NETWORK ADMINISTRATION RESPONSIBILITIES AND ORGANIZATION

ORGANIZATION

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*This section will be furnished at a later date.

1. GENERAL

1.01 This section provides a summary of organizational guidelines and recommendations designed to effectively carry out the job responsibilities related to Network Administration. The section complements Dial Facilities Management Practices, Division A, Section 2, which presents a summary of Network Administration job responsibilities.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The title for each figure includes a number in parentheses which identifies the paragraph in which the figure is referenced.

1.04 Reference in this section to methods, planning data requirements, service levels, and equipment quantities are based on American Telephone and Telegraph Company recommendations.

1.05 ***Any reference to the Bell System TNDS configuration may be substituted with outside vendor names, if applicable. All recommendations should apply with minimal modification when utilizing other vendor products.***

1.06 Organizational guidelines and recommendations presented in this section relate to local office and Toll/Tandem Administration and Network Management in the Total Network Data System (TNDS) environment.

1.07 Organizational recommendations related to No. 4 ESS Tandem Administration and Trunk Administration will be included in future updates of this section.

1.08 This section also assesses the organizational impact of the Total Network Data System (TNDS). It is assumed that the reader has a general knowledge of the system's configuration and capabilities.

2. NETWORK ADMINISTRATION ORGANIZATIONAL CONSIDERATIONS

A. General

2.01 The major factors for consideration in an analysis of Network Administration organizations include:

(a) Functionalization of activities

(b) Specialization by equipment type

(c) Geographical Environment

(d) Nature of the administration job

(e) Complexity of the administration job

(f) Span of personnel control

2.02 In addition to the above factors, there are organizational considerations related to selected areas of responsibility within the Network Administration area. An example would be the unique factors for consideration when a data mechanization system is introduced.

2.03 The factors for consideration discussed below apply most generally to the administration of local switching entities unless specified otherwise. Additional considerations relating to other responsibility areas are brought out where the "Organizational Recommendations" for that responsibility are discussed.

B. Functionalization of Activities

2.04 The functionalization consideration deals with the grouping of work activities by function in order to gain efficiency and expertise. Network Administration local areas of responsibility can be grouped into three distinct functions. These are as follows:

(1) ***Data Functions***

- Traffic and service measuring device administration
- Data scheduling and collection
- Data validation and provision

(2) ***Assignment Functions***

- Line and number administration
- Load and balance

(3) ***Service and Cost Management Functions***

- Main station loading plans
- Equipment operation
- Trunk network administration
- Other balance considerations
- Switching system capacity
- Data analysis
- Growth and utilization forecasting
- Service monitoring and reporting
- Service problem analysis
- Service corrective action
- Equipment transition and/or additions
- Transition administration

2.05 One of the most obvious benefits of functionalization is increased efficiency. This efficiency is an important consideration when significant task workers are involved. This is the case with activities related to "data" or "assignment" functions that are not supported by a mechanized system. However, when the activities are supported by mechanization, the number of task workers is

reduced and the increased efficiencies of functionalization are reduced.

2.06 Another aspect for consideration is the interrelationship of administration functions. With stored program control equipment, assignment functions are very much related to, and affect, the service functions. Data and service functions are also highly related for all equipment types. A supervisor responsible for service functions must be concerned with both data and assignment. These interrelationships among functions must be weighed against the increased efficiency of functionalizing the activities.

2.07 It appears that the benefits of functionalizing the Network Administration local organization are not of sufficient magnitude to offset the effects of mechanization and the interrelationship of the functions. For these reasons, it is recommended that supervisors or administrators of present local administration organizations be ***non-functional*** by task. Total responsibility and accountability for all functions rests with the first level supervisor.

C. Specialization by Type of Equipment

2.08 Specializing work groups and supervisor by type of equipment is another important organizational consideration. The primary advantage of a work group or supervisor having responsibility for only one type of central office equipment is that expertise can be developed that is not possible with combined equipment responsibility.

2.09 The level of technology required to administer the present generation of switching entities indicates a need for technically competent work groups and management. For this reason, specialization by equipment type is recommended wherever possible.

2.10 Specialization will be more prevalent in metropolitan areas, but it is also applicable in non-metropolitan areas where concentration of offices is such that they can be grouped and managed by equipment types. A compromise that may be made is for management of non-metropolitan areas to have responsibility for combined equipment types where this specialization is not possible.

2.11 Responsibility for only one type of switching equipment may be extended through second level where possible to further gain from the advantages of specialized management. This is recommended only when the area does not include multientity buildings with different equipment types.

2.12 In metropolitan areas with multientity buildings having more than one equipment type, the Network Manager should have control over the loading of the entities. For this reason, it would not be advantageous to specialize through second level. Loading plans and other activities that affect the building as a whole must be coordinated at the supervisory or first level and controlled at the second level.

D. Geographical Environment

2.13 Any organization recommended for Network Administration must insure that it accounts for geographic environmental differences. The nature of the administration responsibility takes on different characteristics depending on the geographical area. A metropolitan area requires considerations that are quite different from the non-metropolitan area, and vice versa.

2.14 The only practical distinction that can be made when geographical differences are to be evaluated is the distinction between a predominately metropolitan area and a non-metropolitan area. This distinction is very subjective and can be interpreted differently in different areas.

2.15 A "metropolitan" area can generally be defined as the area within which it would be normal policy to place a No. 1 ESS switching entity. An area where the No. 2 ESS entity is used can generally be classified as non-metropolitan or "outstate".

2.16 Some characteristics of the metropolitan area and the outstate area are:

Metropolitan Area

- Multientity buildings
- Small geographic area
- Higher CENTREX development
- More main stations per entity
- More classes of service

- Distinct trunking arrangement (alternate routing)
- Higher percentage of "business" customers
- More interdepartmental contacts
- More "measured" entities
- Higher toll/tandem concentration
- Unique services, such as TNS and BDN

Outstate Area

- Large geographic area
- Fewer main stations per entity
- Higher percentage of multiparty customers
- More entities
- Distinct trunking arrangements (more direct routing)
- Few "measured" entities
- Fewer toll/tandem entities

2.17 As can be seen from the characteristics listed above, the nature of the administration job in the two areas is different. Organizations must account for the difference in temperament between the job as it is performed in a metropolitan area and in an outstate area.

E. Nature of the Administration Job

2.18 The inherent characteristics or "nature" of administration is a topic that requires analysis and consideration if management guidelines are to be effective. Every job has certain characteristics which define and categorize it. There can be "production" type or "service" type jobs. Jobs can be seasonally affected or highly dependent upon geography. Procedures for the job can be defined in detail, or there may be total lack of specific procedures. A high level of interdepartmental coordination may be characteristic of some jobs while others deal almost entirely with customers. Activities of the job could also be stable, or quite dynamic and subject to fluctuations. Jobs can be specialized or functionalized. The above are only some of the considerations when identifying the nature of an administration job.

Local

2.19 The following is a summary of the more important characteristics of the local Network Administration job:

(a) ***Responsibility mixture***—Although there are some activities that are of a "production" nature, the greatest portion of local administration responsibility is related to the area of "service". Some of the activities that are a part of assignment or data functions are of a production nature (e.g., service order processing, manual data processing). These are the type of activities that can be measured and force projections can be made based on past performance. The service type activities (e.g., loading plan development, capacity determination, service problem investigations) do not lend themselves easily to any type of force control. This combination of responsibilities must be managed and controlled effectively to insure that there is appropriate emphasis placed on ***both*** production (or demand) and service activities.

(b) ***Amount of detailed procedures***—The amount of practices, procedures, or other detailed instructions which dictate the manner in which the responsibilities of a position are to be carried out is a major factor when considering the nature of the job. These procedures or instructions help to "structure" or order the work activities. The amount of detailed procedures available affects the Network Administration jobs significantly. Some local administration activities are performed following fairly detailed instructions and there is sufficient documentation related to these activities. Examples include ESS translation preparation, service order assignment, service reporting and office component capacity determination. Other activities are carried out with relatively little documentation, or local policy or precedent is followed. Examples include those activities related to detailed data analysis, service problem investigations and preparation of corrective action. Generally, the activities of Network Administration are not supported by the level of documentation that many other functional organizations enjoy. The ***Dial Facilities Management Practices (DFMP)*** series is meant to provide procedures and instructions

for most of the administration activities. As these practices become available, the "nature" of the job will change toward one in which the work activities will be performed in a more completely documented environment, and in a more structured manner.

(c) ***Interdepartmental Contacts***—The nature of the local administration activities necessitates a high level of interdepartmental communication. Although there is usually no need for customer contacts, the contacts with other functional organizations are substantial and affect the atmosphere in which the job is performed. Those activities related to "data" functions require contacts with control office (CO) maintenance, design engineering, and usually a centralized data processing center, in addition to other data users [Division of Revenue, Business Services (Marketing) Trunking, etc.] who request and use data processed by administration. The "assignment" related activities normally require communication with Business Services, Marketing, and the Commercial departments and with Central Office Maintenance, Plant Service Centers, Frame Administration, and possibly those responsible for a centralized computer facility (if assignments are mechanized). "Service" activities constitute the majority of the interdepartmental contact requirements. The overall service responsibility is quite broad and, therefore, the need for interdepartmental communications is significant. Any individual or functional group that may indicate a service problem, provide input to identify a service problem cause, or be involved with removing the problem cause is a potential contact. Transition activity requires even more communication with other groups.

(d) ***Dynamic nature of activities***—Service monitoring, problem investigations and transition management are examples of activities that can be termed "dynamic". Administration responsibility is highly related to service, and this service sensitivity causes many of the activities to be quite intense at times. An example of this could be a deterioration of service quality noticed through routine monitoring of near real-time data. An active and immediate analysis of machine data is required in order to identify the cause of poor performance and attribute it either to an overload or to a central office trouble condition which could be corrected before the condition worsens.

Toll/Tandem

2.20 The following is a summary of the more important characteristics of the Toll/Tandem Network Administration job.

(a) ***Centralization***—Toll/Tandem Network Administrators, particularly 4A Supervisors, are often located in a centralized location which handles the administration for one or more numbering plan areas. If the centralized Toll/Tandem Administration Organization is collocated with maintenance personnel in a Switching Control Center, there are possibilities for interaction of the two groups and sharing of exception information from such mechanized support systems as EADAS, PBC, CAROT and COMAS.

(b) ***Responsibility mixture***—Although there are some activities that are of a "production" nature, the greatest portion of Toll/Tandem Administration responsibility is related to the area of "service". Some of the activities that are a part of the utilization or data functions are of a production nature (e.g., preparation of reports before implementation of full downstream programs). These are the type of activities that can be measured and force projections can be made based on past performance. The service type activities (e.g., equipment capacity determination, interpretation of trunk group exception reports, service problem analysis) do not lend themselves easily to any type of force control. This combination of responsibilities must be managed and controlled effectively to insure that there is appropriate emphasis placed on ***both*** production (or demand) and service activities.

(c) ***Variable amounts of detailed procedures***—The amount of practices, procedures, or other detailed instructions which dictate the manner in which the responsibilities of a position are to be carried out is a major factor when considering the nature of the job. These procedures or instructions help to "structure" or order the work activities. The amount of detailed procedures available affects the Toll/Tandem Administration jobs significantly. Some administration activities are performed following fairly detailed instructions and there is sufficient documentation related to these activities. Examples include ETS or PBC translation preparation,

assignment of measurement devices, service reporting and common control capacity determination. Other activities are carried out with relatively little documentation, or local precedent is followed. Examples include those activities related to detailed data analysis and validation, network completion improvement, service problem investigations and preparation of corrective action. Generally, the activities of Toll/Tandem Administration are not supported by the level of documentation that many other functional organizations enjoy. The ***Dial Facilities Management Practice*** series is meant to provide procedures and instructions for most of the Toll/Tandem Administration activities. As these practices become available, the "nature" of the job will change toward one in which the work activities are performed in a more completely documented environment, and in a more structured manner.

