisting in the maintenance of accounting information; and
- handling charges for aborted work.

If additional guidance for any of the tasks is needed, the Charging Team can consult FGAP 4, its agency's policies and guidelines, its agency's accounting group, and the accounting literature.

a. *Establishing and Maintaining User Accounts.* User accounts are the records used to keep track of authorized DP funds and actual expenditures for each user. Information that is usually kept on a user account includes past and current service usage and charges itemized by service. An effective set of techniques for handling user accounts is important to the efficient operation of a charging system. The first task of Step 11 is for the Charging Team to determine the types of data to be maintained in the user accounts and to establish the techniques for opening, closing, and maintaining user accounts. The Charging Team should have these techniques established prior to implementation of the charging system.

b. *Providing Data to the Agency's Accounting Department.* The agency accounting department will need certain information from the charging system. Typically, the accounting department will need at least the following information:

- the amount of funds that users wish to authorize for their accounts;
- the amounts billed to the users; and
- invoices for resources currently in use.

The extent to which the accounting department will be involved with the charging system will vary from agency to agency. The second task of Step 11 is for the Charging Team to determine exactly which data will need to be exchanged between the accounting department and the charging system and to develop the techniques for exchanging the information.

c. *Assisting in the Maintenance of Accounting Information.* Some DP facilities maintain accounting information for their agency accounting departments. The third task of Step 11 is for the Charging Team to develop techniques for:

- maintaining the accounting information,
- determining how to charge for the maintenance, and
- determining how to transfer the pertinent data from the charging system to the accounting files.

d. *Handling Aborted Work.* A problem that exists with every new implementation of a charging system is how to handle the charges for aborted work when it is not the fault of the user. There are several possible ways of handling aborted work. *This Guideline recommends providing free reruns for the users or giving the users credit for the cost of the aborted work.* The DP facility thus absorbs the cost of the aborted work as a cost of operation and eliminates a source of confrontation with its users. After a number of years of collecting data on the cost of aborted work, the costs can be projected and incorporated into the billing rates. The fourth task of Step 11 is for the Charging Team to determine and develop techniques for handling aborted work.

2. Step 12: Account for Usage

The Charging Team will develop and implement the usage accounting procedure of the billing subsystem during this step. Usage accounting refers to the monitoring and recording of the utilization of services, subfunctions, and resources. Detailed data on the utilization of services are needed to determine user charges. Data on the utilization of subfunctions and resources are needed to help determine the subfunction and resource proportions for the distribution matrices. When accounting for the utilization of services, the number of service units utilized by each user needs to be monitored. When accounting for the utilization of subfunctions, the number of work units for each particular subfunction will be needed. Typically, utilization data will be needed for only those subfunctions for which the Charging Team has difficulty determining subfunction proportions. When accounting for the utilization of resources, the number of resource units for each particular resource will be needed. As with the subfunctions, utilization data will be needed for only those resources for which the Charging Team has difficulty determining resource proportions.

The work of the Charging Team in this step assumes that the DP facility has some service, subfunction, or resource usage accounting capability and that any additional capabilities needed can be purchased or developed. This step consists of two tasks:

- designing the usage accounting procedure, and
- developing and implementing the usage accounting procedure.

a. *Fundamental Concepts.* Before attempting to design and develop the usage accounting procedure, it is important for the Charging Team to understand measurement software and usage accounting data. A discussion of each concept follows.

(1) *Measurement Software.* Measurement software is used to monitor and record the computer services received by users and the computer resources used to provide those services. Typically, this software is available from computer vendors or other commercial sources for most of the large computers currently on the market. Service and resource utilization information is collected by the measurement software and stored in a log for later analysis. The content and accuracy of the information collected and stored by this software varies from computer to computer. Measurement software is often not even available for smaller computers. To determine if measurement software is available for its computer, the Charging Team should start by contacting the computer's vendor. Measurement software is usually too complex to be developed in-house and, thus, should be purchased whenever possible.

Measurement software usually accounts for the usage of computer-related services, subfunctions, and resources. Examples of the other services, subfunctions, and resources for which usage must also be accounted are personnel, data entry machines, and CRT displays. If the costs of these services are to be charged to the users, then their usage must also be monitored. Most DP facilities monitor the use of these types of services with manual techniques that have been developed in-house. For example, personnel data can be collected on timesheets and then entered into an automated usage accounting system. It is important that the Charging Team develop techniques that will collect sufficient data to make these charges equitable. But the Charging Team must remember that as it tries to make charges more equitable, it also increases the quantity of utilization data that will need to be collected. Also, increasing the equitability can result in complex and costly monitoring techniques. The Charging Team must determine the proper trade-offs between equitability and costs that will be needed in its charging system.

(2) *Usage Accounting Data.* The decisions that the Charging Team made during earlier steps should be used to help determine the data that will need to be collected with the usage accounting procedure.

- The distribution matrices should help to further define the exact service, subfunction, and resource data elements that will need to be collected.
- The billing rates should help define the eventual format of the service usage accounting data.
- The Charging Team should contact computer hardware and software vendors to determine the type of data collected by its measurement software.

All of this information will be used by the Charging Team while performing the next two tasks.

b. *Design the Usage Accounting Procedure.* The first task in Step 12 is to design the usage accounting procedure, which should be designed in two stages. The first stage is to design automated techniques to monitor service, subfunction, and resource utilization; the second stage is to design the manual techniques.

