3.1.2 Trends in Telecommunications Service Provision in Syria

3.1.2.1 Telephone Service and ISDN

The first Syrian investments in digital telephone systems were made in the early part of the last decade. Unfortunately, this was followed by a period of low investment that lasted into the early nineties. The result was a substantial increase in the number of waiting applicants, a substantial increase in the waiting time for service provision, and a serious degradation in the quality of service for the subscribers connected to the network.

This downward trend was reversed with a 1-million-line telephone network expansion program that commenced in 1993. This had the effect of dramatically improving the quality of service for connected customers. However, the improvements as regards the waiting list and the waiting time for service provision were not as great as expected because the construction of the corresponding subscriber networks was delayed.

The selection of a second-generation digital switching system for the 1-million-line expansion brought with it the possibility of offering a number of supplementary services for POTS subscribers connected to the new switching system (e.g., Call Waiting and Call Diversion). These supplementary services have been advertised by the STE, but up to now the level of subscription has not been significant.

The new digital switching system is also capable of supporting ISDN, and five local exchanges (two in Damascus and one in Aleppo, in Homs, and in Lattakia) are equipped with a total of 450 ISDN basic accesses for the purpose of conducting a pilot ISDN service. However, despite the fact that the exchanges in question were installed in 1993 and 1994, no customers are yet connected and only some trials involving the STE have taken place.

3.1.2.2 Mobile Networks

The STE is at an advanced stage in the preparations for launching a call for tender for a mobile telephone network based on the GSM standard. The STE plans to seek tenders for the provision of the Syrian GSM network on the basis of a 'turn key' project. The contract for this project will include the detailed design of the network.

The tendering process will also include the following, possibly separately contractible, elements:

- training for STE operation and maintenance staff on the GSM system
- technical support and consultancy during the initial two years of operation, and longer if necessary

The turn key project is expected to take 20 months for execution and handover to the STE. Because the specification, tendering, and contract negotiation should take about six months, the GSM network is expected to be ready 26 months after the decision to proceed.

The STE also plans to seek tenders for a Public Paging Network, which will be combined with the GSM in a single tendering procedure and a similar turn key project approach.

3.1.2.3 Text, Image, and Data

Telex service has been running for many years in Syria, but usage levels and demand are falling mainly because of improvements in the quality of the telephone service and the introduction of facsimile service.

Facsimile service is offered with specific connection and usage tariffs additional to those for the normal telephone service.

Data communication services are offered via a small-scale packet-switched data network. This pilot service has been available since 1994, with dedicated and dial-up access to packet nodes provided in the major cities.

3.1.2.4 Other Services

The following are the other main services that have been developed recently or for which development plans are under consideration:

Leased Lines
The STE provides analog leased-line services that are used for dedicated access to the packet-switched data network and for private network applications.

Operator-Assisted Services
The nationwide operator service has been upgraded in the recent network expansion project, which provided more than 500 digital operator positions (terminals connected to EWSD).

Public Payphone Services

One thousand modern coin payphones and 300 debit-card payphones have been provided recently, and public facsimile services are also available at a number of STE public offices.

Directory Information and Value-Added Services

There is not a well-developed market for these services in Syria. Only a basic directory-inquiry service exists, although improvements are planned. Plans are under consideration for the development of the Directory Inquiry service that is based on a database application running on stand-alone PCs and that could be updated from the customer services computer system database. The feasibility of this approach, however, has not been established. No information or value-added service other than a "time announcement service" is available.

3.2 Basic Considerations on Services Provision Strategy for Syria

3.2.1 Methodology for Developing the Services Provision Strategy

Traditional approaches to telecommunications service provision evolved from the days when there was one network (the PSTN) and one service (plain old telephone service) and when Network Planning was therefore effectively the same as "Service Planning." Now a wide range of services is possible, and these services may be provided using one network (an integrated network), a combination of dedicated networks, or a combination of integrated and dedicated networks. These networks and network combinations will give rise to specific requirements in

- all the areas that require fundamental technical plans to be specified (e.g., switching, signaling, numbering and transmission).
- the detailed planning of the telecommunications infrastructure
- the planning for human resource requirements in engineering, operational management, business planning, and marketing
- the planning for organizational change
- long-term strategic planning

These are the reasons a services provision strategy is needed.

The services provision strategy is based on the demand forecasts given in Chapter 4. In addition to the demand forecast, the rationale of the services provision strategy is based on;

- the assumption that the STE, as the organization with sole rights to provide telecommunications services in Syria, is obligated to provide the Syrian business community and the country in general with the most efficient telecommunications services possible

- the high degree of uncertainty as to how the market will develop

- a qualitative analysis (based on professional experience and consultation with the study team members) of trends in telecommunications services and the identification of future directions in services provision that are considered strategically important for the STE.

3.2.2 Corporate Mission

The approach to developing a strategy for telecommunications services provision should rely fundamentally on a full appreciation of the corporate 'Mission' of the company.

While it is not known if the STE has written a mission statement there is little doubt that the STE has a mission. This is clear from its recent investments both in the basic network and in new services. The STE's Annual Report for 1992/1993 provides some insight into the Mission of the company: The STE is dedicated to

- extending the basic telecommunications infrastructure, constructed using the latest technologies, across the entire populated territory of Syria;
- providing advanced services such as Mobile Telephone, Data Communications, and ISDN services to meet the business-communications needs as the Syrian economy grows (and therefore playing a central role in the development of the Syrian economy);
- improving and expanding connectivity to support basic and advanced services with neighboring countries and the international community.

The service provision strategy in this chapter has been developed in line with this mission statement. The successful implementation of this strategy will pose a challenge to the STE. This fifteen-year service strategy does not presume to set any limit on the ability of the Syrian telecommunications network operator (STE) to transform itself in order to be capable of meeting the challenges facing it. In the short term, however, it is recommended that the STE should seriously examine all options to procure appropriate external assistance in improving organizational, management, marketing, and engineering skills for certain key service areas such as mobile-telephone, data-communications, and Intelligent-Network-supported services.

3.2.3 Quality of Service Standards

3.2.3.1 Scope

Probably the single most important challenge facing the STE is the need to improve the overall quality of service to users of the network. The STE has invested (and intends to continue investing) in 'state of the art' telecommunications networks and there is therefore no reason that STE cannot achieve levels of overall service quality that compare favorably with international quality standards. This cannot be achieved overnight, however, and will require a huge commitment by the entire STE organization.

It is not the intention of this section to specify the objectives, targets, and time scales for achieving improvements in the Quality of Service. This is a task that only the network operator itself can undertake.

The purpose of this section is

- to provide an overview of the approach adopted by ITU-T (formerly CCITT) to the subject of Quality of Service, and
- to identify some of the basic indicators by which the Quality of Service can be measured (and, therefore, how the rate of improvement can be evaluated by the STE management).

3.2.3.2 The ITU-T Approach

The concepts and approach to Service Quality adopted by ITU-T are contained in the E-Series Recommendations. The approach is a complex one (mainly because of the wide scope of the subject) and there is therefore a need to define standard vocabulary for describing the various generally applicable concepts. The following is a summary, in a simplified form, of the main concepts.

The ITU-T's approach is based on a methodology that examines Service Quality from the perception of the *user* of the service. In utilizing a telecommunications service the user may perceive two entities:

- the "Network Operator" that provides the means to access and use the service

- the "Network" itself. That is, the terminals (if provided by the operator), lines, switches, etc.

The contribution of the network operator to the quality of service is characterized by one performance concept, *service support performance* (Figure 3.2.3.2-1) which is defined as the ability of an organization to provide a service and assist in its utilization.

The contribution of the network to the quality of service is characterized by three performance concepts:

Service operability performance is the ability of a service to be successfully and easily operated by a user (including the characteristics of terminal equipment, the intelligibility of tones and announcements, etc.)

Serveability performance is the ability of a service to be obtained - within specified tolerances and other given conditions - when requested by the user and to be provided for the requested duration. (Serveability performance thus reflects the response of the network during the establishment, retention, and release of a service connection)

Service integrity is the degree to which a service, once obtained is provided without excessive impairments. Service integrity is therefore primarily concerned with the quality of the signal at the receiving end.

All these concepts are defined from the perspective of the *user* of the service. From the perspective of the network operator, a useful concept is network performance:

Network performance is the ability of a network or network portion to provide the functions related to communications between users. It is a concept by which network characteristics can be defined, measured, and controlled to achieve a satisfactory level of service quality.

The relationship between these concepts is depicted in Figure 3.2.3.2-1.

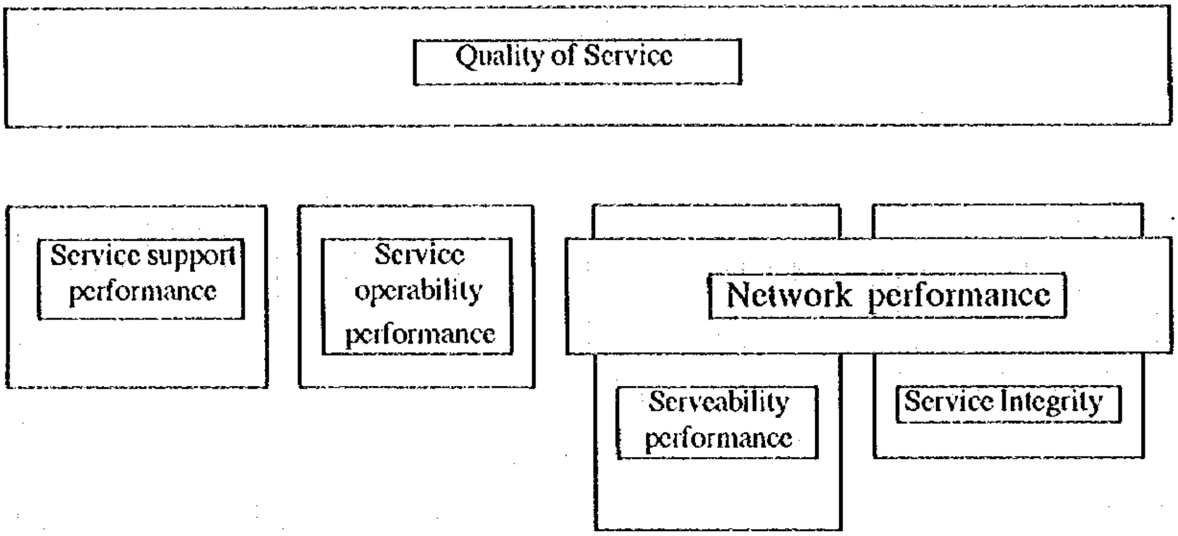


Figure 3.2.3.2-1 Relationship of Service Quality Concepts

Measures of performance based on this approach, as defined by ITU-T, are described in detail in S1-3-1 in the Supporting Report.

The above approach recommended by ITU-T should be seen as a long term target methodology for improving the service quality. The methodology is sophisticated because it is intended for use by network operators whose quality of service is already very good, which implies that more precise ways of analyzing the various quality of service parameters are needed in order to continue to make improvements from the perception of the user.

Therefore the above approach is recommended for Syria, but only as a long term objective.

3.2.3.3 Recommended Short/Medium Term Approach for STE.

It is recommended that the measures of performance as contained in Table 3.2.3.3-1 be adopted by STE. The measures are broadly in line with those recommended by ITU-T and will facilitate a migration towards the ITU-T approach.

Table 3.2.3.3-1 Recommended Measures of Network Performance

Measure of performance	Method of measuring	Equivalent ITU-T performance category
Telephone penetration per 100 population	Based on national statistics	-
Telephone penetration per household	Based on national statistics	-
Service automation (the percent of subscribers connected to automatic telephone service)	Based on STE data on the network	-
Service homogeneity (the percent of subscribers connected to digital exchanges)	Based on STE data on the network	-
Mean service provisioning time	Based on STE data on waiting applicants	Service support performance
Number of waiting applicants	Based on STE data on waiting applicants	Service support performance
Subscriber fault reports per 100 subscribers per year	Collection of data at fault report centers	-
Mean waiting time for fault repair	Collection of data at fault report centers (will require that the time of fault repair be reported to fault report center)	-
Percent of faults reported more than once by subscribers	Collection of data at fault report centers	-
Percent of bills issued on time (normally within 2 weeks of the end of the billing period)	Collection of data at billing centers	Service support performance
Percent of bills disputed by customer	Collection of data at (billing) centers which specifically handle complaints regarding bills.	Service support performance
Percent of bills with overcharging	Collection of data at billing centers	Service support performance
Percent of bills with undercharging	Collection of data at billing center	Service support performance
Dial Tone Delay	Testing according to defined time intervals and busy hours	Serveability performance
Answer/Bid ratio	Traffic measurements, and or statistics from test calls	Serveability performance
Answer/seizure ratio	Traffic measurements, and or statistics from test calls	Serveability performance
Percent of successful calls	Traffic measurements, and or statistics from test calls	Serveability performance
Percent of calls that are interrupted	Very difficult to measure. Only should be investigated in situations where subscriber reports suggest a real problem.	
Percent of established connections with transmission impairments	Using test calls.	Service integrity
Percent of customers satisfied with the overall quality of service	Using surveys of customer attitudes.	Overall service quality

3.2.4 The Importance of Marketing

In the preliberalization days of the monopoly network operator (the PTT), there was a single uniformly applied telecommunications service that was offered to the customer, more or less on a "take it or leave it" basis. The PSTN has nevertheless penetrated practically all corners of the world, basically because it provided a service recognized by users as essential. Most users, particularly in developing economies, do not yet perceive advanced telecommunications services as essential, and instead consider issues such as the quality and price of the basic service to be the most important. Furthermore, advanced services have been developed in telecommunications services markets that are competitive, or that are being geared up for competition. One of the reasons that advanced services are successfully introduced in competitive markets is that competition leads to the development of marketing skills.

The importance of marketing and the importance of business skills in general should therefore not be underestimated when making investments in telecommunications networks to support advanced services. In particular, it is recommended that the following points be given serious and careful consideration when making decisions on plans for service introduction:

Modern telecommunications networks can deliver many services and service features to the customer. Selling these services to the customer, however, will be successful only when supported by a detailed marketing strategy based on a clear understanding of the communication requirements/preferences of the different classes of users and on the targeting of specific user groups with individual services and service features that satisfy their requirements/preferences. This is in contrast to the "take it or leave it" approach.

Some of the services available on modern networks have been designed primarily to increase the usage of other (basic) services, the revenue from which may be much more valuable to the network operator. Therefore the underlying business strategy that led to the design of a service must be understood and assessed to determine if that business strategy is appropriate. And the design parameters of the service need to be understood so that the service can be customized if a different business strategy is needed.
In general, modern systems/services require modern management and marketing techniques, without which the investment may be partly or even wholly wasted. Therefore it is at least as important to develop the commercial skills needed to successfully market modern telecommunications services as it is to develop the technical skills needed to operate the networks these services run on.

3.3 Plain Old Telephone Service (POTS)

3.3.1 Basic Telephone Services for POTS

Table 3.3.1-1 lists the basic telephone services that are recommended to be provided :

Table 3.3.1-1 Recommended Basic Telephone Services for POTS

Basic Telephone Service	Residential Customers	Small Businesses and Professionals	Medium/Large Businesses	Notes
Local, long-distance, and international dialing	x	x	x	Note 1
Access to assistance operators	x	x	x	Note 2
Access to emergency services	x	x	x	Fire, ambulance, police
Access to directory information services	x	x	x	National and international
Private payphone services	-	x	x	Note 3
Line hunting	-	x	x	
Outgoing service restriction	x	x	x	Permanent code barring
Malicious call trace	x	x	x	
Detailed billing information	x	x	x	(Excluding local calls)

Note 1

This service should be made equally available to all customers without any restriction as to the nature of the terminal equipment being used (i.e. telephone, facsimile, modem) provided that the terminal equipment meets the approval requirements for connection to the public switched telephone network.

Note 2

The usual services available through the operator—such as call establishment, assistance, reversed-charge calls, person-to-person calls— should be provided.

Note 3

The private business sector should be encouraged to make telephone services available to the public. This is discussed further in Subsection 3.8.

3.3.2 Supplementary Services for POTS

Supplementary services for POTS can be problematic for the network operator to properly manage. The problems can be understood by first examining the background against which they developed.

In the early eighties there was in the international standardization bodies, a debate about how to handle supplementary services for POTS. The main body of opinion, while recognizing the benefits of standardization for supplementary services for POTS, were fearful of the impact such standards would have on the market for ISDN, the marketing strategy for which in many countries was centered on the ISDN supplementary services that in practice were not a whole lot different from the current POTS versions. But switch suppliers, who had been delaying the development of these services because the standards work was at an early stage, then proceeded to develop their own versions of the services. This development gained momentum from the delays in ISDN deployment, and supplementary services for POTS have gained widespread acceptance in many markets.

There are still no internationally agreed standards (Stage 1 description in ISDN terminology) for the supplementary services for POTS. The CEPT, under a new mandate following the establishment of the ETSI, carried out further work in this area but this work may not be known outside the CEPT countries and may not even be applied by all the main CEPT-based switch suppliers. The problem of standardization becomes more acute when more than one switch supplier is involved.

A second problem that results from the lack of standardization of supplementary services for POTS is that the services interactions are not defined. For example, some switch suppliers are now offering Calling Line Identification (CLI) on POTS lines using DTMF down the analog subscriber line. So in the case of a "diverted call," one could ask the question what CLI number is identified: the "A-Number" or the "B-Number." Nowhere is this service defined for POTS.

A third problem with supplementary services, which is not unique to POTS but is shared by ISDN supplementary services, is that there is a large number of them, their development having followed the trends set in the PABX industry. The total number of individual supplementary services is about 20, and this total is growing. There is a high risk that both the network operator's marketing staff and the customers will become confused. Table 3.3.2-1 lists the commonly available supplementary services for POTS. The brief explanation of each service given there is intended only to give an idea of the function of the service (i.e., it is not a full service definition).

Table 3.3.2-1 Commonly Available Supplementary Services for POTS

Name	Explanation
Abbreviated dialing	Use 1 or 2 digits to dial up to 100 prestored telephone numbers.
Call diversion :	Forwarding, to another number, of all incoming calls:
-Call forwarding unconditional	- independently of the condition of the incoming line
-Call forwarding on busy	- only when the incoming line is busy
-Call forwarding on no reply	- only when there is no answer for a predetermined period
- Call forwarding on busy or no reply	- when the incoming line is busy, or when there is no answer for a predetermined period
-CFU with precedence over CFB/CFNR	- CFU can be activated and has precedence when CFB/CFNR is active on the line
Alarm-clock call (one call)	User sets a time within 24 hours to receive ringing on his line.
Alarm-clock call (daily)	User sets time to receive ringing on his line, daily, for a period.
Call waiting (with call hold)	Call attempt to an engaged line causes a special tone on that line.
Call hold	User may put an active call on hold and answer or establish another call
Three-party conference	To establish, or to join, two simultaneous calls on one line.
Hot line (immediate)	Immediate call attempt to a fixed destination on "pick up"
Hot line (delayed)	Call to a fixed destination, if dialing does not start within a few seconds.
Malicious call trace	Assumed to be part of the basic service
Meter observation	Recording of charge units per call, for a limited period.
Service restriction (by STE)	Assumed to be part of the basic service
Service restriction (by Subs)	Prevent outgoing calls to all or certain destinations (User activated).
Call completion to busy subscriber	Calling subscriber encountering busy, network will establish call when busy line is free.
Calling line identification presentation	Calling line number is signaled to the called subscriber using DTMF
Do not disturb	Diversion of all incoming calls to a network announcement.

A fourth problem is how to properly charge for these services. The STE has published only subscription-based tariffs: usage-based tariffs do not seem to be specified. So, for example, the subscriber may wish to have all his calls diverted from his home to his office but may not understand that all diverted calls may be charged to his home line. And whether the activation of a service actually incurs a charge has not been specified.

For all these reasons it is recommended that the STE proceed with caution and take a stepwise approach to the marketing and sales of supplementary services for POTS.

As a first step, it is recommended that STE select a small number (at most three) of supplementary services for POTS. The services suggested are call waiting, call hold, and three-party conference. These services are proposed because

- they are relatively simple services
- they complement each other to the extent that all three could be invoked on the same call
- use of the services also will imply increased use of the basic services (and therefore, increased revenue)

There are two essential steps that must be taken before offering the service to customers:

- *Testing and verification of the operation of the service:* all aspects of the operation of the services, including the charging for the activation and for the use of the services, should be fully tested against the services specifications from the switch supplier, which in turn should be verified against any available international specifications for the services. Marketing material and instructions for the customer should then be prepared on the basis of the tested and verified service description rather than on the basis of assumptions about how the service works.
- *Fieldtrial:* the services should then be run on a field-trial basis in a restricted exchange area. Following a full assessment of the field trial, the service should be offered to all customers.

Following a reasonable interval, which should be defined in the marketing strategy for POTS and which ultimately will depend on the market reaction to services launched, a second supplementary services group could be introduced (following the above procedure). It is suggested that this service group be the "Call Diversion" services:

- Call forwarding unconditional
- Call forwarding on busy
- Call forwarding on no reply
- Call forwarding on busy or no reply

Further steps could be defined but, in general, the approach should not be based on the assumption that all services for which the exchanges are equipped need to be introduced. It should instead be based on the development of business cases and marketing strategies for each service and service group.

3.3.3 POTS Services for Medium-size & Large Business Customers

One of the most popular POTS services among medium-size and large business customers today is Direct-In-Dialing (DID). An ISDN, DID service is sometimes mistakenly listed as a supplementary service for POTS, but it actually is a service that normally requires a completely different interface structure. In any case, regardless of how it is classified as a service, it is singled out here for special attention because of its widespread popularity as a service that improves business communications efficiency and that also increases call completion rates and, therefore, revenue.

DID enables the network to address the extension line terminals on the customer's PABX without the need for intervention by the customer's call-handling operator. Normally, however, if there is no answer within a certain time, the call should revert to the operator. Apart from the improvements in the efficiency of call handling, DID will enable

- facsimile machines and other communications terminals to be connected to the customer's PABX without the need for dedicated PSTN lines
- calls to be answered at extension lines after normal working hours (when the call-handling operators have stopped working);
- the exploitation of other service possibilities in the PABX, such as voicemail

The main disadvantage of the service from the network operator's point of view is that the service can lead to inefficient use of the available number ranges, depending largely on the way the service is specified by the network operator and implemented by the switch manufacturers. Normally the service treats the PABX, with its extensions, like another local switching node on the public network and therefore has to allocate it a number range like that allocated to any other local node. The number range may far exceed the requirements of any particular PABX and the unused part of the number range may therefore be wasted since it cannot be allocated to another customer. Where there is a high concentration of large customers who want DID service, number ranges in the area may become "eaten-up" faster than expected.

The DID service must, therefore, be taken into account when drawing up the national network numbering plan.

3.4 Mobile Services

3.4.1 Mobile Telephone Service

As described earlier in Subsection 3.1.2.2, the STE is at an advanced stage in the preparations for launching a call for tender for a mobile telephone network based on the GSM standard. With regard to the provision of basic mobile telephone service, evolution to new mobile services, interworking with the digital fixed network infrastructure, international interconnectivity, and roaming with neighboring countries and the rest of the World, GSM is strategically the right choice for the Syrian Public Land Mobile Network. Since the STE has already made this choice it is not considered useful to discuss the alternative options, and it remains to be said only that the choice of GSM is fully endorsed.

