Telecommunications Management and Cost Control

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Telecommunications management and cost control issues are becoming increasingly the responsibility of the data processing professional. Upper management has traditionally looked to the data processing professional for financial data processing services such as accounting and inventory systems, to increase profits and provide cost control of company assets. It is also true that telecommunications managers are being asked to design, select, and implement data processing systems, often for the first time, in order to provide managers with more effective tools to increase company profits, while measuring costs and employee productivity.

As nations become more information oriented, corporations become more dependent on telecommunications (as a source of revenue, strategic business planning, and global competitiveness), the need to manage and control costs associated with these elements of telecommunications systems is critical to productivity and bottom-line business profits. Governments are impacted significantly as well, as revenue sources and tax bases are stressed by increasing demands. Communication management systems can be sources of revenue, measures of employee productivity, and delivery systems for community services.

Telecommunications costs are the last major expense which executive managers have yet to address with the same sophistication and management process of other major business expenses. What is critical to the successful implementation of any system are the policies and procedures unique to each organization, vertical market, and government enterprise. Often, the failure to evaluate policies and procedures as a prerequisite of purchasing a Telecommunications Management System, or TMS, sets the stage for TMS failure: for Telecommunication Management Systems do not make policy, nor can they solve inadequate procedures. Therefore, management objectives, policies, and procedures must be discussed and decisions made before a clear picture is formed of what a particular company or agency needs in order to manage their telecommunications systems.

Why is this?

Management is generally unaware of the need for, or issues where their involvement upfront can save the organization time and money, while reducing the confusion associated with the review of alternative solutions.

Management structure and reporting requirements may need to change as a result of the objectives of such a review of telecommunications strategy. Systems facilitating such changes, or consistent with existing operations, will be critical to the success of any implementation. It may also be true that management reorganization is required before a system can be brought in to meet the objectives. At the bottom line, the flexibility and support provided by the suppliers of such system solutions are critical to the ongoing success of the management process: the telecommunications environment is very dynamic, requiring constant review and change. It is demanding enough for the department responsible for telecommunications

management to keep up with their own organization's requirements, much less to keep up with the technical and regulatory changes involved in the telecommunications marketplace.

What is required for an effective solution is partnership: between supplier and end users, executive management and operational management, technology suppliers and applications suppliers. When a balance of these strategic groups and operational requirements is achieved, the overall performance, cost, and success of implementation and management of such a dynamic system are maximized.

It is the ultimate responsibility of top management to recognize the significant changes required to adequately measure and manage telecommunication costs and their impact in the organization. This process begins as a result of a company deciding on its organizational responsibilities for telecommunications:

1. voice and data responsibilities will be:
   * part of the same department **OR** * in separate departments
2. Reporting responsibilities will be:
   * same for voice and data **OR** * different for voice and data
3. Where a lack of telecommunications management experience in the organization in general exists:
   * Hire a telecom professional and establish a department
   * Identify someone to take responsibility and train them
   * Contract with a consultant to provide one-time or ongoing services:
     a. In place of a telecom department
     b. To supplement the telecom department.

It is equally important that the department or person responsible address, research, and recommend the solutions for telecommunications management, and bring them to the top of management's priorities. Some of the issues may include:

1. policies--e.g., are personal phone calls a company benefit?
2. practices-- How do we identify, charge, and collect time and money from employees?
3. procedures--Are weekly reviews of exception reports and monthly check collections required?
4. philosophies of productivity, technology and management--costs above $5 or 10 minutes are worth attention

These telecommunication management issues often do not have the focus of such management decision-making. They are critical for successful implementation and results. The primary reason is that most TMS are passive. They provide information to manage active features in a PBX such as toll restrictions, least-cost routing, authorization codes, class of service, etc.; and to enforce management policies.

What are the facts?

--Telecommunications costs represent one of the top four expenses of most organizations, often equal to data processing costs.

--Telecommunications usage costs represent one to two percent of total organizational revenues.

--Telecommunications staffs are often significantly underfunded and understaffed, when compared to data processing departments with comparable budget responsibilities.

--It is easier for an employee to make a $25 phone call than to get a $25 book on how to be a more productive employee. To illustrate this point, I offer the following:

Steps required to purchase and pay for a $25.00 book:

1. Request of supervisor
2. Purchase requisition and justification
3. Purchase order and number
4. Make purchase, and get receipt
5. Invoice to accounting, referencing P.O.
6. Accounts payable check reviewed, signed off
7. Item subject to audit
8. Item allocated to cost center.

