Global Modernization Plan of Telecommunications Infrastructure and Services in Slovenia (MTIS)

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Outline of the global modernization plan of information technology and telecommunications infrastructure in Slovenia (MTIS) is presented in the paper. The preparation of this plan has been based on reference documents, supplied by major actors, represented in the Commission for Policy and Strategy of further Telecommunications Development. Its objective is to activate the modernization process, that consists of principles, methodologies and development scenarios of all topics covered by MTIS. The operational plan with detailed analysis of investments, timing and responsibilities will be object of the further document, the Master Plan, which will be produced immediately after the approval of MTIS. MTIS has been primarily focused on the existing status of telecommunications infrastructure and services and on the innovation aspects of the unification of the telecommunications and information technology based on the convergency of needs of different sectors. With the respect to the development three fundamental scenarios, namely natural, accelerated and survival scenario have been presented. The accelerated scenario has been proposed to be brought into effect as soon as possible.

1 Introduction

Telecommunications are, and will increasingly be of critical importance to economic, social and cultural development. They are the nervous system of modern society.

Efficient telecommunication network infrastructures and telecommunications services will be essential for the development, growth and flexibility of Slovenian economy as a whole. Telecommunications have a great influence not only on services in general, such as financial services, transport and tourism, but also on trade in goods and on European industrial co-operation.

Demand for data communications capacity is growing among the big European industrial companies at a rate of 40% a year. Companies are using these services to find out more rapidly what their customers need; others are using communications to reduce stocks of parts, to manage cash, to monitor remote installations, etc. In many trading and financial service activities, the availability of the most advanced communications is already essential to the commercial success. The same is becoming increasingly true for industry. This applies not only to large companies, which need to move large amounts of data among installations, but also to smaller firms for which ad-

vanced communications open up markets, which were previously out of range. Finally, the ability to send and receive information is important for individuals if they are to play their full part in society.

The overriding aim of the MTIS is the development of a strong telecommunications infrastructure enabling Slovenian user a broad variety of world-wide, good quality and low cost telecommunications services.

Outline of the global modernization plan of telecommunications infrastructure and services in Slovenia is given in the paper. At first, the objectives of the development policy are discussed and the basic development principles are introduced. The unification process of telecommunications and information technologies are based on the convergency of needs. After that, the state of Slovenian telecommunications infrastructure and information services is described. Individual needs of the sectors are identified as a basis for further consolidation and development towards digital transparent network, controlled by sophisticated computer software. The guidelines for future development of the unified modernization plan are given with the emphasis on the fibre optics technology and the parallel construction of more main networks must be avoided. After the approval of MTIS by the governmental institutions, the Master plan comprising detailed analysis and specifications, must be composed. With respect to the development policy, various possible scenarios for future development of telecommunications are evaluated. Finally, a single multi-functional transmission network predominantly based on optical fibre cables is proposed in the implementation plan. The result of the harmonious development would be technologically unified, self healing and transparent network, enabling wide variety of new services.

2 Objectives and Principles

The **development of Republic of Slovenia**, keeping in mind both economic and social needs, represents a strategic governmental objective. In order to facilitate the achievement of this objective, telecommunications play an essential role through the interconnection and the services based on information that they can provide.

Telecommunications give a firm backbone for functioning and development of the whole society. Required achievement of higher level of general development includes request for higher level of telecommunications development. Therefore, accelerated investment into telecommunications infrastructure is necessary.

In consistency with the Slovenian governmental program ([2]) **MTIS (Global Modernization plan of Telecommunications Infrastructure and Services in Slovenia)** has been developed with the scope to unify the existing information technology together with the telecommunications facilities and services. Based on the present situation of telecommunications and information technology of Slovenia some various scenarios for the future development has been painted.

MTIS is based on a qualified collection of data and information, provided by the major service providers and major users of telecommunications network.

MTIS provides policy and strategy for further telecommunications infrastructure development, including information and telecommunications services in Slovenia in the form of technological neutral study.

During the last decade the evolution of telecommunications was focused on the digitalization, i.e. the transformation and transmission of information (voice, data and video) in a form suitable to be processed by computers. The introduction of computers into telephone exchanges enables:

- introduction of new information and telecommunications services, where data transmission, processing and storing capacities are of basic importance;
- control, management and monitoring of the telecommunications network using special purpose software.

Reduction of the threshold between the public and private networks gradually leads into integration of telecommunications and information technology. The integration will be consolidated in 3 to 5 years.

A full usage of digitalization may be achieved whenever the integration of applications is envisaged as key principle; the *Integrated Services*

Digital Network (ISDN) is the first step of this phase. The digitalization of telecommunications may in addition allow the national telecommunications providers to diversify services and offer Value Added Network Services (VANS).

The scope of services rendered in Slovenia by service providers is to satisfy the needs of users. The Slovenian market has today individual users (citizens), companies (private and public) and Administration. The satisfaction of users requirements forms the basis for the existence of services.

All users expect from service providers a range of services with the right quality, with the appropriate prices and all of them want to be treated as clients and not as passive actors. Companies are the primary users of the services because they represent the tool to develop their activities. Administrations are although users, but with the aim of intercommunication and monitoring of their activities. The evolution of the spirit of Administration from supervisory phase to productivity phase and effectiveness of activities is envisaged.