There are three areas on which this section will focus:

- the time scale for the launch of the GSM service
- the services to be specified in the tendering process
- organizational issues

3.4.1.1 Time Scale for the Launch of the GSM Service

It is strongly recommended to get started with the GSM service as soon as possible. Mobile telephone service is strategically important for several reasons :

- it is potentially a high revenue earner and, for the operator of the fixed network and the monopoly service provider, the required initial investments will be much less than what would be required of a new network operator starting from nothing;
- it will bring with it a huge boost to the public image of the STE as a service provider, particularly among the influential business sector
- it is a service that brings real added value to the customer in terms of the efficient use of time and the efficient management of a business, and is one that has a positive overall influence on the business environment and business culture
- it facilitates communication for business people and private individuals who travel internationally and it will enhance the image of the country as a place to visit for business, investment, holidays, etc.

- it can be a very valuable service in cases of emergency and may be an economically viable way of providing public payphone services in areas that do not yet have fixed network services.

For all these reasons, the STE should move ahead with the GSM project as soon as possible.

3.4.1.2 Services to be Specified in the Tendering Process

In addition to the standard list of GSM services which have been already specified in STE's GSM procurement specification, reference number 4/93 dated August 1993 (currently planned to be updated by the STE), the voicemail facility should be included in the tendering process as a functionally integrated, but possibly physically separate, solution. The voicemail service may prove very useful for customers who do not have a fixed network telephone to which calls may be forwarded when the customer is outside the coverage area. Since the coverage at the time of service launch will not be extensive, the voicemail service will help to smooth any initial complaints about the coverage and should prove to be one of the selling points of the service.

An interesting variation on the voicemail service is that it can also be used as a faxmail. With this service, a single GSM terminal with a data port, can support sufficient communication functionality to establish a small business. However, the design of the mail box server memory requirements for faxmail will be substantially different than for voicemail, so this option should also be explicitly mentioned in the tendering specification.

It should be specified as a requirement that the network management system shall be in accordance with ITU-T TMN principles. Section 8.5 contains a description of TMN.

In addition, it is recommended that the system shall be capable of supporting Intelligent Network (IN) functionality and interfaces. Information on IN services and network architecture are contained in Sections 3.7 and 6.13 of this report.

3.4.1.3 Organizational Issues

It is strongly recommended that

- a functionally separate management structure be established within the STE for the purposes of handling all aspects of the establishment and operation of the GSM service in Syria.
- the STE procure the services of an external agency or company that is experienced in all aspects of the successful provision of mobile telephone services to support the new management structure for a period of at least two years, and longer if necessary.

3.4.2 Paging Service

Paging Services are now flourishing all over the world since they came into use in U.S.A., and there were more than 53 million subscribers by the end of 1994.

As radio technologies progress, the paging services now provide various kinds of services such as numeric or alphanumeric display, wide-area paging services, and value-added services different from the conventional services paging only by tone signals.

The STE has a plan to introduce a paging system, and as far as possible the system is to utilize the same base transceiver stations that will be prepared for the mobile telephone system. This is one of the most significant matters from the viewpoint of cost savings.

If the STE selects the ERMES system, it will need to coordinate the use of the available radio-frequency band.

3.5 ISDN Services

The services supported on the Integrated Services Digital Network (ISDN) are well documented and specified by international standards bodies, and the specification have been available in publications from those bodies since 1988. It is, therefore, not considered useful to provide a detailed description of the ISDN services in this section. The reader is advised to refer to the relevant material in the ITU-T Recommendations Series I 200.

The ISDN has developed slowly over the past 10 years, but the difficulties are well on the way to being solved and ISDN can be seen as the network of the future not only for big companies but also for small and medium-size companies. ISDN growth rates in some European and other counties are beyond 30% per year. Today some ISDNs have millions of user lines for primary-rate access and basic-rate access.

In general it must be stated that ISDNs will not play a significant role (in terms of the percentage of total subscriber's economic impact, and social effects) for the STE within the next 4 to 5 years. The reasons for this are spelt out in the demand forecast for ISDN contained in the second section of Chapter 4.

There are, however, some good reasons for introducing ISDN services soon:

- strategic reasons
- to satisfy service requirements of certain business customers
- to increase the efficiency with which subscriber lines are used
- to obtain expertise

Therefore it is recommended that the line unit capacity should be expanded during the Eighth Five-Year plan. At most 1% ISDN of the total number of line units seems to be a sufficient amount of ISDN lines for the next 3 to 4 years, but the amount will probably be less than that. It is important, however, that ISDN can be offered on a broader basis in the business area; that is, it is important that ISDN is available to most business customers.

As mentioned above it is important for the STE, together with other interested organizations in Syria, to develop expertise in ISDN techniques and applications. There is currently a lot of ongoing development work on ISDN applications. The STE has the advantage that its digital telephone network can, relatively quickly, be equipped with additional ISDN capacity. It is therefore important that the required expertise be developed and that trials with various services and applications are executed professionally. If circumstances with regard to narrow-band ISDN do not change, the development of this expertise will anyway be necessary in preparing for future trials on faster data communications and B-ISDN services.

The STE's existing capacity of ISDN termination, installed at telephone exchanges in four of the main cities, is an ideal basis for starting ISDN activities. It is recommended that the STE establish an ISDN pilot as soon as possible.

It is also recommended that a full reevaluation of the future potential for ISDN be carried out within 2 years, at the latest towards the end of the Eighth Five-Year plan.

3.6 Data Communication and Wide-Area Networking Services

3.6.1 Background

Data communications has in the past ten years or so undergone a revolution, driven by two main factors :

- substantial growth in demand for more flexible and faster data communications in developed economics.
- liberalization in the telecommunications services market generally and in the nonvoice sector in particular

Data/WAN communications networks that have become well established or that have begun to emerge during the past ten years or so are the following :

- Data communications over the switched telephone network
- Digital leased-line services
- Services based on packet-switched networks
- Frame-relay (FR) services
- Switched Multimegabit digital services (SMDS)
- Metropolitanarea networks (MANs)
- Broadband switching networks (based on the ATM)

This evolution towards higher and higher speeds is being driven by

- a widespread use of powerful computer systems that can generate very large files an organization may want to move around within the organization or communicate to a different organization (in particular the widespread use of Local-area networks (LANs), and the desire by organizations to interconnect these LANs)
- the development of multimedia applications for the services sector and for desktop PC users
- the liberalization of the basic telecommunications infrastructure, allowing competition in the local loop and the marging of interactive entertainment and television distribution with telecommunications services provision.

Typical bit rates and applications foreseen, and the networks that can support them , are listed in Table 3.6.1-1.

Table 3.6.1-1 Typical Bit Rates, Applications, and Supporting Networks

Bit rate	Holding time (avg.)	Applications	Supporting networks/services
up to 64 kbit/s	10 - 1,200 s	Telemetry, Telecontrol, Telegram, Facsimile, File transfer, Videotex, E-mail, Voice, etc.	PSTN, PSDN, ISDN, Leased lines
up to 10 Mbit/s	10 - 1,200 s	Multimedia, Hi-fi sound, Video telephony, Interactive data, Bulk data transfer	ISDN (nx64 kbit/s), B-ISDN, SMDS, MAN, Leased lines
10 - 600 Mbit/s	up to several hours	Video distribution, Video library, Video education, Interactive video	SMDS, MAN, B-ISDN based on the ATM

3.6.2 Options for Data Communications in Syria

3.6.2.1 Data Communications on the PSTN

The PSTN has the capabilities to support certain low-speed data applications, the main one being of course Facsimile Group 3, and is increasingly being used to support file transfer (PC/Server - Server/PC) as an economical alternative to facsimile transfer of text-based files. However, apart from facsimile, the modern day PSTN's main role in data communications is in providing dial-up access to dedicated data communications networks, such as X.25 packet-switched data networks (PSDNs), and the services that may be accessed thereon, such as database access to videotex applications, file uploading/downloading, and electronic mail systems. There has, following the steady and steep decline in prices for personal computers, been a global escalation in the use of electronic mail systems.

The only PSTN data communication application that has found widespread use in Syria is facsimile transmission. The principal reasons for this are the low penetration levels for computers in the country and the strict regulations governing the connection of modems. The PSTN should, however, play an important role in supporting data communications in the following areas:

- in supporting the expected growth in facsimile communications
- in supporting file transfer
- in supporting dial-up access to the PSDN
- in supporting access to information services (e.g., the Internet)

No specific plans need to be drawn up for supporting data communications on the PSTN, but it is recommended that the regulatory situation with regard to the connection of data terminals, modems, etc. should be reviewed to remove unnecessary constraints that may inhibit this sector of the market.

3.6.2.2 Data Communications on the Telex Network

The decline in telex network worldwide has been as dramatic as the rise in the deployment of facsimile machines. It goes without saying that no further investment in the telex network should be made. Current telex traffic appears mainly to be international, and this too will rapidly decline with the improvement in international data communication—including facsimile transmissions to and from Syria.

3.6.2.3 Data Communications on the Packet-Switched Data Network

It is recommended that packet-switched data network (PSDN) form the core infrastructure upon which data communications will be supported in Syria until at least the year 2005. The STE is running a PSDN service in Syria.

The approach to developing the packet-switched data network should start with

- a detailed assessment of the currently running PSDN service, including a detailed assessment of customer's capability to take advantage of the service and how customer usage is expected to evolve
- the identification of STE's own requirements as a user of the service
- a technical evaluation of the packet-switching system installed in Syria
- identification of measures to stimulate demand for the service, including the development of service/information providers, the establishment of service nodes of international electronic mail services such as the Internet or X400, and the establishment of electronic mail services

A detailed feasibility study on the development of the PSDN is therefore urgently needed and should be carried out as part of the next phase of the study. Specifically, the PSDN should be capable of handling

- the expected growth in demand for the service from the government/industry/service sectors for dedicated and dial-up access

- expected growth in demand from small enterprises, PC users, etc. who wish to access the service using dial-up access via the PSTN
- the STE's own future requirements for PSDN services, requirements due to
  - the large-scale computerization of the customer service order system, first with the expected 14 centers in Damascus (and later with the establishment of centers throughout Syria)
  - the large-scale computerization of the billing system and the reliable transfer of call charging data from the digital telephone exchanges/OMCs directly to the Billing System host computer
  - the installation of a network management system which could require very frequent transfer of traffic data and other kinds of data from the digital telephone exchanges and other network components
- interworking with ISDN exchanges to provide service support for field trials and pilot ISDN services to be launched

3.6.2.4 Data Communications on the ISDN

As discussed earlier (Section 3.5), the further deployment of ISDN line unit capacity will be limited. It is assumed, however, that the ISDN will play an increasing role in data communication in Syria.

Clearly it is important to give priority to data applications in the trials and pilot services for ISDN. It is therefore recommended that appropriate interworking capability between the ISDN exchanges and the PSDN be established.

3.6.3 Leased-Line Services

The following leased line services should be offered by the STE:

Ordinary-quality leased lines for telephony and other purposes not requiring the use of special-quality circuits. These leased lines should conform to ITU-T (formerly CCITT) Recommendation M.1040.

Special quality leased lines conforming to ITU-T (formerly CCITT) Recommendation M 1020.

Both the above ITU-T Recommendations are intended for international leased lines but are also widely applied to leased lines for national use and are therefore recommended for use in Syria for both national and international leased lines.

In addition, the STE should extend its leased-line services to cover the whole range of digital leased line services (subrates, 64-kbit/s, nx64-kbit/s, and 2-Mbit/s leased lines). The specific arrangements necessary to provide these digital leased lines have to be worked out.

The STE should also explore the possibility of offering a "value-added" leased-line service (sometimes called Managed Bandwidth Service, MBS).

3.6.4 New Services and Technologies

It has already been pointed out that there is a trend for broad bandwidth. Also new services (e.g., FR for LAN interconnections) are becoming important in data communication. It is therefore recommended that studies on and trials of these new services and technologies be started soon.

3.7 Intelligent-Network-Supported Services

3.7.1 What is the Intelligent Network (IN)?

First of all, it should be pointed out that the Intelligent Network (IN) is not actually a "network" at all. It is a set of functions that, when embedded in a telecommunications network, combine with that network to provide the basic building blocks for creating a completely new range of telecommunications services.

ITU-T (Recommendation Q.1219), which is a useful guide for IN users (i.e., network operators) describes the IN as a concept, for the creation and provisioning of telecommunications services, characterized by

- extensive use of information processing techniques
- efficient use of network resources
- modularization of network resources
- integrated service creation and implementation by means of reusable standard network functions
- flexible allocation of network functions among physical entities
- portability of network functions to physical entities

- standard communications between network functions via service-independent interfaces
- service provider access to the process of the composition of services
- subscriber control of subscriber-specific service attributes
- standardized management of service logic

(Note : The significance of the items in *italics* is explained in the next subsection.)

The IN architecture is described in Chapter 6, Section 6.13, of this report.

3.7.2 What is IN Capability Set 1?

Capability Set 1 (IN CS-1) of the IN is primarily concerned with the characteristics that appear in *italics* in the list of characteristics in Subsection 3.7.1. In effect, IN CS-1 is a subset of the full set of capabilities envisaged for an IN. This approach was developed in ITU-T and ETSI to enable network operators to enhance their existing network resources to support an initial IN capability. This will enable the rapid deployment of IN CS-1 capabilities, allowing network operators to gain the benefits of IN as early as possible while providing a migration path to future IN capabilities.

The principal capabilities included with CS-1 are

- A service implementation platform that will support the definition of many services independent of the equipment providers
- A multivendor capability within an IN-structured environment
- A multinetwork capability that will allow network operators to provide services that span their combined networks
- Rapid service delivery, since the services created using the IN do not depend on further equipment or software delivery by the equipment vendors
- Service deployment independent of the network node

3.7.3 Service aspects of CS-1.

The following are the basic service capabilities of the IN CS-1 :

Flexible routing, in which the service provider maintains the ability to control the routing decisions on the basis of criteria such as: time of day, day of week, and authorization codes.

Flexible charging, in which the decisions regarding the charging for services are under the control of the service provider and can be based on criteria such as location, destination, origin, and authorization codes.

Flexible user interaction, which provides the capability of altering the amount or degree of user interaction on a service-by-service basis.

Examples of specific services ("building clocks") supported by these basic capabilities, or subsets thereof, are the following :

Freephone, which basically enables the called party rather than the calling party to be charged for the call. This service, however, can also incorporate flexible routing capabilities to enable freephone calls to be routed to different call-handling centers depending on criteria such as the origin of the call, the time of day, or the day of the week, or depending on a proportional call distribution algorithm. This means that the Freephone service can be defined to meet the Freephone customer's needs. The network operator will have access to the process of manipulating the building blocks precisely in order to customize the service. Future customers may also have access to the blocks and be able to customize the service. The service has proved itself attractive to companies who use it as a competitive tool to attract customer calls and now represents a substantial revenue earner for many network operators.

Universal Number, which is a call management service that basically decouples the numbering schemes from the network access point and therefore enables the allocation of company-specific numbering that is independent of the location of the company. Such arrangements can involve a shared call charge assignment between the calling and called party. The service can also be adapted to provide *premium rate* services, in which the calling party pays the entire charge for the basic call plus a surcharge for information/consultation provided by a value-added service provider.

Universal Personal Telecommunications (UPT), which enables the user to initiate and receive calls on any terminal by using a personal UPT number. The UPT user who wishes to receive or initiate calls at any telephone can simply register his location with the network.

Televoting, which allows large-scale surveys and opinion polls to be conducted over the telephone network. Such polls are usually conducted via national sound and TV broadcasting stations and can result in telephone traffic surges which are processed (counted) at the distributed service-switching points of the IN rather than at the centralized service control points so that traffic congestion on the network is avoided or minimized.

Virtual private networking (VPN), which provides an alternative (or complementary solution) to the use of leased lines for supporting the internal communications of an organization with PABX facilities at different locations. This is achieved mainly through the support of a private numbering plan for the customer.

Wide-area centrex, which is similar to VPN except that the multisite customer does not have private switching facilities (PABXs) and instead relies totally on the services provided by the network operator. These services are in two parts: Centrex facilities provided for each of the customer's sites, and IN services to interconnect those sites in a wide-area private network that is supported fully on the public switched network. Since customers may have a mix of PBXs and Centrex facilities, their private networks may be supported using both VPN and Wide-Area Centrex services.

It should be pointed out that the Intelligent Network concept has developed as a result of evolving competitive market conditions. For this reason, IN-supported services have not been standardized in detail, since many service providers are reluctant to reveal their future services strategies. The above service description should therefore not be taken as service definitions in the sense of the Stage 1 descriptive methodology used for ISDN.

3.7.4 Recommendations regarding the Intelligent Network for Syria.

In general there are no strong market pressures on the STE to deliver services of the type discussed in the preceding subsection, and the STE is, on the other hand, faced with significant challenges to improve the quality of the basic service and to introduce data and mobile-telephone services. It might then be argued that it is not justified to devote scarce resources to what appears to be a futuristic concept.

To counter this argument, it must be stated that IN-supported services will bring real benefits--in terms of communications--to all network customers connected to the PSTN. Freephone, for example, has proved a major success. In addition, IN services such as Universal Number, and the associated premium-rate charging possibilities, provide an efficient mechanism for connecting third-party service providers to the network and for apportioning revenue. The Universal Number service will therefore greatly encourage the development of third-party service providers.

On the other hand, market conditions can also change rather quickly and demands for specific services, such as Freephone, for example, could result in pressure to introduce this type of service quickly. What should be avoided in this situation is the introduction of services like Freephone or Televoting, in ways that are not supported by the Intelligent Network concept.

It is recommended that the STE establish as a strategic target the introduction of IN-supported services from the beginning of the Ninth Five-Year plan. This will require that an IN-services planning group be established as soon as possible to carry out detailed studies on all aspects of the IN and to prepare for a possible field trial or pilot service, or both, to be launched near the end of the Eighth Five-Year plan.

It is recommended that the following services should be the focus of study by the IN planning group :

Freephone Service
Universal Number
IN-supported access to voicemail (fixed and mobile network)
Televoting
VPN (as an alternative to leased lines for private voice networks)
CENTREX (as an alternative to a PABX)

3.8 Public Payphone and Telecenter Services

The STE has already demonstrated a progressive approach and a commitment to meet its social responsibilities by introducing modern payphone facilities in Syria and by providing facsimile terminals at public call offices. It is recommended that this policy continue and, specifically, that the following course of action be pursued.

The STE should continue to expand its public payphone services. A suggested target penetration of public payphones is 1 per thousand inhabitants by the year 2010 (a roughly 5-fold increase from the current penetration level).

It is recommended that the STE should devise plans to encourage the deployment of private payphones in small-business premises, such as shops and restaurants, so that the burden of providing public payphone services is not carried entirely by the STE. A payphone on private premises, however, is by definition not a "public payphone," and one disadvantage of a private payphone is that access at certain times might not be guaranteed and 24-hour access is usually not possible. Public payphones, however, are not guaranteed to work 24 hours a day either, and maintaining public payphones in proper working order is in fact a problem that most network operators have ongoing difficulties in solving. From the point of view of the public, the availability of private payphones should therefore prove to be at least as beneficial as that of public payphones.

One basic requirement of all payphones, public and private, is that they provide "coin/card free" dialing access in emergency services.

It is also recommended that the STE develop its public call office services to cover a range of communications services. It is suggested that all large towns have a public call office (Telecenter) that provides access to telephone, facsimile, dial-up access to data services, etc. for use by individuals and small start-up businesses. Larger centers could be better equipped and the centers in the largest cities, Damascus and Allepo, should be equipped with videoconference facilities.

The above strategy covers the requirements for public payphones and telecenters only in areas that are already served by a telephone exchange. A separate strategy for areas that do not have any telephone service at all, particularly small isolated villages and rural areas, should be developed. A number of options may be considered :

- the use of GSM payphones (solar-powered if necessary) for small villages and rural areas that are fortunate enough to fall within the GSM coverage areas;
- the use of other suitable terrestrial radio systems
- the use of satellite-based telephone services

All isolated communities without other telephone service should have access to public payphones. The most feasible way of achieving this, and the appropriate targets to be achieved, can only be established after a detailed assessment of population distribution in the country and of the areas not expected to be served by the PSTN during the planning period.

As a basic principle, bearing in mind the economic and social obligations for the provision of universal service by the monopoly telecommunication service provider, all villages not served by a telephone exchange should be provided with public payphone services by one of the means discussed above. Furthermore, as a basic principle, all smaller communities (less than 100 residents) made up of fixed permanent residences in areas not served by the PSTN should be provided with public payphone services no more than 3 kilometers from any point in these communities.

3.9 Value-Added Services

Value-added services are, for the purpose of this Chapter, defined as services that are provided by third-party service providers in co-operation with the STE. The types of services that are typical for this sector are

- General Information Services
  - sports results
  - weather reports
  - financial reports
  - advice lines on various topics
  - travel schedules

- Specialized Information Services
  - access to various databases
  - directory information
  - information retrieval

- Electronic Mail Services

The STE will have to take a proactive role in assisting outside organizations in developing these services. Specifically, it is recommended that the STE encourage the development of electronic mail services based on the establishment of an INTERNET or X400 node for Syria. Planning for the introduction of IN services on a pilot basis should target value-added service providers.

3.10 Long-Term Service Provision Strategy

3.10.1 Summary of Main Strategy on Services

The long-term service provision strategy should be focused on four principal areas :

I *Improving the Quality of Service as a priority objective*

II *The provision and expansion of mobile services*

III The provision and expansion of the packet-switched data network services including new services and technologies

IV The development of Intelligent -etwork-supported services

I Improving the Quality of Service as a priority objective

Probably the single most important challenge facing the STE is the need to improve in the overall quality of the services provided to users of the network. Clearing the backlog of waiting applicants and satisfying their demands is part of this objective. Regarding the other aspects of service quality, STE has invested (and intends to continue investing) in 'state of the art' telecommunications networks and therefore there is no reason that the STE cannot achieve levels of overall service quality that compare favorably with international standards. This cannot be achieved overnight, however, and will require a lot of commitment by the entire STE organization.

Detailed recommendations on methods to establish and monitor improvements in quality of service standards are contained in Subsection 3.2.3.

II The provision and expansion of mobile services

It is strongly recommended to get started with the GSM services and the Paging Services as soon as possible. Although mobile telephone service is strategically important for several reasons, the paging services are more popular. This is because in spite of it's being only a one-way communications tool, it is less expensive than the GSM services.

For these reasons, the STE should move ahead with the GSM and paging services project as soon as possible. In taking this steps, the STE should seriously consider

- a functionary separate management structure to be established within the STE for the purposes of handling all aspects of the establishment and operation of mobile services in Syria.

- the procurement of the services of an external agency or company experienced in all aspects of the successful provision of mobile services to work with the new structure for a period of at least two years, and longer if necessary.

- The trend toward low-earth-orbit (LEO) satellite systems for the mobile communications, including the paging systems. In particular, for the next several years telecommunications operators must seriously take into account the trend of these systems considerations because they have the possibility of changing telecommunications systems drastically. LEO satellite services are also expected to be provided in combination with the existing terrestrial services.

III The provision and expansion of the packet -switched-data-network services including new services and technologies

The PSDN should be capable of handling

- the expected growth in demand for the service from the government/industry/service sectors for dedicated and dial-up access
- expected growth in demand from small enterprises, PC users, etc. who wish to access the service using dial-up access via the PSTN
- the STE's own future requirements for PSDN services, that is, requirements due to
  - the large-scale computerization of the customer service order system, first with the expected 14 centers in Damascus (and later with the establishment of centers throughout Syria)
  - the large-scale computerization of the billing system and the need for the reliable transfer of call charging data from the digital telephone exchanges/OMCs directly to the billing system's host computer
  - the installation of a network management system which could require very frequent transfer of traffic data and other data from the digital telephone exchanges and other network components
  - interworking with ISDN exchanges to provide service support for field trials and pilot ISDN services

A detailed feasibility study on the development of the PSDN is needed and should be carried out as part of the next phase of the study.