The Charging Team must remember that some of the techniques used to monitor the utilization of subfunctions and resources will need to be of a more temporary or intermittent nature, since some subfunction and resource usage data will not need to be collected on a continual basis. For example, determining how much time an operator spends performing data entry each day may only need to be performed for 1 month due to the repetitive nature of the operator's work. Similar examples could be given for other resources and subfunctions.

When designing the automated techniques, the Charging Team should remember that there will be very little to design unless it chooses to develop the techniques in-house. *This Guideline recommends that the Charging Team not attempt to develop measurement software in-house, since such development is usually extremely complex, sophisticated, and requires a great deal of time and expense.*

Since only a limited quantity of measurement software is usually available for any particular computer, the Charging Team, when selecting measurement software, should determine whether or not the selected software will need to be modified. The extent of modification will depend on the number of services, subfunctions, and resources that the measurement software will need to monitor. The Charging Team should determine the exact parts of the measurement software that will need to be modified and design what the new parts will look like. If, for some reason, a service's utilization cannot be monitored by the modified measurement software and there is no other way to monitor it, then that service should be dropped from the charging system.

Manual usage accounting techniques are too numerous and varied to recommend specific techniques. Basically, the techniques should be tailored to fit the charging system. The techniques the Charging Team selects

should be coordinated to meet the objectives and criteria set forth for the charging system and to monitor all of the services, subfunctions, and resources that the automated techniques do not monitor.

c. Develop and Implement the Usage Accounting Procedure. The second task of this step is to develop and implement the usage accounting procedure. This development effort can be fairly simple and straightforward if measurement software can be purchased and the manual techniques are not complicated. On the other hand, the developmental effort can be complex and expensive if the software must be developed in-house and the manual techniques are complicated. *It is recommended that the Charging Team use a balanced, cost-effective approach.*

3. Step 13: Report Usage

The Charging Team should develop and implement the reporting procedure of the billing subsystem during this step. The reporting procedure consists of the techniques for reducing the service usage accounting data, calculating the user charges, and preparing and distributing reports on service usage and charges to the users. If the DP facility is recovering costs, then the reports can be considered bills or invoices. The reporting procedure is typically performed using automated packages. Such packages are commercially available and can be modified to handle the specific type of service data collected by a DP facility's usage accounting procedure. The tasks discussed in this step are based on the following assumptions:

- The usage accounting procedure has been designed, and the data to be collected have been determined.
- All the work in the planning, design, and rate-setting phases has been completed to the point that the types of data needed for the reporting procedure are known.

This step consists of two tasks:

- design the reporting procedure, and
- develop and implement the reporting procedure.

a. Fundamental Concepts. Before attempting to design and develop the reporting procedure, it is important for the Charging Team to understand automated and manual reporting techniques, and reporting data. A discussion of each concept follows.

(1) Automated and Manual Reporting Techniques. The major decision that the Charging Team will have to make during this step is to determine which, if any, of the reporting techniques should be automated. *This Guideline recommends that whenever any of the following situations occur, the Charging Team should choose to automate most, if not all, of the reporting techniques:*

- a large volume of usage accounting data will have to be reduced and analyzed;
- a large number of users will receive reports;
- several different types of reports will need to be prepared;
- the reports will need to be prepared frequently;
- the cost of acquiring or developing the automated techniques is not excessive; and
- in-house personnel are available to develop the automated techniques that cannot be purchased.

(2) Reporting Data. Data from the design phase should be used to determine the requirements for the reporting procedure, such as the recipients of the reports, the content and format of reports, and the frequency of report preparation. Data from the "Assist with DP Accounting" procedure should be used to provide a description of the report recipients and the type of information that should be reported to the accounting department.

b. Design the Reporting Procedure. The first task of Step 13 is to design the techniques of the reporting procedure. These techniques will be used:

- to reduce the service usage accounting data for services,
- to calculate charges, and
- to prepare and distribute the reports on service usage to the users and other pertinent groups.

The main feature that should be designed into all of the reporting techniques is flexibility. Charging systems tend to change frequently, which results in the usage accounting data changing often. Therefore, the reporting techniques should be flexible enough to incorporate these changes without having to undergo extensive redevelopment.

(1) *Reducing the Usage Data for Services.* When designing the techniques to reduce the usage accounting data for services, the most important points that the Charging Team will need to know are:

- the amount, type, and format of the data that will be collected and stored;
- the type of data that will be needed for preparing the reports on usage, for maintaining the user accounts, and for historical purposes; and
- the frequency with which the data will need to be reduced due to storage limitations or reporting needs.

(2) *Calculate Charges.* When designing the techniques to calculate the charges, the Charging Team will need to know:

- the number of different billing rates to be used, and
- the content and format of the reports.

(3) *Preparing and Distributing Charges.* When designing the techniques to prepare and distribute the utilization reports, the Charging Team will need to determine three things.

- The content and format of the reports should be determined. These will depend upon the information reported and the reports' recipients. It is likely that several different report formats will be needed, one for each type of recipient. The reports should at least contain information about what services have been used during the reporting period and the charges that are associated with each. (See fig. 33.) Any type of information that provides suggestions on reducing costs (e.g., the cost estimate if users allocated only the memory that they actually used) will be valuable to the users. *This Guideline recommends that the Charging Team design some mechanism, e.g., reports, to inform users how they can reduce their DP costs.* The mechanism could be anything from highlighting specific portions of end-of-work cost reports to providing a periodic newsletter of cost saving ideas.