(d) ***Interdepartmental and Intercompany Contacts***—The nature of Toll/Tandem Administration activities necessitates a high level of interdepartmental and intercompany communication. Although there is usually no need for customer contacts, the contacts with other functional organizations within an operating telephone company and with counterparts in other operating and/or independent companies and Long Lines substantially affect the atmosphere in which the job is performed. Those activities related to ***data*** functions require contacts with maintenance organizations, design engineering, and usually a centralized data processing center, in addition to other data users (Division of Revenue, Trunking, Network Management, etc.) who request and use data processed by administration. ***Utilization*** related activities normally require communication with Network Engineering, Maintenance personnel, Network Management and Trunk Servicing and Assignment. ***Service*** activities constitute the majority of the interdepartmental and intercompany contact requirements. The overall service responsibility is quite broad and, therefore, the need for interdepartmental and intercompany communications is significant. Any individual or functional group that may indicate a service problem, provide input to identify a service problem cause, or be involved with removing the problem cause is a potential contact. Transition activity requires even more communication with other groups.

(e) ***Dynamic nature of activities***—Service monitoring, problem investigations and transition management are examples of activities that can be termed "dynamic". Toll/Tandem Administration responsibility is highly service related, and this service sensitivity causes many of the activities to be quite intense at times. An example of this could be a deterioration of service quality noticed through routine monitoring of near real-time data results. An action and immediate analysis of machine data is required in order to identify the cause of poor performance and attribute it either to an overload or a central office trouble condition which could be corrected before the condition worsens.

TNDS

2.21 The following is a summary of the more important characteristics of Network Administration management positions in a TNDS environment:

(a) ***Change in data function***—With centralization of the data function, e.g., EADAS Central Control Units (CCU), the role of the local Network Administrator in the Data Administration responsibility is changed. Depending on the degree of centralization within an operating telephone company, there is much less direct involvement in the data collection and scheduling functions. Instead, there is a requirement for foresight and close coordination with those operating the centralized data processing facilities. When one CCU organization is charged with complete data administration functions—from data collection to provision to downstream summaries and reports—the previously recommended non-functional nature of the first-level supervisory network job is changed. The local administrator then becomes free to concentrate on the remaining service and assignment functions, and is in fact a user of the downstream engineering and administrative data provided by TNDS.

(b) ***Real-time surveillance***—EADAS provides near real-time surveillance of measuring equipment and equipment operations. Exception reports are provided to the local and Toll/Tandem Network Supervisors as tools for the detection of service, overload and equipment malfunctioning problems. If these reports are properly utilized, reaction time is minimized and problems can be analyzed and solved more quickly.

(c) ***Reduction in production-type activities***—Centralization of the data functions reduces the number of data clerks in local Network Administration locations, thus affecting the span of control for each supervisor. In addition, a fully mechanized organization has no need for the low first level Data Supervisor since manual data processing is no longer required.

(d) ***Increased training***—Introduction of EADAS requires expertise by local and Toll/Tandem Administrators in errors and the analysis of downstream reports. This expertise must be developed through specific training programs supplemented by system and company practices.

Network Management

2.22 The following is a summary of the more important characteristics of the Network Management job.

(a) ***Dynamic nature of activities***—Network surveillance and control are dynamic activities and together account for the greatest proportion of Network Management involvement. Network management is highly sensitive to the pressure caused by traffic overloads and/or loss of facilities. This sensitivity causes network control activities to be intense since immediate decision-making under pressure is required.

(b) ***Centralization***—Network Management in the EADAS/NM environment allows centralized, real-time surveillance and control of all levels of the switching hierarchy—from Regional Centers to selected end offices within predefined sectors of the network. This centralization requires network managers to interface with a large number of maintenance and administrative personnel from Long Lines, one or more operating telephone companies, and various independent telephone companies.

(c) ***Responsibility mixture***—Although there are some activities that are of a "production" nature, the greatest portion of Network Management responsibility is related to the control function. While one network supervisor is dedicated to administration and maintenance of the EADAS/NM Central Control Unit (production activities), the remaining management personnel in an EADAS/NM environment are devoted to a mixture of network control, preplanning and administrative functions. Although the network control function requires the majority of management attention, the planning and administrative functions are also important ingredients in an efficient and successful EADAS/NM organization. The combination of responsibilities must be controlled effectively to insure that proper emphasis is given to each function.

(d) ***Hours of Coverage***—Network Management requires expanded coverage beyond normal business hours. Surveillance and control activities by management personnel in EADAS/NM centers should be based on two shifts a day. This requires coordination and advance planning so force coverage is adequate.

(e) ***Variable amount of detailed procedures***—The amount of available detailed procedures affect EADAS/NM Network Management jobs significantly. Some Network Management activities are performed following fairly detailed instructions and there is sufficient documentation related to these activities. Examples include loading the EADAS/NM generic, preparation of the data base and operation of the cluster display terminals. There are plans to support the other activities with Dial Facilities Management Practices, Bell System Practices, and Traffic Facility Practices. However, until documentation is more complete, it will be necessary to develop local procedures which are adapted to the requirements of each individual EADAS/NM center.

2.23 The characteristics presented above are meant to explore some of the more salient distinctions of the changing Network Administration job. The role of administration in present Network Services Organizations is quite different from its historical role in the Traffic or Engineering Department. It is important that the true nature of the present and future administration functions be understood.

F. Complexity Of The Administration Job

2.24 Complexity of the job must be considered when developing a Network Administration organizational structure. There are various factors that contribute to making one administration job more difficult than another. These factors must be considered in "sizing" an organization.

2.25 The results of a survery taken of selected operating company administration representatives indicate that the factors or "determinants" contributing most significantly to the complexity of the local administration job include:

(a) Type of central office equipment

(b) Growth (CO equipment additions)

(c) Number of entities

(d) Amount of additional features (eg, CENTREX, custom calling, WATS, etc.)

(e) Number of subordinates

2.26 These determinants of job complexity will be applied in 3.86 through 3.96 to define Network Administration Organization size.

G. Span of Personnel Control

2.27 Span of personnel control can be defined as "the number of direct reporting individuals that can be effectively supervised". The span of personnel control is a variable that is very subjective and certainly varies from one job to another. It is a key consideration, however, because it affects overall organizational structure. Spans of personnel control for the Network Administration management jobs and some of the key reasoning for them are presented in 3.97 through 3.105.

3. NETWORK ADMINISTRATION ORGANIZATIONAL RECOMMENDATIONS

GENERAL

3.01 An organizational structure which ensures that the Network Administration responsibilities are completely accepted and effectively discharged must consider:

(a) Characteristics of the Network Administrator's job (i.e., combined but diverse responsibilities of "service and cost management" and "demand servicing").

(b) The geographical environment of the organization.

(c) Advantages and disadvantages of a functionalized versus a nonfunctionalized structure.

(d) The advantages and disadvantages of specialized equipment types versus a nonspecialized structure.

3.02 The role of Network Administration is changing significantly. The emphasis in the area of service order processing or data gathering is shifting toward the service-related functions as data and assignment activities are supported by various mechanized systems either already implemented or being contemplated. The responsibilities associated with data and assignment will not be abdicated. Mechanization, however, will aid the supervisor or manager by replacing those task workers presently involved in laborious and time-consuming efforts of line assignment or data processing in a manual operation. Managers and supervisors will be aided by mechanization but they will retain the total responsibility they presently have related to these areas. In effect, the mechanization replaces the manual clerical effort which has absorbed a majority of the non-management personnel and management emphasis in the past.

3.03 Organizational recommendations for each of the major Network Administration activities are presented in the following paragraphs. These are guideline structures that will provide a viable and responsive organization within the Network Services Department.

LOCAL

A. General

3.04 The Network Administration Organization that will enable management to discharge effectively the total responsibilities of the local administration job in a contemporary Network Services Organization is one in which the activities are supervised by a ***specialized*** (by equipment type) but, ***nonfunctionalized*** (by work activity) management structure.

3.05 Recommendations provide typical organization structures required to carry out the local Network Administration responsibilities in a fully mechanized environment of the future. The approach to be used in developing and/or envolving organization should be toward these organizations as an ultimate goal.

B. Fully Mechanized Environment

3.06 The following paragraphs outline recommended organizational structures for local office Network Administration responsibilities in an environment that is fully supported by mechanization. For purposes of the recommendation, "fully mechanized" implies the implementation of systems related to both data and assignment activities (ie, data collection and processing is supported by a mechanized system, as is service order processing and assignment).

Metropolitan Area

3.07 The metropolitan area Network Administration local organization for first and second level management in a fully mechanized environment is shown in Fig. 1. The organization can be characterized as being specialized and non-functionalized. Additional characteristics of the metropolitan area Network Administration local organization are as follows:

(a) The network supervisor is specialized by equipment type and is responsible for either stored program control (SPC) equipment only or electromechanical (EM) equipment only. This supervisor is responsible for all functions—service, data and assignment—that are part of local administration. This approach enables the supervisor and reporting clerks to gain the expertise that is inherent with specialization. With mechanization, functional supervisors are not required in order to gain the efficiency that comes with functionalization. Also, service, data and assignment functions are sufficiently interrelated that they form a normal area of responsibility for the network supervisor.

(b) It is advantageous for the specialization that exists at first level management to be carried to the manager level if the area of responsibility does not include multientity buildings of different equipment types. The Network Manager could have responsibility for stored program control offices only. This situation would be encountered where the Switching Control Center (SCC) concept is implemented and none of the switching units related to the SCC are in multientity buildings with other types of equipment.

Outstate Area

3.08 The outstate area Network Administration local organization for first and second level management in a fully mechanized environment is shown in Fig. 2. The organization is quite similar to that presented for a metropolitan area.

3.09 Network Supervisors are nonfunctionalized and maintain accountability for all local administration functions. However, specialization by equipment type that is found in metropolitan areas probably is not possible in outstate areas. For this reason, both the Network Supervisors and the Network Managers have combined equipment types. Where specialization is possible (eg, larger cities in an outstate area), it is recommended and is considered more advantageous than a combined equipment types structure.

C. Transition Organization

3.10 Because there are operating companies and areas in varying stages of implementation of mechanization, many locations will not be able to successfully implement these ultimate organizations. For this reason, recommended organizations for an interim period must be presented. These "transition period" organizations should provide effective structures in which to do the present day job, while at the same time, provide organizations that will facilitate evolution to the ultimate condition.

Metropolitan Area

3.11 The metropolitan area Network Administration local organization for first and second level management in a transition period is shown in Fig. 3. This organization is characterized by the fact there is specialization by equipment type. The Network Supervisors have either stored program control or electromechanical type of equipment only. Additional characteristics of a metropolitan area Network Administration local organization are as follows:

(a) Local Network Administration functions—service, data and assignment—for stored program control equipment are the responsibility of the Network Supervisor. This nonfunctionalized position is possible because of the nature of the data and assignment functions for stored program control equipment.

(b) Network Supervisors having responsibility for electromechanical equipment types do not have all functions for those entities. Assignment for electromechanical entities is the responsibility of the Assignment Supervisor. There is efficiency to be gained by functionalizing assignment activities. The clerical force required dictates that the increased efficiency realized with a functionalized Assignment Supervisor is beneficial.

(c) Activities related to data and service are the responsibility of the Network Supervisor (E/M). This is due to the fact that data and service functions are very much interrelated.

(d) The Network Supervisor (E/M) could possibly have a lower level reporting supervisor with responsibility for data activities only. This position is dictated by need alone and this need is determined by the Network Supervisor's span of personnel control. If the clerical force required to carry out the data activities is such that it exceeds the Network Supervisor's span of control, a reporting Data Supervisor is then required. The Network Supervisor also maintains direct reporting clerks who are concerned with the service functions.

(e) The Network Manager—Administration is shown with responsibility for combined equipment types. In some cases, the manager's area of responsibility may be specialized by equipment type. Where it is possible, this is recommended in order to benefit from specialization.

Outstate Area

3.12 The outstate area Network Administration local organization for first and second level management in a transition period is shown in Fig. 4. The major difference between this organization and the metropolitan structure is that outstate network supervisors will probably have responsibility for combined equipment types. Additional characteristics of an outstate area Network Administration local organization are as follows:

(a) Assignment for electromechanical offices is functionalized under the Assignment Supervisor as it is in the metropolitan area. Data functions for electromechanical offices are the responsibility of the Network Supervisor, but there may be a need for a Data Supervisor due to span of control.

(b) The local administration functions of service, data and assignment are combined for stored program control type equipment and the Network Supervisor maintains overall responsibility for these functions.

(c) The Network Manager—Administration and Network Supervisors are nonspecialized and are shown with combined equipment type responsibility. This does not preclude specialization for administration where possible.

