REPUBLIC OF SERBIA
RATEL
REGULATORY AGENCY FOR ELECTRONIC COMMUNICATIONS AND POSTAL SERVICES

AN OVERVIEW OF THE

TELECOM AND POSTAL SERVICES

MARKET IN THE REPUBLIC OF SERBIA IN **2017**

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Belgrade, 2018

Title:
An Overview of the Telecom and
Postal Services Market in the
Republic of Serbia in 2017

Publisher:
Regulatory Agency for Electronic Communications
and Postal Services - RATEL
Palmotićeva 2, Belgrade
www.ratel.rs

Design and production:
EPOHA d.o.o.
Bakionica BB, Požega

Printed by:
Grafik centar
Kružni put 26, Belgrade

Circulation:
500 copies

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SUMMARY

A WORD OF INTRODUCTION

The share of revenues made from electronic communications in the Serbian GDP in 2017 was 4.3%, amounting to 191.2 billion dinars. The same as in the previous years, mobile service provision accounts for the largest share of total revenues made from electronic communications, which equals 58.5%.

The investments in the electronic communications sector increased as well. In 2017 they grew by 1.6%, amounting to 32.8 billion dinars. The biggest investments were made in mobile (13.5 billion dinars) and fixed networks (8 billion dinars).

The number of mobile users remains to be higher than the population, with 122 mobile users per 100 inhabitants. The number of fixed-line subscribes continues to drop in 2017.

The growing trend in the fixed broadband take-up continued, as the number of subscribers increased by 2% in respects to 2016.

The Internet was mainly used for online newspaper and magazine reading, searching for information on goods and services and social networks.

The growing usage of cell phones for broadband access resulted in the constant increase in the number of mobile Internet users. The volume of data transmission via UMTS and LTE (using a cell phone or modem) doubled in respect to the previous year, amounting to 97 million GB in 2017.

The number of media content distribution subscribers also increased, by 2.4% compared to the previous year, mainly due to higher number of cable distribution system subscribers.

In 2017, the volume of postal services increased by 4% and the revenues made amount to nearly 18 billion dinars or over 152 million euros. Although universal postal service, with more than 90.4% share, is dominant in the total volume of postal services provided, the revenues made from UPS are lower than those made from commercial services. In particular, revenues made from UPS grew by 3.5%, whereas revenues made from commercial services are constantly growing, the current increase rate being over 11%.

The adoption of the Law on Information Security was the first step toward ensuring that operators of essential services take adequate technical and operational measures necessary for risk management, so as to protect network and information systems necessary for their regular operation. Under this law, RATEL is in charge of the tasks performed by the National centre for Prevention of Safety Risks in ICT Systems (National CERT).

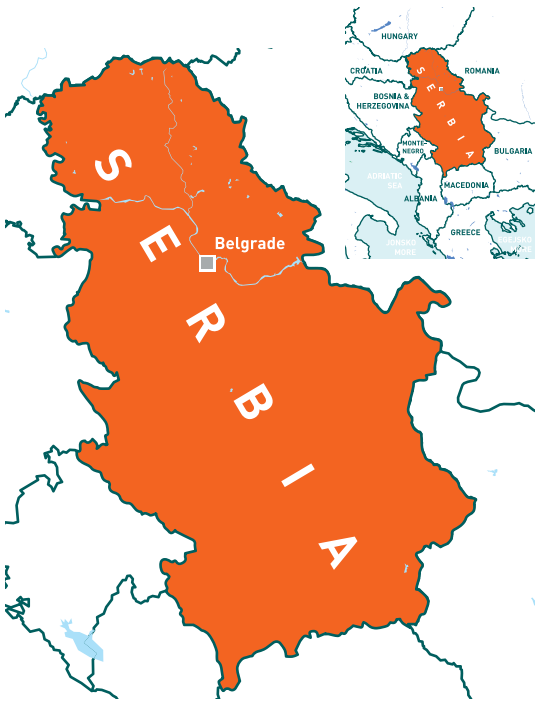
Director

Dr Vladica Tintor

01 BASIC FEATURES OF TELECOMMUNICATIONS MARKET IN THE REPUBLIC OF SERBIA

The data used for the overview of telecom market in the Republic of Serbia have been obtained based on the questionnaires provided by the telecom market participants, and they mainly refer to the territory of the Republic of Serbia without Kosovo and Metohija since this area is under the control of the United Nations, pursuant to the Security Council Resolution 1244, temporary regulating, inter alia, the authority of the international civilian mission in the territory of AP Kosovo and Metohija.

Figure 1. Republic of Serbia – Basic Facts

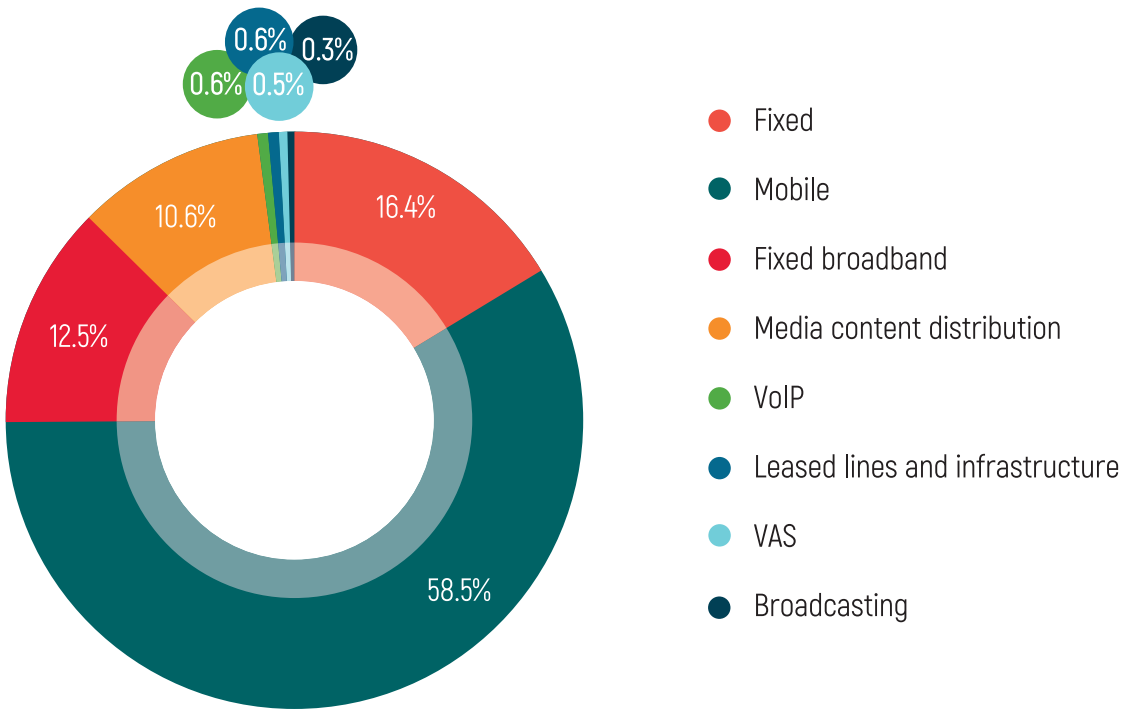


Basic data	
Name	Republic of Serbia
Capital	Belgrade
Area	88,499km^2
Population (without AP Kosovo and Metohija). estimated by the Statistics Office[1]	7,040,272
Country code:	+381
Internet domain:	.rs
GDP in 2017[1]	4,464.6 billion dinars (36.8 billion euros)
Average net income in 2017[3]	47,893 dinars (394.7 euros)

1 Statistical Office estimation for 1.1.2017.
2 Statistical Office estimation for 28.2.2017. (the average RDS/EUR exchange rate for 2017 was 121.3367).
3 Statistical Office data.

The total revenues made in the electronic communications market of the Republic of Serbia in 2017 amounted to approximately 191.2 billion dinars, which is slightly more (ca. 1%) compared with the previous year. According to the annual average middle exchange rate, the total revenues amounted to 1.58 billion euros (3% growth rate). The difference in the growth rate seen in dinars and euros is due to the difference in the average middle exchange rate between 2016 and 2017. The share of revenues from electronic communications in the Serbian GDP was around 4.3% in 2017. In terms of market share accounted for by different services in the Serbian electronic communication market in 2016, same as in the previous years, the largest share went to mobile service provision, accounting for 58.5% of the total revenues.

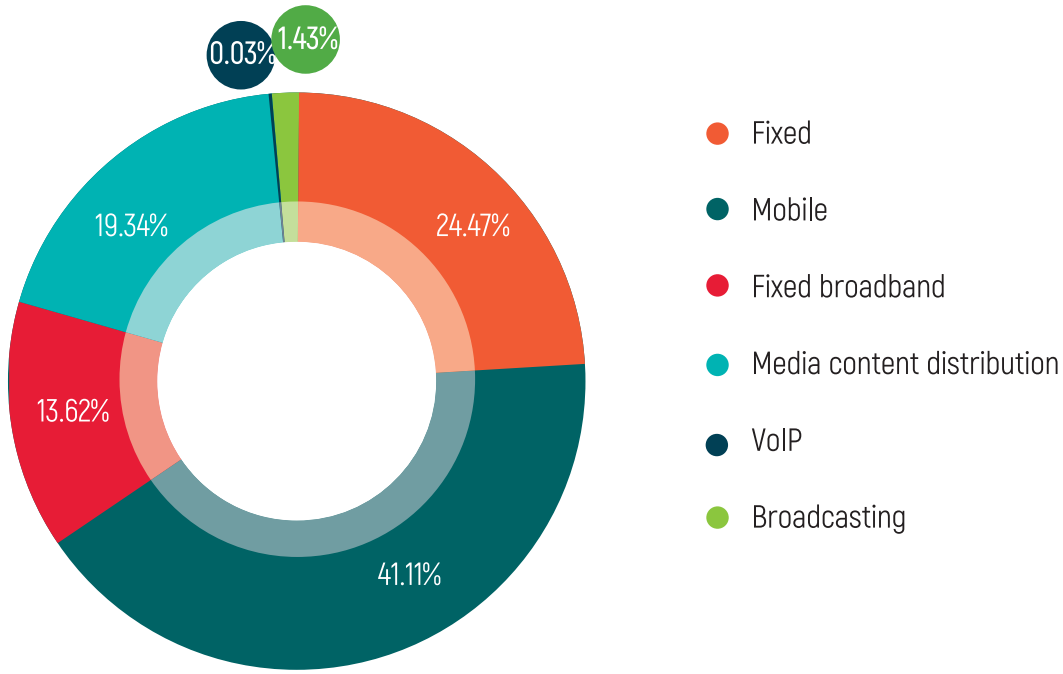
Figure 2. Structure of revenues by services in 2017



Source: **RATEL**

The total investments made in the electronic communications sector in 2017 amounted to 32.8 billion dinars or 270.7 euros, which is by 1.6% more compared with the previous year when they amounted to 32.3 billion dinars. Considered in euros, the investments rose from 262.5 to 270.7 million euros, which is a 3.1% growth. Investments made in mobile and fixed networks make up the largest share in the total investments, amounting to 13.5 billion dinars (111.3 million euros) and 8 billion dinars (66.2 million euros), respectively, jointly accounting for 65.58% of total investments made in 2017.

Figure 3. Structure of investments by services in 2016



Source: **RATEL**

A comparative overview of the number of users and penetration rate for public fixed communication networks, public mobile communications networks, Internet and cable systems in 2013, 2014, 2015, 2016 and 2017 are given in Table 1.

Teble 1. A comparative overview of the number of electronic communications service users in the Republic of Serbia (2013-2017)

	2013		2014		2015		2016		2017	
	Number (mil)	Per 100 inhabi-tants	Number (mil)	Per 100 inhabi-tants	Number (mil)	Per 100 inhabi-tants	Number (mil)	Per 100 inhabi-tants	Number (mil)	Per 100 inhabi-tants
Fixed telephone - subscribers	2.79	38.85	2.72	37.99	2.60	36.80	2.55	36.07	2.48	35.25
Mobile telephone - users	9.2	128.09	9.34	130.76	9.16	129.38	9.09	128.52	8.62	122.46
Broadband - subscribers	1.17	16.34	1.23	17.16	1.32	18.66	1.45	20.50	1.48	21.03
Media content distribution - subscribers	1.38	21.62	1.50	20.95	1.60	22.55	1.66	23.51	1.70	24.13

Low usage basket of electronic communications services shows average monthly expenses of a subscriber/inhabitant for telecommunications services. Tables 2 and 3 illustrate low usage and high usage baskets, representing monthly expenditure per subscriber of electronic communication services in Serbia in 2017, compared with the data retrieved in 2015 and 2016, based on weighted average. According to the obtained data and the data received from the Statistics Office, in 2017, the cost of the low basket equalled 2.58% of the net average annual salary and the cost of the high usage basket equalled 10.69%.

Table 2. Low usage basket of electronic communications services

LOW USAGE BASKET	2015		2016		2017	
	Average bill (dinars)	% of the monthly salary	Average bill (dinars)	% of the monthly salary	Average bill (dinars)	% of the monthly salary
Fixed phone	882.77	1.99%	868.68	1.88%	764.01	1.60%
Mobile phone (prepaid)	334.43	0.75%	294.85	0.64%	321.38	0.67%
TV (national TV subscription)	/	/	150.00	0.33%	150.00	0.31%
Total	**1,217.20**	**2.74%**	**1,313.53**	**2.85%**	**1,235.39**	**2.58%**
Average net salary *	44.437		46.097		47.893	

*www.stat.gov.rs
Source: **RATEL**

Table 3. **High usage basket of electronic communications services**

HIGH USAGE BASKET	2015		2016		2017	
	Average bill (dinars)	% of the monthly salary	Average bill (dinars)	% of the monthly salary	Average bill (dinars)	% of the monthly salary
Fixed phone	882.77	1.99%	868.68	1.88%	764.01	1.60%
Mobile phone (postpaid)	1,297.01	2.92%	1,555.12	3.37%	1,537.60	3.21%
TV (national TV subscription) **	/	/	150.00	0.33%	150.00	0.31%
Internet	1,380.11	3.11%	1,522.32***	3.30%	1432.54***	2.99%
Media content distribution	1,054.89	2.37%	1,186.89	2.57%	1,236.24	2.58%
Total	**4,614.77**	**10.38%**	**5,283.01**	**11.46%**	**5,120.39**	**10.69%**
Average net salary *	44,437		46,097		47,893	

Notes:

*www.stat.gov.rs

** With the entry into force of the Law on Public Media Service (Official Gazette, no. 83/14), on 13 August 2014, the Law on Broadcasting (Official Gazette, nos. 42/02, 97/04, 76/05, 79/05, 62/06, 85/06 and 41/09) ceased to be valid. As the Law on Broadcasting ceased to be valid, the monthly national TV subscription was no longer collected after August 2014. Since January 2016, pursuant to the Law on Temporary Regulation of Public Media Service Tax Collection (Official Gazette, no. 112/15), a monthly tax in the amount of 150 dinars is collected.

***Fixed broadband (excluding the mobile Internet package)

Source: **RATEL**

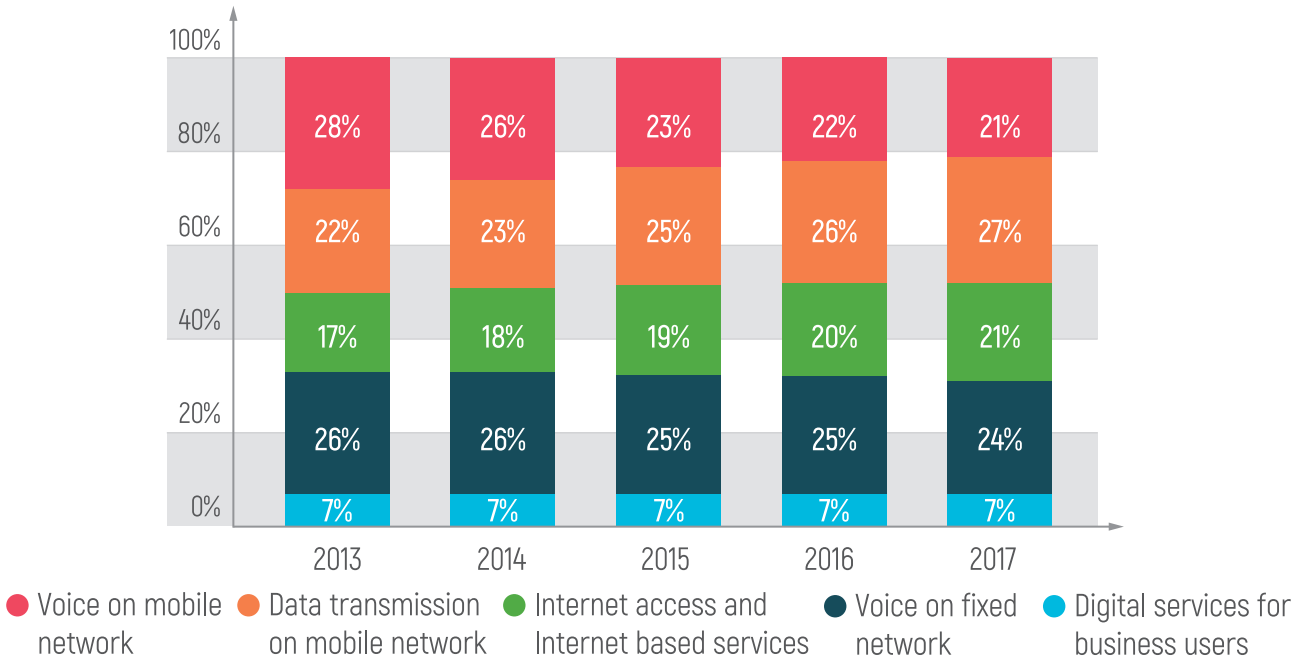
02

EU TELECOM MARKET STATE OF PLAY

Electronic Communications Sector Revenues

It is estimated that the electronic communications market sector globally generated revenues of approximately 1169 billion euros in 2017, where the share of the European operators in the total world market revenues was ca. 22% [1]. Revenue breakdown shows a decrease in the revenues made from voice service both over fixed and mobile networks. In 2017, voice service accounted for 45% of revenues, compared with 54% in 2013. The largest share in the total revenues went to data transmission via mobile network with 27% in 2017 (Figure 4).

Figure 4. Electronic communications market revenue distribution in the EU*



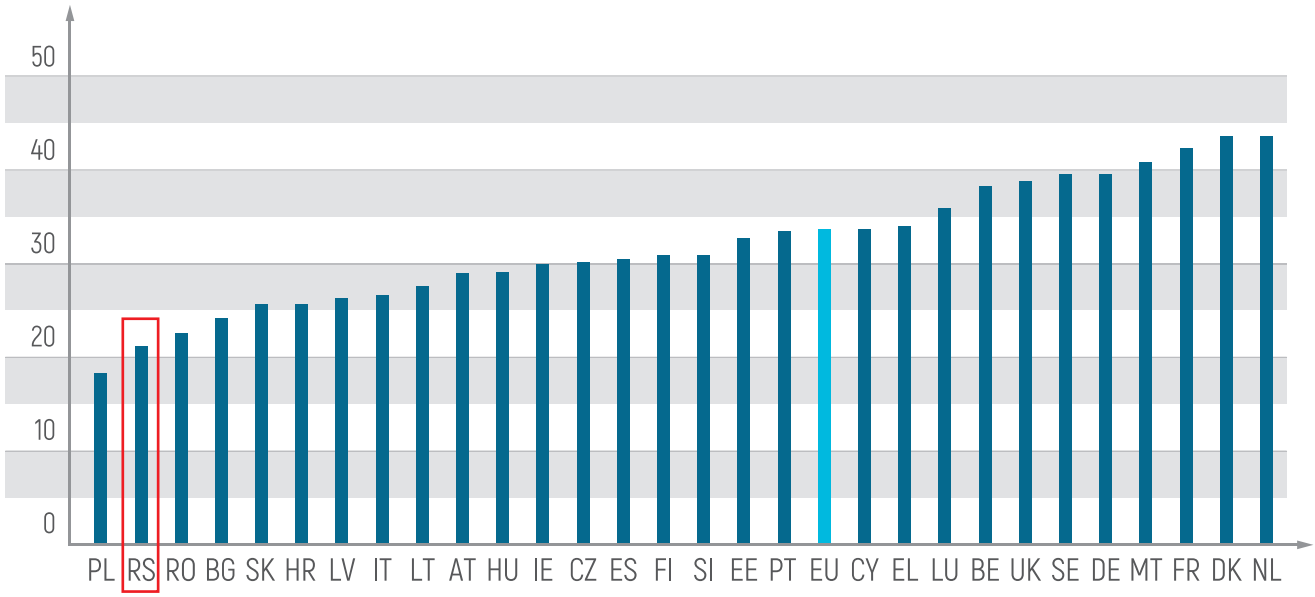
* Revenue distribution is based on data for 7 EU countries (Belgium, France, Germany, Italy, Spain, Greece and UK)
Source: European Commission, Europe's Digital Progress Report 2017 - Connectivity

1 European Telecommunications Network Operators' Association (ETNO) "Annual Economic Report 2017"

Fixed broadband

The number of fixed broadband users in the EU is constantly growing. The total number of fixed broadband users in 2017 grew by 3.3% with respect to 2016, amounting to 172 million, which is a 33.7 penetration rate. The Netherlands, Danemark, France and Malta had the highest fixed broadband penetration rate in 2017, with over 40 subscribers per 100 inhabitants. At the end of 2017, fixed broadband penetration rate in Serbia was 21%.

Figure 5. Fixed broadband penetration rate*

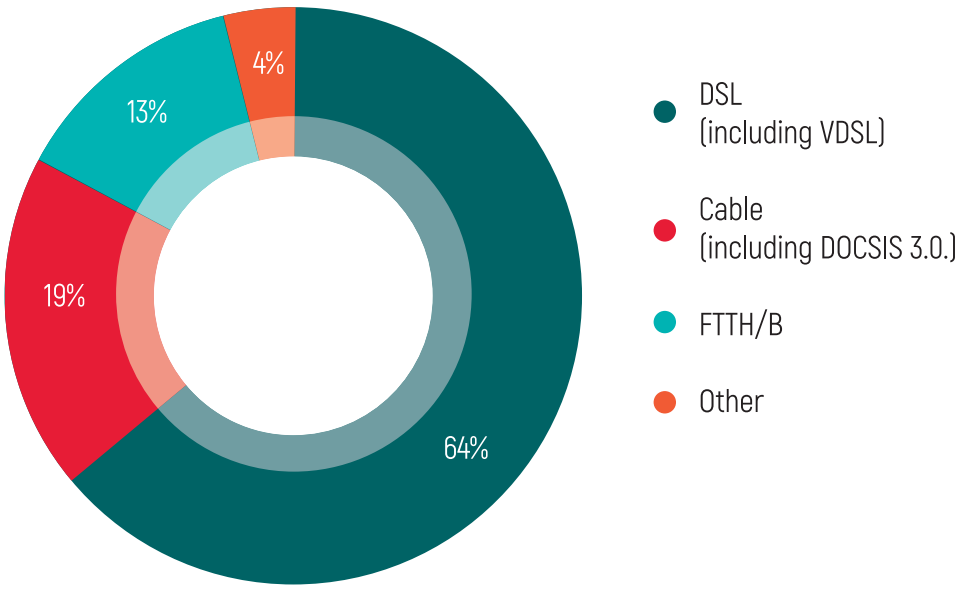


*Data for the EU - July 2017, data for Serbia - December 2017

Source for the EU: **EC - Communications Committee – COCOM**
https://ec.europa.eu/digital-single-market/en/connectivity, as on 30.08.2018
Source for Serbia: **RATEL**

DSL has the largest share in fixed broadband structure, with 64% of total fixed broadband subscribers in the EU. Approximately 13% of the total number of subscribers are using FTTH/B and 19% cable access. Cable access is by far more present in the Serbian market, with 41% of the total fixed broadband subscribers at the end of 2017.

Figure 6. Fixed broadband user distribution in terms of technologies in the EU*

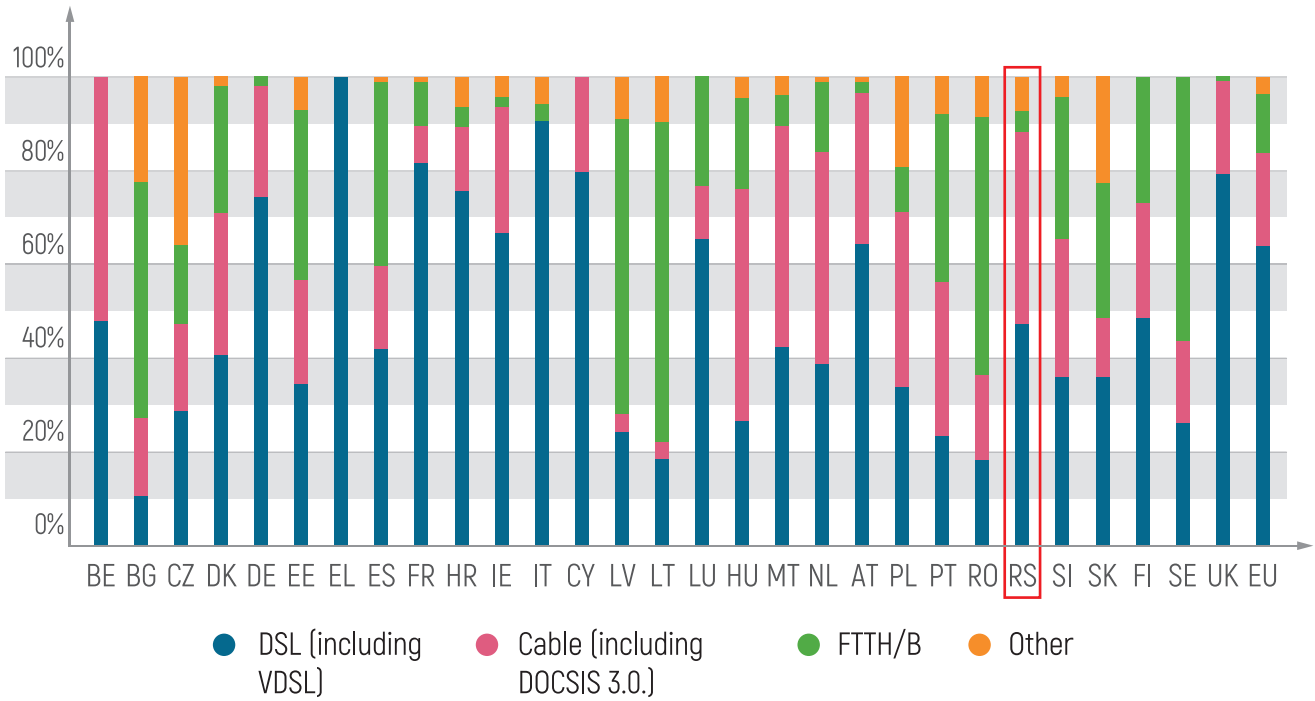


*Data for the EU - July 2017

Source: **EC - Communications Committee – COCOM**
https://ec.europa.eu/digital-single-market/en/connectivity, as on 30.08.2018

Figure 7 shows the usage of different broadband technologies in the EU-countries and the Republic of Serbia. FTTH/B has the largest share in Lithuania, Latvia, Sweden, Romania and Bulgaria, whereas cable access is the most used technology in Belgium, Hungary, Malta and the Netherlands. In Serbia, DSL remains the leading technology, cable is also largely used, whereas FTTH/B is used by 5% of the total fixed broadband subscribers.

