The Computerized System of the Access through the Ordinary Stationary Phones to the Internet Web Based Application

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1 *Overview of the Georgian Telecommunication sector*

1.1 Comparative metrics of an existing condition in the telecommunication sector in Georgia

The comparative data for the Georgian telecommunication sector are given in the table 1.

|	Georgia	Low income countries	Europe	World
Fixed line telephony				
Main telephone lines (k), 2000	860			
Main telephone lines per 100 inhabitants, 2000	15,92	1.64	37,25	14,29
Mobile telephony/ Paging				
Mobile subscribers (k), 2000	97			
Mobile subscribers per 100 inhabitants, 2000	1,80	0,11	13,15	5,38
CAGR of mobile subscribers 1995-2000	296	116,6	63,4	52,1

Table 1: Georgian telecommunication sector

The market of communication services in Georgia includes the activity of 14 operators. Out of them 10 cover the market of fixed telephony, three are operators of cellular one, and one is a paging company.

1.2 Trends

The world is moving in the direction of mergers of separate networks into one uniform network of networks, therefore success of the future network economy depends on two infrastructure factors:

– Availability of network access;
– And, provision of low cost of access.
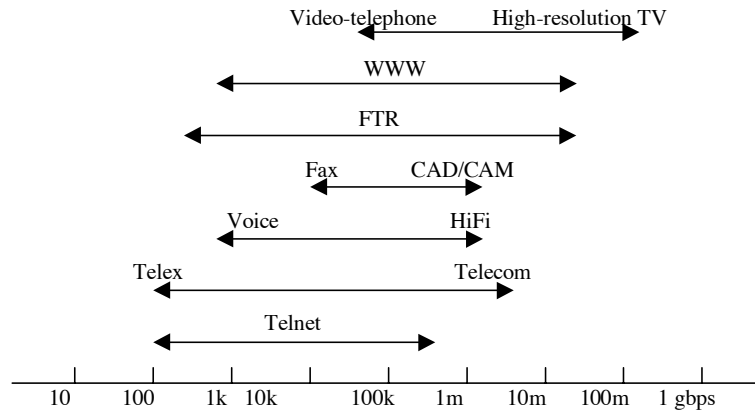
Figure 1: Indispensable capacity of channel

Picture 1 presents the ranges of indispensable capacity of channel for main types of telecommunication services.

Analysis of this diagram testifies, that, when the merger of functions of a TV set and computer happens, it will be required from trunk channels to provide capacities at a level of 0.1-10 gbps. Wide density of channels passing in each house should constitute 128 kbps. This will allow implementing of a video-telephony, digital television of high-resolution, access to centralized information services and many more.

Analysis of existing condition of country trunk channels displays, that presently there is no deficit of channel resources. Taking into consideration the fact that in the nearest future several more projects on creation of channels of trunk connection will be completed, we can conclude, that for some time there will be no deficit of trunk resources in Georgia.

This is not the case with subscriber component of the networks. Especially it concerns rural automatic telephone stations, which presently do not practically work. There are many reasons why many rural areas do not have connections, but main of them are absence of electric power and subscriber networks (which were earlier provided by aerial lines).

1.3   Needs

Telecommunication infrastructure is one of the most expensive ones, sluggish and conservative components of ICT. Therefore, revolutionary way of transition to perspective infrastructure is impossible. Development of telecommunication can only be evolutionary. This means that development of ICT infrastructure is possible only on the bases of the existing telecommunication infrastructure of the country.

Main directions of the Georgia telecommunication development are as follows:

- Substitution of obsolete automatic telephone stations on digital ones with electronic commutation;

– Construction in the cities and regional centers of overlapped digital networks, which should be integrated with existing networks, as well as with newly established;
– Broad usage of radio networks with utilization radio-modems including those used for solution of problems of the "first" or "last" mile;
– Broad utilization the GPRS standard in cellular transmission networks, which will ensure possibility of data transfer up to 128 kbps.