TOLL/TANDEM

A. General

3.13 In a contemporary Network Services Organization, the Tandem Administration Organization that will enable management to discharge the total responsibilities of the job effectively, is one in which the activities are supervised by a ***specialized*** (by type of equipment) but ***nonfunctionalized*** (by work activity) supervisor. This should be the ultimate goal of organizational planning related to Toll/Tandem Administration.

3.14 In addition to the general recommendations that affect Tandem Network Administration, there are unique factors of geography, numbers of toll machines, mixtures of equipment types, degrees of data mechanization and network hierarchy which must be considered before designing the specific tandem organization which will function most efficiently in a given company, area, or district.

B. Organizational Considerations

Metropolitan Area

3.15 In areas with a significant number of toll machines, there are three possible organizational combinations:

(a) Collocation with tandem maintenance personnel in a Switching Control Center (SCC) where interaction between the two organizations is facilitated by the availability of exception reporting under the EADAS and/or PBC systems for administration and such systems as CAROT and COMAS for the maintenance personnel.

(b) A centralized tandem administration group collocated with tandem maintenance personnel in a operations center. Although this arrangement

provides for interaction, it is not possible to take advantage of data from mechanized maintenance systems.

(c) Decentralize tandem administration into one or more physical locations when geographical considerations make this necessary.

Note: Centralization of tandem administration should reflect the network hierarchy, i.e., administrative responsibility should be contained within a primary or sectional center.

Outstate Areas

3.16 When there are few toll machines in a multi-state or multi-area telephone company, toll/tandem administration is usually decentralized, resulting in a combination of equipment types at first level. It is suggested that alternatives would be centralization of 4A or crossbar tandem administration for several numbering plan areas either with or without a comparable operations center. Centralization should be done with regard to the network hierarchy; i.e., while a combination of primary centers may be required, the network manager's responsibility should be contained within a given primary center.

C. Organizational Recommendations

3.17 The following paragraphs outline recommended organizational structures for Toll/Tandem Network Administration activities in an environment that is either supported by mechanization or is progressing toward that state. For purposes of the recommendation, "fully mechanized" implies the implementation of a mechanized data collection and processing system such as the Engineering and Administration Data Acquisition System (EADAS)—Traffic Data Administration System (TDAS).

3.18 Due to the efficiency inherent in mechanized data processes, it will usually be possible for a first-level Network Supervisor to assume a larger span of control over more tandem offices, i.e., in the case of crossbar tandems, to move from administration of two to four crossbar tandems to the administration of three to five under a fully mechanized data gathering system with completely implemented downstream programs.

Metropolitan Area

3.19 The metropolitan area Network Administration Tandem Organization for first and second level management in a fully mechanized environment is shown in Fig. 5. The organization can be characterized as being specialized and non-functionalized.

(a) The Network Supervisor is specialized by equipment type and is responsible for either 4A (or 4A ETS-PBC) equipment only or for crossbar tandem (XBT)) equipment. This supervisor is responsible for all functions—service, data and utilization—that are part of Toll/Tandem administration. This approach enables the supervisor and reporting clerks to gain the expertise that is inherent with specialization. Due to the complexity of tandem equipment and the number of class 5 end offices which usually "home" on a class 3 or higher 4A or crossbar tandem machine, this specialization is essential.

(b) Expertise required in toll/tandem administration (particularly in regard to the 4A-ETS) is enhanced when organizational arrangements are such that the second level tandem administration group can be collocated with maintenance forces in a Switching Control Center (SCC) environment.

Outstate Area

3.20 The outstate area Network Administration Organization must generally encompass both local and toll/tandem administration, since there are usually too few 4A and/or tandem offices to dedicate even at first level. However, if there is a full size 4A ETS machine, a first-level Network Administrator may be dedicated. In a mechanized environment, this organization can be characterized as shown in Fig. 6.

3.21 Network Supervisors are non-functionalized and maintain accountability for all administration functions, although they are rarely able to specialize in one equipment type. Where specialization is possible (e.g., larger cities in an outstate area), it is recommended.

D. Network Management

3.22 In many operating telephone companies today, the Network Supervisor—Crossbar Tandem and to a much greater degree the Network Supervisor—4A Toll is assigned to perform duties

associated with "network management". These surveillance/control activities can be most effectively performed for a much larger section of the network when centralized in an EADAS/NM (Engineering and Administration Data Acquisition System—Network Management) environment. (See 3.70 through 3.84.) However, until network management activities are so specialized in all associated companies, control of network traffic during periods of overload, peak periods or facilities failures will usually be assigned as an adjunct responsibility to Toll or Tandem Administrators. If Toll and Tandem Administrators are assigned network management activities, their job descriptions would be enhanced and should be evaluated in that context.

TOTAL DATA NETWORK SYSTEM (TNDS)

A. General

3.23 Integration of EADAS (Engineering and Administration Data Acquisition System) and other data collection systems together with TDAS (Traffic Data Administration System) and downstream systems (Trunk Servicing, Trunk Forecasting, Central Office Equipment Reports and Load Balance System) combine to make up what has been defined as the ***Total Network Data System.*** The impact of this complete data mechanization system on the Network Administration functions and organizations is significant. This computer-based system will not only collect the required data, but will provide sufficient data to allow for near real-time surveillance of measuring apparatus and equipment operation. Data processing by downstream systems will eliminate the tedious data summarizing efforts that have long been associated with Network Administration data collection procedures. Many of the standard data validity checks are part of these downstream systems and will aid in the generation of valid data.

Engineering and Administrative Data Acquisition System (EADAS)

3.24 EADAS is part of an integrated total network data system which has been developed to meet the long term administration and network management needs of the Bell System. It is an electronic, software-controlled data collection system with capability for near real-time surveillance.

3.25 This surveillance aspect of the system sets EADAS apart from all previous systems. It can provide information required by network supervisors and maintenance supervisors to enable them to make more knowledgeable and effective decisions. It provides the vehicle for person/machine interactions and allows a two-way communications path which has not previously existed. With this communication will most assuredly come greater understanding, compatibility and efficiency in the areas of machine management and data collection and provision.

Traffic Data Administation System (TDAS)

3.26 TDAS is a system which provides those data collection support services which are required to make measurement data usable by the individual downstream programs. These downstream users, such as the Trunk Servicing System (TSS), Trunk Forecasting System (TFS), Load Balance System (LBS), Central Office Equipment Reports (COER) and Program for Administrative Traffic Reports on Line (PATROL), use the data to perform detailed engineering and administrative functions.

3.27 TDAS uses another computer based system to create and maintain its data base. It is called the Common Update Records Keeping Process since it stores a data base of common records for the support of all TNDS systems, (i.e., Trunk Servicing, Trunk Forecasting, and TDAS).

3.28 The design of TDAS allows it to support a variety of measurement devices, providing that the required interface is met. TDAS can support register readings, register differences, No. 1 ESS via EADAS or via paper tape, Traffic Data Recorders (TDRS), Pollable Data Terminals (PDT), No. 2 ESS via EADAS, Individual Circuit Usage Recording (ICUR), 4A Electronic Translator System/Peripheral Bus Computer (ETS/PBC), in addition to standard EADAS system inputs.

3.29 In essence, TDAS provides in a single system those data collection support services which are required to make measurement data usable by the individual downstream programs. Fig. 7 is a diagramatical representation of the entire TNDS system.

B. Impact of TNDS on Network Administration Responsibilities

3.30 Network Administration responsibilities do not change significantly with the introduction

of the Total Network Data System. The general area of Data Administration and the responsibilities related to this area remain essentially as they are defined in DFMP Division A, Section 2. TNDS will, however, have a forcible impact on the manner in which these responsibilities are carried out. This impact is expanded upon in the following paragraphs.

3.31 ***Traffic and Service Measuring Apparatus***—Overall administration of Data Collection Apparatus is the responsibility of Network Administration. TURs as well as the EADAS Traffic Data Converter (ETDC) along with other converters must be assigned and verified. TUR and non-TUR data inputs must be monitored and, where implemented, ICUR inputs must be grouped by components and trunk groups. Network Administration must coordinate and monitor the maintenance of the data collection apparatus and converters or may assume a more active role in the maintenance of these devices.

3.32 ***Central Control Unit (CCU)***—Overall operation and administration of the minicomputer is a Network Administration responsibility, and should be handled at the lowest organizational level possible from an economic standpoint. Such operation will preserve the responsibility implicit in a "network concept" while making it possible to merge separate organizational identities (i.e., District Network Administration groups and a CCU under a common reporting chain). In general, when the CCU must serve entities within multiple districts or divisions, a staff organization is the recommended location for the control of that CCU. Parameters, definitions, and calculations must be generated and maintained and data tapes must be prepared for downstream processing. The EADAS system provides for more efficient computerized data gathering, along with near real-time data for surveillance. This mechanization "tool" must be integrated into organizations as a more efficient replacement for tedious tasks and ***not*** as a replacement for responsibility.

3.33 ***Data Collection and Scheduling***—Overall coordination of the data collection and scheduling effort is a Network Administration responsibility. In the mechanized TNDS environment, this requires more foresight and planning and is accomplished through coordination and interfacing with those operating the data processing facilities.

3.34 ***Data Base Integrity***—In a mechanized environment, accuracy of outputs is dependent on accuracy or integrity of the data base used. Although a mechanized system alters the procedures significantly, this responsibility rests with Network Administration. Part of the TNDS is the Common Update Records Keeping Process (CU) which is the computer-based system to create and maintain the data base. This common set of records supports TNDS systems used by other departments (Trunk Servicing and Trunk Forecasting) in addition to the TDAS system. Data base inputs and a large portion of the Common Update inputs are the responsibility of Network Administration. These responsibilities may be carried out within a centralized or even staff-type organization, but the responsibility remains with Network Administration.

3.35 ***Data Validation***—Although the mechanized data collection facilities and inherent data validation procedures that are part of the data processing system will go a long way toward eliminating data errors, the responsibility for valid data generation continues to lie with Network Administration.

General Assumptions

3.36 Because of the many varied configurations that TNDS affords and because of the options available to the operating telephone companies, some general assumptions about the system are required in order to be able to assess effects of the entire system on the Network Administration job. These general assumptions made for this purpose are:

(a) An entire TDAS system operational with ability to accept all data inputs (i.e., registers, register differences, EADAS, TDRS, PDTs, ESS, ETS/PBC, and also commercial terminals that meet the defined TDAS interface) even if not presently active and collecting data.

(b) An entire TNDS system operation with all downstream programs operational and with Common Update being used as the data base for these systems.

(c) A TDAS system operational and processing data for its users (i.e., Trunk Servicing, Central Office Engineering, Load Balance, and Division of Revenue).

(d) Implementation of EADAS/Network Management (EADAS/NM) is not related to the operation of EADAS. This should be taken to mean that the EADAS/NM CCU operation and data base maintenance will be essentially segregated from EADAS operation.

(e) All considerations related to actual CCU location are subject to cost studies and considerations outside the control of those responsible for day-to-day administration of EADAS and TDAS.

(f) Any combination of EADAS CCUs with minicomputer systems for the purposes of maintenance, attendant efficiency and cost reductions can be considered extraneous. Local management will be required to define modifications where this is the case.

(g) There is a centralized (either at corporate, state or area level) location which is responsible for actual operation of the CCU and for the coordination and training required for interfacing with TDAS. Other supervisors responsible for "pure" staff-type activities could also be within the centralized group.

(h) Any questions relating to user versus vender responsibility for maintenance of the CCU are subject to definition by the OTC.

3.37 It can also be expected that special organizational arrangements will have to be made during the period of TNDS implementation. Unique groups in the form of task forces, training teams, or cutover committees may be required. The structure of such groups is at the discretion of local OTC management.

C. TNDS Organizational Considerations

3.38 In addition to those organizational considerations that affect the local Network Administration organization, there are unique factors that must be considered when a data mechanization system is integrated into an existing structure. Although the listing includes important considerations related to data mechanization, the following factors are not intended to be all inclusive:

(a) Dispersion of Central Control Units

(b) Geographical Area and Density of Entities

(c) Degree of Progress Toward Full Data Mechanization

(d) Dispersion of Network Administration Groups

(e) Expertise of Network Administration Groups

Dispersion Of Central Control Units (CCU)

3.39 Selection of location of the CCU involves such factors as building space, data link cost and availability, and environmental considerations (TFP Division B, Section 9-a). The physical location decided upon will have an effect on local administration personnel. CCUs which are dispersed, often in separate states, will require more coordination and adherence to standard procedures set forth by Company-wide Network Staff. Standardized documentation for network supervisors, CCU administrators and others involved will require that operation of each CCU be reasonably similar.