Figure 7. Fixed broadband user distribution in terms of technologies*



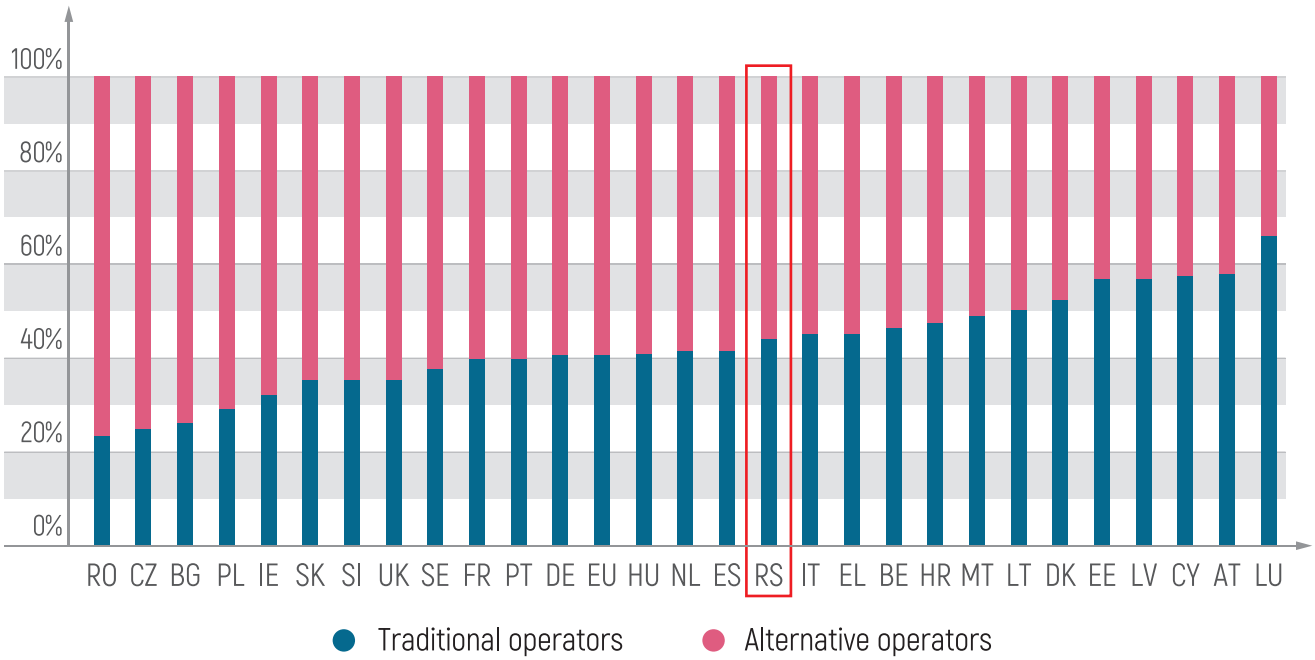
*Data for the EU - July 2017, data for Serbia - December 2017

Source for the EU: **EC - Communications Committee – COCOM,**
https://ec.europa.eu/digital-single-market/en/connectivity, as on 30. 08. 2018

Source for Serbia: **RATEL**

As for the market share of the incumbent operators in the total number of fixed broadband subscribers, it remains high in the EU, at ca. 40%. In Luxemburg, Austria, Latvia, Estonia, Denmark, Lithuania and Cyprus, the incumbent has over the 50% share in the total number of fixed broadband subscribers, whereas the share of the incumbent is below 30% in Romania, Check Republic, Bulgaria and Poland. The share of the incumbent in the total number of fixed broadband subscribers in Serbia is slightly above the EU average, with 44.2% (Figure 8).

Figure 8. Fixed broadband user distribution between traditional and alternative operators



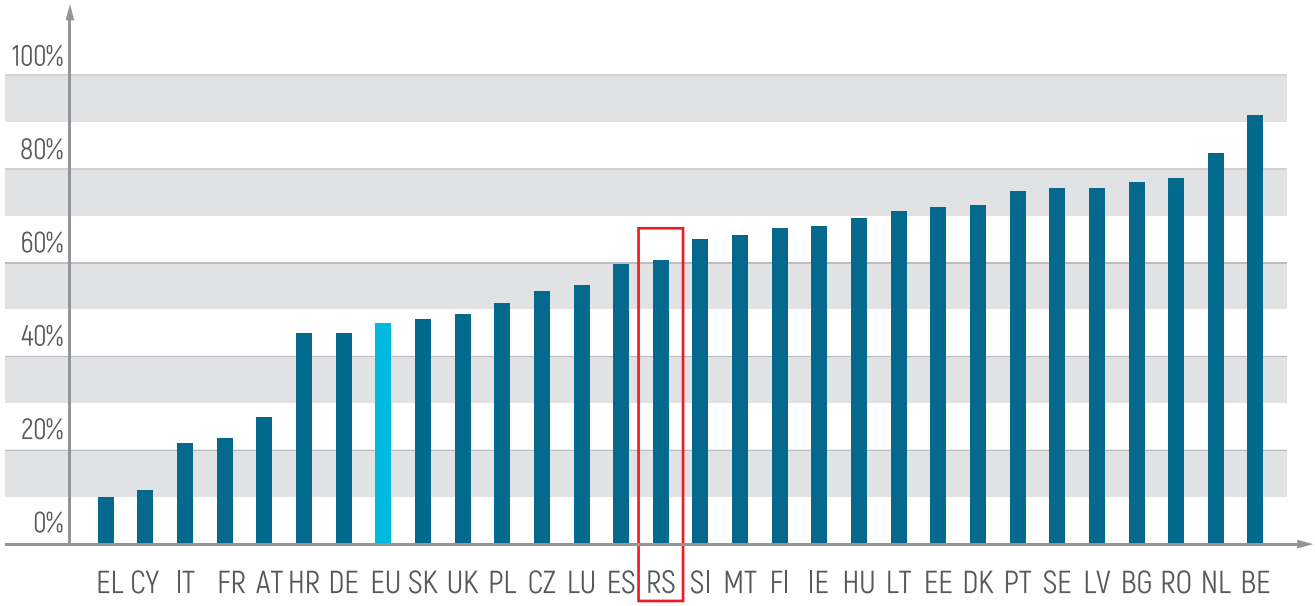
*Data for the EU - July 2017, data for Serbia - December 2017

Source for the EU: **EC - Communications Committee – COCOM, https://ec.europa.eu/digital-single-market/en/connectivity, as on 30. 08. 2018**

Source for Serbia: **RATEL**

Nearly 48% of the total number of subscribers in the EU are using NGA networks, comprising FTTH, FTTB, VDSL and Cable DOCSIS 3.0. Countries with the largest share of NGA are Belgium (92.6%) and the Netherlands (84.1%), whereas the lowest NGA share is seen in Greece and Cyprus. Serbia is above the EU average with 61.2% NGA share, due to large presence of cable DOCSIS 3.0. access, used by 39% of the total number of fixed broadband subscribers.

Figure 9. NGA share in the total number of fixed broadband subscribers *



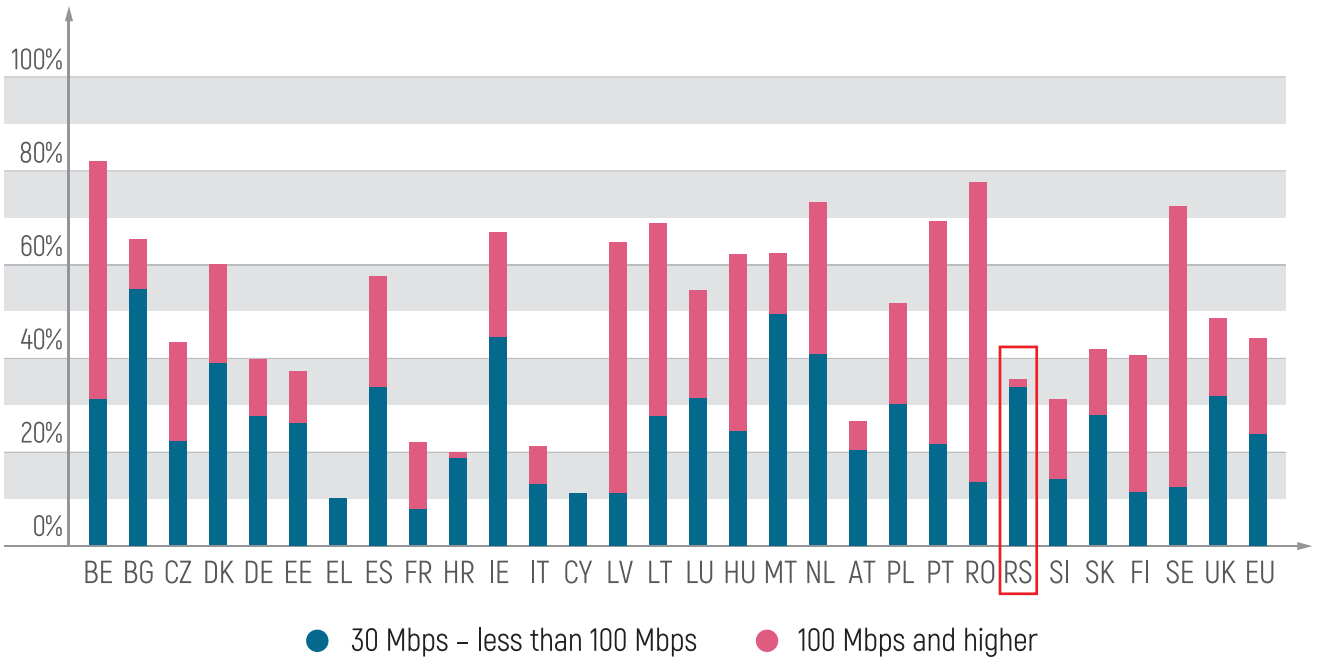
*Data for the EU - July 2017, data for Serbia - December 2017

Source for the EU: **EC - Communications Committee – COCOM,**
https://ec.europa.eu/digital-single-market/en/connectivity, as on 30. 08. 2018

Source for Serbia: **RATEL**

In the EU, 24% of the subscribers used 30 Mbps Internet packages or less than 100 Mbps, whereas 20.4% of the subscribers had access to connections of 100 Mbps and higher. The leading countries in terms of ultra high-speed Internet subscribers (100 Mb/s and higher) are Sweden and Romania, where more than 60% of users have access to this speed, whereas Greece and Cyprus have the least users with connections at these speeds. In Serbia, 34.1% of the subscribers used 30 Mbps Internet packages or less than 100 Mbps, whereas only 1.9% of the subscribers had access to connections of 100 Mbps and higher.

Figure 10. Fixed broadband users share, according to connection speed



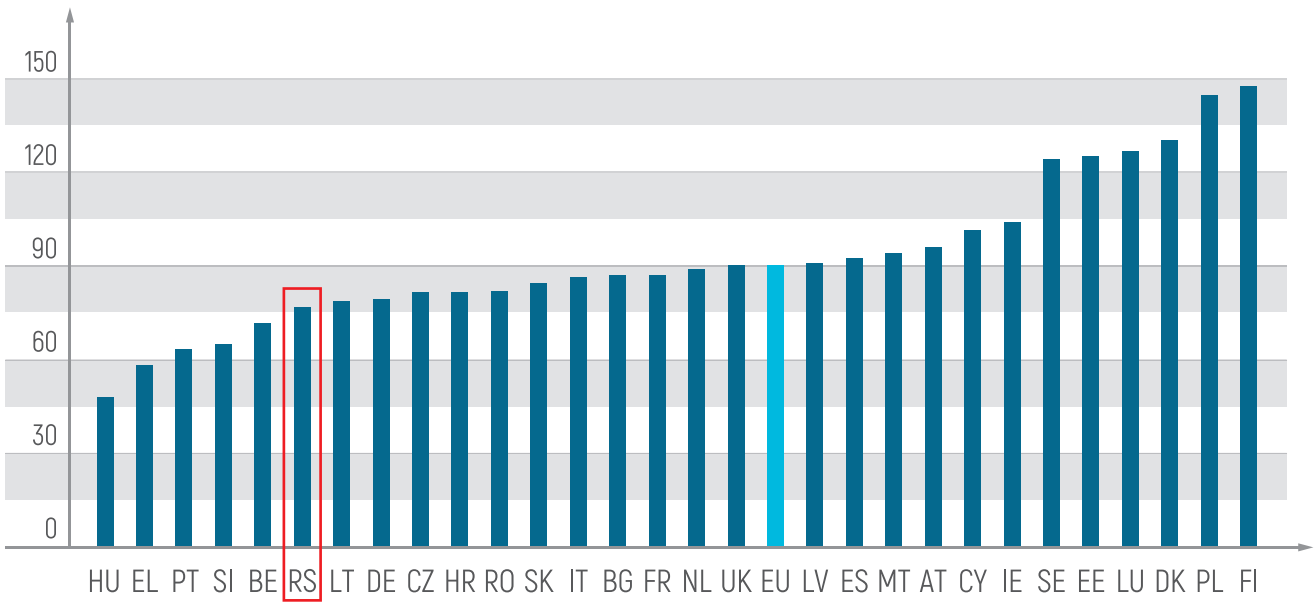
*Data for the EU - July 2017, data for Serbia - December 2017

Source for the EU: **EC - Communications Committee – COCOM,**
https://ec.europa.eu/digital-single-market/en/connectivity, as on 30. 08. 2018

Source for Serbia: **RATEL**

In addition to fixed broadband, mobile broadband is largely used both in the EU and in the Republic of Serbia. Mobile broadband penetration rate in Finland, Poland, Denmark, Luxemburg, Estonia, Sweden, Ireland and Cyprus is over 100%, whereas Hungary has the lowest penetration rate of 49.1%. At the end of 2017, the number of active mobile broadband users per 100 inhabitants was 77, which is below the EU average of 90.2%.

Figure 11. Mobile broadband penetration rate*



Data for the EU - July 2017, data for Serbia - December 2017

Source for the EU: EC - Communications Committee – COCOM,
https://ec.europa.eu/digital-single-market/en/connectivity, as on 30. 08. 2018

Source for Serbia: **RATEL**

03

THE DIGITAL ECONOMY AND SOCIETY INDEX

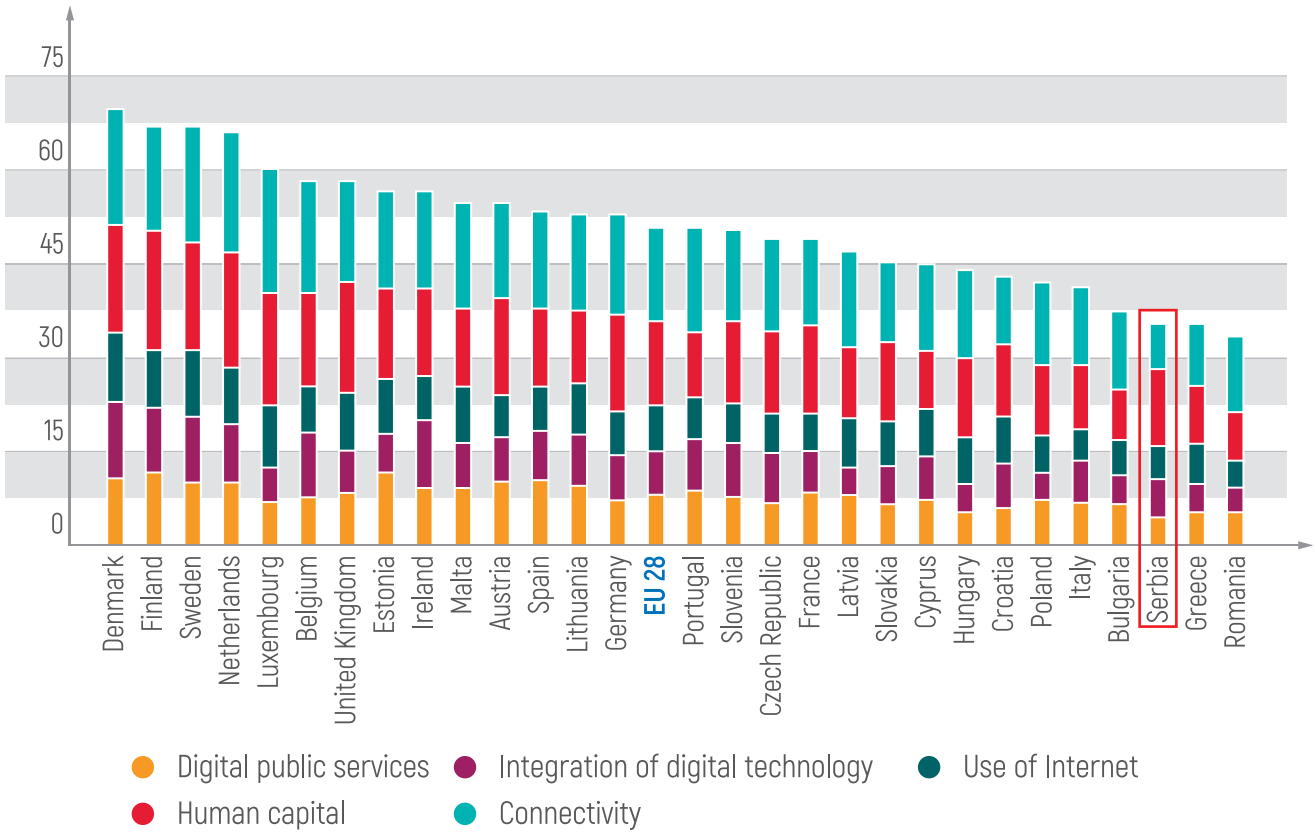
The Digital Economy and Society Index (DESI) is a composite index that summarises relevant indicators on digital performance and tracks the evolution of EU member states in digital competitiveness. DESI provides an insight in country's general performance and offers a simple way to identify areas with room for improvement. DESI consists of 5 components: Connectivity, Human capital/digital skills, Use of Internet by citizens, Integration of digital technology by businesses and Digital public services (Figure 12).

Figure 12. DESI components

DESI has been calculated for EU member states since 2014 and for Serbia since 2017, thus enabling Serbia to be positioned at the European digital performance map. Index for Serbia has been calculated according to the EC methodology of 2 March 2017.

DESI by dimensions for all EU countries and Serbia is given in Figure 13.

Figure 13. 2017 DESI scores of the EU countries and Serbia, by dimensions



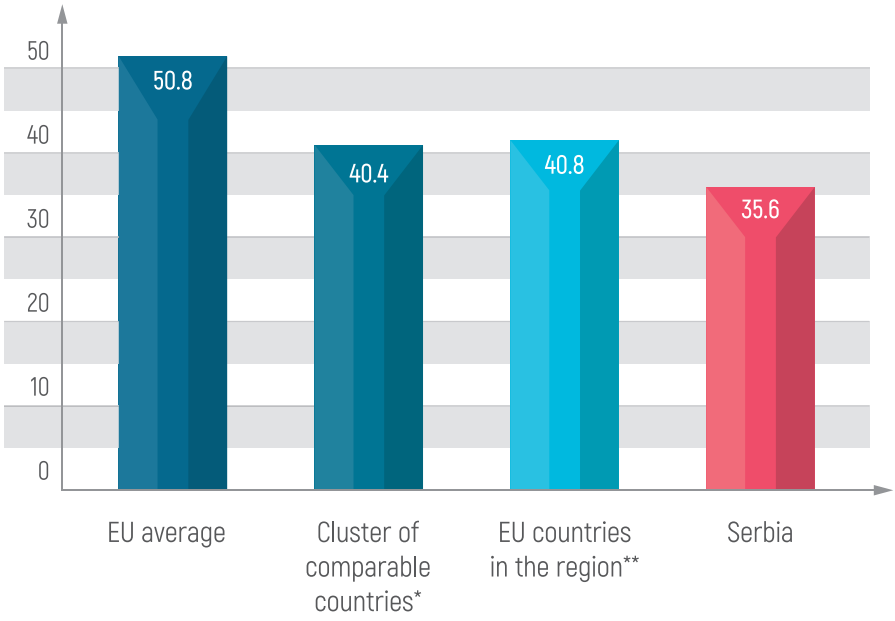
Source for EU countries https://**digital-agenda-data.eu/charts/desi-composite, as on 28.8.2017**

Source for Serbia: **RATEL**

Denmark, Finland and Sweden have the most advanced digital economies in the EU, whereas, Bulgaria Greece and Romania are lagging behind.

Serbia is ranked 27th on the list of European countries, which places it in the cluster of the countries with a relatively low DESI, such as: Romania, Bulgaria, Greece, Italy, Poland, Hungary, Cyprus and Slovak Republic. Serbia is also below the average of the EU countries in the region, as shown in Figure 14.

Figure 14. Comparative DESI overview

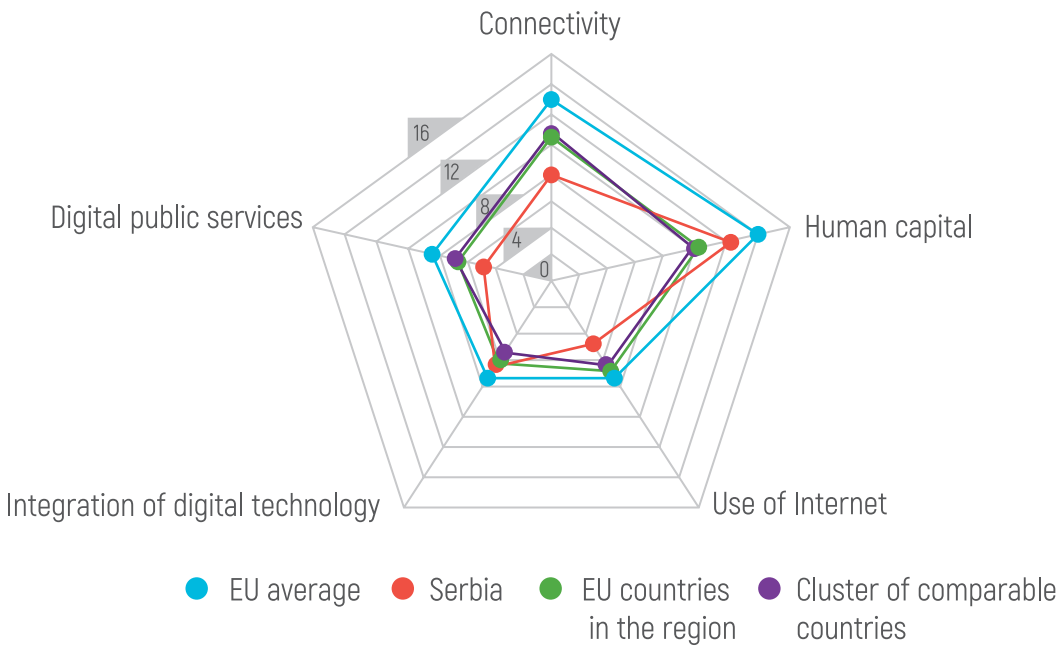


* Cluster of comparable countries includes countries at a similar level of digital development: Romania, Greece, Bulgaria, Italy, Poland, Hungary, Cyprus and Slovakia..

** EU countries in the region: Slovenia, Hungary, Romania, Bulgaria, Croatia and Greece.

Average DESI values by dimensions is given in Figure 15.

Figure 15. Average DESI values by dimensions



Each of the five dimensions includes several sub-dimensions and the values of their indicators are calculation components of DESI. The index is a sum of weighted values for five main dimensions. Sub-dimensions also have weighted values, whereas single indicators within sub-dimensions have equal value, i.e. the same weight. Weights attributed to the DESI dimensions and sub-dimensions are given in Table 4 below.