Steps required to purchase and pay for a $25 telephone call:

1. Pick up the telephone
2. Make the call
3. Pay the bill.

There is mystery and a lack of communication between telephone carriers and customers about pricing. For example, most companies can tell you the cost of a BIC pen by color, size, and quantity purchased, with dozens of vendor options, but could not tell you the cost (with their primary vendor) of a three-minute telephone call to the top ten areas called by that company. Historically, accounting departments and firms have not understood, or had the proper tools to account for telecommunications costs. Budgets and cost allocations are either non-existent in most companies, or are based upon accounts formulas to balance G&A, versus actual usage or costs associated with telecommunications. **The telephone bill is only half the cost of making and receiving calls:** the average cost per minute of an information worker is comparable to the cost of a long distance call.

So, based upon these facts, what is the potential of internal telephone management? Significant! For instance, a pro-forma $100,000,000 company, spending 2% of sales on telecommunications, with a average profit margin of 3.4%:

when this company saves 30% on their telephone bill, it increases bottom-line profits 18%! Using an average sales per employee of $150,000, it would take *over 117 more* employees to generate comparable profits from an increase of sales of $17.6 million.

That's why I believe that a Telephone Management System is the best investment available today for financial managers. Let's review some basics that amplify the significance of this statement. There are two types of companies or organizations:

those that are making money or are properly funded, and
those that are not.

There is a subset common to both of these:

those whose situation is getting better, e.g., making more money; or
those who are not, e.g., losing money.

The impact of an 18% profit increase through effective telephone management is critical for those companies losing money, or whose situation is getting worse. Several of Telenomics' clients purchased a TMS because a 30% savings in telecommunications costs would make the difference between profitability and a loss. It is also true that effective telecommunications plays a significant role in a

company whose situation is better than our example and whose prospects are brighter. One of our clients' telephone bill has gone up every month since our system was installed. How can this be? Shouldn't a TMS save you money? Not necessarily. This company grew from 3 employees to over 3000 in 5 years. As one of the fastest-growing computer companies, they needed to make sure the telecommunications lines were available to take orders, give service to customers, and make money.

It is not the actual dollar amount that is critical in the final analysis of the success of a telephone management system implementation. Rather, it is whether the desired business results have been achieved, with budgeted telecommunications resources; whether these resources are seeing cost reduction, and whether employee use of them is being maximized for company objectives.

What are the key items on which effective telephone management can focus?
First, basic economic priorities must be set:

The average cost of a telephone system, per extension, is about $1,000 installed. The average telephone bill generated by that extension over its life (5-7 years) is about $3,000. Assume 50% of calls are inbound with no telephone bill costs, and 50% are outbound with the associated telephone useage bill. The labor costs associated with this assumption are another $6,000 for a total costs of $10,000 per extension, 90% of which are related to time and usage. Therefore, **usage** is the first area to manage in telecommunications cost control.

Second, how are management issues grouped? There are four key areas:

Abuse
Misuse
Network
Employee Productivity

Here's a list of some of the most common uses for telephone management systems.

Cost Allocation
Division, department, individual budgeting
Chargeback
Clients, projects, etc...
Control abuse
Personal calls, 976 calls...?
Long calls, expensive calls, competitors
Minimize misuse
Incorrect access codes to improper circuits, excessive calls
Facility, Network planning
Establish usage for proper mix of CA, FX WATS, OCC, TIE, T1 etc.
Anticipate rate changes
PBX Software maintenance
Evaluate routing efficiencies
Customize class of service, toll restrictions
Evaluate equipment needs
Plan for purchase of new PBX
Allocation of instruments and features
Improve productivity
Personnel evaluation

Identify telemarketing areas
Telemarketing effectiveness
Collections
Customer service
Market research
Secretarial and message center support

Revenue Generation
Resale of facilities
Redistribution of budgets from operational cost centers to telecommunications departments

Billing Verification
Circuits working
Refund documentation.

Most organizations will initially identify the need for a TMS based upon a need for only a few of the above applications. Many TMS only address a few. However, once a system is installed, and the learning curve is completed on initial applications for a TMS, the need increases for the system to perform more functions, or to be more flexible. Often, these needs will outgrow the system. Telenomics' experience is that over 60% of our customers had already been using a TMS when they decided to install a Telenomics solution.

In addition to the above mentioned applications of a telephone management system, an emerging need to automate the telecommunications department functions is evolving as a requirement. The applications here include:

Equipment inventory
Work order
Trouble ticket
Cable Plant

These can be implemented in various ways. Hewlett-Packard's maintenance management package is an excellent system that many manufacturing companies already have. Lotus 1-2-3 is often used, but is limited for larger organizations where multiple user access is required. Also this approach limits reporting and integration into billing systems.

Since 1983, the phone company is no longer required to keep the records associated with the above applications. A term called USOC went away which was the standard coding system for telephone equipment. This caused a lot of development effort in systems to accomplish the above functions by telecommunications professions who were not familiar with existing commercially available inventory systems or options. Many of these new telecommunications oriented systems cost hundreds of thousands of dollars for mainframes, and are ten's of thousands of dollars on PC systems.

