John W. Lainhart IV
Inspector General

Office of Inspector General
U.S. House of Representatives
Washington, DC 20515–9990

MEMORANDUM

TO: Jeff Trandahl
Acting Chief Administrative Officer

FROM: John W. Lainhart IV
Inspector General

DATE: March 24, 1997

SUBJECT: Audit Report - Changes In Operating Practices Needed To Improve The Economy, Efficiency, And Effectiveness Of House Telecommunications Functions (Report No. 97-CAO-06)

This is our final report on the audit of telecommunications operational activities within the U.S. House of Representatives (House). This audit is the third of five audits performed on the House telecommunications environment. The objective of this audit was to assess the economy, efficiency, and effectiveness of the House telecommunications environment. In this report, we identified 4 findings and made 10 recommendations for corrective actions.

In response to our October 4, 1996 draft report, your office generally concurred with all the findings and recommendations. Your formal written response is incorporated in this report and included in its entirety as an appendix. The corrective actions taken and planned by your office are appropriate and, when fully implemented, should adequately respond to the recommendations. We consider the milestone dates provided for implementing the corrective actions reasonable. With respect to the resource constraints associated with selected actions indicated in your response, we trust that every effort will be made to obtain the necessary resources to implement those recommendations as expeditiously as possible.

We appreciate your office's positive attitude and cooperation throughout this audit. If you have any questions or require additional information regarding this report, please call me or Craig Silverthorne at (202) 226-1250.

cc: Speaker of the House
Majority Leader of the House
Minority Leader of the House
Chairman, Committee on House Oversight
Ranking Minority Member, Committee on House Oversight
Members, Committee on House Oversight

CHANGES IN OPERATING PRACTICES NEEDED TO IMPROVE THE ECONOMY, EFFICIENCY, AND EFFECTIVENESS OF HOUSE TELECOMMUNICATIONS FUNCTIONS

Report No. 97-CAO-06
March 24, 1997

RESULTS IN BRIEF

CONCLUSIONS

Within the House Information Resources (HIR) organization, the Communications Group is responsible for the data, voice, and video communications (telecommunications) needs of the U.S. House of Representatives (House). The Group manages and provides network connectivity, and telephone and voice mail services to Member, Committee, and other House offices. The Group oversees the Campus Data Network, which includes all House offices, is comprised of approximately 7,000 microcomputers on two backbones using Fiber Distributed Data Interface (FDDI[1]) and Ethernet[2] technologies. In July 1996, off campus networks total about 540, consisting of 288 telecommunications frame relay networks and 252 WAN private telecommunications lines to connect Members' Washington, D.C. and district offices. They also oversee the Washington, D.C. telephone system which has over 19,000 extensions operated from over 11,500 multi-button instruments (telephones and faxes). The district office telephone systems are comprised of about 900 locations. Voice mail facilities consist of over 5,600 mail boxes. Group and desktop video technology as well as computer telephony integration (CTI[3]) are in the early phases of deployment. By any standards, this environment would be considered one of the most diverse and complex telecommunications environments in use today.

The Communications Group has been very successful in accomplishing a number of initiatives and projects, which they can take pride in. To name a few, the Group has successfully implemented the frame relay services, which has resulted in a monthly savings to date of $8,000 to the House since January 1996. Continuing efforts to migrate all Members offices will reap further savings to the House. By implementing a network management system to manage and monitor the backbone and wide area network components, network reliability has averaged over 99 percent, which exceeds industry standards. In the problem management area, the Group implemented a 2-hour commitment for on-site response to network problems. In actuality, problems are typically responded to within one hour of the problem being reported. This response

[1]FDDI is a high speed fiber optic transmission technology that was first deployed with the start of the 103rd Congress. Within the House Campus Network, the House's FDDI Network is also known as BUDnet.

[2]Ethernet is a networking scheme that allows microcomputers to be connected to a network. It physically consists of cabling, which connects all the machines on a network.

[3]CTI is the merging of computers and telephones which makes possible fax-back systems, interactive voice response implementations, and a number of other specialized applications.

time is better than the typical response time in the private sector. In addition, the House's outbound long distance voice telecommunications rate is the least expensive in comparison to other government entities as well as private sector companies. Furthermore, the House's dependable and reliable voice services can be attributed to the contract with Lucent Technologies, which was negotiated by HIR. The contract contains extremely rigid requirements for vendor performance. Other projects and initiatives are either planned or underway to improve data, voice, and video telecommunications in meeting the Speaker's CyberCongress vision.

The results of our limited analysis of the House FDDI backbone showed the backbone to be solid from the architecture perspective and operating adequately. Because Congress was not in session at the time traffic statistics were gathered, the utilization statistics were low, as expected.

In short, the Group has provided more than adequate operational support and services. This is consistent with the results compiled from the Customer Satisfaction Survey administered by the Office of Inspector General in conjunction with this comprehensive telecommunications audit. The results of that survey indicated that users were generally "satisfied" to "very satisfied" with the quality of telecommunications services provided by HIR (see OIG Report No. 97-CAO-03, entitled *Results of The House Telecommunications Customer Satisfaction Survey*, dated March 24, 1997).

Notwithstanding the above, our review indicated that while the processes for implementing and maintaining the voice and data networks are generally adequate, some functions/processes are not well documented and can be enhanced by adding additional monitoring steps and system capabilities. In addition, there are opportunities for improving operational efficiency and effectiveness, which are discussed in the Findings and Recommendations Section of this report.

The following is a synopsis of the areas of weaknesses identified during our review:

- The House does not adequately conduct performance monitoring, which is a key function for optimizing network performance. Further, no standardized processes are in place for identifying the general health and performance level of the House switches. Thus, the House cannot comprehensively measure the effectiveness and performance of the engineering and maintenance practices undertaken by House staff or contractor staff related to the House's network.

