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**STUDY OF NETWORK OPERATING
SYSTEMS FOR AMEX-USAID AFRICAN
BUREAU (AFR/MRP/PMI)**

TASK NUMBER 92-036

Prepared For:

**AMEX INTERNATIONAL/
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT
AFRICAN BUREAU
PROGRAM AND MANAGEMENT INFORMATION DIVISION**

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**STUDY OF NETWORK OPERATING SYSTEMS
FOR AMEX-USAID AFRICAN BUREAU (AFR/MRP/PMI)**

EXECUTIVE SUMMARY

A. PURPOSE OF THE STUDY

NMI was tasked by AMEX International and their client, the United States Agency for International Development (USAID) Africa Bureau's Program and Management Information Division (AFR/MRP/PMI) to review the status of the local and wide area network supporting the Program Officers, Advisors and staff located in the USAID Lynn Building, North 19th Street, Rosslyn, Virginia and New State (also called Main State), Washington, DC. Key areas of concern identified by USAID were:

- o **Connectivity and integration** issues surrounding the existence of multiple Network Operating Systems (NOS) (specifically Banyan and Novell).
- o **Network communication and connectivity required to support information** (E-Mail, fax, etc.), applications and data sharing within and external to USAID.
- o **The future viability of current USAID emerging standards and network strategies.**

The primary focus of NMI's review centered on the Novell LAN supporting USAID staff at the Rosslyn Lynn Building location and the issues surrounding network connectivity between this LAN and the other Banyan Vines based LANs within USAID.

NMI conducted a series of interviews with 15 USAID African Bureau personnel, USAID Information Resource Management (IRM) staff, and AMEX management. Based on the result of these interviews and our own examination of the USAID network environment, NMI developed a series of findings and recommendations which are summarized in the following sections.

B. FINDINGS

Connectivity and Integration of Novell and Banyan NOS:

NMI has determined that the most significant current issues facing USAID in the realm of Novell and Banyan connectivity are:

- Circuitous, unstable and low capacity physical network links between Lynn Building and other network users.
- The instability of the IBM hosted (Beltsville) SoftSwitch gateway which routinely causes interruption to electronic mail users and impact their daily job responsibilities.
- A lack of integration of electronic mail software across the USAID network. Post office (names and addresses) updates between Novell and Banyan Servers must be performed manually.
- The significant lag time required to receive mail at a distant international site (e.g., Africa) and the speed at which mail messages are processed within the Washington, D.C. area.

Network Communication and Connectivity Required to Support Information, Application and Data Sharing

The current ability of USAID to support information, application and data sharing is directly related to improving routing and the capacity of network connections between USAID facilities. Network-wide access to available applications and data also requires that tight integration be accomplished between services available on any server (Novell or Banyan). USAID users should not have to care where a given application and its data reside. NMI has concluded that:

- The present USAID networking architecture (see Attachment A) is inadequate to support any meaningful sharing of data or applications on a wide area basis.
- Presently "data sharing" is most commonly interpreted by users to mean "document sharing". Users generally are looking for simple connectivity solutions to allow them to review documents and other literature (studies, reports, etc.) previously prepared within USAID and other agencies (i.e., World Bank network sites). Currently, E-mail is the only widely available networking service to meet

this need.

- Communications within USAID organizations regarding available third-party products and other on-shelf applications is poor.
- No formalized planning process seems to exist to support the long-term development of common applications and/or data within a distributed environment such as that evolving within USAID.

Future Viability of Evolving Network Standards and Strategies:

It is not clear to NMI that a USAID strategy for network development has been implemented. We have concluded the following:

- USAID has *de facto* established Banyan Vines as their standard NOS, based on the number of servers supporting Banyan Vines vs. those supporting Novell's NetWare.
- Certain sites such as the Lynn Building, have become the focal point for establishing network connectivity to valuable external services such as CompuServe and the Internet.
- The Lynn building server seems to be responding to a demand for access to newer, more state-of-the-art products (eg. CD-ROM hardware and software) and applications. This demand is becoming more visible, particularly within the Washington D.C. area, as the level of user sophistication increases.
- In the long run, open systems standards will help resolve issues surrounding the integration of differing Network Operating Systems. In the short run, however, network managers should look for solutions which are more efficient and easily managed.

C. RECOMMENDATIONS/ALTERNATIVES

Connectivity and Integration of Novell and Banyan NOS

The options available to USAID to address Novell and Banyan NOS connectivity are:

- Upgrading of existing network connectivity and Workstation/PC user interfaces (Windows) to support seamless access to services on either NOS product. This option solves the E-mail integration issue by allowing any Lynn Building Novell workstation/PC to access Banyan or Da Vinci mail directly, as well as any other product or service available on the network.
- The replacement of existing Novell network operating systems with Banyan. Moving to Banyan would address the issue of E-mail post office directory updating. Speed and other issues associated with the use of mail would be unaffected since they are issues associated with network routing and capacity.

Both of these options are technically feasible. The selection of which option is most effective for USAID should be based on an analysis of both the costs of replacing current Novell facilities vs. upgrading WAN connectivity and workstations/PCs as well as future budget, telecommunication and network application development plans within USAID.

Network Communication and Connectivity Required to Support Information, Application and Data Sharing

NMI strongly recommends that a comprehensive study be initiated to assist USAID in documenting their goals for a distributed network and planning for the necessary infrastructure (telecommunications, applications, data management, security, staff resources, training, standards, budget, etc.). If USAID is unable to pursue this approach, NMI recommends the following:

- That USAID undertake a limited telecommunications/communication review to identify connectivity upgrades and routing modifications necessary to support a growing E-mail requirement within the Washington, D.C. area. The purpose of this review would be to identify and recommend those upgrades that are both technically feasible and cost effective given the current USAID environment.
- Implementation of the recommended upgrades identified in the above study.

Future Viability of Evolving Network Standards and Strategies

NMI believes that vendor independence and "open systems" strategies are crucial to the long term viability of any network. We also believe that the network itself is becoming indistinguishable from its components, be they wire, servers, operating systems, workstations, applications or data. The ability of a network to inter-operate and integrate with other networks, as well as support a wide variety of vendor products, must be a major goal for any organization hoping to emerge from the on-going upheavals within the Computer and Telecommunications industries. With these thoughts in mind, NMI would recommend that USAID:

- Maintain a broad set of technical options and attempt to manage and integrate multiple vendor products. This approach allows USAID to select the best from all vendors, and give up nothing.
- Focus on the issues necessary to develop the infrastructure required to support a long term migration to a distributed networking environment. Many of these issues are highlighted in the latest (September 1992) GAO study titled "AID IRM Review".