Based upon the cost of inventory being only 10% of the cost of a telephone extension, the inventory systems are hard to justify. They are even more expensive to implement and maintain. One benefit of implementing such a system is that you will discover that the phone company did a rather poor job. You will be surprised at the opportunity for refunds based upon a thorough audit of equipment and services.

Several consultants have specialized in providing a "split the profit" approach providing free inventory services and spliting the credits with the customer as their payament for services. Use your own judgement on this approach as compared to putting and inventory procedure in place with your own staff.

The other applications mentioned involved the automation of paper intensive systems that a computer system could improve upon with regard to speed and reporting. However, software does not solve the problems of a poor manual system and again, policies and procedures should dictate the selection of system features.

The HP-3000 office automation system HP-DESK is an excellent candidate for telecommunications departmental automation. The integrated filing, calender and electronic mail system provide a good way to communicate the multiple input for workorders, and coordination of multiple vendors for repair into a single system.

Telenomics has used HP-DESK as a transport system to communicate status of our systems operation through multiple network nodes. This gives the ability to distribute data acquisistion capabilities to reduce polling costs, yet gives a local and regional managers information as to network operation and information.

Directory systems are often part of a TMS system. They can be integrated or stand-a-lone. The HP-3000 provides for distributed directory capabilities to PC's at remote locations with centralized control at headquarters. Directories are often handled by personnel, printing department, or word processing and in almost every company and organization it is a difficult, expensive task to produce and is out of date the minute it is published. When a directory is integrated into a TMS system and controlled by the telephone operator, the first day a person reports to a new telephone extension, the directory can be updated for everyone to have access to, either on line, or in a printed report upon demand.

The newest area of telecom management is designed to increase the effectiveness of the network engineer. These specialized individuals are scarce and expensive to acquire as in-house experts. Systems that can simulate costing alternatives, traffic patterns and circuit loading options can reduce the amount of manual calculations currently done by these engineers. Network/design and optimization for simple networks can be done by relatively inexperienced telecommunication managers. Large complex networks can be designed by corporations, independent of the phone company engineering staff. The phone company staff may have a different set of priorities in designing a system than an organizations own telecom department. Here, large storage requirements, fast processing times and multiple access by various project managers are required and indicate the need for a departmental system to accomplish the day to day tasks of telecommunications engineering.

All these applications can significantly increase profitability, productivity of employees, improve service of telecommunication systems and reduce costs. However, I want to note here that it is my experience, in over five years and hundreds of prospective customer contacts that the following statements hold true:

* Companies that operate for a profit often manage their telecommunications department as a not-for-profit department.
* Organizations that are not-for-profit often operate their telecommunications departments as a for-profit department.

What causes this????

* Is it because it is no profit to commercial organizations to manage effectively their telecommunications costs?
* Is it because government agencies or departments are so desperate for revenues that any activity which provides a service deserves to be "taxed"?

I believe the above observation holds true between governmental and corporate entities. There is also another observation that can be make about companies and organizations who have not adapted to the deregulated telecommunications environment or embraced information management technologies, and those who have.

In my years of experience, the companies I have met who see telecommunications management from *where they have been*, versus *where they are going*, most often use consultants to choose the telecommunications systems to run their company. It fits best with the traditional approach of letting the phone company make the recommendation when they were a monopoly. It relieves the management group from dealing with the policy issues and business objectives of telecommunications management. However, it can also place the telecommunications manager in the role of a system operator instead of the role of a key corporate manager. It can put the consultant in the undesireable role of corporate strategic decision maker, without the *actual* responsibility of managing the implemented system or the authority to impact management attitudes in the total organization to make it effective.

Consultants can play a key role in raising organizational issues and providing training; as well as supplementing the technical expertise of an organization's staff. They should *never* be used as a complete replacement for developing in-house expertise, which can provide the added benefit of promoting teamwork among other managers to achieve corporate information management objectives using and effective TMS system.

However, the companies I have met who look *where they are going* study their needs, evaluate options, verify system capabilities, plan implementation and operations, AND make telecommunications management an active part of every managers charter in the organization. This results in effective departmental communication to top management about strategic issues of telecommunication needs, supports the telecommunication staff's requests for equipment, reinforces the role of telecommunications manager as a corporate resource; and makes telecommunications management a top management priority.

What is the significance of these two types of organizations? Primarily that the second organization is rare. The predominance of the first organization creates the development of a market for products and services that vary a great deal; which allows confusion and frustration to influence managers who make decisions on systems, and hence the importance of a TMS as a strategic tool is stifled.