3.40 A dispersed CCU will normally be dealing with fewer local supervisors. This facilitates communication and interaction between network supervisors and the CCU operation. On the other hand, centralized CCUs have many advantages in that operation of a central group of combined minicomputers usually requires fewer people. There will also be more CCU expertise developed in the central location and the amount of spare parts and supplies will be reduced. One location for all CCUs also facilitates implementation of the update and change procedures required to maintain the data base.

3.41 A central group will usually be dealing with more local network supervisors. More communications would be required and interaction between the CCU and the users would not come as readily as it would with a decentralized operation. Also, the interface with Accounting to TDAS data processing would be simpler with a central CCU group.

3.42 An important point that must be brought out with CCU dispersion is that it becomes possible for more of the data job to be done within this group. This is because there is less likelihood of the CCU being fully utilized. The term "data job" implies the overall data provisioning responsibility—providing data to the various users. A single CCU, especially if its channel capacity is not fully utilized, is manageable from the point of

view of complete data provisioning. Assignment, updates, calculation changes, and other activities associated with data provision could all be handled centrally with output of the group simply "valid data", and responsibility of the group defined as complete "data base integrity". Because this type of delineation of responsibility becomes possible with small manageable operations, does not mean that it is the best organizational solution. Many other factors require consideration.

Geographical Area and Density of Entities

3.43 As stated above, there are many factors that determine the actual CCU location. Geographical area is, of course, related to the factor of data link cost. Geographical characteristics of the various OTCs will also affect the method chosen to organize the TNDS system.

3.44 A "single state" OTC where one CCU location is most feasible involves a fairly straightforward interaction with the users. A "multi-state" or "multi-area but single state" OTC is quite different. In addition to possible dispersed CCUs, the actual CCU operational responsibility may be assigned to a state or area type headquarters. Within these states or areas, the overall system could be compounded by decisions made that provide one system with options (e.g., ICUR) different from another. Also, one state or area can be substantially different from another in departmental structure.

3.45 The density of central offices (and hence administration locations) can require organizational considerations to differ. A single CCU located in a sparsely populated area or state could require an organization different from a multiple CCU organization in a large metropolitan area.

Degree of Progress Toward Full Data Mechanization

3.46 Many of the Network Administration data collection and processing activities are presently being performed in a variety of modes—manual film reading, TDRS, or other type mechanized environments. Implementation of TNDS is generally on a progressive basis with selected offices being placed on the system. This will cause management to establish separate procedures for the TNDS system. The present organization structure and responsibility separation could be in conflict with a structure best suited for the ultimate TNDS system. In some areas, there will be some offices with EADAS while other offices will be on different systems and possibly even have different options (e.g., ICUR). This compounds the problem of assigning responsibility of data functions.

3.47 An important point to note is that an organizational structure should consider the ultimate mechanization system that will be in operation when TNDS is fully implemented. In the interim, the offices being served will be in various mechanization stages of the ultimate goal. This will necessitate special organizational considerations. It will also make the data job somewhat more complex.

Dispersion of Network Administration Groups

3.48 Physical locations of various Network Administration units interacting with TNDS must also be considered. When these units are small and dispersed, there may be a limited amount of expertise available. Centralized or larger administration groups will have more offices, with more entities on the system and should be more proficient in interacting with it. Centralization may breed this kind of expertise and these centralized groups may be able to do a larger portion of the data job because of this expertise. Conversely, the dispersed groups may not have as many offices on the system, usually will not have the level of experience with it and may be able to effectively accept responsibility for a lesser portion of the total data job. A central CCU operation, for example, could interface with both large centralized administration groups and smaller dispersed units. Organizationally, consideration must be given to this dispersion. Variable or localized organizational structures and definition of responsibility may be the most effective manner in which to organize.

Expertise of Network Administration Groups

3.49 The level of expertise available in administration groups is very difficult to measure. Because of the changing nature of the Network Administration functions, and the evolution of the job's responsibilities, expertise or experience available varies significantly among administration groups. This level of expertise, (as in the management of data scheduling, operation of switching systems and the preparation of source documents), is an important factor which must be considered when implementing any type of mechanization system. The ability of administration

personnel will affect the training required for implementation of the system. A particular organizational guideline may have to be modified or responsibilities redefined because of various levels of expertise.

3.50 Any consideration given to expertise should not exclude the other organizational factors already discussed nor become the sole determinant in selection of the TNDS organization which will best meet the needs of an operating company. However, the varying level of expertise ***is*** a definite factor that must be taken into account when planning implementation of the mechanization system selected.

D. Optimum Grouping of TNDS Activities

3.51 The actual activities associated with the Total Network Data System are many, and some are the responsibility of organizations other than Network Administration. The activities that relate primarily to administration can be grouped together into functonal areas of responsibility. This will help develop patterns and indicate which combination of activities is more manageable.

3.52 When the administration activities are grouped into functional areas of responsibility (Table A), three main areas become apparent:

(a) Data Base Integrity

(b) Central Control Unit Activities

(c) User Applications (both real-time surveillance and downstream data use)

3.53 Various alternative structures can now be analyzed by assigning the three areas into different organizational patterns. The three alternatives that have been developed and are presented in the next paragraphs are:

(a) Alternative "A" - The Traditional Approach

(b) Alternative "B" - The Functionalized Data Supervisor

(c) Alternative "C" - Centralization of Entire Data Administration Responsibility

Alternative "A"

3.54 Paragraph 3.04 through 3.12 of this section defined organizational guidelines for local administration and suggested a specialized but non-functionalized organization structure. This guideline must be tempered somewhat with the implementation of TNDS. Alternative "A" is a possible delineation of activities within a traditional organization. The Network Supervisor would maintain complete responsibility for Data Administration. As can be seen from Fig. 8, a central group is organized to operate and administer the CCU and to provide the necessary interface with TNDS.

3.55 Essentially, local administration retains responsibility for "data base integrity" while interfacing with the centralized group which acts as a production organization providing data to both administration and other users. This organizational approach is most consistent with the present Network Administration job and the responsibilities as they are defined.

3.56 The central TNDS group would be a corporate, state or area level staff group and would normally be integrated as a part of the Network Administration support staff. Advantages of Alternative "A" structure include:

- Minimal alternation of present network administration responsibilities.
- Minimal centralized personnel—only CCU operation and TNDS or Common Update interface are staff responsibilities.
- Local network supervisors maintain managerial control of the entire administration job.
- The central group is responsible for "production" of data to serve clients and need not be encumbered with data base maintenance.
- Managerial controls are applicable because the central group can be held accountable for production of data.

3.57 Disadvantages of Alternative "A" include:

- Introduction of new procedures (forms, data entries, data quality outputs, etc.) to the

local network supervisor requires significant training.

- Integrity of the administration job is maintained, possibly at the expense of a more efficient data job.
- Interface between the central group and the network supervisor becomes more important because of the responsibility delineation.
- The central group will have to interface with many dial groups and individual network supervisors.
- Highly interdependent activities of data base maintenance and data production appear to be fragmented.
- Introduction of new methods of changes requires communication with every network supervisor.
- Interaction of administration with the central group must be documented and priorities established to ensure adequate communication and optimum efficiency.

Alternative "B"

3.58 Although it may not be consistent with a non-functional Network Administration organization, a modification to the "traditional" alternative structure may be beneficial. It is possible to functionalize all data administration activities for a manager's area under one Network Supervisor—Data (see Fig. 9).

3.59 This functional supervisor would be a focal point for all activities related to data. Again, the centralized staff group acts as a production organization providing data for the users. Some of the disadvantages of Alternative "A" now become advantages. The advantages of Alternative "B" are:

- The functional supervisor is one central contact for user-related administration activities.
- Efficiency is gained in having one group responsible for data base integrity for a manager's area.
- Training effort required is not as substantial as it is with the traditional approach.
- Introduction of new methods or changes requires coordination with only one supervisor and not with all network supervisors.
- The interface between the local Network Supervisor—Data and the central group is still critical but much more efficient with only one supervisor per area to deal with.
- The local network supervisor becomes free to concentrate on the service-cost functions, and in fact becomes a primary user of the data.

3.60 Disadvantages of Alternative "B" include:

- A fragmentation of the traditional Network Administration job.
- Interface between the Network Supervisor—Data and other network supervisors becomes more critical.
- Integrity of the Network Administration job is still maintained in effect, again possibly at the expense of a more efficient data job.
- Interface between the Network Supervisor—Data and the central group remains critical.
- Coordination between the network supervisors and the central group responsible for producing the data becomes more complicated, and this could be detrimental.

Alternative "C"

3.61 The concept of this alternative is to centralize all activities related to the data job and have one centralized group responsible for data base maintenance ***and*** data production for a company, state, or area. This is a significant departure from the other alternatives and is in conflict with the traditional role of administration (see Fig. 10).

3.62 However, having a centralized group responsible for the complete data effort will lend both efficiency and expertise to the operation. This is especially true with those systems implementing ICUR as part of a TNDS. With ICUR, virtually

all of the internal TUR cross-connections are eliminated. This reduction in the number of activities allows more measuring apparatus administration to be carried out from a centralized group. For this reason, Alternative "C" is especially attractive to locations with ICUR. Other advantages are:

- The data job can be managed as one total function and a single manager is able to control the entire data effort.
- A centralized group is more efficient and develops more expertise.
- Interfaces between the Network Supervisor—Data and the CCU and TNDS supervisors are more efficient.
- Complex interfaces are minimized. Local network supervisors become solely data users and have no interface relating to data base integrity.
- A centralized group can be more responsive, and can react more effectively to any new methods or changes.
- Local network supervisors can look to the central group as having the total responsibility of data provision. Local administration efforts can be directed at the "assignment" and "service" functions.

3.63 Centralization also can have detrimental effects which should be considered. The disadvantages to Alternative "C" are:

- Fragmentation of the total Network Administration job.
- The number of interfaces becomes significant with the central data supervisor now coordinating with all network supervisors and other data users.
- If there is no central Switching Control Center (SCC), a central data group could not coordinate as efficiently with end office maintenance personnel as local administration.
- Many revisions of historical procedures would be required (e.g., flow of trunk orders, network design orders, measuring apparatus, Method of Procedure (MOP).

Recommendations

3.64 The three alternatives are simplifications of the most common organizational structures either already in practice or contemplated. Selection of the ideal or recommended organization cannot be made solely from the structures presented with their respective advantages and disadvantages. A summary of some very important factors that must be considered has already been discussed. What may look like the best organizational philosophy for one company or area may not be equally as attractive to another location.

3.65 For this reason, a standard organizational structure with which to implement the TNDS is not a viable solution. Rather, an individual and complete analysis of the situation with due consideration for ***all*** factors is necessary.

3.66 As an example, an OTC with a large multi-state or multi-area configuration utilizing localized CCU locations with perhaps one CCU per state or area under control of a network staff may find that one (or more) centralized Data Supervisor at each location, Alternative "C," is able to manage the complete data administration responsibilities. Consideration must be given for such factors as geographical area and the number of offices for which each supervisor will be responsible. Coordination with the Network Supervisor—CCU is direct and can be simplified through collocation of the two groups. This alternative should also consider interaction with local administration groups from the point of view of both the number of network supervisors and dispersion of the administration groups.

3.67 Another example could be a medium-sized or single-state OTC utilizing one centralized location for all CCUs within the company. The centralized group would be integrated into the corporate level staff. Here, the concept of centralizing all data activities may be prohibitive in view of the number of local administration groups and their location. The local administration groups in this instance would remain responsible for the data base maintenance and other user-related data activities. The centralized group would provide the data processing functions on a ***production*** basis. The question of whether there should be a

functionalized Network Supervisor—Data reporting to the local administration manager must be reviewed further and the merits of either Alternative "A" or "B" evaluated.

3.68 A complete analysis of the individual circumstances faced by each OTC must be made in order to evaluate the merits of different organizational alternatives. While the circumstances in each company will differ, Alternative "C" offers an organizational structure which will cover most situations. The advantages and disadvantages of this alternative have already been discussed. The underlying strengths of this structure are that the data job can be efficiently managed as a single entity and that the data expertise required to interface with the mechanized environment will be developed quickly. Based upon these factors and the experience to date in those companies which have similar organizations, it can be recommended that this alternative be implemented coincident with the Total Network Data System (TNDS). ***One word of caution*** is that data administration in a mechanized environment is still evolving. Accordingly, a key requirement of the selected organizational structure is flexibility.