SECTION 1
STUDY OF NETWORK OPERATING SYSTEMS
FOR AMEX-USAID AFRICAN BUREAU (AFR/MRP/PMI)

BACKGROUND

1.1 INTRODUCTION

This study is provided for AMEX International and its client, USAID AFR/MRP/PMI. NMI conducted the study on the present network operating systems (Banyan and Novell) for the Program Officers, Advisors and staff located in the USAID Lynn Building office, Rosslyn, Virginia and New State (also called Main State), Washington, DC. The report is based on the findings from interviews conducted with selected USAID African Bureau personnel and USAID IRM staff. Key areas discussed during the interviews were:

- o **Connectivity and integration** issues surrounding the existence of multiple Network Operating Systems (NOS) (specifically Banyan and Novell).
- o **Network communication and connectivity required to support information** (E-Mail, fax, etc.), applications and data sharing within and external to USAID.
- o **The future viability of current USAID emerging standards and network strategies.**

Network end-user problems were identified with regard to these key areas. Recommendations/alternatives are presented to assist USAID AFR/MRP/PMI in reaching a decision on the current network operating systems (Banyan and Novell) and in achieving their goal of a seamless global inter-networking environment for the end-users.

The primary focus of NMI's review centered on the Novell LAN supporting USAID staff at the Rosslyn Lynn Building location and the issues surrounding network connectivity between this LAN and the other Banyan Vines based LANs within USAID. (Please see Appendix A for Current Network Connectivity.)

NMI is comfortable that the conclusions and recommendations contained in this report can reasonably be assumed to be applicable to the overall USAID network environment. However, USAID must appreciate that each of the areas of concern stated above are complex and warrant serious individual study prior to any management decision regarding priority,

implementation or resource allocation.

1.2 THE NMI STUDY TEAM

The NMI multi-disciplinary team consisted of the following personnel:

- o Dan Carr and Sharon Short, Technical Project Managers
- o Tom Scott, Banyan-Certified Systems Engineer
- o Joanna Jackson, Novell-Certified Systems Engineer

NMI takes pride in providing high-level technical expertise in the areas of networking and systems integration. NMI was a recipient of two Enterprise Networking Excellence (ENNE) awards, and was designated by *Computer Systems News* as one of the Top 50 Systems Integrators. Our relationship with key manufacturers of networking operating systems has been prosperous. NMI continues to be one of Banyan's largest resellers and achieved Banyan Premium Network Integrator Status in 1990. Our alliance with Novell also continues as a Novell Systems Integrator, achieving Novell Platinum Reseller status a few years ago. Thus, NMI is uniquely situated to identify alternative options and to recommend the most cost-effective technologies for the client's business strategy and goals.

1.3 THE USAID AND DEPARTMENT OF STATE PERSONNEL INTERVIEWED

NMI was provided a list of specific USAID and USAID IRM personnel to interview for this study. The determination of who was to be interviewed was made jointly with USAID, and reflected a broad cross segment of typical USAID network users, including technicians, managers, and other support personnel (reference Appendix B for Interview Questionnaire). The selected personnel are as follows:

- o Dennis Lauer, AFR/MRP/PMI
- o Ben Stoner, AFR/ARTS/FARA
- o Carl Lawhead, Project Officer, FARA
- o Jonathan Olsson, RSSA/FEWS
- o Tony Pryor, RSSA/FARA

- o Charles King, RSSA/HHR
- o Hugh Maney, RSSA/HRDA, Banyan LAN Manager
- o Walter Knausenberger, RSSA/FARA
- o Joe Anshien, USAID Banyan LAN Manager
- o Sean Doherty, USAID Banyan LAN Manager
- o Shonni Zeolya, USAID IRM Analyst
- o Bill Miller, USAID IRM LAN/Technical Manager
- o Ed Miller, AMEX Site Administrator
- o Felipe Tejeda, AMEX Contract Manager
- o Pamela Forsyth, AMEX/Novell LAN Manager

1.4 ASSUMPTIONS

NMI has assumed that the staff identified above are a representative cross section of the USAID network user community. During our interviews, NMI presumed that the opinions and responses given by staff under contract to USAID (not Government employees) reflected the opinions of their USAID government managers. NMI made no attempt to independently validate any information given us by interviewed staff, although information from one interview may have been used to structure questions in a succeeding interview. Interview information was generally reviewed with our USAID/AMEX customers.

NMI has reviewed the written material provided by AMEX as background information. These documents consisted of the AMEX Statement of Work, "Africa Bureau Information Needs Assessment," "Draft Issue Paper--Lan Incompatibilities--Convert to Banyan Vines?," several industry articles and references related to comparisons of Novell and Banyan, and the "GAO September 1992 AID IRM Review." Based on these documents, NMI is aware that major issues exist within the USAID IRM organization and across the agency regarding information technology and its applications. Most of these issues are beyond the scope of this particular task; however, NMI believes it is beneficial to point out that the findings, conclusions and recommendations incorporated in this study are symptomatic of the larger issues discussed in

these documents. Generally, no comprehensive solution to current AID issues is addressed in this report, and NMI views our recommendations and conclusions as short term and tactical in nature.

SECTION 2

FINDINGS

2.1 *CONNECTIVITY AND INTEGRATION OF NOVELL AND BANYAN NOS*

During the interviews of the USAID African Bureau personnel, it was determined that all end-users (Lynn Building and New State) depended on electronic mail (E-mail) as their primary link to the organization worldwide. Given this current and growing dependence on the use of electronic mail, the integration of mail products is presently the major issue which is driving the need to integrate Novell and Banyan LANs. Additionally, from a longer term planning perspective, it makes little sense for USAID to pursue investments in network services (applications, gateways, data, etc.) which cannot be globally shared and/or accessed. Regardless of the particular NOS, both Banyan and Novell users should be able to access and request services from any network resident resource.