2 Overview of the Georgian Internet sector

2.1 Providers

The Georgian Internet sector (GeNet) is covered by 12 organizations stating about themselves as Internet service providers. More than 70% of all user connections are supplied by four providers (Table 2), where the doubtless leader is SANET (52%).

ISP	Market Share	Web-site
Sanet	52%	www.sanet.ge
Caucasus Network (ICN)	8%	www.caucasus.net
Iberiapac	4%	www.iberiapac.ge
Global-1	8%	www.global-erty.net
Kheta IT-Group	3%	www.kheta.ge
GeoNet	4%	www.geo.net.ge
TI-Service	4%	www.ti.net.ge
WaneX	4%	www.wanex.net
Georgia-Online	9%	www.rustavi2.com.ge
Multimedia-MMC		www.mmc.net.ge
Orioni	4%	www.orioni.com.ge
Basri-Net Ltd		www.basri.net

Table 2: Georgian ISPs

Majority of the providers offer asymmetric services, i.e. ensure traffic of not less than 512 kbps for outgoing streams, and up to 2 mbps for incoming ones.

Presently there are hubs in 22 cities of Georgia. However, Internet access is unequal: from 60% of the population of Georgia living in 10 regions 19% are Internet users, while in Tbilisi there are 81%.

Nowadays GeNet includes approximately 18-19 thousand individual dial-up connections and 300 ADSL. And their number is constantly increasing with the speed of about 500 dial-up and 10 ADSL connections per quarter of a year.

2.2 Information resources

The number of above-mentioned resources of the GeNet comprises about 2 thousand sites, and there is a tendency of increase in their number with average speed of 200 sites per quarter of a year.

Information resources of the GeNet are comprised of Web-sites, the content of which is prepared in English (66%), Georgian and English (22%), Georgian (8%), and remaining different combinations of the Georgian, English and Russian languages.

There are also some powerful sites, which are constantly being developed. The company SANET has the most complete directory of the GeNet.

The sampling analysis of the content of a part of the GeNet resources has shown, that is possible to describe the content in the following way:

– Business, trade, prices, companies, services – 42%;
– News-18%;
– Culture and education – 20%;
– Sports and entertainment – 14%;
– Others – 6%.

A number of organizations realize consolidation of existing and newly established resources and services in a form of horizontal or vertical portals. To such category refer the resources of GeDG, SANET, GeoNet, etc.

Currently projects are implemented, which offer users the resources and give tool for placement of their web pages. This makes it possible for any user not to resort to the help programmers in order to create his/her own sites.

This should ensure the growth of GeNet in "width", i.e. to lead to great number of small size sites.

Evaluating common idea about current ".ge" resources, it is possible to mention their highly sufficient art processing of each screen on the one hand, and availability of large number of sites containing old information, from the other one.

2.3   Joint characteristics

Currently there are less than 1% authorized users in Georgia. If we assume that through one authorized user 3-4 persons gain access to Internet, even in this case the number of users is insignificant small.

Spectrum of users (as evaluated by providers):

– People dealing with science world and ICT –35%;
– Principals, including government officials – 25%;
– Private persons –20%;
– Persons prominent in cultural affairs and art –10%;
– Students and studying youth –10%.

The estimated analysis of inquiries from GeNet to the world wide net shows that the greatest number of inquiries is directed to: 40% - USA, 25% - Georgia, 15% - Russia, 20% - the rest. Analysis of inquiries to GeNet: 50% - CIS, Russia, 20% - USA, 30% - the rest.

2.4   Analysis

While the existing expenditures, connected with obtaining Internet access for organizations and firms are acceptable, for majority of the country population average size of wages is 50 USD in a month, which is simply impossible. This explains such small composition of the users and rather insignificant rates of its quantitative growth.

Low level of solvency of the population of the country is one of the reasons, limiting network access. If we distract from problems connected with rise in living standards of the population, and to focus on solution of technological problems of Internet access, following will be possible to be considered:

– Problem of the first and last mile;
– A problem of why these networks are needed, i.e. problem of information resources of the Internet.