* 80% of corporate and government organizations have not made policies or decisions on company practices with regard to cost control of telecommunications.
* Of the 20% who have, over 50% of them have made implemented systems to support their decisions which do not work, do not support their objectives,

or are not flexible enough to change as the company priorities and objectives change.

This means that only about one in ten companies are meeting their goals in today's telecommunications management environment. As a result of the confusion within corporate America, several companies are scrambling to take advantage of the situation, and to offer a TMS solution:

* There are many consultants in the telecommunications industry (more than 50,000 employees have been laid off since 1983);
* There are over 100 suppliers of telephone management systems; none of whom dominate the market;
* There is 20% turnover rate in company and products;
* None of the suppliers today were started by a telephone company or a leading computer company;
* Everyone claims to have a better, faster, cheaper, slicker system than the next one;
* The average system takes one to three years to buy;
* A good system installation pays for itself in less than one year.

So where do you start, in order to be one of the top 10% firms in regard to telecommunications management? You will need to start to determine how you will do the following:

1. Get top management to define objectives, policies and procedures
2. Determine the organizational impact
3. Determine the system requirements
4. Evaluate the technological options
5. Evaluate the vendor options
6. Analyze vendor pricing
7. Make a recommendation
8. Secure budget approval
9. Negotiate financing and licensing agreements
10. Implement the system
11. Provide for ongoing management of the system.

The previous list looks like a typical data processing procurement, or PBX request for proposal, checklist that most data processing and telecommunication professionals would recognize. However, the telephone management system procurement checklist is not as involved, as most systems are sold as follows:

1. What does the phone company recommend?
2. What does the switch vendor quote with the PBX?
3. What runs on a PC?
4. What can I afford to buy?
5. What does the consultant recommend?
6. What is the minimum per month cost and shortest commitment I can make?

Seasoned data processing professionals may feel a viable option is to develop this application with existing programming staff and equipment. Most MIS managers who have evaluated this option began to realize this system is difficult to design and maintain with the flexibility required to meet the needs of a dynamic industry and evolving telecommunications policies. Data-based design and maintenance issues such as changes to tens of thousands of area codes and exchanges; hundreds of

tariffs and new price plans, as well as dozens of PBX formats, significantly affect the scope of the task.

It is operationally more successful, and financially more justifiable, to install a proven, off-the-shelf package, provided by a company dedicated to the support, maintenance, evolution, and operation of customer systems. Even if the system requires modifications to meet specific company needs, such modifications can be shared among other customers, or derived from participation in a users group. As the industry and user groups evolve in the implementations of such systems, companies that specialize in this system become valuable business partners. Whether it is to provide voice expertise to data processing departments, data processing experience to voice departments, or management training to executives on the implementation and operation of these systems, the benefits go beyond just software.

Even if the development cost and the application purchase price are comparable, the time lost to develop a system often is enough to justify the purchase of the off-the-shelf package. Typically, such a package is less costly to maintain because of its multiple installations, compared to a single custom installation.

It is important, whether you attempt to develop your own system, or purchase one, to understand some of the technical issues associated with the design and operation of these systems.

Technical Issues:
This portion of the paper will deal with some of the more critical and confusing aspects of telephone management system technology and design criteria. Once your organization has determined what to do with the reports available from telephone management systems, you will still have a sizable task in determining which system to implement. Additional criteria should be used to evaluate the quality, flexibility and reliability of different systems. Three basic aspects of a system must be evaluated:

1. How the data is created and captured by the system
2. How the system is maintained and processes records
3. How the system reports and distributes the information.

Data Element Characteristics:
Telephone management systems work by tracking and analyzing transaction data produced by computerized telephone systems. (PBX). These transaction records are called *call detail records* (CDR) or *station message detail records* (SMDR).

Today, there are no standards for telephone management system data. In fact, the type of data each PBX manufacturer produces varies between models, software releases, and even serial numbers. Further complicating this is frequent change of record layouts, even during a service call when a technician is working on a system doing standard maintenance. Certain data is consistent among all manufacturers and may look like this:

time	extension	#dialed	duration	trunk
9:00	2495	2134956312	02:31	6
9:01	2368	7146213395	10:35	3

There are many other types of records that exist with regard to data detail, such as trunk number, transferred calls, account codes, authorization codes, and date. There are also options which impact the total volume of records produced, e.g., inward call detail and local calls.

