

Boris ARSOV PhD

Agency for electronic
communication of Macedonia

boris.arsov@aec.mk

mob. 070/383819

BROADBAND INTERNET MARKET ANALYSIS IN MACEDONIA

Abstract

Broadband provides the creation and use of new better media content, applications, new innovative services adaptable for different platforms, available for everyone regardless of location or time and personalized according to the end user, according to the priorities or needs. Broadband enables the reorganization of the production and work processes in both the business sector and the administration, and the development of the networked economy and for the transition to knowledge-based societies.

Today, broadband is defined on the basis of a number of parameters that can be offered through existing electronic communications

networks (fixed or mobile networks) and the construction of some next generation of advanced electronic communications networks. This is extremely important for the quality of the received service, because with the existence of the quality of the electronic communication networks, you can have a good, quality and fast data transfer to the end users, and that the thing what actually they want it.

Keywords: broadband; telecommunication infrastructure, Operator of public electronic communication networks and services; access; optical cable; regulation; end users; network coverage.

Introduction

Broadband Internet access or just broadband Internet is a common and usual name for the way how the Internet is connected, which allows high speed of data transmission.

The technologies that are common among the private residential users, the cable modem and the asymmetric digital subscriber line, the so-called ADSL line, as well as the symmetrical digital subscriber line, the so-called SDSL line, allow speeds bigger than 144 kbit / s, which is usually considered as the lower limit of the data

transfer speeds, so that the access can be considered as broadband.

Legal entities as users have the opportunity to the internet access through the other leased lines, which are managed with different technologies, digital subscriber lines, so called. DSL lines and optical lines.

Nowdays, broadband is defined on the basis of the number of parameters that can be offered through existing electronic communications networks (fixed or mobile networks) and the construction of the some

next generation of advanced electronic communications networks. This is extremely important for the quality of the received service, because with the existence of a quality electronic communication network, good, quality and fast data transfer is obtained, to the users, and some of them actually want it.

It is very important to know that after processing the submitted data and information of the operators for existing and planned investments in the construction of electronic communications networks for providing the Internet access at speeds

1. Digital subscriber line

The digital subscriber line is better known as the classic broadband internet access, which is managed through a telephone line with placed pairs of copper wires, and it actually includes many technologies that stand out with their characteristics, such as data flow speed, range and the application. The following is a brief overview of the various examples:

ADSL / ADSL2 / ADSL2 plus (ADSL, ITU-T G.992.1 / 3/5). ADSL is most commonly used by all DSL technologies and has the ability to download data, with a capacity of up to 20 Mb / s and a maximum ability to send data, with a capacity of 1 Mb / s to 3 Mb / s. This ratio between data download and data transmission of 10: 1 is ideal for IPTV - Internet Protocol Television (IPTV) services with high data download speed and high speed Internet, which allows watching TV over the Internet.

Telephone traffic via IP - Internet Protocol, which requires 120 kb / s, can simultaneously run smoothly through the ADSL link. ADSL lines can be set at distances up to 5 km and can be operated from one control center.

bigger than 30 Mbps (so-called next generation access networks) for the period For the next three years 2019-2021, the Agency for Electronic Communications has prepared maps of coverage of operators and state-owned companies that have electronic communication networks.

On the AEK website, all customers have the opportunity to be informed about high-speed internet access with speeds from 30 Mbps to 100 Mbps and access to super-fast internet with access speeds bigger than 100 Mbps in a certain geographical location in the country.

At SHDSL / SHDSL.bis - Symmetrical High Speed Internet Line, ITU-T G.991.2, the capacities for sending and downloading SHDSL data, are equal. Maximum speed is up to 2.3 Mb / s on a cable length and up to 5 km, which can be increased by using a regenerator. An improved version of the SHDSL standard, ie the SHDSL.bis standard, enables speeds of up to 5.7 Mb / s for sending and downloading data. Gedaring of several lines can increase the speed to $N \times 5.7$ Mb / s. So the data transfer and download speeds are the same, SHDSL / SHDSL.bis are the best suited for business applications (with network devices) and the mobile applications between the lines.