New data communication services and requirements as well as necessary consequences (e.g., a "new generation" network) should be studied. New services should include future requirements for more bandwidth requirement and for FR. "Value added" leased-line services could be part of this new platform.

IV The development of Intelligent-Network-supported services

In general there are no strong market pressures on the STE to deliver IN-supported services, and the STE is, on the other hand, faced with significant challenges to improve the quality of the basic service and to introduce data and mobile-telephone services. It might then be argued that it is not justified to devote scarce resources to what appears to be a futuristic concept.

To counter this argument, it must be stated that IN-supported services will bring real benefits—in terms of communications—to all network customers connected to the PSTN. Freephone, for example, has proved a major success. In addition, IN services such as Universal Number, and the associated premium-rate charging possibilities, provide an efficient mechanism for connecting third-party service providers to the network and for apportioning revenue. The Universal Number service will therefore greatly encourage the development of third-party service providers.

It is recommended that the STE establish as a strategic target the introduction of IN-supported services from the beginning of the Ninth Five-Year plan. This will require that an IN-services planning group be established as soon as possible to carry out detailed studies on all aspects of the IN and to prepare for a possible field trial or pilot service, or both, to be launched near the end of the Eighth Five-Year plan.

It is recommended that the following services should be the focus of attention by the IN planning group:

- Freephone Service
- Universal Number
- IN-supported access to voicemail
- Televoting
- VPN/CENTREX

3.10.2 Organizational Issues

Services planning is considered to be essential so that the STE will be in a position to provide advanced telecommunications services at the right time and to ensure at the right price, and that the customer has the resources and skills to take advantage of these services.

The STE will need to develop its partnerships with the other key players in the economy, business, and industry in order to

- jointly plan for the deployment of advanced communication services for strategically important business sectors such as education, health, and tourism.
- encourage the large users to plan their necessary investment in developing technology and skills in ways that are consistent with the STE services planning.
- encourage the development and provision of value-added services by independent service providers.
- encourage the development of a range of related services such as local software/system suppliers, system integrators, consultants, building cabling installers, and so forth.
- ensure that appropriate international standards and codes of best practice are applied generally in the installation and interfacing of customer-premises equipment with the public network.
- apply minimum requirements on the connection of customer-premises equipment and systems to encourage innovation in the development and use of applications that exploit advanced services.

In conclusion, the STE needs urgently to invest in training and management development in order to equip a fully resourced team with the necessary technical knowledge and marketing skills needed to engage the business users, industry, and government agencies in a long-term coordinated marketing and deployment program.

3.10.3 Time Schedule

The approximate time scale for services development in Syria is given in Figure 3.10.3-1.

Services Provision Year	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10
Improve QOS towards intl. standards		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
GSM				■	■	■	■	■	■	■	■	■	■	■	■	■
Paging service				■	■	■	■	■	■	■	■	■	■	■	■	■
PSDN service	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
M1020/M1040 leased lines	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
nx64-kbit/s leased lines			■	■	■	■	■	■	■	■	■	■	■	■	■	■
2-Mbit/s leased lines				■	■	■	■	■	■	■	■	■	■	■	■	■
"New Generation" pilot service				■	■	■										
"New Generation" services						■	■	■	■	■	■	■	■	■	■	■
ISDN pilot service		■	■													
ISDN services				■	■	■	■	■	■	■	■	■	■	■	■	■
IN pilot service					■	■										
IN-supported services							■	■	■	■	■	■	■	■	■	■

Figure 3.10.3-1 Time Scale for Service Development in Syria

CHAPTER 4 DEMAND FORECAST

4.1 Telephone Service

In the study, demand is forecasted by two steps. The first step is a macroscopic level forecast throughout the country. This forecast is a top down forecasting approach. The second step is a microscopic level forecast for each province and each individual telephone service area; i.e. a bottom up approach.

4.1.1 Macroscopic Demand Forecast

The macroscopic forecast of the Syrian nation-wide demand for the long term plan basically conforms to ITU recommendations which standardizes national telephone demand forecast by regression equation. However, the result is corrected to take account of the waiting list.

(1) ITU model

Following ITU's recommendation, the National demand forecast is calculated by the exponential equation showing the correlation between demand density (number of main telephone lines per hundred population) and the level of the Gross Domestic Product (hereinafter referred to as GDP) per capita. The calculation makes it possible to forecast future telephone density at the national level by firstly projecting the GDP and population in the future years. The regression model showing the correlation between telephone demand density and the GDP per capita is obtained by the least square method. The Data on the calculation in taken from world countries' current data of main line density per one hundred population and GDP per capita in US dollar. The world countries' data shows the trend of demand in every stage of the development.

Tables 4.1.1-1 shows the data collected for this study and Figure 4.1.1-1 shows the results of the calculation using the above-mentioned method.

Table 4.1.1-1 Main Line Density and GDP per Capita (1/2)

<GDP per capita: $676-$2,695>

Country	GDP per capita (US$)	Density (ML/100 pops)
Dominica Republic	694	6.35
Republic of Kiribati	750	1.86
Republic of Honduras	763	2.06
Republic of Cote d'Ivoire	765	0.67
Republic of Senegal	775	0.75
Mongolia	800	3.00
Republic of Cape Verde	820	3.14
Republic of the Philippines	824	1.03
Papua New Guinea	830	0.90
Western Samoa	865	4.06
Republic of Bolivia	886	2.38
Republic of Angola	915	0.46
Republic of Guatemala	928	2.20
Democratic People's Republic of Korea	943	4.75
Republic of Djibouti	990	1.44
Republic of Cameroon	1,045	0.43
Kingdom of Morocco	1,075	2.48
Kingdom of Swaziland	1,080	1.92
Republic of Tadzhikistan	1,090	4.87
Romania	1,090	11.17
Republic of El Salvador	1,102	3.05
Syrian Arab Republic	1,119	4.11
The Slovak Republic	1,127	15.49
Hashemite Kingdom of Jordan	1,160	6.49
Republic of Vanuatu	1,170	2.06
Republic of Congo	1,240	0.76
Republic of Peru	1,295	2.81
Republic of Ecuador	1,298	4.95
Republic of Lithuania	1,310	22.14
Kingdom of Tonga	1,315	5.43
Republic of Bulgaria	1,330	26.14
Saint Vincent and the Grenadines	1,385	13.97
The Czeck Republic	1,390	17.64
Jamaica	1,457	6.81
Republic of Colombia	1,490	8.44
Islamic Republic of Iran	1,500	5.02
Federated States of Micronesia	1,500	2.81
Republic of Paraguay	1,528	2.83
Republic of Namibia	1,530	3.99
Republic of Tunisia	1,565	4.46
Republic of Cuba	1,580	3.18
Republic of Kyrgystan	1,620	7.58
Republic of Georgia	1,725	10.42
Republic of Costa Rica	1,757	10.54
Republic of Turkey	1,820	16.17

Table 4.1.1-1 Main Line Density and GDP per Capita (2/2)

<GDP per capita: $676-$2,695>

Country	GDP per capita (US$)	Density (ML/100 pops)
Kingdom of Thailand	1,908	3.10
Republic of Fiji	1,930	6.32
Republic of Iraq	1,940	3.50
Republic of Poland	1,960	10.28
Republic of Bosnia and Herecegovina	1,988	20.39
Republic of Macedonia	1,996	9.35
Commonwealth of Dominica	2,015	19.57
Republic of Lebanon	2,110	9.26
Republic of Armerica	2,115	16.64
Saint Lucia	2,115	13.04
Democratic and People's Republic of Algeria	2,130	3.65
Federative Republic of Brazil	2,151	6.83
Belize	2,171	12.42
Republic of Panama	2,257	9.67
Republic of Moldova	2,305	11.73
Turkmenistan	2,305	6.55
United Mexican States	2,317	7.54
Grenada	2,335	20.56
Republic of Mauritius	2,515	7.42
Republic of Yugoslavia	2,549	17.13
Republic of Botswana	2,570	2.62
Republic of Uzbekistan	2,575	6.70
Malaysia	2,591	11.13
Average of 68 countries	1,531	7.33

Source : World Telecommunication Development Report 1994 (ITU), etc.

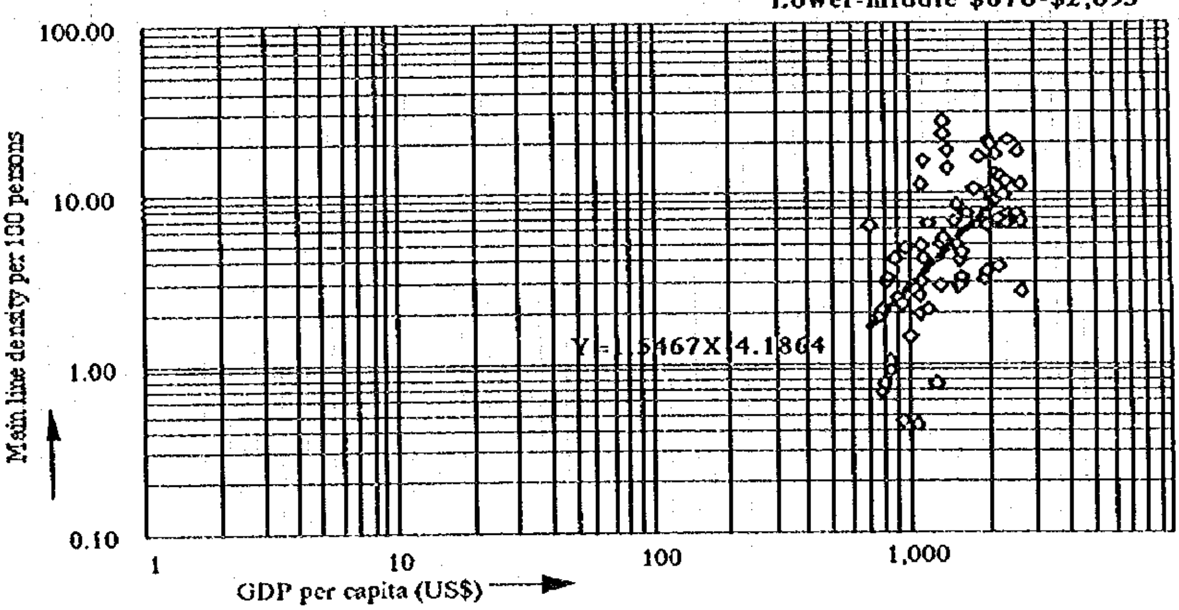


Fig. 4.1.1-1 Main Line Density vs. GDP per capita

The following result using the regression model is obtained by analysis of latest available data on 68 countries reported in World Telecommunication Development Report 1994 (ITU).

$Y=1.5467X-4.1864$ ..... [1] where

$Y=\log y$, y : Main Line Density

$X=\log x$, x : GDP per capita (in US dollar)

The present study uses a slightly modified regression model to take account of the fact that the current telephone density in Syria is higher than what would be expected from the Syrian GDP.

The modified regression model is :

$Y=1.5467X-3.9787$ ..... [2]

The equation [2] is revised upward in correlation with the equation [1].

(2) Forecast of growth of main demand factors

a) Population Forecast

The population of Syria is about 14 million in 1994. Table 4.1.1-2 shows Syrian population statistics from 1963 to 1993. This data shows that the average population growth rate is around 3.3% or 3.4% with yearly fluctuation, especially, an increase in the last 5 years to 3.4%. This study assumes population growth rate of 3.34%, in line with the average for the past 30 years.

Table 4.1.1-2 Syrian Population Statistics

(Unit : thousands)

Year	1963	1970	1975	1980	1985	1990	1991	1992	1993
Population	4,992	6,257	7,380	8,704	10,267	12,116	12,529	12,958	13,393
Growth rate	Average of annual growth : 3.32%				3.35%	3.39%	3.41%	3.42%	3.36%

Source : "Statistical Abstract 1994", Office of the Prime Minister, Syria

Table 4.1.1-3 shows the population forecast used for the study.

Table 4.1.1-3 National Population Forecast

(Unit of population : thousand persons)

Year	1996	1997	1998	1999	2000	2005	2010
Population	14,780	15,274	15,784	16,311	16,856	19,865	23,412

In this projection, Syrian population will exceed twenty million in 2006. This figure corresponds approximately with the "World Population Prospects, 1990 revision" issued by United Nations.

b) Economic Growth Forecast

According to the "Statistical Abstract 1994", GDP is expressed in the Syrian currency [Syrian Pound]. On the other hand, ITU recommendations of telephone demand calculation are based on GDP in US dollar. It is therefore necessary to estimate the GDP growth using the most appropriate exchange rate from among several possible exchange rates. This study uses the UN-rate adopted by some organizations of United Nations including ITU, which is 1US$ = 26.6 SP. Concerning the growth rate of GDP, this study adopts 5.4%, the average growth rate of the last thirty years, because the recent rate of economic growth fluctuates considerably as shown in Table 4.1.1-4.

Table 4.1.1-4 The Present Status of GDP Growth

(Unit : Million Syrian Pound)

Year	1963	1975	1987	1988	1989	1990	1991	1992	1993
GDP (M.SP)	21,284	50,710	78,018	88,272	79,917	86,836	91,590	100,009	103,170
Growth Rate			-2.87%	13.14%	-9.47%	8.66%	5.47%	9.19%	3.16%

Source : GDP at factor cost at constant prices of 1985 by "Statistical Abstract 1994"

Table 4.1.1-5 shows future GDP, and GDP per capita, estimated for this study.

Table 4.1.1-5 GDP Forecast

(Unit : US dollar)

Year	1996	1997	1998	1999	2000	2005	2010
GDP (M.US$)	17,542	18,490	19,488	20,540	21,649	28,161	36,631
GDP per capita	1,187	1,211	1,235	1,259	1,284	1,417	1,565

(3) Result of Demand Forecast

The GDP per capita values listed in Table 4.1.1-5 were used, with equation [2], to calculate national telephone density in Syria. This density was then multiplied by the forecasted population to get national demand.

The demand calculated this way was corrected to take account of existing subscribers and waiting applicants. That is, the long-term demand was calculated from GDP, and the short-term demand was estimated in consideration of all the data presently available.

The number of those on the waiting list was modified by the probability of cancellations of installation contract. And the growth of the demand was estimated taking into account the future increase of the youthful fraction of the population (that is , the proportional decrease in the size of the income class able to pay the installation fee.

Table 4.1.1-6 shows the calculation result of demand forecast produced.

Table 4.1.1-6 Demand Forecast

YEAR	GDP (M. US$)	Population (M.persons)	GDP/capita (US$)	Density Forecast on GDP/C.	Existing Subscribers (thousand)	Waiting List <corrected> (thousand)	Demand on GDP/C. (thousand)	**Demand <corrected> (thousand)**
1993	14,982	13.39	1,119	[4.11]	550	1,089		**1,639**
1994	15,791	13.84	1,141	[4.95]	685			**1,679**
1995	16,643	14.30	1,164	5.80			829	**1,721**
1996	17,542	14.78	1,187	5.98			884	**1,747**
1997	18,490	15.27	1,211	6.17			942	**1,773**
1998	19,488	15.78	1,235	6.36			1,004	**1,799**
1999	20,540	16.31	1,259	6.55			1,068	**1,826**
2000	21,649	16.86	1,284	6.75			1,138	**1,853**
2001	22,818	17.42	1,310	6.96			1,212	**1,880**
2002	24,051	18.00	1,336	7.18			1,292	**1,908**
2003	25,349	18.60	1,363	7.40			1,376	**1,936**
2004	26,718	19.22	1,390	7.63			1,466	**1,965**
2005	28,161	19.87	1,417	7.86			1,561	**1,994**
2006	29,682	20.53	1,446	8.11			1,665	**2,024**
2007	31,285	21.22	1,474	8.36			1,773	**2,054**
2008	32,974	21.92	1,504	8.62			1,889	**2,084**
2009	34,755	22.66	1,534	8.89			2,014	**2,115**
2010	36,631	23.41	1,565	9.17			2,146	**2,146**

4.1.2 Microscopic Demand Forecast

The microscopic demand forecast is classified into overall survey for demand forecast of a whole exchange area and block survey for demand forecast of each distribution unit area of subscriber cables. The microscopic demand forecast is required for new or additional equipment installation designs such as cabling, civil engineering design, and exchange location planning.
In this study, however, demand in each exchange area is simply forecasted by using the number of existing subscribers and waiting list because it is not easy to obtain the stable statistical data for small geographical areas.

Table 4.1.2-1 shows the calculation result of demand forecast in each provinces.

Table 4.1.2-1 Microscopic Demand Forecast

(Unit : thousand persons)

RROVINCE / Year	1996	2000	2005	2010
DAMASCUS CITY	427.3	453.2	487.7	524.9
DAMASCUS RURAL	230.1	244.1	262.6	282.7
ALEPPO (City)	235.6	249.8	268.8	289.3
ALEPPO (Rural)	45.0	47.8	51.4	55.3
HOMS	151.3	160.5	172.7	185.9
HAMA	101.2	107.4	115.5	124.3
LATTAKIA	133.2	141.3	152.0	163.6
DARAA	58.4	61.9	66.6	71.7
SWEDA	39.3	41.7	44.8	48.3
TARTOUS	81.6	86.5	93.1	100.2
IDLEB	84.6	89.8	96.6	104.0
DER ALZOR	46.5	49.4	53.1	57.2
ALHASAKA	73.0	77.4	83.3	89.6
QUENNETRA	5.7	6.1	6.5	7.0
RAKKAH	34.2	36.2	39.0	42.0
<TOTAL>	1,747.0	1,853.0	1,994.0	2,146.0

4.2 ISDN

The demand for ISDN is estimated to be limited (at least for the next 3 to 4 years) due to the following reasons:

- penetration of computerization in business and government is low, as demonstrated by the market survey. Many ISDN applications that are now proving to be selling points for ISDN have been developed from organizations' needs involving the use of distributed computer systems,
- increased penetration in computerization, which is expected in Syria, does not automatically imply an increase in demand for ISDN. This is because many of the applications that involve ISDN use, depend on relatively specialized or sophisticated uses of computers which would be expected in a later phase of development of computerization in Syria,
- a low penetration of PBX systems that may be upgraded to support ISDN functionality; furthermore, the STE specifications for the manufacturing of 125,000 PABX extension line units make no reference to ISDN.

However the international trend shows that ISDN can be seen as the network of the future not only for big companies but also for small and medium-seize companies. Growth rates in some European and other counties are very promising (>30% per year); ISDN is booming in many European and other countries. There are already ISDNs with some million of Primary Rate Access and Basic Rate Access user lines.

The situation for Syria will change, also the situation will be improved if STE takes an aggressive market oriented approach to introduce ISDN, starting with a well planned ISDN pilot service supported by resources from STE, and other organizations that are willing to participate in a pilot service. The main reason for the ISDN pilot service is not a technical one (ISDN is in operation in many countries and has proven to offer reliable services) but can be seen for the following reasons:

- to develop expertise
  - in ISDN techniques
  - in marketing
- to develop and verify tariff structures

In short:

- to develop an ISDN infrastructure

The main objectives for a quick service introduction are:

- to satisfy customers (mainly business customers) requirements (e.g. for data communication)
- to offer new service features
- to use access lines in a more efficient way (one subscriber line instead of two or more)

The Pilot should start as soon as possible using the existing installed ISDN line unit capacity. This capacity should be expanded as required. It is important that ISDN can be offered on a broader basis for the business clientele, i.e. that ISDN is available for the majority of business customers. A maximum of 1% ISDN line units of the total number of line units seems to be sufficient for the next 3 to 4 years but most likely the number will be less than that.

One of the priority areas which should be the focus of the pilot service is the access to the packet switched data services via the ISDN.

It is recommended that a full re-evaluation of the future potential for ISDN in Syria be carried out at the earliest in 2 years (possibly at the end of the Pilot) but not later than towards the end of the Eighth Five-Year plan.

4.3 Mobile Services

It should be pointed out that the introduction of a cellular telephone system and a paging system in Syria could be regarded as a necessary and highly important issue of the national's development and industrialization policy.

In particular, the western region of Syria is the more density settled, accommodating over 80 percent of Syria's population. Therefore, it is also recommended that mobile services be introduced to this area, including the ten major cities first of all. Then, the two systems should be developed in the eastern region.

4.3.1 General Outlook on Mobile Services

The mobile telephone is one of the major growth industries of the last decade. In mid 80's there were only a handful of countries, mainly in Scandinavia, Japan and Germany, operating public mobile networks. By the end of 1992, there were around 23 million subscribers and services were operational in over 100 countries. The total revenues of analog cellular and digital cellular services were around US$10 billion in 1994 (Financial Times 5.5.95, CIT Research).

Mobile communications are usually perceived to be a luxury good rather than an element of basic services. Actually the distribution of subscribers worldwide is concentrated in the developed countries. Even the main users of mobile phones are to be found among the business community rather than residential users. But on the other hand, mobile services with their radio-based technology, offer a viable alternative to traditional fixed link technology. Especially in terms of providing inexpensive radio-based access to the local loop in rural areas and the chance of bypassing waiting lists in areas of high demand.

Paging Services are now flourishing all over the world since they came into use in 1958 in U.S.A., and there were more than 53 million subscribers at the end of 1994.
POCSAG(Post Office Code Standardization Advisory Group), ERMES(European Mobile Message services) and FLEX are considered to be typical examples of paging systems.

The current status of Paging Services around the world includes the following:

a) Paged information has become highly advanced, with features such as numeric or alphanumeric displays.

b) Systems which are accessible in a wide area have been introduced, such as the Global Paging Services, the Wide Area Paging Services and Nationwide Paging Services.

c) New technologies for dead zones(underground shopping centers, tunnels, etc.)using Boosters have been developed.

d) Value-added services such as weather forecasts and stock market information have been introduced.

e) Sets have been down-sized, improvement in the sensitivity has been undertaken, and the information able to be displayed has been augmented.

4.3.1.1 PSTN Substitution

One of the strongest drivers behind cellular market growth in Middle Eastern countries is the insufficient level of basic telephone services. In countries like Egypt and Pakistan, with waiting lists over a half million people long, cellular service presents an attractive alternative to waiting for a telephone line. Sharp growth in the first year of cellular service can be the result of years of suppressed demand for basic telephone services or customer dissatisfaction with the quality and reliability of service. Targeted at business subscribers and users in the upper economic strata who can afford to pay to avoid waiting lists, cellular service provides a more reliable, convenient, and often more advanced telecommunications facility than the basic service.

Yet the ability of cellular to serve as a substitute for public network services is limited by the state of the public network into which most cellular calls eventually connect. Cellular networks can be installed or expanded more easily than fixed infrastructure by avoiding the chief bottleneck in extending fixed services: the local loop. Cellular networks have been installed successfully in as little as eight months e.g. in Hungary within 8 months and in Turkey within 6 months, 40 radio base stations (RBS) have been implemented. To purchase and install a telephone line, basic service carriers in developing countries invest approximately US$ 2,000 - US$ 5,000. Particularly in the emerging digital environment, investment by cellular operators can weigh in below US$ 1,000 per subscriber.
It is also estimated that that part of the upper economic strata in Syria that has long been waiting for the start of telecommunication services will make use of Mobile Telephone Services.

