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INTEGRATED INFORMATION NETWORK FOR EFFECTIVE MANAGEMENT
OF RESEARCH AND DEVELOPMENT INSTITUTIONAL ACTIVITIES

DP/EGY/88/031

ARAB REPUBLIC OF EGYPT

Technical report: Design of the computer-based
communication network for IIN*

Prepared for the Government of the Arab Republic of Egypt
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Wulfdieter Bauerfeld
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Vienna

EXPLANATORY NOTES

Currency

The Egyptian Pound has the official value of 2.59 LE to the US Dollar (January 1990).

Technical Terms

OSI: Open System Interconnection is the acronym for the vendor-independent standardization framework of communication between computers.

ISO: The International Organisation for Standardization issues ISO-Standards for, between others, protocols and services within the framework of OSI (e.g. ISO FTAM).

CCITT: The Comitee Consultatif International de Telephonique et Telecommunication is the international consortium of national PTTs which issues, between others, recommendations on protocols and services in the area of telecommunication (e.g. X.25).

Physical Network or Transport System: Usually it is the term for the description and the actual implementation of the topology (e.g. star-shaped, mashed) and the technique used (e.g. circuit-switching, packet-switching) as well as the underlying media (e.g. telephone links (2-/4-wire), koax, fibre optic) to connect the end-systems of a computer-based communication system. In OSI it comprises the layers 1 (physical), 2 (data link), 3 (network), and 4 (transport).

Logical Network or Application System: Usually it is the term for the description and the actual implementation of end-to-end services (e.g. dialogue, file transfer) and the underlying common elements (e.g. sessions, data presentations). The logical network enables the users to communicate via their end-systems by means of the physical network and reflects a certain community. Optimally, the physical network, i.e. all "wired" connections, should be larger than a logical network, i.e. all potential connection used. A physical network might host several, even different logical networks. The logical network may be realized through "pure" communication services only (like a dialogue facility for any kind of interactive application like a data base or an isolated message

handling system), of "build-in" communication facilities (like a file transfer as an integrated function in a distributed data base to import and export files in a simple way) or a "complete" application (like electronic mail which handles local messages and interconnects, if needed, automatically to other computers). In OSI it comprises the layers 5 (session), 6 (presentation), and 7 (application).

Protocol: It is the definition of a communication within the physical or the logical network between two or more endsystems and describes the format of data sets and their sequence and relative timing in the exchange. Protocols are, according to the OSI-framework, executed in different layers (up to seven) which structure certain responsibilities for resources in the communicating systems (e.g. links, interfaces, switches, end-to-end-relations, data transport, user application systems). The execution of a protocol provides a communication service, common on all endsystems. While a protocol describes "how" communication takes place, a service describes "what" is offered by that communication.

X.25: This CCITT recommendation describes the protocol necessary and service obtained to connect digital end systems like computers to packet switching data networks (PSDN) and is concerned with OSI-layers 1 - 3.

X.3/X.28/X.29: These CCITT recommendations describe the protocols necessary and services obtained to connect line-oriented terminals - or personal computers or work-stations with a terminal emulator - via a PAD (Packet Assembly / Disassembly) to a PSDN and is concerned with OSI-layer 4.

FTAM: File Transfer Access & Management is the ISO Standard to transfer files or components of them between computer systems of different vendors/operating systems. A file transfer executed between two end-systems according to a standardized protocol and interconnects, therefore, the filing system of the two computers. FTAM is concerned with OSI layer 5 - 7 and requires a transport protocol (layer 4, e.g. ISO TP 0 = CCITT T.70) common for all end-systems.

X.400 ff.: These CCITT recommendations describes the protocols necessary and the services obtained for a distributed Message Handling System (MHS) which is often called an Electronic Mailing System. A Message Handling System resides as an application on one or more computers and provides an exchange of messages between "mailboxes", i.e. special data areas on a disk assigned to personal user names. A Message Handling System usually contains functions to write, send, receive and file messages in a user private data area on that computer

and exchanges mes ages with users on the same or other computers. X.400 is concerned with OSI layer 5 - 7 and requires a transport protocol (layer 4, e.g. ISO TP 0 = CCITT T.70) common for all end-systems. X.400 is aimed to become the base for a world-wide exchange of electronic mail.

ABSTRACT

The purpose of the project is the establishment of the Integrated Information Network (IIN) for effective management and coordination of 10 multi-branch R & D centers belonging to the Ministry of Industry in Egypt.

This report describes the findings of the communication expert (11-51) during the first part of the mission. The objectives reached can be described as follows:

- to get acquainted in the field especially with the needs of the communication services and the underlying physical network for IIN;

- to recommend ways and means best for IIN's future progress in terms of communication facilities;

- to understand the planned or existing communication environment in Egypt which become important for the near or far future;

- to specify in detail an advanced communication system and the corresponding equipment and to negotiate with possible suppliers.

