

A MODEL OF A
GENERALIZED AUDIT SOFTWARE PACKAGE

by

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Chapter OneINTRODUCTION

"The Age of the Electronic Rip-off - You could be the victim of a computerized theft right now and not even know it."

Menhus, 1979

Computer crime may be the fastest growing type of white collar offense. Some observers believe that computer crime will generate far greater losses per case in the future. As top management becomes increasingly aware of computer crime's potential dangers, greater recognition is and will be given to the need for more sophisticated security systems. However, according to Donn Parker, a leading world expert on computer crime, abuse and fraud, the only completely safe computer is one that is not used. There will always be a small group of highly skilled experts capable of infiltrating the most sophisticated system and consequently, creating large losses through computer crime. On the other hand, it is possible to take steps to prevent computer abuse and recently, the auditing community has been charged with a significant amount of responsibility for discovering computer fraud. The safest solution now is to complement a secure system with more frequent auditing of controls governing a computer environment.

1.1 THE PROBLEM

The increased use of computer-based systems has therefore generated the need for a new breed of professionals - that of a computer auditor. However, with the rapid developments in technology, this new type of professional is increasingly hard to find. Most auditors are not equipped with a solid technical background to allow them to stay on top of the latest developments. The best example of this has been the introduction and increasing use of data bases. While there is little unanimity as to what an ideal computer auditor is, it is agreed that one does not become a computer auditor overnight. On the other hand, "Auditors excluded from computers will be obsolete. There is no such thing as a manual audit" (Wood, 1982). Thus, the urgent need arises for increased use of computer assisted audit techniques and most importantly - generalized audit software packages. Further, these packages must have the capability to interface with a data base management system.

1.2 TERMS

AUDITING: Auditing has been defined as: "a systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between those

assertions and established criteria and communicating the results to interested users." (AICPA, 1972)

An audit, then, is basically, an investigative process. Frequently, the term "audit" (or auditing) is modified by a descriptive word or phrase to indicate either the particular purpose of the audit or the subject matter of the audit, or both. For instance, we can have financial audits, systems audits, and management audits.

The phrase "systematic process" implies that an audit is based on planning in which a set of interrelated evidence-gathering and evaluating activities are selected and implemented to achieve a set of audit objectives. Moreover, it suggests that auditing is based, in part, at least, on the discipline and philosophy of scientific method.

"Objectively obtaining and evaluating evidence" is the essence of auditing. The types of evidence obtained and criteria employed to evaluate evidence may vary from audit to audit, but all audits center on the process of obtaining and evaluating evidence.

Finally, auditing can be internal or external. Most large corporations maintain staffs of internal auditors with the responsibility of evaluating the efficiency of operations and determining whether company policies are being followed consistently in all divisions of the corporation. The internal auditor, in contrast to the external auditor is not responsible for determining the overall fairness of the

company's financial statements.

SAMPLING: Perhaps the most common and economical method of obtaining and evaluating evidence is the use of sampling. Sampling involves forming an opinion about a large population by examining only a part of that population. There may be various types of sampling, for instance, statistical sampling is the use of a sampling plan in such a way that the laws of probability can be employed to make statements about a population. In contrast, judgement sampling is sampling without regard to the requirements for statistical sampling.

FINANCIAL STATEMENTS: A major part of an auditor's concerns lie in the validity of an organization's financial statements. Financial statements are reports which summarize the financial position and operating results of a business.

BALANCE SHEET: A financial statement which shows the financial position of a business entity by summarizing the assets, liabilities, and owners' equity at a specific date is known as a balance sheet. The owners' equity represents the resources invested by the owners.

ACCOUNTS RECEIVABLE: These are amounts of money which a company expects to collect from its customers for goods and services sold to them on credit.

CONFIRMATIONS: A confirmation is that type of inquiry by which an auditor obtains a written statement from outside companies or individuals on information which that person is qualified to give. For example , the auditor typically

confirms cash on deposit in banks. The auditor may also need information concerning an item that does not have a physical existence, such as accounts receivables.

Accounts receivables may be confirmed by either the positive request method, the negative request method, or by a combination of the two methods. With the positive request method, the debtor is asked to reply directly to the auditor stating whether the balance as indicated on the request is correct or , if it is incorrect, to indicate the correct balance and any possible explanation of the difference.

With the negative request method, the debtor is asked to reply only if the balance as stated on the request is not in agreement with the debtor's records. In other words, the balance is assumed to be correct unless the debtor replies otherwise.

Confirmations are usually requested by sending a standard printed form, a special form, a business reply card, or a letter using the client's letterhead.

AGING: In examining the accounts receivables of a company, a process known as aging is carried out. Aging refers to the process of analyzing accounts receivables for the purposes of judging possible uncollectibility and ascertaining the efficiency of the credit and collection department. Aging schedules may be prepared on the basis of days past the billing date or days past maturity.

ACCOUNTS PAYABLE: The liability arising from the purchase of goods or services by a company on credit is called an accounts payable.

FOOTING: The term footing means proof of the client's totals. Generally, this is of minor interest if there is good internal control in which footings are verified and tested periodically. The type of footings are:

- Complete (including pennies)
- Dollars (or tens or hundreds)
- Scrutiny (footing to approximate totals with the eye).

AUDIT TRAIL: The trail of evidence linking individual accounting transactions to the summary totals in the books of account is known as the audit trail. An audit trail in the computer environment is a record of actions performed by the system.

1.3 COMPUTER AUDITING

Computer-based systems are now an integral part of the operation of most businesses today. This rapid increase has led to the necessity of changing the auditing approach used. Until recently, the common attitude of auditors has been that of auditing "around-the-computer" (Jancura, 1973) where the emphasis is placed on tracing selected input to output and vice versa. The assumption, here, is that if the source data or system input can be proven correct and if the results of

the system accurately reflect these source data, then the output must be correct and the manner in which the system processed the data is of little consequence. The "around-the-computer" approach works well if the system is on a batch processing basis, if transactions are initially recorded manually, and if the audit trail is characterized by extensive printouts. However, as computer systems become more complex, this auditing method becomes costly and difficult if not impossible. The alternative, then, is to audit "through-the-computer" (Jancura, 1973). This, too, requires verification of source data, but, additionally, it emphasizes review and testing of processing procedures rather than verification of output. Thus, the basic premise here is that the results can be accepted if input and processing are found to be proper.

The necessity of auditing through-the-computer has created a demand for computer auditors. One definition of a computer auditor in a firm of accountants is "an auditor who has received suitable experience of computers and computer systems to allow him/her to advise the general audit partner of staff on matters pertaining to their clients who possess or make use of a computer." (Mathieson, 1979) numerous other titles have been given to computer auditors, the most common being EDP auditor. As more and more organizations use computers for financial applications, and systems become more and more complex, clients are beginning to expect their auditors to deal with data processing in the same way as they deal with financial matters. Thus, it is increasingly important for auditors to be conversant with computers. The

techniques which are most commonly used to audit a computer system are file print-outs, the audit of computer programs, the use of test data, and the use of enquiry programs.

1.4 DATA BASE AUDITING

The introduction and increasing use of data base management systems has created new problems for the auditor. Most of the current software available cannot be interfaced with data bases, and, additionally, data base audit techniques are not yet fully developed. Several general characteristics of data bases, as we shall see, cause serious problems for the auditor.

1.5 ORGANIZATION OF STUDY

The increasing use of computers has no doubt created problems for auditors. In the chapters that follow, the above topics are dealt with in more detail.

The role of the EDP auditor with respect to various aspects of computer auditing is discussed in chapter two.

Chapter three discusses the current state of data base auditing, specifically, the problems involved, and possible solutions.

Chapter four contains a review of the features available in some of the current software packages.

Chapter five presents a detailed look at Cullinane's software.

Recommendations for an idealized model are presented in chapter six.

Finally, in chapter seven, an attempt is made to look at what the future generalized audit software package should be.

Chapter Two

COMPUTER AUDITING AND THE EDP AUDITOR

The rapid growth in the number of computerized systems has necessitated a new approach to auditing. It is no longer possible to ignore the presence of the computer and audit outside of the computer environment. Consequently, the computer auditor has been entrusted with a host of new responsibilities.