<i>Service</i>	<i>Usage</i>	<i>Rate</i>	<i>Charge</i>
NAME: PROJECT MCAS			
ACCOUNT NO.: UX 5793			
BILLING PERIOD: 1 Aug 82-31 Aug 82			
PROCESSING A			
PRIME			
HIGH	10,000 sec	.0402	\$ 402.00
NORMAL	162,000 sec	.0201	\$ 3,256.20
NON-PRIME			
HIGH	1,000 sec	.012	\$ 12.00
NORMAL	50,000 sec	.01	\$ 500.00
APPLICATIONS PROGRAMMING			
SENIOR ANALYST	100 hrs	23.64	\$ 2,364.00
ANALYST	40 hrs	19.70	\$ 788.00
APPREN. ANALYST	150 hrs	9.85	\$ 1,477.50
REPORTING			
MICROFICHE	1,000	1.25	\$ 1,250.00
PRINTING (1,000 lines)	10	3.75	\$ 37.50
PAYROLL	500 checks	1.61	\$ 805.00
TOTAL CHARGES =			\$ 10,892.20
ACCOUNT BALANCE=			\$ 65,792.50

FIGURE 33. *Sample billing report.*

- The recipients of the reports should be determined. If the Charging Team can identify the distinct types of user that will be utilizing the DP facility, this will help in determining the type, frequency, and content of the reports to be prepared. Various users will usually need or want different types of report information. Additionally, if the Charging Team tries to allocate scarce resources, a knowledge of the type of user will help determine the kind of information needed to encourage or discourage use of particular resources.
- The frequency of preparing and distributing the reports should be determined. The correct frequency will be a function of the design and the objectives of the charging system. If all the usage accounting and reporting techniques for services are manual, it will be difficult to report usage and charges more frequently than once a week or month. If, on the other hand, the usage accounting and reporting techniques are automated, then reporting more frequently will be feasible. Some DP facilities provide reports of utilization and an estimate of the charges at the end of each computer run or interactive session. This information can be extremely valuable, and the Charging Team should consider providing it whenever possible. The main point that the Charging Team must remember is that the reports are the major source of information for the users on their use of the services, how much of their DP budget they have expended, and possible ways of reducing charges. *This Guideline recommends that the Charging Team attempt to build into the reporting procedure, whenever feasible, the ability to provide users end-of-work cost estimates.*

c. *Develop and Implement the Reporting Procedure.* The second task of Step 13 is to develop and implement the reporting procedure. The Charging Team should follow standard systems development methodology when developing and implementing the reporting procedure. The major decision that the Charging Team will have to make in this task is whether to purchase automated reporting packages or develop them in-house. *This Guideline recommends that, if at all possible, the Charging Team should purchase these packages instead of developing them in-house.* Automated reporting packages should be developed in-house only if the requirements are so unique that the vendor-supplied packages cannot be adapted to satisfy them or the requirements are so simple that it would not be cost-effective to purchase an expensive package. Appendix A provides a list of evaluation criteria for automated reporting packages. This list is a generalized list intended to be used as a starting point. From this list the Charging Team should be able to develop a customized list of criteria to satisfy its own particular requirements.

4. Step 14: Recover Charges

The Charging Team should develop and implement the cost recovery procedure of the billing subsystem in this step. The Charging Team must decide

- whether to recover charges,
- from whom to recover charges,
- how to recover the charges, and
- how to develop and implement the cost recovery plan.

This step assumes that the agency has predefined regulations and procedures for the transfer and handling of funds. This step consists of one task: designing, developing, and implementing the recovery procedure.

a. *Fundamental Concepts.* Before designing, developing, and implementing the recovery procedure, it is important for the Charging Team to understand the following concepts concerning the users of the DP facility.

There are two types of users of a DP facility, internal and external. Circular A-121 states that Government DP facilities must always recover charges from external users but that recovering charges from internal users is optional. The Charging Team must decide whether or not to recover charges from internal users. There are a number of factors that the Charging Team should consider prior to determining if charges should be recovered from the internal users.

- Recovering charges by the actual transfer of funds can have the same effects (e.g., limiting DP utilization) as employing user DP budgets made up of "pseudo funds," but only if both approaches are enforced rigorously.
- Recovering charges encourages more efficient use of the DP facility in order to conserve user funds.

- Recovering charges will augment and emphasize the particular cost-based features designed into the charging system to allocate scarce services.
- Recovering charges will improve the quality of the charging system data that will be sent to senior management, because users are forced to be more accountable for their DP usage.
- Recovering charges will necessitate an increase in recordkeeping and in the overall cost of the charging system.
- *This Guideline recommends that, whenever possible, the Charging Team choose to recover charges from its internal users.*

b. *Design, Develop, and Implement the Recovery Procedure.* The only task of Step 14 is to design, develop, and implement the recovery procedure. When doing this, the Charging Team must remember that the major objective of the recovery procedure is to recover the charges reported to the user by transferring funds from the user's account to the DP facility's account. There are two techniques that the Charging Team can use to accomplish this objective.

- The first technique involves recovering the charges after reporting them. Users in this situation would be required to transfer funds to the DP facility only when billed.
- The second technique is for users to open accounts with the DP facility and transfer a prescribed amount of funds into that account. Each time a service is utilized, the user's account would be debited. Under this technique, users are never actually billed but merely receive reports of the charges.

The Charging Team will need to determine which of the two techniques is best for its own environment.

It is not within the scope of this Guideline to attempt to establish the techniques for the transfer of funds. Each agency should have existing regulations and policies governing funds transfer. If the Charging Team has decided to recover the charges from internal users, it should follow the agency's procedures for transferring funds.

The completion of this step should be used as the last major checkpoint by senior management to determine the progress of the Charging Team. At this time, a comprehensive review of the work completed by the Charging Team should be undertaken by senior management.