2.1.1 *General Communications Requirements*

General communications connectivity requirements identified as being driven by electronic mail and pertinent to Novell/Banyan connectivity included the following:

- o Within the Washington, D.C. area
 - Lynn Building to New State (Main State) via SA40 (Beltsville)
 - Lynn Building to SA14 (USA TODAY Building)
 - Lynn Building to OICD (USDA) Novell LAN
 - Lynn Building to CDIE Novell LAN
 - Lynn Building to DISC Novell LAN
 - Lynn Building to SA40 (Beltsville) Gateway
- o In Africa
 - All Users link through SA14 to Africa
 - FIDONET link to 22 select sites in Africa
- o In Internet
 - Some Lynn Building users (contractors and universities) link via

Compuserve

o At the World Bank

Access exists to World Bank network via Compuserve at the Lynn Building.

NMI found it interesting to note that connectivity to Novell LANs external to USAID is required regardless of a decision to standardize all LANs within USAID on Banyan. Examples of these links are to USDA, CDC, and the Department of Commerce (Census).

Washington, D.C. Connectivity Requirements

Currently there are two communication links to New State from Lynn Building. The first link is HRDA (Banyan LAN) via a 2400-baud modem. This link is established via Banyan's Server-to-Server dial-up link. Repairs on the 9600-baud modem would increase data throughput. Additionally, it should be noted that the link is a voice-grade telephone line.

The second link to New State from Lynn Building is the Novell server (also called Gateway 4) connected via the SA40 (Beltsville, Maryland) Softswitch Gateway. The Lynn Building link to SA40 is via a 9600-baud modem. Note that the communications path for a message from Lynn Building is through SA40, Beltsville; then SA14, USA Today; and next, the New State connection. It has been determined that this connection has frequent reliability problems that can significantly impact end-users in their daily job responsibilities. Attachment A of this report presents a simplified network drawing for further understanding of these links.

The RSSAs have specific needs for electronic links to their "home-base," such as a link to OICD at USDA. It was noted that the networks discussed during the interviews were all Novell LANs.

Africa Connectivity Requirements

The Lynn Building link to Africa can presently take three or four days for E-mail, which sometimes never arrives at the African destination on the network. This E-mail connection flows to SA40, Beltsville; then SA14, USA Today; and next, to the specific African LAN.

FIDONET has proven to be a reliable link to Africa. It is a point-to-point dial-up service. Once the link is established, data, E-mail, or file transfers can be sent at a baud rate of up to 9600. FIDONET was initially established for the South African Drought Relief program a year ago; however, it remains reliable today and could become a communications alternative for 22 specific sites in Africa (where low technology will continue to be the environment).

Internet Connectivity

All interviewed end-users strongly expressed requirements to utilize Internet. This network offers connections to contractors and universities, vital sources of pertinent information and contacts. Currently, Pamela Forsyth, the AMEX/Novell LAN administrator at Lynn Building, has established a link to the Internet via a 9600-baud connection to CompuServe. Once a user logs into the Novell Da Vinci mail system, they can access Internet through this CompuServe connection. During discussions at USAID IRM, it was determined that they are considering a direct link to Internet from SA14.

World Bank Connectivity Requirements

Several end-users need to access specific worldwide sites, such as sites in Europe and Africa. Intra-network connectivity with a network such as the World Bank (X.400 capability) network can provide access to these sites, as well as links to valuable information and applications. Limited electronic mail access is presently available through the Lynn Building Da Vinci mail CompuServe gateway.

2.1.2 Overall Connectivity Issues

NMI has determined that the most significant current issue facing USAID in the realm of Novell and Banyan connectivity is the integration of electronic mail across the USAID network. The Novell Da Vinci mail product, while offering more sophisticated user features, is unable to automatically accept or distribute post office names and address directory updates with its Banyan counterpart. This lack of integration requires that post office updates be performed manually on both the Novell and Banyan Servers. The Banyan mail product, however, through use of StreetTalk and the VINES global naming features, automatically updates its post offices with name and address changes. In addition to the basic issue of being able to address mail using an up-to-date post office directory, other issues surrounding the use of E-mail were also noted. These additional issues all centered on either the time required to receive mail at a distant international site (i.e., Africa), as well as the speed at which mail messages are processed within the Washington, D.C. area. Several users noted that their ability to receive and send mail was routinely interrupted by problems associated with the IBM, (Beltsville) SoftSwitch.

Moving beyond the issues of electronic mail, NMI would offer two perspectives regarding the long-term Novell/Banyan integration and connectivity issues facing USAID. From a technological perspective, true seamless integration of these two NOS products is highly dependant on USAID's ability to provide a robust WAN environment supporting high capacity and reasonably direct links between USAID facilities. Additionally, client/workstation PC must be of sufficient capacity to load and manage dual transport protocols (IPX and VINES IP), or USAID may alternately consider implementing a single standard transport such as TCP/IP. The present USAID WAN configuration is not, in our opinion, conducive to achieving seamless multiple NOS integration.

From a user perspective, seamless integration will require implementing a NOS-independent user interface such as the Microsoft Windows, a graphical user interface (GUI), (a software interface to systems and applications residing on a PC). This interface will most probably require augmentation with a third-party product to support transparent switching

between NOS services, i.e., just click an icon and the correct NOS is accessed to execute the appropriate application or product. Although NMI noted Microsoft Windows on several USAID workstations, we are unclear regarding USAID's plans for its use as a standard GUI. In addition, use of a product such as Windows requires a minimum workstation/PC capacity equivalent to a high-end 386 configured with at least 4 MB of memory.

2.2 NETWORK COMMUNICATION AND CONNECTIVITY REQUIRED TO SUPPORT INFORMATION, APPLICATION, AND DATA SHARING

A variety of applications are currently being used within the different groups at both Lynn Building and New State. WordPerfect and Lotus are used almost universally. A number of other applications, such as Harvard Graphics, Lotus Freelance, Quattro Pro, Timeline, dBASE, and Foxpro, are used by various groups. In addition, Windows is increasingly being used, particularly at Lynn Building. In addition to the Lynn Building and New State sites, these applications are used extensively by employees in the field. Dial-in access with laptops remains data files, applications, and E-mail.