4.3.2 Mobile Telephone Demand Forecast

Forecasts has been carried out using two methodological top-down approaches. One approach shows a comparison of neighboring countries of Syria that have already introduced cellular systems successfully. On the other hand there is a correlation of cellular development worldwide. Hereby close attention has been paid to current mobile telephone development in the Middle East.

The following table gives an overview of the current cellular development in selected countries in terms of penetration and GDP per capita:

Table 4.3.2-1 Cellular Penetration in Selected Countries in 1993/94

Country	GDP/Capita '91 in US$	Penetration in % Ranked
Cyprus *	10,010	3.9%
Kuwait	26,000	3.3%
UAE	20,655	2.9%
Bahrain	7,585	1.8%
Greece *	9,990	1.3%
Qatar	15,165	0.8%
Oman	6,745	0.3%
Turkey *	1,880	0.3%
Lebanon	1,160	0.1%
Saudi Arabia	7,065	0.1%
Jordan	995	0.03%
Tunisia	1,565	0.02%
Algeria	1,710	0.02%
Morocco	1,075	0.01%
Egypt	550	0.01%
Yemen	635	0.01%

(Sources: ITU Development Report 1994; European Mobile Communications, 11/ 1994)

According to our experience in the introduction of cellular communication systems worldwide, there is no close relation between per capita GDP and mobile telephone density similar to the close relation between per capita GDP and telephone density in the fixed network. But for a first feasibility forecast, the following approach delivers reasonable results.

By the logarithmic model, the best corresponding formula for example would be the function:

$$\text{Log } Y = a+b*\text{Log } X$$

where:

Y = Telephone Line Demand Density

X = GDP per Capita

and a & b are constants with a given value:

a = -4

b = 1.0007

an example....where X=1,235 US$ (:GDP per capita in year 1998 in Syria)

Y=0.1242..... an average figure for every place in Syria

The following graph Figure 4.3.2-1 shows this regression curve embedded in a country survey of mobile penetration rates at the end of 1991 and GDP per capita worldwide.

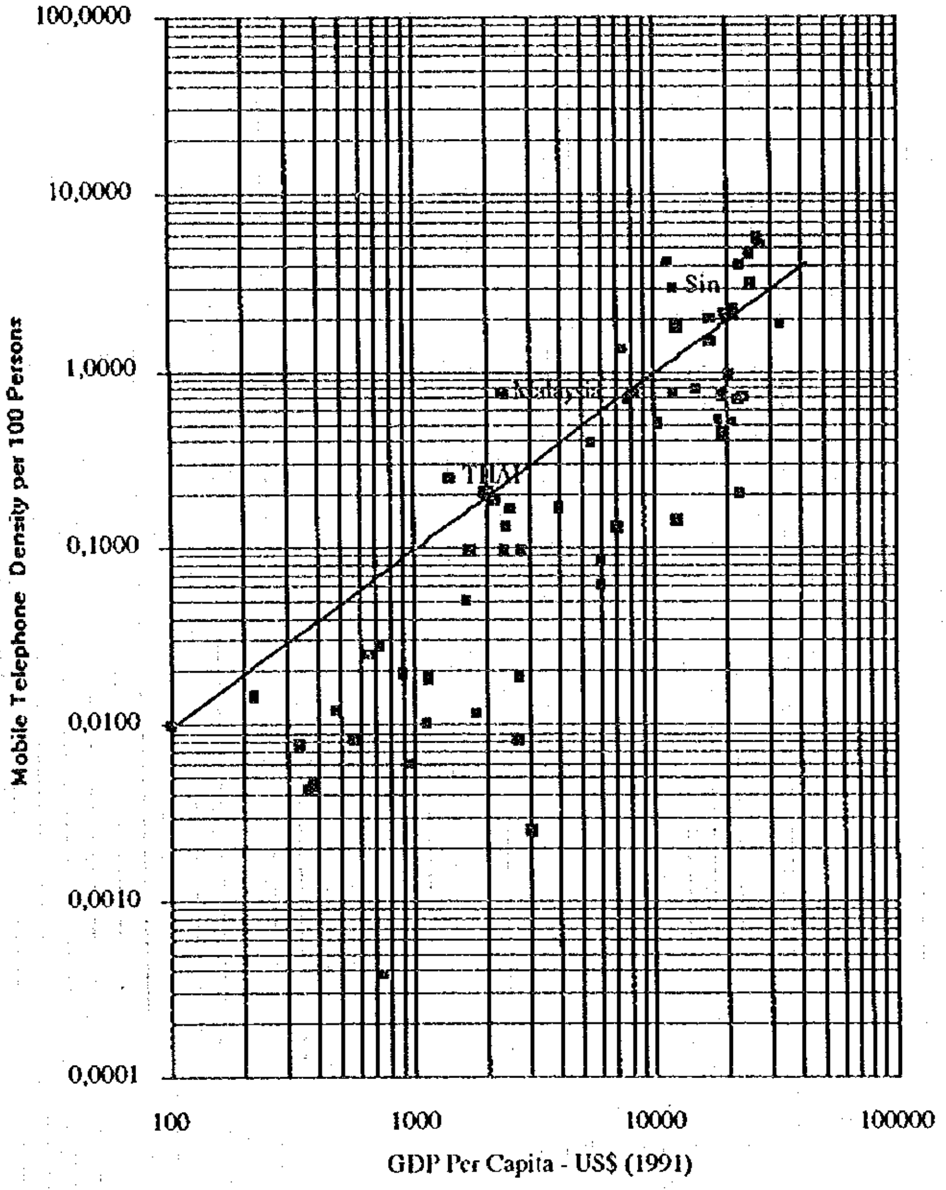


Figure 4.3.2-1 Mobile Telephone Density and GDP per Capita 1991

For the forecast, the following points should be noted.

a) In 1998, the number of applicants awaiting service is expected to be more than 1.5 million, of which from 1 to 3 percent are expected to apply for Mobile Telephone Services as so-called Substitutors.

b) The penetration rate in city areas is expected to be approximately double that calculated as a nationwide rate.(See Table 4.3.2-2.)
Therefore, the actual penetration rate in urban areas of the large western cities is predicted to reach 0.24824.... in 1998.

Table 4.3.2-2 Big City Density Ratio and GDP per Capita

Country	GDP per capita	Telephone Density (National)	City	Telephone Density (City)	City Density / National Density
Tanzania	105	0.29	Dar Es Salaam	1.95	6.83
Senegal	746	0.94	Dakar	2.87	3.05
Morocco	963	1.20	Casablanca	3.27	2.74
Papua New Guinea	764	0.83	Port Moresby	3.97	4.78
Ethiopia	110	0.25	Addis Ababa	4.05	16.3
Philippines	716	0.82	Metro Manila	4.70	5.77
Honduras	538	1.36	Tegucigalpa	4.99	3.67
Paraguay	910	2.30	Asuncion	8.49	3.67
Jamaica	1,441	3.59	Kingston & St. Andrew	8.78	2.45
Iran	5,816	4.32	Tehran	10.55	2.44
Fiji	1,783	5.81	Suva	11.86	2.04
Oman	3,986	6.00	Muscat	12.02	2.01
Brazil	818	5.78	San Paulo	14.61	2.53
Surinam	3,012	9.10	Paramaribo	17.35	1.91
Costa Rica	1,654	8.89	San Jose	17.59	1.98
Tunisia	656	3.77	Tunis, Ariana & Ben Arous	17.62	4.67
South Africa	2,738	9.62	Johannesburg	18.39	1.91
Uruguay	1,867	11.69	Montevideo	19.10	1.63
Turkey	1,734	12.16	Istanbul	24.56	2.02
Malaysia	2,164	7.38	Kuala Lumpur	24.89	3.37
Israel	10,461	33.73	Jerusalem	30.81	0.91
Malta	7,814	28.42	Gozo	32.40	1.14
South Korea	4,940	24.60	Seoul	32.66	1.33
Czech & Slovak	3,958	12.84	Prague	36.01	2.80
Portugal	4,581	17.83	Lisbon	36.42	2.04
Spain	9,700	28.06	Madrid	38.74	1.38
Cyprus	8,322	42.71	Nicosia	45.94	1.08
Italy	14,937	34.93	Rome	46.63	1.34
Australia	14,638	46.57	Melbourne	47.38	1.02
New Zealand	12,595	43.22	Auckland Metropolitan Area	47.72	1.10
Greece	5,687	38.55	Athens	54.77	1.42

Source : ITU Yearbook, 1993, World Telephone, 1991

c) It is assumed that Mobile Services will become available in the three big cities in the eastern region of Syria and the major roads between them in 2005. Their penetration rate and growth rate are deduced by the same method as that used for the western region.

The subscriber base forecasted is the population scenario in the governorates (mohafazat) covered by Mobile Services (see following Table 4.3.2-3).

Table 4.3.2-3 Scenario of Population and Coverage by Governorates (Mohafazat)

Governorates	Population 1998 ** in Covered Areas	Population 2005 ** in Covered Areas	Demand in 1998	Demand in 2005
Damascus	1,928,138	2,426,706	12,000	33,550
Homs	781,576	983,672	3,500	9,785
Hama	483,293	608,260	2,500	6,990
Aleppo	2,183,628	2,748,261	6,500	18,173
Idleb	226,544	285,122	2,500	6,990
Lattakia	392,675	494,211	6,500	18,173
Tartous	161,098	202,754	3,500	9,785
Al-Rakka	0	743,503	0	2,119
Deir-El-Zor	0	859,765	0	2,450
Al-Hasakeh	0	1,478,394	0	4,214
Darra	179,976	226,513	1,700	4,753
Al-Sweida	90,617	114,049	1,500	4,194
Quneitra	51,320	64,590	600	1,677
TOTAL	7,167,305	12,102,256	50,000	148,574

(Source: Statistical Abstract Syria 1994, ** JICA Estimation, Average Population Growth Rate 3.34%)

Table 4.3.2-4 Compound Average Growth Rate of Mobile Telephone Services in the Middle East

Country	Subscribers 1990	Subscribers 1992	CAGR 1990 - 92 in %
Algeria	500	4,800	New launched network, not considered
Bahrain	6,900	9,700	18.50%
Egypt	4,000	6,900	31.80%
Jordan	1,400	1,500	0.80%
Kuwait	20,700	51,000	56.80%
Lebanon	0	3,800	New launched network, not considered
Morocco	900	3,200	New launched network, not considered
Oman	2,700	4,700	31.50%
Qatar	3,800	4,200	5.40%
Saudi Arabia	14,900	15,800	3.20%
Tunisia	1,000	1,900	40.80%
UAE	33,500	48,900	20.70%
Yemen	0	1,600	New launched network, not considered
TOTAL			23.27%

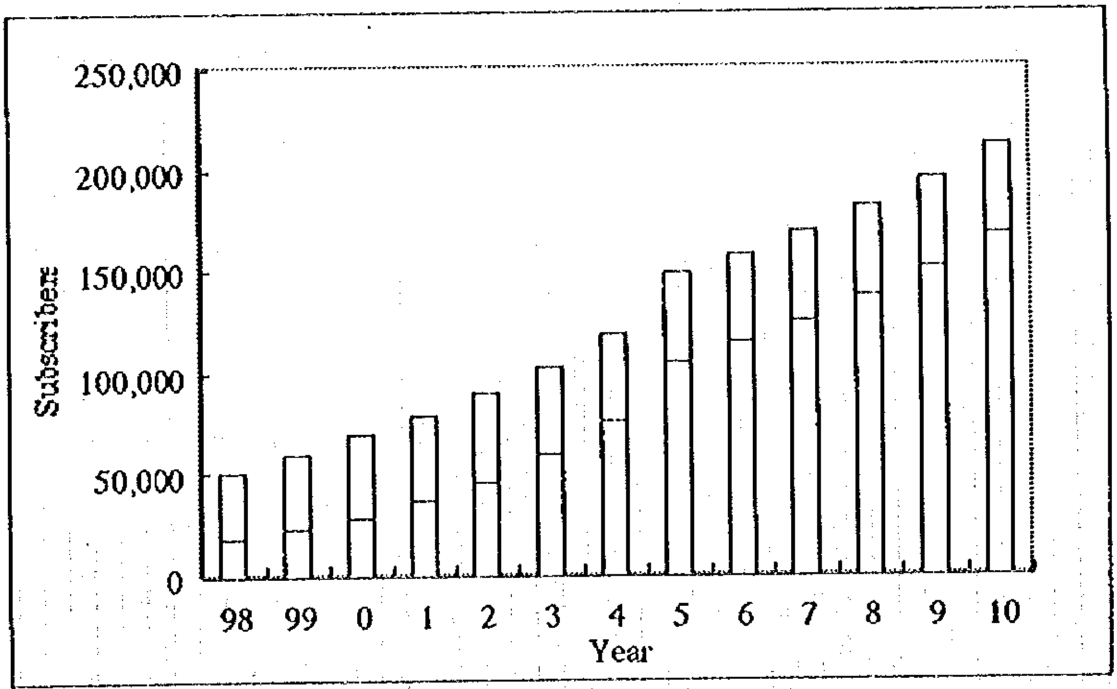
(Source: ITU Arab States Telecommunication Indicators, 1994)

Table 4.3.2-5 Base Scenario of Mobile Subscriber Growth in Syria According to Network Rollout

Year	Population in Covered Areas	Potential Penetration in Covered Areas	Top-Down Forecast	Substitutors	Total Number of Subscribers in each Area	Grand Total of Subscribers
1998	7,167,305	0.248	17,775	32,225	50,000	50,000
1999	7,406,693	0.306	22,664	37,000	59,664	59,664
2000	7,645,077	0.377	28,822	43,000	71,822	71,822
2001	7,909,723	0.465	36,780	43,000	79,780	79,780
2002	8,173,908	0.573	46,836	43,000	89,836	89,836
2003	8,446,916	0.706	59,635	43,000	102,635	102,635
2004	8,729,043	0.870	75,943	43,000	118,943	118,943
2005	9,020,593	1.073	96,791	43,000	139,791	148,574
	3,081,663	0.285	8,783	0	8,783	
2006	9,321,881	1.116	104,032	43,000	147,032	158,210
	3,184,590	0.351	11,178	0	11,178	
2007	9,633,232	1.160	111,745	43,000	154,745	169,324
	3,290,955	0.443	14,579	0	14,579	
2008	9,954,982	1.207	120,157	43,000	163,157	181,317
	3,400,873	0.534	18,161	0	18,161	
2009	10,287,478	1.255	129,108	43,000	172,108	195,233
	3,514,462	0.658	23,125	0	23,125	
2010	10,631,080	1.305	138,736	43,000	181,736	211,190
	3,631,845	0.811	29,454	0	29,454	

(Note: The upper figures for years after 2005 indicate data of the western region; lower figures are data for the eastern region.)

The base scenario assumes that service commencement in the western region will be at the beginning of the year 1998. After that initial phase of the "New Syrian Mobile Network" the CAGR (compound average growth rate) of all introduced mobile systems in the Middle East Region (see table 4.3.2-4) has been applied. In the year 2006, a first saturation has been predicted. For the following years it is estimated to have a yearly growth rate of around at least 4%. The following Figure 4.3.2-2 Subscriber Development for Mobile Telephone Services, Syria 1998 - 2010, describes the forecasted development of mobile subscribers in Syria.
On the other hand, services in the eastern region will begin in 2005 in its three big cities and major roads between those cities, and there are expected to be no Substitutors at that time because Urgent Requesters will have already utilized PSTN Services.



(Note: The upper portions of the bars indicate the number of Substitutors.)

Fig 4.3.2-2 Scenario of Possible Subscriber Development for Mobile Telephone Services, Syria

4.3.3 Paging Services Demand Forecast

At present there are no paging services offered in Syria. Normally the demand for paging services is user-dependent. Typical user groups are emergency services, security patrols, medical doctors, professionals, craftsmen etc. But again there were problems carrying out a demand forecast because of structural changes in the country. Therefore a top-down approach based on the penetration rate per 100 was chosen. The data available with respect to paging services is still very poor because it is a fairly new service.

4.3.3.1 Penetration in Other Countries

Figure 4.3.3.1-1 shows the paging service penetrations in other countries. The following result using the regression model is obtained by analysis of Figure 4.3.3.1-1.

$$\text{Log } Y = -4.22 + \text{Log}X \ldots\ldots(1)$$

where:

Y = Paging Subscriber Density per 100 persons
X = GDP per Capita

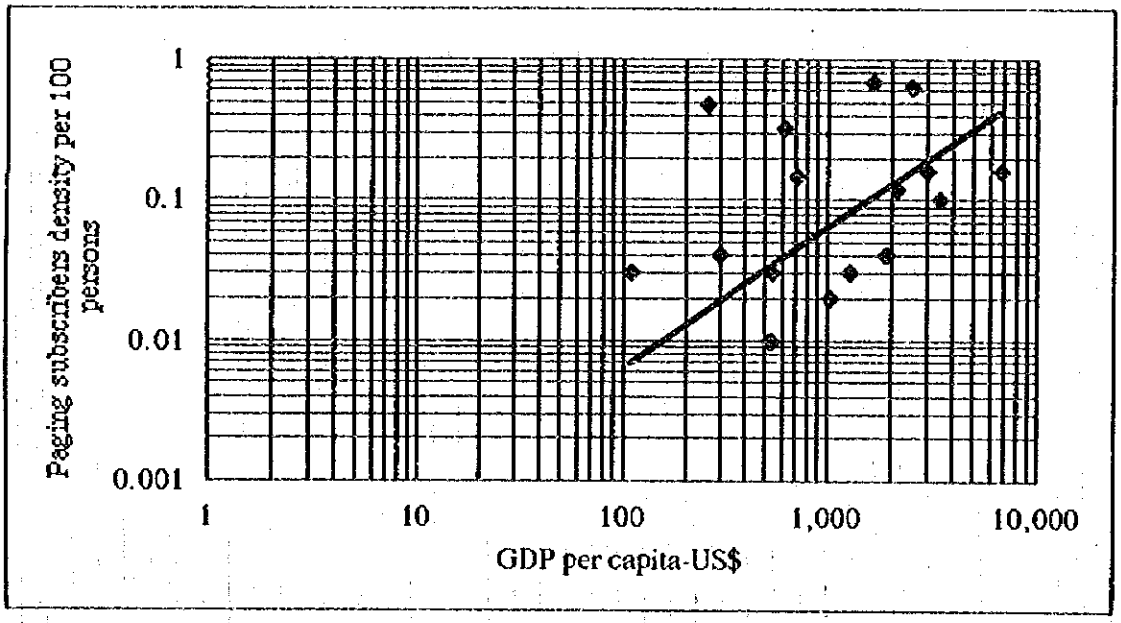


Figure 4.3.3.1-1 Radio Paging Subscriber Density per 100 Persons

4.3.3.2 Demand Forecast

Using formula(1) above, the demand forecast for Paging Services in Syria was made as follows:

a) Although the penetration rate amounts to 0.0774... by calculation, the penetration rate in city areas is expected to be approximately double that calculated as the nationwide rate.(See Table 4.3.2-2.)
Therefore, the actual penetration rate in urban areas of the large western cities is predicted to reach 0.1548.... in 1998.

b) The growth rate is also estimated to be 23.27 percent per year for Paging Services, which is the same as that for Mobile Telephone Services in the Middle East.

c) Although it is very difficult to estimate saturation levels because of the great dependency on a wide variety of the country's own peculiar factors, based on a life cycle concept and experience gained in the provision of other services, the first saturation will occur in 2005 in the western region.

d) It is assumed that Paging Services will become available in the three big cities in the eastern region of Syria and the major roads between them in 2005. Their penetration rate and growth rate are deduced by the same method as that used for the western region.

Table 4.3.3.1-1 Scenario of Number of Subscribers in Syria and Penetration in Covered Areas

Year	Population in Covered Areas	Potential Penetration in Covered Areas	Top-Down Forecast	Total Number of Subscribers in each Area	Grand Total of Subscribers
1998	7,167,305	0.149	10,000	10,679	10,000
1999	7,406,693	0.183	13,554	13,554	13,554
2000	7,645,077	0.226	17,278	17,278	17,278
2001	7,909,723	0.279	22,068	22,068	22,068
2002	8,173,908	0.344	28,118	28,118	28,118
2003	8,446,916	0.424	35,815	35,815	35,815
2004	8,729,043	0.522	45,566	45,566	45,566
2005	9,020,593	0.644	58,093	58,093	63,362
	3,081,663	0.171	5,270	5,270	
2006	9,321,881	0.669	62,363	62,363	69,083
	3,184,590	0.211	6,719	6,719	
2007	9,633,232	0.696	67,047	67,047	75,571
	3,290,955	0.259	8,524	8,524	
2008	9,954,982	0.724	72,074	72,074	82,957
	3,400,873	0.320	10,883	10,883	
2009	10,287,478	0.753	77,465	77,465	91,312
	3,514,462	0.394	13,847	13,847	
2010	10,631,080	0.783	83,241	83,241	100,892
	3,631,845	0.486	17,651	17,651	

(Note: The upper figures for year after 2005 indicate data for the western region; lower figures are data for the eastern region.)

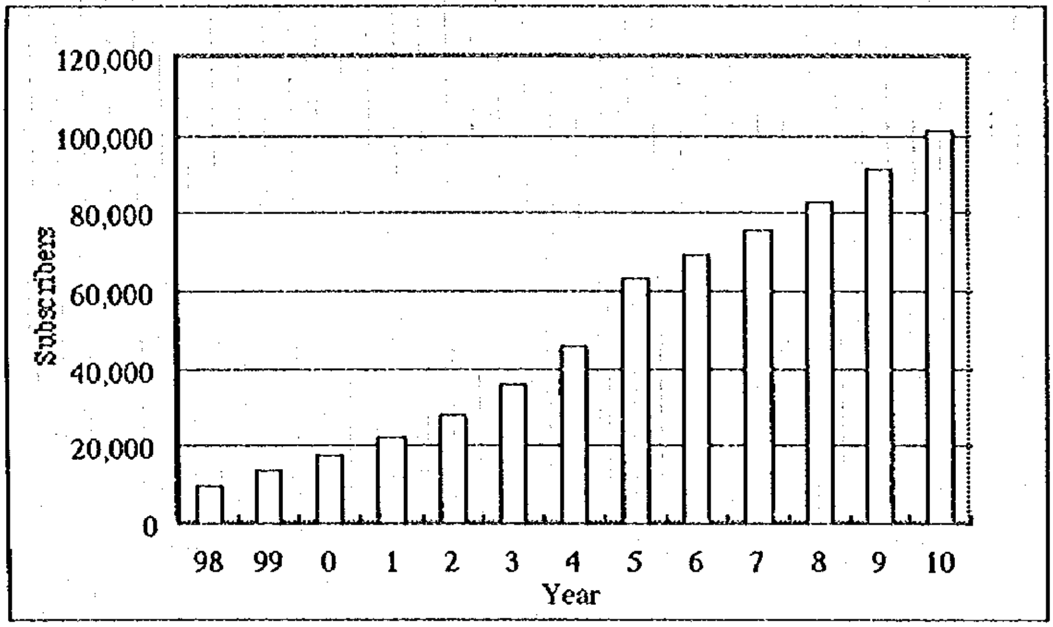


Figure 4.3.3.1-2 Scenario of Possible Subscriber Development for Paging Services

Table 4.3.3.1-2 Development of Paging Subscribers by Governorate (Mohafazat)

Governorates	Population 1998 ** in Covered Areas	Population 2005 ** in Covered Areas	Demand in 1998	Demand in 2005
Damascus	1,928,138	2,426,706	2,563	13,942
Rural Damascus	688,441	866,455	1,965	10,689
Homs	781,576	983,672	748	4,066
Hama	483,293	608,260	534	2,905
Aleppo	2,183,628	2,748,261	1,388	7,552
Idleb	226,544	285,122	534	2,905
Lattakia	392,675	494,211	1,388	7,552
Tartous	161,098	202,754	748	4,066
Al-Rakka	0	743,503	0	1,271
Deir-El-Zor	0	859,765	0	1,470
Al-Hasakeh	0	1,478,394	0	2,528
Darra	179,976	226,513	363	1,975
Al-Sweida	90,617	114,049	320	1,743
Quneitra	51,320	64,590	128	697
TOTAL	7,167,305	12,102,256	10,679	63,363

** Source: Statistical Abstract Syria 1994, JICA Estimation, Average Yearly Population Growth Rate 3.34%

Regarding the forecast, the following points should be noted:

a) At the present time, paging is a more or less unknown telecommunications service in Syria at the customer level. In order to develop the Paging Services market, it is necessary that STE increases public awareness of the advantages offered by the Services through advertising in newspapers, ratio and television, and through the holding of exhibitions.

b) There are three types of paging terminals: alphanumeric, numeric and tone. From experience in other countries where PSTN quality is not good, alphanumeric terminals tend to retain a predominate position.