It turned out that one of the original tasks, to test telecommunications channels to be used, was of less importance according to the solution now proposed. The main tasks for the second part of the spiit mission are described in an updated workplan.

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INTRODUCTION

The purpose of the project is the establishment of the Integrated Information Network for effective management and coordination of the R & D institutional infrastructure of the Ministry of Industry (MoI) in Egypt.

The Integrated Information Network (IIN) is to be designed and implemented in order to establish an effective tool of horizontal coordination of activities among 10 multi-branch R & D centers belonging to the Ministry of Industry and to provide vertical monitoring and servicing facilities from industry via R & D centers to the Ministry and backwards.

This report describes the findings of the communication expert (11-51) during the first part of the six weeks split mission. The main purpose of this first part (12 days in the field) was to test telecommunications channels to be used for the IIN computer network and specify in detail the network configuration and hardware to be used for its implementation and to advise on possible suppliers. Other objectives immediately identified on site by the expert were:

- to get acquainted in the field with the present stage of the project, especially with the needs of the communication services and the underlying physical network for IIN;

- to recommend ways and means best for IIN's future progress in terms of communication facilities;

- to understand the planned or existing communication environment in Egypt which become important for the near or far future;

- to specify advanced communication equipment and to negotiate with possible suppliers; to prepare an updated workplan for the second part of the split mission.

All objectives were reached.

RECOMMENDATIONS

The following recommendations are made to the Ministry of Industry in Cairo (MoI), the UNIDO headquarters in Vienna (UNIDO) or the UNDP office in Cairo (UNDP):

1. (to UNIDO and MoI): to drop the assumption that a simple star-shaped network topology, based on dial-up or dedicated links of the telephone network and the usage of modems, is - without any other switching facilities or more advanced technique - sufficient to fulfill the actual and future requirements of an open, computer based communication system like IIN should accomplish;

2. (to UNIDO): to understand that the spreading of data processing and information retrieval to main frames and work-stations or personal computers as end-systems of a network will continue and that the varies types of processing have to be integrated in IIN now and in the future in a common communication system;

3. (to UNIDO and MoI): to consider the UNIDO project EGY/88/031 as a nucleus and a pilot demonstrator for integrated computer-based communication facilities and to follow the proposed pathes in all future expansions;

4. (to UNIDO and MoI): to align all necessary hard- and software purchases and/or implementations for the communication system (interfaces, switches, protocols and services) according to International Standards (ISO) and/or Recommendations (CCITT);

5. (to MoI): to install, therefore, on a step-by-step base a packet switching data network (PSDN) with X.25 access (CCITT recommendation) which will interconnect all terminals, PCs, and main frames as end-systems of a network within IIN and will offer a variety of communication services with different functionality on top of this basic switching and data transport system;

6. (to MoI): to provide, therefore, for this PSDN a technical solution which is in alignment with the publik packet switching data network in Egypt (EGYPTNET) and which use its service to a large extent and considers the physical layout of IIN as a private extension of EGYPTNET by using a private branch exchange (X.25 PABX);

7. (to MoI): to consider EGYPTNET as the principal service provider of wide-are communication facilities and to gain experience with different physical solutions for interconnection (leased or dial-up lines, private or public PADs, direct X.25 access) in order to minimize operational costs;

8. (to UNIDO and MoI): to purchase appropriate end systems and to install on all corresponding end-systems (computers) the necessary hard- and software for three different types of higher communication services as there are: dialogue access, file transfer and electronic mail;

9. (to MoI): to install for dialogue access according to the CCITT recommendations X.3/X.28/X.29 facilities in order to make all terminals in the network interactable with applications on the computers with multi-user operating systems either via public (provided by EGYPTNET) or private hard- or software PADs and appropriate terminal emulators (e.g. according to VT 100) on the end-systems (computers);

10. (to MoI): to install for electronic mail as a first step at one of the multi-user systems at MoI in Cairo an Electronic Message Handling System which runs as a remotly accessable application and follows, if available, the CCITT recommendation X.400 to provide further expansion in a standardised way;

11. (to UNIDO and MoI): to collaborate as closely as possible with the UNDP project EGY/87/006 (Electronic Mail) and to consider common meetings with their specialists;

12. (to MoI): to install for file transfer on all appropriate systems within IIN the corresponding software which follows, if available, the ISO-Standard called FTAM and is based on a transport protocol following an ISO-standard;

13. (to UNIDO, UNDP, and MoI): to purchase any equipment needed for IIN (hard- and software, whether as end- or as switching-system) in Egypt due to two reasons: a) the Arabisation of any computer product is only guaranteed if purchased in an Arabic country and b) the complex interconnection of private application and communication hard- and software residing on different end-systems (computers) together with the facilities of a public network service provider (EGYPTNET) needs deep technical knowledge in installation, warranty and maintenance which only can be provided through a local distributor;