2.2.1 General Information, Applications, and Data Sharing Requirements

The major specific application requirement brought to our attention was for an integrated method of supporting project staff resource and calendar management, sharing/routing of project-specific notes and mail, and shared document development. Work groups supported by these applications could be formalized by organization or ad hoc project staff assembled to address a current USAID crisis.

Timeline, the project management package currently in use, is not being fully utilized. There is an immediate need for this software to be used concurrently by employees at both Lynn Building and New State. In order for this to occur, network users at each site, some currently using Novell and others using Banyan, must have access to the same project data files. Currently, the only means to achieve this is for users to send files via E-mail. As employees at both sites update files regularly, it is impractical for each employee to E-mail their updated files to every other employee who might need to access those files. In addition, Timeline is complex

and difficult to use without extensive training.

Similar difficulties were reported as associated with using available scheduling and calendaring software. NMI noted that although a need was expressed for this type of software, it is not widely used at Lynn Building or New State, and some users seem unaware of the existence of any available scheduling/calendaring system. As with project management software, effective use of a calendaring or scheduling package would require a reliable, high-speed, realtime interchange of data between the two sites.

2.2.2 Overall Information, Applications, and Data Issues

The current USAID WAN capabilities are apparently the result of a demand-driven, rather than planned process. Connectivity between and internal to buildings varies from T1 to voice-grade 2400-baud modems. Connectivity for Virginia buildings collocated in Rosslyn is routed through a Beltsville-based, IBM gateway or the New State facility in Washington, D.C. Indeed, connectivity between floors in the Lynn Building facility could technically be accomplished by routing through the Beltsville IBM hosted SoftSwitch gateway to the Rosslyn USA Today building, back to the New State building in Washington, and finally through a 2400-baud modem connection back to Lynn Building. Realistically, this approach is unworkable. Plans are apparently underway to address some of these issues, but the communication of these specific activities to the various sites (such as the Lynn Building) is poor. NMI was unable to locate any formalized telecommunications planning document.

The current ability of USAID to support information, application and data sharing is directly related to improving routing and the capacity of network connections between USAID facilities. The present USAID networking architecture is inadequate to support any meaningful sharing of data or applications on a wide-area basis. Any effective use of project management or scheduling software requires a basic file-sharing capability across the network. Network-wide (or Lynn Building) access to applications and databases resident at various USAID sites, such as the African Management Information System (AFRMIS), requires communication links robust

enough to permit timely viewing of files and database records while on-line. These issues point to the same two inadequacies in the connectivity between Lynn Building and New State: there is no high-speed link between the sites and no means, beyond E-mail, for communication between the Novell and Banyan systems.

NMI's investigations into applications and data sharing also uncovered an issue of poor communications within USAID Bureaus regarding available third-party products and other on-shelf applications. No formalized planning process seems to exist to support the long-term development of common applications and/or data within a distributed environment such as that evolving within USAID. Presently, "data sharing" is most commonly interpreted by users to mean "document sharing." Users generally are looking for simple connectivity solutions to allow them to review documents and other literature (studies, reports, etc.) previously prepared within AID and other agencies (i.e., the World Bank network sites in Europe and Africa).

2.3 FUTURE VIABILITY OF EVOLVING NETWORK STANDARDS AND STRATEGIES

During this study, it was learned that the USAID IRM policy and regulations manuals are presently being rewritten. The existing documents were said to be over five years old and, therefore, not applicable to the USAID environment today. NMI is unclear as to whether a USAID strategy for network development has been implemented. USAID has *defacto* established Banyan VINES as their standard NOS, based on the number of servers supporting Banyan VINES verses Novell's NetWare. The major (and correct) rationale supporting the selection of Banyan over Novell is one of ease of use and maintenance, particularly in a WAN, multiple-server environment. Generally, USAID clients and their locations (i.e., Africa) require that NOS products support a relatively low threshold of technological sophistication (physical and user). While Banyan addresses this need, concern exists regarding the long-term viability of VINES in a marketplace driven by rapid and radical improvements in technology. Novell is clearly the dominant marketplace leader and offers a wide and ever-increasing number of third party vendors supporting NetWare. Novell has also taken recent steps which NMI believes warrant serious attention, namely the acquisition of Unix Systems Laboratories (USL) and subsequent release of

Novell/Unixware, as well as the most recently released NetWare version 4.0. NetWare 4.0 comprises a complete rewrite of the NetWare OS to support a very "VINES like (Global-Naming/StreetTalk)" directory and service naming system. A move to standardize only on Banyan addresses only the short-term issues of E-mail post office updates. The optimal solution would be a NOS capable of offering both simplicity of installation and maintenance, as well as cutting-edge technological sophistication. The issue facing USAID is that such a NOS does not exist within today's marketplace.

From an overall industry perspective, Banyan is known for its adherence to an integrated product strategy which incorporates major network applications (such as e-mail) as part of their operating system product bundle. Banyan also was the first major NOS vendor to directly address the concerns of naming and accessing resources across multiple servers on a wide area network. The results of this approach is a network product which is highly integrated (in terms of user interface) and easy to manage.

Novell, on the other hand, has consistently targeted the provision of an operating system kernel around which third party vendors can successfully build products. Only recently has Novell expanded to address wide area network management service naming issues (NetWare 4.0). Again, Novell will rely on third party vendors to bring to market sophisticated management applications using the new global naming features of NetWare 4.0. This approach has insured that NetWare users have available a wide range of state-of-the-art network product and applications. However, the integration and management of these products is much more the responsibility of the user and requires a more advanced level of training and knowledge.

The issue facing USAID in addressing a Banyan only solution to networking is whether Banyan can by itself keep up with the rapid advances in technology. If Banyan elects to retain its present course of internalizing applications, NMI believes that serious concerns may arise regarding Banyan's ability to keep current with changes in the marketplace.

Market forces such as Microsoft Windows are already rapidly forcing the integration and

standardization of third party applications, without any compromise to the technical sophistication of these products. NMI believes that products such as MicroSoft Windows and the present trend towards 'open systems' will provide long term benefits and support the integration of multiple NOS products.