4. MAINTAINING AND EVALUATING THE CHARGING SYSTEM

The purpose of this section is to briefly summarize the routine maintenance tasks that will be required for the charging system and the techniques that can be used to evaluate the efficiency and effectiveness of the charging system.

4.1 Routine Maintenance

1. Maintaining Accounts

User accounts will require routine maintenance that consists of keeping the accounting information current and providing information to users about the status of their accounts. Users typically prefer to receive as much information about the status of their accounts as the DP facility can provide. One approach is to give the users access to as much raw usage accounting data as possible. If users desire more detailed information, they can analyze the data themselves. This will free the DP facility from having to service every user's unique request for detailed information about their utilization and charges.

2. Adjusting Billing Rates

Billing rates should be adjusted as infrequently as possible and almost never during the middle of a rate-setting period. (Typical rate-setting periods for Federal agencies are a fiscal year, 6 months, or 3 months.) The only real justification for adjusting the billing rates during the middle of a rate-setting period is when a major change occurs in the DP facility. Such a change could be the installation of new hardware, modifying the services, restructuring the DP facility, or some other unexpected major occurrence.

3. Adjusting the Reporting Frequency and Report Format

When the charging system is first implemented, the reporting frequency and report format will most likely have to be adjusted. Once a suitable reporting frequency and report format have been obtained, the Charging Team should not modify them unless absolutely necessary. If the reports are to be used to improve efficiency, they should provide consistent and accurate information. This will enable users to experiment with different ways of improving their efficiency.

4. Correcting Errors

Techniques should be established to allow users to correct or resolve errors in their reports. All errors discovered should be resolved by adjusting the charges. There are two main benefits that the DP facility will receive by providing an error correction capability.

- Correcting the errors will foster better relations with the users.
- Errors could reflect other problems in one or more of the charging system procedures, and, by encouraging users to report the errors, the problems will be easier to detect.

Another type of error that can be difficult to deal with is what to do when it has been discovered that the DP facility has over- or under-charged its users over a certain period. *This Guideline recommends that the Charging Team develop techniques to adjust charges when over- or under-charging occurs.* If the DP facility over-charges, it could give its users a rebate. If it under-charges, it could assess its users a one-time charge to make up the deficit. When one of these two situations occurs, it is important that the DP facility provide its users with as much advanced notice as possible.

4.2 Evaluating Charging System Performance

In order to evaluate the performance of the charging system, the Charging Team will need to develop evaluation criteria and measurement techniques. *This Guideline recommends using the following three techniques and associated criteria.*

1. Variance Analysis

First, the Charging Team should perform a variance analysis to determine the differences between projected and actual costs charged out or recovered. This is the most important of the three techniques, because the results may be used in the rate-setting process for the next rate period. A variance analysis should consist of calculating the difference between the amount that was expected to be billed to the users and the actual amount that was billed. The Charging Team should attempt to explain any major differences that occur between the two.

A more in-depth variance analysis that the Charging Team could perform consists of calculating the difference between the projected costs of the resources utilized by the DP facility and the actual costs of the resources for the rate period. Once again, the Charging Team should attempt to explain any major discrepancies.

The criteria that the Charging Team should use for a variance analysis is some minimum amount of variance between projected and actual costs for any given period. If this minimum is exceeded, corrective action should be taken. Performing a variance analysis is not always as easy as this section may indicate; it can be a long and involved process. The Charging Team should consult the appropriate literature to obtain more detailed information on performing variance analyses.

2. Criteria Comparison

The Charging Team can compare the criteria that were determined in Step 2 with the implemented charging system. This will enable the Charging Team to determine if the charging system is performing as it was designed. The comparison should be on a criterion-by-criterion basis with the resolution of any discrepancies occurring only after all comparisons have been made. Prior to modifying any part of the charging system, the Charging Team should perform a cost-benefit analysis to determine if the modification is worth doing. If the Charging Team proceeded carefully during the design and development of the charging system, the number of these types of modifications should be minimal.

3. Usage Analysis

The Charging Team should analyze the usage patterns of the users to determine if the charging system is producing the desired effects. The usage analysis technique is especially pertinent if one of the purposes of the charging system is to allocate scarce resources. The criterion for usage analysis would be the type of usage patterns that the charging system was suppose to create. If the usage patterns are not what they should be, then the Charging Team should determine what the problems are and attempt to rectify them.

GLOSSARY

Area of Management Responsibility

An Area of Management Responsibility (AMR) is an organizational grouping of work areas managed by one individual within the DP facility. Costs are accumulated by areas of management responsibility in order to obtain a better understanding of the costs of operating the DP facility. "Income" from billing for service usage may also be calculated for each AMR by backtracking through the distribution matrices, and compared to the cost to help evaluate management performance. Examples of AMR's are administration, computer processing operations, and software development and maintenance.

Billing Period

The billing period is the period of time for which the charges for service usage are calculated. This time period varies widely between, and even within, DP facilities, from as short as a per job basis to as long as a fiscal year.

Billing Rate

The billing rate is the amount that is charged to the users for utilizing each unit of a service.

Costs

Costs are the funded and unfunded expenses incurred by the DP facility for the resources needed to provide DP services to the users. Examples of the costs which could be incurred for a CPU resource are lease or purchase expenses, maintenance, depreciation, delivery, and installation. FGAP 4 provides guidance on the procedures for DP cost accumulation and accounting.

Direct Resource

Direct resources, as used in this Guideline, are resources that can be associated with one or more work areas (i.e., subfunctions) because there is a distinct logical and measurable relationship between them. Computer equipment and application programmers are typically categorized as direct resources.