The different actors involved in the process of modernization of all the national sectors have the natural attitude to support with the highest priority the budgets of their own sector. In parallel, the permanent economic constraints of any administration make frequently difficult the acceptance of the sectorial budgets. Finally, the wish from the social and economic viewpoint to speed up the modernization process may produce an unbalanced effect of acceleration for some sectors. All the previous elements, together with the human behaviour, may generate the wish to develop anyhow the modernization in some sector without the appropriate coordination. The effect of this behaviour is a plan that is much more near the survival scenario than the natural one; definitively it is far from the accelerated one. This must not happen.

3 Development Policy

The rationales of the **development policy** of telecommunications infrastructure and services are the following:

- better telecommunications and information services in the near future based on better telecommunications infrastructure;
- definition of telecommunications infrastructure that enables the set of services comparable to those in western Europe and the entrance into the open European market of information;
- recognition of Slovenia as a state with appropriate modernization plans and investment possibilities providing the approach and later the integration into European community;
- establishment of basic prerequisites needed for setting up those state functions that are preconditions for approach to EC (e.g. creation of the system for EDI (Electronic Data Interchange) for daily added value taxation);
- prevention of development of parallel networks for different monopolistic organizations (Electricity, Railways);
- cutting down the expenses for state and local administrations;
- quicker turn-over of the capital;
- exceeding of lagging;
- coordinated regional development;
- diminishing of daily migrations, etc.

Appropriate **legislative** in the field of telecommunications and information services and infrastructure should be adopted in 1993. It should be done similar to the EC legislative and should consist of at least following items:

- the law of telecommunications and services:
  - disjunction of post and telecommunications;
  - deregulation and liberalization of services and equipment market;
  - de-monopolization and licensing;
  - prevention of capital flow from the monopolistic services into the marketed services (i.e. prevention of unfair competition);
  - restoration of ownership of telecommunications organizations, infrastructure, ...
- the law of radio-diffusion (frequency space),

- the law of cable distribution systems,
- appropriate technical regulations and standards and
- appropriate tariff system and price policy.

The process of unification of telecommunications with the information technology together with the process of modernisation should be a part of the **permanent program of informatization**. This program could be developed with the modern technologies themselves and spread at the appropriate levels.

The offer of services made available to citizens as the result of MTIS and related further activities has to be licensed to the concessionaires due to liberalisation of services, as already applied in the majority of European countries.

The validity and the applicability of MTIS and related further activities strongly depend on the services that will be selected and offered to citizens; the decision to offer payable or free of charge services is also related to the social impact that will have to be decided by the government.

The offer of terminal equipment must remain as liberalized as it is now.

Satellite communications should be treated in the same way as in the EC.

The government should monitor and control the concessionaires, especially in the case of their monopolistic status.

Concessionaires should provide only the licensed services. This will lead into reorganisation of PTT, RTV to provide adequate economical effects. Actual synergistic results are expected to emerge as a consequence.

Corresponding social effects can be expected as well, for accelerated increase in telecommunications and information services and infrastructure open new, highly specialized, productive and non-polluting jobs. Export of services, at present represented by analog voice telecommunications traffic, should overgrow into the integrated services, forming preferred export activity.

4 Development strategy

The **unification** of **telecommunications infrastructure** and **information services** makes available a very wide range of services owing to the continuous decrease of costs of information technology and in parallel to the harmonisation of tariffs.

The **strategy** requested to activate the process of modernisation and unification may be based on the following items:

1. identification of priorities in sectors,
2. identification of priorities in technology, telecommunications and informatics necessary to fulfil the priorities selected for sectors,
3. economic analysis and cost evaluation of implementation of priorities,
4. accurate analysis and decision between: consolidation of what already exists or development of new services.
5. provision of appropriate standards and technical regulations, and their accommodation with the European community standards.

Every single network existing in Slovenia (PTT, Electricity, Railways, RTV) has its own historical genesis; a synergy between the above networks must be analyzed and implemented whenever necessary. The objective of the above synergy is to produce a scale production effect made obligatory by the size of Slovenia.

The strategic pattern defined at governmental level must take into consideration not only the social effect of the modernisation plan but also the economical and industrial. The decision to implement the modernisation plan in under-developed areas in Slovenia compared with the developed areas represents a key issue to calculate the risks of implementing/not-implementing.

MTIS represents the **initial phase** of the **Master Plan** of modernisation and is a subset of it. The production of the Master Plan is the technical result of the accomplishment and approval of MTIS. General methodology of Master Plan should be aligned with the MTIS methodology; however a strict monitoring activity is requested for Master Plan.

Priority investments in telecommunications field should not be conditioned by the Master Plan approval, but they have to run in parallel, for possible procedural barriers must not prevent extremely necessary development.

5 State of the art

5.1 General

The development policy and provision of telecommunications services has completely changed with deregulation, liberalisation and the technical and technological advance in the world. The reorganisation of the PTT service in Slovenia has not yet taken place, but it is included in the development plan and is envisaged to proceed.

Given a range of functional networks built in parallel with public networks, the telecommunications activity is rather uneconomically organised. Involved is not a rival supply of public telecommunications services on a basic infrastructure, as is the case in Europe, but an excessive building of infrastructure networks of the same type.

During 1992 the economical and political situation in Slovenia have brought the attention of the government to the stabilization of the country and to the approval of a new and complete set of laws and regulations. The actors playing the function of the "service providers" have not been included within the priorities of the activities yet; in parallel, the process of privatization is not yet operational and the link between service providers (actors) and industry is still undefined.

The large national companies operating in the service areas are passing through reorganization and the unbalanced situation between the activities at former Yugoslav level combined with export activities catch a relevant attention, but still without specific implementation plans.

Not whole domestic industry has adequate level of competitiveness to compete with the European industry; this requires the development of the research of strategic partners to facilitate the introduction of new technologies in telecommunications and information technology areas.