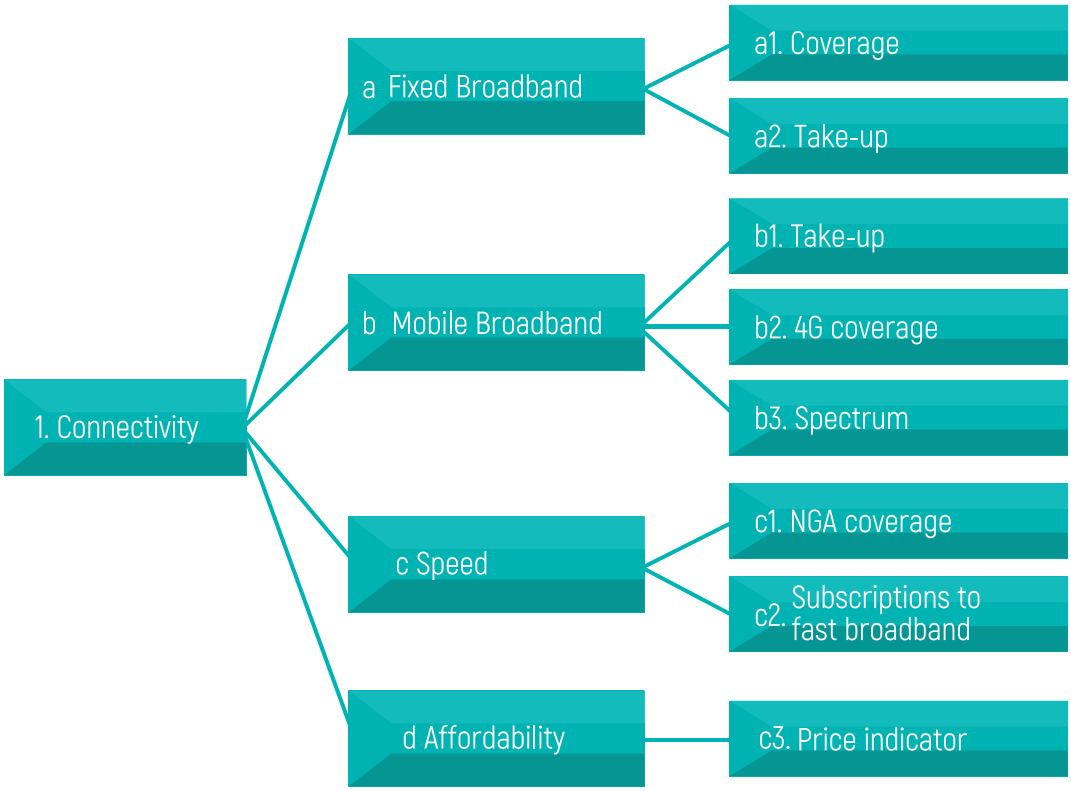
Table 4. Weights attributed to the DESI sub-dimensions

DESI dimensions/sub- dimensions	Weight
1 Connectivity	**25%**
1a Fixed Broadband	33%
1b Mobile Broadband	22%
1c Speed	33%
1d Affordability	11%
2 Human Capital	**25%**
2a Basic Skills and Usage	50%
2b Advanced skills and Development	50%
3 Use of Internet Services	**15%**
3a Content	33%
3b Communication	33%
3c Transactions	33%
4 Integration of Digital Technology	**20%**
4a Business digitization	60%
4b eCommerce	40%
5 Digital Public Services	**15%**
5a eGovernment	100%

Connectivity Dimension

Connectivity is a necessary infrastructure of the digital economy and society, hence this dimension provides information on the types and quality of the Internet access and availability. The sub-dimensions and their indicators are given in Figure 16.

Figure 16. Connectivity: Sub-dimensions and their indicators



The leading countries in this area are Luxemburg, the Netherlands and Denmark, whereas the countries with the lowest score in the EU are Romania, Croatia and Greece. The values for connectivity dimension for the EU countries and Serbia are given in Figure 17, while the comparison between Serbia and the cluster of comparable countries and countries in the region is given in Figure 18.

Figure 17. Values for connectivity dimension for EU countries and Serbia

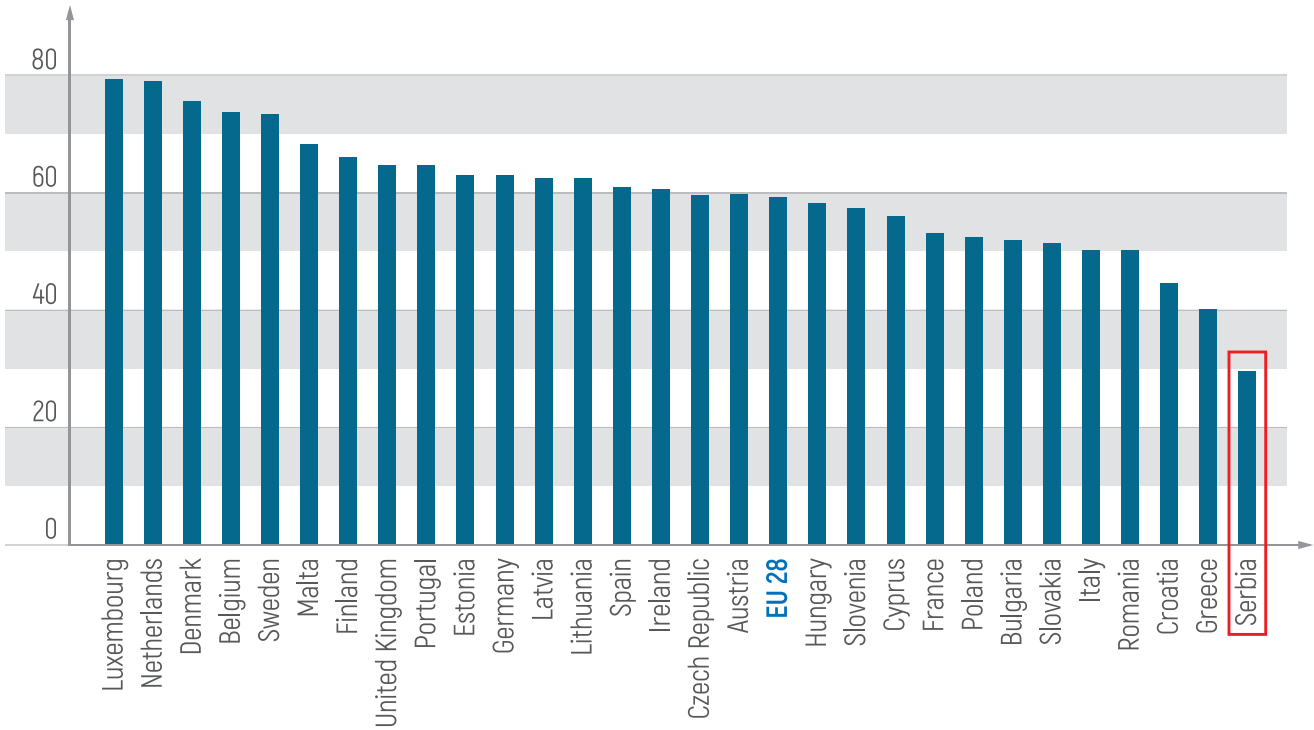
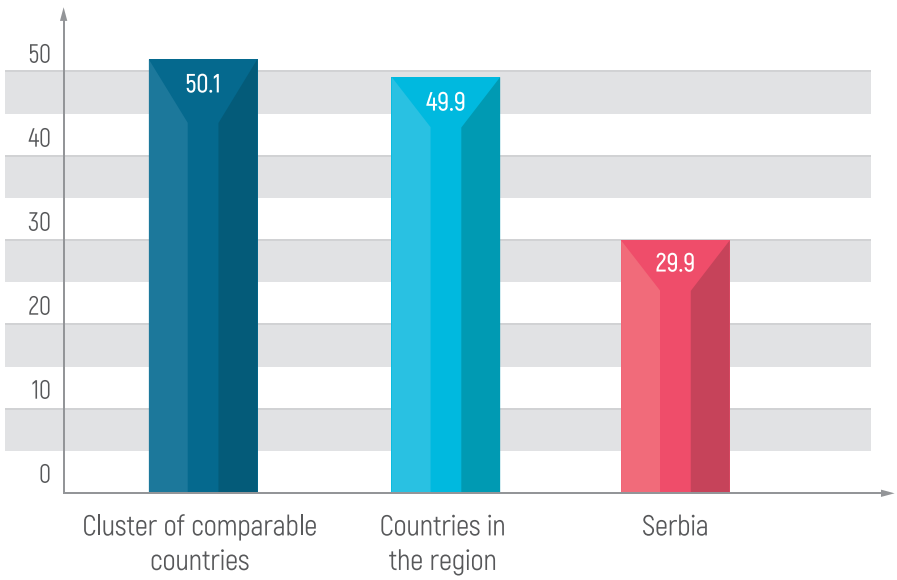


Figure 18. Compared overview of connectivity values



Serbia has the lowest result in connectivity dimension, compared to the EU countries. This is mainly due to low rate of broadband coverage. The values for connectivity dimension for Serbia are given below.

Table 5.

Indicators - Coverage	Serbia	Min*	Max*
1a1 - Fixed Broadband Coverage - household penetration rate	69.4%	80%	100%
1a2 - Fixed Broadband Take-up - household penetration rate	59.5%	50%	100%
1b1 - Mobile Broadband Take-up - Number of mobile data subscriptions per 100 people	76.1	25	150
1b2 – 4G Coverage - % of populated areas coverage by 4G	91.2%	0%	100%
1b3 – Allocated spectrum %	29.3%*	25%	100%
1c1 - NGA Coverage - % households	62.4%	0%	100%
1c2 – Fast Broadband take-up - % of households subscribing to broadband of at least 30 Mbps	36.1%	0%	100%
1d1 – The Fixed Broadband Price - (% of average gross income)	2.3%	0%	4%

* Minimum and maximum value is predefined and used to normalize different units of indicators, converting them into values on scale from 0 to 10.

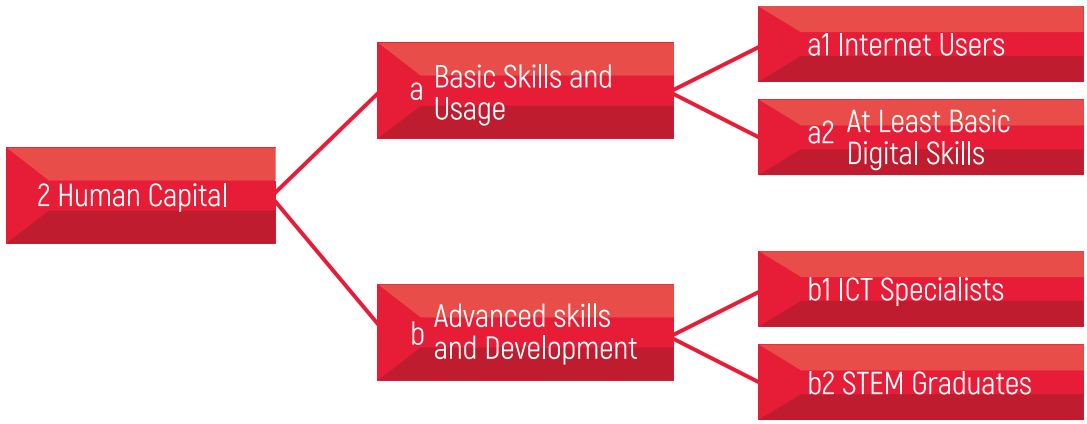
**Indicator 1b3 has not been considered in DESI calculation for comparison reasons, since it is no longer used due to changed methodology.

Source: **RATEL**

Human Capital Dimension

The Human Capital dimension measures digital skills, basic and advanced, needed to take active part in the digital society and to use digital products and services. Hence, digital skills together with the Internet access, analyzed under the previous dimension, are considered to be necessary infrastructure for the digital economy and society. Sub-dimensions and indicators under Human Capital dimension are given in Figure 19.

Figure 19. Human Capital – sub-dimensions and indicators



The leading countries in this dimension are Finland, Luxemburg and the Netherlands, whereas the countries with the lowest score in the EU are Greece, Bulgaria and Romania. The values for Human Capital dimension in the EU and Serbia are given in Figure 20, whereas the comparison with the comparable countries cluster and countries in the region is shown in Figure 21.

Figure 20. The values for Human Capital dimension in the EU and Serbia in 2017

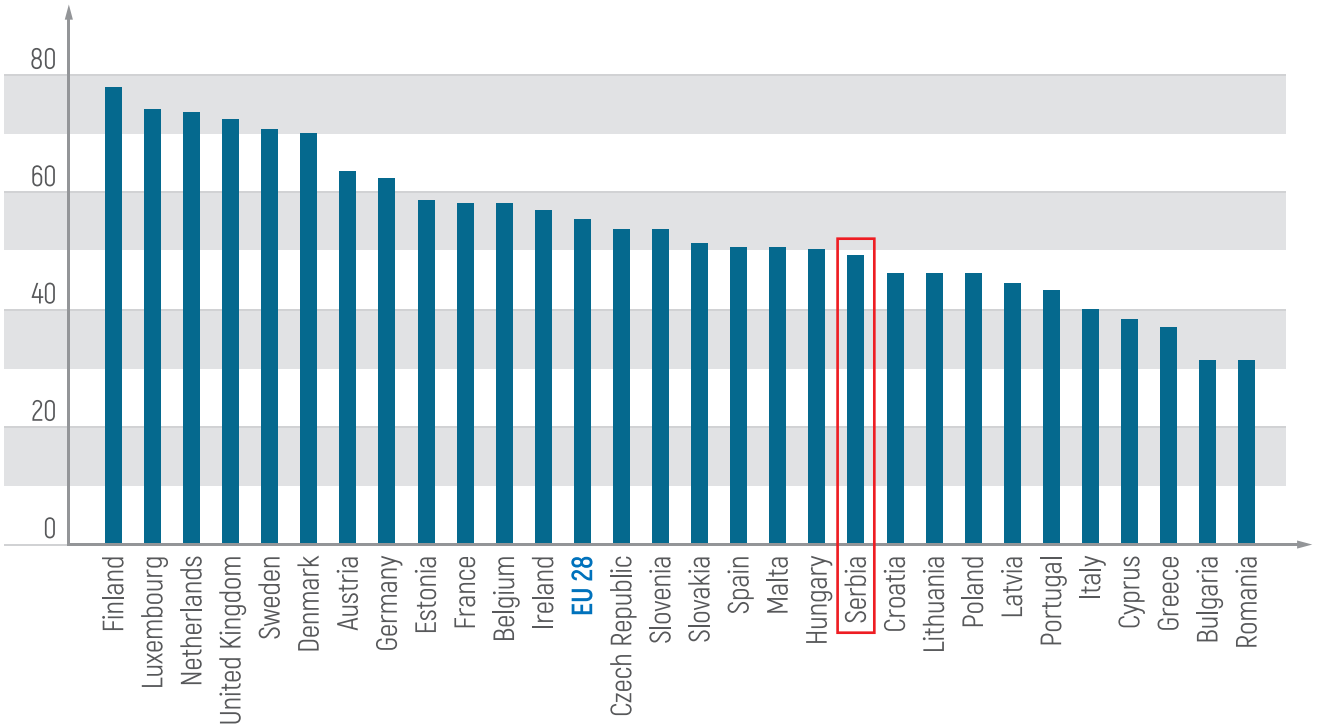
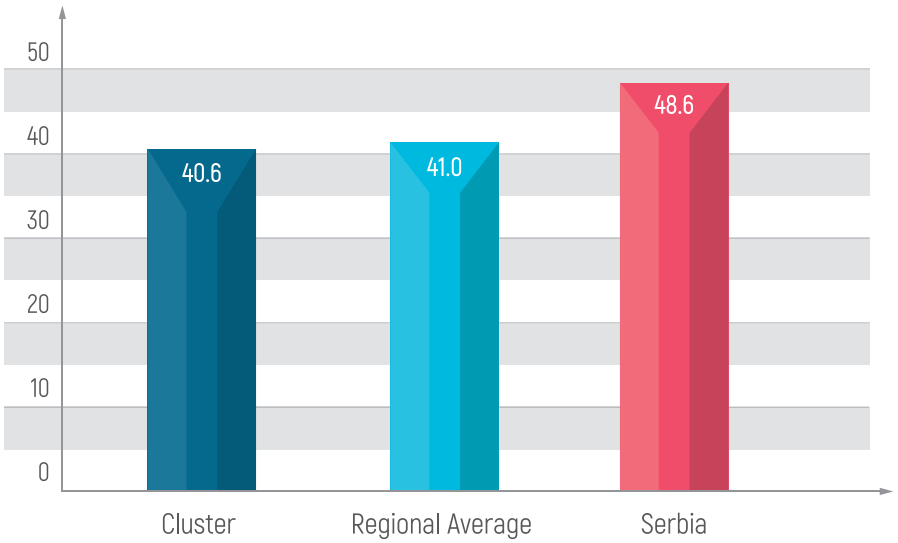


Figure 21. Overview of compared values for the Human Capital dimension



Serbia is ranked 19th in this dimension, which is below the EU average, yet above the value calculated for the cluster of comparable countries and above the regional average. Therefore, the results may be considered to be satisfactory, however it is important to follow the indicators over time. The values of single indicators under Human Capital dimension for Serbia are given below.

Table 6.

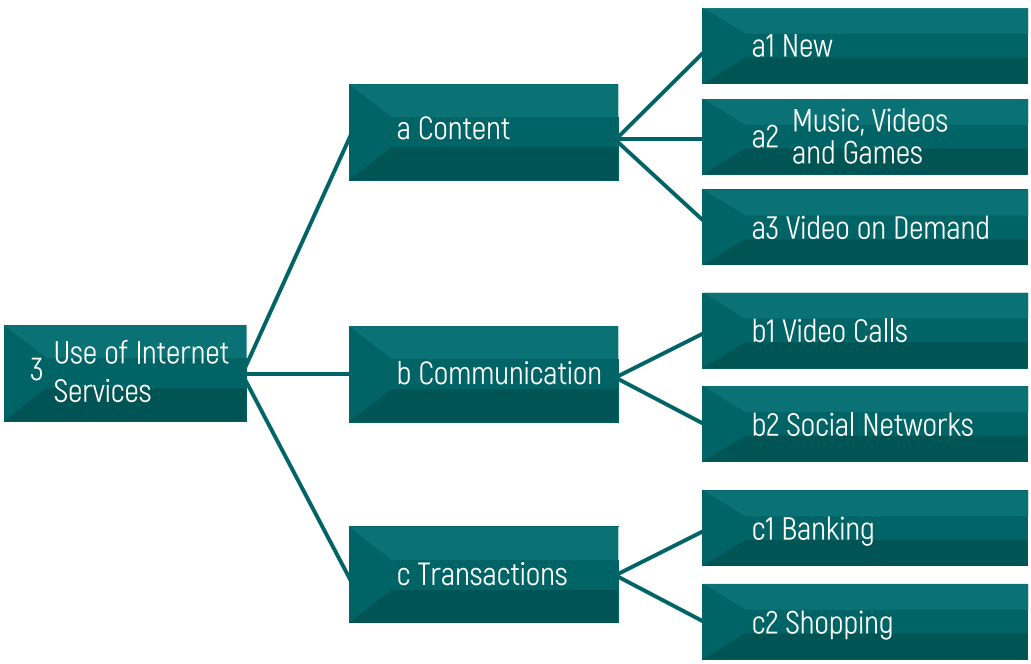
Human Capital – indicators	Serbia	Min*	Max*
2a1 Internet Users	74.4%	40%	100%
2a2 At Least Basic Digital Skills	64.9%	0%	100%
2 b1 ICT Specialists	2.1%	0%	7%
2b2 STEM (Science, Technology, Maths) Graduates	17.1	0	40

Source: **RATEL, Statistical Office**

Use of Internet Services Dimension

This dimension measures the usage of online content (music, films, video games, social networks), modern communications (video calls) and e-commerce. These activities are key drivers of broadband networks and services development. Sub-dimensions and indicators under Use of Internet Services dimension are given in Figure 22.

Figure 22. **Use of Internet Services: Sub-dimensions and indicators**



The leading countries in this dimension are Denmark, Sweden and Luxemburg, whereas the countries with the lowest score in the EU are Bulgaria, Italy and Romania. The values for Use of Internet Services dimension in the EU and Serbia are given in Figure 23, whereas the comparison with the comparable countries cluster and countries in the region is shown in Figure 24.

Figure 23. The values for the Use of Internet Services dimension in the EU and Serbia

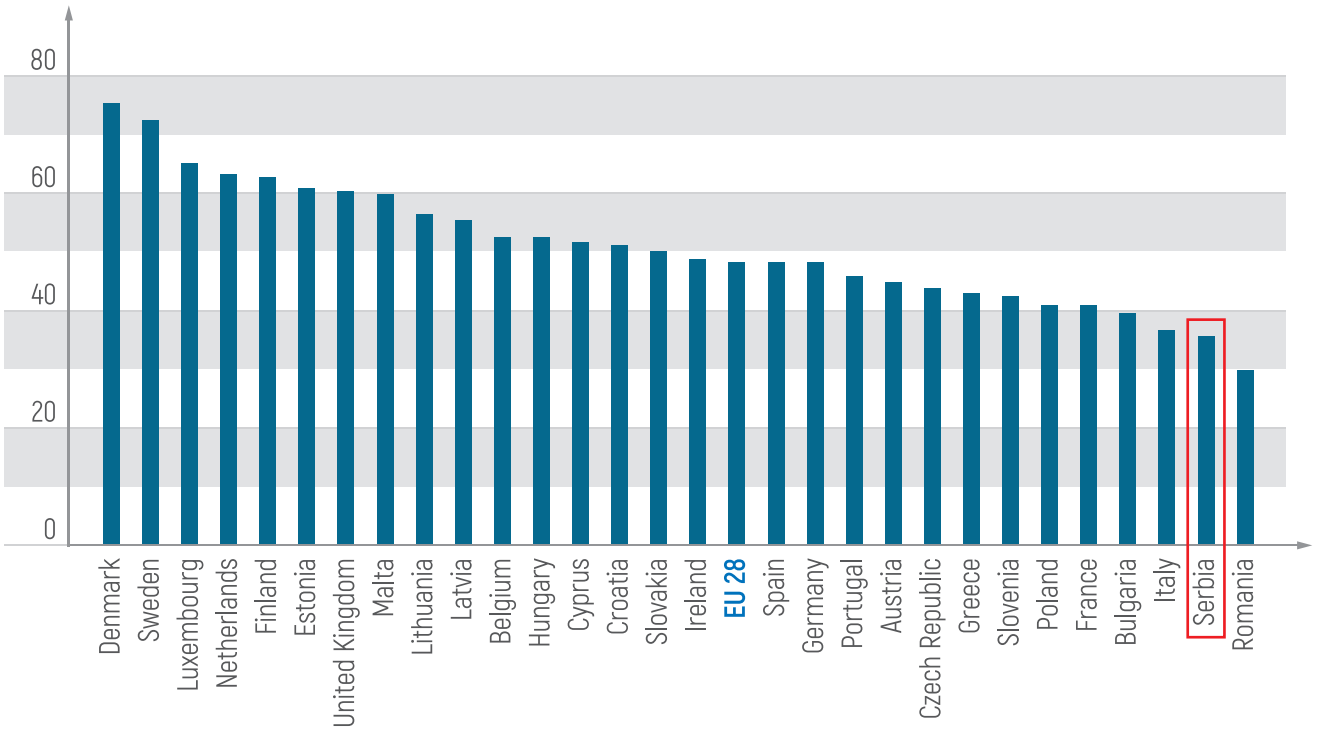
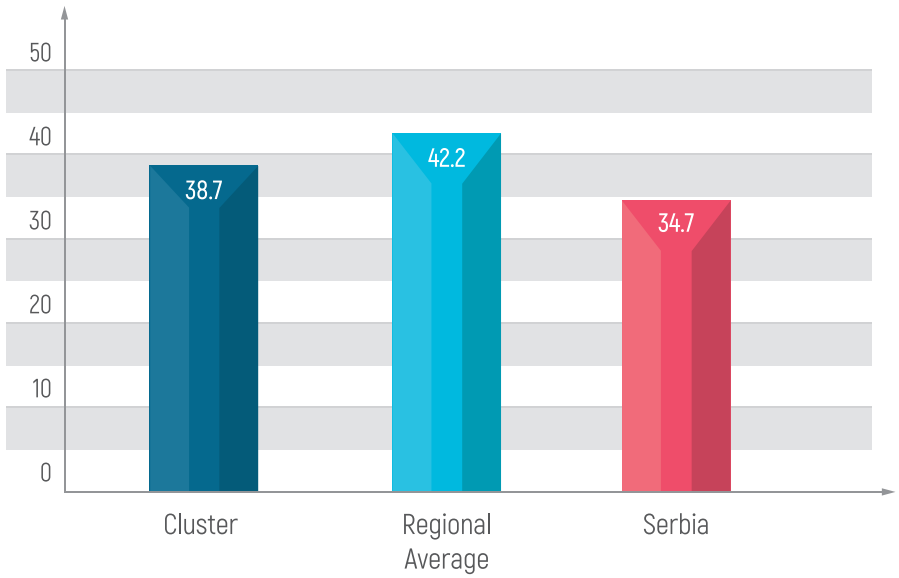


Figure 24. Overview of compared values for the Use of Internet Services dimension



Serbia is among the lowest ranked countries in this dimension. This is mainly due to low values for online transactions indicator – e-banking and online shopping, which indicates a high level of distrust in the safety of online payments in Serbia. The values of single indicators for Serbia are given below.

Table 7.