Distribution Matrices

The distribution matrices, which can be viewed as the nuclei of the rate-setting subsystem, are the mechanisms by which the costs of the resources are proportioned to the services and a billing rate is calculated for each of the services. The use of a series of matrices, instead of some other allocating mechanism, is recommended, because matrices provide the clearest, easiest technique for tracking the large volume of information required to calculate the billing rates.

DP Facility

A DP facility is the organizational entity that obtains and utilizes resources to provide DP services to a user or group of users. Circular A-121 applies to Federal DP facilities that a) are operated by, or on behalf of, a Federal agency; b) provide service to more than one user; c) operate one or more general management computers; and d) exceed \$100,000 per year for the full cost of operation.

Indirect Resources

Indirect resources, as used in this Guideline, are resources that can be associated with one or more work areas (i.e., subfunctions) because there is only a logical and not readily measurable relationship between them. Space is typically categorized as an indirect resource.

Overhead Resources

Overhead resources, as used in this Guideline, are resources that can be associated with all of the work areas (i.e., subfunctions) but only by management fiat, because there is neither a logical nor measurable relationship between them. Management personnel are typically categorized as overhead resources.

Rate Period

The rate period is the period of time for which the charging system's billing rates are being set. Thus, if the billing rates are being determined for the next fiscal year, then the rate period is the next fiscal year.

Resource

A resource is any item used by the DP facility to provide services. In order for a resource to be included in the charging system, the DP facility must incur a cost for obtaining or using the resource. The primary categories of DP

resources, as given in Circular A-121 and FGAP 4, are personnel, equipment, software, supplies, contracted services, space occupancy, intra-agency services and overhead, and interagency services.

Resource Unit

A resource unit is the metric used to measure or determine the amount of a resource used to provide a particular subfunction. Only one resource unit should be associated with each resource. Examples of resource units are CPU seconds, for a CPU; number of hours, for operations staff; and square footage, for space occupancy. The resource unit selected should be an accurate metric of the dominant type of work performed by the resource. Resource units may or may not be the same as some of the service units.

Service

A service is any work done by the DP facility for a user or group of users. In order to be formally classified as a service for the purposes of this Guideline, the DP facility's work must be measured by a single metric (called a service unit) which has a billing rate associated with it. A service can be as simple as a CPU service, for which a service unit is a CPU second, or as complex as a payroll service, for which a service unit is a printed check.

Service Center

A service center is a logical grouping of one or more similar services for the purpose of developing the billing rates for the services. Services are grouped into service centers in order to (a) normalize between services that use similar resources with different capabilities (e.g., two processing services that use different CPU's); (b) apply surcharges and discounts to services; and (c) charge for different classes of the same service (e.g., applying a different charge for high, medium, and low priority use of a processing service). The numerical value of the billing rate for each service, within a given service center, is a function of the reason for grouping the services into that service center and the cost of the service center. The total amount charged for the utilization of all the services of a given service center, over a given rate period, should not exceed the cost to the DP facility, for the rate period, of providing that service center.

Service Unit

A service unit is the metric used to measure the amount of service received by the users. For the purposes of these Guidelines, only one service unit can be associated with each service. Examples of service units are CPU seconds, for a CPU service; lines printed, for a printing service; and checks processed, for a payroll service. The service unit selected should be an accurate metric of the dominant type of work performed by the service. If a single unit cannot be determined, then the possibility of dividing the work into two services should be considered.

Subfunction

A subfunction is a discrete work area for which costs can be accumulated and work measurements made. A group of similar machines whose use is measured by a common unit can be considered a subfunction. A work function is usually made up of one or more subfunctions, and a subfunction is always contained within one work function. Costs are accumulated by subfunction in order to obtain a more detailed understanding of the costs of operating the DP facility and to distribute the costs to the service centers. Examples of subfunctions for a computer operations work function are central processing unit, core memory, storage devices, channels, and spooling functions.

User

A user is an organizational or programmatic entity (whether a single person or an entire agency) that receives DP service. A user may also be either internal or external to the agency responsible for the DP facility.

Work Function

A work function is a work area for which costs can be accumulated and work measurements made. An AMR is made up of one or more work functions, and a work function is always contained within one AMR. Costs are accumulated by work function in order to obtain a more detailed understanding of the costs of operating the DP facility. Examples of work functions are DP administration, computer operations, reporting, technical support, and software development.

Work Unit

A work unit is the metric used to measure or determine the amount of a subfunction used to provide the services of a given service center. Only one work unit should be associated with each subfunction. Examples of work units are CPU second, for a CPU subfunction; number of hours, for an applications software development subfunction; and number of lines, for a printing subfunction. The work unit selected for a subfunction should be an accurate metric of

the dominant type of work performed by the subfunction. Work units may or may not be the same as some of the resource or service units.

APPENDIX

Automated Reporting Package Evaluation Criteria

The criteria presented below are intended for use by the Charging Team as a starting point in its evaluation of automated reporting packages. The criteria have been separated into four categories, general, cost accumulation, data analysis, and reporting, and a brief description of each criterion has been provided. The Charging Team should expand the criteria list as necessary to suit its particular requirements. Additional information on many of the automated reporting packages, available on the market today, can be found in EDPPM 80.