2.1 THE REVIEW AND AUDIT OF COMPUTER INSTALLATIONS

Data processing departments normally operate within a set of standards or rules. Auditors are concerned to ensure that these standards and rules are adequate and, even more important, that they are being consistently applied. The review and audit of computer installations must cover the following broad areas:

2.1.1 OPERATIONAL CONTROLS

The auditor should be familiar with the general operational controls such as details of the computer equipment, programming languages supported, times when the computer is operated etc. The review of computer room operations can begin by observing the physical layout and general working conditions. Computer equipment should be

arranged for efficient use. For example, there should be easy access to magnetic tape and disks. Sufficient table space should be available for use as input and output preparation areas. The scheduling of work to be run on the computer and computer operating procedures should also be reviewed since this relates to computer utilization. Effective scheduling provides a continuous flow of work to the computer so that there will be a minimum of idle time and work can move on as planned. In reviewing scheduling procedures the auditor should check to see if schedules are prepared in advance and if routine production jobs are segregated from priority and non-priority jobs.

2.1.2 ORGANIZATIONAL CONTROLS

A review of the details of data processing personnel, division of duties and responsibilities within the data processing department itself and between the data processing department and other departments within the organization is necessary, since auditors are interested in the separation of duties. The organization's standards programs and its means of enforcement also fall within this area.

2.1.3 DATA CONTROLS

The general procedures operated by the data preparation and data control departments will need review. With the increase in online and real-time systems, there may be no formal data preparation department. However, the most sophisticated computer can do no more than manipulate data. A greater threat to an organization's data may well be human

error. the output will always reflect errors that may be present in input data. Thus, the auditor must determine that controls are adequate to assure the accuracy of data input to the system. Further, the controls for handling data files need review. The auditor must verify that sensitive data is protected and that back-ups are run. It is important too, that these back-ups are stored off-site and with adequate protection.

2.1.4 SOFTWARE CONTROLS

This should include not only the organization's systems development life cycle methodology, but also the controls concerning the program library. The program library must be protected and only authorized and necessary changes must be permitted. Entire libraries can be wiped out if strict controls are not enforced. Additionally, documentation standards must be reviewed.

2.1.5 SECURITY AND INTEGRITY CONTROLS

This is perhaps, one of the most important functions entrusted to the computer auditor. There is a growing need to design computer systems with security as a primary objective and to implement security countermeasures to effectively prevent or deter the exploitation of threats and vulnerabilities. Ample evidence documents the ease with which the computer systems designed without adequate security considerations can be penetrated by internal and external means. Yet, many organizations are not conscious of this. They fail to consider data as a resource much like capital and

other assets.

Computer system security addresses the problem of ensuring that the protected data processing assets are accessed in a legitimate manner by authorized users. The overall information security problem can be decomposed into three distinct , but related issues (Srinivasan & Dascher, 1981) :

1. Data confidentiality...ensure the protection of data from accidental or intentional disclosure to unauthorized users.

2. Data integrity...ensure the protection of data against accidental or malicious destruction or alteration by unauthorized users.

3. Availability of service...ensure against malicious denial of service to authorized users.

Management should formally recognize the need for a computer security program, and make a commitment to ensuring its implementation.

An important aspect of any security plan is physical security which can be considered in two categories: protection against natural disasters, such as fire and floods; and protection against intruders by restricting physical access (Hsiao 1979). An effective security plan should also consider identification, authorization, audit log, and data encryption procedures.

Identification: Personal accountability is considered the cornerstone of computer security. A major step toward realizing that accountability is the accurate identification of the computer user. There are three basic methods by which a person's identity can be established: something the person knows (i.e. passwords); something the person has (badges, passes, cards with machine-readable information); something the person is (signatures, fingerprints, speech).

Identification is essentially a two-step procedure: identity definition; and identity authentication. In the first step, the user provides the system with his/her name and a codeword. In the second step, the user supplies only his/her name. The system performs a table lookup on the name and, based on name and codeword provided initially by the user, assures that the same name and codeword have been presented to it in the identity definition step.

It should be recognized that sound security practice requires positive identification of not only computer users, but of all data assets as well. That is, each accessible device (equipment and components) has a unique identification: all programs have a unique name and version; and data sets and record names are completely identified.

Authorization: Once the user or system resource is identified, the next step is to determine the scope and extent of access permitted to the identified subject. i.e. what actions are to be allowed. For example, one may be authorized to read certain information, but not to change it. The

process of authorization is again a two-step process. First, the authorization definition provides the system with the set of valid users of the system, the information needed to identify the user uniquely, the resources of the system, and the valid authorization relationships between the users and the resources. Second, Authorization verification utilizes the authorization definition to ensure that the user and the resource involved in access were previously delineated in a valid authorization relationship. This step is used to grant or deny access.

Audit log: An audit log or audit trail implies keeping a permanent record of every significant action taken by the system. This audit log can then be used for detecting security violations. Audit logs can also be used to recover from system crashes, and as a deterrent to security violations. However, a careful study is required to determine what information should be captured in the audit log, and how it should be organized for most effective use. Further, if security violations are to be detected in a timely manner, a definite plan of examination is necessary. In many installations audit logs are generated but never used. Standard reports should be developed that can be used to detect unusual situations, such as a large number of invalid log-in attempts. Since the log contains a record of possible misuse, it is subject to security violations as well. In other words, the log itself must be audit logged.

Data encryption: A computer system is often viewed as a

network of terminals, storage devices, or processing units(Hsiao 1979). Data encryption techniques are needed to protect the content of data as communication takes place between the terminals, devices and units.

2.2 THE USE OF COMPUTER ASSISTED AUDIT TECHNIQUES

This is another essential area of work for the computer auditor. Currently, there are four main techniques available. These are: file printouts, audit of computer programs, use of test data, and use of enquiry programs.

In the first approach, the auditor requests file printouts and then audits the system as if it were a manual system. However, this approach is no longer very practical due to the increasing volume of data processed by the computer.

The second technique is theoretically a sound method of checking on the computer processing. However, most auditors restrict this method to using special computer programs which "trace" the path of transaction through a program via a number of checkpoints or generate flowcharts which can be used as aids to checking on the logic of the program being examined. If auditors were to examine entire programs, they would be faced with an impossible task in terms of time. In cases where the programs are not documented the problem is further complicated. Finally, even after the program has been thoroughly audited, there is no guarantee that it will be used throughout the year or that it will not be temporarily

tampered with in the absence of the auditor.

The third technique involves using data to test all aspects of a program(Mathieson,1979). The computer is used to process the test data in order to ensure that programs deal with each type of transaction in the expected manner. The expected results of processing have to be calculated manually, and the comparison is made between the processed results and the manual figures. One method of dealing with the test data is to have it processed by the programs being tested, using copies of the master files required by the programs. Another method is to run it in parallel with the company's data during a normal operational run, thereby utilizing current or live master files and updating them accordingly with both the real (the company's) and the fictitious (test) data. If this is done, it is possible to use only certain records on the master file. However, in this method there is the risk of corrupting genuine data.

Whichever method is used, it is important that the test data created covers all known possible eventualities, because the auditor must be sure that the programs not only deal with acceptable data but also reject unacceptable data for the correct reason. A number of points in favor of using test data along with some serious disadvantages are provided in table 2.1.

Advantages

1. Positive proof of the correct functioning of programs and the various controls can be provided.
2. The data can be designed theoretically to cover every type of transaction, both correct and in error.
3. The auditor can gain more knowledge of the system.

Disadvantages

1. It is difficult for test data to be comprehensive.
2. It is time consuming to create a comprehensive set of test data and to calculate the results manually.
3. Systems are likely to change, and the effort and cost of documenting and maintaining test data can be considerable.
4. Test data only tells the auditor that the program which processed test data performed as expected at the time of the test and not throughout the time of the audit period.

Table 2.1 - Advantages and Disadvantages of
using test data for computer audits

Enquiry programs are computer programs specifically designed to be used by auditors which examine computer files and produce printed reports of the results of their examination. There are two main types of enquiry programs: those written for a specific exercise and those which are generalized and have parameters which can be altered from run to run. Due to the high costs of writing special programs, the generalized programs have been more widely used. These programs are commonly known as Generalized Audit Software Packages or GASP's.

Table 2.2 is representative of some of the capabilities of GASP's which are increasingly attractive to auditors and management teams (Romney & Peterson, 1980).