With speeds of up to 100 Mb / s in both directions, VDSL2 - High Speed Internet, ITU-T G.993.2, is the right solution for the modern applications that require the high bandwidth. This type of DSL is used to transmit multiple high definition TV channels, fast internet access and VoIP. The disadvantage is that in order to achieve a speed of 50 Mb / s, copper cables, that are used, should be at a distance of no longer than 500 m, which is less than the average length used in the most countries in the world. Figure 1

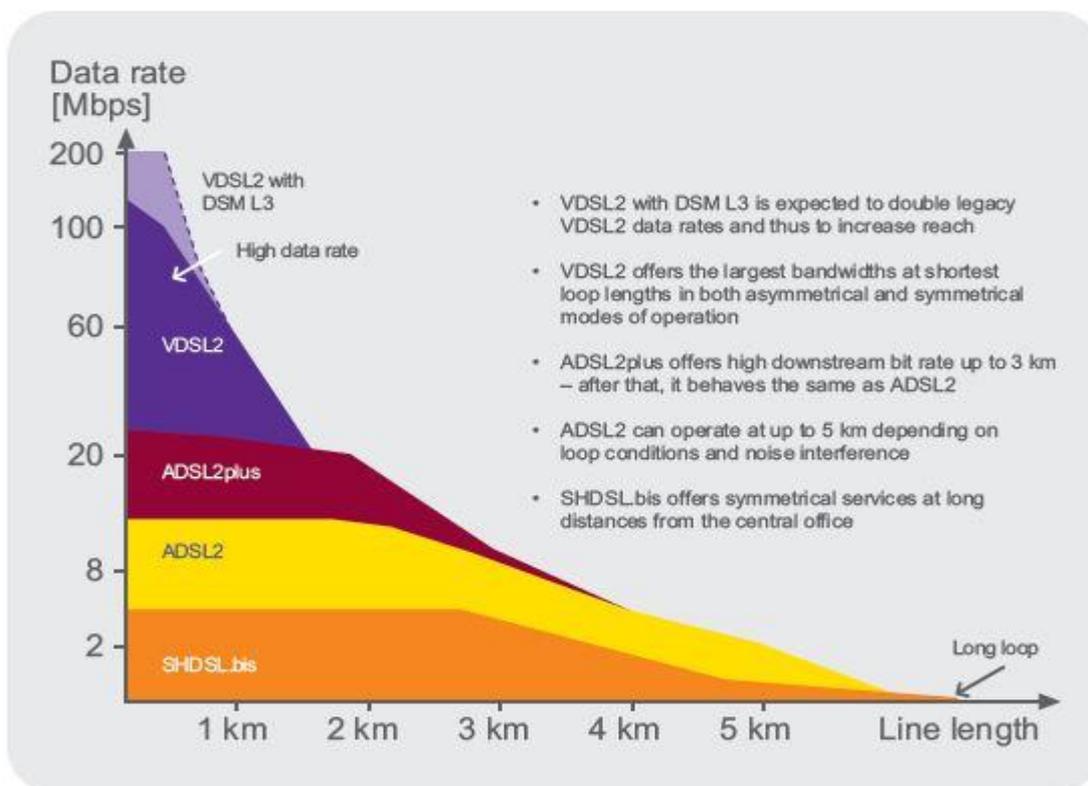


Figure 1:
Data download speeds with different DSL technologies

This ability, bringing to the subscribers a very fast symmetrical Internet, provides a real multi-purpose service, networking applications, such as video sharing and other services in the virtual Internet environment. In this case it is a great opportunity to make quite good earnings by the Operators of electronic communications networks and services.

Although the VDSL2 standard was approved in 2005, there is still so much a work to be done for abgrade of this technology. Efforts are actually being made to improve interference resistance and

can come up with a suitable opportunity to offer telephone traffic such as VoIP via DSL.

reduce signal interference or other types of voice, for the speed to be increased. This is called: Dynamic Third Level Spectrum Management (DSM L3).