14. (to UNIDO and MoI): to have specialists from Egypt visiting institutions (preferable in Europe) in order to see similar projects in information and data networking using computer based systems and to gain experience in operational problems;

15. (to MoI): to install, as a service usable from any terminal in IIN, the access to the GE Mail facilities, provided by NILENET, in order to interchange regularly mail with INTIB and, therefore, with the staff at UNIDO in Vienna;

16. (to UNIDO and UNDP): to install at the UNDP office in Cairo an end-system (computer) with dialogue access to the hosts and services in IIN, in order to have it integrated;

17. (to UNIDO): to purchase and install in the near future, if possible through an extension of this UNIDO project, local communication facilities at the remote R & D centers; these equipments (like X.25 - switches, appropriate interfaces and cables) should interconnect as many as possible other end-systems (computers) and their users in the named or other R & D centers to include them as an integrated part of the nucleus communication system IIN.

I. ACTIVITIES AND FINDINGS

1. General

The principal activities carried out were aimed at mapping the communication needs (present and near future) to the intended uses (Ministry of Industry and R & D centers) of a physical network - layout, topology, and technology - and logical network - applications and user services - in order to build up the base for an advanced, homogenous communication system. A number of discussions has been held at or with:

- Ministry of Industry
- UNDP office in Cairo
- ARENTO, the telecommunication authority in Egypt
- PAA, the Postal Administration authority in Egypt

and computer vendors or distributors to obtain information on systems from

- DEC
- HP (ORASCOM)
- ICL
- NCR

and previously (already in Vienna) IBM.

Many of these discussions were hold jointly with Mr. Shams (Supervisor of the Information Systems Center for the Ministry of Industry / MoI) and specialists from UNIDO, Mr. Muraszkiewicz (11-01) and Mr. Page (11-02).

Additionally, there existed a large pile of notes, meeting minutes, messages and comments, assembled by Mr. Page (11-02) which describe extensivly the situation at the R & D centers and elsewhere in Egypt concerning communication facilities. This was considered as very valuable sources for the findings. Therefore. between others, a service description of NILENET could be included in the evaluation.

2. Existing Equipment and Communication Links

Elements of the desired Integrated Information Network (IIN) exist in the Ministry of Industry but are basically manual. Only its minor parts are computerized or use computer-based communication facilities. At the Ministry of Industry in Cairo as a central hosts system there is a ICL ME 29 computer with ten communication links installed. Twelve personal computers, located at MoI are connected to that main frame and can be used as interactive terminals. Some of the R & D centers to be integrated in the IIN have at least one IBM-compatible personal computer installed; the majority of them is not intensively used.

For communication a rack containing modems has been installed which provide communication links to the central host at the MoI (ICÃ ME 29). Four of these links leading to R & D centers within the city limits of Cairo, have been successfully tested. These links accept a transmission rate of 2400 bps. The status of three others is uncertain, since they cannot be connected to any remote test system in the corresponding R & D centers because of lack of basic equipment (cables, plug-ins, interfaces).

3. EGYPTNET

EGYPTNET is a public packet switching data network (PSDN) service in Egypt operated by ARENTO which offers in and between Alexandria, Cairo, and Suez X.25 access to customers. The network is operational since December 15th, 1989 and consists of nine nodes. It will be upgraded and eventually extended to Upper Egypt according to the need of customers. Egypt Net offers a large range of access speeds (50 - 64 000 bps). The tariff is independent of the distance and essentially depending of the volume of data really transmitted.

Between others, asynchroneous access via V.22/V.22bis modems via a dial-up telephone link and a public PAD (1) and synchroneous access via direct X.25/V.22 modems or X.32/V.22bis/V.32 modems (2) is offered. The cost in Egyptian Pounds for a 2400 bps connection used between 6 am and 6 pm would be the following:

Installation	(1)	300	(2)	600
Annual Charge	(1)	120	(2)	500
Connect Time	0.05 for each 3 minutes			
Data Transmission	0.05 for each ksegment (64 000 * 8 bit)			

Discounts are given for transfer at other times of the day or for large amounts of data. The tariffs in EGYPTNET are considerably low. In contradiction to many European networks there is no call-set-up charge.

4. Electronic Message Handling Systems (E-Mail)

The representative of NILENET was quite motivated to suggest how GE Mail can be used even between the R & D institutions in Egypt. If R & D centers are equipped with dial-up modems, they could access GE Mail for national and international communications.

GE Mail is not based on the international CCITT recommendations X.400. There is no mail distribution between mailing nodes in Egypt. All mail is sent via a satellite link to a computer system in the USA. Since IIN will deal to a large extent with Egyptian government information, there might be resentments concerning the confidentiality of the data. Additionally, the system seems to be too expensive for internal use within IIN.

There is an electronic mail project of the Postal Administrative Authority in Egypt. This is an experiment based on EGYPTNET to deliver messages electronically to some selected post offices where the messages are printed and delivered by regular local mail service. The system is specifically designed to handle Arabic messages.