SECTION 3

RECOMMENDATIONS

3.1 *CONNECTIVITY AND INTEGRATION OF NOVELL AND BANYAN NOS*

There are two options available to USAID: first, the replacement of existing Novell network operating systems with Banyan, and second, the upgrading of existing network connectivity and Workstation/Pc user interfaces (Windows) at the Lynn Building to support seamless access to services on either NOS product. The first option (moving to Banyan) would address the issue of E-mail post office directory updating. Speed and other issues associated with the use of mail would be unaffected since they are issues associated with network routing and capacity. The second option (upgrading WAN connectivity and PC user interfaces), solves the E-mail issue by allowing any workstation/PC to access Banyan or Da Vinci mail directly, as well as any other product or service available on the network.

The selection of which option is most effective for USAID must be based on an analysis of the costs of replacing current Novell facilities vs. upgrading WAN connectivity and workstations/PCs, as well as future budget, telecommunication, and network application development plans within USAID. Please note that, regardless of the option selected, NMI is recommending that Da Vinci mail be abandoned or replaced, since our discussion with its developer indicates that automatic updating of multiple post offices will not be available in the foreseeable future. USAID may also wish to consider, under the second option (WAN upgrade), a decision to standardize on the Banyan mail product, since access would be available from any workstation/PC. However, such a decision should be predicated on ensuring that mail connections presently available through the MHS/Da Vinci mail system are retained through similar connectivity on a Banyan Server.

3.2 NETWORK COMMUNICATION AND CONNECTIVITY REQUIRED TO SUPPORT INFORMATION, APPLICATIONS, AND DATA SHARING

NMI strongly recommends that a comprehensive study be initiated to assist USAID in documenting their goals for a distributed network and planning for the necessary infrastructure (telecommunications, applications, data management, security, staff resources, training, standards, budgetS, etc.). The present USAID networking architecture is inadequate to support any meaningful sharing of data or applications on a wide-area basis. If USAID is unable to pursue this approach, NMI recommends that, at a minimum, a telecommunications review be conducted to identify connectivity upgrades and routing modifications necessary to support a growing E-mail requirement within the Washington, D.C. area. Specific attention should be paid to the Lynn Building backbone recommended in the previous section, and an upgrade of the connectivity between HRDA and New State. USAID may also wish to consider rerouting the present HRDA connection to New State to directly access the USA Today facility. These upgrades will improve E-mail performance, as well as facilitate access between Lynn Building and other Banyan users. From a basic telecommunications perspective, other alternatives which should be investigated include increasing the number of T-1 lines, sharing current T-1 on a fractional basis if traffic volume is low, and acquiring leased lines or upgrading to the use of Hayes 9600 Smart modems supporting 42 bps.

While the current ability of USAID to support information, application and data sharing is directly related to improving routing and the capacity of network connections between USAID facilities, the long-term success of USAID in developing a robust "information network" is linked to the correct selection of applications, products, and data managers which support distributed processing. Generally, USAID must begin to consider products which are transaction-based as these offer more robust operation within a wide area network. Transaction-based products also support the concept of a "data server or engine," which is accessible to all network users. A data engine is typically a single-purpose, high-end PC server supporting a database product such as Sybase or Oracle. These data engines exist as a unique network node and permit data to be shared and centralized across a network without requiring the copying of redundant

files or uploading data to a centralized database. Most of these database products also support Standard Query Language (SQL) and are FIPS-127-compliant. SQL ensures that both users and applications have a common means of requesting and managing data, regardless of the specific database vendor product being used.

USAID should also begin to evaluate the feasibility of a standard PC user interface. GUI products, such as Microsoft Windows, provide a user with a standardized "look and feel" and generally have been found to be significantly more intuitive to operate. In a network, GUI-type products offer users a simplified means of using network services, and are capable of managing multiple NOS protocols such as IPX (NetWare), VIP (VINES) and TCP/IP (UNIX and OS/2). Many third-party products are now available to facilitate the development and use of Windows applications accessing SQL data engines.

NMI also recommends that USAID investigate an alternative to Timeline to provide for shared project management. During our interviews, we learned that numerous copies of Lotus Notes are available to USAID facilities. Lotus Notes should be examined as a possible means of providing an on-line, multi-user project scheduling and workgroup management tool.

3.3 FUTURE VIABILITY OF EVOLVING NETWORK STANDARDS AND STRATEGIES

NMI believes that vendor independence and "open systems" strategies are crucial to the long-term viability of any network. We also believe that the network itself is becoming indistinguishable from its components, be they wire, servers, operating systems, workstations, applications, or data. The ability of a network to interoperate and integrate with other networks, as well as to support a wide variety of vendor products, must be a major goal for any organization hoping to emerge from the on-going upheavals within the Computer and Telecommunications industries. With these thoughts in mind, NMI would recommend that USAID consider either managing and integrating multiple vendor products, including Novell and Banyan, or standardizing on Banyan.

In general, NMI believes that USAID should place a priority on basic network architecture planning and connectivity implementation for their networks. These issues will impact long-term, overall network performance and success, regardless of which NOS (Novell or Banyan) is used. USAID's *defacto* standardization on Banyan raises no immediate concerns and has demonstrable benefits in terms of ease of use and maintenance. From an industry perspective, Banyan is perceived to be vulnerable to its competitors (Novell, IBM, and Microsoft) and has not achieved a market share sufficient to ease concerns regarding its long-term viability. However, given the shortened life cycle expectations of technology overall, the long-term success of Banyan is not, in our opinion, an immediate concern.