1. Preformatted files are not required by the packages and some can provide access to more than one file structure.
2. Many of the software packages can handle multiple input files and can produce multiple output files and reports.
3. All packages allow the user to select or test certain items using standard logical operations.
4. Computational capabilities of higher level languages are available in some packages.
5. The audit software packages can be used to match items on two or more files or to add items from one file to another.
6. Most packages can sort on different fields within the file.
7. Several of the packages have fairly sophisticated statistical sampling capabilities.
8. Most of the available GASP's today are able to function in a multi-programming environment, so that exclusive use of the computer is not required.
9. The reporting capabilities are fairly extensive.
10. Many of the packages have several levels of totals and subtotals to summarize information.

Table 2.1 - Representative capabilities of current GASP's

The significant capabilities become even more impressive when we recall that these audit software packages can be implemented by the users with minimal training. Thus, the enquiry program technique seems to be the most useful and cost effective computer assisted audit technique available.

2.3 THE EDP AUDITOR : PRESENT PROBLEMS

As greater numbers of critical business systems are computerized, the need for computer auditing will continue to grow, and consequently, the demand for EDP auditors. However, most EDP auditors are confronted with a host of problems which include the following (Levine, 1974) :

1. It is difficult for auditors to stay current with developments in EDP technology and to assess the audit impact of these developments. The problem of staying up-to-date is not unique to auditors. Data processing people face the same problem, since EDP developments advance at an fast pace. Consequently, for auditors without a technical background , this poses a serious problem.

2. The documentation in support of application programs and systems is often insufficient. This makes it difficult for the auditor to understand the system. The auditor is forced to create such documentation before a system review can be completed.

3. Auditors are rarely involved in the design of new systems. as a result it is difficult for them to fully understand an application.

4. The separation of duties is of major concern to auditors. However, as more and more applications are computerized, the duties become more concentrated and control is weakened. Thus, new control techniques are needed.

5. In advanced systems the audit trail may be maintained within the computer and so become invisible to the auditor. Once data is processed as systems input, it is often reformatted, used in calculations, summarized and then processed to update other records. By the time this process is completed, transactions may lose their identity, and it may be difficult to maintain the integrity of complete transactions. Since control over all this processing is a function of the computer programs within the system, The auditor must evaluate program controls. However, programs are subject to frequent modifications. The effects of these modifications may not be reflected in the output. Auditors need to know about program modifications and must be able to respond to those that may impact control. Ideally, once the auditor is satisfied with a particular program and its related controls, the auditor should have the ability to ensure that no modifications of that program are made without his/her knowledge.

6. As computer applications become more sophisticated, the interactions between systems become more complex. as a result, The time cycle for transaction processing is compressed. This reduces the time available for detecting and correcting errors. further, Errors proliferate as

transactions are processed through other related systems. This makes errors more difficult to find. In order to cope with these problems, the auditor needs some new audit tools. There needs to be a better way to test controls and monitor transaction processing.

7. Perhaps, the most difficult problem is the absence of generally accepted data processing principles (Bariff, 1982). In addition, evaluating a computer based system at one point in time provides no assurance as to processing and data integrity at another point in time. Appropriate functioning of system software controls should safeguard programs and data. However, security can only be stated in probabilities. There is no such thing as an absolutely secure system. Thus, an EDP auditor cannot be expected to provide a broad assurance of appropriate controls. EDP auditors will have to conduct a number of interim examinations to gather evidence that system controls appear to be operating appropriately throughout the audited period.

2.4 THE SOLUTION

The solution to many of the problems lies in designing better controls in the computer environment and the education of auditors in data processing techniques. In any system audit controls must be built in and not added on. All new systems designs must be evaluated in terms of control requirements before they are introduced. Thus, internal auditors must be involved in the design of new systems to ensure that the end product incorporates adequate controls.

Currently, however, the number of internal auditors in computer-based organizations is scarce. Consequently, there is an urgent need to increase management awareness of the potential problems resulting from insufficient controls. to take an active part in systems design, auditors will need a knowledge of both business operations and computer science/information systems . This indicates the need for a five-year program; perhaps joint computer science and mba degrees. Lastly, it is important that the data processing and auditing communities work closely to develop control guidelines.

2.5 THE FUTURE CHALLENGE

The role of the auditor is expected to change continually with increasing responsibilities. The recent emphasis is a switch away from balance sheet audits within a company to "auditing the process that produces the results." (Wood, 1980) As management increasingly look to EDP Auditors for advice , the role of the EDP auditor will continue its climb to importance. Consequently, the following trends can be expected (Bariff, 1982):

First, greater emphasis will be given to audits of operational systems which are critical to core production processes or services offered by an organization, for example automated manufacturing. further, government may mandate independent audits of computer systems which affect public interest and safety.

The second EDP audit role change has already begun. Specialists within the EDP audit community are focussing their skills on operating systems, data communications, data base management systems, and minicomputers.

Thus, to meet the demands of increases in computerized systems, the EDP auditor of the 1980's must develop an understanding of data processing and be able to audit through the computer rather than around it. Specifically, he/she will be expected to be able to do the following: (Andersen, 1982)

- Deal with important issues such as the reconstruction of data files, physical security, and the theft of services or data in the system.

- take an active role in developing policy on auditability, testing, standards, and general controls.

- provide management with independent assessments of data processing decisions, and their impact on the company in general.

- ensure that the alternatives or risks for a project have been carefully considered and that the technical hardware and software solutions are correct and reasonable, and that costs are reasonable.

Indeed, to meet the future challenge, auditors must have a knowledge of business as well as computer science.

Chapter ThreeDATA BASE AUDITING

"No recent development in the Computer field is of more significance to business users of computers than data base management systems...It should not be long before most business users of computers will be operating some type of Data Base System."

Richard Canning

This prediction made by Richard Canning in 1971 is now fast becoming a reality, to the point that even small business systems based on microcomputers now incorporate data bases. Data Bases are an important part of Management Information Systems. Senior managers are beginning to recognize its potential, but this recognition also carries with it concerns about its hazards. In data bases, all data flows from the same source and it is either all right or all wrong, and managers are uneasy about the possibility of the latter. To avoid this possibility, they are turning to auditors to monitor the integrity of their data. However, auditors are faced with a dilemma because current audit software is lagging behind technological advancements. Presently, most of the audit software available cannot be interfaced with data bases and alternative data base audit techniques are not yet developed. Yet, with so much of the financial data being

concentrated in a data base, an effective audit requires that the data base be accessed to obtain the necessary audit evidence.

3.1 DEFINITION

Data Base Auditing refers to the review, testing, and evaluation of the data base system controls, processing and surrounding environment by an auditor independent from the data processing department staff (Scott, 1978). The primary objective of a data base audit varies with the circumstances and the audit procedures will vary according to the audit objectives.

3.2 OBJECTIVES

In a given data base audit the objective may be one or more of the following (Scott, 1978):

Attestation: Since the financial statements are based in part on data from the data base, the auditor must ensure that these statements are correct. Thus, auditors will be looking for procedures that ensure the completeness and accuracy of input and update. They will also need to ensure that the data stored remains correct and up-to-date.

Preventive: Here the auditor will examine data base controls and security on a continuing basis to encourage the installation of effective controls in the data base.

Detective: The auditor needs the assurance that the data collected about the functioning of the data base is

complete, so that errors or weak controls are not overlooked.

Corrective: The auditor must ensure maximum identification and correction of data base processing errors, weak controls and frauds.

Utilization: Finally, a data base audit can be conducted to evaluate the cost and efficiency of the data base, to inform management about the reliability and integrity of the data base and to assess how effectively the data base helps management pursue corporate goals.

Auditors are primarily concerned about the attest objective. The auditors's attestation verifies that the company's financial statements contain no misstatements.

3.3 PROBLEMS

Several general characteristics of data bases cause problems for the auditor.

1. Data Bases are complex:

Probably, the greatest impact on data base auditing is the increase in complexity brought about by data base systems. these complexities include increases in systems software, computing equipment and the number of systems programmers needed. As an example, data bases use inverted lists and network structures but there is little consistency among implementation standards even in different vendor data bases using the same basic structure. An increase in complexity also increases the time required for auditors to understand

the system. This in turn means that they must ensure that their clients understand that increased audit costs will be involved. Another example of increased complexity is the fact that there is not just one, two, or three data base management systems, but many. This means that auditors often must understand many systems all having different technical specifications. Finally, more complex information systems are possible with data bases and this creates further auditing difficulties.