The system runs on an NCR Unix based host and will be migrated to a X.400 compatible system probably within one year. Even if there was interest in the possible use of this service in IIN, it should be postponed because of the unknown tariffication.

II. COMMUNICATION SYSTEM FOR IIN

1. Options

During the '70s, computer usage moved into online processing. Because processing power was very costly, central computer(s) were used to handle in most cases batch jobs or, if accessable by directly attached end users, to process simple transactions. Later, during the '80s, computing became less expensive and processing spread out to departments, workgroups, and individual offices. In general, users began to recognize the need for connectivity and its advantages. Islands of information quickly formed on the basis of proprietary communication architectures.

As looking forward to the '90s, one can see clearly a continuation of the spreading of processing and, therefore, for computer based communication. The integration problem is solvable only with a combination of hardware and software that detachs end users from specific hosts and provides them with with access to both the different computers and people in the corresponding community or even elsewhere in the world.

However, if such a solution is to be cost effective, it must take into consideration existing and future investments in application hosts and related software, work-stations, and communication transport mechanisms.

In general, one has to choose between two alternatives of a physical network for computer based communication:

- a classic serial or multiplexer network based on dial-up or dedicated links of the telephone system

or

- a network based on a digital switching technique like it is offered through X.25.

Egypt's telephone system, notorious for being one of the most frustating in the world, has been revamped with mixed success (source EI' Country Profile 1989 - 89). During the period 1982/83-1986/87 the number of telephone lines was expanded from 542,000 to 1.4 million and this number is expected to increase to some 2 million by 1992. Cairo's

telephone system was replaced in 1985 and, in some of the city's areas, is now extremely efficient.

Nevertheless, one has to consider that with the installation of a "classic" network on top of a telephone system, nothing has been decided upon the protocols and services to be used for switching, multiplexing or between the end-systems. On the other hand, a complete stack of communication protocols (standardized by ISO and/or CCITT) is defined over X.25.

X.25 packet switching offers a standardized communications method totally independent of an operating system and constructor. Moreover, its protocol guarantees error-free transmission. In a number of countries private X.25 networks are in operation or PTTs are offering X.25 switching in the form of public data-switching networks. Interconnecting these national networks creates a far-reaching international X.25 network. A public X.25 network can be easily extended - similar to the public telephone network - by installing private X.25-switches which uses the less significant digits (1 - 3) of the subscriber number.

For remote users, with low-volume or one-off transmissions, these networks provide a solution which is as simple as it is economical. The principle of logic channels governing these networks offers even further advantages:

- tremendous potential for expansion without extra hardware

- several application protocols operating in conjunction on a single link.

An X.25 network, furthermore, is the ideal solution for anyone wishing to:

- communicate with national or international users or data banks, or

- remain available to remote correspondents.

Thus, X.25 offers a sound and reliabel base for the physical network or Transport System. Furthermore, it has to be decided what should be the actual implementation of the topology (e.g. star-shaped, mashed) and the underlying media (e.g. telephone links (2-/4-wire), koax, fibre optic) to connect the end-systems of IIN.

One should not forget that the physical network, i.e. all "wired" connections, can be larger than a logical network of a certain community, and might be shared with users of other communities for costs benefits. Therefore,an additional answer should be given on the choice between the usage of a private and a public X.25 network.

The decisions on how to implement the logical network depends evidently on the needs of the specific user community. It would be far beyond the aims of this report to list all possible choices of application protocols and services.

2. Conclusions

Above all, the physical as well as the logical network framework must be open-ended, providing for future acquisitions of unencumbered hardware/software solutions. Because of the rapid pace at which technology is changing and the expanding potential for the use of more and different types of computers, the network must, as much as is practical, not limit future buying decisions. Thus, IIN should go for standardized solutions as closely as possible.

Additionally the investive and operational costs should be as small as possible; sharing an existing infrastructure with others would minimize them. The support by public service provider is, therefore, strongly recommended at least for the physical network.

The communication system for IIN will have a standardized architecture containing the following protocols and/or services:

2.1 Physical Network

Physically the IIN uses a packet switching system, based on X.25. It encompasses the X.25 service of EGYPTNET which provides the physical connections within Alexandria and within Cairo and between these cities.

Additionally there will be installed a private extension switch located at the MoI to interconnect all end-systems there and bypassing EGYPTNET

by a privately owned, local (sub-)net. Similair solutions (private switches connected to a public system) are well known from the telephone network.

The access to EGYPTNET at the R & D centers and can either be implemented as a direct X.25 access or through the public telephone network to a PAD provided as a public service by EGYPTNET. Both solutions differ in costs and the choice depends on the data traffic expected or experienced and on the application services used. A PAD access can usually only be used for interactive access to hosts from a remote terminal.

Additionally, if from certain R & D centers the access to EGYPTNET is not (yet) possible, dial-up links using the public telephone network will be connected to the private switch at MoI. One system connected to that switch as well is a private PAD located at MoI to enable access to the end-systems from local or remote terminals.