Under the conditions of difficult mountain contour, for solution of the first problem it is necessary to use radio, mobile and satellite communications more widely. Moreover that the expenditures for application of cordless technologies are closing up to the expenditures in traditional technologies.

During creation of web-resources and portals it is necessary to envisage such possibility, that access to them will be possible both through traditional Internet and the mobile telephony, as well as a TV set.

Currently existing business-model based exclusively on the incomes from banner advertising may be considered not effective. Because on average only 2% of the visitors of a site "click" on advertising banners (in the USA this figure constitutes 0,38%). Therefore, it is necessary to develop new technologies, directed not to the mass market, but on individual user. This can be promoted by development of services personalization, as organizational concepts of a site. The idea is that the more information is left by a visitor about himself in the site (as personal customizations, own web pages, protected by keyword, etc.), the more difficult it will be to him to leave to other resources.

Apparently with the growth of the Internet, special measures for fixing advertising will be more and more effective. Such tools can be quizzes with prizes, competitions, and detailed schedules of interesting measures. It is certainly more expensive than simple advertising, but the effect is also different.

It is known that more than 80% of information resources of the Internet are in English. The fact that a person does not speak the English language (about 3% of the population of the country knows the language) deprives his of an access to huge data. There are no presently known any program, which makes translations from English to Georgian. There is also no electronic version of the English-Georgian dictionary.

Navigation on the Georgian resources of the Internet requires creation of the modern search engines. Some attempts on creation of such a search engine were undertaken by the Sanet group, however, there are no positive results yet.

Effective tools for attraction of visitors remain traditional media channels and usage of the references with the help of different search engines and rating systems.

Development of Internet access from mobile telephones is one of effective ways of extension of an audience. As the statistics displays, the amount of cordless Internet users increases by 8 million people monthly, and the majority of them lives in the developing countries.

2.5 Need

The Georgian Internet sector should be shaped as to satisfy interest of each person in the country in usage of information as resource for public and individual development.

For this purpose it is necessary:

– To promote rise of investment attractiveness of the Internet projects;
– To develop new business-models for supporting self-repayment of the Internet projects;
– To exploit mobile Internet, with usage of WAP and GPRS technologies;
– To develop technologies of guaranteed security, including technology of users identification;
– To create modern search engines for the Georgian Internet sector;
– To implement projects on creation of the software systems of translation to and from the Georgian language, including creation of electronic dictionaries.

According to the data of researches, which we conducted earlier, presently there are about 150 thousand computers in Georgia. Out of them about 60% is Pentium; 30% - Pentium II and higher; 8% such as IBM 486 and 386.

Currently the country is beginning to actively adopt new technologies. According to the local statistical data, there are approximately 2000 new computers sold monthly in Georgia. The following chart demonstrates the level of computerization among regions:

1. Tbilisi
2. Imereti
3. Ajara
4. Kakheti
5. The rest
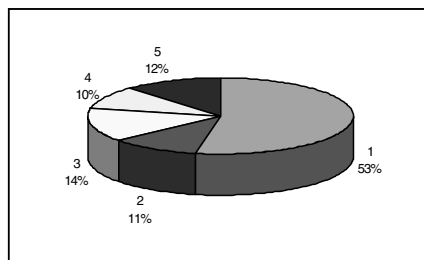
2.6 Internet availability

Computer and Internet penetration is quite low in Georgia, but the local populace, together with the government and private sector understand that the country is competing with the rest of the world to create jobs and gain inward investment. Georgia needs to consider developing policies to encourage knowledge workers to its cities and regions. Organizations and communities, which recognize and value their information resources, should be able

to create employment. Those, which make their information available electronically, will create these opportunities.

The market for online services and data communications in Georgia is still in its infancy: in 1999, approximately 6,000 subscribers accessed Internet in dial-up mode. A relatively small percentage of the public in Georgia has an access to Internet. Today the number of regular users having access to Internet is approximately 100,000 people in Georgia, i.e. about 2% of population. Only 0,2% of them (or about 10 000 people) are home-users of Internet.