- The House's current automated problem management system does not adequately track recurring problems. As a result, HIR is not able to adequately identify recurring problems in order to effectively identify trends. The current problem management system should be replaced.

- With a wide assortment of hardware and software to maintain, HIR staff must be diligent in assuring that all network components are functioning 24 hours a day, 7 days a week. The maintenance of critical equipment should be supported by adequate cost-effective procedures. Without formal maintenance policies and procedures stating when, how, and by whom

maintenance should be performed, management cannot be assured that operational errors and inefficiencies will not occur, which in turn can adversely impact the quality of service to users and potentially increase costs.

- HIR has not developed an effective plan for identifying and implementing CTI technology. As a result, the House may not be able to take full advantage of the opportunities, including cost savings, offered by this technology. In order to develop a useful plan that maximizes the benefits of CTI, the House must develop and implement a structured approach to identifying and implementing CTI.

RECOMMENDATIONS

We made a total of 10 recommendations to the Acting CAO to improve the operational aspects of the telecommunications functions. The recommendations include: (1) defining, identifying, and prioritizing all of the key points in the House network and implementing agents for those points; (2) initiating a proactive performance monitoring plan for each of the identified key points in the network, utilizing the network management system (NMS) to automate the process, and collecting historical data for trending and forecasting analyses; (3) implementing and executing a monthly switch analysis process to establish benchmarks and grade the health of the entire House switching platform; (4) establishing formal processes and procedures for implementing trending and forecasting analyses by transferring relevant switch measurements, such as the information from the switch analysis process, into a software tool that will allow management to forecast and better manage the growth of the House environment; (5) replacing the HIR Client Support System with a more effective system; (6) developing and implementing a plan to fully utilize the newly installed NMS, including defining thresholds and alarm conditions, configuring automated alarms and thresholds within the NMS, and developing and documenting procedures and policies for reacting to alarms; (7) requiring Lucent Technologies to provide a more detailed monthly Quality Assurance Report that will provide the necessary detail to conduct effective problem trend analyses; (8) developing and implementing formal maintenance policies and procedures; (9) conducting a cost-benefit analysis to determine whether it would be more economical to pay for service for district office voice equipment (i.e., small electronic key systems) on a time and materials basis rather than continue with the full service maintenance agreement; and (10) requiring HIR to follow an SDLC methodology, including a user needs analysis, for identifying and implementing CTI within the House.

MANAGEMENT RESPONSE

On January 16, 1997, the Acting CAO concurred with the findings and all 10 recommendations (see Appendix). According to the response, several initiatives are underway or planned to improve telecommunications operational areas. Examples of actions taken include: (1) defining, identifying, and implementing network management agents for many key network points, such as campus and frame relay routers; (2) implementing specific maintenance policies and procedures, such as end users notification, delineation of maintenance responsibilities, periodic analyses of maintenance contracts, and preventive maintenance schedules; and (3) evaluating current maintenance costs for reasonableness against a time and materials cost basis.

Major actions planned include: (1) documenting the definition, identification, and prioritization of all key points in the House network; (2) implementing agents for all key points on the House network; (3) initiating a proactive performance monitoring plan for each of the identified key points in the network, utilizing the NMS to automate the process, and collecting historical data for trending and forecasting analyses; (4) establishing and documenting the critical switch measurements, establishing top performance benchmarks, and grading the health of the entire House switching platform on a monthly basis; (5) establishing formal processes and procedures for implementing trending and forecasting analyses by transferring the information from the monthly switch analysis process into a software tool with growth graphing capabilities; (6) identifying and procuring a Customer Tracking System; (7) prioritizing the key network components, and developing and implementing a plan to fully utilize the installed NMS, including the definition of thresholds and alarm conditions, and automated alarms; (8) requiring Lucent Technologies to provide a more detailed monthly Quality Assurance Report that will provide more specific detail on trouble reports, maintenance activities, and trend analysis; and (9) ensuring that the Communications Group follows the SDLC methodology adopted by HIR in June 1996 in implementing CTI within the House.

Notwithstanding the planned actions, the Acting CAO informed us that implementation of several of the planned actions and/or their completion would be dependent upon their ability to obtain additional resources.

OFFICE OF INSPECTOR GENERAL COMMENTS

The Acting CAO's actions are responsive to the issues we identified and, when fully implemented, should satisfy the intent of our recommendations. The milestone dates provided for selected actions appear reasonable. With respect to the actions indicated in the report where implementation is dependent upon securing additional resources, we trust that the Acting CAO will make every effort to obtain the necessary resources to implement those recommendations as expeditiously as possible.

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I. INTRODUCTION

Background

House Information Resources (HIR) is the major provider of information technology services to the Members, Committees, and other offices of the U.S. House of Representatives (House). HIR is responsible for the voice, data, and video infrastructures used within the House, with the exception of the office level systems in the Member suites.

Two of the four groups within HIR, the Communications Group and Client Services Group, have responsibilities for providing and maintaining the telecommunications function. This audit evaluated the economy, efficiency, and effectiveness of the processes, procedures, and infrastructure used by these groups in the delivery of services to the user population.

The Communications Group provides voice, data, and video operations and services. It is responsible for the telecommunications needs of all House offices. This group manages networks and connectivity for all Washington, D.C. and district offices, providing telecommunications access and services to all Member, Committee, and other House offices. It also provides and manages telephone and voice mail facilities, and supports video conferencing capabilities. Internet[1] connectivity and administration is another aspect of the group's responsibilities facilitating Member and staff research and providing for dissemination of House information to the public. There are also over 1,300 active users via mainframe access connections. The Group oversees a large telecommunications arena. They oversee the Campus Data Network, which includes all House offices and is comprised of approximately 7,000 microcomputers on two backbones using Fiber Distributed Data Interface (FDDI[2]) and Ethernet[3] technologies. In July 1996, off campus networks total about 540, consisting of 288 telecommunications frame relay networks and 252 WAN private telecommunications lines to connect Members' Washington, D.C. and district offices.