DSL is a technology chosen by the Operators who could use a telephone electronic communications installation again. ADSL / VDSL use a spectrum that is above POTS / ISDN, so that the telephone traffic runs smoothly. On the other hand ADSL / VDSL can work without the basic POTS / ISDN with the separation service. So the competing of the local operators

2. Using the fiber optic cables for the broadband

The usage of the fiber optic cables instead of the copper, several times

increases the speed and the range of the Internet. The optical cable can be used for

the network devices from the central switch or from the optical junction box to the subscriber or to the DSLAM. So, several

subscribers can share the cable with the passive optical networks.

3. The Broadband Internet Access and Its Importance

The Digital data transmission has an increasing role in the lives of citizens and in the operation of public institutions and companies. The great availability and speed of the Internet, which enables the broadband Internet access, are key to helping the companies in Europe to maintain their competitiveness in the global society. For example:

- Increasing the number of broadband connections in certain countries by 10% would lead to the increasing in GDP per capita by 1% per year;
- Increasing the number of broadband connections by 10% could lead to a 1.5% increasing in labor productivity over the next five years.
- Investments in broadband internet access will contribute to the providing of quality education, improving the social inclusion of the people, and will also provide a benefit in the rural and remote regions.
- Some experts believe that the broadband internet access is so important that it could be placed in the category of the basic utilities, along with communal hygiene, electricity, heat energy.

So, "Broadband" in the context of Internet access has no special technical significance, but is used to describe any infrastructure for the high-speed Internet access that is always available and fast compared to the traditional telephone line access. There are three categories of data download speeds:

- "Basic access" with speeds from 144 Kbps to 30 Mbps;
- "Fast access" with speeds from 30 Mbps to 100 Mbps;
- "Ultrafast access" with speeds faster than 100 Mbps;

Broadband access network is generally consists of three parts: basic network or core network, aggregate network and access network.

For estimating the internet speed, it is important to make a distinguish between data download speeds and data loading speeds, the data download speed and data upload speed.

Data download speed means the speed of receiving data from a remote level, for example when searching something on the Internet or transferring video content, while data loading speed means the speed of sending data at a remote level, for example when someone is having a video conference call.

Some other technical features are increasingly important for the provision of certain services (such as video conference call, complex cloud computing operations, networked driving and e-health).

The current use of infrastructure networks define the upper limit of the speed of using the Internet. There are five types of infrastructure for providing broadband access services: fiber optics, coaxial cables, copper telephone lines, terrestrial wireless equipment (antenna stations / poles) and satellites. Rapid technological development makes available a growing number of the other technologies that can be used to

provide high-speed broadband Internet access services.

However, the actual speed in real situation, which would be available to the

4. Fiber to the Home (FTTH)

In the FTTH infrastructure, the optic cables are placed all the way to the end user's premises. With current technology, it allows download speeds of 70 Mbits (downstream) or higher and in the long run, almost unlimited bandwidth (given the technological advances in optical equipment). This infrastructure offers a number of the configurations, including symmetrical broadband and guaranteed high bandwidth.

From a technological point of view, there are two ways for implementation of this type of infrastructure: point-to-point optics, with optical cable for each end user, and point-to-multipoint optics, where several end users share the same optical cable.

In the case of fiber optic connection from point to point, each end user is assigned an optical fiber and the end user has access to the full two-way band to the

customers, depends on the service provider and the technical upgrades and capacities of the network itself and its components.

optical distribution frame, ie to the optical line terminal. The fiber optic length can be up to 80 km and in the long run this architecture is considered to be the most flexible.

In the case of point-to-multipoint optic connection, one fiber optic connects the optical line terminal to the passive optical splitters, which can be underground or in a small street cabinet, and then from the optical splitters each end user is connected to the special optical fibers. Currently, the capacity of such connection is 64 end users at one optical fiber at a distance of up to 20 km.