4.4 Leased Lines

There are two broad categories of Leased Lines (or private circuits), analog and digital. Analog circuits are suitable for lower traffic volumes.

An analog circuit, capable of carrying voice and data alternatively, is the simplest method of connecting two sites. Connection to an analog circuit for data transmission is normally via a modem. Voice communication over leased lines is normally via the customer's PABX.

Digital private circuits have faster transmission speeds, and can carry voice and data simultaneously.

Typical applications of leased lines are :

- they may be used by large organizations to extend their private voice network over two or more sites by linking the PABXs located at each site.
- internal fax transmission
- interconnection to public data network
- interconnection of computer systems at different sites
- interconnection of PC/Computer Networks (LAN bridging)
- slow scan TV
- video conference

Digital leased lines can prove attractive to medium and large organizations due to the wide availability of low bit rate digital voice encoding systems that can enable at least four voice calls to be multiplexed on a single 64 kbit/sec digital channel. Simultaneous multiplexing of a mix of voice and data calls on a single 64 kbit/s channel is also possible.

At May 1995, the current number of leased lines in use in Syria was reported to be 200. (Currently, only analog leased lines are provided in Syria.)

In the future, demand for leased lines will be met using 2 wire and 4 wire analog leased lines, and subrates (<64 kbit/s), 64 kbit/s, nx64 kbit/s and 2 Mbit/s digital leased lines. A 2 Mbit/s leased line can, for the purpose of the forecast, be considered as equivalent to 30x64 kbit/s leased lines. The precise timing of the change-over to digital leased lines is not considered critical for the purposes of the forecast.

The key influences on the demand for leased lines in Syria in the short to medium term will be the rate of development of the PABX market in the medium/large business segment, the rate of development of the Packet Switched Data service and the rate of development of the computer (LAN) sector. In the longer term, the requirements for private voice networking of many medium/large organizations may better be met with IN services like Virtual Private Networking.

Regarding the PABX market, an indicator of what STE considers to be the potential for leased lines is the provision for tie-line ports in STE's technical specification for the manufacture of PABX systems (Issue III, dated November 1994) in the medium and large PABX size range. A total of approximately 6000 tie-line ports have been specified. This would correspond to a maximum demand of 3000 leased lines for PABX voice networks. The actual number specified is less significant than the fact that a large number has been specified, which clearly indicates that STE intends to pursue a policy of providing leased lines for private voice networks.

The principal assumptions on which the forecast for leased lines is based are :

- that demand in the short and medium term will come from the medium and large organizations which will build private voice networks, using PABXs and leased lines. In the medium and long term this market should be partly overtaken by VPN services or ISDN/B-ISDN.
- demand in the short and medium term will also come from the development of data communications which will lead to a growth in the demand for leased lines. In the medium to long term, this market may be overtaken by ISDN/B-ISDN which will enable integrated access to data communication services and have the effect of reducing the growth rate in the demand for dedicated leased line access from the customer premises.
- experience in other markets shows that strong demand for leased lines arises from the appearance of third party service providers and network operators, assuming the regulatory conditions allowed this. However, there is no evidence to suggest that this market sector will emerge during the planning period.
- that the current demand for leased lines is 200 in 1995.

It is forecasted that demand for leased lines will grow at an average rate of 20% per year up to the year 2000 and continuously decreasing to 10% per year thereafter based on the above assumptions and on comparative data on similar markets in the region. Therefore the demand for leased lines, to the nearest hundred, is forecast at :

Table 4.4-1 Leased Lines

	1995	2000	2005	2010
64 kbit/s/s circuits	220*	500	900	1200

Notes:

- The figures include leased line access to the PSDN
- The basis of the calculation are 64 kbit/s leased lines, i.e. one nx64 kbit/s leased line is calculated as n 64 kbit/s leased lines

Up to now there is no specific platform for leased lines. However it is believed that there is a demand for high quality leased lines (some times called "Managed Bandwidth Service, MBS"). These leased lines are based on dedicated platforms (e.g. TDM based Cross Connect Systems). It is therefore also important to estimate the demand for this service because it may be the basis for a future dedicated leased line platform or better the "managed bandwidth" platform.

Table 4.4-2 "Managed Bandwidth" Service

	1995	2000	2005	2010
< 64 kbit/	*220**	150	80	10
>= 64 kbit/s	-	220	380	650

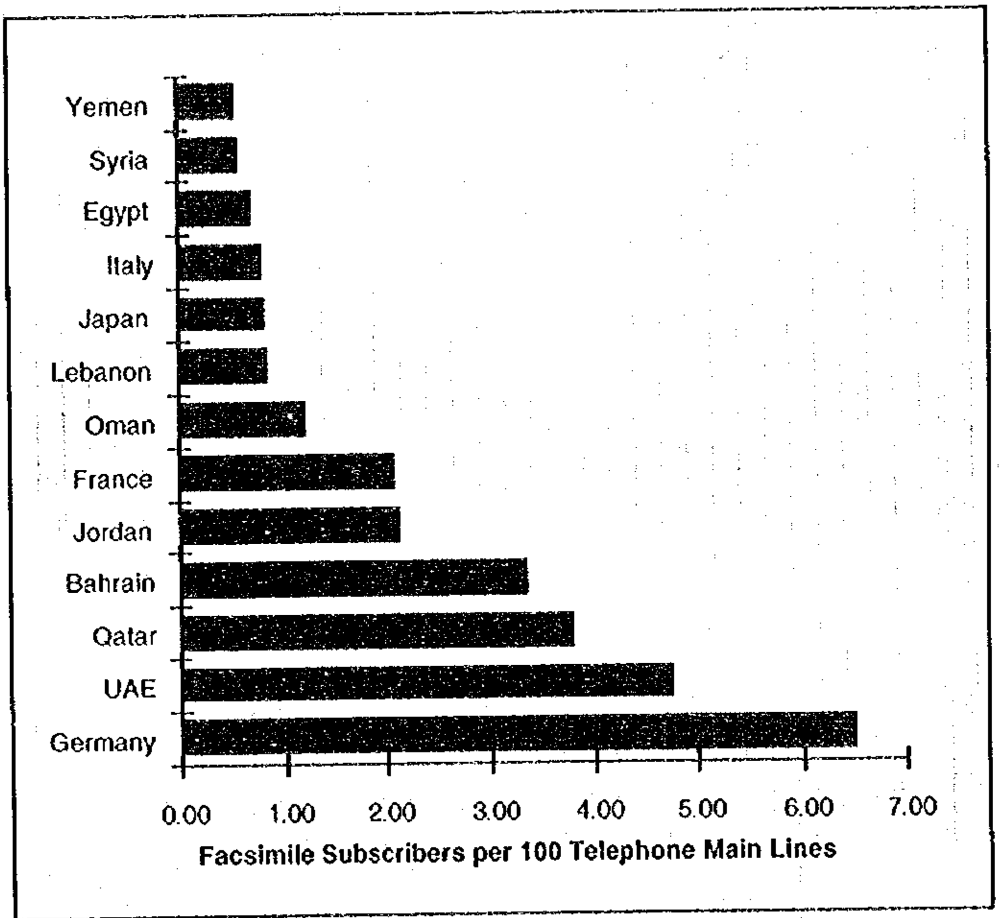
Note:

- * For information only (analog LL according M.1020 (not managed bandwidth service))

4.5 Other New Services

4.5.1 Demand Forecast for Facsimile

In the industrialized countries the facsimile market has been one of the strongest telecommunication growth areas of the 80's. Nearly every business subscriber has at least one facsimile. Particularly the self-employed small business people switched from telex and telegraph to facsimile communication. Today there are only 4005 official facsimile subscribers in Syria. But it could be fairly assumed that the real number of facsimile ownership in Syria is more or less twice this number. Importance should be laid to the tight relationship between the number of available main lines at the PSTN and the demand for facsimile service because it does not make any economic and technical sense to observe the growth of facsimile subscribers separately. An overview of penetration rates of facsimile subscribers in relation to the provision of PSTN worldwide is presented by Figure 4.5.1-1.



(Sources: Arab states telecommunication indicators ITU 1994, TeleGeography 1993)

Figure 4.5.1 - 1 Penetration Rates of Facsimile Subscribers Worldwide

In Germany for example at the end of 1993 there are 37 million main lines and 2.4 million facsimile connections (official 1.3 million) equal a penetration rate of 6.5 %. Assuming the GDP per capita relation between Syria (in 1995) and Germany mentioned in chapter 4.3.3: 1 : 16.9 there is an actual demand rate for Syria of 0.38 % in 1995 equal to 6460 subscribers.

Demand rate 1995 = (6.5 % / 16.9) * 1.7 million (demand for main lines in 1995).

Depending on the existing shortages of the available main lines this number should be corrected by the actually higher share of business subscribers particularly in Damascus and Aleppo than by a sufficient provision. Consequently it is assumed that the above mentioned number of 6460 could be 20 % higher (equal 7752). The saturation level is estimated as 0.52 % which is equivalent to 10,851 subscribers by 2.1 million available main telephone lines in year 2010.

- Demand rate 2010 = (6.5 % / 12.58) * 2.1 million (demand for main lines in 2010).

At the long run the growth aspects for facsimile communication are very limited in future. Due to the strong increase of personal computer and the thereto linked data transmission techniques (E-Mail etc.) a quickly going on substitution could be expected. Therefore the facsimile demand scenario follows the logistic function.

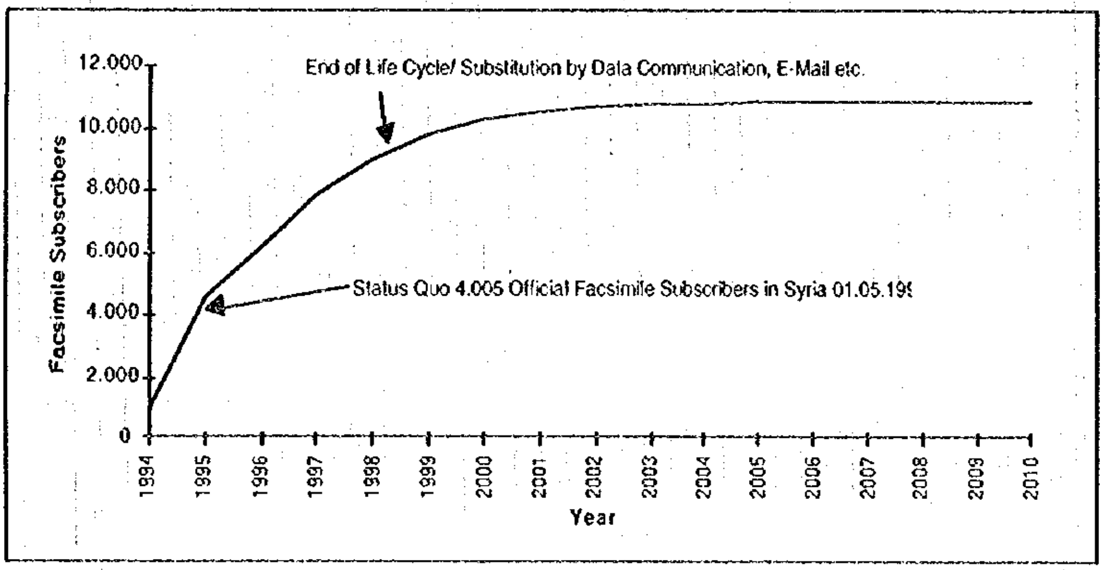


Figure 4.5.1 - 2 Growth Scenario of Facsimile Subscriber in Syria

But this scenario of facsimile saturation will only happen if there is a fundamental change in the current contraproductiv tariff policy of facsimile services in Syria. Facsimile should be provided to the customers without any additional charges than voice telephone. If there is no rapid change in STE's sales strategy of facsimile service there will be an direct technology jump to data transmission techniques particularly in the segment of business users. Worldwide facsimile service and traffic are considered as a part of the PSTN.

4.5.2 Demand Forecast for Free Dial Service and Videotex ISDN Service

The free dial service (freephone) or toll free service, consists of a service which enables subscribers to pay for the calls made to them from the STE network or from abroad. Videotex enables customers to dial up information, via a special adapter, which can then be displayed on a normal TV screen. These kind of enhanced and advanced new services are driven from the competition of private companies within a market economy. Due to the actual existing system in Syria with the dominant element of central planning there is no visible market for these services. It is recommended that these findings should be re-evaluated after two years, when the path of economic development of the country is more foreseeable.

CHAPTER 5 DEMAND FULFILLMENT PLAN AND TRAFFIC FORECAST

5.1 Demand Fulfillment Plan

The public service telephone network (PSTN) in Syria is unable to meet current demand, especially in terms of quantity, as evidenced by the many waiting applicants. The telephone density is 4.95 (number of main telephone lines per 100 inhabitants), which is lower than that of surrounding countries. Moreover, the expansion of subscriber lines has been generally stagnant for the past several years despite the high demand for telephone service.

A telephone facilities plan should meet the requirements for the forecasted demand; however, in Syria it will be difficult to clear the current backlog and to catch up with the new demand before the year 2000. Consequently, a demand fulfillment plan has been established to meet these objectives by the year 2000. Figure 5.1-1 shows the demand fulfillment plan for the year 2000.

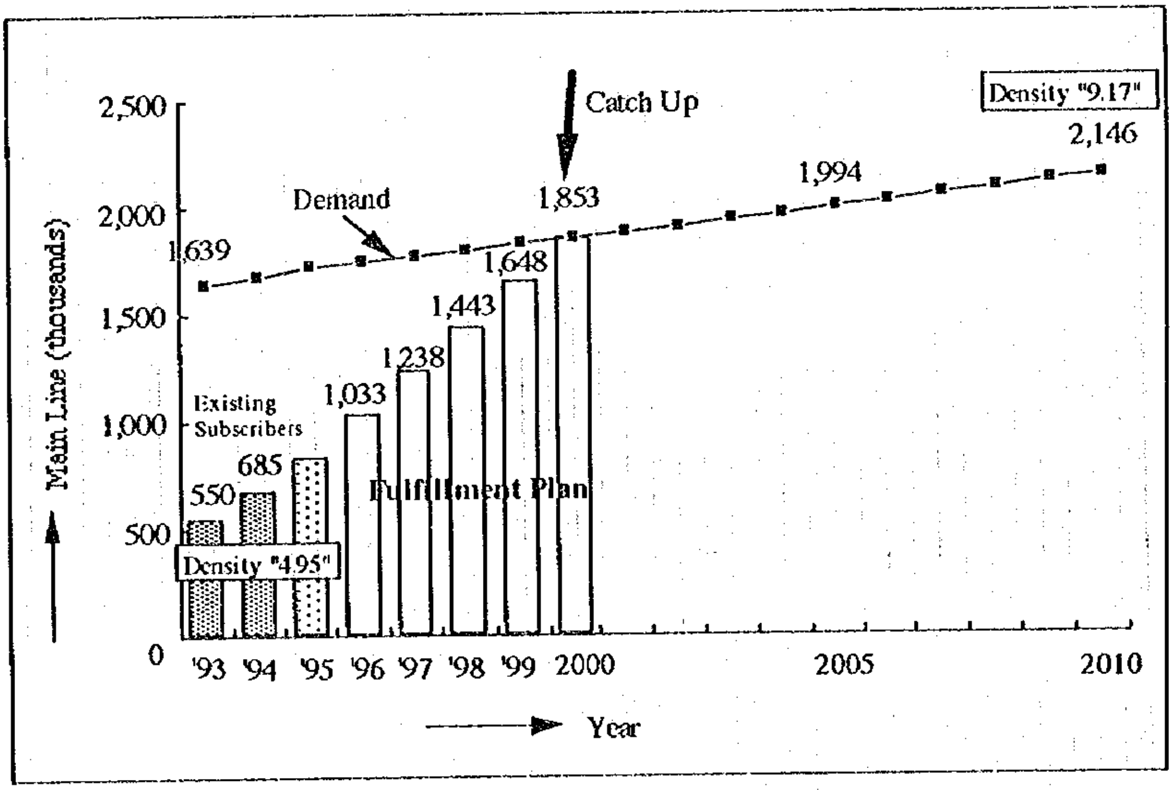


Figure 5.1-1 Demand Fulfillment Plan by Year

Table 5.1-1 shows the demand fulfillment plan by province.

Table 5.1-1 Demand Fulfillment Plan by Province

(in thousands)

Province	1996	1997	1998	1999	2000
Damascus City	427.3	433.7	440.0	446.6	453.2
Damascus Rural	230.1	233.5	237.0	240.5	244.1
Aleppo	280.6	284.7	288.9	293.3	297.6
Homs	151.3	153.6	155.8	158.2	160.5
Hama	101.2	102.7	104.2	105.8	107.4
Lattakia	133.2	135.2	137.2	139.2	141.3
Daraa	58.4	59.3	60.1	61.0	61.9
Sweda	39.3	39.9	40.5	41.1	41.7
Tartous	81.6	82.8	84.0	85.3	86.5
Idleb	84.6	85.9	87.2	88.5	89.8
Der Al Zor	46.5	47.2	47.9	48.6	49.4
Al Hasaka	73.0	74.0	75.1	76.3	77.5
Quennetra	5.7	5.8	5.9	5.9	5.9
Rakkah	34.2	34.7	35.2	35.7	36.2
Total	1,747.0	1,773.0	1,799.0	1,826.0	1,853.0

5.2 Demand Fulfillment Plans for the Individual Exchange Centers

The demand fulfillment plans for individual exchange centers are listed in S1-5-1 in the Supporting Report.

5.3 Traffic Forecast

The traffic was forecasted according to the demand fulfillment plan through 2000. The demand from 2001 to 2010, in which the number of subscribers to be installed each year is planned, was forecasted assuming traffic calling rates and distribution figures by using the following methods.

5.3.1 Methods used in Forecasting Traffic

(1) Determination of Calling Rates

The average traffic volume per subscriber, including originating and terminating calls during peak periods, is called the total calling rate. It is used for calculating the traffic volumes for exchange units and specified trunk circuit routes. The future calling rate should be estimated by taking into account many factors: actual measured traffic, growth in telephone density, social-geographical conditions, etc.

- The traffic volume per subscriber used in this study was estimated based on the values presently used for design by the STE:

Category	Total calling rate
Business	0.12 Erl
Residential	0.07 Erl

- The level of originating traffic is approximately equal to that of terminating traffic.

- As the number of waiting applicants is reduced, the number of low-volume-traffic subscribers will increase, causing the calling rate to go down. However, the new network services to be offered by the STE are expected to increase the calling rate. Therefore, the calling rate in this plan is the same as the present one.

- The traffic volume for exchange units and trunk-circuit routes varies depending on the ratio of business to residential subscribers. The calling rates and distribution ratio are determined by area and by exchange center because of the different social-geographical conditions.

Table 5.3.1-1 shows the current ratio of business and residential subscribers and the originating calling rate by area.

Table 5.3.1- 1 Ratio of Business and Residential Subscribers and Originating Calling Rates by Area

Area	Business (%)	Residential (%)	Originating Calling Rate (erl./sub)
Damascus City	30	70	0.043
Damascus Rural	20	80	0.040
Aleppo City	30	70	0.043
Aleppo Rural	20	80	0.040
Homs	20	80	0.040
Hama	20	80	0.040
Lattakia	20	80	0.040
Daraa	10	90	0.038
Sweda	10	90	0.038
Tartous	20	80	0.040
Idleb	10	90	0.038
Der Alzor	10	90	0.038
Alhasaka	10	90	0.038
Quennetra	5	95	0.036
Rakkah	10	90	0.038

(2) Traffic Distribution by Route

The total traffic volume should be distributed among the routes according to the business-to-residential ratio. The routes include those for intra-office calls, local calls to other exchanges, national calls, and international calls. Table 5.3.1-2 shows the ratio of originating traffic by route in each area. Figure 5.3.1-1. shows the distribution flow of originating traffic from a local exchange.

Table 5.3.1-2 Distribution Ratio of Originating Traffic by Route by Area.

Area	Intra-Office	Local	National	International
Damascus and Aleppo City	16.0 %	75.0 %	8.0 %	1.0 %
Other Cities	40.0 %	51.3 %	8.0 %	0.7 %
Rural Areas	30.0 %	61.5 %	8.0 %	0.5 %

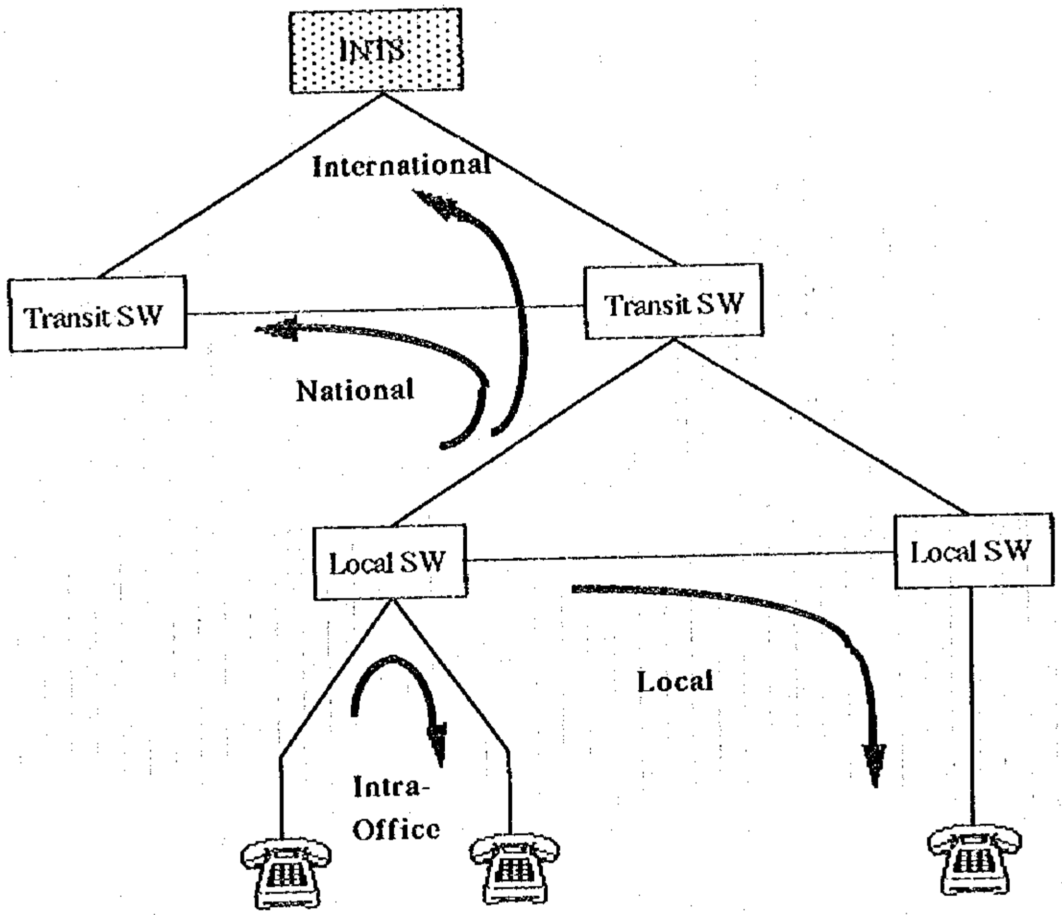


Figure 5.3.1-1 Distribution Flow of Originating Traffic from a Local Exchange

5.3.2 Traffic Matrices

A traffic matrix is prepared according to the volume of originating traffic for each exc. center. The traffic volume is normally calculated using the gravity model, which assum unequal affinity rate between telephone centers and is affected by the distance betw telephone centers, except for the Damascus City area because of its narrow coverage. The traf. matrices are projected by applying the Kruithof Algorithm to the anticipated level of originatin and terminating traffic for telephone centers.