Data Acquisition:
The data is produced by the PBX, or by using ancillary equipment such as line scanners. Centrex systems now can provide RS-232 data output from the central office as an alternative to line scanners or costed call tapes. A costed call tape is essentially the centrex phone bill. In general, PBX manufacturers have the following options:

1. Magnetic Tape on the PBX

This has been the traditional approach, as the tape drives were included as part of the PBX acquisition. These could easily be read by IBM mainframes, where (in the early days of call accounting) most of this sort of analysis took place. Also, call accounting started on the largest PBXs, which could justify software development for this application; hence the high-storage capacity of the tape drive was needed. The problems associated with this solution are: high cost of tape drives ($30,000 or more); high maintenance/low reliability characteristics of most of these tape drives; data unavailable until tape read (usually at the end of the month); no error reporting; manual intervention and handling of tapes causing damage, loss; and management's attention, etc.

2. Floppy disks

With the introduction of floppy drives, manufacturers began to offer this lower-cost alternative. Most of these drives were non-standard, had substantially lower storage capabilities, higher maintenance and lower reliability than magnetic tape drives, yet they were lower in cost. These disks were then put on a special disk reader to get the information into a computer for processing.

3. Real-time data stream (RS-232 format)

The third and best option is a pure real-time data stream from the PBX called a *list option*. For the manufacturers, it was the simplest to implement and the lowest in cost; but the burden of data capture was now on the telephone management system vendors and end-users.

In order to use an RS-232 list format, two approaches exist to provide data acquisition into a computer: *direct connect* and *data buffers*. Here the problem now becomes one of what type of computer is doing the processing of this data and what are its data communication capabilities? Buffers come in two flavors: *Solid state* (no moving parts) and *systems with moving parts* (floppy drives, winchester drives etc.) Solid state provides higher reliability, but smaller storage capacities, compared to systems with moving parts, which can provide larger storage capacities.

Computer architectures and data communication capabilities vary tremendously in the marketplace. Suffice it to say, most business computers are designed to work with terminals, tape drives, printers, etc. Communications is usually done through a

front end processor or technical polling computer to do file transfers of data from unintelligent devices. When a direct connect option is chosen, a protocol buffer is often required. An example of such a product for the HP-3000 is the Telamon PBX Engine connected to a serial terminal port.

Personal computers can be programmed to provide data capture capabilities. By using serial ports, main memory, hard drives, and file transfer software to connect to mainframes, data can be uploaded for processing. Usually some intervention is required at the PC to initiate transfers. Also, the dedication of a productivity tool for data acquisition is a less than optimal investment. Most critical is the reliability and serviceability of a PC in such an application: PCs have more moving parts, boards, etc, and each component is subject to the stresses of 24-hour operation.

You will find in the market, that, as a result of experience, even the PC software manufacturers recommend a buffer in front of the PC, for increased reliability, data redundancy, data capture, ability to service the PC, and for freeing up the CPU & memory for processing.

Most mainframe equipment is weak in asynchronous communications without front-end processors and/or PC's. Netview PC is an IBM product announcement, where a PC front-end with polling software that communicates with buffers or additional PCs, uploading information to a mainframe. Now, the problem is that several devices, with multiple components and software, are required for a successful transfer of data from a PBX. This increases the opportunity for higher failure rates and makes it difficult to diagnose and repair. It also increases the cost to acquire and maintain such a system.

The previous scenario is complicated by PC communication ports and operating system limitations restricting growth. Front-end processors or technical computers lack utilities or application software, which make the system difficult to use and cumbersome to integrate into business processing applications.

Once multiple sites at various locations become part of the installation, polling over various types of data communication facilities becomes an issue. Should the data be captured using dial-up modems, leased lines, synchronous, asynchronous, LAN's, switched data, MUX, X.25, T-1 etc? Being able to facilitate existing data networks to reduce costs is important along with having proven, flexible, high reliability capability as a back-up.

Data Translation

As mentioned earlier, the data formats and information vary greatly. How can one piece of software and computer process various data from different PBXs and produce comparable results, reliably and at a low cost? There are two approaches to this:

First: Pre-processing

Pre-processing translates the raw data, in either the buffer or the PC which captures it, and sends a common format to the main computer. This supposedly relieves the software manufacturer and operations staff of worrying about format changes and such. It is a design criteria common to many software manufacturers, which the buffer manufacturers have rushed to to solve. However, as a system grows, the problem of managing the

translation software, in multiple remote buffers or PCs (in either firmware *or* software), can be difficult and eventually impossible operationally. Raw records can be improperly translated and irrecoverable after transmission to the main computer. The large storage capacities of buffers can buy you time to get translation programs to the device, but the information is then delayed in being processed for use by managers, in reports or online.

Second: No pre-processing

In this scenario, the raw data is brought into the main computer without any translation, to allow for substantial error correction, redundancy of data, and control of information for translation management, at a central point. This approach with daily (or more frequent) polling allows for regular auditing of the quality of raw data, software generation, testing of communication links; as well as ease of database updates, such as area codes, extensions, and so on. It also spreads the processing requirements over a longer time, for greater flexibility in scheduling off-hours, and minimizes the impact of month-end processing requirements for data acquisition.