The Client Services Group provides the client interface for voice, data, and video telecommunications resources. The Group oversees the Washington, D.C. telephone system which has over 19,000 extensions operated from over 11,500 multi-button instruments (telephones and faxes). The district office telephone systems are comprised of over 1,300 locations. Voice mail facilities in use consist of over 5,600 mailboxes. Group and desktop video

[1] The Internet is a large international network that connects many computer systems, providing network services including electronic mail (i.e., E-mail), remote terminal sessions, and multi-media services such as the world-wide web.

[2] FDDI is a high speed fiber optic transmission technology that was first deployed with the start of the 103rd Congress. Within the House Campus Network, the House's FDDI Network is also known as BUDnet.

[3] Ethernet is a networking scheme that allows microcomputers to be connected to a network. It physically consists of cabling, which connects all the machines on a network.

technology is in the early phases of deployment. The Client Services Group administers over 540 calling cards and 647 cellular phones.

HIR's Fiscal Year (FY) 1997 telecommunications budget was approved at $8.2 million, which included funds for existing operations and services, as well as new initiatives, such as migrating to a network-centric computing environment, creating a paper-less environment, and telecommunications system upgrades. Further, HIR's long-range telecommunications plan entitled *Five Year Investment Plan for the Infrastructure and Operations of the U.S. House of Representatives Communications* called for a total of $85.2 million between 1996-2000. This figure has since been reduced to $77.7 million, which reflects a $7.5 million budget reduction by the Subcommittee on Legislative Appropriations for FY 1997. Of the $77.7 million, $43.2 million (55.6 percent) is for equipment, operations and maintenance, and district to Washington, D.C. data services for Members; $15.5 million (19.9 percent) is for continuing switch and telephone upgrades; and the remaining $19 million (24.5 percent) is required to continue major enhancements to the House telecommunications infrastructure and services. Examples of infrastructure initiatives include campus data networking, switches, video and teleteaching, wiring, cables, fiber optics, voice processing, voice mail, cellular and wireless telecommunications, computer telephony integration, security, and disaster recovery.

Objectives, Scope, And Methodology

This audit is the third of five telecommunications audits aimed at evaluating the House's telecommunications environment. The five audits, all performed concurrently, focused separately on telecommunications security; telecommunications costs; economy, efficiency, and effectiveness of telecommunications; contingency planning, backup, and disaster recovery; and telecommunications management. In addition, we performed a telecommunications customer satisfaction survey.

The objective of this audit was to evaluate the controls pertaining to the economy, efficiency and effectiveness of the telecommunications environment. The scope of the review included voice, data, and video telecommunications within the House. The review encompassed the period of August 1995 through August 1996 and we conducted the work during the months of June through August 1996.

In addition, we conducted a network backbone analysis, using automated diagnostic software products, to assess whether HIR can improve the FDDI network backbone configuration to better manage network traffic and improve response time at the House. This backbone analysis study included gathering network performance and traffic information. The work was conducted between late September and mid-October 1996.

We conducted our audit in accordance with *Government Auditing Standards*, issued by the Comptroller General of the United States. To gather and verify data, we interviewed key personnel, reviewed relevant documents, and performed appropriate tests of various processes

and procedures. Specifically, we interviewed personnel in HIR as well as selected vendors. The methodology used to evaluate the controls surrounding the telecommunications network included:

- Determining whether proper planning processes exist and whether they guide day-to-day activity.

- Reviewing the current policies, procedures, and systems in place to ensure they met management "best practices".

- Evaluating the vendor contracts to determine the optimization level and cost efficiency.

- Determining the types of tools used in the various management processes.

- Conducting a network backbone analysis, using automated diagnostic software products (i.e., Network General's Distributed Sniffer System and FDDI Expert Analysis software), to gather network performance and traffic information for analysis.

Internal Controls

Within the scope of this audit, we evaluated internal controls related to economy, efficiency, and effectiveness of the telecommunications function. The audit disclosed internal control weaknesses related to moves, adds, and changes to network systems, configuration management, performance monitoring, trending/forecasting, problem management, change management, preventive maintenance, and computer telephony integration. These internal control weaknesses are described in the *Findings and Recommendations* section of this report.

Prior Audit Coverage

No prior audits have been performed related to economy, efficiency, and effectiveness of the House's telecommunications environment.

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II. FINDINGS AND RECOMMENDATIONS

Finding A: Inadequate Performance Monitoring Procedures Can Result In System Inefficiencies

The House does not adequately conduct performance monitoring, which is a key function for optimizing network performance. Further, no standardized processes are in place for identifying the general health and performance level of the House switches. Thus, the House cannot comprehensively measure the effectiveness and performance of the engineering and maintenance practices undertaken by House staff or contractor staff related to the House's network.

Current data telecommunications performance management process is inadequate

Performance monitoring is the monitoring of network activity to facilitate network fine tuning. It includes the (1) definition and prioritization of key network points (i.e., backbone[1] and Internet routers), (2) ability to monitor network performance on an ongoing basis, (3) capability to monitor remote components, and (4) trend analysis and forecasting. Effective performance monitoring optimizes both the network resources and end user performance. Under best practices, a large wide area network (WAN), such as the House network, should be managed centrally, and should include functions that automatically monitor network resources on a continual basis.

There is no formal process for defining and prioritizing key points on the House network. All key points in the network should be defined to include all interconnection devices (i.e., links that connect multiple offices and/or multiple users, local area networks (LANs), and any other links that provide access to the House network). Without a formal process for prioritization of key points in the network there may be confusion regarding the priority levels to be used for improving network performance or enhancing network performance to meet future needs.