Currently in Georgia there are approximately 20 000 individual dial-up accounts and over 300 ADSL (dedicated lines). The number of dial up accounts has reached its growth peak in 1997, but due to an economic hardships the number of Internet subscribers has been gradually decreasing until 2000 year's upraise. The following chart demonstrates an individual dial-up account subscription pattern:
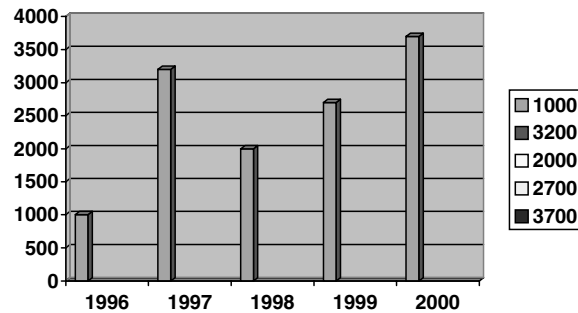

The Internet is gradually becoming an important instrument of choice for the Government of Georgia as the country moves from a rigid centrally planned economy to a free market economy. Between 1995 when the first 64 Kpbs leased line was opened and the end of 1996, only some 900 computers were connected to the Internet and web sites numbered 7. Some of the very first web sites were designed by the 1st Internet Service Provider (ISP) in Georgia – Sanet and by the Parliament of Georgia. Total bandwidth of the leased international connections has been increased to 2 Mbps.

Distribution of Internet access, however, remains unsatisfactory with the 10 regions with 60 percent of the nation's population accounting for only 29 percent of users, whereas the capital – Tbilisi (40 percent of the population) - accounts for 71 percent of overall use of Internet. The following graph illustrates the modem pool distribution in Georgia.

Internet access
1. Tbilisi
2. Imereti
3. Ajara
4. Kakheti
5. The rest
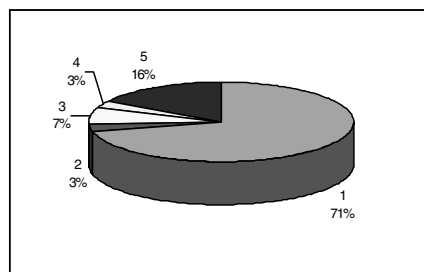
2.7   Internet affordability.

Tight competition has also affected pricing structure for Internet connection in Georgia. The prices of Internet access varies between $0.30 per hour ($0.20 per hour at night) and $1.30 per hour for dial-up access. Price for the leased lines (unlimited access), ranges from $99/month for asynchronous lines to $1,400/month for synchronous lines. Phone calls are charged as a local call except when an ISP has no node in a particular city where customer wants to connect to the Internet. Currently, the nodes are in 22 cities and towns of Georgia (but not all of them provide Internet access, some provide access to public data network only), though the highest payment capacity is still observed in the capital and large cities:

Payment Capacity
1. Tbilisi
2. Imereti
3. Ajara
4. Kakheti
5. The rest
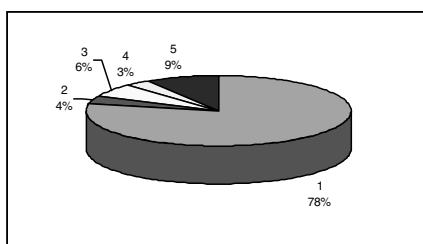
According to sociological assessments, approximately 65% of population is aware of the Internet:

As of early 2001, more than 100,000-120,000 people have used the Internet. This is 1.85-2.2% of the population. The number of recent computer users has considerably increased and is estimated to be about 200,000-250,000 that makes 3.5-4.5% of population. Still there is a growing tendency in the number of Internet users.