Data Accuracy

Data accuracy is impacted by signaling technology and pre-processing; both by the telephone company and the PBX manufacturer.

Answer Supervision

This feature communicates between switching computers when a call is actually answered, and a billing clock can start. This is currently only available to AT&T and other large vendors--not to PBX end-users as yet.

Call Record Timing

As a result of the above situations, PBX manufacturers, and even long distance carriers, set their switches to assume when a call begins, usually in numbers of seconds. Thus, the call record in the TMS will vary from the call record in the telephone bill, and the total number of records will vary as well.

Billing Problems

Due to deregulation, hundreds of new carriers came out with "dial tone", or telephone service, and hundreds of billing systems emerged. Many large carriers have purchased smaller companies, or provided billing services for others. It is therefore possible and common that multiple bills, duplicate records, and so on, **can occur**. This situation requires a highly flexible and accurate system to audit these bills, which are ultimately to be paid.

Costing Calls

Costing calls is complicated by the various ways calls are placed, rated, regulated and sold. Some costing is measured some is fixed, some are distance sensitive some are time sensitive, some are load sensitive some are circuit sensitive etc. Large carriers are regulated, smaller ones are not. Rates change with notice, others with none. The need for end users to understand how they are being billed by their carriers is the most important aspect of effective telecommunications management today. The customer orders the circuits, uses them and pays the bill.

It is not the responsibility of the software developer to provide the rates, but more importantly to provide a flexible way to implement them to maintain a high degree of accuracy. TMS system suppiers provide maintenance support services to provide rates, however, this information is available directly to the

end user through the same data bases and operator services that the TMS companies use.

The most accurate method of costing is using V & H coordinates. These are the verticle and horizontal mileage distances between exchanges in North America. Other methods are average costing, zone costing, retro costing, useage costing Without using the most accurate method of costing, you will not be able to have a valid refund document, evaluate carrier pricing plans accurately, or fairly charge back cost centers. The other methods are used to simplify the programming task or to minimize processing requirements. These compromises impact the quality of the TMS system, its effective uses, and its credibility as a management tool.

System Processing and Data Base Design

System Processing and data base design for telephone management functions vary significantly, depending on the objectives the designers had, or the limitations of the operating system with which they were working. Preliminary characteristics are segmented by the following:

1. Service bureau designs, or batch processing
2. Single user/single-tasking PC, or processing on the fly
3. Single user/multi-tasking or partitioned processing
4. Multi user/multi tasking or transaction processing

Service bureau designs and batch processing are designed for operational efficiency at month end. Limited flexibility in reporting and in database maintenance are characteristics which can lead to report formats not applicable to departmental needs, as well as inaccurate data, which loses credibility for whomever (or whatever) it represents. Online inquiry is not available or very limited. If the user actually contracts with an outside third party to process, they are actually releasing valuable business information of their control suh as customer lists, volume of business etc. Another servious issue is that these systems do not meet the needs of network managers in being able to respond on a timely basis to circuit outages, new PBX least cost routing software audits and network optimization management.

Single-user systems doing one job at a time become a ball-and-chain for the manager or operator of the system. Each and every aspect of the system has to be done repeatedly at maintenance, reporting time and for daily operation. In order to provide for greater processing capacity at report time, processing on the fly is done to maximize the available processing power. This technique is often used with fragmented data records, compressed into "buckets" to save storage and speed up processing. The basic record is destroyed to accommodate the limitations of DOS and PC design.

Single user machines which partition main memory provide a multi-tasking illusion. In effect, this non-standard method of providing PC access (while buffering or processing call detail records) restricts operations on the PC and dramatically increases chances for lost data, lost files, and other errors: these systems, when loaded with file transfer software to allow uploading of information to mainframes, often crash. These methods are proprietary to most software designers, and are not documented for the end-user. Most users of such system design, after loosing call records or Lotus files, end up dedicating the PC for one application or the other, or

putting a buffer on the PC to segment the applications. Even 9-track tapes have been recommended for use on PCs to solve this problem. At this point, the PC deals with telephone management as another application requiring operator intervention to execute and manage.

Multi-user, multi-tasking systems, using leading computer hardware, proven operating systems, common languages, and popular databases, are all factors which have led to the growth of distributed computing for business applications. Now that such computers are available in small low-cost configurations, departmental computing is fast becoming the growth area for computer manufacturers. In fact, the computerization of the telecommunications department is a becoming a necessity because of the shortage of experienced personnel, restricted budgets, and importance of timely information by end-user departments such as telemarketing, sales, and accounting.