All EGYPTNET connections as well as the dial-up connections require the purchase of modems. Modems are not needed for the local connections at MoI.

2.2 Logical Network

IIN encompasses a user community which is well known from other network projects to serve research and development. Those users need to have regularly interactive access to remote data bases. They need to exchange specific files between data bases and other data files like programs, experiment data or other findings between their end-systems to make their results visible to their fellow colleagues at other institutes.

Furthermore, the support of human-to-human relationships is extremely important in a distributed R & D environment. The exchange of "formal" data via file transfer or the access to commonly used data bases is therefoe not sufficient. Traditionally, for this kind of communication the telephone, to a lesser extent the normal mail are used. Most telephone calls in this community are needed in order to deliver some sort of spoken message which does not require prompt reaction but some careful thinking; in these cases there is no real need for an "on-line" dialogue. Neve .neless, statistics, acquired from measurements in Europe, show tha about 40 % of all telephone call

attempts fail because of absence of the person needed or his/her telephone is busy.

In an environment where the usage of computers becomes more and more familiar for scientific applications these systems can be used additionally to store written messages and have them available whenever the addressee has time to retrieve all "electronic mail" which came in. Thus, human-to-human communication is considerably supported by the implementation of a computer-based message handling system.

The logical network of IIN on top of the X.25 service offers to the user as a most simple application a dialogue access to multiple hosts in IIN. This access has to be provided via soft- or hardware PADs according to the CCITT recommendations X.3/X.28/X.29. Via a terminal or an emulator programme any remotely located interactive application program like data bases, editors, compilers, or even a non-distributed, single electronic mailing system residing on a remote host can be used via the network.

Such an electronic mailing system, if available according to the CCITT recommendations X.400, will be installed as a part of the logical network. For each user within IIN an electronic mailbox (.i.e. a dedicated data area with specific access rights on a disk) accessable through his/her personal name, will be provided on one dedicated computer. In a second stage with a growing user community, more than one system can be installed on different computers in order to form a distributed mailing system. Some messages of a local community will not leave the local computer but are forwarded from the mailbox of the sender to the mailbox of the addressee. Other mesages are send via the physical network to the corresponding addressee, owning a mailbox on a different computer. An ultimate goal which is already partially available, is a worldwide electronic mailing system based on identical protocols (X.400).

The logical network of IIN should be completed by a transfer facility which allows the transfer of binary or character-oriented data from any end-system to any other end-system within IIN. Preferable the file transfer protocol should follow the ISO standard FTAM and is based on a common transport protocol (e.g. ISO TP 0 = CCITT T.70).

3. Selection Criteria for Communication Hard- and Software

There are selection criteria stated in the report of the CTA, Mr. Muraszkiewicz, which are concerned mainly with the suitability of the equipment for the data base(s). The data bases are are from the communication point of view the main application within the logical communication system network of IIN.

The following criteria have been used for selecting the hard- and software for the physical communication network of IIN as well as for the base software of the logical communication system:

- suitability for implementing a future oriented network and protocol architecture, especially oriented towards International Standards (ISO) and recommendations (CCITT);

- availability of X.3/X.28/X.29 (PAD) functions either as hardware boxes or as a software packages on the work station/main frame and costs; availability of X.400 on the main frame and costs;

- availability (of any) of FTAM on the work stations and the main frame(s) and costs;

- quality of documentation;

- reference installations (if any) and for proof of compatibility with EGYPTNET;

- expandibility of the physical and logical network, i.e. the whole IIN communication system.

4. Name of the Project and the Communication System "IIN"

IIN stands for - as stated earlier - Integrated Information Network. Especially the term "network" is somewhat misleading in the enflish language since it can be understood as the physical or the logical network or even be restricted to the protocols and services of the OSI

layer 3 (network layer). Following the examples of older communication systems one can avoid the term network without loosing clarity. No one talks about the mailing or the telephone network or even the railway or the airline network, unless one wants to express or describe specific characteristics of that system. For these reasons, the author wants to express that the usage of the term "network" within the name of the project "IIN" should be avoided.

Therfore, another name for the whole project is hereby proposed::

RAMSES

which stands for **Research-Data Access** and **Management System for Engineers and Scientists.**

WORKPLAN

The following workplan contains the most important tasks for the second phase of the split mission respectivly its prerequisits:

1. Purchase in Egypt of the IIN hard - and software through UNIDO and timely delivery to the Ministry of Industry in Cairo.

2. Negotiations and installation of the EGYPTNET access points (direct X.25 access) at the Ministry of Ministry in Cairo.

3. Negotiations on and installation of the EGYPTNET access points (direct X.25 access) at appropriate sites (R & D centers) in Cairo and/or Alexandria.

4. Negotiations on and installation of the EGYPTNET access points (through PSTN) at appropriate sites (R & D centers) in Cairo and/or Alexandria.