S1-5-2 in the Supporting Report shows the calculated traffic volumes between transit exchanges and traffic volumes between local exchanges throughout the country in matrix for the years 1996, 2000, 2005, and 2010.

CHAPTER 6 FUNDAMENTAL TECHINICAL PLANS

6.1 Numbering Plan

6.1.1 Basic Concept

A telephone number is a combination of digits, and it has a basic information for selecting and connecting destinations and aiming subscribers (International, Long distance, Local and Intra-office calls) and for distinguishing charging tariff (Basic telephone, Cellular phone and other new services). A telephone number should be easy to use, in other word, it should be as short as possible for memorizing and should not be changed over a long period. In this point of view, the numbering plan should have a sufficient capacity and an appropriate structure which can deal with increasing subscribers and new services introduction. The following points comprise the basic concepts for the numbering plan.

- No change in future, and sufficient capacity for the future expansion in subscribers
- Universal numbering structure throughout the country.
- Simple numbering structure for routing and charging.
- Conformity with ITU-T Recommendations E.160 to 167.
  (a) "0" is preferable for the trunk prefix.
  (b) "00" is preferable for the international prefix.
  (c) The number of digits for an international number should be 12 or fewer and for an ISDN number should be 15 or fewer (ITU-T Recommendation E.164). The plan should be implemented by 23:59, 31 December 1996 Coordinated Universal Time.

6.1.2 Capacity

The present numbering structure is ;

Country Code +	Area Code +	Trunk Code +	Subscriber Code
963	XX	XX(X)	XXXX

composed of two (2) digits Area Code, two (2) or three (3) digits Trunk Code and four (4) digits Subscriber Code. According to the present numbering structure the maximum capacity is approximately 640 million in Syria, because the codes of 0 and 1 (both of Area Code and Trunk Code) are unusable. This capacity is sufficient to the demand (2,146 thousand) in the year 2010 in Syria.

6.1.3 The National Numbering Plan

(1) Structure of numbering

Country Code + Area Code + Trunk Code + Subscriber Code
963 XX XX(X) XXXX

In future City Area boundary will expand at both urban and rural areas, and introduction of Seven (7) digits for local call will have an opportunity according to introduction of new digital exchanges and replacement of manual exchanges. Seven (7) digits for local call should be considered deeply and adopted step by step, taking expansion of local areas into account.

(2) Prefix code

00 : International
0X : National
09 : New services (090 : Cellular, 091 to 099 : other new service such as Paging)

(3) A/B Code Table for National Call

A/B codes including new services such as Cellular, paging and direct international services to neighboring countries are assigned as shown in the following table.

	B CODE									
A CODE	1	2	3	4	5	6	7	8	9	0
1	Damas-cus, its rural	Al Nabek	Zabadani	Quen-netra	Darra	Sweda				
2	Aleppo	Rakka	Idleb							
3	Homs		Hama							
4	Lattakia		Tartous							
5	Deir Ezzar	Al Hasaka								
6										
7										
8										US Access
9										Cellular
0	International									

(4) 11X Code Table for Special Service

	C code									
AB code	1	2	3	4	5	6	7	8	9	0
11		Police	Fire		Military Police	Military Police	Military Police	Military Ambulance	Military Ambulance	Ambulance

6.2 Transmission Plan

6.2.1 Objectives and Scope of Application

The transmission plan will be based on following objectives.

(1) To comply with trends in transmission technology development.
(2) To incorporate Syria's existing transmission systems.
(3) To meet the demand level estimated in chapter 4 of the report.
(4) To increase network security and flexibility.

The scope of the transmission plan covers transmission between telephone offices, including microwave systems, fiber-optic systems and related outside plants. According to the plan, facilities installed in 1994 will be replaced with systems of larger capacity where the demand necessitates and the replaced facilities are to be reinstalled to meet demand at other locations. However, total replacement of the facilities is not proposed in the plan, although the facilities will be probably reaching their operating life after 2005.

6.2.2 World Wide Trends in Transmission Technology

The introduction of fiber-optic transmission systems and digitization has been lowering transmission costs, the impact of which has led to networks with significantly flatter and fewer switch level configurations, Accordingly, the number of high usage circuits directly connecting many telephone offices has been increasing to the extent that transmission nodes are becoming highly complex and use many multiplexers. Synchronous Digital Hierarchy (SDH) systems are designed to make transmission nodes much simpler and with fewer multiplexers, offer flexibility to networks using cross-connection functions, and enable much easier operation and maintenance.

The STE should definitely introduce SDH systems as early as possible and cancel plans to buy any more conventional PDH systems, except for areas with low demand where small capacity transmission systems are required. SDH systems perform to their full potential in exclusively SDH networks.

Development of the following transmission technology is anticipated.

(1) Systems with much longer repeater spacing and larger capacity.
Current targets are optical amplifiers, soliton transmission, wave division multiplexing (WDM) and others.

(2) Automatic fault localization, and statistical diagnosis, based on long term observation for transmission systems.

(3) Q3 interfaces and intelligent management for TMN integration

SDH systems will continue as a central technology, and optical fibers of quartz glass with possible fiber structure modification will be used for some time. Microwave systems will play a major roll in backing up optical fiber systems and in areas where fiber-optic line cannot be installed easily.

6.2.3 Existing Transmission Technology of STE Network

In 1994, digitization of transmission systems in the backbone and junction networks in main cities was conducted on a large scale. Now the STE has brand-new digital transmission systems and is proceeding with further digitization in more remote and rural areas. STE is just starting to introduce SDH systems.

6.2.4 Strategy for Future Deployment of Transmission Equipment

SDH systems must coexist with conventional PDH digital transmission systems for the time being, even after the Tenth five year plan, because, presumably the PDH systems in Syria will not yet have reached their operation life. PDH systems can connect with SDH systems at speeds of 2Mbit/s, 34Mbit/s and 140Mbit/s. According to the plan, 2Mbit/s interconnection is normally used, so that the STE can cross-connect circuits by the bunch at 2Mbit/s with the SDH systems. The transmission interfaces with switches are now 2Mbit/s and the STE has many 2Mbit/s interface units in the existing PDH systems, and so it need not buy extra ones. The STE can transfer excess 2Mbit/s interface units to other locations to reinstall them.

The plan employs 34Mbit/s PDH and SDH interconnection for TV transmission .

It is assumed interfaces with switch systems are based on 2Mbit/s during the three long-term plans. However since sub-STM-1(52Mbit/s) and STM-1 interfaces with switch will become (or are) available, the STE should, in due course, consider changing interface speed for large switches.

For sections which require only small capacities (less than 16 x 30ch), sub-STM-1 system should be recommended in the plan (see ITU-R 750/751). However, for such sections, conventional

34Mbit/s microwave systems are assumed, for cost estimation purposes. Note that this is just for cost estimation.

Based on present prospects, SDH systems will be installed in sections where there are or soon will be shortages of circuits. The SDH STM-4 systems are installed to increase capacity, and to replace 140Mbit/s systems, which are to be used again in other sections.

The following are guidelines for measures implemented in each of long term plans.

6.2.4.1 The Eighth Five-Year Plan (1996-2000)

(1) Digitization of Analog sections in the Long Line Network (Aleppo-Kamichily).

(2) Setting up New micro wave systems to back up existing fiber-optic systems where fiber-to-fiber restoration is impossible in the Long Line Network (Damascus-Homs).

(3) Introduction of SDH systems in sections of Damascus and Aleppo junction networks where high circuit demand is expected.

(4) Introduction of SDH systems in sections between main transit switches (i.e. Damascus, Aleppo, Homs, Hama, Lattakia) to achieve 100% circuit restoration.

(5) Installation of Digital transmission systems in local sections where high circuit demand is expected.(Especially , for Tartous-Safita, new fiber-optic cables is planned for SDH systems.)

(6) Use of Digital transmission systems for manual switches in line with switch plans (see section 6.5.4).

6.2.4.2 The Ninth Five-Year Plan (2001-2005)

(1) Digitization of a long local analog section (Deir Elzor-Abukumal).

(2) Introduction of SDH systems in sections of Damascus where circuits capacities are almost full.

(3) Digitization of local sections where medium demand is forecast.

(4) Use of Digital transmission systems for manual switches in line with switch plans (see section 6.5.4).

6.2.4.3 The Tenth Five-Year Plan (2006-2010)

(1) Digitization of a long local analog section with lower circuits demand (Homs-Tadmor).

(2) Introduction of SDH systems in sections of Damascus where circuit capacity is not insufficient, but where SDH systems are required for 50% circuit diversity and for network flexibility in the wide central area of Damascus.

(3) Introduction of SDH systems to enhance capacity of some intra-city sections (Homs, Lattakia).

(4) Digitization of local sections where low demand is expected.

6.3 Security and Availability

6.3.1 Transmission Network Reliability

There are several ways to improve transmission network reliability. However, the methods to be applied will be decided in a trade-off between the desired degree of reliability and acceptable cost-to-performance factors. General methods are described in the following sections.

(1) Route Redundancy

Standby transmission lines are on reserve so that damaged transmission lines can be switched over in the event of failures.

a) Spare system in the same transmission link but different transmission system

The standby system is prepared in different formats, such as cable systems (fiber-optic system) to back up radio systems (microwave system) and vice versa as shown in Figure 6.3.1-1.

This is useful for a failure of transmission systems, but ineffective in the event of break-downs in buildings or of power failures. In cases where the above possibilities may be ignored, the reliability of this type of backup can be considered sufficient.

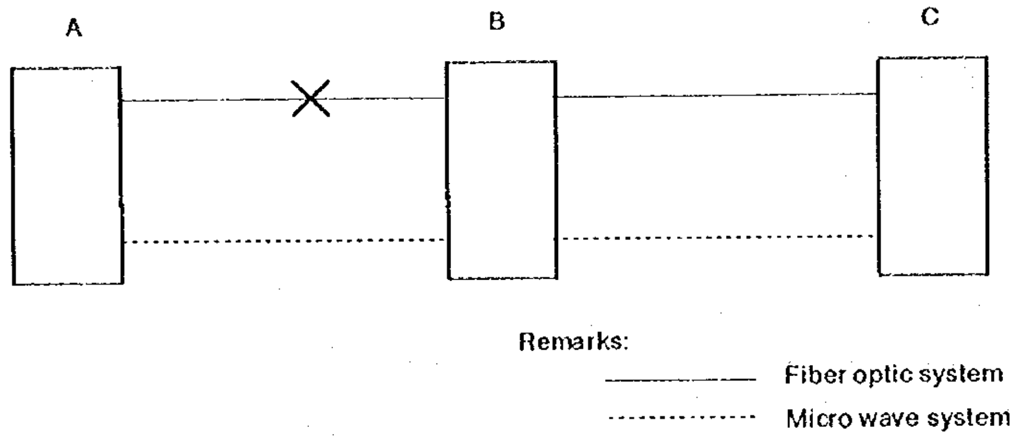


Figure 6.3.1-1 Different Transmission Systems

b) Spare System in Different Transmission Links

A standby system for other transmission links are usually formed as the type of transmission loop shown in Figure 6.3.1-2.

This method is effective to prevent service interruption.

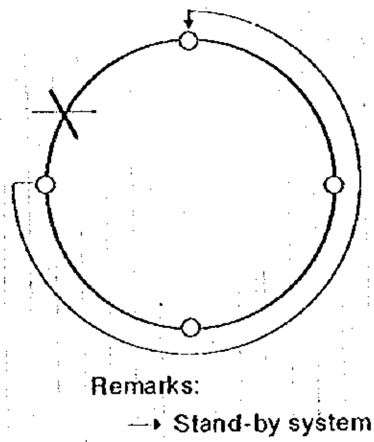


Figure 6.3.1-2 Loop Transmission

(2) Proposed Reliable Network Structure for Syria

Different types of transmission systems and loop transmission methods should be introduced to enhance network reliability in a long distance trunk network. A conceptual view of the network plan is shown in Figure 6.3.1-3.

(3) Availability

Availability performance for a hypothetical 2,500 km reference circuit in one direction is over 99.6% for the duration of one year (ITU-T Recommendation G602).

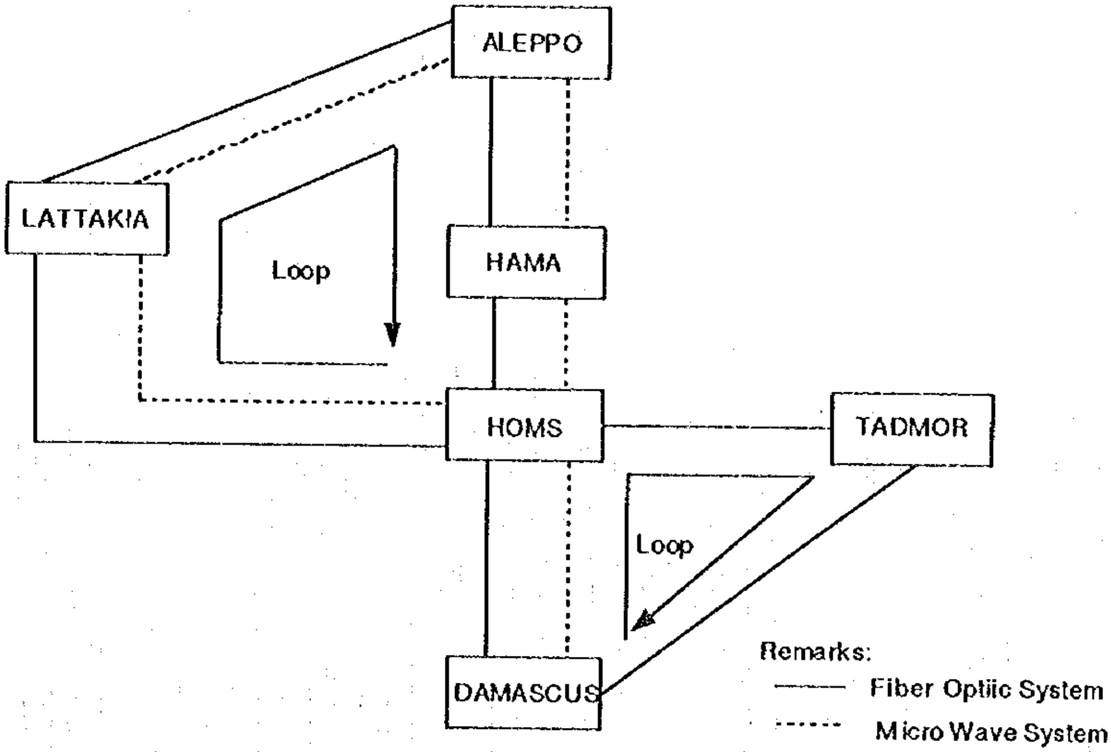


Figure 6.3.1-3 Proposed Reliable Network

6.3.2 Switching Network Reliability

(1) Transit Center

It is desirable that two STD exchanges will be installed at each Transit Center (Damascus, Homs, Hama, Aleppo and Lattakia) to enhance switching reliability for a network system.
Thus, if one exchange is damaged, the other exchange remains operational and carries the traffic.

(2) Network Synchronization

To maintain network synchronization of digital network, two master clocks with stand-by should be built. Proposed locations are the Damascus INTS center and the Aleppo INTS center.

(3) Maximum Size of a Local Exchange

In case that a local exchange is out of order, all subscribers in the exchange can not use telephone services. Therefore, the maximum size of a local exchange should be limited for security and availability considerations, and it is preferable that the maximum size be set no more than 50,000 subscribers per exchange.

6.4 Traffic Loss and Transmission Loss Allocation Plan

6.4.1 Traffic Loss Allocation Plan

Loss probability in circuit groups is allocated, as shown in Table 6.4-1, on the basis of ITU-T Recommendation E.520.

Table 6.4.1-1 Loss Probability

Condition	Loss Probability
Normal load (per link)	0.01
High Load (per link)	0.07

Note:

1. Normal load: Mean of the 30 highest working days during a 12-month period.
2. High load : Mean of the highest days in the same period.

If loss probability allocated to each connection of a digital transit exchange and terminating exchange is 0.001, the total loss probability between exchanges on both ends becomes 0.007, as shown in Figure 6.4.1-1.

The ITU-T recommends a loss probability of 0.05 (one side) for domestic data switching networks (Rec. X.131). This means that the end-to-end loss probability of digital switched networks should not exceed 0.1.

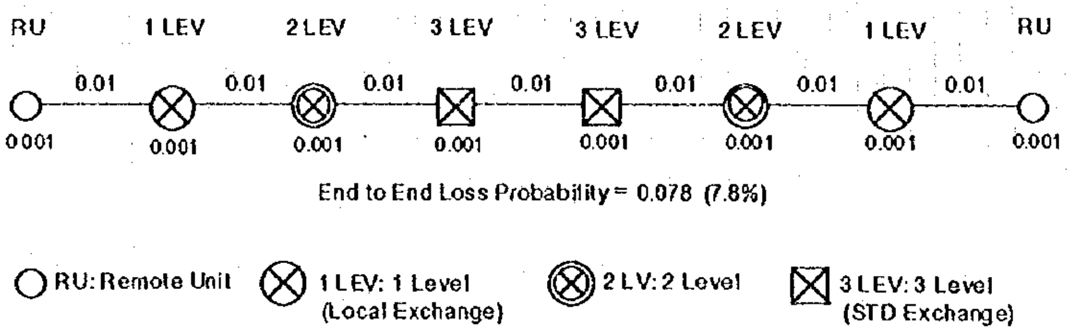


Figure 6.4.1-1 Traffic Loss Allocation Plan

On the basis of the figures shown above, the Study can assume that the end-to-end connection has a loss probability margin of 0.022 which can be assigned for a mixed analog and digital switching network.

6.4.2 Transmission Loss Allocation Plan

A typical transmission loss allocation between subscribers is shown Figure 6.4.2-1.

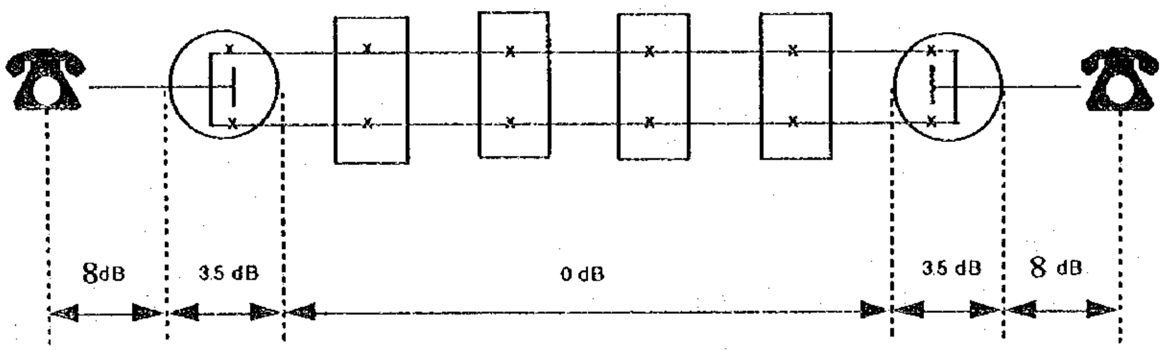


Figure 6.4.2-1 Transmission Loss Allocation

In this Study the transmission loss allocated to the two-wire subscriber lines does not exceed 8 dB, and its direct current loop resistance does not exceed 1500 ohm.
The losses for digital sections and hybrid portions are 0 dB and 3.5 dB.

6.4.3 Network Quality

The target values for network quality are listed in Table 6.4.3-1.

Table 6.4.3-1 The Target Values for Network Quality

Network Quality	Grade of Service	Target Values	Related ITU-T Recommendations
Connection Performance	Initial address message delay (for signaling system No.7 netwowks)	Total delay 4 sec. International 1.5 sec. National 2.5 sec	E723
	Answer message delay (for signalling system No.7 network)	Total delay 2.5 sec. International 1.0 sec. National 1.5 sec	E723
	Probability of end-end blocking	Local connection 2% Toll connection 3% Intenational connection 5%	E721
Transmission Performance	Transmission Loss for Digital Links	Total loss 0 dB	
	Bit Error Ratio for Severely Errored Seconds of Digital Network	Fewer than 0.2% of one second intervals to have a bit error ratio worse than 1x 10^{-3}	G821

6.5 Switching Plan

6.5.1 Objectives and Scope

This switching plan has two basic objectives: Based on a review

- of the world wide development trend in switching technology,
- the present state of switching technology deployment in STE's network, and
- the demand for new services estimated in chapter 4 of this report,

this switching plan provides an out-line recommendation, which switching technologies should be deployed in STE's at what point of time and in which way.

The scope of this plan covers switching for voice and integrated services for fixed and mobile access.

This switching plan tries to look ahead over the next 15 years (Eighth, Ninth and Tenth Five-Year plans). However, since switching technology as well as the demand for new services are developing world wide with increasing momentum, the recommendations given must be reviewed at regular intervals considering the newest demand analysis and the newest technology trends.

reviewed at regular intervals considering the newest demand analysis and the newest technology trends.

6.5.2 World Wide Trends in Switching Technology

6.5.2.1 Switching for PSTN/ISDN

State of the art in switching technology for PSTN and ISDN applications are presently second generation digital 64 kbit/s switching systems with A/D conversion per line, distributed control and common channel signalling (ITU-T Signalling System No.7, SS7).

Major technological advances are not to be expected for the visible future in this technology. The main reasons for that are that the systems are mature in architecture and in reliability and that the major switch suppliers concentrate on the new ATM switching systems (see 6.5.2.3).

However, to be expected are as main developments for further exploitation of the technology:

- Implementation of new services and features for ISDN and PSTN subscribers,
- Implementation of the Intelligent Network Service Switching Point functionality,
- Implementation of Q3 interfaces and management intelligence for TMN integration,
- Implementation of Universal Personal Telecommunications (UPT).