The Slovenian know-how in telecommunications and information technology areas is potentially adequate to fulfil the objectives; nevertheless, the qualification of the resources to enter into the "phase of services" or "post-industrial society" is not yet in process; in addition, the spirit of commercially oriented service providers is not yet spread out at all levels and in all governmental bodies.

The national standards for telecommunications infrastructure elements, their management and maintenance are mostly inadequate or non existing; however, the greater part of investors into telecommunications infrastructures follows the CCITT recommendations and ISO standards upon their own consideration.

5.2 Telecommunications services

At present there are six different telecommunications services available in Slovenia for the domestic market.

1. **Telephony:** There are 500.000 telephone subscribers and only 2.500 public telephones, what is insufficient.

2. **Data transmission:** (SIPAX.25): X.25 is available for 380 subscribers; this density is about ten times less than European average. More than 2.500 users use PTT leased lines.

3. **Mobile communications:** An analogue mobile system has 5.000 subscribers and is in the intensive phase of development.

4. **Telex:** Telex is on decline because it is replaced by the modern technique of fax; 2.000 connections are available.

5. **Fax:** 6.400 faxes are officially installed: The availability of fax service through personal computers and workstations is not yet spread enough.

6. **Cable TV:** There is a rough estimation of 120.000 subscribers that are already linked to cable TV distribution networks. There's no exact figures about cable distribution system providers. For the majority of them there are no official manager, investor and/or owner. The regulation of cable distribution systems by appropriate legislation is still missing.

5.3 Information services

Only widespread information services are mentioned:

1. **Automatic call distribution:** The PTT has organised and maintains several automatic call distribution services providing online information on telephone subscribers' numbers and various prerecorded information (weather and traffic reports, etc.).
2. **Electronic mail:** First installations are in the process in academic research institutions based on the X.400 and X.500 standards (ARNES). Very few medium and large companies adopt the service Smail.400 provided by PTT, mostly for mail transmission at international level (100 users).
3. **Videotex (VINET):** An experimental VINET system connects more than 440 subscribers for the following services: information services, non-standard electronic mail, electronic phone directory and telex.
4. **Paging:** Teleray enabled cordless massage transfer to 4.000 users. Paging system operates in accordance with RDS system, known as CENELEC EN 50 067 standard adopted by majority of West European countries and by Slovenia as well.
5. **Governmental information services:** databases contain information on governmental, parliamentary and jurisdictional documents, official gazette, etc.
6. **Information services of Slovene Chamber of Economy:** commercial and economic data basis are available off-line; on-line interactive access to the data will be available in near future.
7. **Shared cataloguing information system:** contains information about recent articles, periodicals, books and research reports available in Slovenian libraries.
8. **TV and radio programs:** can be treated as information services for great number of subscribers.
9. At the end let us mention also non formal organised DECNET network, superimposed on leased telephone lines and SIPAX.25, which interconnects more than 300 computers located in various institutions in Slovenia. There are several other networks used by Slovene Chamber of Economy, governmental and local administration etc., which will not be further discussed.

5.4 Service providers

At present the **Slovenian PTT** is the major provider of the telecommunications services. PTT is (currently, i.e. in July 1993 still) organised into nine companies, each with individual autonomy. About 8.000 employees are in PTT with rough 2.500 people in telecommunications sector; during 1991 telecommunications activity have contributed for around 2/3 of PTT revenues.

The level of penetration of telephone lines in Slovenia is about 25 lines per 100 inhabitants, to be compared with the EC average which is about 35 lines per 100 inhabitants. The quality of public services is critical particularly because of the underdeveloped public infrastructure. The process of digitalization of the public infrastructure in Slovenia is activated following the recommendations of the European Council of 1986, but not completed. The optical communication backbone is under development and the reorganisation of telecommunications and of PTT organisations together with restructuring of the network has not started yet. All the above points reduce the competitiveness of the Slovenian services mostly in the international arena.

RTV and governmental administration are actually service providers for many years. In the last few years telecommunications services are also increasingly offered by various registered providers such as Teleray for paging and Mobitel for mobile telephony.

5.5 Public and dedicated telecommunications networks

Public telephone network: The telephone network in Slovenia is built hierarchical. Combined international and transit exchange is located in Ljubljana and connected to 12 main exchanges and other lower level exchanges. 53% of exchanges are in crossbar technology and 29% of them are analog SPC exchanges. Four years ago

the first digital exchanges ESWD, SI and AXE were installed in Slovenia what represents now 18% of total capacity. Nine out of twelve main exchanges are digitalized.

The transmission network has been built-up mainly on metal cables and the analogue cable and radio-relay systems. Recently we have commenced introducing optical cables and digital radio-relay systems.

Railways telecommunications network: Railways have their own functional network with the 55% of nodes older than 25 years, not expandable to additional users and under serious technical degradation. Telegraphic network has the technology of 1964 with limited equipment and different cabling. The global status of Slovenian railway telecommunications is today inadequate to play the role of the bridge between Italy, Hungary, Austria and Croatia.

The electric power supply telecommunications network: Concerning the electric power network, the voltage distribution is dominated by 110 kV lines with 1160 km, followed by 380 kV lines with 400 km and finally by 220 kV lines with 300 km. The communication lines are bound to electro-energetic wires.

The underground cables are in the last few years intensively replaced by optical cables implemented in aired ground wires, which are cheaper and more reliable in normal conditions.