General Criteria

1. *Type of Automated Reporting Package.* There are basically two types of automated reporting packages on the market today. The first type consists of software that contains "hooks" into or modifications of the computer's operating system. These hooks cause the collection of additional usage information that would not normally be collected. The second type consists of software with no hooks into or modifications of the computer's operating system.
2. *Charging System Criteria.* The automated reporting package selected by the Charging Team should be able to satisfy as many of the charging system characteristics, that were determined in Step 2, as possible. Additionally, the Charging Team should evaluate the mixture, or balance, of characteristics that the automated reporting package supports.
3. *Cost.* The cost of the automated reporting package should be an important consideration of the Charging Team, but its influence on the final decision should be balanced with the other criteria.
4. *Source Code.* The availability of the source code for an automated reporting package is an important criteria, because without it, custom modification of the package is not possible. Of course, if custom modification of the automated reporting package is not needed, then the importance of this criterion is diminished.

Cost Accumulation Criteria

1. *Multiple Diverse Services.* The ability of the automated reporting package to handle multiple diverse services should be an evaluative criterion of the Charging Team, especially if it intends to have diverse services in the charging system. Diverse services refers to including non-computer (processor) services, such as consulting services, supplies, etc.
2. *Data from Non-Computer (Processor) Services.* This criterion refers to the ability of the automated reporting package to incorporate or process usage and cost data for services that are non-computer (processor) services. The advantage of having an automated reporting package with this capability is that the user's total charges can be included on one invoice or report.
3. *Account Modification.* This criterion refers to the ability to automatically credit or debit user accounts based upon their usage. This capability will enable all reports to users to contain account balances.
4. *Calculation of Charges.* The ability of the automated reporting package to calculate the charges based on the usage figures and billing rates is a moderately important criterion for a billing package.
5. *Modifiable.* It is important for an automated reporting package to be capable of incorporating new services and deleting old services. This capability is important because DP environments change quite often and subsequently the service offered by the DP facility will need to be changed.

Data Analysis Criteria

1. *Account Status.* This criterion refers to the ability of the automated reporting package to provide information to users regarding the status of their accounts.
2. *Service Revenue.* This criteria refers to the ability of the automated reporting package to provide summary data on the amount of revenue brought in by each service.

3. *Summarization.* The ability of the automated reporting package to provide summarized information about a user's account and usage can be a worthwhile feature.

4. *Additional Statistics.* This criterion refers to the ability of the automated reporting package to provide statistics on usage and charges other than the standard summarizations. This additional information is usually valuable to both the Charging Team and the users.

Reporting Criteria

1. *Report Content.* This criterion refers to the capability and ease of modifying the contents of the automated reporting package reports. This is a valuable feature since the contents of every report will periodically change.

2. *Report Format.* This criterion refers to the capability and ease of modifying the format of the automated reporting package reports. This is a valuable feature since it is sometimes better to custom design the reports to satisfy a particular user's needs, than to force the user to use reports which are difficult to understand.

3. *Report Frequency.* This criterion refers to the capability and ease of modifying the frequency with which the reports of the automated reporting package are prepared. This is an important feature in that the frequency of users wanting usage and charge reports will typically vary from user to user.

BIBLIOGRAPHY

- [ADPNA 76] "Transaction Pricing: A Tool to Improve User Relations." ADP Newsletter. 1976 March; 10: 1-4.
- [ALWAS 75] Alward, Sam A. "How to Cost and Charge for DP Services." Data Management. 1975 September; 13: 54-59.
- [ANDEJ 74] Anderson, John J. "Direct Chargeout of Information Systems Services Costs." Management Advisor. 1974 March-April: 27-33.
- [ARNDD 74] Arndt, Donald A., et al. "Budgeting for the D.P. Department/Chargeback to User Departments." The Interpreter. 1974 August: 24-31.
- [BCS 75] Boeing Computer Services, Inc. "Computer Resource Unit (CRU) Coefficient Determination." Prepared for Air Force Logistics Command under Contract No. F33600-74-C-0334.
- [BELLT 00] Bell, Thomas E. "Managing Computer Performance and Cost." Unpublished and undated report from Computer Technology Group, 18 Roberts Rd., Warren, NJ.
- [BERND 77] Bernard, Dan, et al. Charging for Computer Services: Principles and Guidelines. Petrocelli. 1977: 128pp.
- [BOROI 77] Borovits, I. and Neuman, S. "Internal Pricing for Computer Services." The Computer Journal. 1977 March; 21(3): 199-203.
- [BOROI 74] Borovits, Israel. "The Pricing of Computer Services." Data Processing (Great Britain). 1974 May-June: 160-163.
- [BUTLD 73] Butler, David. "Chargeback for Information Systems." Data Processing (Great Britain). 1973 July-August: 250-253.
- [COMPG 79] Comptroller General of the United States. "Accounting for Automatic Data Processing Costs Needs Improvement." GAO Report to the Congress. 1978 February: 57pp.
- [COTTI 76] Cotton, Ira W. "Some Fundamentals of Price Theory for Computer Services." Performance Evaluation Review. 1976 March; 5c(1): 1-12.
- [COURR 73] Courtney, Ralph "Who Pays What? Solutions to the Job-accounting Quandry." Computer Decisions. 1973 July: 12-16.
- [CRINJ 72] Criner, James C. "Managerial Accounting for Federal Automatic Data Processing Services." The Federal Accountant. 1972 December: 43-55.
- [CUSHB 76] Cushing, Barry E. "Pricing Internal Computer Services—The Basic Issues." Management Accounting. 1976 April; 57(10): 47-50.
- [DEARJ 73] Dearden, John and Nolan, Richard L. "How to Control the Computer Resource." Harvard Business Review. 1973 November-December; 51: 68-78.
- [DOOLC 78] Dooley, Charles R. "How to Develop A Data Communications Charge-Back System." Data Communications. 1978 November; 7(11): 39-43.
- [DOOSH 80] Dooskin, Hert P. "Equitable Billing of Computer Services." Data Management. 1980 April; 18: 34-35.
- [EDPAN 74] "Charging for Computer Services." EDP Analyzer. 1974 July; 12(7): 1-13.
- [EDPPM 80] "Job Accounting and Chargeback." EDP Performance Management Handbook. 1980 June: 2.0.1-2.840.
- [EDPPR 81] "Standard Costing in Data Processing." EDP Performance Review. 1981 June; 9(6): 1-6.
- [EDPPR 75] "A User-Oriented Approach to Chargeback." EDP Performance Review. 1975 February; 3(2): 1-6.
- [FINNJ 74] Finney, John E. "Costing in a Data Processing Department." Management Accounting. 1974 October: 29-35.