A network management system (NMS[2]), NetView for Advanced Interactive Executive (AIX[3]), capable of performance monitoring has been installed. Performance monitoring is only done on an "as needed" basis (e.g., telneting to routers to manual track backbone statistics). Furthermore, remote monitoring of components requires that agents[4] be implemented in each device. The

[1]Backbones are networks implemented with the primary purpose of connecting other, smaller networks. Backbone networks rarely have end users directly connected to them but rather connect end user networks.

[2]A network management system is a system used to perform several critical management functions--problem management, performance management, and configuration management--within a data network.

[3]NetView for AIX is a network management system that utilizes the AIX operating system. The AIX operating system is International Business Machines Corporation's implementation of the UNIX operating system.

[4]An agent is a piece of software deployed in a hardware device such as a personal computer, router, or hub that provides usage and status information to an NMS.

House's backbone routers are configured with these agents, but other elements (e.g., the LAN hubs[5]) have not been upgraded to implement these agents.

Analysis of switch performance can be improved

Best practices call for the establishment of a consistent and thorough process for the analysis of performance indices on the various House voice systems on a regular (e.g., monthly) basis. These indices should be used to measure the performance of HIR staff, Lucent Technologies' staff, and the overall operation and health of the switching systems. The analysis of performance indices involves the compilation of available operational measurements that are then statistically weighted to reveal the performance level and real time usage of the switches. This practice will provide a system which is consistently and fairly scored while simultaneously eliminating any subjective inputs to this measurement process.

There is not a consistent, thorough process for grading the general health and performance level of the House switches. Without this process, HIR cannot comprehensively measure the effectiveness and performance of the maintenance and engineering practices conducted internally or by Lucent Technologies. The House Private Branch Exchanges (PBXs[6]) generate many operational measurements related to the performance of the critical components of the switches. HIR presently monitors the critical components of the network on a real time basis to identify trouble conditions. Processor occupancy is the key measurement used to identify abnormal conditions. Reports are also generated each week on several measurements during peak periods. However, the performance measurements are not statistically weighted to grade overall system and personnel performance.

Lack Of Trending/Forecasting Can Adversely Affect Capacity Planning

Trending and forecasting of switch usage and router port[7] usage is not performed uniformly. Lack of trending and forecasting can adversely affect capacity planning functions and current and future user needs determinations, lead to wasted resources, and inhibit problem prevention.

Based on industry best practices, trending and forecasting should be done on a regular basis on all

[5]A hub is a device that is used to connect other devices to provide a LAN between personal computers, printers, and other devices that have a need to communicate and are located in proximity to each other (e.g., a Member office).

[6]A PBX is a specialized computer system that provides voice telecommunications services in a specific locale. Because of its size, the House uses four PBXs that are connected together.

[7]A router port is a piece of hardware within a router that terminates a physical connection to either an end user or a network service.

key points, such as PBX components**,** backbone routers, etc. In its simplest form, trending involves migrating performance measurements and traffic reports, and placing them into a spreadsheet. This process provides invaluable at-a-glance historical usage trending of all relevant switch subsystems, trunks, peripherals, etc. It also represents a tool used to forecast necessary growth of the PBX switching and/or the backbone network.

Trending and forecasting is not performed uniformly over all relevant components of HIR's switching platform on a consistent basis**.** The current trending process is performed on a weekly basis on selective switch metrics. However, some trending and forecasting is done on router port utilization when the routers are directly attached to the FDDI backbone. FDDI port usage statistics are obtained on a regular basis, but all other ports are monitored on an "as needed" basis for troubleshooting and problem solving purposes. The existing NMS has capabilities for monitoring router port usage and collecting historical data, but these capabilities have not yet been utilized.

Without an effective trending and forecasting process, capacity planning functions are less effective. Trending information provides valuable insight into the current needs of the users when planning for upgrades, new technologies, etc. Inadequate planning can lead to misuse of funds and wasted resources, and inhibit problem prevention.

Recommendations

We recommend that the Chief Administrative Officer:

1. Define, identify, and prioritize all of the key points in the House network and implement agents for those points.

2. Initiate a proactive performance monitoring plan for each of the identified key points in the network, utilizing the NMS to automate the process, and collect historical data for trending and forecasting analyses.

3. Implement and execute a monthly switch analysis process to establish benchmarks and grade the health of the entire House switching platform.

4. Establish formal processes and procedures for implementing trending and forecasting analyses by transferring relevant switch measurements, such as the information from the switch analysis process, into a software tool that will allow them to forecast and better manage the growth of the House environment.

Management Response

On January 16, 1997, the Acting CAO concurred with this finding and all four recommendations (see Appendix). According to the response, the HIR Communications Group has already defined, identified, and implemented network management agents for many key network points, such as

campus and frame relay routers. Planned actions include: (1) documenting the definition, identification, and prioritization of all key points in the House network by June 1, 1997; (2) implementing agents for all key points on the House network by December 31, 1997; (3) initiating a proactive performance monitoring plan for each of the identified key points in the network, utilizing the NMS to automate the process, and collecting historical data for trending and forecasting analyses by the end of FY 1998; (4) establishing and documenting the critical switch measurements, establishing top performance benchmarks, and grading the health of the entire House switching platform on a monthly basis; and (5) establishing formal processes and procedures for implementing trending and forecasting analyses by transferring the information from the monthly switch analysis process into a software tool with growth graphing capabilities. For item 3 above, the response indicated that they would take action to implement our recommendation by the end of FY 1997 for key components that are deemed high priority. The processes surrounding the action items 4 and 5 are expected to be established and fully documented by the end of FY 1997.