5. Local tests at the MoI of the X.25 equipment (X.25 switch, X.25 interfaces to ICL ME 29 and to HP3000, hardware PAD) and dialogue access tests.

6. Tests with dialogue access to the mainframes at MoI from PCs/work-stations via direct X.25 access or via PADs located at remote R & D centers.

7. Installation of dial-up modems and hard- and software PADs at R & D centers not accessible via EGYPTNET.

8. Installation of corresponding partner modems at the X.25 switch at MoI, remote dialogue access tests from the remote R & D centers.

9. Installation of an (distributed) E-mailing system (Electronic Message Handling) at the appropriate end-systems (computers) at MoI and, if applicable, elsewhere.

10. Installation of FTAM (or other file transfer) software on all appropriate end-systems.

11. Installation of a PC/work-station with communication facilities through X.25/dialogue at the UNDP office in Cairo.

12. Final test and demonstration.

ACKNOWLEDGEMENTS

Places/organizations to visit

1. JANET (Joint Academic Network) in UK

JANET is the computer network of the British academia which
bases on a private X.25 physical network and offers a large
variety of communication services like dialogue, file transfer,
electronic mail. All universities and many research institutes
are interconnected through JANET. Its headquarters and central
management group is located in the Rutherford Labs (near
Oxford).
contact: Dr. Robert Cooper

2. DFN (Deutsches Forschungsnetz / German Network for Research)

DFN is the computer network for the research communities in
West-Germany and assembles about 400 different institutions
ranking from universities to publically funded institutes and
industrial labs. DFN services are similar to JANET services but
are strictly based on international standards (ISO) or
recommendations for telecommunication (CCITT). The DFN-
headquarter is based in Berlin where not only the DFN-
information system as a central data base is provided but a
small (sub-) network with computer based communication
facilities on PCs and small main frames is operated. The central
management of DFN can organize visits to research institutes in
Germany for computer sciences and communications like GMD in
Bonn and Darmstadt (near Frankfurt).
contact: Mr. Klaus Ullmann

3. RARE (Reseaux Associee Recherche Europeenne)

RARE is the umbrella organization of all research networks in
Europe and holds close contacts to similar organizations in USA
and Canada. RARE has its headquarter in Amsterdam. There are
computer based facilities used. RARE is not only an
administrative body but executes the Europe-wide project COSINE
(Cooperation on Open Systems Interconnection Networking in
Europe) as a distributed effort.
contact: Dr. James Hutton

Installation List and Equipment Cost

ICL (incl. subcontractors and connections to EGYPTNET)

1. Installation of a private X.25-switch with integrated PAD functionality (CODEX 6525 with 12 ports) at the premises (Comp. Center) of MoI;

2. Connection of the private X.25-switch through a modem (9600 bit/s, V.29, CODEX MT 2345) to the EGYPTNET PPSDN (public packet switched data network) via synchroneous, direct X.25 access (4 wires, 9600 bit/s) with one-digit subadressing;

   Proof of interworking with EGYPTNET;

3. Interconnection of the already existing computer ICL ME 29 to the private X.25-switch via the ICL X.25 interface;

   Proof of interworking with EGYPTNET through the private switch (X.25 packet access and PAD functionality);

4. Installation and connection of one IBM-compatible PC (ICL DRS M55) at the premises of MoI to the private X.25-switch (PAD function);

   Installation of emulation-software (start-stop-terminal emulation with output at the asynchroneous port) on the PC under MS-DOS;

   Proof of interworking (remote log-in facility) through the private X.25-switch with the ICL ME 29 computer;

5. Connection of two telephone links on the premises of MoI (Comp. Center) direct or via the private telephone switch at MoI to the ARENTO PSTN (public switched telephone network) through modems (MultiTech 224, 2400 bit/s) to the private X.25- switch (PAD function);

6. Connection of four already existing IBM-compatible PCs located in R&D centers in Cairo and/or Alexandria (final decision up to the discretion of MoI) to the ARENTO PSTN through dial-up modems (MT 224, 2400 bit/s);

Installation of emulation-software (start-stop-terminal emulation with output at the asynchroneous port) on the PCs under MS-DOS;

Proof of interworking (remote log-in facility) through the PSTN (direct telephone dial-in) to the private X.25-switch (PAD function) with the ICL ME 29 computer;

7. Installation and connection of one IBM-compatible PC (ICL DRS M55) in a R&D center in Cairo and/or Alexandria (final decision up to the discretion of MoI) to the ARENTO PSTN through dial-up modems (MT 224, 2400 bit/s);

Installation of emulation-software (start-stop-terminal emulation with output at the asynchroneous port) on the PC under MS-DOS;

Proof of interworking (remote log-in facility) through the PSTN (direct telephone dial-in) to the private X.25-switch (PAD function) with the ICL ME 29 computer;