The advantage of the point-to-point optic connection is that it allows virtually unlimited bandwidth for each end user, while PON currently allows 100 Mbits / s to be shared among the end users (assumed to reach 2 Gbits / s in the future with the new technologies.

5. The Project "fast speed Internet 2020"

The goals of the Digital Agenda 2020 of the European Union envisage that by 2020 all citizens of Europe will have access to the Internet with speeds of 30 Mbps or higher, while 50% of the population in Europe will have access to the Internet with speeds of 100 Mbps or more .

For that purpose, the operators in Macedonia should migrate their network to networks that are completely or partially based on optic fiber in order to be able to support higher data transfer speeds. According that, Macedonia will follow the

European trends and will introduce similar obligations for the operators in Macedonia.

The deadlines for realization are:

- December 2016 - at least 30% of the households will be able to access to the Internet with speed of 30 Mbps and at least 15% of the households will be able to access to the Internet with speed of 100 Mbps;
- December 2018 - at least 60% of the households will be able to access to the Internet with speed of 30 Mbps and at least 30% of the households

will be able to access to the Internet with speed of 100 Mbps;

- December 2020 - 100% of the households will be able to access to the Internet with speed of 30 Mbps and at least 50% of the households will be able to access to the Internet with speed of 100 Mbps.

Every internet user in Macedonia, whether is located in urban or rural areas, will have an internet with a speed not less than 30 Mbps, until 2020. Agency for electronic communication in 2011 adopted the Rulebook on the manner of construction of public electronic communications networks and associated facilities, which aims to protect the working and environment area, as well as human health and safety, to encourage the promotion, development and investment in public communications by new networks generation.

The same Rulebook was amended in 2014 and last changing was in September 2016.

The Rulebook says that until 2020 all internet users in Macedonia should have internet access with speed of over 30 Mb / s and 50% of the subscribers should have internet access with speed of over 100 Mb / s. It envisages the migration of users to high-speed networks in stages. Currently, in Macedonia, according to the data submitted by the operators, in the fourth quarter of 2018 there are:

- Internet access with speeds > 30 Mbps - users 552,327 and
- Internet access > 100 Mbps - users 147,241.

It also provides a map of coverage and internet speeds, for each settlement in Macedonia, by supplementing the WEB GIS project Application for submission of data for a newly built electronic communication network and associated

means. With this activity, the regulator (AEC) and potential investors will have a clear picture of the actual situation in this market and the actual utilization of this service by the users.

In that way, the competition between the providers of this service can be increased. Citizens and tourists visiting the country will have the opportunity to see what the Internet access opportunities are at each place they are planning to visit.

The current penetration of high speed internet through optical networks is very good. Therefore, together with the operators of electronic communications services, a several measures and improvements in the regulation proceses are being worked on, so that will encourage larger investments in the construction of networks for providing high-speed transmission and migration of Internet users to these networks. This achieves the digital agenda of the European Commission, ie what is today considered super fast internet, and in 2020 will be the standard.

Next generation access networks are wholly or partly based on optic fiber. In case the operator develops the next generation of access networks, then the optic fiber extends from the operator to the home of the end user. In case the next generation access networks are partly based on optic fiber, then they are built partly on optic fiber and partly on coaxial cable or copper coin (such are cable networks primarily installed for transmission of TV signals or HFC - Hybrid Fiber Coaxial DOCSIS 3.0 or FTTC / FTTB, using VDSL access technology).

The new generations of networks enable the monitoring of multiple high-definition video streams (HDTV), interactive video games, fast internet browsing, high-speed multimedia content monitoring, as well as better quality parameters, such as shorter

network propagation time which are very important for real-time applications (usually speech or video conferencing over the Internet).

Particularly significant benefit of these networks is that they offer symmetrical inbound and outbound internet access. This means that the transfer of files from the local terminal equipment (computer, smartphone, tablet, etc.) to an Internet server will be done much faster. So, the downloading a standard of 700 MB movie via a traditional 6 Mbps internet connection, takes approximately 15 minutes, and in the case of a next generation access networks with 100 Mbps internet connection it will take less than 1 minute.