Notwithstanding these planned actions, the response emphasized that implementation of these actions will be dependent upon the Communications Group's ability to obtain additional resources.

Office of Inspector General Comments

The Acting CAO's actions are responsive to the issues we identified and, when fully implemented, should satisfy the intent of our recommendations. The milestone dates provided appear reasonable. However, we trust that the Acting CAO will make every effort to obtain the necessary resources to implement the recommendations as expeditiously as possible.

Finding B: Current Automated Problem Management System Provides Limited Tracking Capabilities

The House's current automated problem management system does not adequately track recurring problems. As a result, HIR is not able to adequately identify recurring problems in order to effectively identify trends. The current problem management system should be replaced.

Problem management system needs to be replaced

Generally accepted standards for "help desk" operations indicate that the problem management system should be user friendly and provide meaningful data in the form of easy to read trouble tickets and reports. However, HIR's Client Support System, which is HIR's mainframe-based problem management system, is not user-friendly. For example, the system does not (1) provide "help desk" statistics, (2) link hardware problems to a specific piece of equipment via a tracking number, such as a serial number or asset tracking sticker, (3) have the flexibility to allow Network Control Center (NCC) staff to correct input errors, such as incorrect spellings or codes, (4) have security safeguards to prevent unauthorized access, and (5) allow for the easy generation of meaningful reports. As a result, NCC staff keep an on-going problem log on an independent, microcomputer-based system. The microcomputer-based system in place is an on-going word processing report that is used to track the status of all problems. However, even though the microcomputer-based system is more user friendly, it does not have the effective problem management tools discussed above. The Client Support System needs to be replaced by a system which has effective problem management tools.

The HIR Client Support System also tracks moves, adds, and/or changes (hereinafter referred to as M/A/Cs) to networks. Any change to a hardware or software component on any of the telecommunications supported networks requires that a change ticket be opened and tracked. Some M/A/Cs for the network are tracked via individual spreadsheets and microcomputer-based systems that are not integrated with the HIR Client Support System. Consequently, the Communications Group must gather information from multiple sources to provide status reports on M/A/Cs. Based on the information from the HIR Client Support System and individual spreadsheets, the Communications Group provides a report to management several times a week describing M/A/Cs that are in progress or completed as a result of requests that have been received. This data is useful to management for planning purposes, however, the method for gathering this data needs improvement.

The HIR Client Support System is not integrated with the NMS (i.e., NetView for AIX), which has the capability of detecting the location and type of equipment attached to the network. Interfacing these two systems would make system inventory (e.g., hubs and routers) easier and would facilitate the reconciliation of equipment locations as a result of M/A/Cs.

Network reporting tools should be integrated into one NMS

According to best business practices, all tools providing statistics on the health of the network should be integrated under one NMS to assist in the timely detection of errors. Several facilities exist in HIR for timely detection and correction of errors on key network components such as routers, workstations, servers, hubs, bridges,[8] and the cable plant[9]. These facilities include sniffers[10] on key WAN segments and CiscoWorks[11] on the Cisco routers. Frame relay reports are provided by MCI, and other WAN/LAN management tools (e.g., NetView for AIX) are also used. However, each of these tools are operating independently, many without threshold or alarm conditions set. In addition, due to the scope and complexity of the various data components that make up the WAN, various tools are used to monitor each component. As a result, the Network Administrator must be familiar with each component and understand the statistics being provided. Standardization, using one management tool, such as NetView for AIX, makes this task easier. Instead of having to learn and/or maintain many diverse systems, the Network Administrators can effectively develop and use one system tool to their full advantage. By relying on various tools that are not integrated, HIR has heightened the difficulty in managing and maintaining the network.

Finally, automated thresholds and alarms have not been fully configured within the NMS. Thresholds are the maximum acceptable, pre-defined operating conditions and limits under which a device should operate. Alarms provide notification of unusual network conditions such as increasing error counts and increasing utilization. Some network resources are checked for availability on a regular basis, but very few thresholds have been set. Thresholds can be set to trigger an alarm. Thresholds should include error rates, high utilization, and collisions. Alarms can include all, or some, of the following:

- Pager notification.
- Audible tones.
- Color changes (on the network management console).
- Messaging.

[8]A bridge is a computer device that is used to connect LANs.

[9]A cable plant is the physical wiring placed throughout a building to provide LANs, backbone networks, PBX extensions, and any other telecommunications services.

[10]A sniffer is a specialized computer that is placed on networks to gather traffic information.

[11]CiscoWorks is a software program added to NetView for AIX that provides for management of products from Cisco Systems Inc. (Cisco). Cisco is a leading provider of routers and Cisco routers are widely installed in the House networks.

Without thresholds and alarms, telecommunications managers do not have advance warnings of impending problems, which limits their ability to prevent failures or degradation of service to users.

To the credit of the Communications Group, they were aware of these network reporting and management weaknesses and planned to address these issues in FY 1997 and FY 1998. According to section II.H, entitled Network Management, of the House Information Resources Communications Group Strategic Project Plans and Descriptions 1997-1999 document, management plans to (1) develop a standard mechanism for reporting network traffic statistics and utilization in FY 1997; (2) implement automatic paging and notification functions in FY 1998; and (3) set appropriate system thresholds for alert reporting in FY 1998.

Problem identification and tracking processes are inadequate

Under best practices, the House should regularly analyze the types of problems their telecommunications systems are experiencing in order to identify problem areas as soon as possible and to establish a plan to minimize such problems. Currently, there is a manual process in place to analyze the House's telecommunications systems.

The House's process for identifying and tracking the causes and frequency of recurring network problems is inadequate. HIR's Client Support System is cumbersome and difficult to use. It does not provide sufficient trending statistics because of its limited reporting capabilities. Recurring problems are noticed only as a result of staff familiarity with the nature of the problems they are dealing with. Also, a lack of standard verbiage used to describe a problem makes it difficult to determine if a problem is recurring.