The latest evolution of departmental TMS systems can be characterized by scarcity or limited installations. Few telephone management development companies chose this route in 1983, when the telecommunications management business took off, due to deregulation in the industry. Most sophisticated systems were written for IBM mainframes: IBM had a large percentage of the market and could take on AT&T. The systems which cause the most products to be announced are based around PC technology. It became available about the same time, and allowed for a low-cost way to enter the marketplace in one's spare time *or during unemployment*: remember that *over 50,000 industry people* were laid off between 1983 and 1987. Traditional call accounting system hardware manufacturers continued to make smaller, cheaper, and limited function systems, taking advantage of microprocessor technology for the mass market and vertical niches, such as hotels. Nonetheless, these systems did not address the multiple telecommunication management requirements of most business and government enterprises.

However, let us contemplate the ideal: **What if...** a telephone management system were designed with:

* An award winning database standard to manufacturers' line of business computer systems;
* A popular and easy-to-use language, such as COBOL II, where source code was provided, and a well-documented system;
* A powerful business transaction operating system allowing most system operations to be automated in job streams;
* A scalable hardware architecture, allowing a company to start out managing a single site, with growth to hundreds of sites and users;
* Integrated polling and processing;
* Multiple communications options for capturing and distributing information;
* A large portfolio of business application software for integration of telephone management information.
* Highest rated manufacturer for reliability, service and support.

What are the general designs and characteristics?

1. Home-grown software on in-house computers
2. Proprietary hardware and operating system

3. Industry-standard hardware and proprietary software
4. Industry-standard hardware and software

Home-grown software is commonly available, due to the history of call accounting and the availability of computers today. In the early 1970s, large corporations with the personnel and computer capacity, would staff projects, using the in-house accounting computer, to address specific management requests to allocate costs of telephone bills, etc. Today, with many computers available in various types for various sizes of organizations, the ability to sort call detail records quickly can be easily addressed. However, most home grown systems do not provide accurate costing and often use average, or historical bill allocation to cost calls. This results in limited usefulness do to either inaccurate reports or delays in information. Most of these systems fall short on being comprehensive by the nature of their design: they are often written to fill a specific need. Then, as needs change, or new requirements are brought up, the system has to be modified or rewritten in order to keep up. Hence systems which seem cost-effective initially end up costing many times more than an off-the-shelf system designed and maintained by a supplier dedicated to this market place.

Another critical weakness to these systems is the designer's perspective, although any system could suffer from these. Telecom people will design functional reports, but have inefficient data base design; data processing people will have great data base designs, but write reports that are not as useful. These are generalizations, but demonstrable in the marketplace.

Another big problem is turnover in high technology positions. Once the designer of the system leaves a company, so does the support: often these systems are not documented, and can no longer keep up with the changing telecommunications and computer operating system environment. These systems eventually fall into disuse, or become completely inaccurate and relatively useless.

Proprietary Hardware and Software: these systems have played a traditional role in the Telephone Management marketplace. The companies providing these systems supply them to AT&T and the regional Bell Operating Companies. Several of these companies almost went out of business due to their dependence on a few large contracts with operating companies, without adapting to the new PC open-architecture environment. However, because of the dozens of manufacturers vying to fill market niches, these devices will continue to be sold where singular functionality and low cost are required to meet a specific application. As mentioned earlier, a hotel check out system would be and example.

Another example of this is the PBX manufacturers' attempt to provide call accounting data processing concurrent with voice switching. It is typically the case with most large PBX manufacturers that they have failed miserably in their attempt to merge data processing with voice switching processing. Even the data switch manufacturers have not been successful in providing network management packages for anything other than their own proprietary system. Some new or smaller PBX manufacturers are attempting to differentiate themselves with call accounting as a feature, but again it is limited to their own products.

The primary reason for their failure is that the R&D dollars go into switching

applications, rather than management applications. Even the PBX operating system will always put an MIS function as a lower priority compared to providing dial tone, or other basic features. Economics drive this as well, because the MIS function represents only about 10% of the purchase price of the PBX, and no PBX manufacturer is going to lose business over a secondary function that would make the system too expensive. An exception to this is automatic call distribution (or ACD) switch manufacturers, who have learned that the MIS function is as **important** to the sale as the reliability and features of the ACD switch.

Industry-Standard hardware and proprietary software and Industry-Standard Hardware and Software: These categories can be debated on definition alone, but this paper attempts to indicate differences in approaches to developing and marketing software that exist today. Major computer manufacturers, such as IBM, HP,DEC, UNISYS, etc, can be considered "industry standard" with their tens of thousands of machines installed in business applications worldwide.

Here the question becomes one of portability and maintainability: some developers focus on maximizing market penetration, ensuring that the software application they write will run on many manufacturers' equipment. This portability increases sales potential, but increases the costs and complexity for the support organization, who must keep the product up-to-date on current operating system releases by each supported manufacturer. Most companies providing this development and support do not have access or experience in depth in-house to provide a high level of remote training or support, on multiple manufacturers' models.