6.5.2.2 Switching for Mobile (Voice) Networks

Mobile switching centers (MSC) are throughout based on the same digital core switching technology as used for PSTN and ISDN, and no prospects for major innovations in the basic technology are visible.

Presently, the GSM standard seems to dominate the market for digital mobile systems. The IS-54 standard has not yet had any real success outside the United States.

The main developments to be expected for further exploitation of the technology are similar to those in the switching for ISDN and PSTN:

- Implementation of new services and features for GSM mobile subscribers,
- Implementation of the Intelligent Network Service Switching Point functionality,
- Implementation of Q3 interfaces and management intelligence for TMN integration.

However, there is under the name "Future Public Land Mobile Telecommunication Systems" (FPLMTS) an activity under way, with the aim, to come to one single commonly accepted uniform mobile telecommunications standard till 1997. This activity should be observed closely.

6.5.2.3 Switching for Broad Band Networks

Presently, the dominating issue in switching technology is the finalization of the development of the Asynchronous Transfer Mode (ATM) switching systems which allow the switching of broad band bearers with bit rates variable on a per connection basis in accordance with the subscriber's call set up request.

The ATM technology packetizes the information for transfer across the network. The ATM switches set up virtual connections for the packetized information.

In several networks, pilot projects and field trials are operational. However, they all still work with non-standardized network and subscriber signalling.

The first generation of ATM switching systems is impatiently awaited by all major network operators as basis for the upcoming Broad band ISDN (B-ISDN) and the multi-media applications. The strategic alliances and mergers which were formed between traditional network operators and media corporations during the last two years especially in the United States reflect best the high expectations in this area.

6.5.3 Existing Switching Technology in STE's Network

Presently, most of the switching capacity deployed in STE's PSTN is provided by digital switching systems.

Both International Gateway Exchanges (IGE) with a total capacity of approximately 16,400 national trunk ports and international line ports are second generation digital systems.

All highest level trunk (STD) exchanges with a total capacity of approximately 55,000 trunk ports are second generation digital systems.

All combined trunk / local exchanges with a total capacity of approximately 25,000 trunk ports are second generation digital systems.

Of the total capacity of approximately 1,503,000 line units in the local exchanges,

- 1,005,000 are provided by second generation digital exchanges,
- 158,000 by first generation digital systems (E10A, E10B and NEAX61),
- 221,000 by a electro-mechanical analog system (EMD), and
- 119,000 by manual analog systems.

Another 250,000 line units to be provided by second generation digital systems are partly commissioned and partly under negotiation and scheduled for implementation in the 1996 - 1997 period.

For ISDN 400 Basic Accesses have been deployed in the course of a pilot project.

A mobile system has not yet been deployed by STE, but is planned.

An Intelligent Network infrastructure is not yet deployed in STE's PSTN / ISDN.

6.5.4 A Strategy Proposal for Future Switching Equipment Deployment

In the following a course of action in switching and for the supporting systems is proposed for the next three five year plans. This involves a rather long period of 15 years. Therefore, especially for the Ninth and Tenth Five-Year Plan, the proposed course of action has to be seen the more as a general guideline, the more away in the future the period under consideration is.

First of all, the future economic development of Syria is presently very hard to predict. Dependent on the real development it may be needed to accelerate or to slow down the course of action.

Furthermore, since telecommunications technology develops rapidly with increasing momentum, the general development must be observed and analyzed continuously and the planned course of action must be revised in accordance with any new significant technological and technical development. This is most likely to lead to completely new issues to be inserted into the list of actions.

However, as a starting guideline, the following list of actions is given based on present prospects.

6.5.4.1 The Eighth Five-Year Plan (1996 - 2000)

- Satisfy the PSTN demand in switching for the year 2002 (Fulfillment plan)
- Introduce a mobile system

- Replace 60,000 manual line units
- Replace all EMD exchanges (221,000 line units)
- Introduce an Intelligent Network infrastructure
- Expand ISDN deployment carefully in accordance with the experience in the pilot
- Introduce first part of a network management system (resource management)
- Analyze development of TMN and start planning of TMN integration
- Analyze development in telecommunications and gain orientation for the future

6.5.4.2 The Ninth Five-Year Plan (2001 - 2005)

- Provide (PSTN) switching capacity in accordance with the demand
- Reach full country covering in basic telecommunications (no village without telephone)
- Expand ISDN deployment in accordance with the demand
- Expand the service area of the mobile system
- Replace all remaining manual line units
- Replace all first generation digital exchanges (158,000 line units)
- Analyze the demand for B-ISDN and plan deployment of ATM switches
- Introduce second part of the network management system (traffic management)
- Start of TMN integration of existing management islands
- Analyze development in telecommunications and gain orientation for the future

6.5.4.3 The Tenth Five-Year Plan (2006 - 2010)

- Provide (PSTN) switching capacity in accordance with the demand
- Expand ISDN deployment in accordance with the demand
- Expand the service area of the mobile system and reach full country covering
- Introduce B-ISDN by deployment of ATM switches
- Continue TMN integration
- Analyze development in telecommunications and gain orientation for the future

6.5.5 Considerations on Local Exchange Sizes

Modern second generation digital switching systems can under normal conditions serve 100,000 subscribers and more. However, it is hard to imagine a main distribution frame (MDF) accommodating for 100,000 and more subscribers.

The increased limits allow to make more use of remote units hosted by the exchange under consideration, thus keeping the MDF on a moderate size.

The final capacity for digital local exchanges in STE's network as planned presently is 30,000 subscribers. It is due time to reconsider this limit, which is not only dependent on technical constraints but also security and availability considerations, and to increase it remarkably.

However, such decisions have to be made in the context of the local network structure considerations, and are therefore discussed in more detail in section 6.11.

6.6 Signalling Plan

On the current telephone network, telecommunication information and signaling information are transferred over the same communication circuits. This conventional signalling is limited in the various telematic services and value added services it can provide. For the implementation of ISDN, ITU-T's No.7 CCS (Common Channel Signalling System) is essential. The CCS can also be adopted on the various networks as it provides economical and reliable transmission of signalling information.

6.6.1 CCS Network Configuration

There are two kinds of No.7 CCS network configurations with regard to the allocation of the communication and the signalling links shown in Figure 6.6.1-1.

(1) Associated mode

Each exchange (Signalling Points: SP) has a direct CCS link associated with communication lines to other exchanges (mesh connections).

(2) Quasi-associated mode

In the Non-associated mode, signalling information is sent over two or more links in tandem, passing through one or more Signal Transfer Points (STPs). The Quasi-associated mode is a limited Non-associated mode in which the pass for the signalling message is predetermined and fixed.

In the Associated mode, the number of CCS links increases according to the number of exchanges, as opposed to number of links with the quasi-associated mode. The Associated mode is easier and more economical to implement when the number of exchanges is comparatively small.

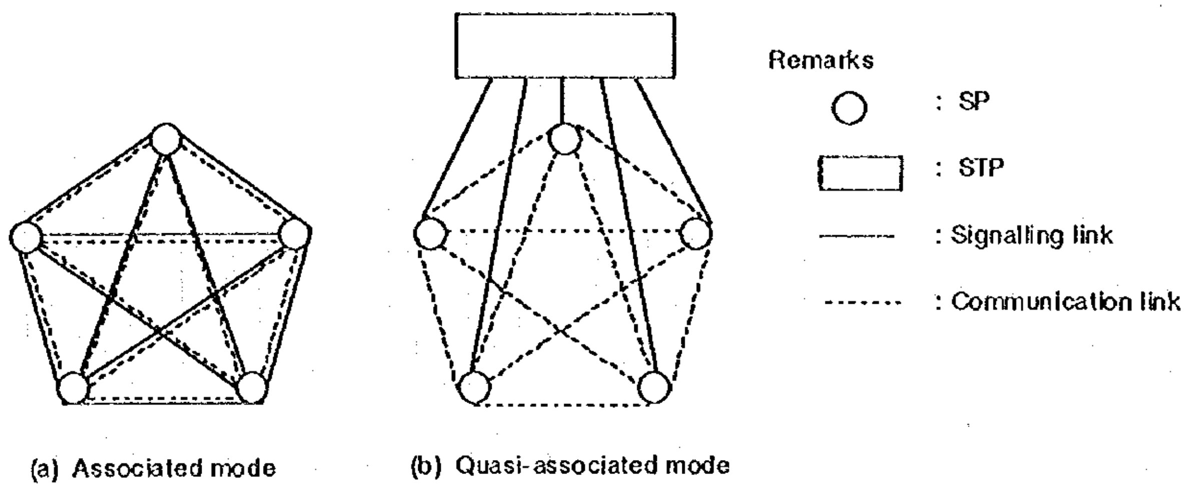


Figure 6.6.1-1 CCS Network

Signaling circuits are separated from speech circuits in the Quasi-associated and Non-associated modes of operation. The signalling is relayed to the terminating exchange along a separate route and complex control is needed to associate speech circuits with their signals. The advantage offered is the elimination of the need to set up a signal path for each inter-exchange speech circuit, thus making operation of signalling circuits more economical. The Non-associated mode signalling network will be introduced when there is a large number of exchanges in Syria.

6.6.2 Selection Procedures

When selecting signalling systems, it is necessary to consider not only the signalling system, but also the configuration and size of the telecommunications network. Ideally, signals should be standardized for the entire network, preferably in conformance with the standard system recommended in the ITU-T No.7 Signalling System. Other systems exist, however, such as the MFC R2 signalling system, and these must be interfaced.
Signaling systems are very closely related to exchanges with which they have shared a similar course of development. This is why the selection of exchanges requires consideration of the long-term development situation.

6.7 Charging Plan

6.7.1 The Present Charging System

The present charging systems are as follows:

(1) International call

AMA (Automatic Message Accounting) system is applied to international calls at the STD exchanges (EWSD), to which ID (Identification) is transmitted from all local exchanges except for EWSD type which has AMA system by itself.

Calls are charged by calculating call duration and destination according to the tariff.
The exchanges which have the AMA system send MT (Magnetic Tape) to the billing center once per month.

(2) Long distance call

The same AMA system as international calls is applied at all STD exchanges.

(3) Local call

Electronic/mechanical meter system is applied at each local exchanges.
The exchanges which have the electronic meter system send MT (Magnetic Tape) to the billing center once per three(3) months.

The charging systems by each local exchange type are shown in Table 6.7.1-1.

Table 6.7.1-1 Charging System by Each Exchange

	International call	Long distance call	Local call
EWSD	AMA	AMA	Electronic meter
NEAX61	AMA(atSTD)	AMA(atSTD)	Electronic meter
E10A	AMA(atSTD)	AMA(atSTD)	Electronic meter
EMD	AMA(atSTD)	AMA(atSTD)	Mechanical meter

6.7.2 Charging Plan

New establishment of digital exchanges, replacement from EMD exchanges to new digital exchanges and expansion of existing digital exchanges are planned. Accordingly charging system to be introduced should be AMA system for international and long distance call, and electronic meter system for local call.

6.8 Synchronization Plan

Network synchronization plays a key role in establishing high quality digital telecommunication networks. Network synchronization is indispensable to providing high speed digital leased circuits and ISDN services and to connecting digital lines internationally.
There are three basic types of synchronization methods, which are:

i) Plesiochronous synchronization

ii) Mutual synchronization

iii) Master-slave synchronization

Generally, each country has its own high-accuracy time generator, such as an atomic clock, which operates independently, while the master-slave is used commonly within the country.

6.8.1 Present Situation

The STE has adopted the master-slave synchronization method. It uses a cesium-beam oscillator located at the Al Nasser STD transit and international center. The clock timing signal is distributed from the master station (Al Nasser) to the other offices (slave offices), as shown in Figure 6.8.1-1.

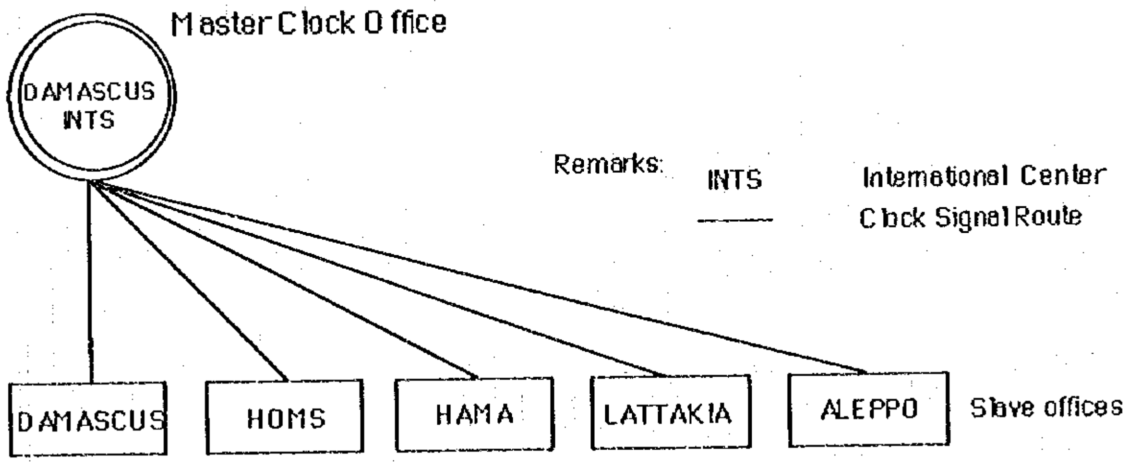


Figure 6.8.1-1 Configuration of Present Clock Signal Route

6.8.2 Network Synchronization Plan

(1) Clock Distribution System

A master-slave synchronization system will be employed in the Syrian digital network.

(2) Stability of Clock

The stability of the master clock and back-up oscillators in each hierarchy stage will be as follows:

Master clock (International switch)	10^{-12}
STD (Toll transit switch)	10^{8}
LS (Local switch)	10^{8}
RSU (Remote switch unit)	10^{6}

(3) Clock distribution Network

The clock distribution network is shown in Figure 6.8.1-2.
In the near future, the Aleppo INTS will have a submaster clock as a stand-by for the masterclock at the Damascus INTS. In the event the masterclock fails, the submaster clock will distribute a clock signal to the entire Syrian digital network.

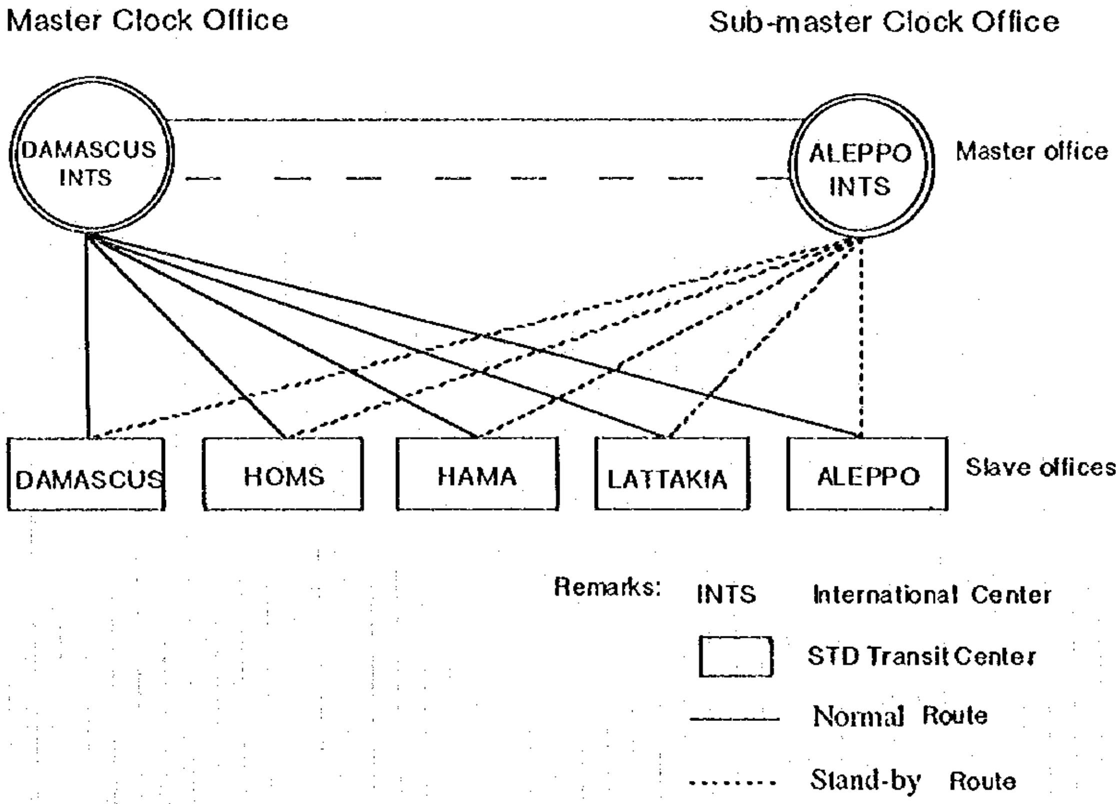


Figure 6.8.1-2 Proposed Network Synchronization Plan

6.9 Transmission Network

6.9.1 Network Configured with SDH Systems

Transmission networks are classified into the following three network layers (see Figure 6.9.1-1):

(1) The circuit network which connects switches and service providing systems

(2) The path network which is independent of services and transmission media, and is a target of operation activities in transmission sector.

(3) The transmission media network which consists of fiber-optic transmission systems, microwave systems and others.

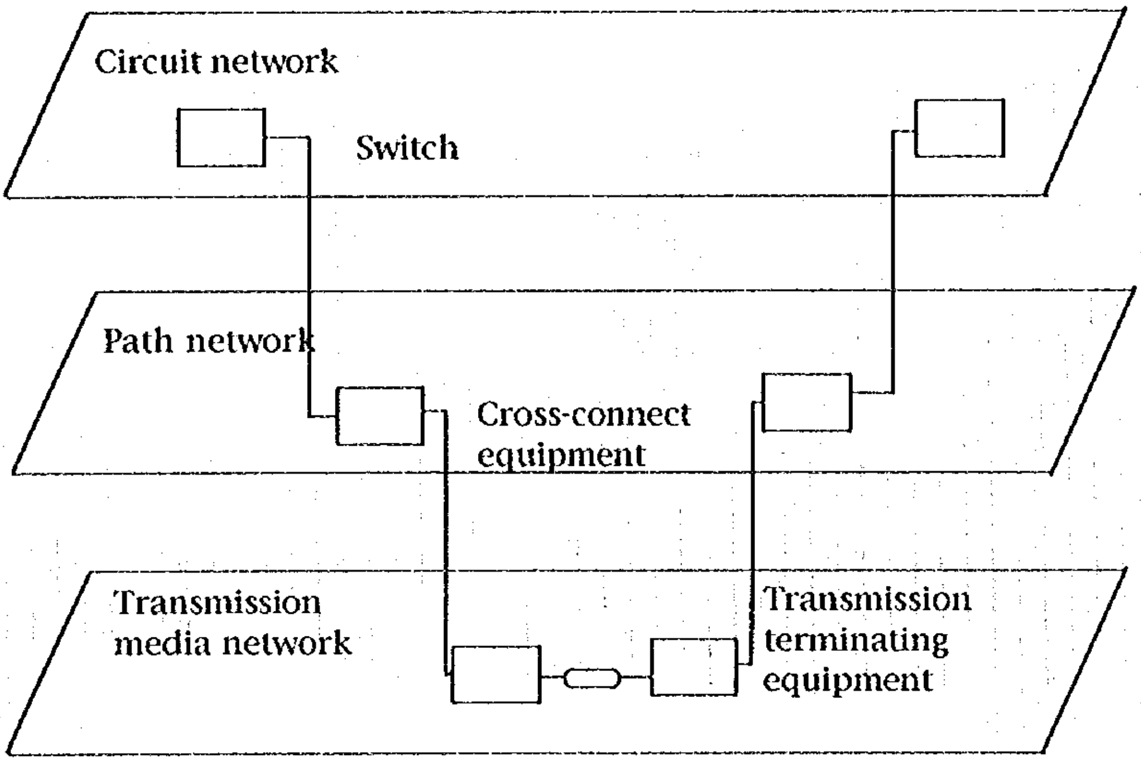


Figure 6.9.1-1 Three Transmission Network Layers

Of the three layers, the Path Network with cross-connect equipment is the key to simplifying the transmission network structure. An illustration of simplification is shown in Figure 6.9.1-2.

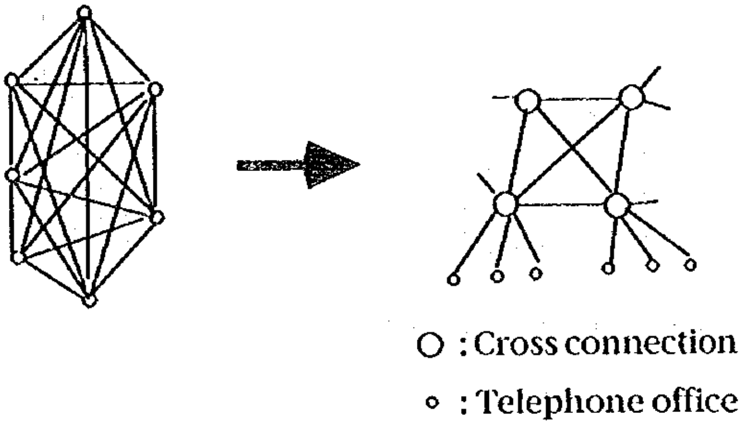


Figure 6.9.1-2 Network Configuration Simplified Using SDH Systems

In Syria, the standard is 2Mbit/s for the path units (as proposed in section 6.2). Thus, circuit supply plan will use units of 2Mbit/s (30 channels).

6.9.2 SDH Ring Configuration

For mainly security reasons, SDH ring configuration should be adopted for the plan if possible. The SDH ring configuration is shown in Figure 6.9.2-1 below.

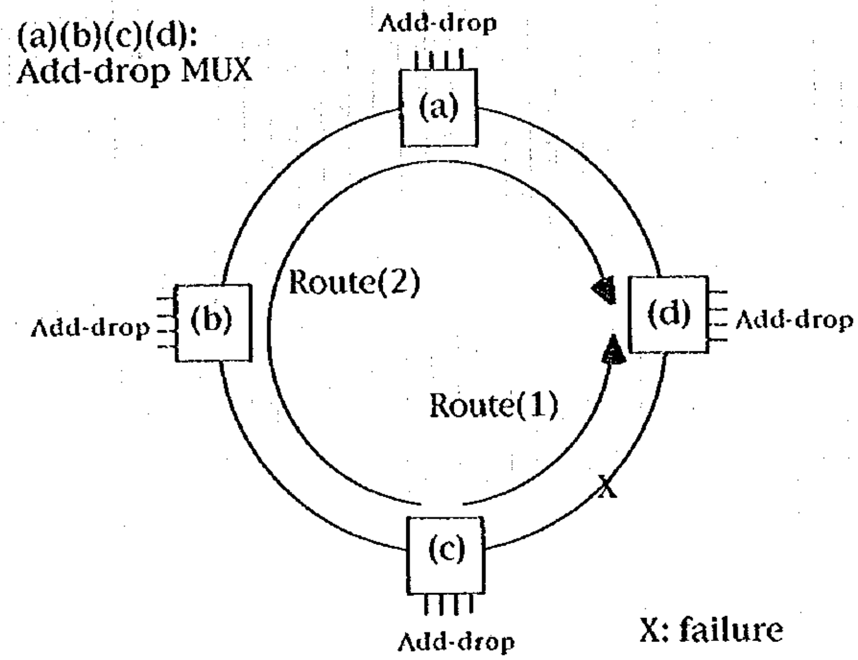


Figure 6.9.2-1 SDH Ring Configuration

The "Add-drop MUX" in Figure 6.9.2-1 is a multiplexer with cross-connection function. If 50% of the traffic between (c) and (d) flows on Route (1) and the other 50% flows on Route (2), 50% traffic can be maintained even in the case Route (1) fails. If all of the traffic passes over Route (1), and the Route (2) has enough spare capacity, all the traffic can be saved by switching from Route (1) to Route (2) in the case of Route (1) failure.