Lucent Technologies provides HIR management a monthly "Quality Assurance Report", which is intended to identify and track the causes and frequency of recurring problems to facilitate performance trend analysis of these problems. However, the report is insufficient to effectively perform this task. The report consists of one page of information that identifies the number or problems/maintenance visits broken out for various types of equipment. The document does not describe the types of problems for each piece of equipment and, therefore, does not provide enough information to accurately perform problem trend analyses. This lack of information decreases HIR's ability to perform analysis activities. For instance, HIR has cited as a reason for upgrading the telephone instruments the fact that other members of a Definity user's group complained about the faceplate membrane on the instruments wearing out. This is the type of information that should be included in the quality assurance report and tracked from month to month.

There are several impacts of not performing adequate problem trend analyses. First, HIR may not be able to identify frequent problems and their causes. They, therefore, cannot take the necessary steps to minimize such problems. Second, certain problem trends may provide early warning signs of serious problems that could cause catastrophic outages. Any such trends would

presently go undetected. Finally, limited numerical data exists to support telecommunications system upgrade strategies based on system/device failure.

The Systems Support Group, implemented in May 1996 to provide support to the Technical Support Representatives, is tasked with reviewing the Client Services Group's "Open Issues Report" and based on that analysis, identifying recurring problems. While this group has contributed to problem trend analyses, more needs to be done.

Procedures for automating the addressing scheme are not incorporated into the NMS

Network addressing should be automated and maintained in an inventory database that is integrated with the NMS. At the very least, network addresses for infrastructure components should be logically monitored and tracked to prevent address conflicts. Currently, the addressing scheme for the House network is maintained manually on a spreadsheet. The NMS is able to automatically monitor and track these network infrastructure addresses, but the system has not been fully configured to do so. Without proper addressing schemes, problems such as network address conflicts and network resource failures can occur.

Recommendations

We recommend that the Chief Administrative Officer:

1. Replace the HIR Client Support System, ensuring that the replacement:

    - Contains a user-friendly means of inputting data;
    - Provides "help desk" statistics;
    - Facilitates the easy detection of problem trends;
    - Includes trends and open issues information in its reports;
    - Interfaces problem management information with the installed NMS; and
    - Contains security safeguards to prevent unauthorized access.

2. Develop and implement a plan to fully utilize the newly installed NMS, including addressing the following areas. (This requires an investment in additional resources--i.e., time and personnel, hardware, and software.)

    - Define thresholds and alarm conditions, then configure automated alarms within the NMS.

    - Develop and document procedures and policies for reacting to the alarms.

3. Require Lucent Technologies to provide a more detailed monthly Quality Assurance Report that will provide the necessary detail to conduct effective problem trend analyses.

Management Response

On January 16, 1997, the Acting CAO concurred with this finding and all three recommendations (see Appendix). According to the response, efforts are underway to identify and procure a Customer Tracking System. The new system is expected to include all the functionalities and capabilities outlined in Recommendation 1. This system is expected to be implemented by the end of Calendar Year 1997. In addressing Recommendation 2, the Communications Group plans to prioritize the key network components, and then develop and implement a plan to fully utilize the installed NMS, including the definition of thresholds and alarm conditions, and automated alarms. Policies and procedures will be developed and documented for reacting to alarms. The response stated that full implementation could not be accomplished until the end of FY 1998 due to the size of the House network and the number of key components that need to be addressed. However, they expected to complete action on key components that are of higher priority by the end of FY 1997. Lastly, the Communications Group intends to require Lucent Technologies to provide a more detailed monthly Quality Assurance Report that will provide more specific detail on trouble reports, maintenance activities, and trend analyses. These new reporting requirements are expected to be in place for the February 1997 reporting cycle.

The response emphasized that full implementation of corrective actions related to Recommendations 1 and 2 will be dependent upon HIR's ability to obtain additional resources to assign to the projects.

Office of Inspector General Comments

The Acting CAO's actions are responsive to the issues we identified and, when fully implemented, should satisfy the intent of our recommendations. The milestone dates provided appear reasonable. We trust that the Acting CAO will make every effort to obtain the necessary resources to implement the recommendations as expeditiously as possible.

Finding C: Lack of Formal Preventive Maintenance Policies And Procedures Could Result In Extended Telecommunications Downtime And Excessive Repair Costs

With a wide assortment of hardware and software to maintain, HIR staff must be diligent in assuring that all network components are functioning 24 hours a day, 7 days a week. The maintenance of critical equipment should be supported by adequate cost-effective procedures. Without formal maintenance policies and procedures stating when, how, and by whom the maintenance should be performed, management cannot be assured that operational errors and inefficiencies will not occur, which in turn can adversely impact the quality of the service to users and potentially increase costs.

Formal maintenance policies do not exist

Generally accepted standards in this area state that a maintenance policy should exist and should include, but not be limited to, the following:

- Preventive maintenance schedules, based on vendor recommendations.
- Acceptable hours when maintenance can occur.
- Notification procedures for end users.
- Areas of responsibility.
- Pricing for items not covered under warranty or contract.
- Acceptable billing time frames for contracts (monthly, annually, etc.).

There are currently no formal maintenance policies or procedures within the House that define the tasks performed in order to keep equipment and systems operational. Currently, maintenance is defined by HIR as a function of system changes, and some procedures are outlined in the *Communications/Operations Binder* (section entitled *Communications Group Network Change and Problem Procedure*). However, the procedures do not adequately cover maintenance requirements.

The lack of formal maintenance policies and procedures could potentially have an adverse impact on the overall telecommunications operations. Without a document stating when, how, and by whom the maintenance should be performed, a lack of standard practices results, which contributes to increased costs and inefficiencies and decreased quality of service to users.