Some developers stick with proven hardware, but provide custom databases, unique calls to the operating system specific to a given model of computer, and not available to other models or compatibles; or they may include a piece of hardware, and some software, to modify the operation of a system in order to accomplish design goals. These systems look dedicated to a manufacturer, but typically are non-standard implementations requiring thorough documentation and constant developer support in order to assure reliable operation and maintainability.

A third approach is to develop and support an application on a major supplier's hardware platform; use standard database management systems, that benefit from other utilities and application packages written for the system and minimize the use of proprietary software. This reduces maintenance and support costs and allows for a rich development environment for a strong users' group.

Any of these approaches can provide users with reports. What becomes more critical with time is how the system will be supported, maintained, and enhanced, in order to meet changing industry requirements and company needs. The approach used may be more significant in the **long term** success of the system.

Reporting and distribution of information: the significance of this section is that a passive management system requires active management. This means that access to information is the most critical aspect of the system. Multiple managers, at different company levels, with different objectives and reporting cycles etc., will need access to the information., both in a facility and at remote locations.

A PC limits access to the telecommunications manager. He or she become a slave

to the single-user machine responding to multiple requests to produce multiple reports. The telecom manager is often forced to limit access to the information, as a result of this sort of an implementation, and force standard reports, limited historical analysis, and limited detail. Slow print timesnd processing times, along with limited software designs and operating systems aggravate this situation. As a result, most PC implementations that are successful are in small installation with less than 200 telephones.

A mainframe environment is best used for very large amounts of data. Tens of millions of call records per month is where these machines are best used. However, because of corporate accounting systems residing on these machines, call accounting has often ended up in this environment. The problem cited most with this environment is flexibility, priority and turnaround time. Large corporate centers have production schedules, standard operating procedures etc. which limit ad-hoc reporting or on demand information. Month end processing or other peak periods for major corporate applications will put telecommunications reporting lower on the priority list.

Cost is another factor. CDR, SMDR processing can take up alot of storage and processing power. As a result, a large percentage of the overhead associated with the large corporate mainframe will be charged to telecommunications. With the power and cost effective storage devices available for mini-computers today, this application can be more effectively run on a mini-computer.

A mini-computer provides the power of a mainframe at PC prices. Its multi-user multi tasking operating system allows for many managers to have access to various modules and reports available on the system. The multiple communication cababilities such as:

serial direct connect ports to terminals
serial direct connect to PC's
LAN connections to PC's
Dial in or out
IBM or DEC mainframe links
X.25 links

These communication hardware and software options make minicomputers, expecially the HP-3000 especially suited for departmental telecommunications management.

Reports can be processed on high speed printers, downloaded to PC's or other HP-3000 for printing, provided on-line, or shipped through electronic mail. Report writers available with database management systems facilitate custom reporting requirements. Desk top publishing and cooperative processing with PC's such as products like NEW WAVE open up new opportunities for increased automation and effective communication of telecommunications information.

How Hewlett-Packard addresses this market

Hewlett-Packard addresses this market in several very important ways.

1. Hardware reliability. Most PBX's are designed for very high reliability because a telephone system that is down impacts everyone. HP-3000's track record of high reliability, coupled with features such as power failure auto restart make it a perfect match as an applications processor for the PBX. Also, many PBX rooms are not computer rooms, and the new HP Micro 3000 machines can handle a common PBX environment well.

2. Hardware support. Many telephone systems are operated 24 hours a day 7 days a week. The ability to have fast response times, world wide, with various maintenance options depending on how a company does business is critical to total uptime of a system. Proprietary hardware, PC systems etc can not match such levels of service. When HP is compared to the largest manufacturers, it comes out #1 again.

3. Software Vendor evaluation and support. HP has the #1 Software supplier and VAR program in the industry. It is designed to promote the highest standards of product development, customer support and vendor relations. The referenced software program or VPLUS is a valueable seal for both developer and customer. The high qualifications to be a Value Added System Supplier with Hewlett-Packard are another indicator of a companies dedication to a verticle market and partnership with Hewlett-Packard.

4. Technology, Communications & Office Integration. HP's commitment to improving the HP-3000 product line, increase its price performance, offer multiple communications capabilites, and provide integration tools into office applications such as HP-Desk relieves the application developer from spending resources on system related expenditures, computer environment requirements, expanding office automation demands.

In summary, a partnership between the applications developer and HP, HP and the End user, the vertical market support company and the telecommunications department, provide a strong foundation for the data processing manager, telecommunications manager and executive manager to prepare a telecommunications management framework designed to meet the goals and objectives of a deregulated telecommunications marketplace, and an information oriented business and government environment.