From a strictly technological perspective, Banyan still holds an edge in the simplified management of, and access to, wide area network resources and services. However, Novell is steadily improving and is presently ahead of Banyan in terms of products supporting Simple Network Management Protocols (SNMP). SNMP products are becoming increasingly important in permitting cost-effective management of a network from a centralized site. In addition, as noted earlier, under Version 4.0 of its NetWare Operating System, Novell is beginning the process of directly competing with Banyan's Global Naming and StreetTalk functionality. NMI believes that both Banyan and Novell, as well as NOS vendors such as Microsoft and IBM, will continue to be major network vendors. *The ability to integrate with NOS systems other than Banyan will most likely always be a requirement because the scope of "the network" is not bounded by the agency boundaries of USAID.*

SECTION 4

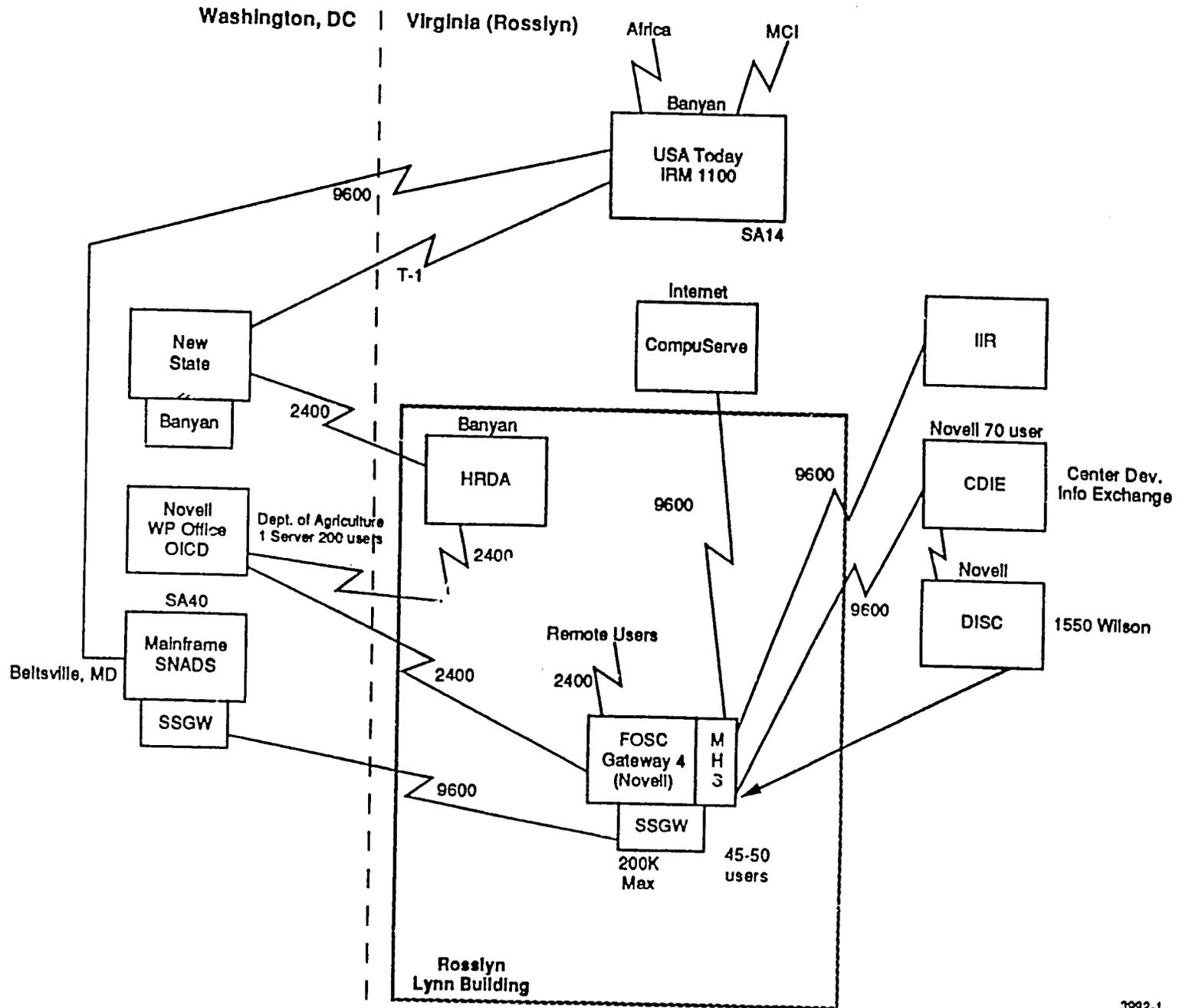
SUMMARY

NMI is pleased to have an opportunity to assist the USAID African Bureau (AFR/MRP/PMI) in addressing the current network operating systems with regards to end-user requirements and problem areas at the USAID Washington, D.C. area facilities.

We look forward to briefing our findings and recommending alternative solutions to your management in May. The NMI team and NMI management are fully committed to a successful completion of this study, as well as any additional efforts in systems integration and network management.

ATTACHMENT A
SIMPLE NETWORK DRAWING FOR USAID

CURRENT NETWORK DIAGRAM



ATTACHMENT B
NMI STUDY TEAM QUESTIONNAIRE FORM

USAID STUDY TEAM

Tasks:

A. Communications:

Current problems:

Causes:

- .Features of NOS
- .Physical infrastructure
- .Hardware
- .Training
- .Other

E-Mail Problems:

- .Maintenance of global dir.
- .Gateway outages
- .Mailboxes full
- .Send/Rec. network faxes

Network Administration Issues:

- .Administration. of User Accounts
- .Mail Services
- .Print Services
- .File Services
- .Network Security

Communication Needs (E-Mail, fax, on-line) with:

- .Other Gov't Agencies
- .Universities and other Collaborators (Internet)
- .Other contractors
- .USAID Missions in Africa
- .African-based collaborators

B. Application/file-sharing

Applications: Wordprocessing, calendars, DBs, project mgmt., spreadsheets, statistics, GIS, graphics

User Concerns: user-friendly and transparency, security, record and file locking and updating

.Can applications interface with each NOS?

.Does each NOS provide seamless interface between two different applications?

.Should remote users run applications on Rosslyn network?

C. Information-sharing

Improving access to inside and outside information sources

User needs?

ATTACHMENT C
AMEX/USAID STATEMENT OF WORK



AMEX INTERNATIONAL, INC.
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SCOPE OF WORK COMPARATIVE STUDY OF LAN OPERATING SYSTEMS AMEX-AFR/MRP/PMI

A. SUMMARY

This scope of work (SOW) describes the need for a study to assist AMEX International and USAID Africa Bureau's Program and Management Information Division collect information and present facts related to the current network operating systems for the Advisors and staff located in the Rosslyn, Virginia, office of the Africa Bureau's Technical Advisors and contract staff. A number of issues mandate a review of the current network situation there, including an increasing user base, the desire to migrate between systems, requests for network applications sharing, remote access for offsite users, the need for better communications outside of the Washington area (US, Europe, Africa), and emerging Agency automation standards. This SOW calls for a multi-disciplinary team to collect information about current and future needs of the client base, analyze the strengths and weaknesses of the two competing network operating systems (NOS), look at the applications currently being used by the client/user base to guide management in a decision on what direction to take in the near future.