3.69 At the Company level, there will have to be reinforcement of the selected organization through detailed responsibility definition and modification of established procedures. Additionally, consideration must be made on a local basis for situations that exist or options of the system used that are not part of the basic assumptions.

NETWORK MANAGEMENT

A. General

3.70 Network Management Organizations vary in size and complexity throughout the Bell System. Until the introduction of recent developments in this field (No. 4 ETS/PBC, CCIS, No. 4 ESS and EADAS/NM), there were very few full-time managers dedicated to the control of equipment and circuits to maximize call completion during peak traffic conditions or facility failures. Although the AT&T Long Lines Department appointed full-time network managers to perform the control function for regional centers, associated telephone companies have usually assigned network management as an adjunct to the basic responsibilities of Local or Toll/Tandem Network Administrators.

B. Engineering and Administration Data Acquisition System—Network Management (EADAS/NM)

3.71 EADAS/NM is a computerized system which allows centralized, real-time surveillance and control of all levels of the switching hierarchy—from regional centers to selected end offices—within predefined sectors of the network. As such, EADAS/NM works in conjunction with EADAS or peripheral bus computers (4A/ETS machines) to monitor network data from critical switching machines and to advise the network manager of potential congestion immediately. The sophistication of the EADAS/NM tool, the complexity of current and future switching machines and continued growth in the volume of toll messages have combined to change the emphasis previously placed on network management. With EADAS/NM a full-time Network Management Organization will be dedicated to integrated monitoring and management of a much larger segment of the network hierarchy, both local and toll.

General Description of EADAS/NM

3.72 EADAS/NM utilizes a minicomputer (the PDP 11/70) to provide the following features:

(a) Real-time surveillance of switching machine and trunk group data. Calculations are performed at five-minute intervals on the most recently acquired data and compared with previously set exception values. Specific exceptions are reported to the Network Manager for possible action.

(b) A network exception display system which is driven by calculated data exceptions and by selected discretes. This display system includes receive only printers, Cathode-Ray Tube (CRT) terminals, and an exception display board organized according to the identity of the network cluster of offices associated with a specific EADAS/NM.

(c) Centralized, remote network management control capability via the computer. By utilizing the CRTs, control measures can be instituted quickly to protect the call carrying capacity of the network.

3.73 Substantial economies have been realized by integrating the operation of EADAS/NM into the network data collection features already established in EADAS. Terminal equipment at

the switching machine locations together with data links installed for EADAS are shared by the two systems in most cases. Fig. 11 outlines the total system configuration. The following traffic features are provided by the EADAS/NM system:

(a) Attempt and usage data are collected by EADAS in real-time from electromechanical offices and at five-minute intervals from 4A/ETS machines equipped with a Peripheral Bus Computer (PBC). Data will also be collected from those No. 1 ESS offices equipped with the Centrex Generic 8 or later generic programs.

(b) EADAS and PBCs pass the selected data to EADAS/NM for network management calculations. These calculated results are compared to preset thresholds and if these values are exceeded, the exception display system is activated. Additional network management data can be acquired on demand from the computer through CRT terminal devices.

(c) Discrete data (off/on indications) to provide information concerning office status are transmitted at 20-second intervals to EADAS/NM via EADAS from No. 1 ESS offices, Crossbar offices, Crossbar Tandems without Traffic Supervisory Cabinets (TSCs), and 4A/ETS equipped with PBCs. 4A card translators and Crossbar Tandems with TSCs require E2A telemetry links to input this data directly to the EADAS/NM computer.

(d) Controls are centralized at the EADAS/NM Center and can be activated and deactivated via the CRT terminal or at the remote central offices. Control leads for local offices use EADAS data links while E2A telemetry link equipment is utilized for reverse control commands to Crossbar Tandem and 4A ETS and Card Translator offices.

General Assumptions

3.74 The EADAS/NM System offers possibilities for a variety of organizational structures to perform centralized network management. Differences in existing network configurations, as well as variations in machine ownership between Long Lines and the operating telephone companies, make it necessary to make certain assumptions about the system when determining the effects upon the network management job. The general assumptions made for this purpose are:

(a) The principles and purposes of network management as generally understood for 4A and Crossbar Tandem machines are unchanged with EADAS/NM, although the tools and data available to the network manager are vastly improved.

(b) Functions which are allied to network management—those of Local Network Administration, Toll/Tandem Administration, Trunk Administration and EADAS Central Control Unit (CCU) Maintenance—are treated separately.

(c) Arrangements for the maintenance and administration work forces and operation of the EADAS computer may be considered apart from EADAS/NM operation. Long Lines and operating telephone company management will be required to plan a smooth interface of the two operations, with adequate consideration to such items as computer failures, scheduling requirements, and network cutovers.

(d) All considerations related to actual EADAS/NM location are subject to cost studies and considerations outside the control of those responsible for day-to-day administration of EADAS/NM.

(e) Companies may modify outside vendor systems to emulate the role of basic EADAS in EADAS/NM. If the equipment interface specifications for scanner/accumulator data terminals are met, EADAS/NM may be installed without replacement of present data collection computers.

(f) The existence of network control capabilities [such as Dynamic Overload Control (DOC), Directional Reservation Equipment (DRE), route transfer keys, etc] at the machines covered by an EADAS/NM installation must be treated as a separate subject.

(g) Any questions relating to user versus vendor responsibility for maintenance of the EADAS/NM equipment are subject to definition by the companies concerned.

(h) Changes in EADAS/NM configuration or operation will probably occur with the future

development of No. 4 ESS Toll Machines, Common Channel Interoffice Signalling (CCIS) installations, the Inter-EADAS/NM System and the Network Operations Center (NOC).

3.75 It can also be expected that special organizational arrangements must be made during the period of EADAS/NM planning, installation, and implementation. Unique groups such as task forces, training teams, or cutover committees may be required. In particular, a steering committee with representation from the participating companies should determine the system parameters. Some of these considerations are:

(a) Definition of the ***"EADAS/NM Cluster"*** (subdivision of the system DDD switching network served by the network management center using an EADAS/NM computer).

(b) Identification of machines subject to surveillance and those subject to both surveillance and controls.

(c) Physical location of EADAS/NM operation.

(d) Accessibility to higher management.

(e) Building preparation and alterations.

(f) Availability of back-up power.

(g) Placement of orders for computers and associated equipment.

(h) Creation and maintenance of the EADAS/NM Data Base.

(i) Placement of orders for Cathode Ray Tubes, Exception Display Board, E2A telemetry system, receive-only printers (ROPs), etc.

(j) Scheduling of associated rearrangements, conversions, transitions and required end office modifications.

(k) Planning and ordering of furniture and fixtures.

(l) Definition and division of responsibilities, functions and required operating personnel for the EADAS/NM Center.

(m) Operation, maintenance and staffing of the Central Control Unit associated with EADAS/NM.

(n) Ownership agreement and cost allocations.

EADAS/NM Organizational Considerations

3.76 In addition to those general considerations usually examined when planning a centralized organization, there are additional factors which should be reviewed to enhance the effectiveness of the EADAS/NM sytem. The following list includes some of these factors, but is not intended to be all inclusive:

(a) Geographical area and types of offices

(b) Degree of progress toward full data mechanization

(c) Identity of participating companies

(d) Single integrated organization

(e) Hours of coverage

Geographical Area and Types of Offices

3.77 The design of EADAS/NM is such that effectiveness is promoted when a "complete" network can be monitored and controlled. Subtending offices, even those belonging to different associated companies, can be monitored more effectively when data for toll and local offices are available for example, from both ends of a trunk group.

3.78 An important consideration in planning the structure of a network cluster concerns the capabilities of toll, tandem and local switching machines within a geographical area. Consideration must be given to the following items:

(a) 4A ETS/PBC offices can have a network management system associated with the PBC modification which will interface directly with EADAS/NM. (This would be considered an optional "EADAS port").

(b) No. 4 ESS toll machines will also be able to transmit network management data to the EADAS/NM Center.

(c) Beginning with the Centrex 8 Generic Program, No. 1 ESS offices will gain the capability for sending network management data via EADAS to EADAS/NM.

Degree of Progress Toward Full Data Mechanization

3.79 The full benefits of EADAS/NM can only be realized with a fairly complete data acquisition system such as EADAS (or equivalent outside vendor system), the Peripheral Bus Computers (PBCs) associated with 4A toll machines, and No. 1 ESS offices equipped with the Centrex 8 or later generic. If there are important gaps in data from subtending offices, the effectiveness of an EADAS/NM Center will be lessened.

Identity of Participating Companies

3.80 In most instances the geographical area placed under the surveillance of an EADAS/NM Center will contain machines and trunk facilities owned by an associated company, an independent telephone company and/or AT&T Long Lines. The success of the EADAS/NM Center will be dependent upon how successful the involved companies can be in developing a workable management strategy with respect to the Network Management Center.

Single Integrated Organization

3.81 One obvious benefit associated with centralization is reduction in redundant activity. In addition, network management functions cannot be effective with more than one director. Thus, parallel organizations with personnel from several companies merely sharing quarters and equipment should not be created. There can be substantial gains in efficiency, experience and economy if functions can be performed by first level management personnel of the different companies without undue consideration of individual company identity or reporting authority.

Hours of Coverage

3.82 Network management may require expanded coverage beyond normal business hours. Surveillance and control activities by management personnel in EADAS/NM Centers could be based on two shifts a day (16 hours total), seven days per week. This requirement must be recognized when planning the organization and when forcing for training and vacation requirements.

Optimum Grouping of EADAS/NM Activities

3.83 Network management activities under an EADAS/NM environment may be grouped into four major responsibilities:

(1) Data Base Integrity

(2) Network Control

(3) Preplanning

(4) Administration

EADAS/NM Organizational Recommendations

3.84 Variations in the size and complexity of the EADAS/NM clusters in service or in the planning stages preclude recommendation of one ideal organization. However, the general structure of an integrated organization which will fulfill the four major network management responsibilities is outlined below. This suggested organization is shown in Fig. 12.

(a) When more than one area, NPA, or state in a multistate associated company are integrated into a network cluster, it is recommended that responsibility be vested in the company corporate staff organization.

(b) The organization can be staffed by either or both Long Lines and the associated company.

(c) The percent of time allotted to each function performed by the network supervisors will vary by assigned concentration. Rotation is recommended between the three major network management functions—data base, control and planning.

(d) Because of shift requirements, all network supervisors must be trained in the control-surveillance function.

(e) For ease of administration, it is suggested that vocational personnel be selected and report to a supervisor from ***one*** of the responsible associated companies or AT&T Long Lines.

TRUNK ADMINISTRATION

3.85 This information will be furnished at a later date.

ORGANIZATION SIZING GUIDELINES

A. General

3.86 The recommendations in this document provide administration management with organizations that are sensitive to the demands and responsibilities of Network Administration functions. The organizational objective should be to evolve toward ultimate organizations which are fully supported by mechanization systems. Any "transition period" organizations discussed are meant to facilitate the transition to a fully mechanized environment and provide an effective organization in the interim.

3.87 An area of responsibility must be defined for the recommended organizations. Proper sizing of the structures is crucial to successful implementation. The following paragraphs present recommended guidelines to be used in sizing administration organizations.

B. Local

3.88 Table B presents recommended sizing guidelines for administration of local entities. It should be emphasized that some of the most important factors for sizing are not quantifiable.

3.89 The determinants that contribute to the complexity of the job should be used as much as possible in sizing the jobs. A range in the number of main stations is used to define job size only because it is generally accepted and identifiable when defining an area of responsibility. There is more to looking at job size than looking solely at the quantity of and types of main stations.

3.90 The ranges shown in Table B will obviously have exceptions. For example, it is highly possible that a first-level supervisor in a metropolitan area may be responsible for only one entity due to complexity of the job for that one entity. The non-quantifiable considerations contribute to the job and require consideration when sizing administration jobs.

C. Toll/Tandem

3.91 The complexity of Toll/Tandem Administration depends upon the mixture of types of central offices, the number of tandems and density of the network. These determinants should be considered when sizing the administrator jobs.