- [GALLW 72] Gallop, W. J. "The Great Costing Allocation Debate." Canadian Data Systems. 1972 November: 22-25.
- [GIAMT 76] Giammo, Thomas. "Deficiencies in Computer Pricing Structure Theory." Performance Evaluation Review. 1976 March; 5c(1): 12-21.
- [GLADH 75] Gladney, H. M.; Johnson, D. L.; and Stone, R. L. "Computer Installation Accounting." IBM Systems Journal. 1975 V4: 314-339.
- [GRILJ 74] Grillos, John M. "Pricing EDP Resources." Computer Decisions. 1974 November: 16-17.
- [GRINK 73] Grindley Kit. "Internal Charging for Computer Services." Accountancy (Great Britain). 1973 March: 32-35.
- [ICADP 79] "A Look at Charging for Computer Services in the Federal Government." Interagency Committee on Automatic Data Processing Special Interest Group on Installation Management. 1979 June.
- [LUDEG 75] Luderer, Gottfried W. R. "Charging Problems in Mixed Time-Sharing/Batch Systems: Cross Subsidization and Invariant Work Units." Performance Evaluation Review. 1976 March; 5c(1): 89-93.
- [MCKEL 79] McKell, Lynn; Hansen, James V.; Heitger, Lester E. "Charging for Computer Resources." Computing Surveys. 1979 June; 11(2): 105-110.
- [MORRM 76] Morris, Michael F. "Problems in Implementing and Processing Computer Charging Schemes." Performance Evaluation Review. 1976 March; 5c(1): 84-88.
- [NBS 79] National Bureau of Standards. Federal Information Processing Standards (FIPS) Publication. "Guidelines for Documentation of Computer Programs and Automated Data Systems for the Initiation Phase." Washington, DC: NBS; 1979 August 1; FIPS PUB 64. 49p.
- [NBS 76] National Bureau of Standards. Federal Information Processing Standards (FIPS) Publication. "Guidelines for Documentation of Computer Programs and Automated Data Systems." Washington, DC: NBS; 1976 February 15; FIPS PUB 38. 55p.
- [NOLAR 77] Nolan, Richard L. "Effects of Chargeout on User/Manager Attitudes." Communications of the ACM. 1977 March; 20(3): 177-185.
- [NOLAR 77] Nolan, Richard L. "Controlling the Costs of Data Services." Harvard Business Review. 1977 July-August: 114-124.
- [NOLAR 74] Nolan, Richard L. "A Panel Session—Charge-out System for Management Acceptance and Control of the Computer resource." Proceedings of the 1974 National Computer Conference; 74: 1013-1016.
- [OMB 80] United States Office of Management and Budget Circular No. A-121. "Cost Accounting, Cost Recovery and Inter-Agency Sharing of Data Processing Facilities." 1980 September.
- [PALMC 76] Palmer, Carl R. "A Brief Review of the GAO Task Group's Recommendations on Management Guidelines for Pricing Computer Services in the Federal Government." Performance Evaluation Review. 1976 March; 5c(1): 71-83.
- [RIZZC 78] Rizzuto, Christine and Rizzuto, Ralph. "Chargeouts: A Perspective for Change." Datamation. 1978; 24(13): 125-128.
- [SEAMJ 80] Seaman, John. "How to Charge Users." Computer Decisions. 1980 July; 12(7): 62-68.
- [SCHAC 74] Schaller, Carol. "Survey of Computer Cost Allocation Techniques." Journal of Accountancy. 1974 June; 137(6): 41-49.
- [SCOTS 77] Scott, Shirley E. "Pricing DP Products: A Timesharing Implementation." Performance Evaluation Review. 1977 Fall; 6: 8-12.
- [SOLLH 77] Sollenberger, Harold M. "A Cost Accounting Framework for EDP Management." Management Accounting. 1977 October: 48-56.
- [STATN 77] Statland, Norman et al. "Guidelines for Cost Accounting Practices for Data Processing." Data Base. 1977 Winter; 8: 2-20.

- [STEFE 76] Stefferud, Einar. "Slide Presentation at ACM-SIGMETRICS, Sigmetrics Technical Meeting on Pricing Computer Services." *Performance Evaluation Review*. 1976 March; 5c(1): 31-70.
- [USGAO 78] United States Government Accounting Office. "Federal Government Accounting Pamphlet Number 4: Illustrative Accounting Procedures for Federal Agencies." 1978.
- [USGAO 77] United States Government Accounting Office. "Current Practices of Cost Accounting and Cost Control for Automatic Data Processing Activities and Systems." 1977.
- [USPS 80] United States Postal Service. "Automatic Data Processing Resource Accounting System. The Pricing Process." United States Postal Service. 1980 August.
- [ZMUDR 75] Zmud, Robert W. "Selecting Computer Resources for Inclusion Within a Pricing System." *Journal of the American Society for Information Science*. 1975 November-December: 346-348.