3   Internet access through the ordinary phones by speech interface – alternative IT

The analyses of these data show, that the satisfaction of the information needs of the society is at very low level, and the process of the formation of the information society requires new information technologies, on the basis of the available IC infrastructure. For this purpose the most rational seems to be an information infrastructure on the base of the ordinary phones, with an access to Internet, and with the speech interface "client-server-client". The general scheme of this technology can be presented as follows (pic. 2):

The advantages of this technology:

– Simplicity of the hardware;
– Easy familiarization with the system interaction by the user;
– Easy usage of the system by the user;
– Cheap enough implementation of the system, as well as of its functioning;
– Convenience of the usage of system for the user;
– Special efficiency for the very long distance system "client-server";
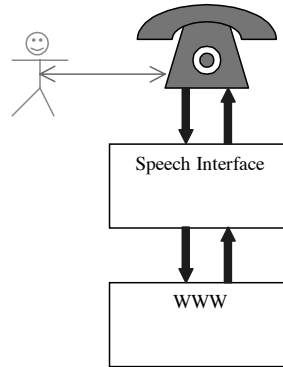
**Figure 2:** General scheme of the technology "client-server" with the speech interface

  – Possibility of the access at the same time from the computers and from the telephones.

The disadvantages of the technology:

  – The necessity of the limitation of the functional possibilities of the system;
  – The complexity of the construction of the component: "the speech interface";
  – The necessity of the creation of the specialized web-sites, supporting the speech interface;
  – The complexity of the creation of the web-editors for the web-sites, supporting the speech interface;
  – relative "slowness" of the functioning.

3.1   The Structure of the Speech Interface

The general structure of the speech interface is presented on the picture 3.
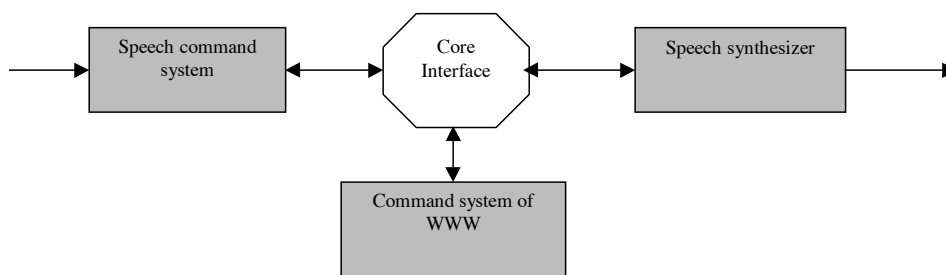
Figure 3: The general structure of the speech interface

The speech command system is intended for the reception of the speech command from the user and contains the limited subset of the colloquial speech, such as: "search",

"read", "write", change", execute", "cancel", "continue", "return", "enter", "yes", "no", "stop", "command", "copy", "delete", "move", "paste", "start", "finish", "key", etc.
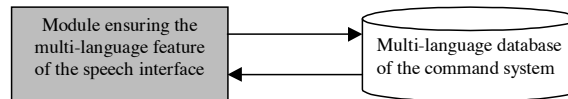
The speech synthesizer is intended for the speech communication with the user and is generating a speech on the basis of the information, provided to the user.

The command system of WWW is intended for the interaction with a web application and contains the set of commands, by means of which the navigation is performed in a web application, also for the reception of information, provided by the web application.

The core of interface is performing the coordination of the work of the other components of the interface and their interaction. When receiving a command from the user, the core is ensuring the functioning of the chain "the speech command system" - "command system of www", and when receiving the information from a web application – it ensures the functioning of the chain "command system of www"- "speech synthesizer".

### 3.2   The multi-language feature of the speech interface

The multi-language feature of the speech interface is one of the important features. This feature, along with other parameters of the interface, should be customisable by the user. It is necessary to ensure the availability at least of 2 languages – national (Georgian – in our case), and English. The structure of multi-language subsystem is shown below (pic. 4):

Figure 4: The structure of the multi-language feature of the speech interface

3.3   The structure of the web application, intended for the work with the speech interface

The structure of web application (block WWW on the picture 2) can be presented by this way (pic. 5):
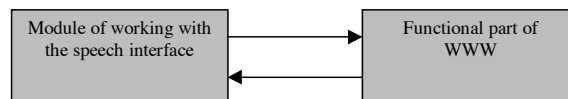
Figure 5: The structure of the web application working with the speech interface

The module for the working with the speech interface is performing the reception of the commands and data from the speech interface, and transfers back, in its turn, the informa-

tion, provided to the user. The exchange of information is done through the component "command system of WWW". The most relevant for the functional part of the web application seems to be the following functions:

– Working with the databases;
– Realization of the speech electronic mail with the conversion into the digital form and vis versa;
– Realization of the speech chats and mixed (phone and computer) chats.