8. Installation of the telephone dial-in facility to the PAD-function of EGYPTNET in Cairo and in Alexandria, to forward remote log-in access through EGYPTNET to the private X.25-switch at MoI;

9. Connection of one (already existing) IBM-compatible PC located in a R&D center in Alexandria(final decision to the discretion of MoI) through a modem (MT 224, 2400 bit/s) with direct asynchroneous access (direct 2 wires 2400 bit/s) to EGYPTNET (PAD-function);

Installation of emulation-software (start-stop-terminal emulation with output at the asynchroneous port) on the PCs under MS-DOS;

Proof of interworking (remote log-in facility) through the PAD-function of EGYPTNET and the private X.25-switch at MoI with the ICL ME 29 computer;

10. Installation and connection of two IBM-compatible PCs (ICL DRS M55), one in a R&D center in Cairo (final decision up to the discretion of MoI) and one at the premises of the UNDP office in Cairo through modems (MT 224, 2400 bit/s) with direct

asynchroneous access (direct 2 wires 2400 bit/s) to EGYPTNET
(PAD-function);

Installation of emulation-software (start-stop-terminal emulation
with output at the asynchroneous port) on the PCs under MS-DOS;

Proof of interworking (remote log-in facility) through the PAD-
function of EGYPTNET and the private X.25-switch at MoI with the
ICL ME 29 computer;

11. Final proof of interworking from all PCs with the ICL ME 29 and the
HP 3000 GX computer (remote log-in facility) via

- telephone dial-in to the PAD-function of the private X.25-switch

or

- telephone dial-in to the PAD-function of EGYPTNET in Cairo and
Alexandria, forwarded through EGYPTNET to the private
X.25-switch at MoI

or

- direct access to the PAD-function of EGYPTNET in Cairo and
Alexandria, forwarded through EGYPTNET to the private
X.25-switch at MoI.

Notes:

The Installation Costs to connect to EGYPTNET should be
included as well as one annual charge for each connection.

There is no assessment given for an estimate concerning the
relation between users (time charge) and for data
transmission (voulme charge).

All remote log-in provisions from remote PCs to the ICL ME 29
and the HP 3000 GX computer shall be evaluated according to
experiences with reliability of telephone links, availability of
access to the private PAD-functions or the public PAD
provided by EGYPTNET in terms of frequency of data transfers
and resulting tarification issues.

Inst	Qty	Equipment needed	Price (US-$)
1.	1	X.25-switch: CODEX 6525, 12 ports up to 9.6 kbit/s with integrated PAD functionality	4500
2.	1	Modem: CODEX 2345 (no offer available, app. price)	1800
3.	1	ICL Comm-HW: F 3570/15 X.25 HDLC Coupler	4000
	1	ICL Comm-SW: E 70103/02 X.25 Protocol TME	2000

4.
1	Work-Station DRS M55-041	3346
1	VGA Monoch. Monitor	244
1	Matrix-Printer ML 193+	1429

		5019

		discount 10%	4517
		Emulation-SW.Start-Stop-Terminal (app. price)	500
		DRS 55 Software	1774

5.	2	Modem: Multitech MT 224 (700.- each)	1400
		Cables, Plugs, Adapters, etc. (app. price)	1000
6.	4	Modem: Multitech MT 224 (700.- each)	2800
7.	1	Work-Station DRS M55-041 (compl., 10 % disc.)	4517
	1	Modem: Multitech MT224	700
8.		Installation charge and annual costs only (see list for EGYPTNET conn.)	

9.	1	Modem: Multitech MT224	700
10.	2	Work-Station DRS M55-041 (compl., 10 % disc.)	9034
	2	Modem: Multitech MT224 (700.- each)	1400
11.		no extra charge	-------
		Sum	**40642**

Connections to EGYPTNET to be provided through ICL:

Type and Location	Price (in E..P.)	
	Install./Ann.Ch.	

- Synchroneous Access with two digit sub-addresses
  at the premises (Comp. Center) of MoI
  direct X.25, 4-wires, 9600 bit/s   600   1000

- Asynchroneous Access
  at the premises of one R&D Center in Alexandria
  direc: , 2-wires, 2400 bit/s   600   500

- Asynchroneous Access
  at the premises of one R&D Center in Cairo
  direct , 2-wires, 2400 bit/s   600   500

- Asynchroneous Access
  at the premises of the UNDP office in Cairo
  direct , 2-wires, 2400 bit/s   600   500

- Asynchroneous Access through PSTN
  in Alexandria (public PAD)
  1200 or 2400 bit/s   300   120

- Asynchroneous Access through PSTN
  in Cairo (public PAD)
  1200 or 2400 bit/s   300   120