In a case of uploading documents or multimedia content, the difference in the speed is even more drastic, because the speed currently used by xDSL and cable internet users reaches only 1 Mbps and is incomparable to the speed they will get with the next generation networks. Installing the next generation of access networks requires high investment by the operators, but the operating costs for these networks are much lower than traditional networks.

In order to reduce the costs of the installation of the next generation networks, AЕК is committed to joint cooperation between all operators, cooperation with other institutions and public-private partnership, through which the state should support the construction of these networks.

6. National Broadband Goals and Deadlines

Having on mind the broadband internet goals and deadlines of the EU, the performed mapping, as well as the future announced investments of the operators in the next three years, the national broadband access targets for Macedonia are the following:

- At least one city will be covered by 5G signal, by the end of 2023,
- The main corridors in accordance with the Agreement for establishing a transport community on the basic and comprehensive road network in the country to be covered with uninterrupted 5G signal, by the end of 2025,
- All cities in the country to be covered with uninterrupted 5G signal, by the end of 2027,
- Everyone should be able to have an access to the Internet via 5G with a minimum internet access speed of at least 100 Mbps, by the end of 2029,
- At least 50% of the total number of subscriber agreements of households in the whole country, to be for internet access of at least 100 Mbps, by the end of 2029,
- All households with affordable price to have access to a network that provides download speeds of at least 100 Mbps with the ability to upgrade to gigabit speed, by the end of 2029,
- All public institutions (schools, universities, research centers and other educational institutions, health institutions, ministries, courts, local governments and other state bodies) should have symmetrical Internet access with speed of at least 1 Gbps, by the end of 2029,

Conclusion

The Broadband enables the creation of new and innovative services, applications and content, promotes the development of new services and improves the quality of their delivery to customers. Enables reorganization of work and production processes and is the basis for the development of information and communication technologies, which are the main carriers of productivity and economic growth in the country. It can be concluded that the development of new types of services provided by broadband internet

requires a rapid transition from copper infrastructure to new generations of very fast access networks (for example optic fiber to each user). Unlike the time when the existing copper infrastructure was set up and when the state telecommunications monopolies had a guaranteed number of users, ie guaranteed demand, today the situation has changed significantly - there are many operators in the market and there is a risk in investing in new networks due to uncertainty. user base.

Literature:

1. L. Holt, M. Jamison, Broadband and contributions to economic growth: lessons from the US experience, publikacija Telecommunications Policy, sv. 33, str. 575–581; Global Industry Leaders' Forum, Broadband enabled innovation, ITU, 2011.
2. M-Lab , Open Technology Institute, Google Open Source Research, PlanetLab with the Colledge of Princeton New Jercey;
3. The State of Broadband, Broadband Commission for Sustainable Development, ITU i UNESCO, јули 2019;
4. Arsov, B., Trajchevski, Z., Spalevic, Z., *The Internet services on the telecommunication market in the Republic of Macedonia over Leasted Lines*, S15 - The Use of the Internet and Development Perspectives (17:00 - 19:00 h), Room 047, Sinteza 2014 Conference Programme 25.04.2014. Singidunum University Beograd (R.Serbia);
5. Arsov, B., Trajkovski, V., Sherifi, V., Development and Improvement of the quality of the Mobile services at the mobile market in Macedonia, Book of abstract from the 6th International Conference on Business and Innovation 2017 – Durres Albania (page 28), UBT Prishtina Kosovo 2017;
6. Arsov, B., Aleksov, Z., WEB GIS System for electronic data delivery for newly constructed electronic communications networks, Conference ETAI, Struga 2018, R.Macedonia;
7. Arsov, B., Aleksov, Z., Applied Internet speed measurement system for fixed networks, Conference ETAI, Struga 2018, R.Macedonia;