By means of such system it is rational to build the information systems and ecommerce sites, to organize the registration of users, the input of the simple forms, the search of the records in the databases, matching simple search criteria, the online input of simple orders etc.

3.4   Web-editors for the speech web applications

Web-editors should ensure automatic generation of the web application module which works with the speech interface, as well as of all necessary features of the web application, including the interactivity features, and features of working inside WWW.

3.5   The multi-language feature of the web applications

Naturally, for the functional integrity of the system it is necessary to support the multi-language feature of the web-applications. We would consider 2 principal ways for the resolution of this task:

1. To ensure the representation of the information content of the web application in different languages;
2. To store the information on the web only in one language (for example, in national language) and, when required, to ensure the translation in other languages by means of the software tools of translation.

First method is better in view of adequacy of the same information, represented in different languages. But its shortcomings is the necessity to duplicate the same information in different languages, that is reducing the efficiency of utilization of the peripheral memory, and also makes more laborious the process of the preparation and the input of the information in web.

Second method is free of the shortcomings of the first one, however the necessity of the usage of the auxiliary automatic tools of translation makes important the question of adequacy of translation of the information in other languages.

The structure of the multi-language feature of the web applications is shown below (pic.6):

3.6   System of the automatic translation of the information content of the web applications with the speech interface

This issue is of general character, not specific for the case of the web with the speech interface. However, in the case of the limitation of the possibilities of the information
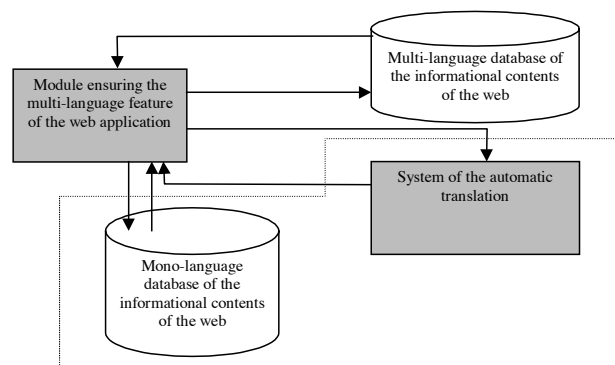
Figure 6: The structure of the multi-language feature of the web applications supporting speech interface

perception in the multimedia form by the person (when visual form is unavailable) the automatic translation of the information is more important. We suppose that in our case for the improvement of the machine translation the system of the automatic translation should possess general and specialized dictionaries in different sectors: economy, politic, healthcare etc. They should include also the expert system and a knowledge base and a meta-knowledge base in the field of translation. The structure of this subsystem is shown below (pic. 7):
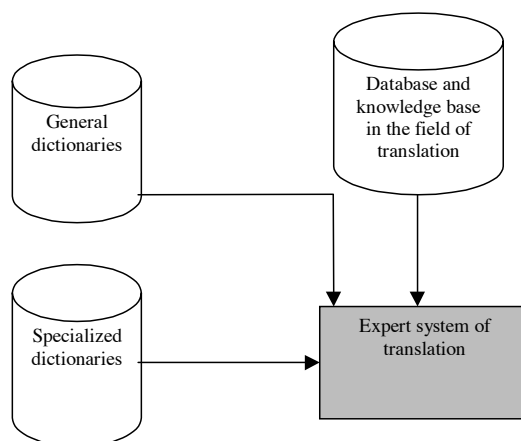
Figure 7: Structure of the automatic translation system of the speech interface web applications' information content

In the framework of such system the important issues to be addressed are the security of transactions and usage of digital signature with the speech interface web applications.

The described technology is only a general conception. Its concrete form of realization depends on selected means and platform of information technology. It should be examined in the light of available IC infrastructure of country.