3.92 With mechanized data processes, the first-level network supervisor will be able to assume a larger number of machines than in a manual data collection environment. In the case of crossbar tandems, a span of three to five crossbar tandems with full mechanization (data gathering with downstream programs) is possible.

3.93 Due to the complexities of 4/A (or 4A ETS-PBC) and their usual position in the network hierarchy (class 3 or higher), a first level network administrator may be dedicated. Where appropriate, network management responsibilities may also be assigned to the Network Supervisor—4A Toll.

D. TNDS

3.94 Mechanization of data related activities requires a centralized TNDS organization for each alternative. Guidelines for sizing this centralized organization are necessary. The impact of data mechanization on the local administration sizing guidelines is minimal—regardless of which alternative is selected. Local managers should assess all sizing determinations. Positions can then be seized within the guidelines with consideration given for the location of the data job.

3.95 The size of a centralized TNDS group is dependent on local decisions regarding location of the group. The central group could be located on a corporate, state or area level staff. The Network Manager-Staff may also have other areas of responsibility in addition to the EADAS/TDAS.

3.96 There are other important factors that must be taken into account when sizing centralized groups. The following are some factors that must be considered by local management to insure that their organization is sensitive to local characteristics:

(a) Number of CCUs at the central location

(b) Collocation of other non-EADAS minicomputers

(c) Amount of TNDS update activity

(d) Amount of EADAS change activity

(e) Location of TNDS keypunch activity.

SPAN OF PERSONNEL CONTROL

A. Local Administration

3.97 ***Network Supervisor***—Span of control for this position is ***three to five*** subordinates reporting directly. These can be all non-management or, in the transition organization, could include a Data Supervisor. Some of the rationale for this span of control is:

(a) Many of the work activities are unstructured.

(b) The nature of the job is basically dynamic.

(c) Most of the activities requiring technical expertise lie with this supervisor.

3.98 ***Data Supervisor or Assignment Supervisor*** (in transition period organization)—The Data Supervisor and the Assignment Supervisor can effectively supervise ***five to nine*** non-management clerical subordinates. The rationale is:

(a) Work activities are more structured and more stable than the "service" related activities.

(b) Work activities can be considered to be "production" oriented (i.e., processing service orders or processing data) for the most part.

(c) Some documented procedures and/or practices are available for these activities e.g., DFMPs.

3.99 ***Network Manager-Administration***—The span of control for the second level Network Manager is ***three to five*** supervisors. This is not inconsistent with manager-supervisor relationships for similar functions. This span of control is limited by the fact the the manager is directing technical supervisors.

B. Toll/Tandem

3.100 ***Network Supervisor-Crossbar Tandem and the Network Supervisor-4A Toll***—The Network Supervisor—Crossbar Tandem and the Network Supervisor-4A Toll have ***three to five*** non-management subordinates. Some of the rationale for this span of control is:

(a) Many of the work activities are unstructured

(b) The nature of the service function is basically dynamic

(c) Technical expertise is required of these supervisors.

3.101 ***Network Manager-Toll/Tandem Administration***—The span of control for the second level Network Manager is ***two to four*** Network Supervisors. In metropolitan areas, these supervisors will be dedicated by Toll or Tandem machine type. Outstate areas may combine Toll and Tandem Administration with administration of local office.

C. Centralized TNDS Group

3.102 ***Network Supervisor—CCU***—Span of control for this position is very much related to the stage of EADAS implementation and the amount of activity but should not be more than five computer attendants or clerks reporting directly. If the CCU operation is such that more non-management personnel are needed, additional supervisors are required. This span of control is limited due to the technical expertise required and the generally unstructured nature of work activities.

3.103 ***Network Supervisor—TNDS***—Span of control for this position is obviously related to the amount of TNDS updating activity as well as the location of the centralized TNDS organization. The nature of the activities, however, and the fact that this position requires significant output report analysis dictate that between five to nine non-management clerks report directly.

3.104 ***Network Supervisor-Data*** (in Alternatives B & C only)—Span of control for this position should be between five to nine non-management clerks. Consideration must be given to the unstructured nature of the work activities and amount of supervisor involvment required with these activities. The responsibilities of this position also require interaction with personnel in both local and centralized organizations.

3.105 ***Network Manager-Staff***—This position supervises three network supervisors who are concerned with operation of the EADAS/CCU minicomputer, with TNDS programs and with coordination of data processing. This position could also oversee other supervisors who are involved with non-TNDS activities, depending on the organizational location of the centralized TNDS group.

4. NETWORK ADMINISTRATION CAREER PATH PLANNING

4.01 The changing nature of Network Administration and the fact that current management roles are significantly different than they have been in the past, requires a reorientation of management development and career path planning.

4.02 Historically, many of the "Dial" Administration management positions have been filled with former dial clerical personnel. Main sources of dial clerical personnel have been either the operator services side of traffic or new clerical hires. In many instances, clerical help was borrowed from the operator forces for short periods of time to handle special studies, peak seasonal loads or other temporary needs. Quite often, this help would become permanent when a clerical opening occurred. This method of obtaining the necessary clerical force nearly always presented training problems. Dial groups as a result, were formed almost entirely from the traffic operating groups. Internal promotions and the fact that dial was a part of the traffic department restricted the caliber of administration management personnel to those generally without technical skill and perhaps no aptitude for this type of work.

4.03 More recently, as the need for some of the more technical skills was realized when the administration job began to change, personnel from the technical side of the business, specifically Traffic Engineering and Central Office Maintenance, were added as sources of input.

4.04 Network Administration has evolved from line and number assignment to the overall administration of the network. The complexity of the job has increased and the level of technical and managerial skills and knowledge required to do the job has also increased. For example, present local administration managers require technical skills in such areas as switching, equipment operation, capacity determination, trunking capacity determination, detailed data analysis and even Western Electric Company's methods of transition.

4.05 For these reasons, the career path leading to either manager-level or district-level administration positions must be structured to insure that these managers develop the required skills and acquire the necessary knowledge.

4.06 Two main areas of skills and knowledge that relate directly to Network Administration management responsibilities are those associated with Central Office Maintenance and Design Engineering. The three areas of Administration, Maintenance and Design are highly interrelated and vitally interdependent. To insure that there is sufficient experience in each of these areas and to insure that the network organization is a dynamic and viable operating unit, there must be interaction and planned job rotation within these areas.

4.07 The ideal career path of a Network Administration manager, therefore, requires job content exposure to both maintenance and design. In other words, the Network Administration manager should possess both maintenance and design skills. From the practical viewpoint, adequate training can sometimes be a substitute for actual experience as an incumbent in a maintenance or design position. Additionally, college graduate level personnel with a properly prepared training program are a source for administrator management.

4.08 Mobility of management personnel among the administration, maintenance and design functions has a significant effect upon a manager's career path. Management jobs need to be structured so that lateral transfers and interfunctional promotions are not only feasible, but readily made and encouraged. This will insure that administration managerial positions are occupied by managers with technical skills and knowledge that match the present nature and demands of the Network Administration job.

TABLE A

MAJOR "WORK-FLOW" ACTIVITIES RELATED TO NETWORK ADMINISTRATION TNDS RESPONSIBILITY

ACTIVITY	FUNCTIONAL RESPONSIBILITY GROUPING
1. End office data collection apparatus assignment and administration	Data Base Integrity
2. CCU connected apparatus assignment and administration	Data Base Integrity
3. Scheduling of user-related data	Data User Applications
4. Data collection	CCU Activities
5. EADAS system definitions and calculations	Data Base Integrity
6. Real-time data surveillance - office equipment operation	Data User Applications -
7. Real-time data surveillance - measuring apparatus operation	Data User Applications -
8. Maintenance of Common Update System	Data Base Integrity
9. TDAS interface	CCU Activities
10. Data analysis - record base accuracy and measuring apparatus	Data User Applications -
11. Data analysis - office equipment operation and overall administration	Data User Applications -

TABLE B
RECOMMENDED GUIDELINES FOR SIZING

SIZING CONSIDERATIONS	LOCAL ADMINISTRATION	
	NETWORK SUPERVISOR	NETWORK MANAGER-ADMINISTRATION
TYPES OF CENTRAL OFFICE EQUIPMENT	NON-QUANTIFIABLE CONSIDERATIONS	
GROWTH (CO. EQUIPMENT ADDITIONS)		
AMOUNT OF ADDITIONAL FEATURES		
NUMBER OF ENTITIES: • METROPOLITAN • OUTSTATE	 2 - 4 > 4	 6 - 15 > 12
TOTAL SUBORDINATES • TRANSITION PERIOD • WITH MECHANIZATION	 3 - 15 3 5	 20 - 40 15 - 25
MAIN STATIONS	30,000 - 70,000	100,000 - 200,000

ORGANIZATION RECOMMENDATION
METROPOLITAN AREA

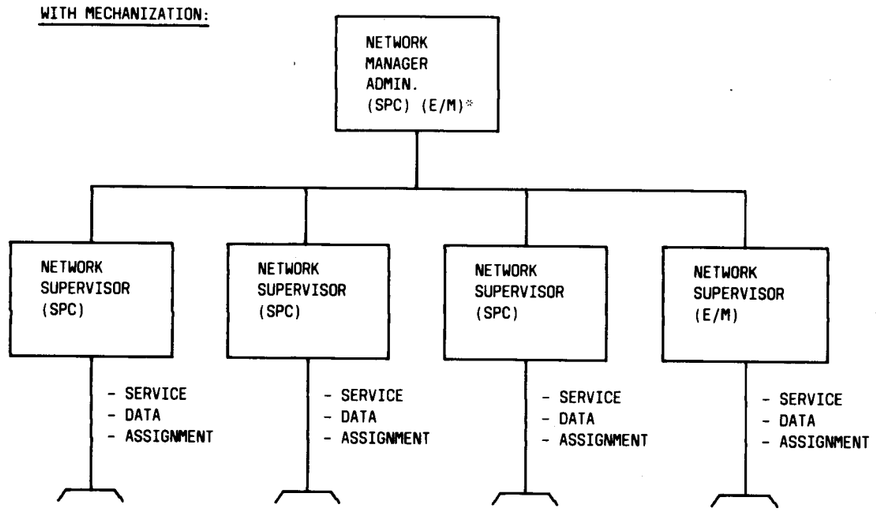


Fig. 1—Organizational Recommendations—Local Metropolitan Area (With Mechanization)—(3.07)

ORGANIZATION RECOMMENDATION
OUTSTATE AREA

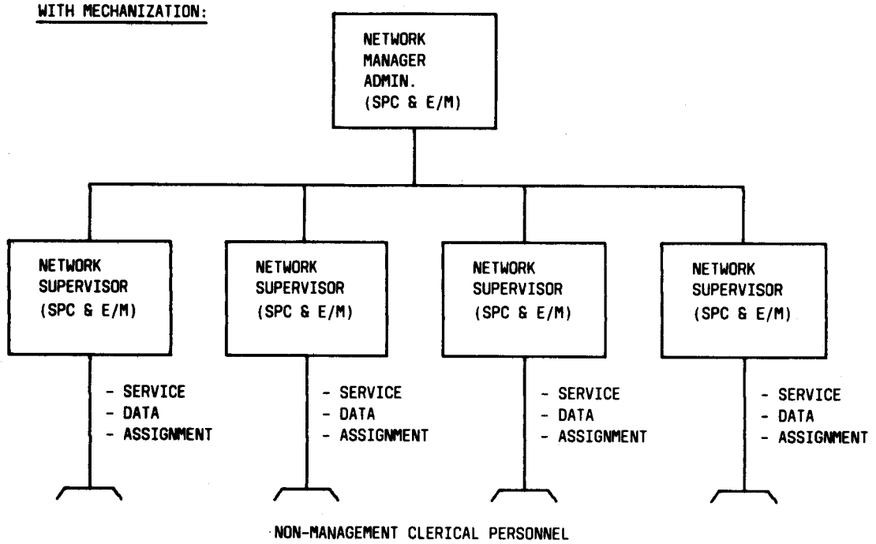
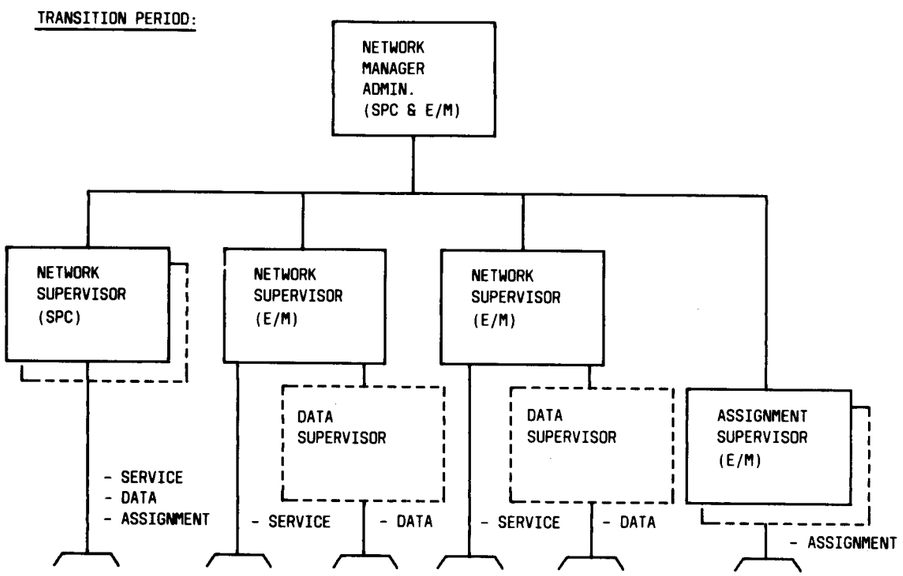