RTV broadcasting and cable-TV networks: RTV broadcasting system is devoted to 500.000 radio and TV and to 150.000 only radio subscribers. About 20% of TV subscribers are connected to cable distribution network, provided by several domestic and international companies.

5.6 Sectorial plans

Only the review of major actors will be stated, for which the development plans exist. The plans are not coordinated. Their consolidation is one of Master Plan tasks, which must be done as soon as possible.

The introduction of digital, transparent network controlled by sophisticated computers has meant that many of the functions that were previously carried out inside of the network and could be carried out only by the controlling administration, can now be performed outside the network by the increasingly sophisticated terminal equipment.

PTT services: PTT is the most important service provider in Slovenia. We plan an annual 6% growth in the number of main telephone subscriber lines by the year 2000 so that the average of 40 telephone lines per 100 inhabitants will be reached. The use of packet switching X.25 public data network will be more intensive in the first half of the decade then in the second half, so that the number of 5.000 users is planned to be reached at the end of the century. The number of fax subscribers at that time would be 25.000.

The range of services that can be offered by the switching systems is increasing. Telecommunications exchanges can now perform many additional functions in addition to switching simple calls. The exchange can also store, process and retrieve information.

The analog mobile telephony grows rapidly and will reach in 1995 15.000 analog terminals. They will be gradually substituted by digital GSM terminals. We envisage to have 70.000 GSM telephone terminals by the year 2000.

The number of videotex users is envisaged to reach 4.000 and the number of ISDN users 16.000 by the end of the century.

In the medium and long term, modern telecommunications networks will be more and more independent of the service being carried. They will be able to carry a broad range of services independently of network operation.

In the terminal equipment market the trends towards integration of functions will show up strongly in near future.

PTT network: We plan to introduce by 1995 the digital transmission systems to connect the international exchange in Ljubljana with all main exchanges in Slovenia. One branch of the main transmission lines is envisaged to go from Austria via Kranj, Ljubljana and Novo mesto to Croatia and the other one from Austria or Hungary to Italy.

We expect that the demand of multimedia telecommunications will increase rapidly, and that the telephone network will be gradually replaced by N-ISDN and later on by B-ISDN network. The development would require high-speed and high-capacity transmission and switch-

ing. Slovenia has started to introduce the common channel signalling system SS7, a precondition for the building of the intelligent network, enabling centralised network management and fast and easy implementation of new data, broad-band and multi-media services. Such networks are already operating in the world. We plan to include the 155 Mbit/s MAN network in the second half of the decade and the B-ISDN network after the year 2000. At the same time we plan to introduce value added services.

In the middle of the decade we shall be included in satellite communications on international lines. Satellite based systems are capable of providing transmission capacity with very wide geographic coverage and the ability to provide point to point, point to multi-point or multi-point to multi-point services.

A standardised concept of the universal computer controlled Telecommunications Management Network (TMN) has been widely adopted in the world. This system enables an efficient administration, control and management of network resources, traffic and services, as well as the maintenance and further building of networks. In the middle of the decade we plan to link the control centres in Slovenia and to built TMN modules for the control of the entire Slovenian telecommunications network.

Slovene Railways: The objective of the modernisation plan of Slovenian Railways is the construction of digital network infrastructure based on ISDN concept. Telecommunications system must assure safe and reliable railway traffic. Such a system consists of digital transmission system, switching system, radio communication system, station telecommunication system, information system and control and operating system for the Slovene Railways telecommunications infrastructure.

Telecommunication system will necessarily be based on standards and regulations enabling specific tasks of the railways and the conjunction with the public network. The international traffic and data exchange with the railway directions in neighbouring countries must be assured.

Electric power distribution system: The appropriate telecommunication system must meet the requirements for following functions:

- data processing for the system control,
- high capacity inter computer and computer to terminal connections in individual power distribution companies and in the distribution centre,
- integration of dedicated telephone network with public telephone network,
- transmission of long-distance security data,
- remote maintenance and abnormal state control,
- transmission of meteorological and seismic data.

RTV dedicated network: The modernisation plan of RTV telecommunication network comprises:

- fixed communications which serve to distribute RTV programmes from production centres to central transmitters at transmission stations,
- interconnection among RTV programme production centres.
- international bilateral programme communications with Austria, Italy, Croatia and Hungary,
- Fixed communications via satellite for exchanging RTV programmes with the European Broadcasting Union,
- mobile program communications for RTV programmes and their transmission,
- communications for supervision of transmission and converter functional networks as well as computer data transmission (telesignalling, telemeasurement, etc.). Regarding Cable-TV network evolution, the growing potential for two way use brings Cable TV networks into the mainstream of telecommunications policy considerations.

Academic and research Community: It is composed of:

- more than 3.700 researchers in 50 autonomous institutes and in more than 150 research and development departments in the companies,
- more than 1.700 lecturers and 37.000 students on 2 Slovenian Universities. With regard to the innovative spirit of the academic sector, which is traditionally higher then in the other sectors, the prevailing need is data communications, comprising electronic mail, electronic conference system, shared cataloguing system and scientific, technological information system, multimedia communications, computer added learning, etc.

Banking, payments, taxes, custom duties and insurance: For those activities the existing network can be used for performing and development of their own services. The services can now be performed outside the network by the appropriate infrastructure and terminal equipment. Taxes, banking and payments require immediate set up of Electronic Data Interchange (EDI). Tax and custom duties must be processed with high priority needed for immediate control of goods and financial flows. In the European Community the above mentioned functions are subjected already to the EDI.