Use of Internet Services - indicators*	Serbia	Min*	Max*
3a1 reading online news sites, newspapers or news magazines	75.6%	33%	100%
3a2 playing or downloading games, images, films or music	65.8%	50%	100%
3a3 Video on Demand	16.1%	0%	60%
3b1 Video Calls (e.g. Skype)	45.9%	20%	100%
3b2 Social Networks	67.8%	40%	100%
3c1 e-Banking	22.8%	0%	100%
3c2 Shopping online	28.3%	1%	100%

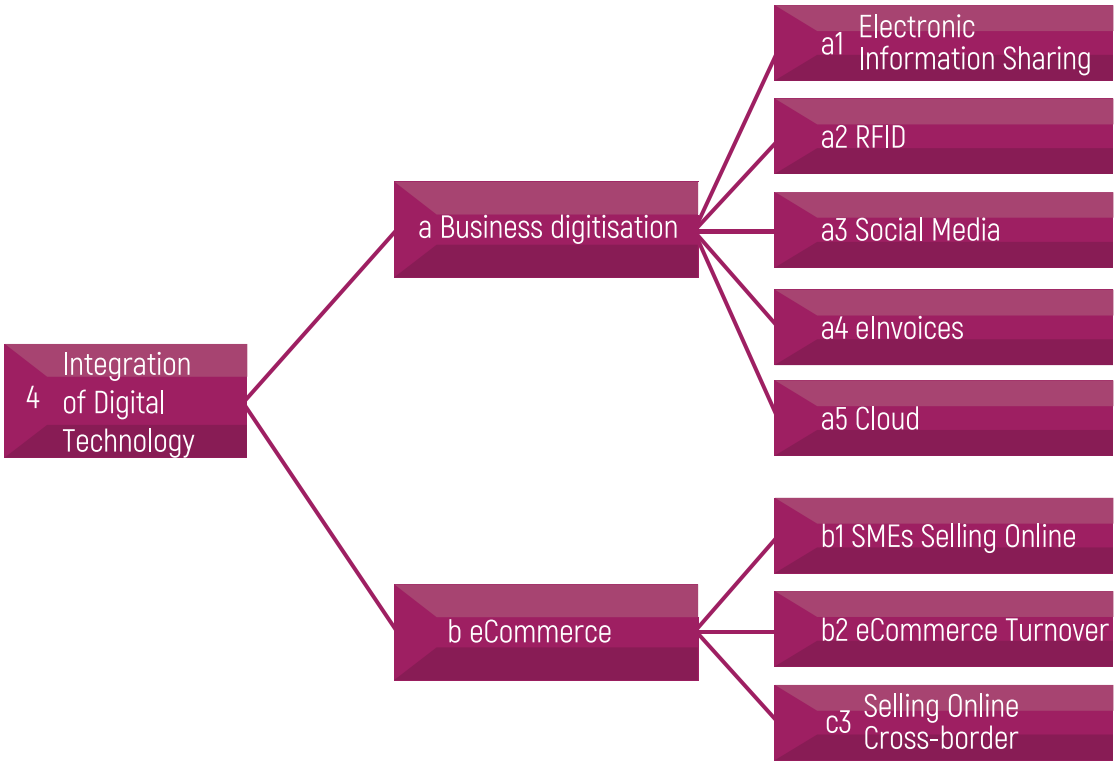
* Values of the indicator refer to the percentage of the Internet users who have used the Internet in the past three months.

Source: **RATEL, Statistical Office**

Integration of Digital Technology Dimension

The Integration of Digital Technology dimension reflects the fact that digitisation is one of the main drivers of economic growth. By adopting digital technologies (cloud, Big Data, IoT, etc.) businesses can enhance efficiency, reduce costs and better engage customers and business partners, therefore it is crucial for competitiveness. Sub-dimensions and indicators under the Integration of Digital Technology Dimension are given in Figure 25.

Figure 25. Integration of Digital Technology - sub-dimensions and indicators



The leading countries in this dimension are Denmark, Ireland and Finland, whereas the countries with the lowest score in the EU are Bulgaria, Poland and Romania. The values for Integration of Digital Technology dimension in the EU and Serbia are given in Figure 26, whereas the comparison with the comparable countries cluster and countries in the region is shown in Figure 27.

Figure 26. The values for the Integration of Digital Technology dimension in the EU and Serbia for 2017

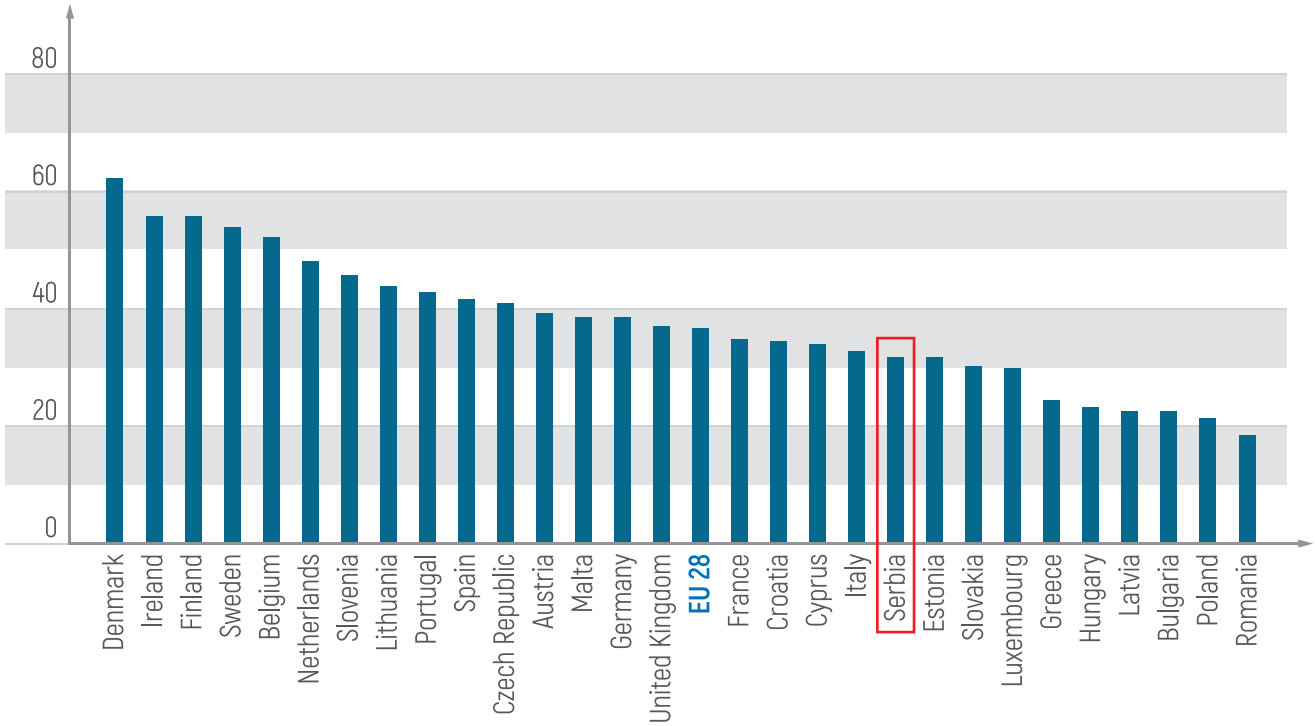
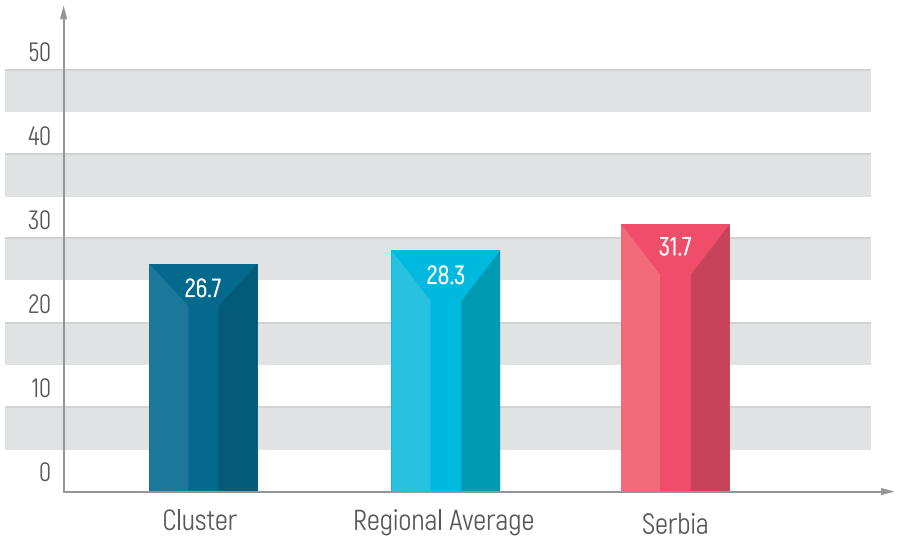


Figure 27. Overview of compared values for the Integration of Digital Technology dimension



Serbia is ranked 20th among the EU countries in this dimension, with scores above the value calculated for the cluster of comparable countries and above the regional average. The values of single indicators under Digital Technology dimension for Serbia are given below.

Table 8.

Digital Technology dimension – indicators	Serbia	Min*	Max*
4a1 Electronic Information Sharing (businesses with ERP software)	18.1%	0%	60%
4a2 Using RFID for after sales identification or as part of the production and service delivery	1.3%	0%	15%
4a3 Using social media	18.0%	0%	50%
4a4 Sending e-Invoices which allow automatic processing	5.9%	0%	50%
4a5 Cloud	9.3%	0%	50%
4b1 SMEs selling online (at least 1% of turnover)	23.1%	0%	33%
4b2 e-Commerce turnover	16.3%	0%	33%
4b3 SMEs selling online cross-border	6.3%	0%	25%

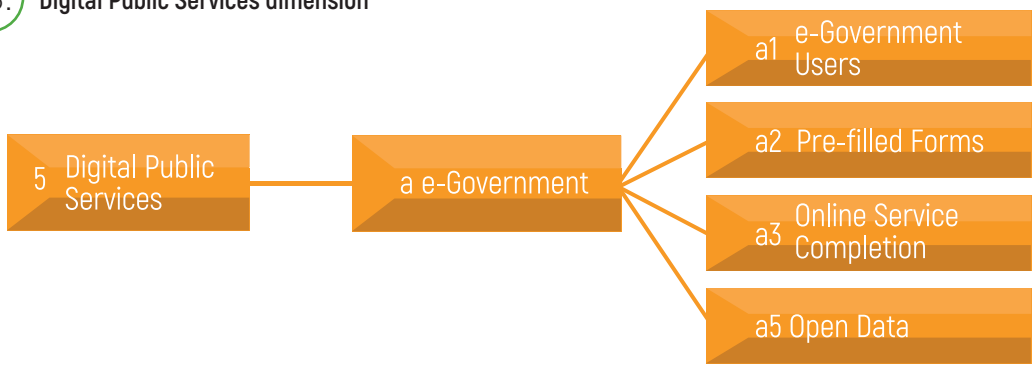
*Individual indicators refer to the percentage of businesses applying different forms of business digitisation (Business digitisation sub-dimension) or the percentage of SMEs selling online (e-Commerce sub-dimension).

Source: **Statistical Office**

Digital Public Services Dimension

Digital Public Services dimension measures digital technologies which serve to enhance the interaction of citizens and businesses with public administration, focusing on e-Government, as shown in Figure 28. Pre-filled forms, online service completion and open data are composite indicators, consisting of several sub-indicators.

Figure 28. Digital Public Services dimension



The leading countries in this dimension are Estonia, Finland and Denmark, whereas the countries with the lowest score in the EU are Romania, Greece and Hungary. The values for Digital Public Services dimension in the EU and Serbia are given in Figure 29, whereas the comparison with the comparable countries cluster and countries in the region is shown in Figure 30.

Figure 29. The values for the Digital Public Services dimension in the EU and Serbia for 2017

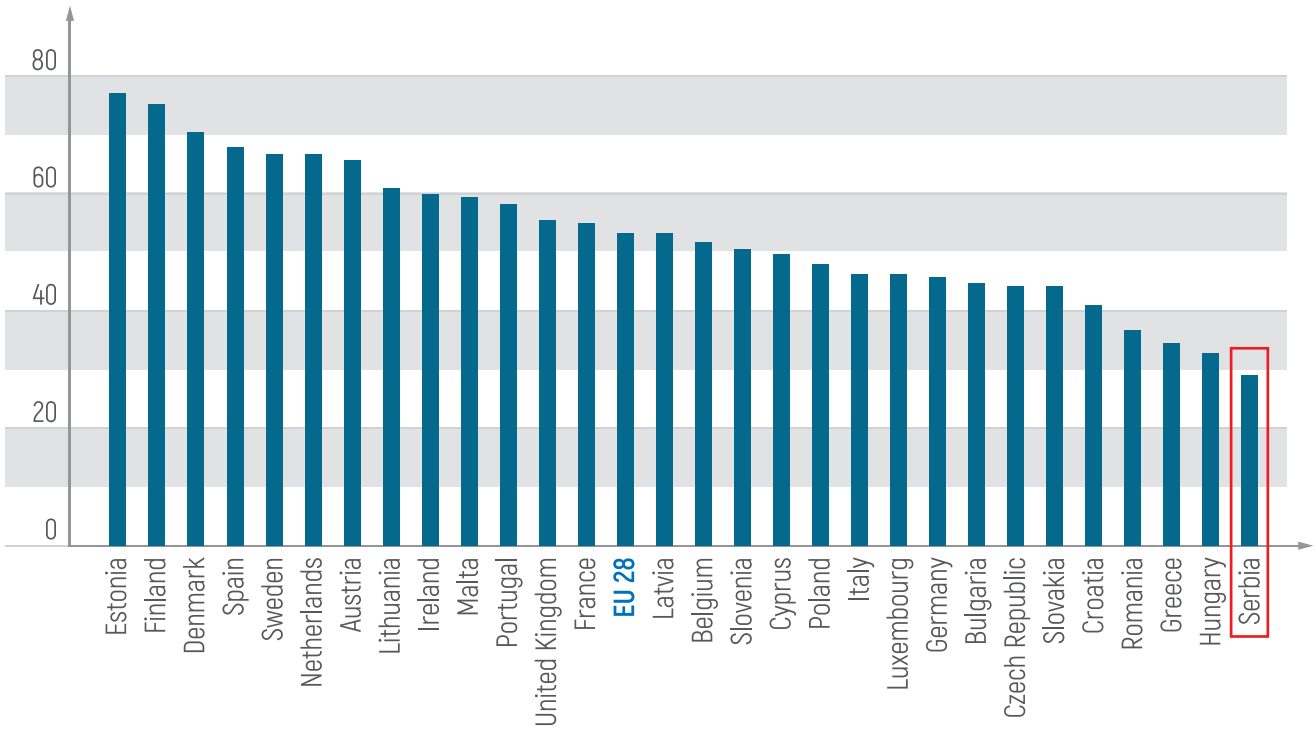
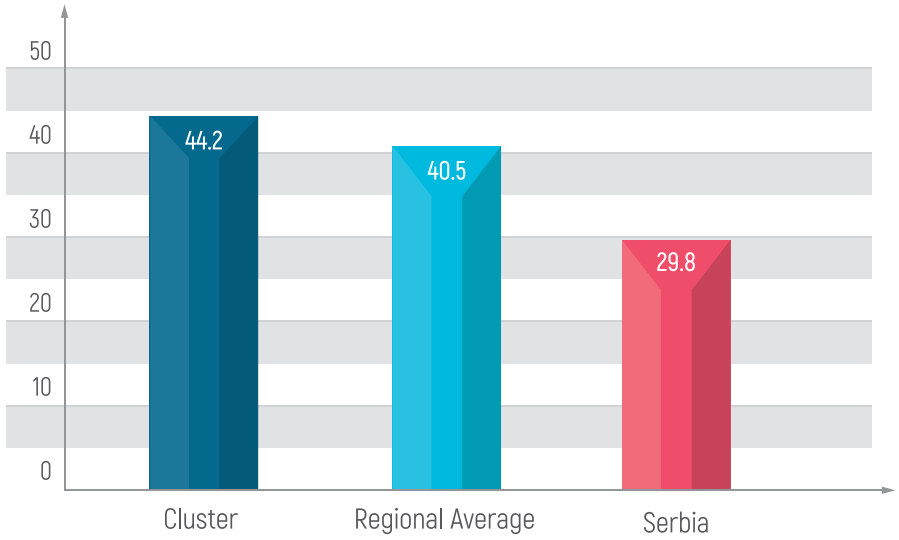


Figure 30. Overview of compared values for the Digital Public Services dimension



Compared with the EU countries, Serbia is the least successful country in this dimension. This is due to low values of e-Government-related indicators, indicating the level of sophistication of public administration services available online. Open Data indicator is a composite indicator, indicating the degree to which a country applies open data policy, and also political, social and economic impact of open data, along with the characteristics of the national data portals (functionality, availability and usage). The value of this indicator varies significantly from one EU country to another and Serbia is getting closer to the EU average. The values of single indicators under Digital Public Services dimension for Serbia are given below.

Table 9.

Digital Public Services dimension – indicators	Serbia	Min*	Max*
5a1 e-Government Users	16.8%	0%	80%
a2 Pre-filled Forms	23	0	100
5a3 Online Service Completion	55	40	100
5a5 Open Data	50.3%	0%	100%

Source: **RATEL, Statistical Office**

ICT DEVELOPMENT INDEX

With the aim of measuring and monitoring the development of information society and determining the digital divide among UN Member States, the International Telecommunication Union (ITU) publishes the indicators of ICT development on a regular basis. The indicators are obtained on the basis of a representative sample of the households and population. The list of core indicators for households and individuals in the Republic of Serbia for 2017 are given in Table 10 below. The indicators are presented according to the ITU Manual for Measuring ICT Access and Use by Households and Individuals, published in 2014, which defines the key parameters and the methodology for data collection and analysis. In 2016, ITU included three additional indicators (HH17, HH18 i HH19) to those given in the mentioned Manual, which are an integral part of the table below.

Tabela 10. ICT development indicators

	Indicator	Definition	2017.
HH1	Proportion of households with a radio	*This is the proportion of households that have a radio.* A radio is defined as a device capable of receiving broadcast radio signals, using common frequencies, such as FM, AM, LW and SW. A radio may be a stand-alone device, or it may be integrated with another device, such as an alarm clock, an audio player, a mobile telephone or a computer.	77.9%
HH2	Proportion of households with a TV	*This is the proportion of households that have a television (TV).* A television (TV) is a device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. A television set is typically a standalone device, but it may also be integrated with another device, such as a computer or a mobile telephone.	98.9%

	Indicator	Definition	2017.
HH3	Proportion of households with telephone	*This is the proportion of households that have a telephone.*	
	Proportion of households with fixed telephone	*A fixed telephone line refers to a telephone line connecting a customer's terminal equipment (e.g. telephone set, facsimile machine) to the public switched telephone network (PSTN) and which has a dedicated port on a telephone exchange. It may not be the same as an access line or a subscription.*	81.1%
	Proportion of households with mobile cellular telephone	*A mobile (cellular) telephone refers to a portable telephone subscribing to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems and technologies such as IMT-2000 (3G) and IMT-Advanced. Users of both postpaid subscriptions and prepaid accounts are included.*	90.5%
HH4	Proportion of households with a computer	*The proportion of households with a computer* *A computer refers to a desktop computer, a laptop (portable) computer or a tablet (or similar handheld computer). It does not include equipment with some embedded computing abilities, such as smart TV sets, and devices with telephony as their primary function, such as smartphones.*	68.1%
HH5	Proportion of individuals using a computer	*This is the proportion of individuals who used a computer from any location in the last three months.* *A computer refers to a desktop computer, a laptop (portable) computer or a tablet (or similar handheld computer). It does not include equipment with some embedded computing abilities, such as smart TV sets, and devices with telephony as their primary function, such as smartphones.*	67.7%
HH6	Proportion of households with Internet	*This is the proportion of households with Internet access at home.* *The Internet is a worldwide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer – it may also be by mobile telephone, tablet, PDA, games machine, digital TV etc.). Access can be via a fixed or mobile network.*	68.0%
HH7	Proportion of individuals using the Internet	*The proportion of individuals who used the Internet* is calculated by dividing the total number of in-scope individuals who used the Internet (from any location) in the last 12 months by the total number of in-scope individuals. The Internet is a world-wide public computer network. It provides access to a number of communication services including the World Wide Web and carries e-mail, news, entertainment and data files, irrespective of the device used (not assumed to be only via a computer – it may also be by mobile phone, PDA, games machine, digital TV etc.). Access can be via a fixed or mobile network.	70.5%
HH8	Proportion of individuals using the Internet, by location	*This is the proportion of individuals who used the Internet from specified locations in the last three months.*	n/a

	Indicator	Definition	2017.
	Proportion of individuals using the Internet, by type of activity	*This is the proportion of individuals who undertook one or more activities using the Internet for private (defined as non-work) purposes from any location in the last three months.*	
HH9	Getting information about goods or services		75.5%
	Seeking health information (on injury, disease, nutrition etc.).	Includes information on injury, disease, nutrition and improving health generally.	74.1%
	Getting information from general government organizations	*General government organizations* should be consistent with the SNA93 (2008 revision) concept of general government. According to the SNA "... the principal functions of government are to assume responsibility for the provision of goods and services to the community or to individual households and to finance their provision out of taxation or other incomes; to redistribute income and wealth by means of transfers; and to engage in non-market production." (General) government organizations include central, state and local government units.	31.3%
	Interacting with general government organizations	Includes downloading/requesting forms, completing/lodging forms on line, making online payments and purchasing from government organizations, etc. Does not include receiving information from government organizations.	37.0%
	Sending or receiving e-mail		55.7%
	Telephoning over the Internet/VoIP	Using Skype, iTalk, etc.; includes video calls via webcam.	65.1%
	Participating in social networks	Creating user profile, posting messages or other contributions to Facebook, Twitter etc.	67.8%
	Access to chat sites, blogs, newsgroups or online discussions		15.6%
	Purchasing or ordering goods or services	Purchase orders placed via the Internet whether or not payment was made online; excludes orders that were cancelled or not completed; includes purchasing of products such as music, travel and accommodation via the Internet	28.3%
	Selling goods or services		25.1%
	Using services related to travel or travel-related accommodation		34.9%
	Internet banking	Includes electronic transactions with a bank for payment, transfers, etc, or for looking up account information. Excludes electronic transactions via the Internet for other types of financial services such as share purchases, financial services and insurance.	22.8%
	Doing a formal online course (in any subject)		7.6%

	Indicator	Definition	2017.
HH9	Searching information for learning purposes	Consulting wikis (Wikipedia etc.), online encyclopaedias or other websites for formal learning purposes	32.5%
	Reading or downloading on-line newspapers or magazines, electronic books	Includes accessing news websites, either paid or free of charge. Includes subscriptions to online news services.	75.6%
	Uploading self/user-created content to a website to be shared	Text, images, photos, videos, music, software, etc.	44.6%
	Using storage space on the Internet	Using storage space on the Internet to save documents, pictures, music, video or other files (e.g. Google Drive, Dropbox, Windows Skydrive, iCloud, Amazon Cloud Drive)	19.5%
HH10	Proportion of individuals using a mobile cellular telephone	*This is the proportion of individuals who used a mobile telephone in the last three months.* A *mobile cellular telephone* refers to a portable telephone subscribing to a public mobile telephone service using cellular technology, which provides access to the PSTN. This includes analogue and digital cellular systems, as well as IMT-2000 (3G). Users of both postpaid subscriptions and prepaid accounts are included.	92.6%
HH11	*Proportion of households with Internet, by type of service*		
	Fixed (wired) narrowband network	Fixed (wired) narrowband network includes analogue modem (dial-up via standard telephone line), ISDN (Integrated Services Digital Network), DSL (Digital Subscriber Line) at advertised download speeds below 256 kbit/s, and other forms of access with an advertised download speed of less than 256 kbit/s.	1.2%
	Fixed broadband	Fixed broadband refers to technologies at speeds of at least 256 kbit/s, in one or both directions, such as DSL (Digital Subscriber Line), cable modem, high-speed leased lines, FTTH/FTTB and other broadband technologies.	61.9%
	Mobile broadband via a handset	Mobile broadband network (at least 3G, e.g. UMTS) via a handset.	53.6%
	Mobile broadband via a card or USB modem	Mobile broadband network (at least 3G, e.g. UMTS) via a card (e.g. integrated SIM card in a computer) or USB modem.	6.7%
HH12	*Proportion of individuals using the Internet, by frequency*	*This is the frequency of Internet use by individuals who used the Internet in the last three months.*	
	At least once a day	Once a working day for respondents who only (or most frequently) use the Internet from work or from school	88.2 %
	At least once a week but not every day		8.6 %
	Less than once a week		3.2 %

	Indicator	Definition	2017.
HH13	*Proportion of households with multichannel television, by type*	*This is the proportion of households with multichannel television (TV) and by type of multichannel service.*	
	Cable TV (CATV)		58.4%
	Direct-to-home (DTH) satellite services		8.3%
	IPTV		18.1%
	Digital terrestrial TV (DTT)		30.4%
HH14	Barriers to household Internet access are:		
	Do not need the Internet (not useful, not interesting, lack of local content)		22.4 %
	Have access to the Internet elsewhere		2.3 %
	Lack of confidence, knowledge or skills to use the Internet		7.3 %
	Cost of the equipment is too high		7.8 %
	Cost of the service is too high		7.0%
	Privacy or security concerns		0.2 %
	Internet service is not available in the area		0.5 %
HH15	Individuals with ICT skills, by type of skills		
	Copying or moving a file or folder		74.5%
	Using Word text processing software		54.5%
	Using a spreadsheet program		34.2%
	Installing and configuring software		38.5%
	Creating electronic presentations with presentation software (including text, images, sound, video or charts)		35.0%
	Transferring files between a computer and other devices		52.3%
	Writing a computer program using a specialized programming language		5.8%
HH16	Household expenditure on ICT	This measures the percentage of total household expenditure that is expended on ICT (telephone and telefax equipment, telephone and telefax services, equipment for the reception, recording and reproduction of sound and picture, information processing equipment, Repair of audio-visual, photographic and information processing equipment, etc.)	5.7%