B. PURPOSE OF STUDY

Under the goal of ensuring a seamless global inter-networking environment for users in USAID, AMEX is supporting a group of technical advisors and contract staff of approximately 60 users in Rosslyn VA, and providing them with network management services. The purpose of this study will be to provide AMEX, and its client, AFR/MRP/PMI with an analysis of the comparative advantages of Banyan VINES and Novell Netware Network Operating Systems (NOS) in support of the Rosslyn-based users. Recognizing that the current network environment is a mixed one, where the Rosslyn network operating system is Novell Netware 3.11, yet other users in the Agency are operating under a Banyan VINES standard, the study should include an examination of those factors that would improve or degrade network performance under a change in NOS to Banyan from Novell.

C. NATURE OF THE PROBLEM

The issues which have arisen concerning the performance of the network include a number of perceived deficiencies and problems which face network users, as well as concerns over future needs of these users. These include communications, application/file sharing, and information sharing concerns.

OVERSEAS:	Côte d'Ivoire: Box 5722 01 Abidjan Tel: 327202 Fax: 217202 Telex: 42143 (DIOT CI)	Guinea: Box 3114 Conakry Tel: 442282/442551 Fax: 444311 Telex: 22165 (DIOT CKRY)	Togo: Box 443 Lomé Tel: 214745/215950 Fax: 210866 Telex: 5099 (ITT)	Zaire: Box 2691 Kinshasa 01 Tel: 23811/23815 Fax: 25399 Telex: 21320 (TAK ZR)
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C.1. Communications problems: improving connectivity

A major feature of the current network operating system is the need for relatively problem-free immediate communications among current users in a metropolitan area configuration (Rosslyn, Department of State [DOS]) which emulates the speed and efficiency of the existing DOS communications, and the growing need for direct linkages in a wide area configuration (other collaborators throughout the U.S. and in Africa, and USAID missions overseas). These communications need to be rapid, accurate and complete, and documents need to be exchanged seamlessly between network platforms.

Users in the DC area are currently experiencing a variety of problems with communications, and solutions need to be proposed which address these. Some of the issues currently identified by users and network management staff are:

- **E-mail problems:**
 - maintenance of global directory
 - gateway outages
 - mailboxes full
 - sending and receiving network faxes
- **Network administration issues**
 - administration of User Accounts
 - mail services
 - print services
 - file services
 - network security
- **Communication needs (E-mail, fax, on-line) with:**
 - Other Government agencies (both Novell and Banyan users)
 - Universities and other collaborators (Internet access)
 - Other contractors, not necessarily at Government sites
 - USAID Missions in Africa, of which some:
 - are not currently networked, but with direct-dial hook up capability
 - are Banyan sites on direct dial-up (no real-time access possible here)
 - are on other NOSs (Wang, Novell)
 - are linked through FIDONET
 - African-based collaborators, of which some:
 - are already on Internet or other networks
 - have direct-dial hook up capability

C. 2. Application/file sharing: improving work efficiency

Current USAID management perceives a need for network users to go beyond sending attached files through E-mail to actual application-sharing within the DC-area USAID network as well as with remote locations. Plans call for sharing and/or linking files within the following kinds of programs: wordprocessing, calendars, databases, project management, spreadsheets, statistics, GIS, graphics. User concerns in this kind of environment include the need for seamless application sharing, user-friendliness and transparency, security, record and file locking and updating.

C.3. Information-sharing: improving access

Rosslyn users will need to increase their access to information sources, both inside and outside USAID. This will include the CDIE/DISC and other in-house electronic information sources, as well as on-line databases, University databanks, and other out-side sources of information, using capabilities of Internet and other electronic messaging and bulletin board features. This information can be accessed currently through a remote request system using dial-up capabilities.

D. SCOPE OF RESEARCH

The study team will address the following areas in their study: communications, application-sharing, information-sharing, comparative strengths and weaknesses of each NOS and the strategic views of the competing network operating systems.

D.1. Communications

The study team will address the issue of improving connectivity, collect a list of communications problems from current users via a study team questionnaire (including validation of the items listed above), identify causes for each problem area (whether it be NOS-related or otherwise), and consider the other communication capabilities mentioned above and by users. Other questions include how many of these problems are due to features inherent in the NOS, which are related to physical infrastructure, hardware, insufficient training of end users, or other factors?

D.2. Application-sharing

Questions the study team should address for both the current Novell and proposed Banyan solutions include: can USAID applications interface with each NOS. Does each NOS provide a seamless interface between two different USAID applications (e.g. Wordperfect and Lotus 1-2-3)? Will it be necessary for users on a remote system to actually run applications on the Rosslyn network?

D.3. Information-sharing

The study team should address what the current issues are around electronic information access, how will the users be able to increasingly access and share information with outside sources and users (both in US and abroad), is this access needed in a real-time interactive mode, or can the current store-and-forward system continue to be used and how does each NOS address these issues?

D.4. Comparative strengths & weaknesses of each NOS

A brief written summary presentation of each NOS¹ will be done, focusing on the strengths and weaknesses of each product. The key areas to be addressed include:

NOS Philosophy

Topologies Supported

File Management

Directories – Netware Directory Services vs. Street-talk

System Security

- login procedure
- trustee rights
- file attributes security
- virus protection

Network Utilities

- Netware provided
- Banyan provided
- Third party

Print Utilities

- setting up print job configurations
- printer use

Network Bridges and Gateways

- bridge/router software
- SNA connectivity
- Asynchronous Communications Server

System Fault Tolerance

- Banyan capabilities
- Novell capabilities
- Protocol Transparency
- Openness towards hardware (NIC cards)

D.5. Strategic views:

¹ For purposes of this study, Novell Netware 3.11 and the latest release of Banyan VINES will be used. If newer versions of these products already exist and are being considered for use, information on these newer versions should be also presented, and the timing of the newer releases specified. The costs of purchasing these newer versions should then be included under the cost-benefit analysis.