The House may be overpaying for district office telephone maintenance contracts

Best practices dictate that maintenance contracts be reviewed periodically to determine if they are the most cost-effective option available. In order to conduct this analysis, records must be

maintained that indicate the number of maintenance calls for each month, the length of each repair visit, and the procedures that were performed.

HIR provides small electronic key systems[12] for use in the Member's district offices. Most of these systems are purchased from Lucent Technologies. The House has a maintenance contract for this equipment with Lucent Technologies at a cost of approximately $25,000 per month. This contract is a full service contract under which Lucent will repair any faulty equipment in return for a fixed monthly fee per handset. These instruments (i.e., systems and handsets) are typically very reliable systems and therefore do not require much maintenance. Full service contracts are usually an expensive option for maintaining this type of equipment compared to other available maintenance plans. Lucent provides a maintenance plan option under which the House can pay time and materials charges for each instance in which Lucent is dispatched on a maintenance call.

Presently, the House does not conduct periodic analyses of its maintenance contract because it does not maintain the necessary information. Furthermore, Lucent Technologies is not able to readily provide this information. Failure to conduct this analysis may mean that the House pays more than necessary to maintain this equipment.

Recommendations

We recommend that the Chief Administration Officer:

1. Develop and implement formal maintenance policies and procedures that include:
    - Preventive maintenance schedules, based on vendor recommendations.
    - Hours when maintenance can occur.
    - How end users are notified of upcoming maintenance.
    - Delineation of maintenance responsibilities.
    - Pricing for common procedures not covered under warranty or contract.
    - Approved billing cycles for maintenance contracts.
    - Periodic analyses of maintenance contracts to determine the most cost-effective options.

2. Conduct a cost-benefit analysis to determine whether it would be more economical to pay for service for district office voice equipment (i.e., small electronic key systems) on a time and materials basis rather than continue with the full service maintenance agreement. Based on

[12] An electronic key system is similar to a small PBX and is a specialized system that provides voice telecommunications services. This system supports handsets and provides features, such as hold, transfer, and call forwarding.

the results of this study, if warranted, make a recommendation for change to the Committee on House Oversight.

Management Response

On January 16, 1997, the Acting CAO concurred with this finding and both recommendations (see Appendix). The HIR Communications Group stated that many of the specific policies and procedures cited in Recommendation 1 were implemented and practiced. They agreed to document maintenance policies and procedures to include all issues addressed in the recommendation by the end of FY 1997. In responding to Recommendation 2, the Acting CAO indicated that maintenance costs are and will continue to be periodically reviewed by HIR's Client Services Group for reasonableness. The response indicated that HIR recently conducted a review of the type of services provided by Lucent Technologies and compared current costs for those services against a time and materials cost basis. Based on this work, HIR concluded that, at this time, it would be more economical to stay with the existing maintenance agreement. In addition, the Acting CAO further informed us that the Office of Procurement and Purchasing was in the process of developing a certification program for maintenance providers, whereby Members could select a maintenance provider from a list of certified providers.

Office of Inspector General Comments

The Acting CAO's actions are responsive to the issues we identified and, when fully implemented, should satisfy the intent of our recommendations. The milestone date provided for Recommendation 1 appears reasonable. We consider Recommendation 2 closed.

Finding D: Inadequate Planning Of Computer Telephony Integration Could Delay Deployment Of This Beneficial Technology

HIR has not developed an effective plan for identifying and implementing Computer Telephony Integration (CTI[13]) technology. As a result, the House may not be able to take full advantage of the opportunities, including cost savings, offered by this technology. In order to develop a useful plan that maximizes the benefits of CTI, the House must develop and implement a structured approach to identifying and implementing CTI.

CTI is the result of advances in the computer-based technologies used in the public telephony network and in most business locations. It represents the true integration of voice and data telecommunications and processing technologies. CTI involves subscribing with public carriers to receive the identification of the calling number. The calling number is captured by the voice switch and routed to a database. This database will attempt to match the calling number with a specific customer's number(s). If there is a match, both the phone call and the specific customer records are delivered to the answering position simultaneously. The major benefit is the increased efficiency in handling calls because the process of conducting a search for records pertaining to the call is eliminated.

CTI is presently very popular in business locations that handle large numbers of incoming calls as it facilitates this process. Under best practices there should be a structured approach to identify and implement CTI in those areas of the House that handle large numbers of caller inquiries (e.g., HIR "help desks", central operators, and Member offices).

HIR has identified several areas within the existing user community that would benefit from the implementation of CTI. The 5-year budget includes funds in Years 4 and 5 for the implementation of this technology. Present responsibility for identifying and implementing CTI rests with the vendors providing information systems to the Members' offices. While HIR has identified potential uses of this technology, responsibility for further development of these opportunities rests with these outside vendors**.** Dependence on outside vendors for the development of such technology is inappropriate. Without a formal internal plan for identifying user CTI requirements and implementing CTI applications, opportunities to make the House telecommunications system as effective as possible may be overlooked. In addition, cost savings that typically are the result of the implementation of CTI may not be realized.

In order to develop an effective plan that will meet the needs of the House and maximize the benefits of CTI, the House must first develop and implement a formal systems development life cycle (SDLC) methodology. An SDLC methodology provides a well-established, structured approach for managing a system implementation project. This structured approach includes guidelines spanning from planning the project to execution of key activities throughout the project

[13]CTI is the merging of computers and telephones which makes possible fax-back systems, interactive voice response implementations, and a number of other specialized applications.

to system implementation. Some of the fundamental baseline activities in an SDLC methodology include identifying user requirements, conducting feasibility studies, and performing a cost-benefit analysis, conducting comprehensive testing, executing a well thought-out implementation plan, and addressing on-going maintenance requirements.