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Install. and fixed Comm. Costs 1st year   **3 0 0 0**   **2740**
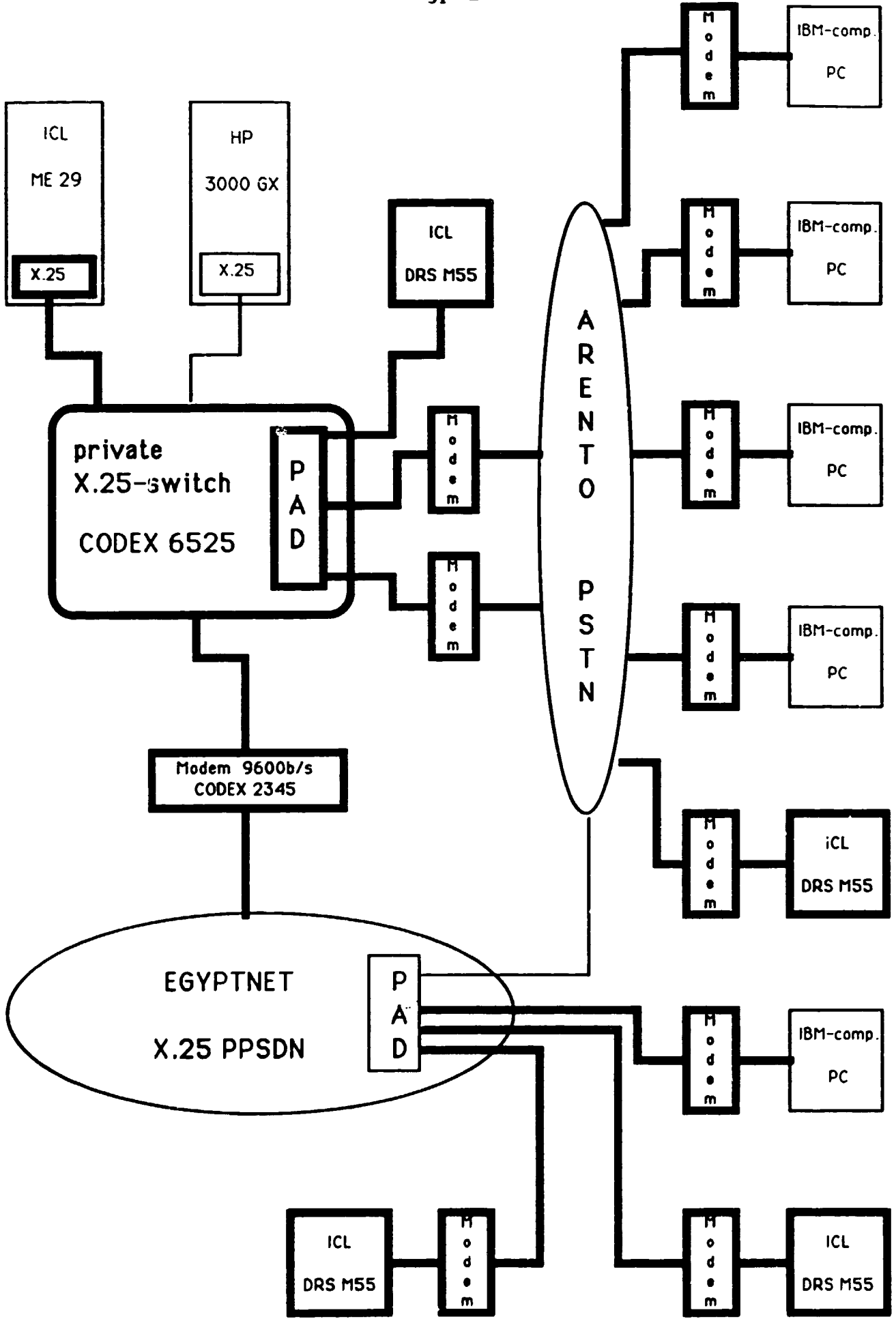
HP (ORASCOM, incl. subcontractors)

1. Installation of a computer HP 3000 GX (incl. Power house software) and connection to the private X.25-switch at the premises (Comp. Center) of MoI;

2. Proof of interworking with the ICL ME 29 computer (remote log-in facility from each site to the other);

   Proof of interworking with EGYPTNET with 1 digit sub-addressing;

   Proof of interworking from all already connected PCs mentioned above with the HP 3000 GX computer (remote log-in facility) via different possibilities.

Qty	Equipment needed		Price (US-$)
1	Complete Data Base Computer with X.25 connection:		
	32536A, HP 3000 GX	17292	
	C10016, bilingual workstation 700/92	3204	
	2235, rugged Writer Printer	1400	
	3244A, NS 3000/V Network Services	3588	
	24405, NS X.25 3000/V Network Link	6032	
	MPE Operating System		
	Turbo Image D.B.		
	COBOL, BASIC Compilers		
	36570, HP desk manager	6760	
	27535F, Advance Mail II	4810	
	Power House 4th G.L.	5800	

		51386	
	Discount 10%		46247
1	Voltage Equ.: AZTECH 4kVA	2500	
	Discount 10 %		2250

	Sum HP (ORASCOM)		**48497**
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