Tourism: Tourism activities together with airtraffic and travel agencies can be connected to the existing networks or to the international networks, such as Amadeus. The similar analysis can be carried out for specific needs in health service or in any domain requiring intensive and fast access to data basis.

Governmental administration: It has considerable amount of specific telecommunications and information needs.

The Ministry of Environment Protection and Regulation established The Geographic information centre which need high capacity (2 to 34 Mbit/s) links among the regional nodes in the Geographic information system.

The Ministry of Defence and the Ministry of Interior: The design of telecommunication infrastructure for both actors must consider the synergy of their needs. The management and the control aspects can be combined with technical, logistic, personal and economics aspects. The security aspect can be covered by joint information system based on the modern telecommunications tools and alternative interconnections. High level of data protection requires the supervision over:

- access to the workstations, terminals and personal computers,
- access to the data and data bases,
- access to the lines,
- access to the transmission equipment.

Specific needs may be also identified by the following actors: Republic Administration of Telecommunications, Republic Institute of Informatics, Institute for Standardisation and Measurements, Agency for Quality, Republic Institute of Statistics, etc.

Local administration: there is an intensive need to establish the data connections among regional centres and the corespondent governmental bodies enabling management and processing of taxes, land-register, health care, pension-fund, company-register, etc.

Industry: The greater part of the companies has or will have the possibility of data interchange through the existing networks. One of the best possibilities is offered by EDI services. The small and the medium size companies will be able to use the information services provided by the Chamber of Economy of Slovenia on the local or governmental level.

Education and health care: An intensive growth in computer equipment can be noticed in the elementary and medium school level. The introduction of voluntary health care system could be a motive for evolution of global and universal information system in Slovenia.

5.7 European status

Telecommunications are already, and will increasingly be of the critical importance to economic, social and cultural development in Europe.

Since 1984 the Commission of the European Communities (CEC) has presented a **Program of Development of Telecommunications** for Member States. Five major axes have been decided:

1. development of future telecommunications networks: integrated services digital network, mobile communications and broadband communications;
2. creation of a European market for terminals and equipment;
3. activation of research and development program covering the technologies of broadband communication;
4. development of services and network in all the Member States;
5. definition of the European strategy for the international markets.

Since 1984 a considerable progress has been achieved through decisions, standards, directives, regulations and recommendations.

The international technical standardisation represents the key for the success of the modernisation of infrastructures and services. Through standardisation, the continuity and coherence of future markets is guaranteed; in addition the same equipment may be used in different environments, the investments are protected and scale production with low costs may be envisaged. Finally new services and products may be developed based on the modern concepts of Open System Interconnection. Particularly the usage of the open standards for the public tenders of the telecommunications institutions brings the access to public markets to all European actors.

Some examples are relevant to understand the spirit of the European strategy:

- CADDIA: cooperation program for the automation of the exchange of data and documentation related to input/output activities together with the management and financial control of agricultural markets;
- AIM (Advanced Informatics in Medicine in Europe): program with the objective to integrate information technology and social/medical care.
- EUREKA-8/COSINE, project, which introduced the first OSI based telecommunication infrastructure in Europe and has together with high definition television project and with the project for road infrastructure development, the highest priority among the CEC projects.

The optical fibre transmission has been introduced 15 years ago. Up to the year 1988 the cost per meter was reduced for the factor of 10 times. In general, the total cost of transmission is reduced 50% every ten years. Thanks to the optical fibre technology, new services such as video conference, video telephone and broadband TV may be introduced. The CEC has set up the program RACE to facilitate the penetration of the related new services.

In 1987 the Commission of the European Communities has approved **The Green Paper on the Development of the Common Market for Telecommunications Services and Equipment** ([1]). The purpose of the Green Paper is to start a common thinking process to be a basis for discussions aimed at the achievement of maximum synergy between current developments in the Member States. It includes new areas of convergency of telecommunications and informatics such as Environment, together with the liberalisation of supplying of equipment to national administrations with the scope to eliminate monopolistic activities. Current 1992 in view of the single market, additional decisions have been taken by the Commission related to the rationale of the European tariffs and to the compatibility and interpretability of telecommunications services at European level.

Every European Community member state has decided for its domestic market the most appropriate strategy of the organisation and restructuring of telecommunications administrations in view of unification of telecommunications services. A relevant position is achieved by France as leader in the Videotex/Videotel services, by Great Britain in the area of privatisation of some services, by Italy in the area of the private TV and by Germany with separation of national service providers into highly specialised bodies.

6 Guidelines for future development of the unified modernization plan

6.1 Services

The range of services available in Europe today, as a reference for this analysis, is identified as a third generation of services. The **first generation** services was based on analog telecommunications infrastructure with limited capabilities of network control and management. The characteristic of **second generation** services is digital voice and data transmission and improved network control relative to the first generation. The **third generation** services may be developed only with a new generation of telecommunications infrastructure based on B-ISDN. Examples of the third generation services are:

- videophone,
- videoconference,
- high speed coloured telefax,
- high speed data transmission,
- CAD/CAM transmission,
- remote printing and publishing,
- high performance networking,
- multimedia communications,
- HDTV,
- EDI - electronic data interchange,
- upper-layer OSI services.

The process of service implementation requests not only a methodology that is common to all the services but also an analysis, specific for each service. The analysis is the prerequisite to evaluate the cost effectiveness ratios that will enable the decision makers to decide whether or not to activate the services. The ratios are based on the social impact, the cost per call, the subscriber fees versus the free of charge options, the number of users in the short and medium term, the investments and the maintenance. Other ratios may complement this analysis; however, the performance ratio of the service - that is price of the service/quality of the service - will be essential for the success of the service itself.