	Indicator	Definition	2017.
HH17	Proportion of individuals using the Internet, by type of portable device and network used to access the Internet		
	Mobile phone via cellular network		38.4 %
	Mobile phone via other wireless networks (e.g. WiFi)		43.4 %
	Portable computer (tablet, (laptop, notebook, netbook) via mobile cellular network, using USB key/dongle or integrated data SIM card or mobile cellular telephone as modem		6.7 %
	Portable computer (laptop, notebook, netbook) via other wireless networks (e.g. WiFi)		20.1 %
	Other portable devices (e.g. portable games consoles, watches, ebook readers etc.)		3.3 %
HH18	Proportion of individuals who own a mobile phone	An individual owns a mobile cellular phone if he/she has a mobile cellular phone device with at least one active SIM card for personal use. It includes mobile cellular phones supplied by employers that can be used for personal reasons (to make personal calls, access the Internet, etc.) and those who have a mobile phone for personal use that is not registered under his/her name. It excludes individuals who have only active SIM card(s) and not a mobile phone device.	92.6%
HH19	*Proportion of individuals not using the Internet, by type of reason*	*Reasons for not using the Internet.*	
		Do not need the Internet (not useful, not interesting)	16.1%
		Do not know how to use it	5.4%
		Cost of Internet use is too high (service charges, etc.)	7.2%
		Privacy or security concerns	0.3%
		Internet service is not available in the area	0.8%
		Cultural reasons (e.g. exposure to harmful content)	0.1%
		Don't know what Internet is	0.1%
		Not allowed to use the Internet	0.2%
		Lack of local content	0.1%
		Other reasons	0.9%

Source: **The Statistical Office the Republic of Serbia, RATEL**

The ICT Development Index (IDI), has been published annually since 2009 by the International Telecommunication Union (ITU), for the purposes of measuring the development of information society. It is used to monitor the developments in information and communication technology. The main objectives of the IDI are to measure:

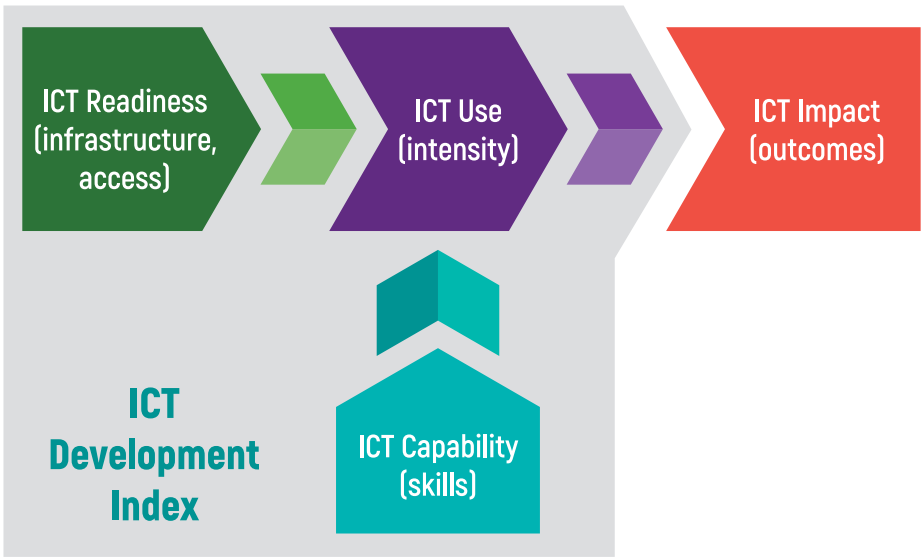
- the level and evolution over time of ICT market;
- progress in ICT development in both developed and developing countries;
- the digital divide, i.e. differences between countries in terms of their levels of ICT development; and
- the development potential of ICTs

IDI includes 11 indicators divided into the following 3 sub-indices:

1. CT infrastructure and access
2. ICT use
3. ICT impact (outcomes of an efficient ICT use).

Given the fact that these three sub-groups of ICT development cannot be monitored by means of a single index, there is a necessity for the establishment of a single composite index for monitoring the development of information society in each country. Infrastructure, developed to meet the needs of end-users, as well as an appropriate level of education, act as prerequisites for the use of ICTs and evolution towards an information society (Figure 31).

Figure 31. IDI structure



Source: **Measuring the Information Society - The ICT Development Index, ITU**

The list of 11 indicators is given in the table below, along with reference (normalized) values prescribed by the ITU, sub-indices value and IDI Index value for the Republic of Serbia in 2017. The values of the sub-indices were calculated by normalizing the 11 indicators by means of reference values. The final value of IDI Index is calculated as a sum of sub-indices multiplied by weight coefficients. The ICT Access and ICT use sub-indices are given 40% weight each, whereas the skill sub-index is given 20% weight.

Table 11. 2017 IDI for the Republic of Serbia

	Indicator	ITU ideal value	Value for Serbia in 2017
ICT Access			
a	Fixed telephone lines per 100 inhabitants	60	37.07
b	Mobile cellular telephone subscriptions per 100 inhabitants	120	122.46
c	International Internet bandwidth per Internet user	2,158,212	115,107
d	Proportion of households with a computer	100	68.10
e	Proportion of households with Internet access at home	100	68.00
ICT Use			
f	Internet users per 100 inhabitants	100	67.70
g	Fixed broadband Internet subscriptions per 100 inhabitants	60	21.03
h	Mobile broadband subscriptions per 100 inhabitants	100	76.08
ICT Skills			
i	Adult literacy rate	15	14.60*
j	Secondary gross enrolment ratio	100	88.20*
k	Tertiary gross enrolment ratio	100	48.40*

	Indicator	ITU ideal value	Value for Serbia in 2017
ICT Access – Normalized values		**Formula**	
z1	Fixed telephone lines per 100 inhabitants	a/60	0.62
z2	Mobile cellular telephone subscriptions per 100 inhabitants	b/120	1.02
z3	International Internet bandwidth per Internet user	log(c)/6.33	0.80
z4	Proportion of households with a computer	d/100	0.68
z5	Proportion of households with Internet access at home	e/100	0.68
ICT Use – Normalized values		**Formula**	
z6	Internet users per 100 inhabitants	f/100	0.68
z7	Fixed broadband Internet subscriptions per 100 inhabitants	g/60	0.35
z8	Mobile broadband subscriptions per 100 inhabitants	h/100	0.76
ICT Skills – Normalized values		**Formula**	
z9	Adult literacy rate	i/100	0.97
z10	Secondary gross enrolment ratio	j/100	0.88
z11	Tertiary gross enrolment ratio	k/100	0.48
L	**ICT Access – Sub-index**	**y1+y2+y3+y4+y5**	**0.76**
y1	Fixed telephone lines per 100 inhabitants	z1*0.2	0.12
y2	Mobile cellular telephone subscriptions per 100 inhabitants	z2*0.2	0.20
y3	International Internet bandwidth per Internet user	z3*0.2	0.16
y4	Proportion of households with a computer	z4*0.2	0.14
y5	Proportion of households with Internet access at home	z5*0.2	0.14

	Indicator	ITU ideal value	Value for Serbia in 2017
M	**ICT Use – Sub-index**	**y6+y7+y8**	**0.59**
y6	Internet users per 100 inhabitants	z6*0.33	0.22
y7	Fixed broadband Internet subscriptions per 100 inhabitants	z7*0.33	0.12
y8	Mobile broadband subscriptions per 100 inhabitants	z8*0.33	0.25
N	**ICT Skills – Sub-index**	**y9+y10+y11**	**0.77**
y9	Average years of schooling	z9*0.33	0.32
y10	Secondary gross enrolment ratio	z10*0.33	0.29
y11	Tertiary gross enrolment ratio	z11*0.33	0.16
IDI	**ICT DEVELOPMENT INDEX**	**((L*0.4)+(M*0.4)+(N*0.2))*10**	**6.94**

***the last available data (2016)**

Source: **The Statistical Office of the Republic of Serbia, RATEL (value for individual indicators); calculations: RATEL**

The value of IDI Index for the Republic of Serbia in 2017 is 6.94, which shows a slight growth compared with the previous year. The trend of IDI in the last 5 years is shown in Figure 32.

Figure 32. The trend of IDI for Serbia in the last 5 years

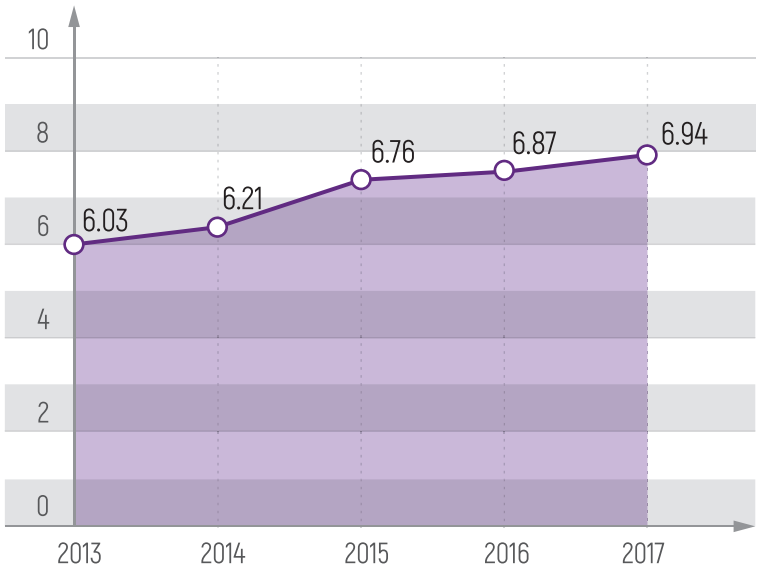
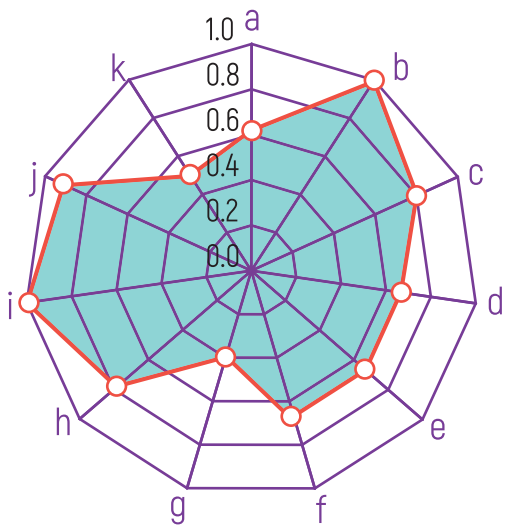


Figure 33 illustrates normalized values of 11 indicators with values ranging from 0 to 1. The value of ICT skills indicators (i to k) is satisfactory.

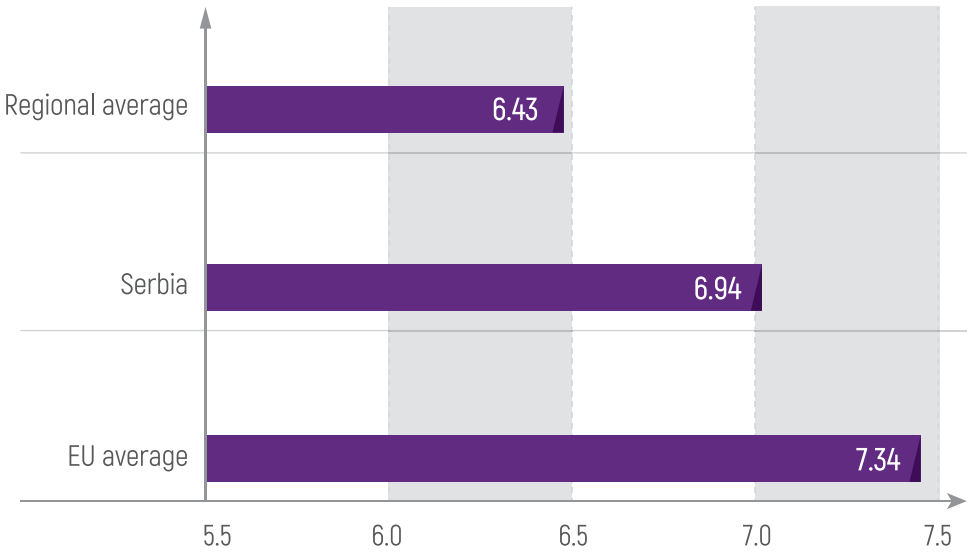
Figure 33. Graphical representation of 11 Indicators (normalized values)



Source: **RATEL**

According to ITU survey, the best ranked country in 2017 is Island with IDI value of 8.98 (in theory the range is 0 to 10). It is followed by the Republic Korea and Switzerland, whereas Eritrea is at the bottom of the list with 0.96. The average IDI value calculated for 176 countries in the world was 5.11.

Figure 34. Comparative overview of IDI value for Serbia, EU-member states and the region



Source: **RATEL (data for Serbia), ITU (data for other countries).**

Compared with the regional average (Romania, Bulgaria, Macedonia, Albania, Montenegro, Croatia, Slovenia, Bosnia and Herzegovina and Hungary), Serbia has a higher IDI value, which is however below the EU average, as shown in Figure 34.

PUBLIC FIXED TELECOMMUNICATIONS NETWORKS AND SERVICES

At the end of 2017, there were 39 operators registered for the public telephone service provision over fixed-line network.

The following operators are holders of the licence for public fixed telecommunications network and services:

- *Telecommunications Company "Telekom Srbija" Joint Stock. Co. holds a licence to build, own and operate a public fixed telecommunications network and provide public fixed telecommunications network services provision, issued in 2007, and a licence for public fixed wireless access (FWA) network in 411.875-418.125/ 421.875-428.125 MHz frequency bands and voice services, data transmission services and simultaneous voice and data transmission, issued on17 June 2009;*
- *Orion telekom, Ltd., Belgrade, (previously Media Works, Ltd.), who was issued a licence for public fixed wireless access (FWA) network in 411.875-418.125/ 421.875-428.125 MHz frequency bands and voice services, data transmission services and simultaneous voice and data transmission, in 2009;*
- *Telenor, Ltd., Belgrade, holds a licence for public fixed telecommunications network and services, issued in 2010.*

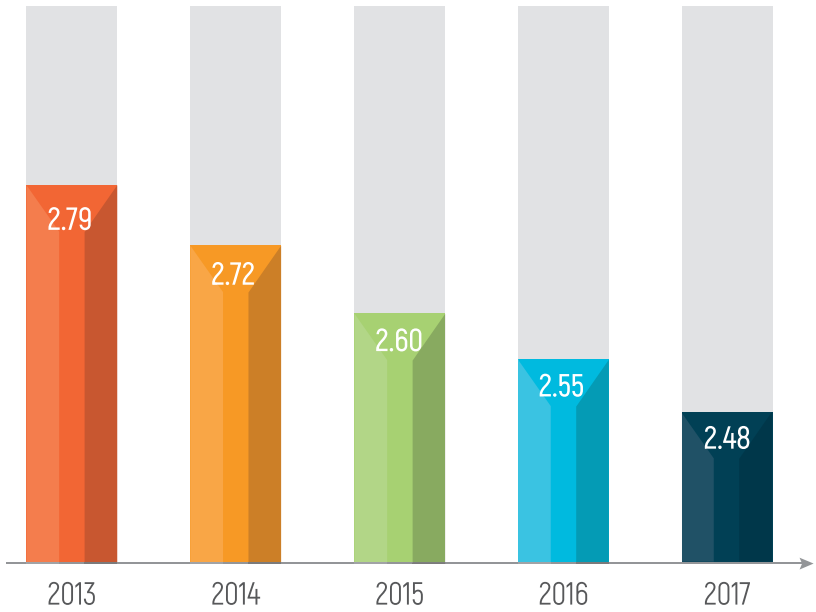
Pursuant to Art. 149 of the Law on Electronic Communications, since 1 January 2012 the provision of public fixed telecommunications network and services has been under the general authorization regime. Hence, in addition to the above licence holders, in 2017 public voice service via fixed network was also provided by another 25 operators, whereas other operators who mainly registered in 2017 have not started with the service provision by the end of the year.

In 2017, in the operators' register kept by RATEL, the number of public fixed wireless network stations of 294 remained the same (99 Orion telekom and 195 Telekom Srbija).

The number of fixed line subscribers continued to decrease, amounting to 2.48 million at the end of 2017. The number of subscribers includes users of electronic communications services provided at a fixed location via public mobile networks (Cellular Local Loop - CLL) which take up 0.2% of the

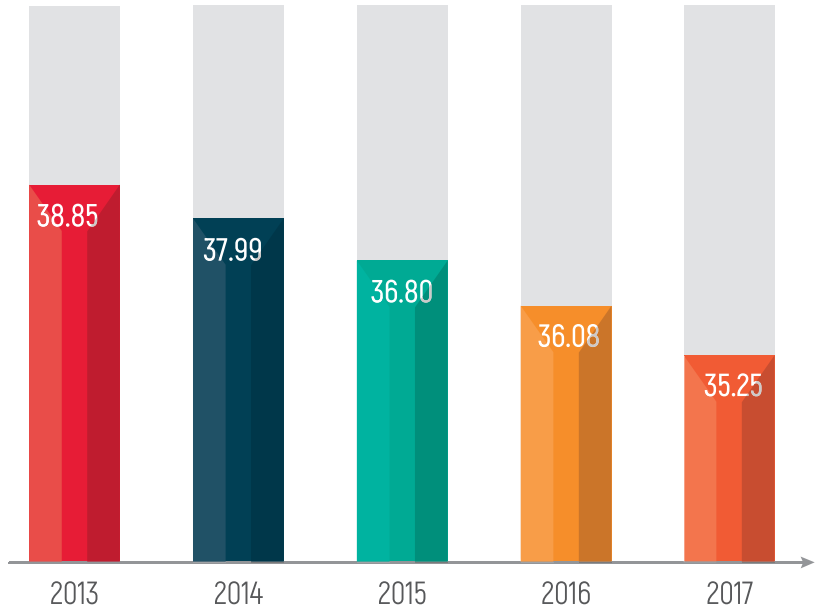
total number of subscribers. Residential users are still dominant with a 89% share in the total number of users. In 2017, the digitalization rate rose to 99.95% in Telekom Serbia's network, whereas all other operators have a 100% digitalization rate. The number of payphones continued to decrease, amounting to 2 631 in 2017.

Figure 35. Number of fixed network subscribers (million)



Source: **RATEL**

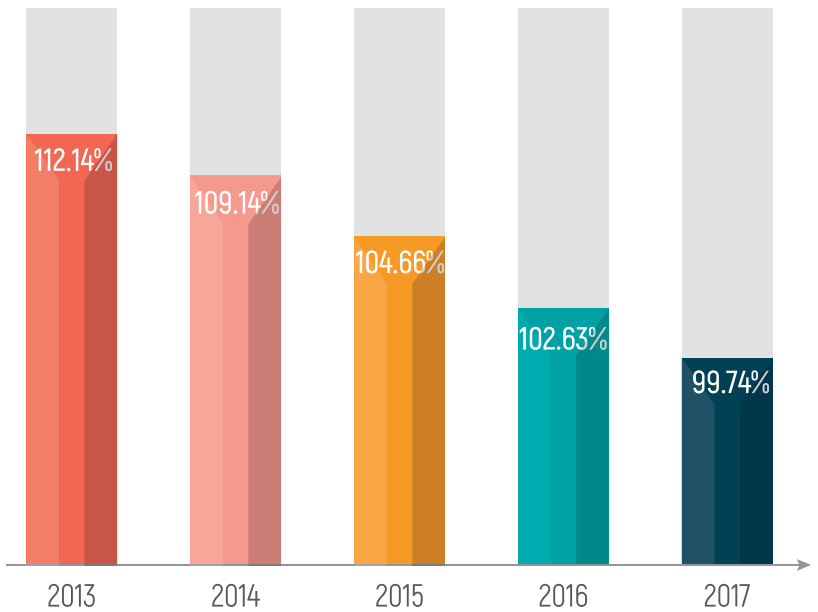
Figure 36. Fixed line penetration rate - users



Source: **RATEL**

In 2017, fixed line penetration rate was 35.25%.

Figure 37. Fixed line penetration rate - households



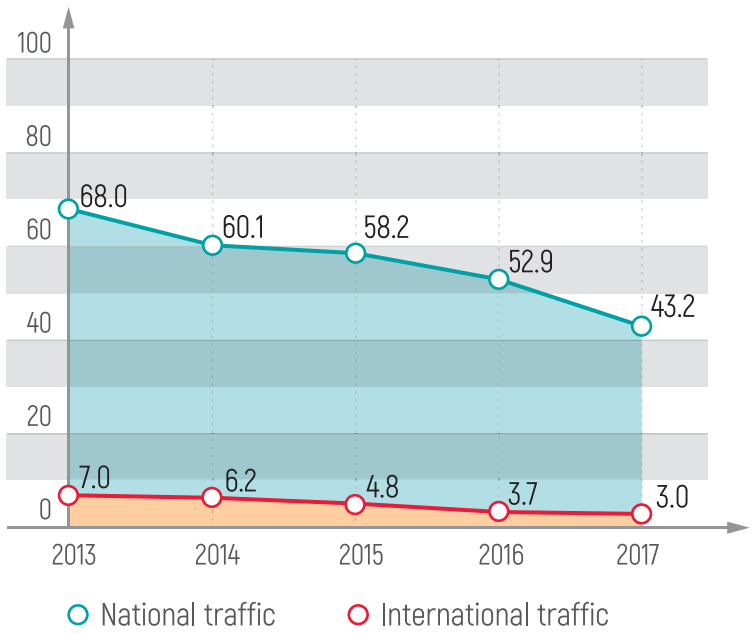
Source: **RATEL**

In 2017, fixed line penetration rate in terms of households was nearly 100%.

The number of ISDN subscribers in 2017 was approximately 35 thousand, which is by 14% less year on year. 5% of ISDN subscribers have primary rate access, whereas other users have a basic rate access. As expected, ISDN connections are following a downtrend, due to technological migration of users to advanced IP-based technologies.

The total traffic over fixed network in 2017 decreased by approximately 18% year on year, the national traffic being estimated to 4.3 billion of minutes and the international traffic to 300 million of minutes. As shown in Figure 38, the downward trend continued, mainly due to other types of services available. The biggest fall was seen in traffic made within the home network, by almost 24%. The traffic made to other fixed networks was increased by 19% due to user fluctuation and migration to other networks. International traffic, with 19% of minutes less than in the previous year, continues to drop, due to the increasing trend of using VoIP applications.

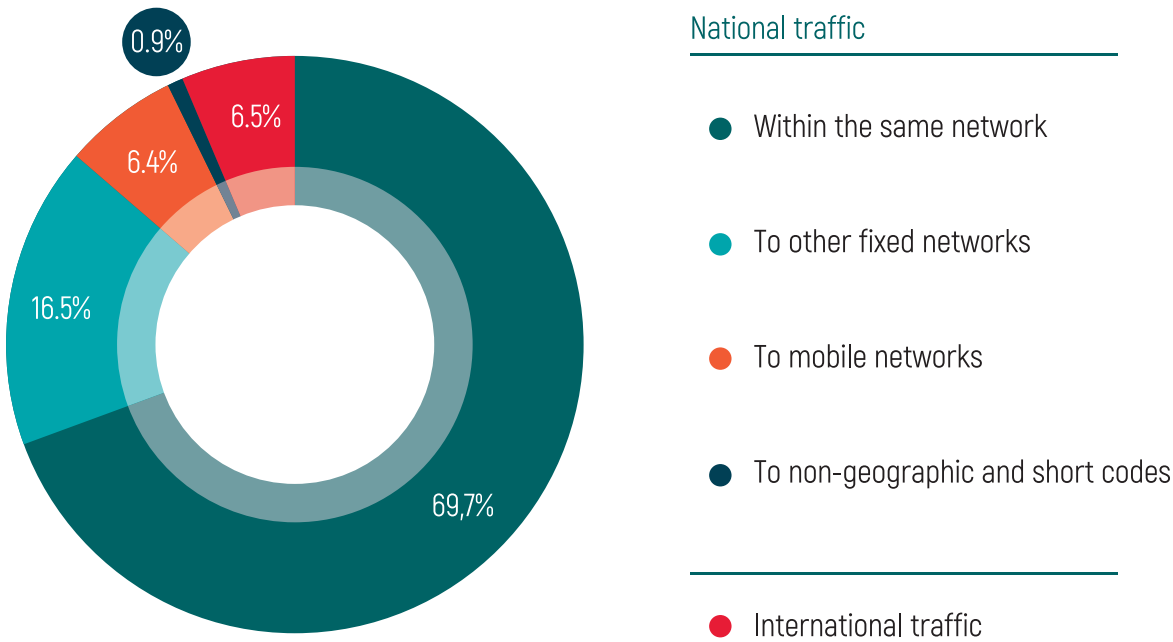
Figure 38. Total traffic (in hundreds million minutes)



Source: **RATEL**

Despite its gradual decrease, the biggest share in the total traffic has been the traffic made within the same network (69.7%), whereas the least traffic was made to non-geographic numbers and short codes (less than 1%). The distribution of the fixed network traffic in 2017 is given in Figure 39. The traffic to non-geographic numbers and short codes comprises minutes to own and other fixed networks, whereas the international traffic includes telephony traffic made from fixed to foreign operators' mobile networks.