INDEX

- Aborted Work 67
 Accounting 7, 17, 67
 Actual Cost Distribution 41
 Adaptability 19
 Allocation of Scarce Resources 18
 Areas of Management Responsibility 9, 25, 35
 Auditability 19
 Automated Reporting Package 70
- Base Rate 30, 57, 62
 Billing Period 10
 Billing Phase 16, 67
 Billing Rate 9, 25, 30, 62, 73
 Billing Subsystem 10, 11
 Budgeting 7, 17, 62, 67
- Capacity 44
 Charging System Characteristics 17, 20
 Charging Team 7, 17
 Circular A-121 7
 Controllability 19
 Costs 9, 29
 Cost Accounting 20, 21
 Cost/Benefit Tradeoff 13
 Cost Forecasting 45, 47
 Cost Recovery 72
 Cost of Service Center 29, 57
- Data Requirements Document 41, 42
 Depreciation 21
 Design Phase 13, 20
 Direct Resources 49
 Discounts 62
 Distribution Matrices 25, 30, 39, 44, 47
 DP Cost Accounting 20, 21
 DP Facility Characteristics 17
 Dynamic Data 42
- Equitability 19
 Errors 74
 External User 72
- FGAP 4 7
 Full Cost Allocation 25
 Functional Requirements Document 41, 42
- General System Design 41, 43
- Incremental Development and Implementation 11
 Indirect Resources 49, 52
 Internal Users 72
- Maintenance 73
 Measurement Software 69
- Normalization 61
- Overhead Resources 49, 52
 Oversight Official 17
- Partial Cost Allocation 25
 Planning Phase 13, 16
 Priorities 61
 Product-Oriented Work Function 35, 57
 Project Manager 17
 Project Plan 20
 Project Structure 16
- Rate Period 9
 Rate-Setting Phase 15, 44
 Rate-Setting Subsystem 9, 10
 Repeatability 19
 Resource 9, 29, 39
 Resource Charging Algorithm 12
 Resource Proportion 29, 47, 52
 Resource Proportion Cost 29, 47
 Resource Unit 39, 44
- Senior Management 7, 11, 17
 Service 9, 30, 31
 Service Center 9, 29, 31
 Service Forecast 30
 Service Unit 9, 30, 31, 44
 Simplicity 20
 Stability 19
 Standard Cost Distribution 41
 Standard Systems Development 7
 Standardization Factor 30, 61
 Standardization Forecast 30, 61, 62
 Static Data 42
 Subfunction 9, 29, 35, 52
 Subfunction Proportion 29, 52
 Subfunction Proportion Cost 29, 52
 Support-Oriented Work Function 35, 57
 Surcharges 62
- Total Cost of Subfunction 29
 Trial Budget 45
- Understandability 19
 Usage Accounting 68
 Usage Forecasting 44, 45
 Usage Reporting 70
 Users 7, 12, 17
- Variance Analysis 74
- Work Area 9
 Work Function 9, 25, 35
 Work Unit 36, 44

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH—The Journal of Research of the National Bureau of Standards reports NBS research and development in those disciplines of the physical and engineering sciences in which the Bureau is active. These include physics, chemistry, engineering, mathematics, and computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodology and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Bureau's technical and scientific programs. As a special service to subscribers each issue contains complete citations to all recent Bureau publications in both NBS and non-NBS media. Issued six times a year. Annual subscription: domestic \$18; foreign \$22.50. Single copy, \$5.50 domestic; \$6.90 foreign.

NONPERIODICALS

Monographs—Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NBS, NBS annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

Applied Mathematics Series—Mathematical tables, manuals, and studies of special interest to physicists, engineers, chemists, biologists, mathematicians, computer programmers, and others engaged in scientific and technical work.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a worldwide program coordinated by NBS under the authority of the National Standard Data Act (Public Law 90-396).

NOTE: The principal publication outlet for the foregoing data is the Journal of Physical and Chemical Reference Data (JPCRD) published quarterly for NBS by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements available from ACS, 1155 Sixteenth St., NW, Washington, DC 20056.

Building Science Series—Disseminates technical information developed at the Bureau on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NBS under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The standards establish nationally recognized requirements for products, and provide all concerned interests with a basis for common understanding of the characteristics of the products. NBS administers this program as a supplement to the activities of the private sector standardizing organizations.

Consumer Information Series—Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

Order the above NBS publications from: Superintendent of Documents, Government Printing Office, Washington, DC 20402.

Order the following NBS publications—FIPS and NBSIR's—from the National Technical Information Service, Springfield, VA 22161.

Federal Information Processing Standards Publications (FIPS PUB)—Publications in this series collectively constitute the Federal Information Processing Standards Register. The Register serves as the official source of information in the Federal Government regarding standards issued by NBS pursuant to the Federal Property and Administrative Services Act of 1949 as amended, Public Law 89-306 (79 Stat. 1127), and as implemented by Executive Order 11717 (38 FR 12315, dated May 11, 1973) and Part 6 of Title 15 CFR (Code of Federal Regulations).

NBS Interagency Reports (NBSIR)—A special series of interim or final reports on work performed by NBS for outside sponsors (both government and non-government). In general, initial distribution is handled by the sponsor; public distribution is by the National Technical Information Service, Springfield, VA 22161, in paper copy or microfiche form.

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE
COM-211



3rd Class Bulk Rate