6.2 The process of unification

The traditional approach to **unification** among different worlds is based on the fact that there is a need of synergy, so the process must be activated; worlds that are separated then became unified. The world of **telecommunications** and the world of **information technology** are fitting to this scheme. However, the individual technological evolution of each of the two worlds has brought them to be unified spontaneously, through the automatic convergency of their technologies.

As a matter of fact, the right way of developing the process of unification must not be done through the convergency of technologies, being this automatic, but through the definition and harmonization of user needs. A need is considered the collection of economical, social and political objectives of a sector, and the major sectors have been already explored in the previous paragraphs. Practically, the appropriate way of activating the unification process must be based on the convergency of needs of the different sectors. Based on the full knowledge of the needs of every sector, the consolidation of the needs can be achieved through information technology and telecommunications as integrators: telecommunications and information technology do not need to be integrated, because they already are in this status, but they produce both the integration and the unification of the needs of the sectors.

With this in mind, the individual needs of the sectors are identified, their consolidation is achieved, the way how to solve the need is designed through unified solutions based automatically on information services and telecommunications infrastructure.

One example may be useful: in order to modernize and develop Tourism sector, it is necessary to identify the general need of the sector. Let us assume that the needs are:

- access to booking centres by all Slovenian travel agencies;
- access to hotel, bank, congress centres and restaurant catalogues with tariff by all or part of main tourist centres inside Slovenia and along the borders;

– access to major international booking systems and databases.

With the above needs defined by the sector, request for the solution (including computer system, i.e. hardware and software as well as their telecommunication lines) will be delegated to an appropriate team that will submit to the sector some proposals of solutions with related budget, costs and timing of implementation.

Again, if switched lines or private lines or optical fibres or digital networks will be used, this should not be the priority for the sector, but will be fundamental for the providers of the technologies. The **priority** of the sector is **to provide services** and not technologies.

The quality of services provided by the tourism will then be jointly monitored by the sector and by the providers of technologies keeping in mind the optimisation of the usage of existing networks, workstations and installed systems.

Four *classes* of public networks are in use in Slovenia today:

1. PTT public network, enabling transmission of voice (and data) through telephone lines and modems,

2. leased line network, enabling transmission through PTT owned lines,

3. SIPAX special X.25 public network; it is intended exclusively for data transfer among computer systems,

4. functional network of Slovenian RTV covering the needs of radio broadcasting.

The above four networks must be analyzed in term of their adequacy to the data/information transfer, requested by different sectors; only under this condition any lack of adequacy will produce an improvement of technology. The objective is to satisfy the needs of sectors and to provide services with classes of networks having the appropriate functionalities.

As far as information services are concerned, every sector should define also their needs of processing, data access, data transfer, inter-computer communications and data protection. All these needs will have a solution once more based on a joint unified telecommunications and information technology platform.

The unification process must be considered as a **principle** and not as a consequence; unification is an objective. The effect of a good unification is the right service with the good quality and appropriate price/performance. In conclusion, telecommunications and information technology facilitate the objective to provide services; they both go across the sectors, they generate a link and they play the role of catalyst of the harmonious process of unification.

The integration role of telecommunications and in information services is not sufficient to speed up the development. The Government has to confer the concessions and determine the competent holders of public telecommunications infrastructure and information services development.

6.3 Main Telecommunications Network

The technological bases for further development of telecommunications networks converge according to the world-wide digital network standardization process. Plesiochronous Digital Hierarchy (PDH) will be progressively replaced by Synchronous Digital Hierarchy (SDH), a suitable basis for high speed networks. Some world-wide pilots have successfully been tested already.

Asynchronous Transfer Mode (ATM) could be introduced as leased line network and, via switched network, finally becomes a platform for narrow-band (N-ISDN) and broad-band (B-ISDN) integrated services digital network (voice, data and video services).

There has been a significant advance in the area of fibre optical communications in the past few years. There are several advantages to built the network based on fibre optic technology:

– installation of optical fibre system is cheaper than installation of coaxial cable system at length higher than 100 meters;

– powerful radio links highly pollute environment with electro-magnetic radiation;

– intensive introduction of low-power wireless local subscriber loops is in progress, substituting the expensive cooper cables;

- high speed optical fibre technology is more appropriate than radio and satellite technology due to lower signal latency;
- the fibre optic cable consists of several tiny optical fibres; doubling the number of optical fibres within the same cable increases the total investment only by 10%;
- there's no electro-magnetic interference in fibre optic cables;
- optical fibres enable high bandwidth transmissions over long distances.

Parallel construction of more main networks is uneconomical. Therefore, to design a new telecommunications **backbone** is a high priority task in order to optimize both capacity and routing problems in networks. It is necessary to find out the optimal number of installed fibres and the most suitable topology of the network (multiple interconnected rings give sufficient self-healing properties and provide maximal accessability).

6.4 Master plan

Sectorial development plans, mentioned above, do not consider synergy effects. There has to be a governmental decision to set up the synergical solution, i.e. **Master Plan of Telecommunications**.

After the approval of global modernization plan MTIS by the governmental institutions, the preparation of the Master Plan must be envisaged. Master Plan must be completed as soon as possible. Besides it, the structure of state administration has to be rearranged according to the Master Plan and the appropriate mechanism of independent supervision has to be established.

Master Plan must specify the decision about actual configuration of main telecommunications network, capacity of lines and interconnections to the infrastructure of neighbouring countries to upgrade the transit traffic.