Systems complexity poses a serious detriment to EDP auditing. Yet, a competent audit is not possible unless the auditor understands the system, however complex it may seem.

2. Data bases are integrated:

In contrast to conventional file systems where the records were unrelated, in a data base, linkages (example pointers) exist among different records so that related data can be accessed by following the record may simultaneously cause an update in the accounts receivable and inventory records. As the number of transactions increases, it becomes difficult for the auditor to keep track of which errors are being caused by which transaction without first understanding the detailed file structure.

3. Data bases are comprehensive:

All of the data is in one file or system of files - or data sharing is now possible among many applications. Thus, auditing outside of the data base system is less effective and

perhaps not possible at all. Further, the concern arises for increased controls to limit access to authorized users only.

4. Data Bases have "insulated" data :

Because of the complex file structures and the existence of the DBMS as a buffer between the files and the applications programs, data in a data base is more insulated from the auditor than in conventional file systems. Consequently, the auditor is more dependent on dp personnel and systems software. For example, the auditor will probably rely on the DBMS to retrieve data for audit purposes. This dependence on system software and data processing personnel can jeopardize the auditor's independence.

5. The data base state of the art:

Data Base technology is still a dynamic field and auditors are faced with the problem of keeping up-to-date on new DBMS releases. As new enhancements are released continually, auditors cannot benefit greatly from their previous experiences.

3.4 PROPOSED SOLUTIONS

Several solutions have been proposed for solving the problems of complex file structures and to permit the GASP access to the data base for audit purposes.

1. Modify GASP's to directly access the data base; Under this approach the GASP would be revised to enable it to access the data contained in the data base. i.e. the GASP

must incorporate the data management functions present in the DBMS. Currently, data base systems are being developed in two ways, either on a host language basis or as self-contained system which provide standard routines for all data base processing functions.

Under a self-contained system, audit software would have to directly access the data base. However, it is unlikely that a single package could be designed to handle all the various physical implementations of different data base systems. Unless some consistency of implementation can be enforced among the manufacturers of self-contained data base systems, the development of audit software that can process all DBMS's seems impossible.

With host language systems, if a standard data base language is used by all manufacturers, existing audit software written in higher level languages, such as COBOL could be modified to include data base functions written in a standard language. In this case, access to the data base by the software would be through the compiler. Audit software could be recompiled for different data base systems in the same manner that COBOL based audit software is recompiled for different makes of machines. This would solve the problem of the varying physical implementations of logical file structures by the different manufacturers of data base systems. However, it would require that both the audit software and the host language be based on the same programming language.

In either case, the cost involved would be substantial.

2. Standard audit software interface with data base systems: Another solution to the problem could be to develop a standard interface between audit software and data base systems. Such an interface could be thought of as a special "window" in the system with rights and privileges specially designed and reserved for use by the auditor (litecky & weber, 1974). With the assistance of the standard interface, this solution would allow the audit software to use the data base system to get to the stored data. Given the specifications of standard interface, data base system manufacturers could include this interface in their systems. If the manufacturers chose not to include this interface, implementation of this solution would be difficult to achieve.

The disadvantage to this approach is that the auditing profession would have to take the responsibility to develop and maintain the standard interface which would be costly. Further, it is unlikely that an agreement can be reached between the auditing profession and the manufacturers of data base systems as to the standard interface required.

3. Dump the Data Base: The approach most frequently used now for data base auditing is that of using the operating system or the DBMS itself to dump the data and then processing the data with a GASP. However, special programs are required to reformat the dumped data. The major disadvantages of this approach are that the data is dumped in flat file form and the internal data relationships are not retained. Also, the

auditor must rely on the client-controlled operating system to perform the dump.

4. Modify the data base system to include audit functions: current DBMS's already contain many audit functions such as record selection routines and the addition of others seems cost-effective. Thus, if future DBMS's were to contain all of the audit functions, the solution to the problem would be found. auditors will no longer have to write their programs. However, this solution also implies that the auditor must become familiar with many data base systems.

5. Ad Hoc Methods: Until a consensus is reached on a preferred audit approach many ad hoc approaches will be used. At present, these are difficult to categorize, but all seem to be incomplete, useful for only one or a few data base installations and costly to develop. These approaches include, for example, writing special audit software for each data base installation and relying as much as possible on the utility programs provided by the vendor to accompany the DBMS.

3.5 DESIRABLE CONTROLS

Four categories of controls are desirable in a data base environment: Division of responsibility, Access to data, Operations, and Application programs(Reneau, 1977).

3.5.1 DIVISION OF RESPONSIBILITY

Here, the need for segregation of functions between application programmers, systems analysts and operators

remains the same as in conventional file systems. In addition, organizational controls are required. A DBA should be responsible for the definition, organization, protection, efficiency and control of the data base. Only the dba should have the authority to make changes in the data base. Any changes should be performed by a person independent of application program development. The DBA should not be allowed unsupervised access to the computer. since the DBA is the person with complete knowledge of the data base contents and all application programs, he/she could gain access and manipulate any data items in the data base.

3.5.2 ACCESS TO DATA

In a data base the application programs no longer access data or perform data management functions directly. The DBMS acts as an interface to all programs using the data base. This change in access strategy requires the following controls:

1. Unauthorized programs must not be allowed access to the data base. An organization's data is in an on-line status, resulting in high exposure if there is unauthorized access.

2. Authorized programs should be permitted access only to those data items required to execute their processing task. This concern is new, resulting from the change in physical data file/program relationships.

3. Data elements must be understood and used correctly.

In traditional file systems there was less data sharing, and the relationships and data definitions were more clearly distinguishable. In data bases, the DBMS may use the same data elements for many purposes. This will require a broader view of the data in terms of their meaning, use and the results of data manipulation functions on other applications (in particular, updates and deletes.) auditors must now consider the multiple relationships that may exist among the data.

4. Data elements must be controlled: In file systems, the users and providers of data were normally one and the same. In data bases, some users may rely on data provided through other applications. A broader view must be taken of each data element's purpose in relation to all the programs using the data. It is the organization's responsibility to have procedures that ensure each data element is controlled and to identify and supervise those responsible for control. The controls and the timeliness of their execution must satisfy the needs of all users of the data element in question. Individuals and departments responsible for input control should be clearly identified for each data element.

5. The live data base should be separate from the data base used for program testing. This ensures that live data is not contaminated during program testing.

3.5.3 OPERATIONS

To ensure that control over operations is maintained, it is important that The dba approve and log all changes to the

data base. This control is needed to ensure that only required data items are accessed by an application program. The dba should also approve all major modifications (both in-house and manufacturer) to the DBMS software, since he/she can assess the impact of these modifications. As back-up and recovery become even important in a data base environment, well-defined procedures are required to ensure that back-up arrangements are adequate.

3.5.4 APPLICATION PROGRAMS

Suggested controls over application programs in a data base environment include the following:

1. There should be written programming standards that specify what type of data manipulation language (DML) calls can be used to access the data base and what program actions are to be taken for each DBMS return code. The use of certain DML call verbs (insert, replace, delete) may be unnecessary for certain applications and should be restricted.

2. There should be written documentation standards for all application programs, which must be reviewed by the dba before the program is put into production. Documentation is more critical in data bases because the data base is accessed by so many programs. The dba must be able to determine the impact of new programs and program modifications on all other application programs.

3. Backup and recovery procedures should be tested

prior to implementation. In a data base environment, the failure of any application program could alter the effectiveness of any other application program which accesses that data item.

3.6 THE DATA BASE ADMINISTRATOR

Recently, the data base administrator is being increasingly charged with managing the large volumes of data in an organization. auditors have also begun to realize the importance of a Data Base Administrator. When data from different applications are integrated into files of a data base, the departments that previously controlled the data no longer have this control. Unfortunately, many auditors have not yet realized its importance, nor have many companies. The lack of such a function causes problems for data base auditors. Firstly, in the absence of a data base administration function, the complexity and audit difficulties of data base systems are likely to appear even greater than actually the case. This is because a data base administration function would interrelate all data base activities so that it would be easier to understand the system. Thus, audit efficiency is reduced in the absence of the data base administrator function. Secondly, without a proper perspective on data base administration, data base auditors are unable to adequately evaluate data base organization and administrative controls. What was good control with separate files is no longer adequate and should not be acceptable to the data base auditor.