Fig. 2—Organizational Recommendations—Local Outstate Area (With Mechanization)—(3.08)

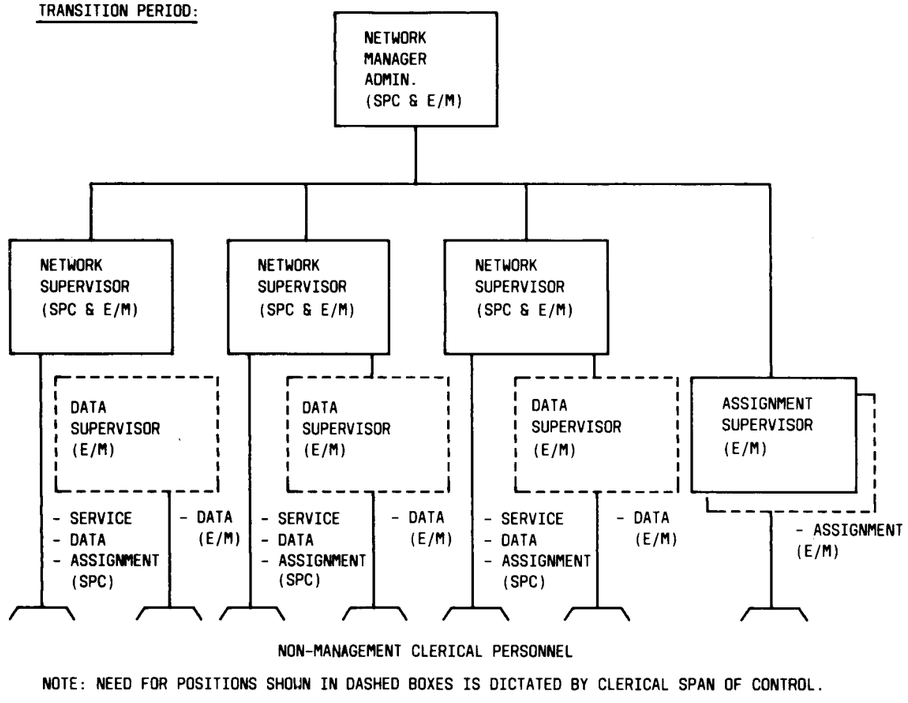
ORGANIZATION RECOMMENDATION
METROPOLITAN AREA



NOTE: NEED FOR POSITIONS SHOWN IN DASHED BOXES IS DICTATED BY CLERICAL SPAN OF CONTROL.

Fig. 3—Organizational Recommendations—Local Metropolitan Area (Transition Period)

ORGANIZATION RECOMMENDATION
OUTSTATE AREA



NOTE: NEED FOR POSITIONS SHOWN IN DASHED BOXES IS DICTATED BY CLERICAL SPAN OF CONTROL.

Fig. 4—Organizational Recommendations—Local Outstate Area (Transition Period)—(3.12)

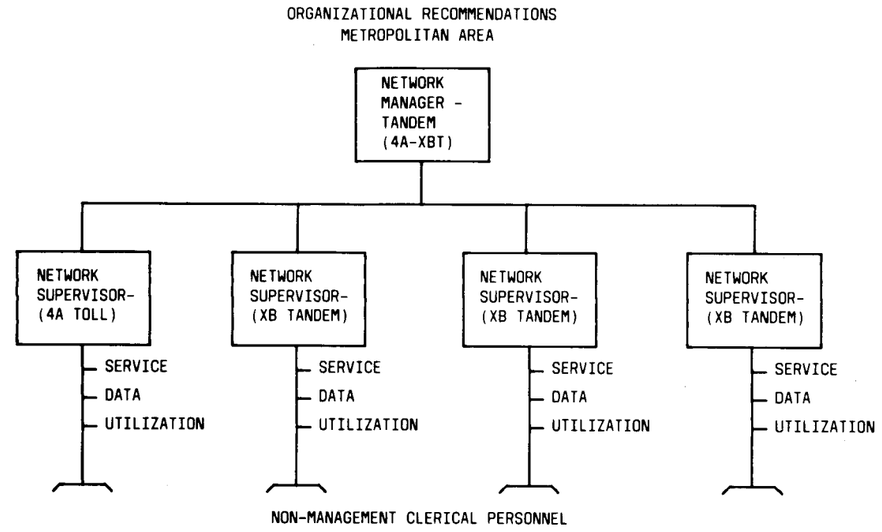


Fig. 5—Organizational Recommendations—Toll/Tandem Metropolitan Area (3.19)

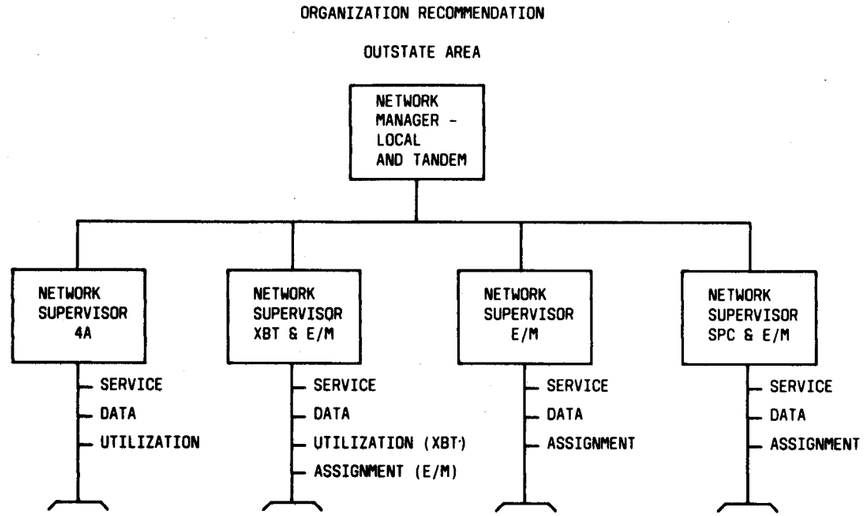


Fig. 6—Organizational Recommendations—Toll/Tandem Outstate Area (3.20)

TOTAL NETWORK DATA SYSTEM

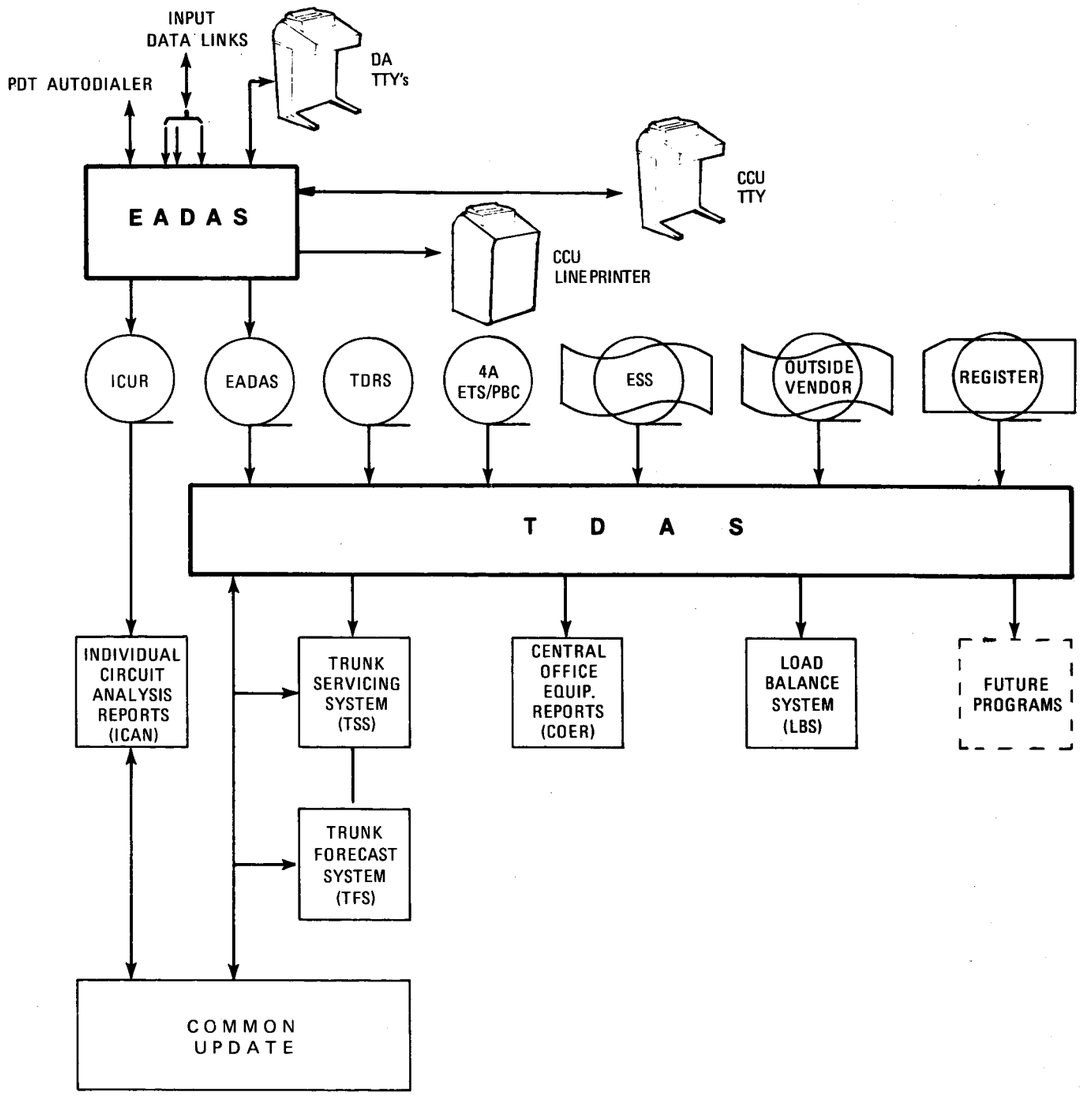


Fig. 7—Total Network Data System (3.29)

ALTERNATIVE A

TRADITIONAL APPROACH

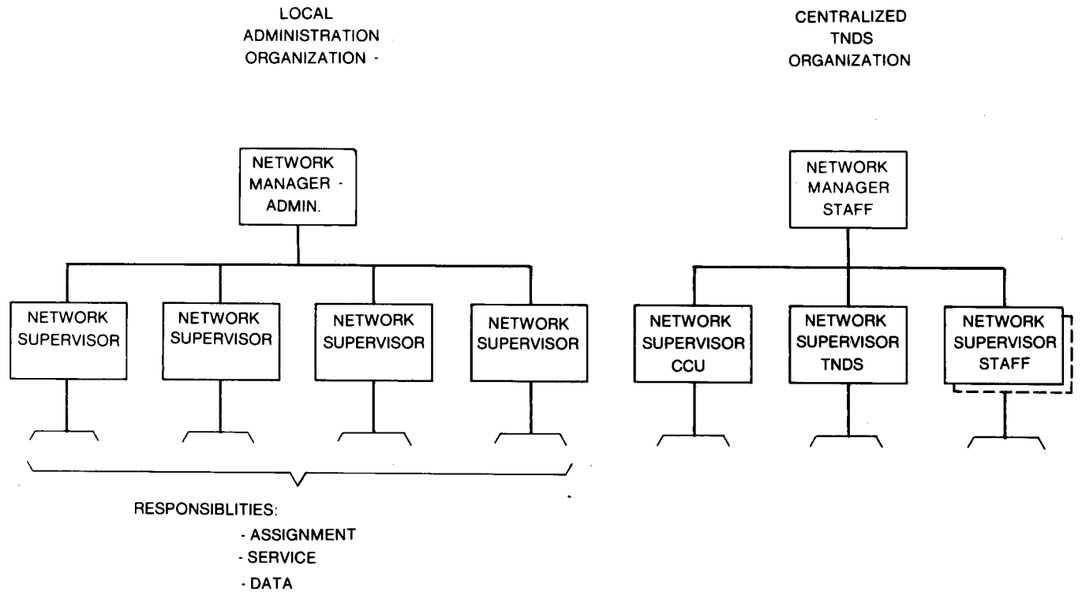


Fig. 8—Alternative "A"—Traditional Approach (3.54)