Examples of application are provided in section 7.1. A STM-4 ADM is normally used as an Add-drop MUX in the plan to increase route capacity in place of conventional PDH multiplexers. A minimum 50% circuit restoration is the target for central Aleppo and in the wide central area of Damascus. A maximum 100% circuit restoration is considered in the plan for circuits on main transit switches (i.e. Damascus, Aleppo, Homs, Lattakia, Hama).

6.10 Long Distance Telephone Network

6.10.1 Current Network Configuration

The current long distance network uses an hierarchical configuration consisting of 4 levels. The highest is the 4th level which is composed of Damascus, Aleppo, Homs, Hama and Lattakia. The level 4 networks are mesh and connected with each other.

The current long distance network is illustrated in Figure 6.10.1-1, the exchange office rankings are listed in Table 6.10.1-1.

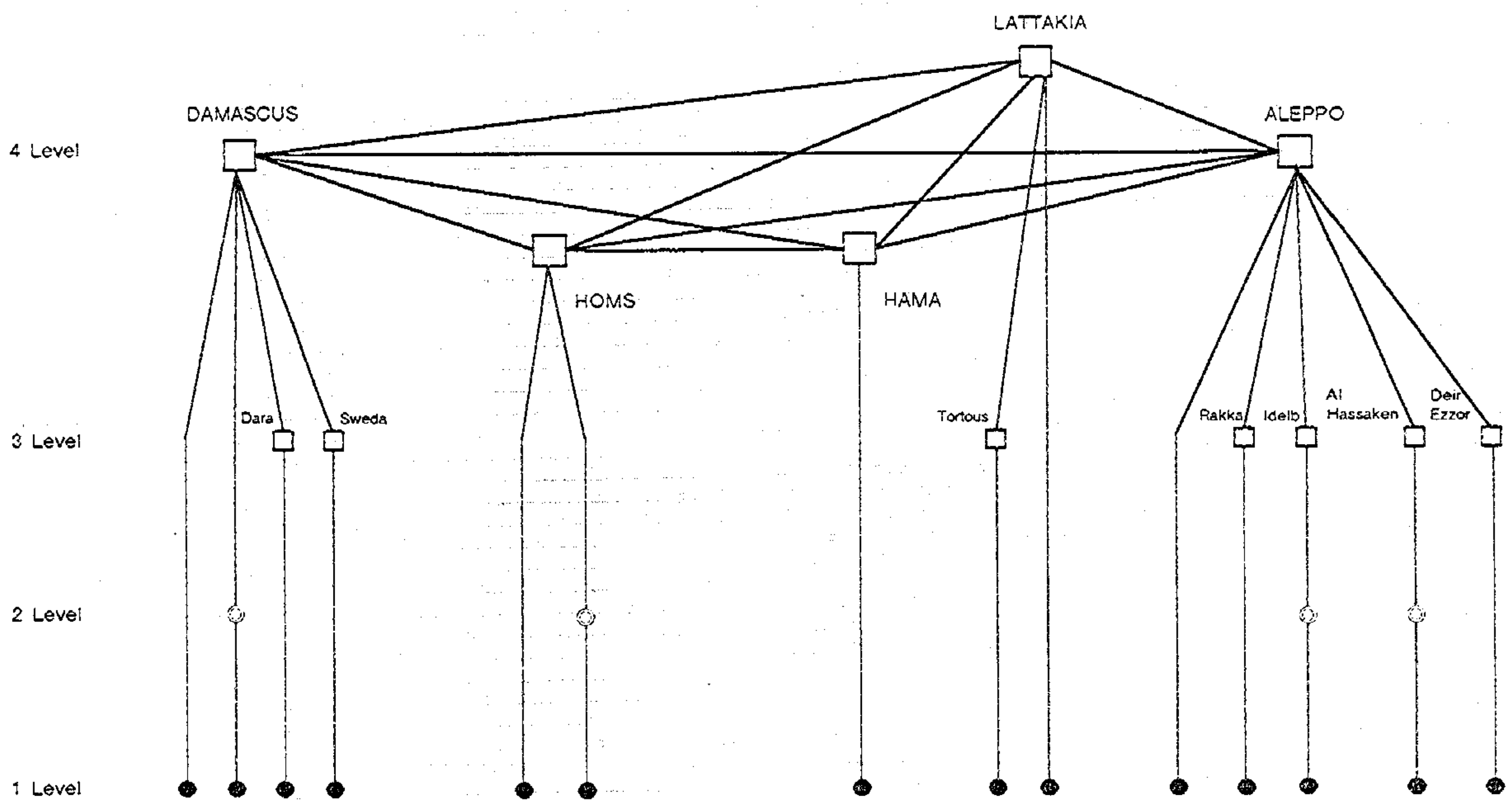


Figure 6.10.1-1 Current Long Distance Telephone Network

Table 6.10.1-1 Nationwide Telephone Network Configuration (Damascus)

4 level	3 level	2 level	1 level
Damascus	(Damascus)	(Damascus)	Al Nasser, Al Thawra, Kefr Souseh, Domer, Al Mohajrin, Jallaa, Bab Sharki, Mazzeh(1,2), Al Miedan, Mazzeh (3), Barzeh, Al Yarmouk, Roknaldien, Baghdad, (Damascus City)
			Doma, Mleaha, Jaramana, Babela, Keswa, Nashabeah, Zamalka, Darayah Jd Artouse, Katana, Sehnaya Harasta Al Dmear, Adraa Al Hamah Al Fegi, Kora Al Assad Al Tall Sydnaya (Damascus Rural)
		Zabadani	(Zabadani), Blodan, Bokken, Madala, Enahore Arawtha Al Sahel
		Alnabek	(Alnabek) Derattiah, Karra, Yabrod, Kottefeh Jerod, Malloa, Einteneh,
		Al Quennetra	(Al Quennetra)
	Daraa	(Daraa)	(Daraa) Dael, Taffas Kazzaleh, Bosra Al Hrak Shaykh Miskin Ezrae, Jassem Sanamen, Nawa
	Sweda	(Sweda)	(Sweda) Shahaba Al Qraya Salkad

Nationwide Telephone Network Configuration (Hama)

4 level	3 level	2 level	1 level
Hama	(Hama)	(Hama)	Kowatlle, Kamhaneh, Al Mahtta, Soran, Mesyaf, Mhardeh, Salammeh, Skelbeyeh Talsalhab Kalet, Al Matheek

Nationwide Telephone Network Configuration (Aleppo)

4 level	3 level	2 level	1 level
Aleppo	(Aleppo)	(Aleppo)	Al Jameleha, Kan-Al Wazeer, Al Solymaneyeh, Al Ansari Al Sabele Al Hamdaneyeh, Sfera, Al bab, Aezaz, Efreen, Tal-Refaet, Hanano
			Manbeg, Jarablos, Ein-Al arab,
	Rakka	(Rakka)	(Rakka) (1), Rakka (2), Talabyath Al Thaowrah
	Idelb	(Idelb)	(Idelb) (1), Idelb (2), Arieha, Kofer-Takariem, Selkien, Harem, Maert-Misrien, Srakeb, Jessr-Shkour, Al Dana
		Al Mareh	(Al Mareh) Kofernobel-Khansheekon
	Al Hassakeh	(Al Hassakeh)	(Al Hassakeh) Rasalein
		Kameshli	(Kameshli) Malkeah, Amoda, Derbaseah
	Deir Ezzor	(Deir Ezzor)	(Deir Ezzor) (1), Dieir Ezzor (2), Mayadine, Boukmal,

Nationwide Telephone Network Configuration (Homs)

4 level	3 level	2 level	1 level
Homs	(Homs)	(Homs)	Al Kwatli, Al Mahlta, Al Waer, Talkalakh, Al Nasra, Sheen, Taldo, Talbeseh, Al mkaram, Kosser, Al Rastan, Al Kareyten
		Tadmor	(Tadmor)

Nationwide Telephone Network Configuration (Lattakia)

4 level	3 level	2 level	1 level
Lattakia	(Lattakia)	(Lattakia)	Lattakia (1), Lattakia (2), Kasab, Al Hafeh, Slonfeh, Kerdaha, Beat-Yashot, Al Daleah, Jableh, Raes-Albasset (RDLU) Alshatea-Alazrak (RDLU)
	Tartous	(Tartous)	(Tartous) Banyas Sheak-Badoer Arwaad Safetta Dreakesh Mashta

6.10.2 Optimizing Network Configuration

The Study proposes a plan to optimize the national telephone network. Structuring a network involves determining demand (forecasting demand and traffic), estimating the number of required local exchanges (according to service areas and offered services), and delineating the toll (transit) exchange districts. Decisions must also be made on the number of the stages (or levels), network configuration type (mesh or star), the cities in which to install toll exchanges, and the direct and alternate routes.

(1) Network Configuration

When determining the number of switching levels (or stages), it is necessary to compare the exchange and transmission costs of two network configurations using the number of exchanges and levels as parameters. For the purpose of evaluation, the Study selected two network patterns (Figure 6.10.2-1) for evaluation based on the traffic matrix estimated for 2010.

Pattern 1: Two levels for transit switching hierarchy

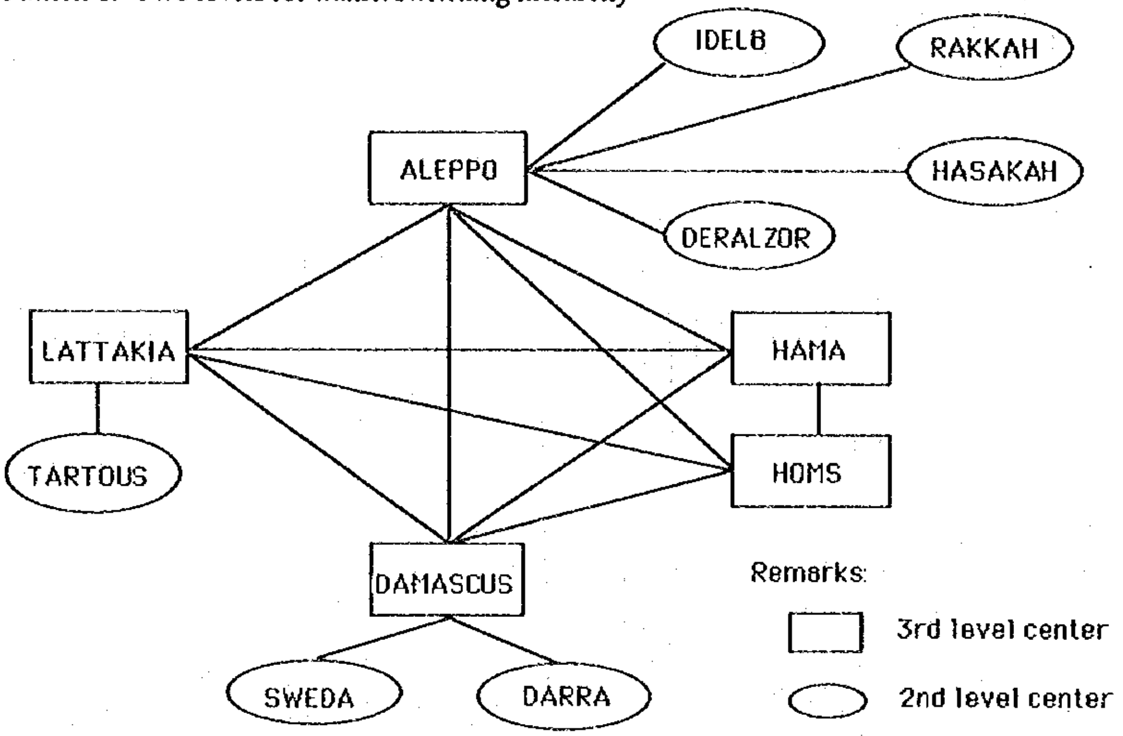
3rd Level: Damascus, Homs, Hama, Lattakia, Aleppo (5 centers)

2nd Level: Darra, Sweda, Tartous, Idleb, Rakkah, Deralzor, Hasakah (7 centers)

Pattern 2: One level for transit switching hierarchy

Damascus, Homs, Hama, Lattakia, Aleppo Darra, Sweda, Tartous, Idleb, Rakkah, Deralzor, Hasakah (12 centers)

(1) Pattern 1: Two levels for transit switching hierarchy



(2) Pattern 2: One level for transit switching hierarchy

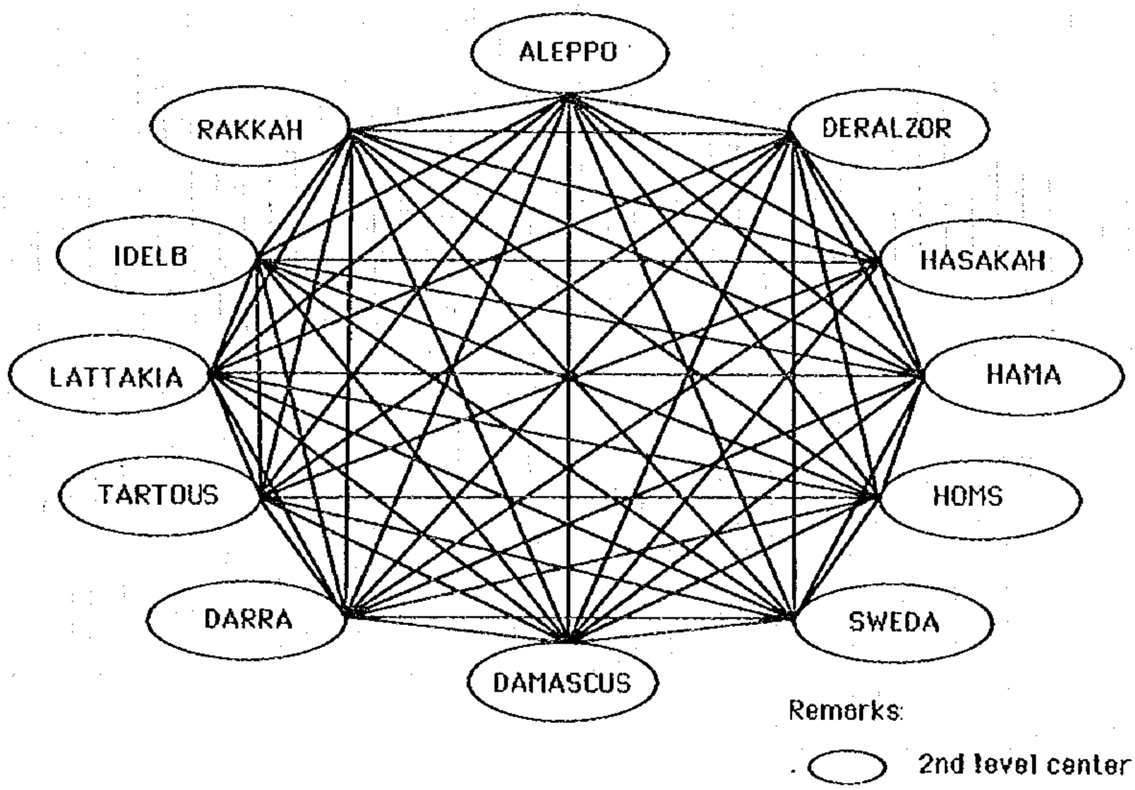


Figure 6.10.2-1 Network Configuration Patterns

(2) Results of Evaluations

The comparison results are shown in Figure 6.10.2-2. Pattern 1 is the most economical network. It was adopted for the Study because the total length of the circuits for Pattern 1 is much shorter than that for Pattern 2.

Ease in developing network functions, effective operation and maintenance, and network stability have become important factors in network optimization.

The network configuration in Pattern 1 is preferable for the Syria's digital STD network.

Figure 6.10.2-3 shows a development plan for a long distance network.

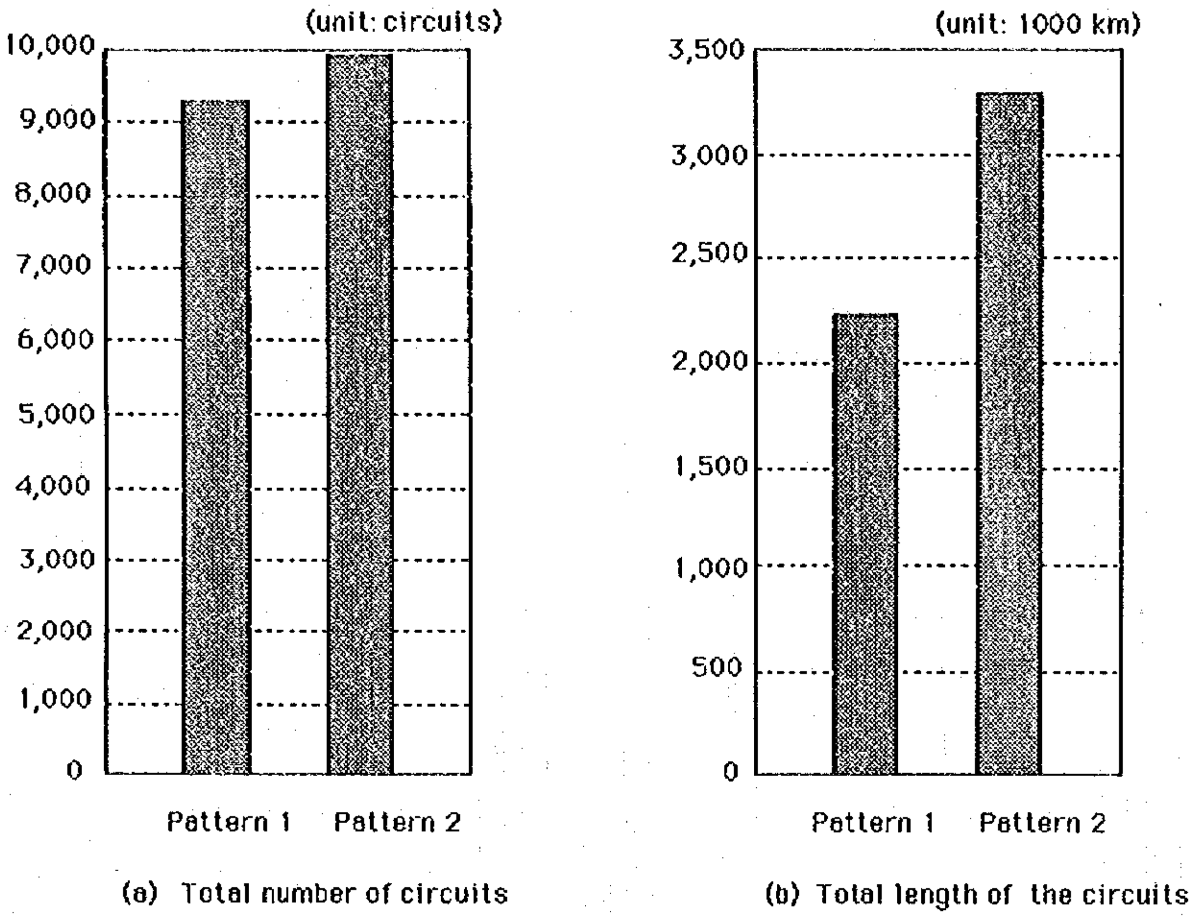


Figure 6.10.2-2 Comparison of Network Configuration Patterns

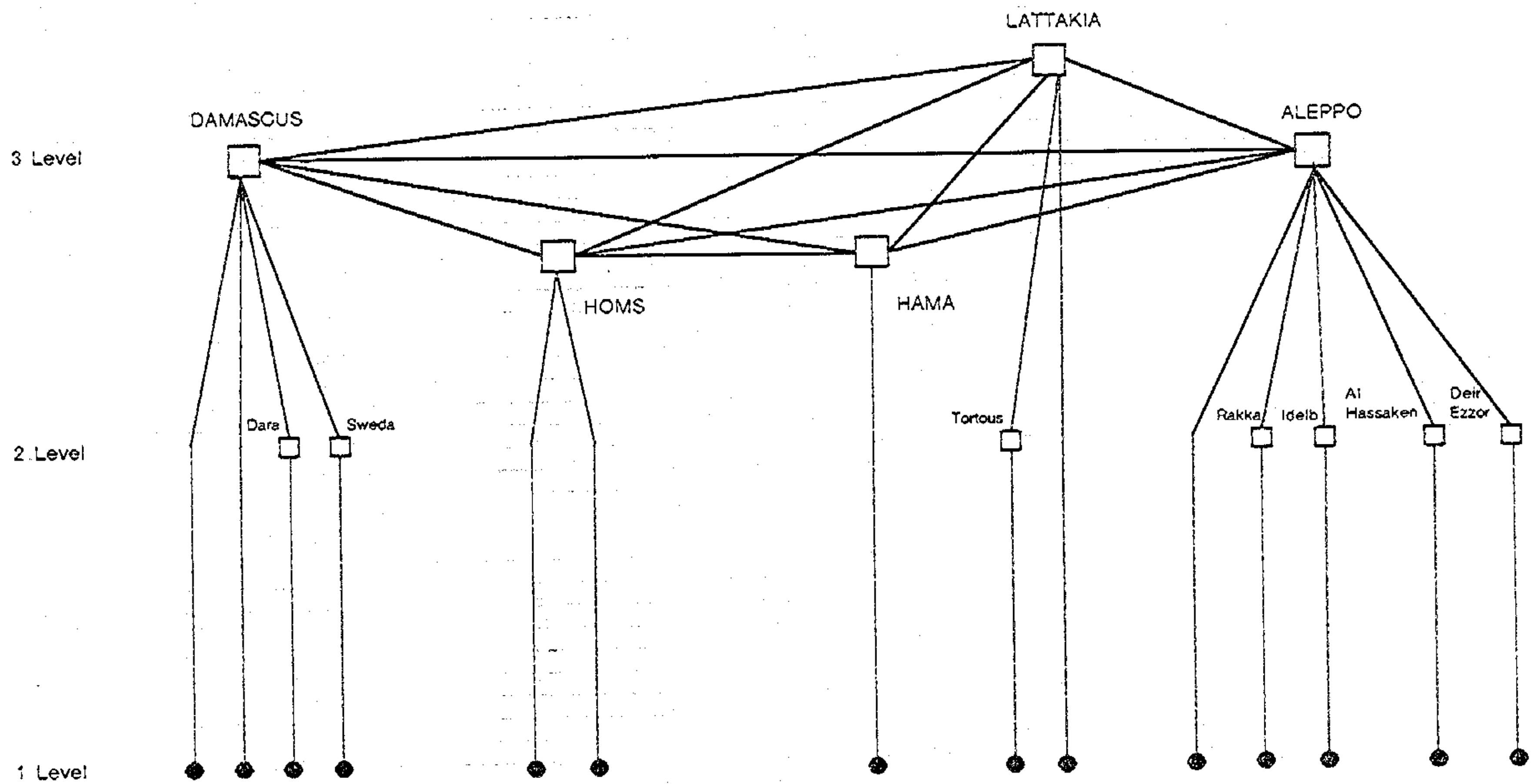


Figure 6.10.2-3 Development Plan for Long Distance Telephone Network