D.5. Strategic views:

In order for AMEX and USAID management to make an informed decision on the NOS question, the team should prepare, distribute and evaluate a Network User Questionnaire and carry out four or five representative interviews of the USAID client base; meet with key USAID/IRM staff concerned with these issues; conduct a review of the literature (trade journals); collect information from NOS developers (Novell and Banyan). Two kinds of strategic information need to be collected and analyzed.

D.5.a. The NOS Industry: The team should research and present a review of where Novell and Banyan are going with products and services. Issues to be covered include the specific features of these products which are being revised/updated, what the major drawbacks of each system are related to the Rosslyn user group's needs, what each vendor is doing to address these specific shortcomings, and what the time frame is for the issue of these new releases. Specific product development information should be included, particularly third-party products which will ease the communication between the two systems.²

D.5.b. USAID's emerging standards: The study team should identify and present an overview of the emerging standards of USAID, overseas African Missions, and USAID/IRM, and where the Agency is going in the network and applications field. Recent policies regarding the Excellence Through Automation (ETA) policy should be reviewed, as well as Agency choices and recommendations for network, applications and operating system software.

D.6. Advantages of each NOS:

Finally, a summary of the advantages of remaining with Novell Netware and of migrating to Banyan Vines should be given. This summary should be based on the findings of the report.

². Currently, the Rosslyn network administrator is experimenting with the Trellis gateway product to assist the Novell and Banyan network users to communicate more easily. Another USAID Novell LAN is using the Banyan ENS for Netware. Implications of these and other similar products should be explored in the study.

ATTACHMENT D
NMI CAPABILITIES STATEMENT

NMI CORPORATE PROFILE

HISTORY AND ORGANIZATION

NMI is a unique information systems consulting and integration firm chartered to provide a full range of services and products spanning the distributed networking field. Successful systems integration requires knowledge of the technologies and issues surrounding the transition from centralized to distributed network computing, the "Technology Transformation" occurring in the business world today. NMI is well positioned to provide a unique set of capabilities and expertise to assist clients in strategic planning, infrastructure development, and transitioning to new, distributed computing environments.

Headquartered near Washington, DC in Fairfax, Virginia, NMI employs more than 300 managers, designers, engineers, programmers, technicians, network administration and operations personnel who are providing consulting services, and/or building and managing networks at customer sites and at company offices located across the country and in Europe. Founded in 1986, the company acquired CRC Systems, Inc., a highly successful network operations and management firm. Other acquisitions followed: Programmatic and Contel Network Design Center, network design and analysis firms, in 1988; LAN Services, Inc. and Account Data Group, both specialists in systems integration and support, in 1989; and NetTech, Inc., a LAN integration and support company, in 1990. Through these acquisitions and progressive integration of the acquired experience and resources into its corporate culture, NMI has come to project and apply a depth and breadth of communications and information management expertise that is second to none. Exhibit 1 depicts NMI's organization and scope of activities.

NMI is the recipient of two Enterprise Networking Excellence (ENNE) awards, and was designated by Computer Systems News as one of the TOP 50 Systems Integrators in the United States. And *Washington Technology* elected NMI in 1990 to its "FAST 50," as one of the fastest growing technology firms in the Mid-Atlantic Region.

SERVICES FOR TECHNOLOGY TRANSFORMATION

At the leading edge of technology, NMI supports organizations through the technology transformation from centralized to distributed systems, and provides complete network management and technology enhancement services to networked clients. NMI's mission is, as a strategic resource to clients, to provide a mix of information management functions that address business imperatives cost-effectively on behalf of client organizations.

NMI offers a broad range of telecommunications and information resource consulting, network management and integration services. These services encompass systems engineering; network analysis and design; facilities management for networks and computer systems; software and systems development; network management products; and LAN and WAN design, installation, integration, maintenance, and administration.

As one of the largest local and wide area network systems consultants and integrators, NMI has well-established relationships with all the key manufacturers of network operating systems. This includes Novell, IBM, Banyan, Microsoft, and virtually all the other strategic network products that comprise a multi-vendor network, e.g., Sun Microsystems, Sybase, Compaq, Synoptics, Cabletron, and Wellfleet. Thus, NMI is uniquely placed to identify alternative options and to recommend the most cost-effective technologies for the client's business strategy and goals.

APPLICATIONS DEVELOPMENT SERVICES

For firms moving to distributed computing, NMI offers full life-cycle applications development services using, for example, Oracle and other 4GLs. Our experienced staff of counselors can advise and guide you on the path from centralized to distributed computing. They will help you to determine the best technology fit for your application needs.

Experience with client/server implementations on a UNIX operating foundation differentiates us in this marketplace. Our experience ranges from the high-volume system with real-time data feeds in distributed relational databases to small office environments. Applications may be mission-critical with high availability and fault-tolerance, or simple desk-top office automation. NMI will provide staff to help you with the design implementation of your applications on a time and materials or fixed fee basis.

To bring you the full range of support, we partner with many firms that complement our services. In the database area we focus on Sybase implementations. Our services range from the fully custom-designed applications to the integration of off-the-shelf software packages. We can assist with project management of your new applications. By working alongside your staff, we can effectively train and transfer to them the necessary skills to successfully implement client/server technology.

LOTUS NOTES-RELATED SERVICES

NMI entered into a strategic relationship with the Lotus Development Corporation to be a Value Added Reseller (VAR) of *Lotus Notes*. Lotus Notes is used on networked PCs to develop and deploy applications (e.g., customer tracking, status reporting, project management, information distribution, and free-form discussions) in a user-friendly environment that is ideal for geographically dispersed organizations. NMI has highly trained personnel experienced in Novell, Banyan, and LAN Manager, who provide expert service from site evaluation, installation, and training to help-desk and hotline support to a growing number of Lotus Notes clients.

ON-SITE SYSTEM ADMINISTRATION SUPPORT

NMI has its own unique *Certified Systems Administrator (CSA)SM* program in which it trains its best-qualified technicians to assume the duties and responsibilities of on-site network administration and support. At NMI, Systems Administration is not a tactical offering, where "Administrators" simply perform tasks on their own at the client's site; it is a strategic line of business, headed by a Vice President of System Administration. Managing customers' distributed environments is our corporate strategy, and we have invested in an infrastructure and support mechanisms that are designed to ensure the highest possible level of client satisfaction.