ALTERNATIVE B

FUNCTIONALIZED DATA SUPERVISOR

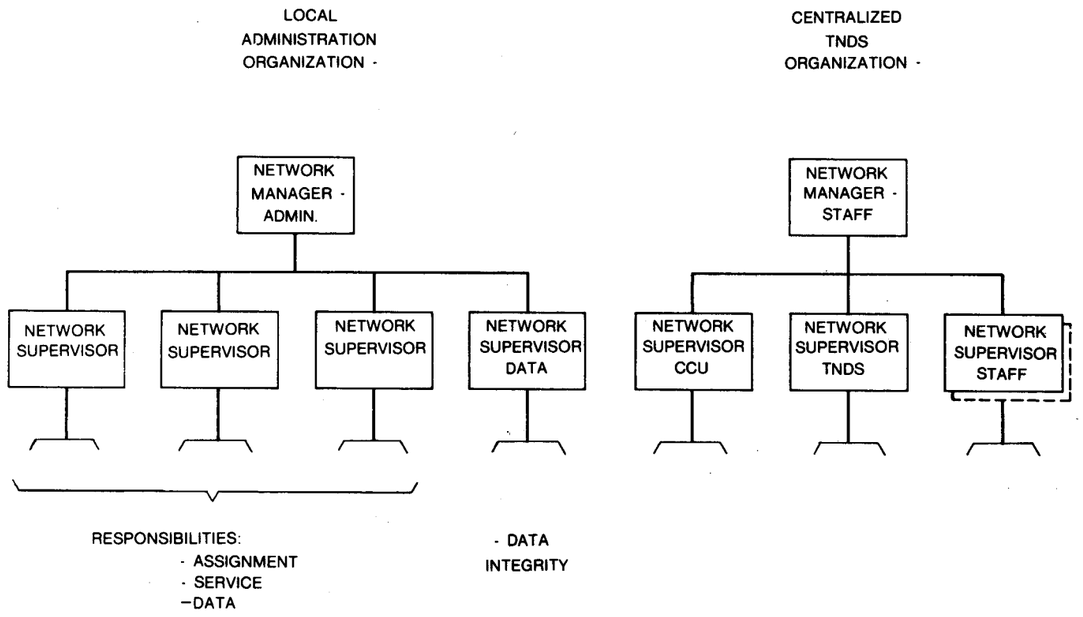


Fig. 9—Alternative "B"—Functionalized Data Supervisor (3.58)

ALTERNATIVE C

CENTRALIZATION OF DATA INTEGRITY RESPONSIBILITY

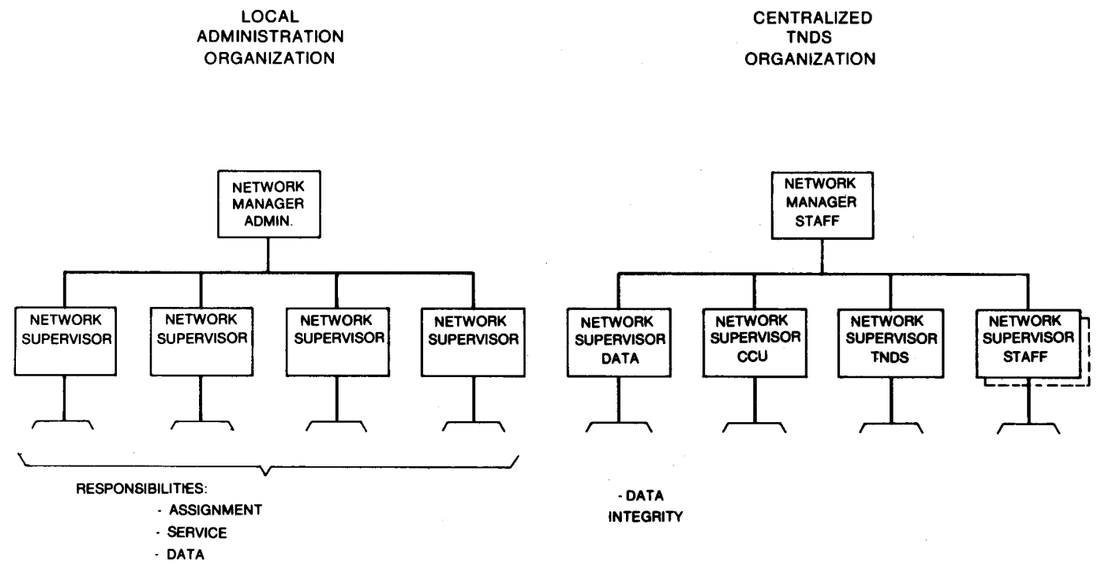


Fig. 10—Alternative "C"—Centralization of Data Integrity Responsibility (3.61)

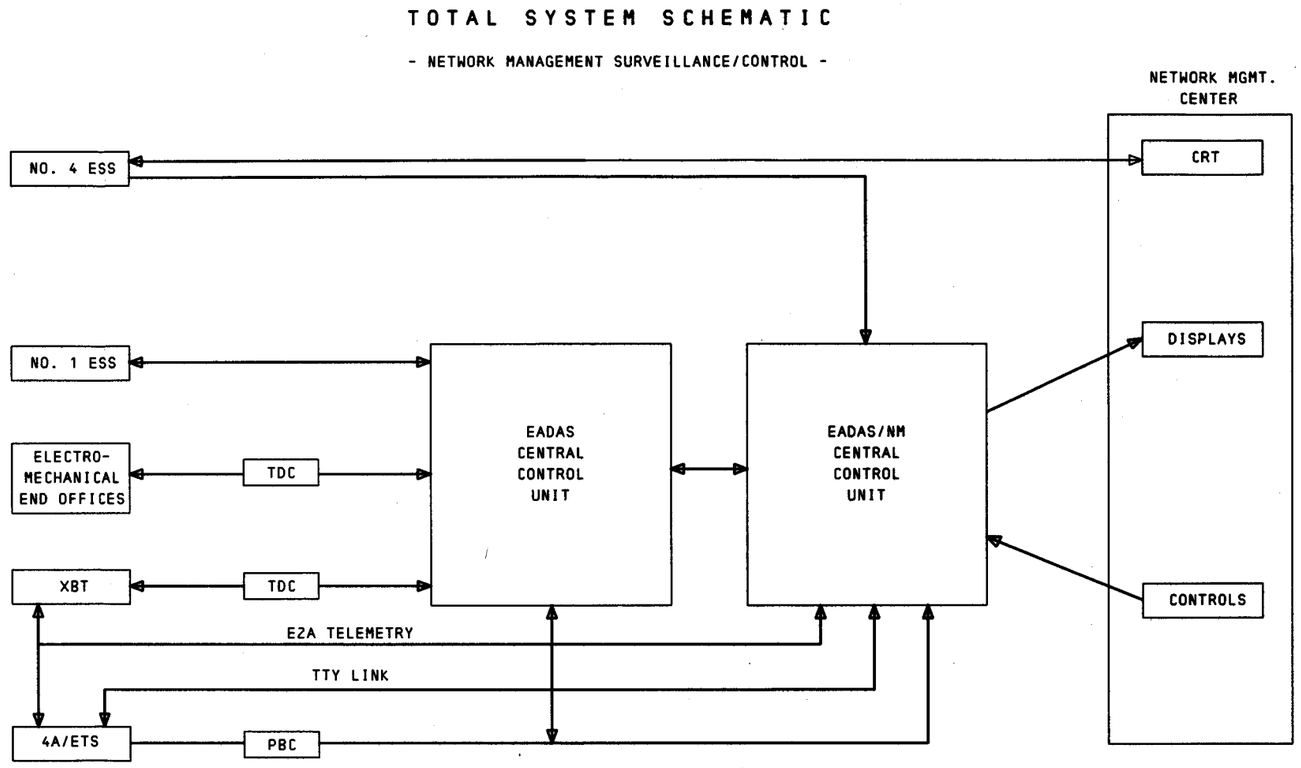


Fig. 11—Total System Schematic (3.73)

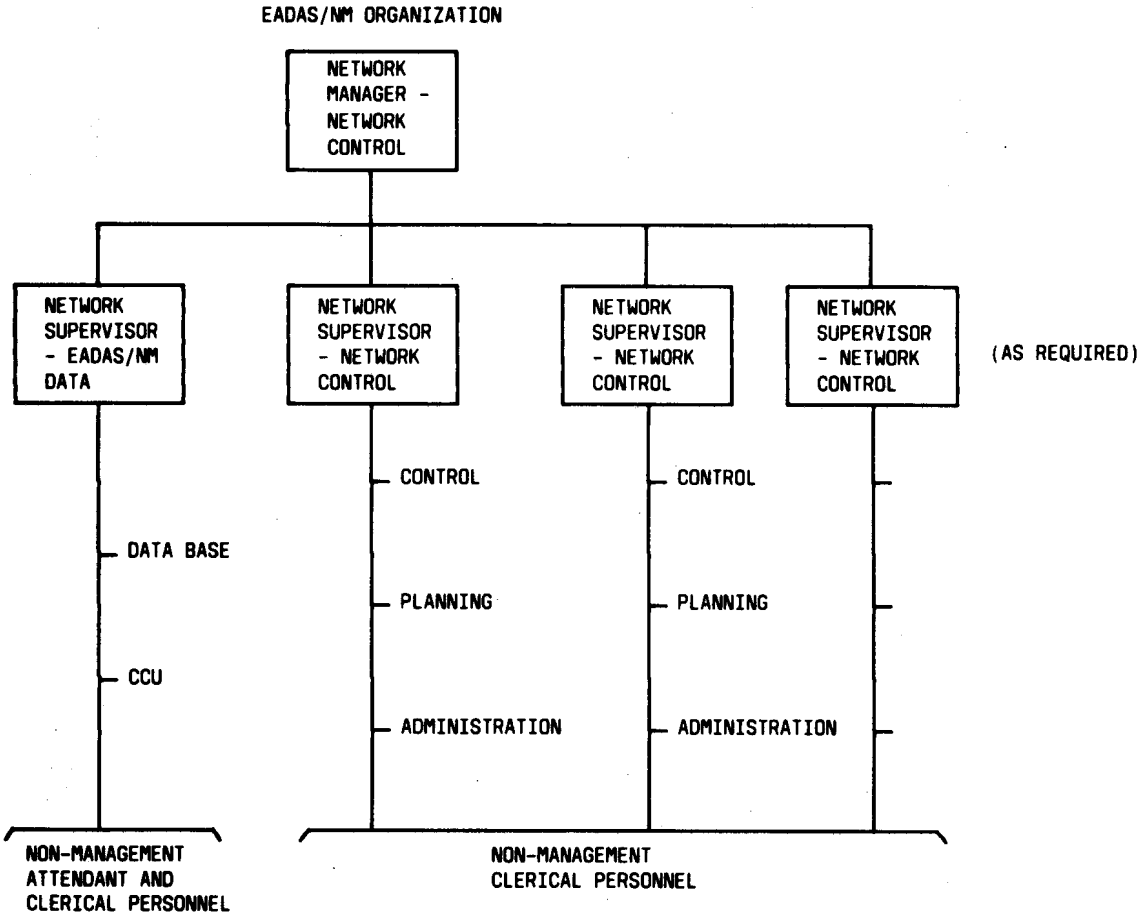


Fig. 12—EADAS/NM Organization (3.84)