All sectorial plans has to be modified and coordinated according to the finally adopted Master Plan.

6.5 Alternative scenarios of further development

The basic objective of MTIS is the identification of needs for the introduction of new services through unification of technologies. With respect to the development of the national market, different **scenarios** may be envisaged. Three scenarios are fundamental and give the complete picture of national needs, together with costs and investments.

Natural scenario: The principles of scenario are:

1. development of public telecommunications system as scheduled by national development plan;
2. introduction and testing of new services covered by a budget that must be fixed every year;
3. evolution of informatization on the national level with a growth rate, consistent with the market trends;
4. *spontaneous* informatization of local and central administrations, due to the present lack of a coordinated national plan;
5. *spontaneous* telematization of the territory;
6. tariff of public services and new telematic services defined independently of any specific financial plan to support underdeveloped geographical and sectorial areas.

Accelerated scenario: The principles regulating the scenario are based on hypothesis of development of services and informatics with a rate higher than the market growth rate:

1. financing acceleration of informatization of some priority sectors, mainly related to the economics, administration and social environments;
2. development of specific solutions for niches; examples are the creation of land register computer and telecommunication support within Geographical Information Systems (GIS), control the environment quality, automatization of medical informatization system;

3. accelerated development of public telecommunications with consistent plan of investments;
4. development of class of services and tariff that may accelerate the modernization of the republic;
5. intensive introduction of new services, starting from those using X.25 network;
6. solid program of informatization of local and central public administration;
7. definition of medium/long term plans with the scope to rationalize the national industries in telecommunications and information technology.

Survival scenario: The principles governing this scenario suppose the national network development with the rate under the market growth rate and with a deregulated growth of the other private networks. Within this scenario, the investments available for the development of the sectors are low. Such a scenario corresponds to political decisions of not investing in some sector or disinvesting in other sectors or finally to partially privilege only few strategic sectors.

Even if the survival scenario could be considered as *restrictive* and *limitative*, compared with the first two scenarios, it has however a specific area of existence and influence; the environment of this scenario is identified with private investments in telecommunications and information technology.

For some sectors and for some services private service providers may replace public service providers due to lack of capability and budget of the latter. Survival scenario was used in Slovenia till now, forming the current poor state of the art within telecommunications in Slovenia. For example, due to low tariff rates the public PTT can not successfully establish the system of public telephones, but in the same time private service providers can provide the same service on their own tariff principles.

Each of the above three scenarios must be **qualified** through a feasibility study with estimation of the market need, the technical and technological needs and the niches of interest. Risk areas and the budget must be determined considering the consequences of the introduction of services for the national industry, for the institutions managing the public networks and for the social environment.

7 Methodology

Regulation, executive and supervision must be completely **separated** to provide successful modernization of telecommunications infrastructure and integration into Europe.

Regulatory role is provided by the State administration:

- Parliament should adopt appropriate legislative;
- Office for standardization and metrology should adopt appropriate standards and technical regulations;
- the Government should provide necessary organizational structure of State administration;
- Ministry of transport and communications should carry out all the operational tasks, given by the Government or by the Parliament.

Executive role is left to the (competitive) service providers.

We propose that the independent external **supervision** over the modernization of telecommunications would be provided by Commission for Development of Telecommunications (Komisija za razvoj telekomunikacij - KRT). KRT would be nominated by the Government or by the Parliament and its main task would be to monitor the preparation and execution of the Master Plan in order to promote and accelerate the development and to assure the synergic effects.

Modernization process may be divided into two phases: the beginning phase and the main phase of modernization.

The **beginning phase** is currently in progress. On the 22^{nd} session on October 1992, The Slovenian Government passed the Proposal of activities in the field of telecommunications develop-

ment in Slovenia. After that, the Minister of science and technology nominated in accordance with the Minister of transport and communications the Commission for Policy and Strategy of further Telecommunications Development in Slovenia which elaborated the global modernization plan MTIS, presented in this paper. MTIS was also meant to give the argumentation for investments in telecommunications infrastructure on the occasion of adopting the budget for 1993.

The **main phase** would start after the approval of the modernization plan MTIS. At that stage the Master Plan would be prepared and introduced to the Government. After adoption, the Master plan would be executed. The above mentioned Commission for Development of Telecommunications KRT would be responsible for preparation and execution of the Master Plan. KRT would report on the modernization progress to the Minister of transport and communications and to the Government.

To accelerate the elaboration of the Master Plan the Ministry of Transport and Communications would establish a professional **Working Team for Master Plan**. The Working Team should perform the following tasks:

- identification of needs upon new services in the future development of telecommunications services,
- collection of relevant data and coordination of sectorial plans;
- elaboration of elements for Master Plan;
- preparation of legislation proposals;
- preparation of KRT sessions,
- execution of KRT decisions,
- implementation of priority investment plans, etc.

The Working Team should consist of at least four members (telecommunications profile, information technology profile, economic profile and research&development profile).

The commissions for the development of the telecommunications and information services exist in all countries of European Community for more than 10 years or even more than 20 years (France, United Kingdom).

8 Implementation plan

Short, medium and long term plans will be defined by Master Plan according to the governmental decision, which of the three possible scenarios (survival, natural or accelerated) should be selected for telecommunications development.

Authorized investor for priority plan of investments in 1993 should be PTT up to the liberalization of services and granting of concessions.

Priority investments for 1993 should not be deferred and dependent on the adoption of the Master Plan. However, it is necessary to start with the investments into telecommunications infrastructure *immediately*. This action would produce the following effects:

- accelerate the *development of Slovenia*,
- enable Slovenia to play the role of a *transit country* at the crossing between East and West and between North and South,
- provide the appropriate *technological basis* to achieve the objectives of MTIS.