Figure 39. Fixed network traffic distribution in 2017



Source: **RATEL**

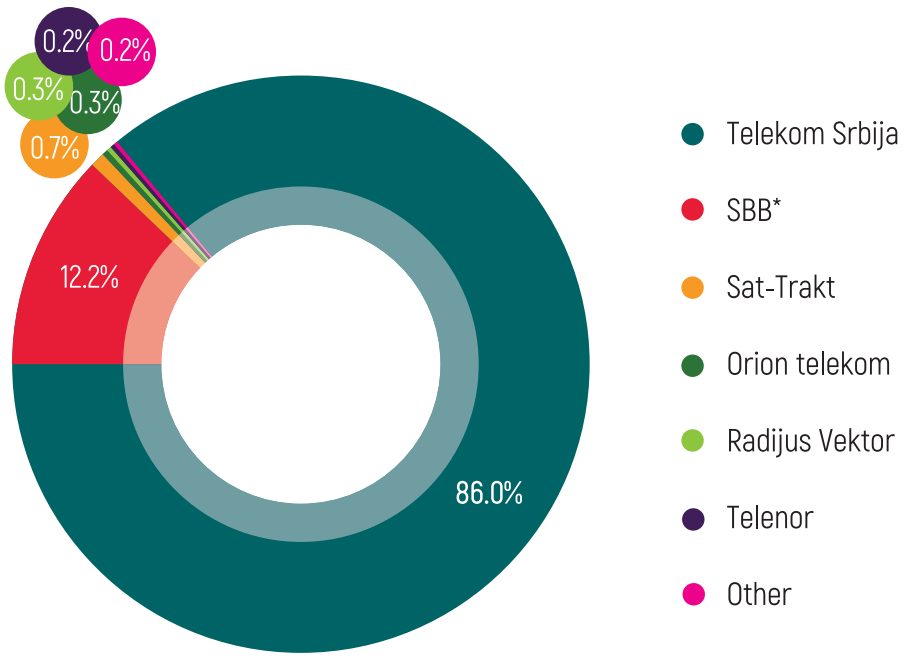
The average duration was 3.78 minutes for a call made within the same network, 1.53 minutes for a call made to mobile network and 4 minutes for an international call.

The total number of VoIP operators at the end of 2017 was approximately 41.5 thousand, which is a 26% decrease year on year. There were 8.2 million of minutes of traffic and there were 99 million minutes of international transit.

Telekom Srbija is still the largest active operator of the fixed telecommunications network, hence its business activities had the biggest impact on the fixed telephony market in 2017. In addition to the Serbian market, Telekom Srbija is also present in the Republic of Srpska and Montenegro.

In 2017, SBB increased the number of users of the public telephone service provided over its own public fixed telecommunications network. Operators Sat-Trakt and Radijus Vektor also had a significant increase in the number of users. Market share of fixed network operators, in terms of number of fixed lines, is given in Figure 40.

Figure 40. Market share of fixed network operators

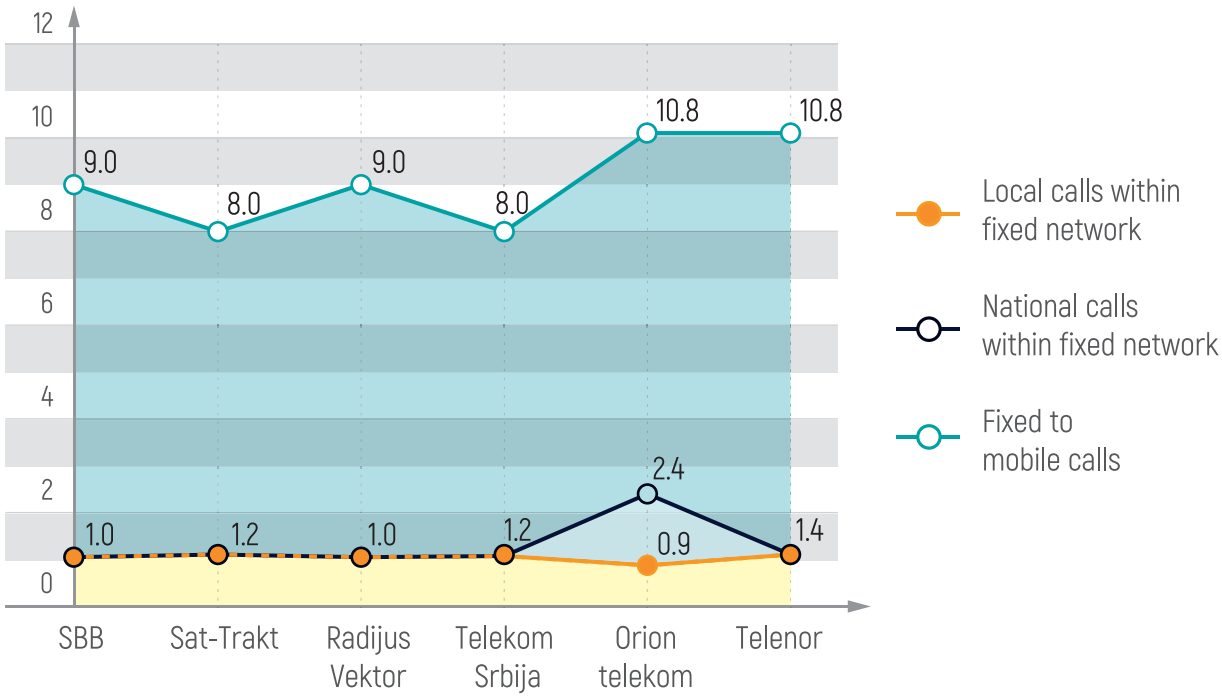


*The data for SBB include the data for I.KOM, following the merger which is official as of 3 January 2018.

Source: **RATEL**

Per-minute rates for the local and national calls and for calls to mobile networks of the operators with the biggest number of subscribers are given in Figure 41. The rates ranged between 1 and 2.4 dinars per minute for local and national calls, and between 8 and 10.8 dinars per minute for calls made to mobile networks.

Figure 41. Local, national and fixed-to-mobile telephone service rates in 2017, VAT included (RSD/min)

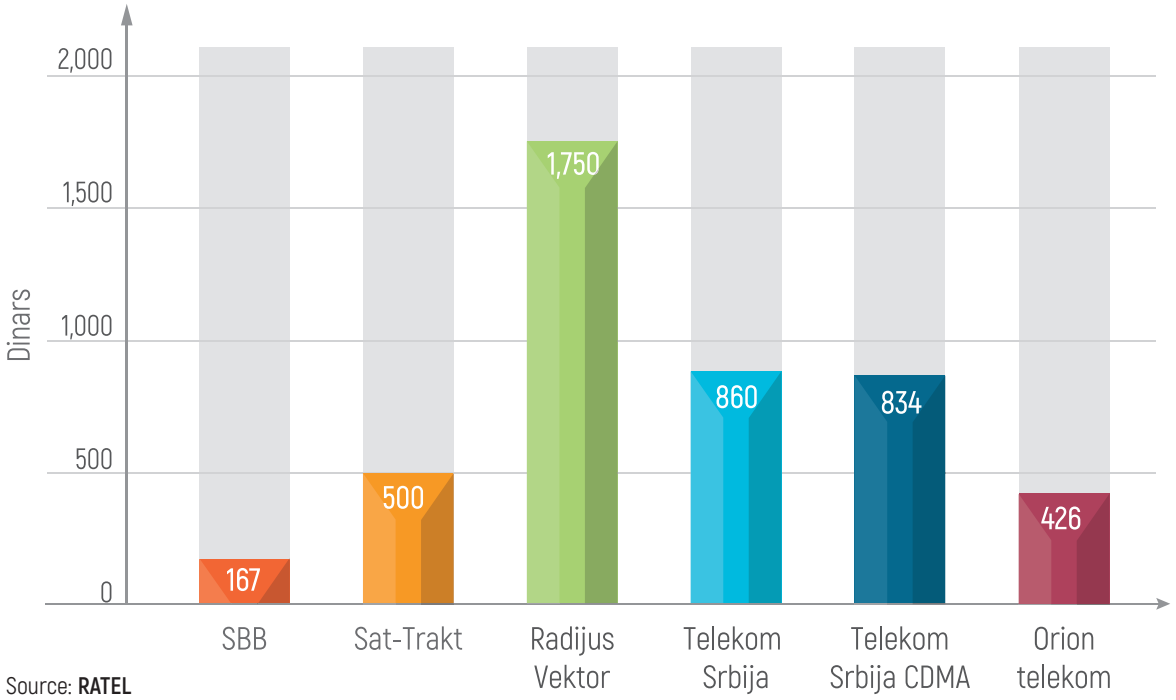


Source: **RATEL**

The rates for the international calls have not been significantly modified compared with the previous year. The information on the rates is available on the official websites of the operators.

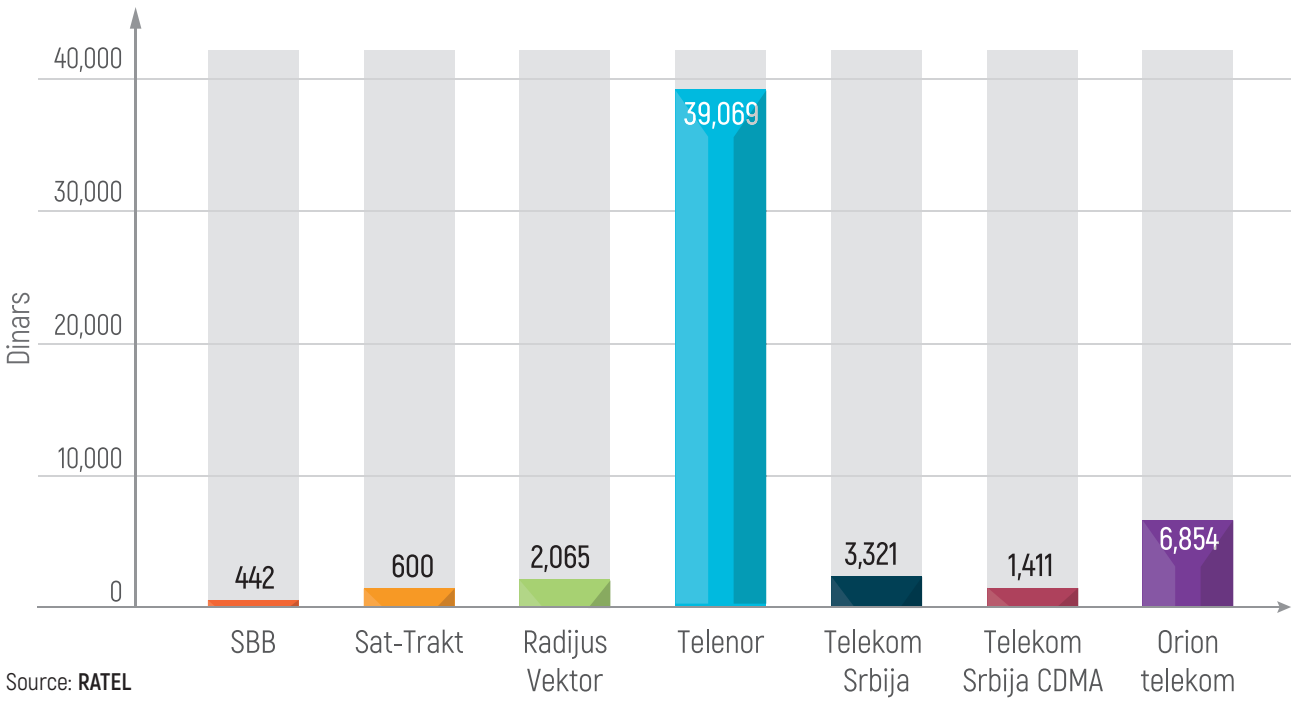
Average monthly bill charges by the operators with most users ranged between 167 and 1,750 dinars for residential users and between 442 and 30,069 dinars for business users. Average monthly bills charged to residential and business users are given in Figures 42 and 43.

Figure 42. **Average monthly bills charged to residential users (in dinars)**



Source: **RATEL**

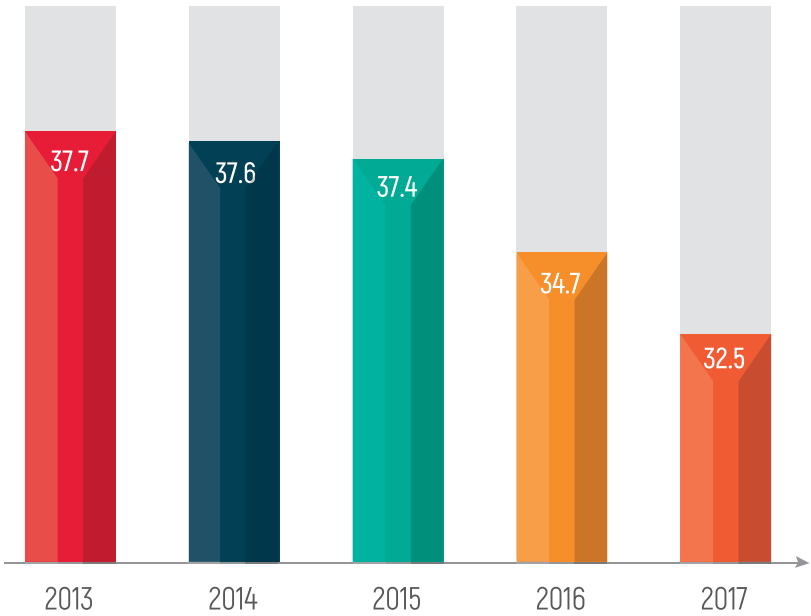
Figure 43. **Average monthly bills charged to business users (in dinars)**



Source: **RATEL**

The total revenue from fixed telephone services provided by all operators in the territory of the Republic of Serbia in 2017 were by 6% lower compared to the previous year, amounting to 32.5 billion dinars, including the revenues made from VoIP services in the amount of 1.2 billion dinars. The investments made in the fixed telephony services in 2017 amounted to approximately 8 billion dinars, which is by 12% more compared with the previous year.

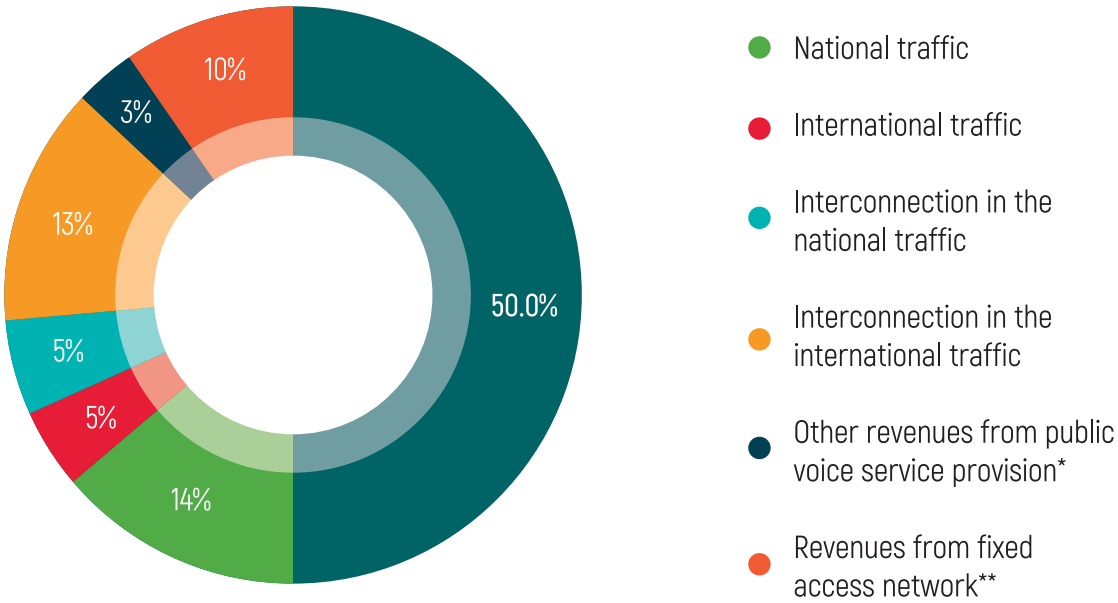
Figure 44. Revenues from fixed telecom network services (billion dinars)



Source: **RATEL**

The largest share in the total revenues goes to the subscription charges in the amount of 15.6 billion dinars, accounting for almost one half of total fixed network service revenues in 2017. The revenues made from the national traffic, in the amount of 4.3 billion, and the international traffic, in the amount of 1.4 billion, both dropped, by 19% and 18% respectively, due to reduced number of users and minutes of calls compared with the previous year, however their share in the total revenues remains roughly the same. The revenues from interconnection in 2017 include the revenues from interconnection in the national and international traffic, which dropped by 2% and 19%, respectively.

Figure 45. Structure of revenues from fixed telecom network in 2017



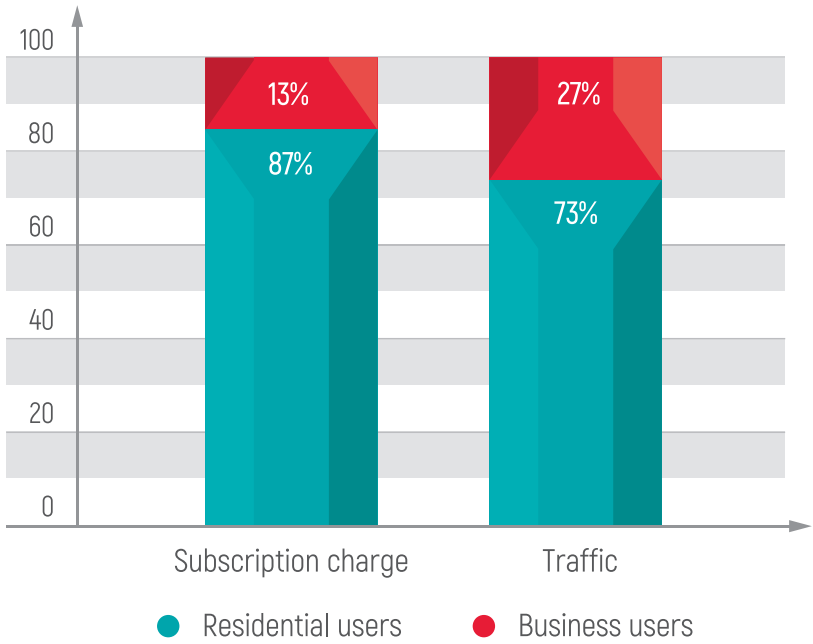
* Other revenues from public voice service provision include revenues from: special services on fixed network, connection fees, VAS, public payphones, etc.

**Revenues from fixed access network include revenues from: data transmission, leased capacities on national market, international data transmission and leased capacities, LLU (full or shared) co-location, leased cable ducts, etc.

***Revenues of I.KOM operator are included in the total revenue previously referred to in the text, however they have not been included in the diagram since revenue breakdown is not available for this operator.

Source: **RATEL**

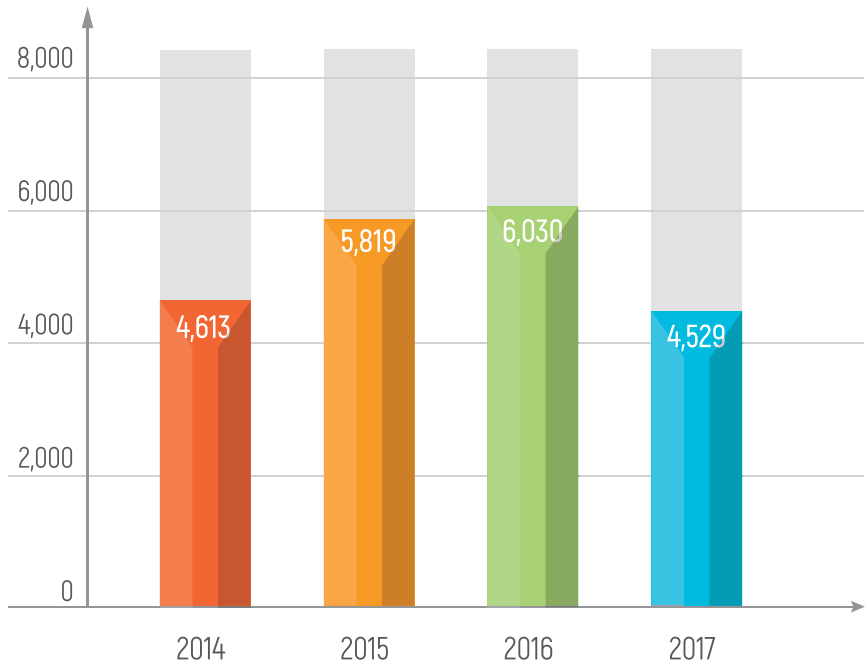
Figure 46. Share of residential and business users in the revenues made from subscription charge and traffic made



Source: **RATEL**

Figure 46 shows the share of residential and business users in the revenues from subscription charge and traffic made.

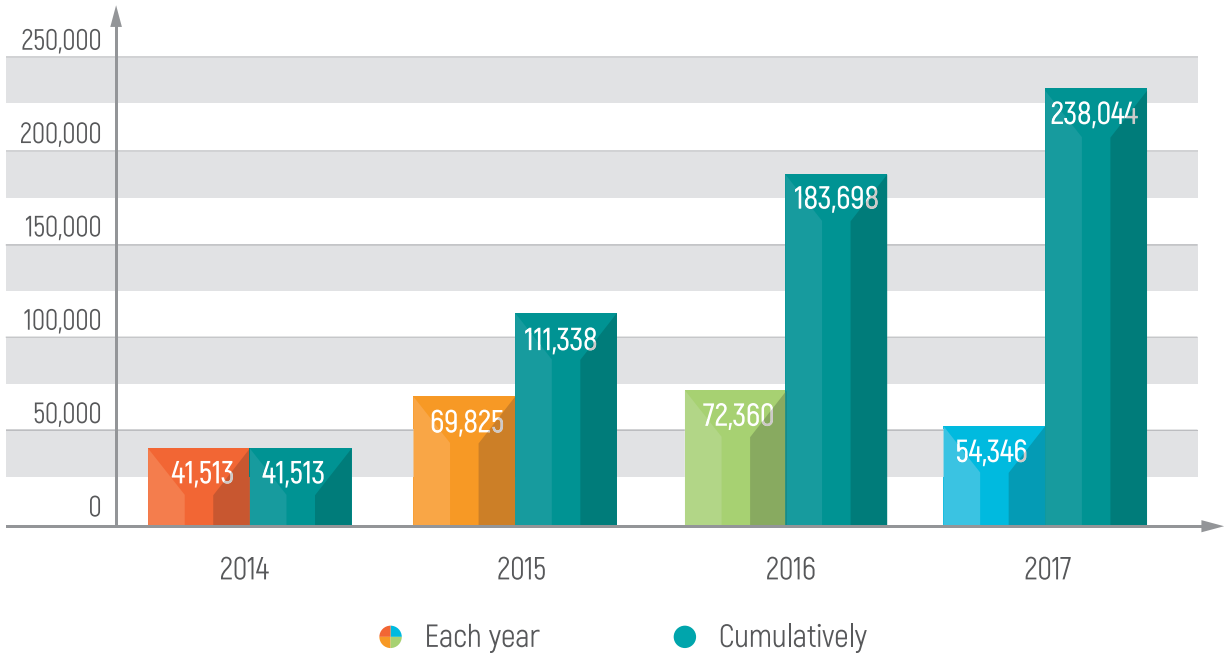
Figure 47. Monthly average of ported numbers each year



The interest in the number portability service on public telephone networks, available since 1 April 2014, showed a slight decrease, the monthly average of ported numbers being 4529.

During 2017, there were 54,346 fixed line subscribers who changed the operator while keeping the same number, so that the total of ported numbers amounted 238,044 at the end of 2017 (Figure 48).

Figure 48. Portings made each year and in total



Source: **RATEL**

PUBLIC MOBILE TELECOMMUNICATIONS NETWORKS AND SERVICES

Mobile telephony services in the Republic of Serbia were provided by the following three operators in 2017:

- ***Telecommunications Company Telekom Srbija Joint Stock Co. - Mobilna telefonija Srbije MTS**, 58.11% owned by the Republic of Serbia – the Government of the Republic of Serbia, 20% owned by Telekom Srbija, 14.95% owned by the citizens of the Republic of Serbia and 6.94% owned by the current and former employees of Telekom Srbija and its predecessor[2];*
- ***Telenor Ltd., Belgrade.**, 100% owned by PPF TMT Bidco 1 B.V., the Netherlands*
- ***Vip mobile Ltd.**, 100% in the ownership of Mobilkom CEE Beteiligungsverwaltung GmbH, Austria.*

All three operators were granted licences for public mobile telecommunications networks and public mobile telecommunications network services in accordance with GSM/GSM1800 and UMTS/IMT-2000 standards, issued by RATEL. The licences were issued for the territory of the Republic of Serbia, for a period of 10 years, and in 2016 they were extended for another 10 years.

In 2016 two virtual mobile operators were also registered Mundio Mobile d.o.o. and Globaltel.