Recommendation

We recommend that the Chief Administrative Officer follow an SDLC methodology, including a user needs analysis, for identifying and implementing CTI within the House. Specifically, the user needs analysis should focus on those areas that receive a large number of calls, in particular, the House/Senate operators and HIR.

Management Response

On January 16, 1997, the Acting CAO concurred with this finding and recommendation (see Appendix). According to the response, the Acting CAO intends to ensure that the Communications Group follows an SDLC methodology in implementing CTI within the House. They also intend to hire a contractor to conduct a user needs analysis and develop recommendations for CTI implementation for the House/Senate operators and HIR. Pending the availability of FY 1997 funds to do this, the Communications Group anticipates being able to develop recommendations by the end of Calendar Year 1997.

Office of Inspector General Comments

The Acting CAO's actions are responsive to the issues we identified and, when fully implemented, should satisfy the intent of our recommendation. The milestone date provided appears reasonable.

Office of the
Chief Administrative Officer
U.S. House of Representatives
Washington, DC 20515

MEMORANDUM

To: Robert B. Frey III
Deputy Inspector General

From: Jeff Trandahl
Acting Chief Administrative Officer

Subject: Telecommunications Economy, Efficiency and Effectiveness Audit

Date: JAN 16 1997

Thank you for the opportunity to comment on the draft audit report. We have carefully reviewed the draft audit report and the recommendations contained therein, and are in general agreement. Specific comments on each recommendation follow.

Finding A:
Recommendations:

1. **Concur** HIR Communications has already defined, identified and implemented network management agents for many key network points such as campus and frame relay routers. Given the appropriate resources, HIR Communications will document the definition, identification, and prioritization of all key points in the House network by June 1, 1997. Given the appropriate resources, HIR Communications will implement agents for all key points on the House network by December 31, 1997.

2. **Concur** Based on the prioritization of key components in the preceding recommendation, HIR Communications will initiate a proactive performance monitoring plan for each of the identified key points in the network, utilize the NMS to automate the process, and collect historical data for trending and forecasting analyses. Because of the size of the House Network(s) and the expected number of key points to be addressed, comprehensive compliance to this recommendation is forecasted by the end of fiscal year 1998. For key components determined to be higher priority, action will be taken to implement this recommendation by the end of fiscal year 1997. The ability to perform the functions

detailed above is contingent upon the availability of additional personnel, hardware, and software resources.

3. **Concur** HIR Communications will establish and document the critical switch measurements, establish top performance benchmarks, and grade the health of the entire House Switching platform on a monthly basis. This process will be established and fully documented by the end of Fiscal Year 1997. The ability to perform the functions detailed above is contingent upon the availability of additional resources.

4. **Concur** HIR Communications will establish formal processes and procedures for implementing trending and forecasting analyses by transferring the information from the current monthly switch analysis process into a software tool that will allow growth to be graphed. This process will be established and fully documented by the end of Fiscal Year 1997. The ability to perform the functions detailed above is contingent upon the availability of additional resources.

Finding B:
Recommendations:

1. **Concur** HIR is in the midst of a project to identify and procure a Customer Tracking System. The new Customer Tracking System will include a user-friendly means of inputting data, 'help desk' statistics, an easy means of detecting problem trends, trending and open issue reporting capability, an interface capability to the House NMS, and security safeguards to prevent unauthorized access. This new system is scheduled to be in place by the end of 1997. The ability to implement the system detailed above is contingent upon the availability of the necessary resources.

2. **Concur** Based on the prioritization of key network components, HIR Communications will develop and implement a plan to fully utilize the installed NMS, including the definition of thresholds and alarm conditions, automated alarms, and the development and documentation of procedures and policies for reacting to alarms. Because of the size of the House network(s) and the expected number of key components to be addressed, comprehensive compliance to this recommendation is forecasted by the end of fiscal year 1998. For key components determined to be higher priority, action will be taken to implement this recommendation by the end of Fiscal Year 1997. The ability to perform the functions detailed above is contingent upon the availability of additional personnel, hardware and software resources.

3. **Concur** HIR Communications will require Lucent Technologies to provide a more detailed monthly Quality Assurance Report that will provide more specific detail on trouble reports, maintenance activities and trend analysis. These new reporting requirements will be in place for the February 1997 report.

Finding C:
Recommendations

1. **Concur** HIR Communications has implemented and practices many of the policies and procedures listed in this recommendation including notification to end users, delineation of maintenance responsibilities, periodic analyses of maintenance contracts, preventative maintenance schedules, and identification of hours when maintenance can occur. By the end of Fiscal Year 1997, HIR Communications will document formal maintenance policies and procedures to include all issues raised in this recommendation.

2. **Concur** The maintenance costs paid for by the House are and will continue to be reviewed periodically by HIR Client Services for "reasonableness." That is, reports are generated with the types of maintenance calls and the cost for the call, if any. Empirical data collected during the most recent periodic reviews indicate that Lucent is called more often for reprogramming of telephones and control units or for moving equipment within an office suite. Therefore, at this time it is more economical to stay with the existing maintenance agreement.

   In addition, the Office of Procurement and Purchasing is preparing a certification program for maintenance providers. A Member office may select a maintenance provider from the list of certified providers. In the future, Member offices will make the decision whether to sign a maintenance agreement, not the HIR Client Services Telecommunications Group.

Finding D:
Recommendations:

1. **Concur** HIR Communications will utilize an SDLC methodology, and follow the House of Representatives' *Guidelines for the Procurement of Goods and Services* to hire a contractor to conduct a user needs analysis and make recommendations on CTI implementation for the House/Senate operators and HIR. If Fiscal Year 1997 funds can be made available for this purpose, it is anticipated that a recommendation can be secured by the end of Calendar Year 1997.