On the other hand, as auditors begin to appreciate the significance of the DBA function, they will begin to insist that companies implement sophisticated dba functions. This will permit auditors to perform better and more efficient audits. By examining the data base administration function and assuring themselves that this function is properly controlled, EDP auditors will be well along toward completion of the EDP audit since this will give them an assurance about the data. In effect, auditors will be able to substitute evaluation of data base administration controls for evaluation of the internal controls of the data base itself in the same manner that auditors are able to substitute evaluation of internal controls for substantial testing of transactions. However, until the data base administration function reaches the needed level of sophistication, alternative solutions must be sought. To this end, close cooperation between vendors and the auditing profession is essential if these problems are to be resolved.

Chapter Four

A REVIEW OF FEATURES IN GASP'S

A generalized audit software package or GASP is a program specifically designed to be used by auditors. Its basic function is to examine data files and produce reports of the results. GASP's have gained considerable importance recently due to the necessity of auditing data contained within computers and the fact that the other techniques of computer auditing have not been adequate in meeting the needs of the computer auditor. All audit software packages are designed with the same basic objective - to aid the auditor in carrying out the task of auditing the organization.

The following study constitutes a broad review of the features available in current audit software packages and was based strictly on product information received from the respective companies. It is by no means an attempt to evaluate the individual packages. However, for the purposes of comparing the packages, the following list of questions was compiled:

1. Can the software package be interfaced with a data base management system?

This feature is of prime importance due to the growth in the use of data base management systems. As discussed earlier, the absence of this feature can be a source of grief

for the auditor in many ways.

2. What types of hardware can be used to implement the package ?

This too, can be of major significance to the auditor. the more versatile the package in terms of the variety of hardware it can be used with, the more popular it will tend to be among auditors.

3. What is the nature of input to the package?

This includes the number of files that can be read at any given time. Typically, auditors would need to examine more than one file at the same time. For example, an organization may have separate inventory files for each branch location, and all these files must be processed together.

4. What kinds of file processing capabilities are present?

The following are included in this category:

(i) Matching/merging of files: This feature addresses the need to process different data files together.

(ii) Search through a file based upon a condition

(iii) selections based on logical relationships

Most auditing applications require the auditor to perform operations on specific segments of the data file. For example, all accounts in branch x, or all accounts over

\$10,000.

(iv) Compare files for data exception

Two or more files containing similar data may need to be compared for exceptions. As an example, there is often a need to compare salary fields in payroll files for two different months.

5. Can the package perform a sort?

The answer to this question is important if a particular application requires a sort. If a sort is not available, the auditor may have to use the utility programs .

6. What are the output facilities?

Frequently, the auditor may need to segregate items within a file and thus produce more than one report in the same run.

7. Are there any mathematical functions?

Aside from simple addition and subtraction, it is useful to have function routines such as square root and exponentiation.

8. Are there built-in routines specifically related to auditing?

The nature of the auditor's task requires that certain standard procedures be followed. Built-in routines save the auditor's time and effort in that they eliminate the need to

code them.

9. What is the degree of the ease of use of the package?

This is probably a subjective question and difficult to measure. However, certain features such as free form input can go a long way toward making the package easier to use. Another point to be considered is that auditors would probably prefer minimal coding.

10. What kinds of error checks are available?

These include:

- (i) Missing sequence test
- (ii) Duplicate record test
- (iii) arithmetic overflow
- (iv) Invalid operations such as division by zero

(i) and (ii) are useful in examining any numeric field such as check number or invoice number to determine if there are any numbers missing from the file or if any numbers appear more than once.

11. Are there statistical routines available?

This question seeks to determine the kinds of routines that may be available for statistical analyses. The most useful of these is perhaps that of sampling. A major task of the auditor is to review a client's records in as efficient a

manner as possible. This requires the auditor to examine representative portions of data and draw conclusions based upon them. In addition, as the size of an organization grows, the volume of data to be examined will also grow. This means that it will be necessary to be able to summarize such large volumes of data in the form of frequency distributions.

12. Is it possible to audit on-line?

It is often more convenient to enter data and audit on-line, rather than wait on batch turnaround.

13. Does the package allow user-written routines?

Occasionally, the auditor may encounter a situation where the built-in routines are not adequate. Such situations necessitate the writing of special routines to meet the specific needs of the organization.

Table 4.1 presents answers to the above questions with respect to four audit packages currently on the market.

Table 4.2 summarizes some of the audit and statistical routines found in the packages.

Table 4.3 contains some representative mathematical routines present.

Routines/Packages	Mark IV/Auditor	Audex	Auditpak II	Penaudit
1. DBMS Interface	No	No	No	
2. Hardware	IBM System 360's, 370's, Univac 70/90 Siemens 4007, Amdahl 470	Any IBM System 360 Model 25 or larger	Any hardware with a COBOL compiler	Any IBM or compatible mainframe
3. Max no. of input files	11	2	2	No limit
4. (i) Match/merge	Yes	Yes	Yes	Yes
(ii) Search on condition	Yes	Yes	Yes	Yes
(iii) Logical selection	Yes	Yes	Yes	Yes
(iv) File compare	Yes	No	No	Yes
5. Sort	Yes	Yes	Yes	Yes
6. Max no of reports	255	6	9	No limit
7. Math routines	No	No	No	Yes
8. Audit routines	Yes	Yes	Yes	Yes
9. (i) Free form	No	No	No	Yes
(ii) Help statement	No	No	No	No
10. (i) Missing sequence	Yes	Yes	No	Yes
(ii) Duplicates	Yes	Yes	No	Yes
(iii) Arithmetic overflow	Yes	No	No	Yes
(iv) Invalid operations	Yes	No	No	Yes
11. Statistical routines	Yes	Yes	Yes	Yes
12. Online auditing	Yes	No	No	Yes
13. User-written routines	Yes	Yes	No	Yes

Table 4.1. - Major features in current GASP's

<u>Routines/Packages</u>	<u>Mark IV/Auditor</u>	<u>Audex</u>	<u>Auditpak II</u>	<u>Paraudit</u>
Aging analysis	Yes	Yes	Yes	Yes
Confirmations	Yes	Yes	Yes	Yes
Table look-up	Yes	No	No	Yes
Source program compare	No	No	No	Yes
Sampling	Yes	Yes	Yes	Yes
Frequency distribution	No	No	Yes	Yes
Correlation & regression	No	No	No	Yes

Table 4.2 - Audit and Statistical routines

<u>Routines/Packages</u>	<u>Mark IV/Auditor</u>	<u>Audex</u>	<u>Auditpak II</u>	<u>Paraudit</u>
Exponentiation	No	No	No	Yes
Quantity & percent Comparison	No	No	No	Yes
Random Number Generator	No	No	No	Yes
Square Root	No	No	No	Yes

Table 4.3 - Math routines

From the information received, it is not possible to ascertain whether Panaudit can actually interface with a data base management system. It does however, claim to be able to retrieve any kind of record from any kind of file structure including IMS, DLI, TOTAL, and IDMS.

Another package called the generalized reporting system or grs was considered for inclusion into table 4.1. However, after a closer examination, it was excluded as it does not possess many of the features specifically related to auditing. GRS is primarily a report writing tool designed for use on the DEC PDP-11 series under the RSTS/E v7.0 operating system.

Finally, a software package called Strata developed by Touche Ross & Co., an accounting firm has also been used fairly widely, although no information was obtained concerning it.

Chapter Five

Cullinane's software : AIMS

The importance of the ability of a software package to interface with a data base cannot be over-emphasized. Many of the packages currently available do not have this feature. As the use of data base management systems continues to grow, these packages may soon be rendered useless, because it is virtually impossible to audit outside of the data base. On the other hand, the package that has gained considerable popularity is the Audit Information management system or AIMS marketed by Cullinane. Recent statistics show AIMS commands approximately 80% of the total market of audit software. This success can be attributed to the fact that AIMS can be used to access a data base as well as conventional file systems.