Development role: It is well known that there is a proportion between the GNP level and the status of telecommunications development. The increased investment into telecommunications would then:

1. accelerate development in general,
2. relax the economic crisis, particularly in the telecommunication industry,
3. enable Slovene telecommunications industry to build at home the references needed for further potential export activities.

Transit role of Slovenia at the crossing between East and West, North and South: The layout of Slovenian 13 main switching centres and 4 international transit points (to Italy, Hungary, Austria and Croatia) enable the design of telecommunication network in the shape of cross. The telecommunication cross must be completed until the end of 1994; otherwise, Slovenia will

become an isolated telecommunications island in this part of Europe.

In the case that the number or the structure of the administrative centres in Slovenia will be changed, the connections to the new nodes will have to be taken into account.

Technological basis: The main national telecommunications network is rather underdeveloped compared to the regional and local public networks. The reasons are:

1. local self-imposed contributions that enable local and regional public network development;

2. regionally-organized PTT companies (till July 1993) that supported investments into local and regional networks and neglected investment into the backbone of national telecommunications network.

The underdevelopment of the main telecommunications links cause a high percentage of unsuccessful call set-ups. An accelerated digitalization and modernization of the communication backbone is the only reasonable way to be followed.

In addition, the investment into the **fibre optic** connections among the network nodes is economically reasonable, for it justifies and saves investment because of:

1. technological limitations of metallic cables;

2. high quality and reliable transmission through optical fibres, mostly in the case of realization of main connections in the shape of the rings in separated routes; this dictates high level of coordination and synergy consideration among PTT, Railways, Electricity and RTV in designing the network;

3. long life cycle of fibre optic cables;

4. the technological perspective for further development guarantees the leading role of fibre optic cables within the next 15 years and enables the enlargement of network capacity by replacing only terminal transmission or switching equipment;

5. the technological adequacy for the digitalization of main telecommunications network.

The investment must be made by strictly considering the unification principle and using solution with the best synergic modernization effect (with tight collaboration of PTT, Railways, Electricity and RTV), giving secure services (to satisfy the needs and strict requirements of Defence and Interior ministries).

The **Master Plan** must include as many operational plans as there are selected sectors. The operational plan summarizes the activities, the timing, the cost and the responsible body for every sector and niche, with the record of risks and advantages.

Production of Master Plan should go *step by step*; the Working Team must give higher priority to the largest and the most important sectors.

The **responsibility** of the members of KRT, Working Team and Governmental bodies represents the key parameter to make the Master Plan happen.

It is underlined that the leader of each sector must have the authority to request all the data from the institutions belonging to the sector of his competence, plans and elements that will enable him to produce the sectorial plan. A periodical reporting is produced by the leaders of every sector and submitted to the Working Team for the consolidation process.

9 Conclusion

The most efficient way to modernize the telecommunications infrastructure in Slovenia is achieved by integration of financial, technological and professional potentials. The final results of harmonious development would be technologically unified and transparent telecommunications network, better service quality, greater variety of services and lower cost of telecommunications services.

At the first stage of the modernization process the most important task is to establish a basic integration mechanisms which would lead to the preparation of the Master Plan, acceptable for service providers and for major actors in the field of telecommunications. The Master Plan must consider the most modern telecommunications techniques recognized in the world and enable high transmission capacities suitable for present and future wideband information or telecommu-

nications services. The main telecommunication transmission equipment must be based on fibre optics, which offer new possibilities for telecommunications network design.

Limited funds and short time available for development require a rational use of resources. Therefore, the forming of an inter-sectorial Commission for Development of Telecommunications KRT was proposed. KRT would provide the coordination of sectorial plans and preparation and realization of the Master Plan.

In MTIS we propose to the Slovenian Government to accept the accelerated scenario of the development of telecommunication infrastructure and services.

The process of evaluating and approving of the global modernization plan MTIS slowed down after general elections in December 1992, when new Government has been formed.

In the case that the modernization plan will be rejected or postponed, the telecommunications development will become unbalanced and without appropriate coordination. The negative effects will progressively be stronger and therefore more difficult to overcome. Besides that, the main international traffic flows will avoid Slovenia and will form an isolated island in the middle of Europe. Finally, the lack of information links will have negative effect on social and economic development, particularly on the national economy.

10 Appendix

Members of the Commission for Policy and Strategy of further Telecommunications Development:

President of the Commission: dr. Gorazd Kandus, Jožef Stefan Institute.

Commission members (in alphabetic order): mag. Cene Bavec, Ministry of Science and Technology, dr. Jure Beseničar, Ministry of Environment Protection, mr. Tomaž Banovec, Institute of Statistics, mr. Tine Brajnik, Ministry of Defence, mr. Bogo Brvar, Ministry of Internal Affairs, dr. Marko Jagodič, Iskra Tel and University of Ljubljana, mr. Ivica Kranjčevič, SP PTT, mr. Peter Mori, RTV Slovenia, dr. Branislav Popovič, Iskra Telekom, mr. Niko Schlamberger, Institute of (Public Administration) Informatics, mr. Stanko Starec, Slovene Railways, mr. Vladimir Šmit, Electricity, spec. Mitja Vavpotič, SP PTT, dr. Jože Vugrinec, Telecommunications Administration and mr. Miran Zrimec, SDK.

Secretary of the Commission: mag. Iztok Tvrdy, representing Ministry of Science and Technology.

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