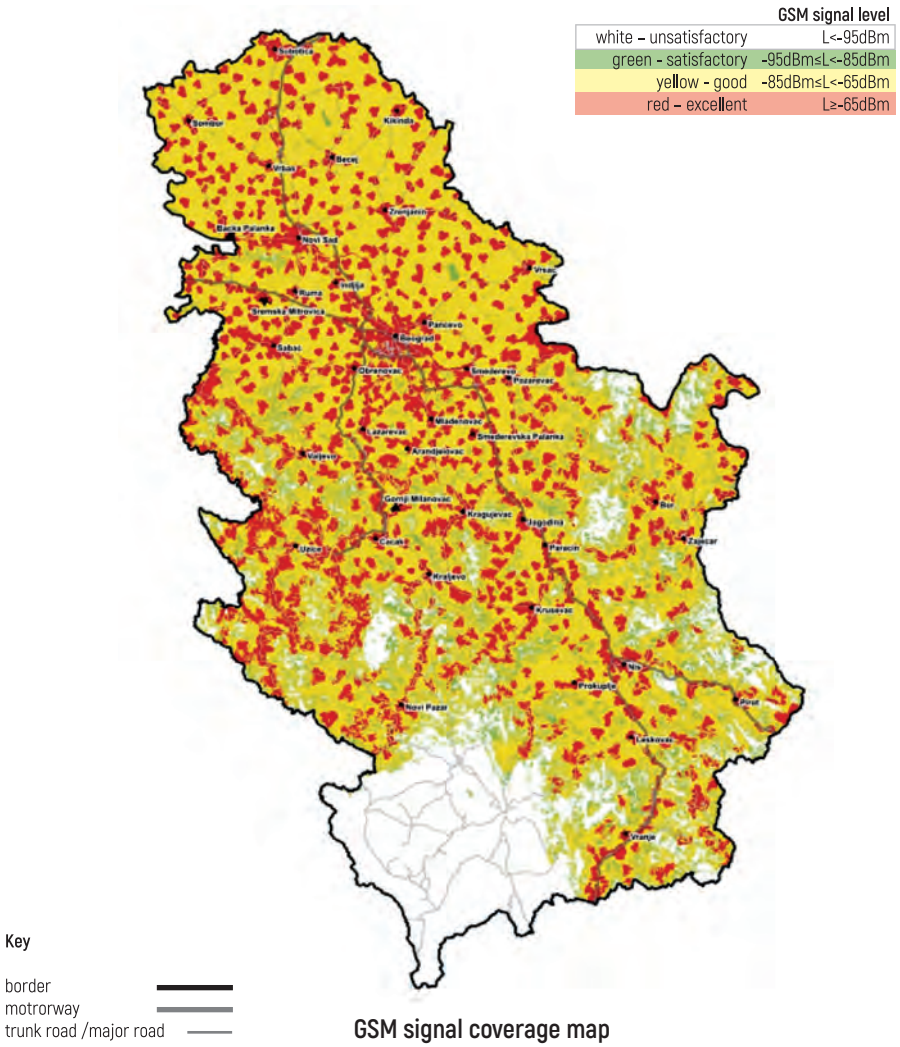
4G network was launched in 2015 in the Republic of Serbia. In the beginning of 2015, the public bidding procedure for the issuance of individual licences for the usage of radio frequencies in the 1710-1785/1805-1880 MHz frequency bands, in which all three mobile operators had participated, was completed. In March 2015, individual decisions were awarded to all three operators, granting the usage of two 5 MHz-radio frequency blocks, each. The requirements were thus met for the 4G mobile technology to be launched, enabling better coverage and faster Internet on the territory of the Republic of Serbia. In the second half of 2015, public bidding procedure for the issuance of individual licences for the usage of radio frequencies in the 791-821/832-862 MHz frequency bands in the territory of the Republic of Serbia, in which all three mobile operators had participated, was successfully carried out. Upon the completed procedure, in January 2016 individual decisions were awarded to all three operators, granting the usage of two 10 MHz-radio frequency blocks, each, in the 791-821/832-862 MHz frequency bands.

2 Source: **www.mts.rs**

Telenor has been in the Serbian telecoms market since 2006, when it purchased the company Mobi 63 (ex Mobitel) established in 1994. In 2018 the ownership structure changed, since Telenor Group sold its business in Central and Eastern Europe, consisting of subsidiaries in Bulgaria, Hungary, Serbia and Montenegro and Telenor Common Operation Serbia, to PPF Group. As part of the regional transaction, PPF Group purchased 100% of shares in Telenor Ltd.

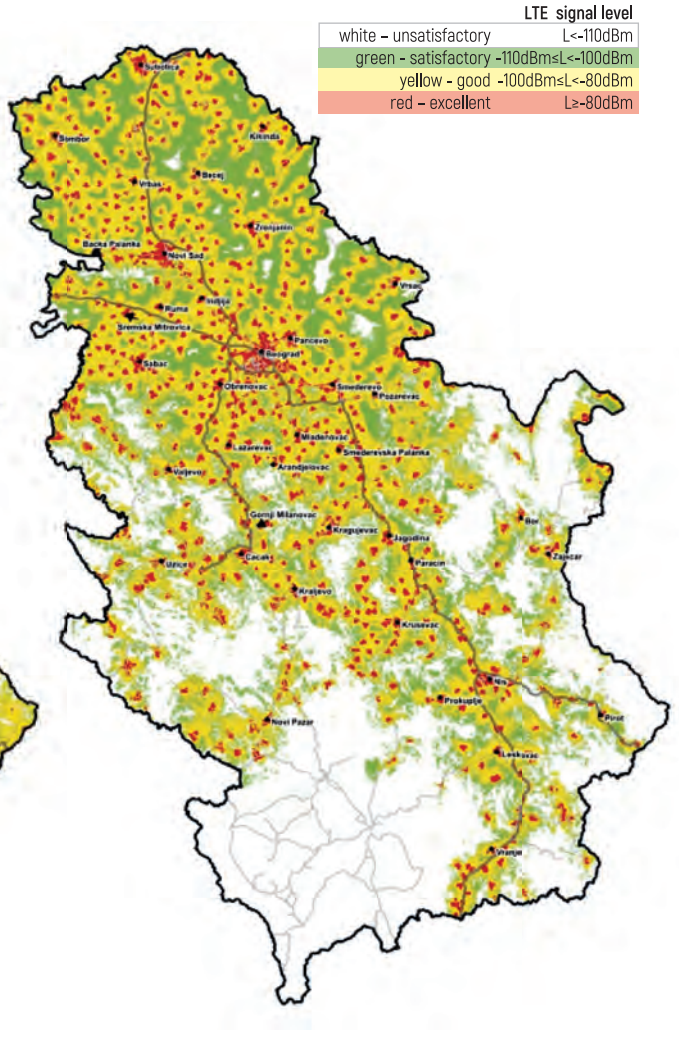
The coverage maps for Telenor, as on 21 December 2017, are given in Figure 49.

Figure 49. Mobile operator – Telenor



GSM signal coverage map

UMTS signal coverage map



LTE signal coverage map

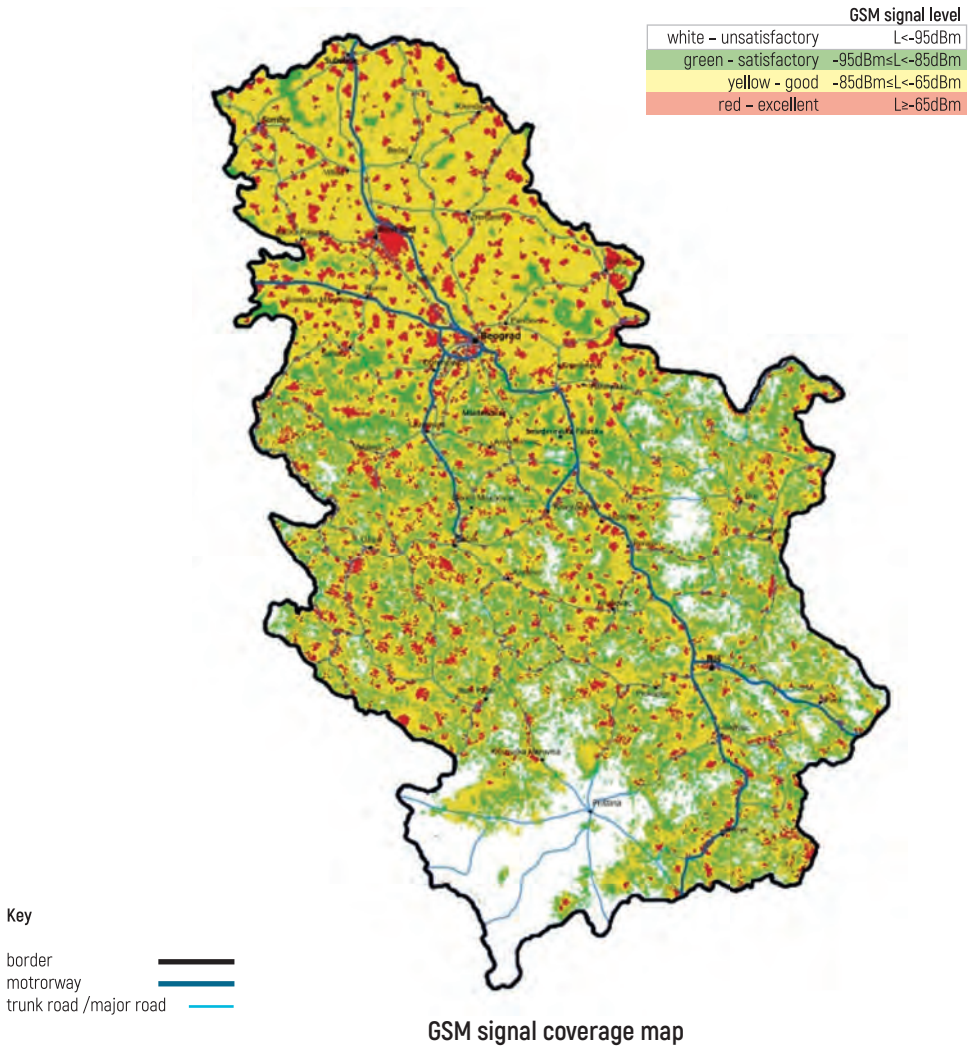
Official data

Name	Telenor Ltd.
Head office	Belgrade
Ownership	100% owned by PPF TMT Bidco 1 B.V., the Netherlands
Percentage of territory covered by GSM network signal	91.90%
Percentage of population covered by GSM network signal	99.42%
Percentage of territory covered by UMTS network signal	91.02%
Percentage of population covered by UMTS network signal	98.67%
Percentage of territory covered by LTE network signal	67.79%
Percentage of population covered by LTE network signal	93.80%

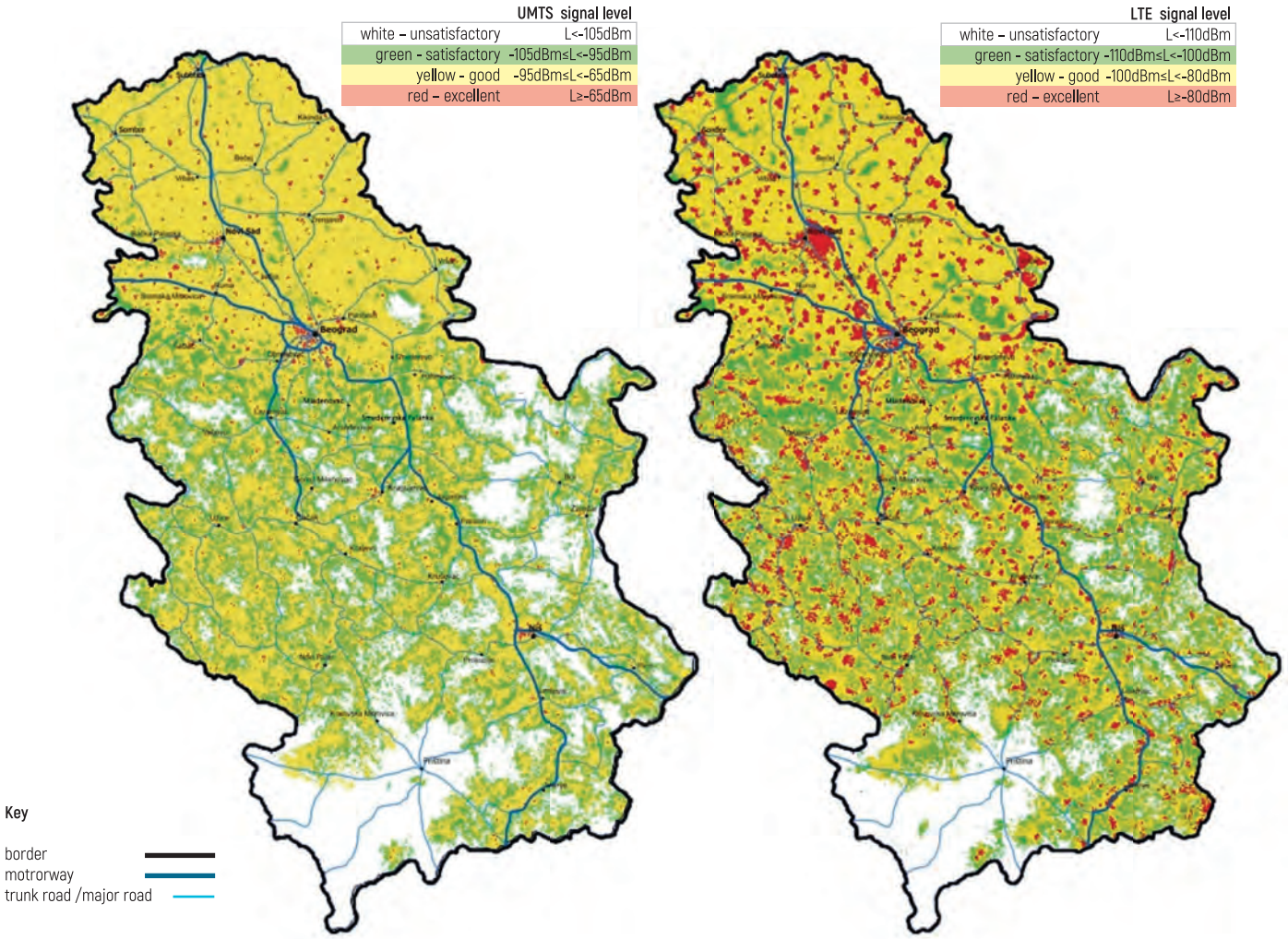
Source: **Telenor d.o.o.**

Telekom Srbija Joint Stock Co. has been providing mobile telephony services since 1998. In addition to Serbian market, Telekom Srbija is also present as a mobile operator in the region, in Bosnia and Herzegovina and Montenegro. The coverage maps for Telekom Srbija are given in Figure 50.

Figure 50. Mobile operator – Telekom Srbija



GSM signal coverage map



UMTS signal coverage map

LTE signal coverage map

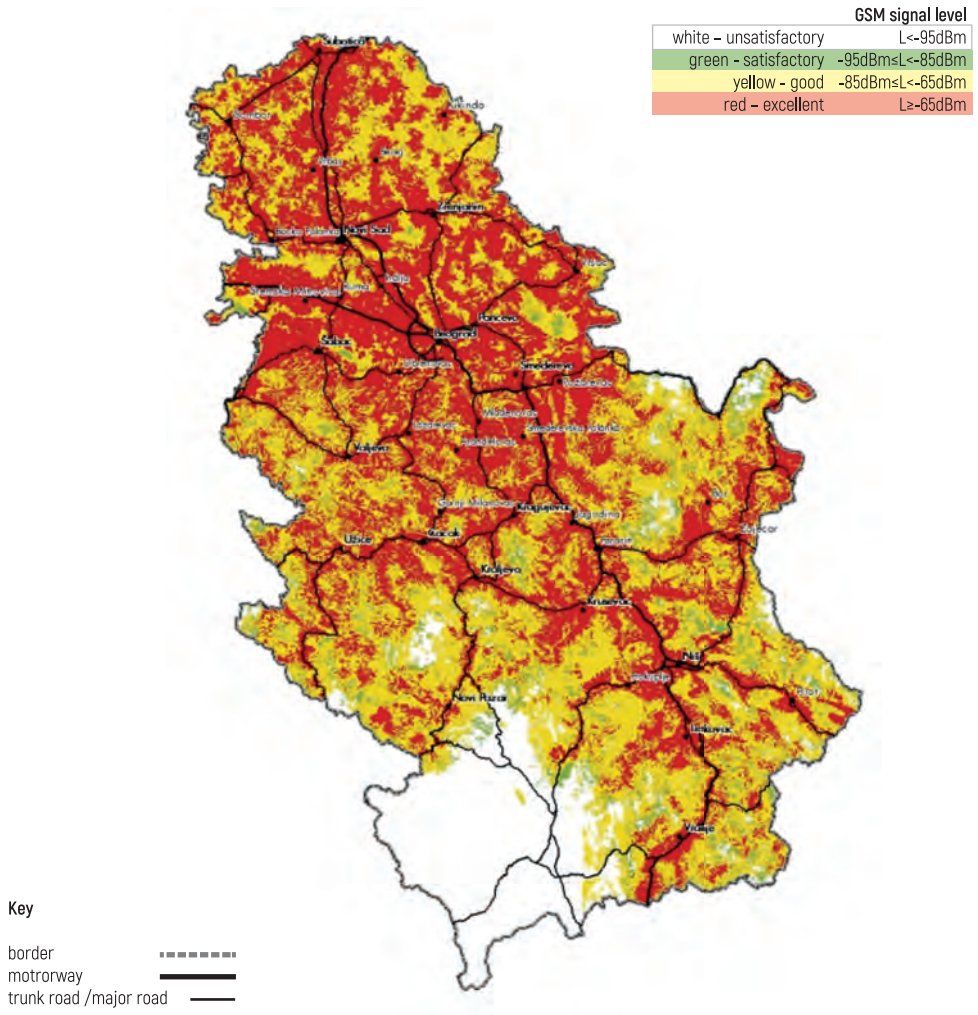
Official data

Name	Telecommunications company "Telekom Srbija" Joint Stock Co.
Head office	Belgrade
Ownership	58.11% the Republic of Serbia, 20% Telekom Srbija, 14.95% the citizens of the Republic of Serbia and 6.94% current and former employees of Telekom Srbija and its predecessor.
Percentage of territory covered by GSM network signal	90.68%
Percentage of population covered by GSM network signal	99.76%
Percentage of territory covered by UMTS network signal	85.82%
Percentage of population covered by UMTS network signal	97.68%
Percentage of territory covered by LTE network signal	49.46%
Percentage of population covered by LTE network signal	85.31%

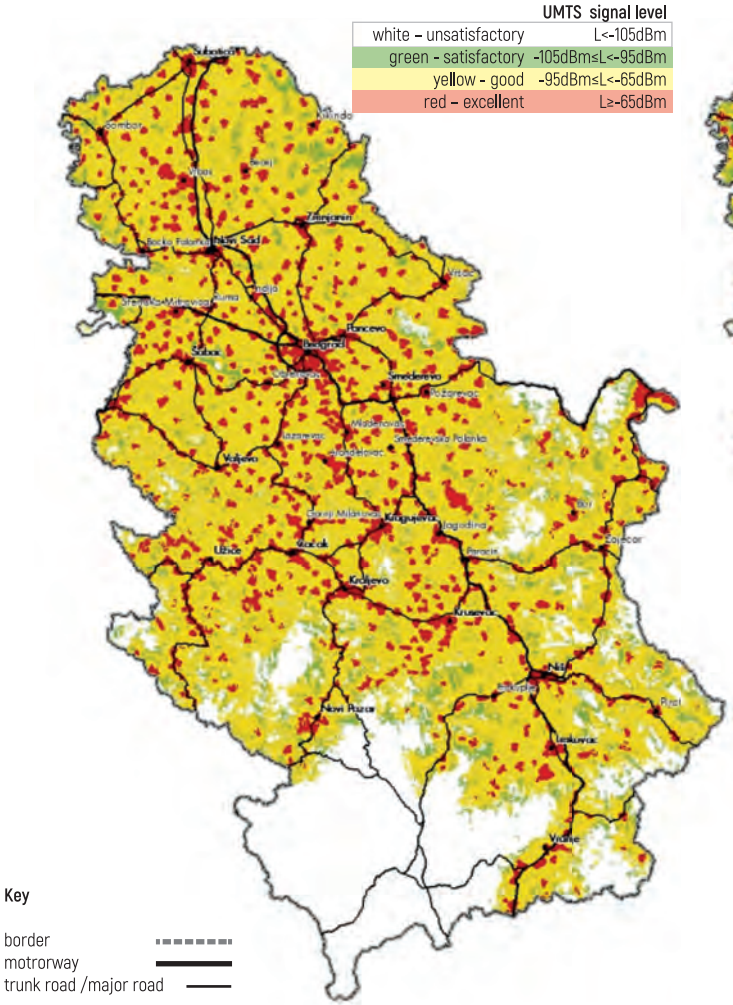
Source: **Telekom Srbija a.d.**

Vip mobile Ltd. is a member of the Telekom Austria Group, present in 7 European countries, including the following countries in the region: Croatia, Bulgaria and Macedonia. Vip mobile has been present in the Serbian market since 2006. The coverage maps for Telekom Srbija are given in Figure 51.

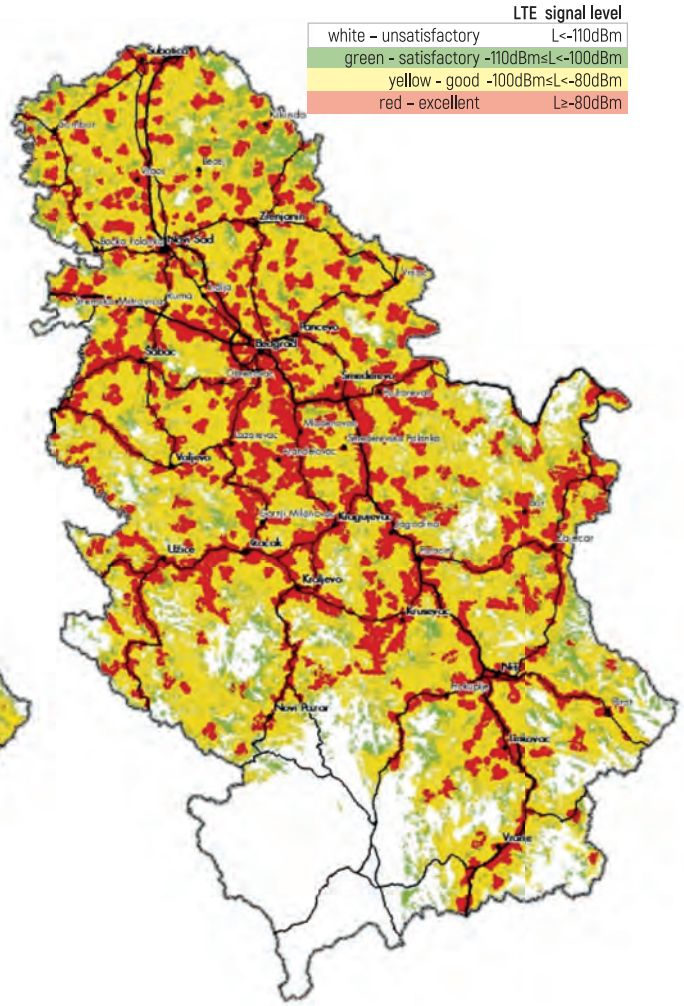
Figure 51. Mobile operator – Vip mobile



GSM signal coverage map



UMTS signal coverage map



LTE signal coverage map

Official data

Name	Vip mobile Ltd.
Head office	Belgrade
Ownership	100% Mobilkom CEE Beteiligungsverwaltungs GmbH, Austria
Percentage of territory covered by GSM network signal	88.9%
Percentage of population covered by GSM network signal	99.2%
Percentage of territory covered by UMTS network signal	75.3%
Percentage of population covered by UMTS network signal	97.1%
Percentage of territory covered by LTE network signal	66.3%
Percentage of population covered by LTE network signal	94.4%

Source: **Vip mobile d.o.o.**

Table 12. An overview of wireless access network on 31.12.2017 for all three operators

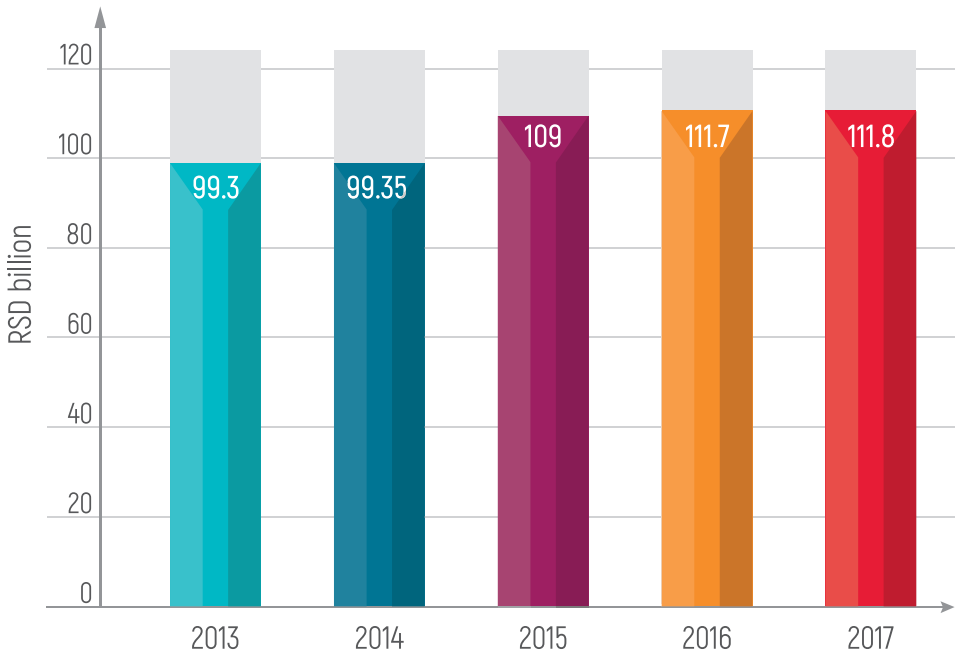
I		TELEKOM SRBIJA	TELENOR	VIP MOBILE
1.	Total number of sites with base stations	2,517	2,051	1,822
2.	Raw land sites (RL)	1,518	1,188	1,088
3.	Rooftop sites (RT)	954	826	711
4.	Indoor sites	35	16	18
5.	RL +RT sites	10	21	5
II				
6.	ADAS indoor	3	0	1
7.	DAS indoor	38	36	21
8.	ADAS + DAS indoor	4	1	1
III				
9.	GSM base station sites (all frequency ranges)	1,952	1,987	1,816
10.	GSM1800 network base stations	25	32	840
11.	GSM900 network base stations	1,659	1,454	385
12.	GSM900+GSM1800	268	501	591
IV				
13.	UMTS network base stations	2,381	2,036	1,784
14.	UMTS2100 network base stations	2,375	62	1,780
15.	UMTS900 network base stations	6	289	2
16.	UMTS900 + UMTS2100 network base stations	0	1,685	2

V		TELEKOM SRBIJA	TELENOR	VIP MOBILE
17.	LTE network base stations	1,127	1,620	1,582
18.	LTE800 network base stations	371	1,148	668
19.	LTE1800 network base stations	714	199	802
20.	LTE800 + LTE1800 network base stations	42	273	112
VI				
21.	Indoor repeater sites	430	211	162
22.	Indoor GSM repeater sites	83	8	23
23.	Indoor UMTS repeater sites	227	22	55
24.	Indoor dual repeater sites (GSM + UMTS)	120	171	2
25.	Indoor LTE repeater sites	0	0	0
26.	Indoor dual/triple repeater sites (LTE+GSM/UMTS)	0	10	82
VII				
27.	Outdoor repeater sites (only remote if different from donor)	21	13	0
VIII				
28.	WiFi sites	803	15	0
29.	Indoor WiFi sites	363	0	0
30.	Outdoor WiFi sites	247	14	0
31.	Indoor + outdoor WiFi sites	193	1	0

IX		TELEKOM SRBIJA	TELENOR	VIP MOBILE
32.	GSM900 base radio stations	1,927	1,973	976
33.	GSM1800 base radio stations	293	541	1,431
34.	UMTS900 base radio stations	6	1,986	4
35.	UMTS2100 base radio stations	2,375	1,783	1,782
36.	LTE800 base radio stations	413	1,423	780
37.	LTE1800 base radio stations	756	484	914
38.	WiFi AP	1,756	15	0
39.	Indoor WiFi AP	1,080	1	0
40.	Outdoor WiFi AP	676	14	0
41.	Indoor repeaters	430	243	0
42.	Outdoor repeaters	21	13	0

The revenues from mobile networks in 2017 amounted to around 111.8 billion dinars or 922 million euros. Observed in the national currency (RSD), the revenues increased by 0.1% year on year, whereas the revenues observed in euros increased by 1.6%. The difference in the revenues in the two currencies is a consequence of increase in the average exchange rates for euro in 2017, compared with the previous year.