5.1 Overview of AIMS

AIMS is a set of software specifically designed for use by auditors. The major highlight of AIMS is that it can access data base as well as non-data base files. AIMS is centered around the Information Directory (see figure 5.1) which is based on Cullinane's Integrated Data Dictionary (IDD). The components of AIMS are : Information Directory, Culprit, Interact , EDP-auditor, Online Query, Online English, Cars, and EDP-auditor/3 What follows is a brief summary of the capabilities of each of these components.

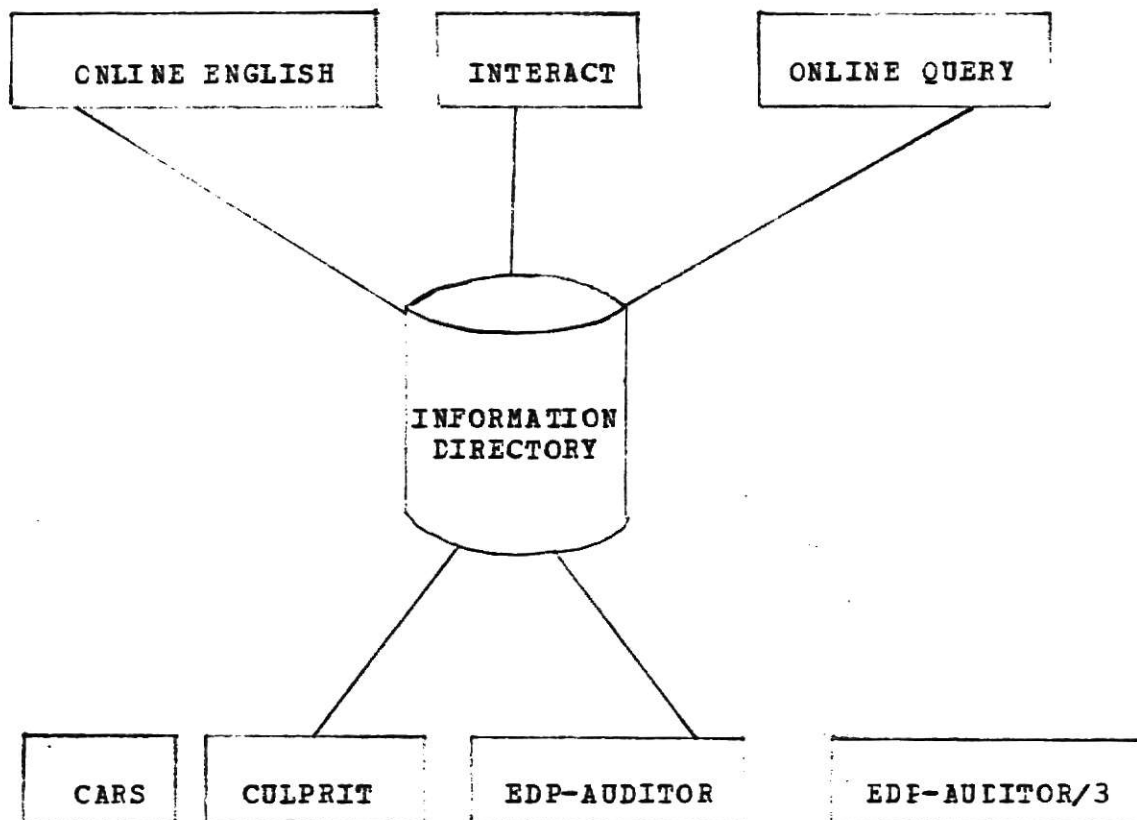


Figure 5.1 - Audit Information Management System

1. Information Directory

This is the "heart" of AIMS and is based on Cullinane's Integrated Data Dictionary or IDD. The IDD is a system that stores and maintains information about data. The data can be part of a data base, a conventional file, teleprocessing network or a manual system. IDD stores all information in an organized central repository known as the data dictionary. The data dictionary organizes information about data by providing major categories called entity-types. For example user is an entity type within the data dictionary; an occurrence of the user entity type exists in the data dictionary for each user within an organization and contains information specific to that user (e.g., user name user description). Using IDD entity types, the user can document various kinds of information about an organization's data, including the source, relationship, physical characteristics, frequency of access or updates, names of persons who use the data, and places where the data resides. Once the information is stored in the data dictionary, it is available to users in the form of online reports or batch reports provided by the data dictionary reporter (DDR). These reports enable the user to view and monitor the contents of the data dictionary.

The features of IDD include a free form data dictionary definition language (DDDL), used to define an organization's data, and provision of both batch and online capabilities for executing the DDDL. Online reports can be provided of entity occurrences to which access is authorized. Besides twenty

three standard entity types, IDD users can create any number of user-defined entity types. Similarly, sixty-nine standard reports are available through the data dictionary reporter (DDR) with the option to modify or write unique ones through the DDR. IDD supports an unlimited number synonyms for elements, records and files. IDMS utility programs allow backup, recovery and expansion of the data dictionary. Finally, security features are provided whereby only authorized users can access the data dictionary and restricted views of the data dictionary can be defined for particular users if desired.

2. CULPRIT

This is a free form report generator designed for use on IBM compatible hardware. Culprit can access data base as well as non-data base files. The data bases it can access are IDMS, IMS/DLI, TOTAL, RDMS for RDM based applications including CIP and the financial control system (FCS). Like other report generators, culprit provides a sort (upto 20 fields), and the ability to select or bypass records based on given conditions or logical relationships. Output from Culprit is limited to 100 reports in a single pass. In addition, output can be in any media and file matching can be performed. Finally, a macro library facility is provided whereby the code for any Culprit report or routine can be stored in the information directory and requested as needed.

3. INTERACT

This is an online , interactive system designed for text entry, editing and formatting; remote job processing, and program development. Interact operates in response to user supplied commands entered from a terminal . It also incorporates security features. Password protection is provided and restrictions can be made on the use of certain commands. It is of considerable use to auditors in terms of savings on time as batch processing can then be avoided.

4. EDP-AUDITOR

This is a version of Culprit designed for use by auditors. It comprises a collection of culprit routines that perform tasks related to auditing. In addition, it allows user-written routines for unique situations. No special data processing background is required to use the EDP-auditor. The collection of routines include file focking to verify data totals and exception analysis to aid in detecting errors in data files such as missing ID numbers or negative balances. The summary analysis routines are used to identify patterns in data and to summarize large volumes of data. There are 13 routines to assist the auditor in the task of confirmation. Ten sampling routines are provided along with a 7-digit random number generator. Finally, the System Management Facility or SMF routines aid the auditor to ensure that the data processing operation is in compliance with the rules established for the site .

5. ONLINE QUERY

This is a conversational query system for accessing information stored in an IDMS data base or the dictionary/directory. Online query or OLQ uses its own command language to format and display ad hoc reports or production reports based on the retrieved information. In a non-OLQ environment, to retrieve data and generate a report from information contained in a data base, the programmer must write an application program that defines the report format, reads data from appropriate records in the data base; moves the data into the report format storage area; performs desired computations; and displays the report. In addition, the program must be compiled and tested. With OLQ, all this can be eliminated. Further, a refinement to a report merely requires additional requests. Security in OLQ is provided through user restrictions on accessing data and executing commands.

6. ONLINE ENGLISH

This is an English language query system that enables users to obtain computer-stored information by means of simple requests. Online English or OLE accepts and interprets requests, retrieves the appropriate data and performs all processing necessary. The capacity to accept english phrases is a powerful feature of OLE that distinguishes it from traditional query systems. OLE supports the use of synonyms and pronoun reference. Through pronouns, users can refer back to data obtained in prior queries. This eliminates the need to retype all the criteria. A hard copy of information

displayed at the terminal for either individual queries or for an entire OLE session can be obtained. Queries can also be processed in batch mode. Twenty-four comprehensive functions can be used to obtain distinct types of information , for example, averages. All arithmetic computation capabilities are present. Security features include the maintenance of a log file of all OLE session activity and the ability to limit access to authorized users only.

7. CARS

This is an audit software program which allows the user to select and combine data from upto 7 input files and to output this data in the form of user-defined reports, a new data file, confirmation letters, and a system-defined totals report. However, the most outstanding feature of Cars is that it can be used to audit any manufacturer's computer that supports ANS COBOL. These include IBM, HONEYWELL, WANG, BURROUGHS, NCR, UNIVAC , HP 3000, ICL, SYSTEM 34, and DATA GENERAL. Cars takes user parameter cards and creates an audit program based on requirements defined by these parameters. These audit programs can be stored and executed when needed. The generated audit program is in Cobol. However, no knowledge of Cobol or any other computer language is required to write Cars programs.

Cars provides routines to allow testing of new audit programs, an extract feature to specify the type of records to be processed, file matching from multiple input files and the specification of confirmation output requirements. Other

routines allow sorting, aging, duplicates and data error handling and the capability to select records for output on the basis of a particular record's position in the input file.

8. EDP-AUDITOR/3

This is an information retrieval program designed for use with IBM System/3 to generate reports, produce audit confirmations and create new files. The input data files can be on punched cards, tape, or disk. EDP-Auditor/3 provides the capability to sort and select records, combine data from two files and prepare up to three reports in one run. There are two sampling techniques. Selected records can be stratified into seven age categories. Calculations and comparisons can be performed, the results of which can be used for subsequent calculations or as sort criteria for reports.

Table 5.2 presents a summary of all these products.

Information Directory - central control file based on the
integrated data dictionary (IDD)

Culprit - free form report generator

Interact- online interactive system

EDP-Auditor - audit related culprit routines

Online Query - conversational query system
to access IDMS or IDD

Online English - English language query system

Cars - audit software compatible with a number of machines

EDP-Auditor/3 - audit software for IBM System/3

Table 5.2 - Components of Cullinane's
Audit Information Management System (AIMS)

5.2 EVALUATION

The reasons for AIMS' success are obvious. The essential feature that distinguishes AIMS from other GASP's currently available is that AIMS comprises a set of integrated software. Additionally, AIMS can be interfaced with a DBMS and can be used on a greater variety of hardware types. Lastly, Cullinane also offers considerable user support and on-going enhancements which are invaluable to auditors.

Chapter SixAN IDEAL GASP

The revolution in computer technology has had major implications on the auditing community. Auditors are experiencing difficulties in coping with the rapid growth and increasing complexity of data processing systems. The increase in the number of computerized systems coupled with the advent and growth of data base management systems has made it impossible to audit "around-the-computer." The ideal auditor is expected to have a thorough understanding of business as well as detailed procedures in data processing, along with expertise in auditing techniques, internal control, statistics, data analysis and fraud detection. To add to this is the necessity of auditing "through-the-computer." Presently, there are only a handful of auditors with such a wide range of skills. The continuing emergence of EDP auditing as an area of specialty helps to alleviate the problem, but it is only part of the solution. Auditors still face major problems when confronted with a GASP. The ones currently on the market are not necessarily compatible with major types of hardware. More importantly, they lack the ability to be interfaced with a data base management system. In seeking a solution to this problem, a model of an idealized GASP will be discussed.

6.1 FEATURES

The features desirable in an idealized GASP can be categorized into three broad areas: hardware, software, and audit support.

6.1.1 HARDWARE

The continuing increase in the number of new systems or new releases of existing systems poses a serious problem to auditors. Typically, auditors can be called to audit a wide variety of organizations, large and small. This means that the kinds of hardware to be dealt with will vary widely too. It is virtually impossible for an auditor to be conversant with all the kinds of hardware he/she encounters. Additionally, it is becoming difficult to build on previous knowledge as new versions and enhancements are continually released. An ideal GASP would solve this problem by its ability to interface with all or at least as many hardware types as possible.

6.1.2 SOFTWARE

The recent trend of major businesses has been that of incorporating data base management systems. The auditor then must be able to audit data contained in the data base. Hence, the emphasis in an ideal GASP should be the ability to interface not only with standard file types, but also data base management systems. To accomplish the latter, the most

sound approach is to allow the GASP direct access to the data dictionary as well as the data directory. This is because, the data dictionary is the prime source of information concerning the entire organization's data. A data dictionary is a central place containing information about all aspects of different types and structures of data residing in data bases or file systems. It can store information about data elements and data items used within records and files as well as the relationships of data to other data. Thus, the data dictionary contains data about data or metadata.

One of the basic objectives of a data dictionary is to facilitate the control of data. Instead of different definitions of the same data item, a standardized definition can be adopted. As these standardized definitions are stored in the data dictionary, redundancies will be reduced and eventually eliminated. Further, the centrally maintained data definitions support more efficient systems design, programming and maintenance as complete documentation of data is available. The data dictionary can also be used to enforce security safeguards both for data entities within the data base as well as for the data dictionary itself. It must also be remembered that a data dictionary is useful not only for DBMS's , but also for non-data base environments, in which case the data dictionary would contain information concerning all applications programs and data files.

The data dictionary can be valuable to the auditor because it helps him/her understand the relationships between

entities. The auditor by accessing the data dictionary would be able to obtain information concerning the control, accuracy and flow of data. Specifically, he/she would know what data is being used by whom. The data dictionary can also provide audit trail reports which the auditor can use to determine whether any security violations have been made, or whether adequate security exists for the protection of sensitive data.

Figures 6.1 and 6.2 show the relationship of an ideal GASP to static and dynamic data dictionaries. A static data dictionary is defined as one that interacts with the user program at compile and/or load time only. i.e. a subschema compilation is rejected if it fails to coincide with the dictionary version of the schema with which it is associated. Under a static data dictionary system, the DBMS interacts with both the compiler and the operating system. The data directory is accessed via the operating system only. The GASP then is interfaced with the data dictionary only (figure 6.1).

On the other hand, a dynamic data dictionary (figure 6.2) is one that interacts with the user program at execution time. Under this system, the data dictionary has access to the compiler, operating system, and the data directory. The DBMS may or may not be interfaced with the operating system. Note that if the data dictionary does not have access to the data directory, this access must be given to the GASP to enable the auditor to obtain details concerning the location of data. These access paths are shown by the dotted line on

both figures.

A GASP without the capability to access the data dictionary, then would place serious restrictions on the auditor. Further, the existence of an online query capability is imperative. This query language needs to be English-like so that it does not become necessary for the auditor to learn a new language.

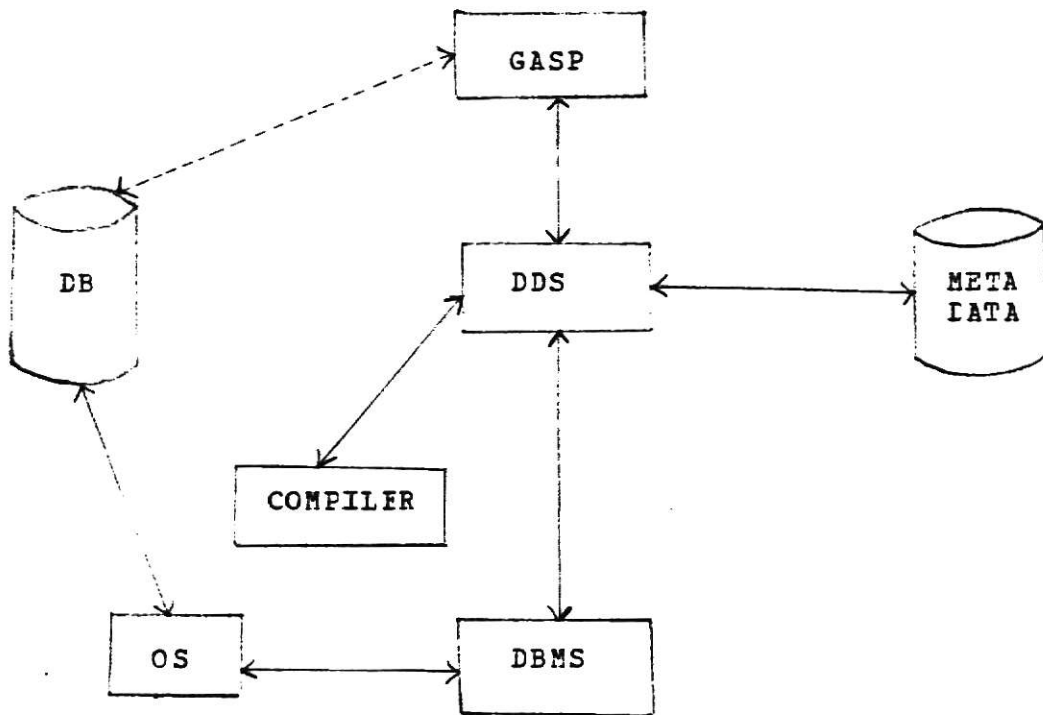


Figure 6.1 - Relationship of an Ideal GASP to a Static Data Dictionary System

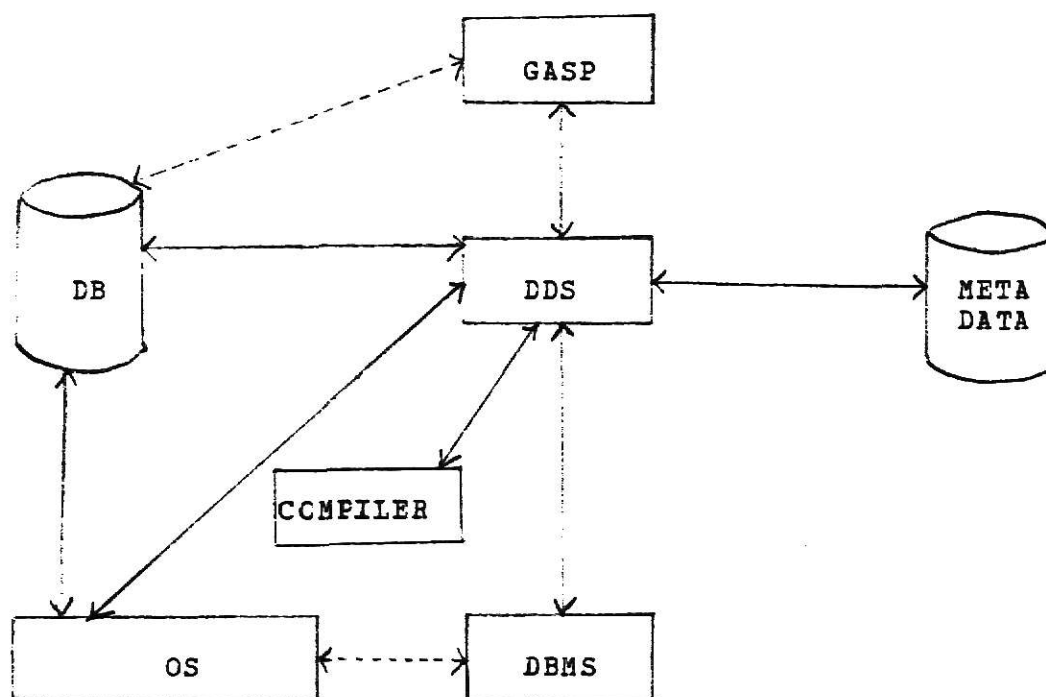


Figure 6.2 - Relationship of an Ideal GASP to a Dynamic Data Dictionary System

6.1.3 AUDIT SUPPORT

A major task of the auditor is to conduct the audit in as efficient a manner as possible. To this end, several characteristics of a GASP would serve to speed up the time required for the audit. Due to the nature of the auditing task, it is essential that an ideal GASP provide pre-written standard routines, which should include the minimum of those shown in table 6.3.

An important function of the auditor is to verify that records are correct. Thus, auditors must foot items in records to ensure that there are no errors. Footing routines can greatly simplify this task.

Auditors usually do not verify every transaction that occurs during the year. To do so would be both unnecessary and uneconomical. Auditing standards require only that the auditor obtain "sufficient competent evidential matter" on which to base an opinion (Hermanson, 1980). Much of this evidence is obtained by testing a representative sample. The extent of testing that is required in a particular circumstance depends on the auditor's evaluation of the effectiveness of the client's system of internal controls. Usually the more effective the controls, the smaller the sample that will be required to test. The need then arises for different sampling techniques to enable the auditor to select the most appropriate one called for in any situation.

Since auditors must deal with large volumes of data, it

is imperative that routines be provided to facilitate the meaningful interpretation of statistics. An example would be a frequency distribution.

The audit of accounts receivables is an important part of any audit. Auditors are concerned to ensure that an organization's accounts receivables are not over-stated and that strict internal controls exist concerning them. Aging routines can aid the auditor by enabling him to perform the required analysis in a more efficient manner. Using the routines, the auditor can prepare aging schedules without having to write a separate routine. the presence of routines to print confirmation forms as well as mailing labels are also helpful.

Exception analysis routines must aid the auditor in determining the presence and extent of erroroneous conditions such as inactive accounts.

Another characteristic of GASP's that would provide considerable support to the auditor concerns the language or method of using the GASP. Since not all auditors are fully trained in computers, the GASP should be as simple to use as possible. For example, keywords such as select and include, are preferable to entire statements resembling the high level computer languages , so that coding is kept at a minimum.

The feature that seems to be lacking in the GASP's studied in this report is the 'help' statement. This appears

essential especially in GASP's providing online auditing. an auditor confronted with a new machine or language is frequently lost. he/she should be able to enter 'help' to get further instructions when desired. In other words, the GASP should be user-friendly.

Table 6.4 summarizes the features desirable in an ideal GASP.

- Footing
- Sampling
- Statistical analysis
- Aging
- Exception analysis

Table 6.3 - Routines for Audit Support

- Hardware - interface with more than one hardware type
- Software - interface with DBMS via data dictionary
- Audit Support
 - built-in audit routines
 - ease of use
 - user friendly

Table 6.4 - Features of an ideal GASP

Chapter SevenTHE FUTURE GASP

So far the entire discussion has assumed a non-distributed environment. The various aspects of computer auditing were discussed, following this the problems in data base auditing were presented and some of the current solutions to these problems were proposed. A review of the major features available in current software packages was presented, and the features of Cullinan's software highlighted. Finally, an attempt was made to define an idealized GASP. recent trends indicate, however, that the number of distributed systems is on the rise. Already, numerous distributed data base systems exist. Soon, the auditor will have to confront another set of problems. The future GASP then must center on handling the problems of auditing in a distributed environment.

A major feature of future GASP's will have to include provisions to allow the auditor to accomplish his/her task at a central location, as it may not always be feasible to travel to each location or node to conduct the audit. In addition, tighter internal controls will be called for. For example, logs of all critical transmissions and actions must be kept at each node. It will also be desirable to have authorization to highly sensitive data built into hardware to ensure maximum protection. Security during data transmission will be an

increasingly important concern. The GASP should have the capability to access all logs from a central location. The auditor must also be able to send programs to remote nodes for purposes of testing. Most importantly, the GASP must allow the auditor to examine all data from a central location.

The data dictionary will assume the critical function of controlling and directing the distributed data bases. As the number of nodes increases, the presence of a data dictionary at every node will become feasible. The local data dictionary can be used to hold information concerning user access rights. Thus, any request for information can be screened as to whether it can access only local data or remote data as well. In the latter case, then, the request can be sent to the appropriate node.

Presently, an immediate solution to the problem of the lack of an adequate data base interface in current GASP's does not exist. However, as data dictionaries assume increasingly important roles, it is imperative that all future GASP's be interfaced to the DBMS via the data dictionary.

To conclude, the need for an increase in awareness of the current problems stemming from a lack of security and controls is urgent due to the high incidence of computer crime. To this end, the installation of stricter internal controls, and the audit of data contained in computer systems is necessary. To facilitate the successful completion of such audits, auditors will need the support of the data processing

community, specifically, in the form of GASP's which take into consideration the suggestions presented in this report. This will offer the hope of a solution to many of the problems confronting the auditors today.

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A MODEL OF A
GENERALIZED AUDIT SOFTWARE PACKAGE

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AN ABSTRACT OF A MASTER'S REPORT

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The increase in the number of computer-based systems has necessitated a new approach to auditing. It is no longer possible to audit outside of the computer environment. Auditors are confronted with a host of problems as there is a lag between audit procedures and current data processing techniques, specifically, the growing use of data base management systems. Most of the generalized audit software packages currently available cannot be interfaced with a data base management system. This report discusses computer and data base auditing, and presents a broad review of features found in some generalized audit software packages on the market today. The importance of the ability of the generalized audit software package to be interfaced with a data base management system is emphasized and suggestions are offered for a model of an ideal generalized audit software package.