Figure 52. The total revenues from the mobile telephony (RSD billion)



*includes revenues from mobile data traffic, amounting to 3.97 million dinars in 2017.

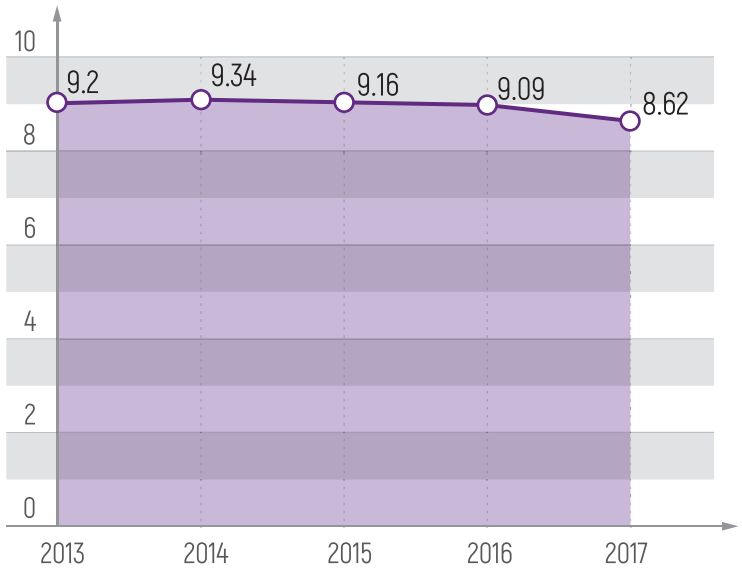
Source: **RATEL**

Investments in this market segment increased by 21% compared with the previous year, amounting to 13.5 billion dinars.

The total number of mobile users dropped by 5.2% year on year, amounting to 8,621,771 at the end of 2017. The total number of users has been decreasing in the past two years, due to a decrease in the number of prepaid users. Nonetheless, the volume of outgoing voice traffic in minutes is increasing.

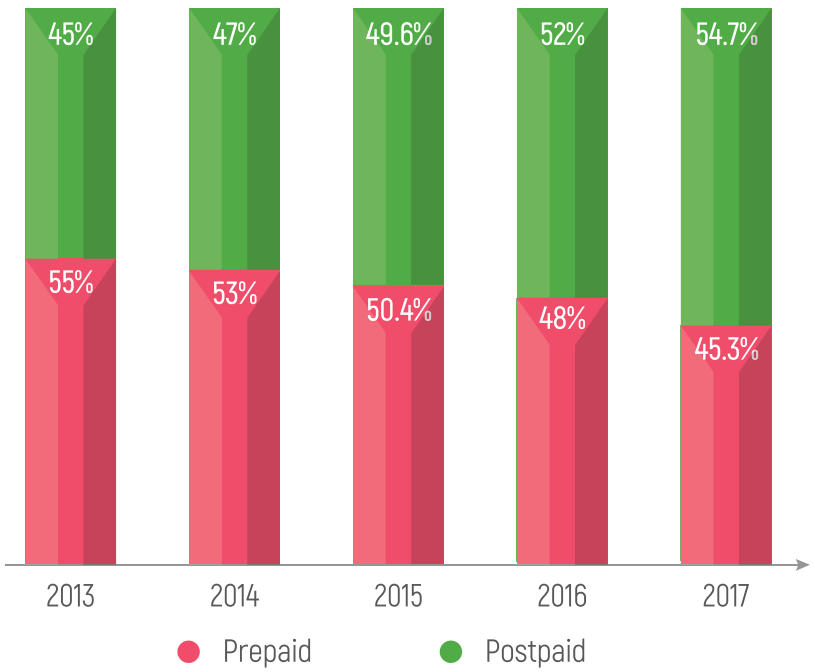
Figure 53 shows changes in the total number of users in the previous period.

Figure 53. Total number of active mobile telephony users (million)



Source: **RATEL**

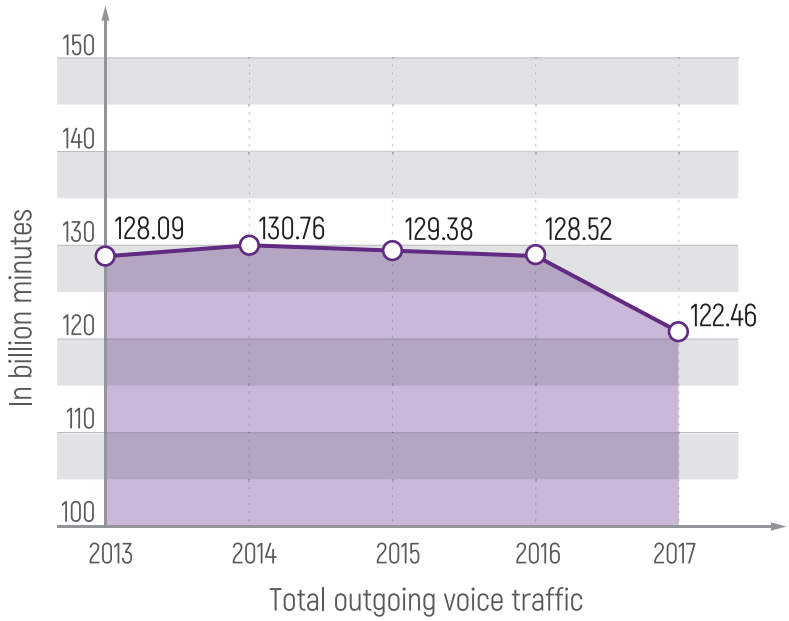
Figure 54. Prepaid/postpaid users ratio



Source: **RATEL**

The total number of users consists of postpaid and prepaid users active in the last three months of the observed year. The share of the prepaid and postpaid users is given in Figure 54. In 2016 the number prepaid users exceeded the number of postpaid users for the first time and this trend continued in 2017 with a share of 54.7%.

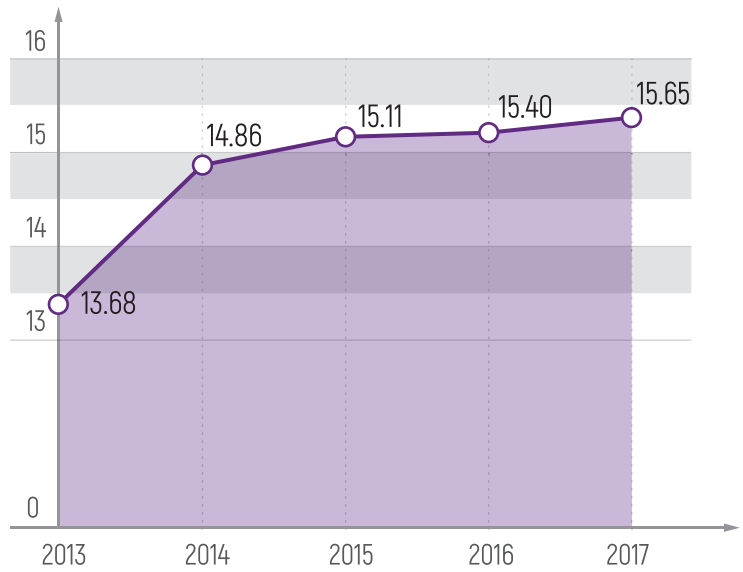
Figure 55. Prepaid/postpaid users ratio



Source: **RATEL**

The number of mobile network users is again higher than the number of inhabitants in 2017, the mobile penetration rate being 122.46%. This indicates that some people are using more than one mobile number.

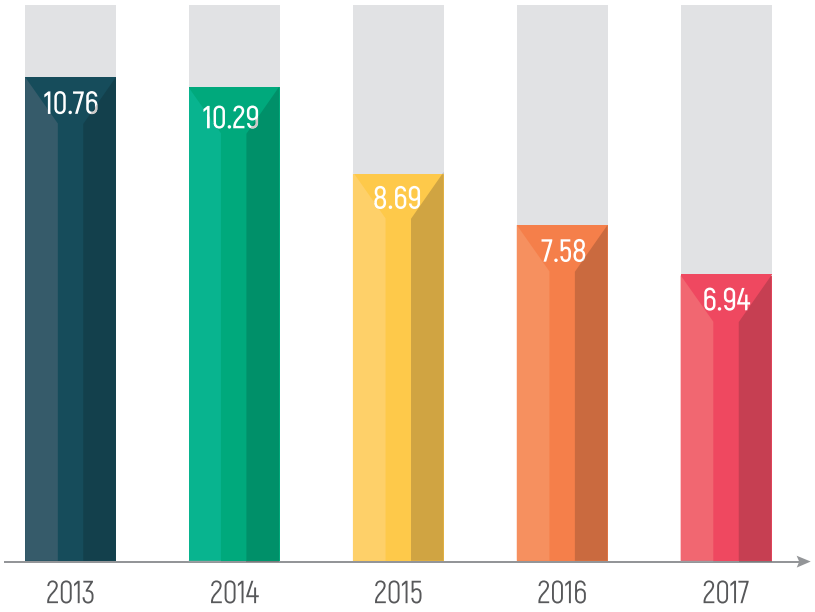
Figure 56. Total outgoing traffic (billion minutes)



Source: **RATEL**

The minutes of calls made from mobile networks are constantly increasing year after year. In 2017, the total outgoing traffic on the mobile network amounted to 15.65 billion minutes, which is an increase 1.6% compared with the previous year when it amounted to 15.4 billion minutes. The annual average of traffic per user in 2017 was 1 815 minutes or approximately 4 minutes and 58 seconds a day.

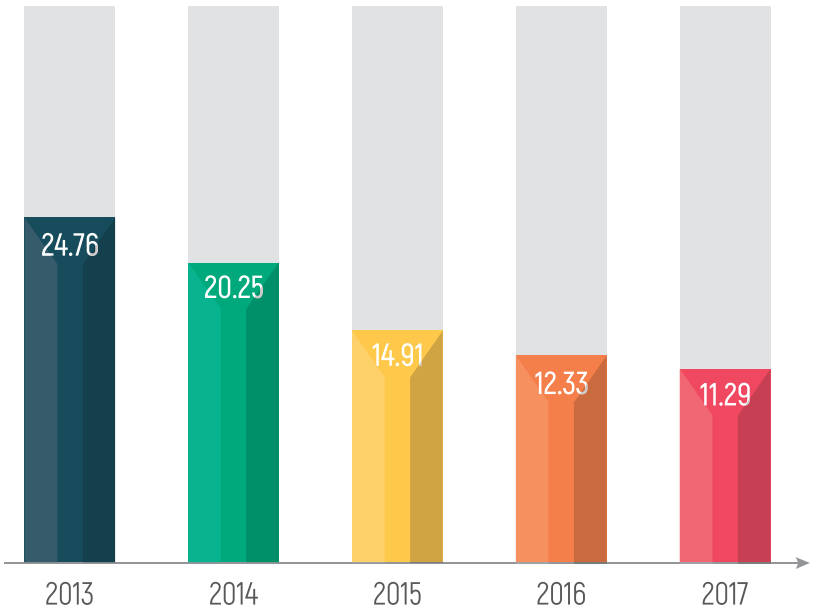
Figure 57. Number of sent text (SMS) messages (billion)



Source: **RATEL**

The number of sent text messages continued to decrease. In 2017, the total of 6.94 billion SMS messages were sent, which is a decrease by 8.4% compared with 2016 when 7.58 billion SMS messages were sent. The average number of text messages sent in 2017 per user was 805, or 2.2 SMS messages a day.

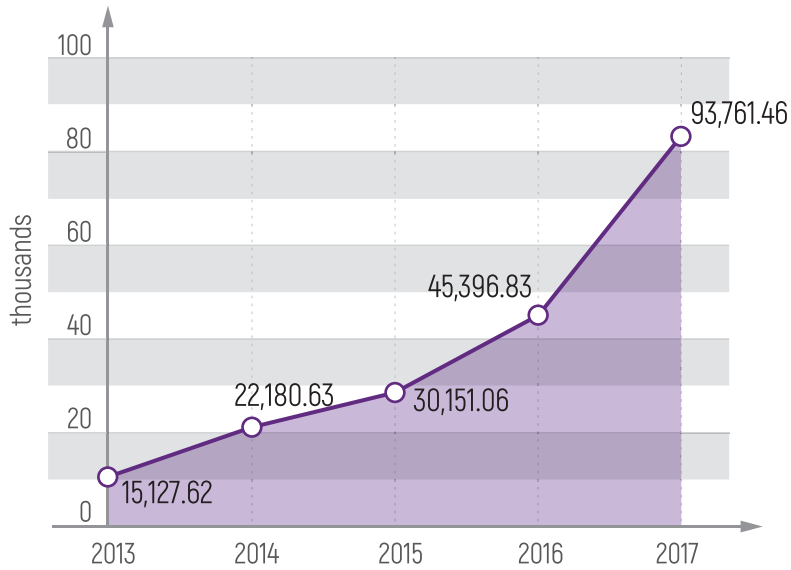
Figure 58. Number of MMS messages sent (million)



Source: **RATEL**

The number of MMS messages also continued to drop. In 2017, 11.29 million MMS messages were sent, which is a decrease 8.4% in respect to 2016.

Figure 59. Data traffic in TB (GPRS+UMTS+LTE)

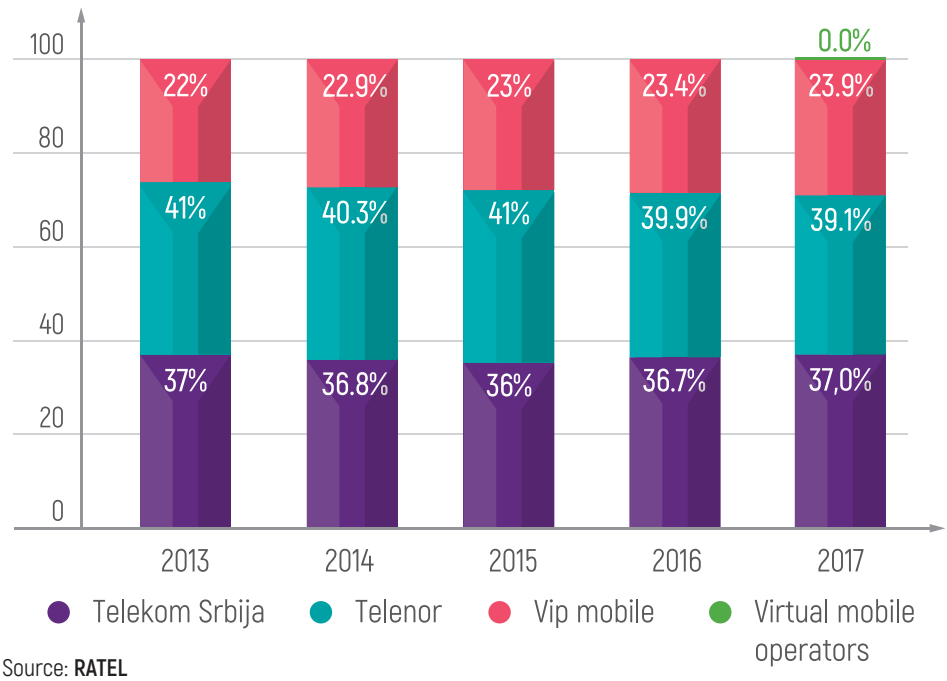


*As of 2016 data traffic over LTE network is also included.

Source: **RATEL**

Data traffic has been constantly growing during the observed period (Figure 59). During the analysed five-year period, the average annual growth rate of the transmitted data was 58%.

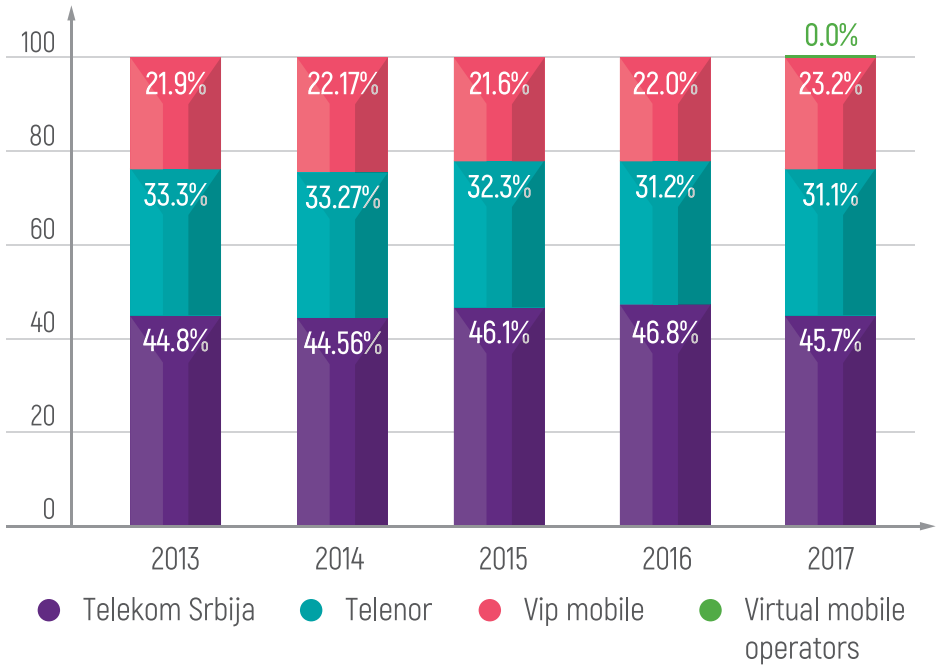
Figure 60. Share in the total revenues made from mobile services (%)



Source: **RATEL**

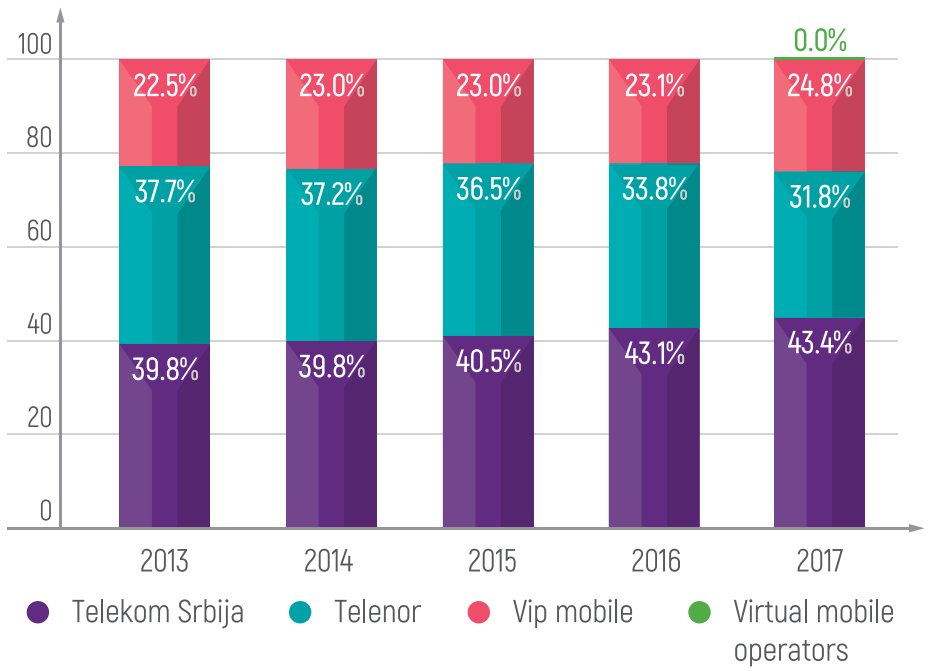
Figures 60 - 65 show the share of mobile operators in terms of revenues, number of users, outgoing traffic, number of text and multimedia messages (SMS and MMS) sent and data traffic made, based on the available data.

Figure 61. **Market share in terms of number of users (%)**



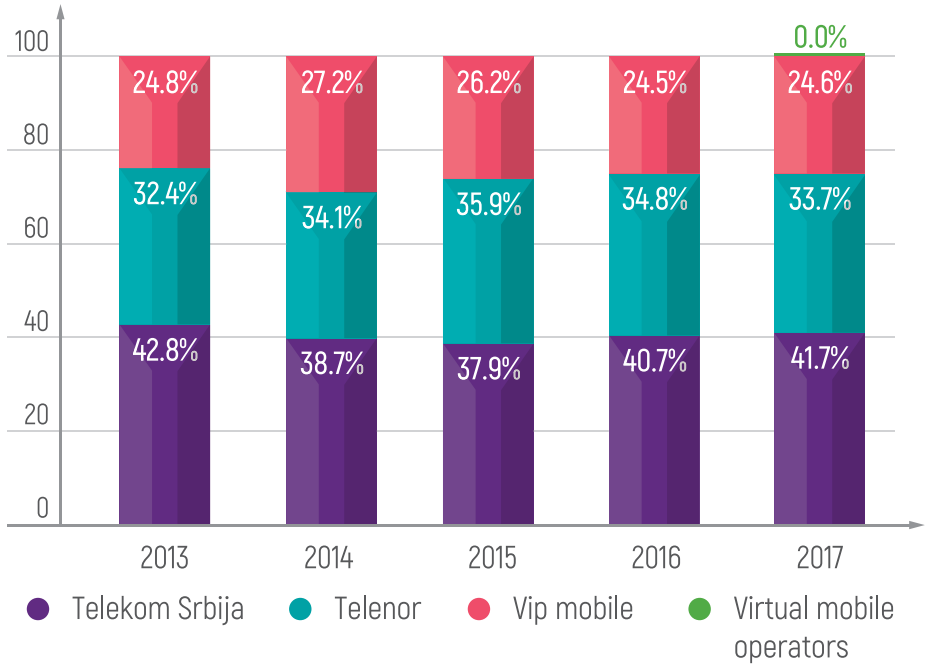
Source: **RATEL**

Figure 62. **Share in the total outgoing voice traffic (%)**



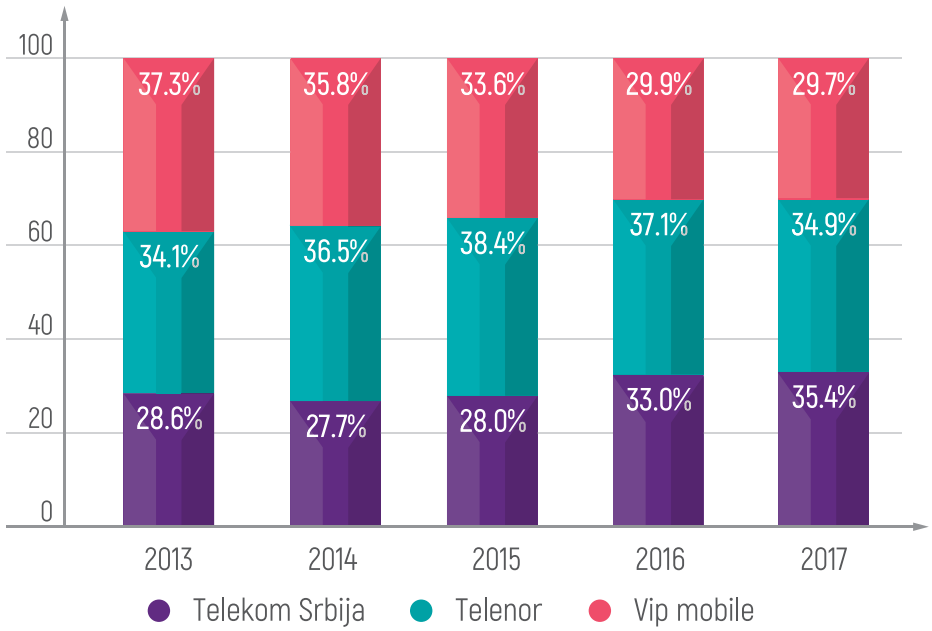
Source: **RATEL**

Figure 63. Share in the total number of sent SMS messages (%)



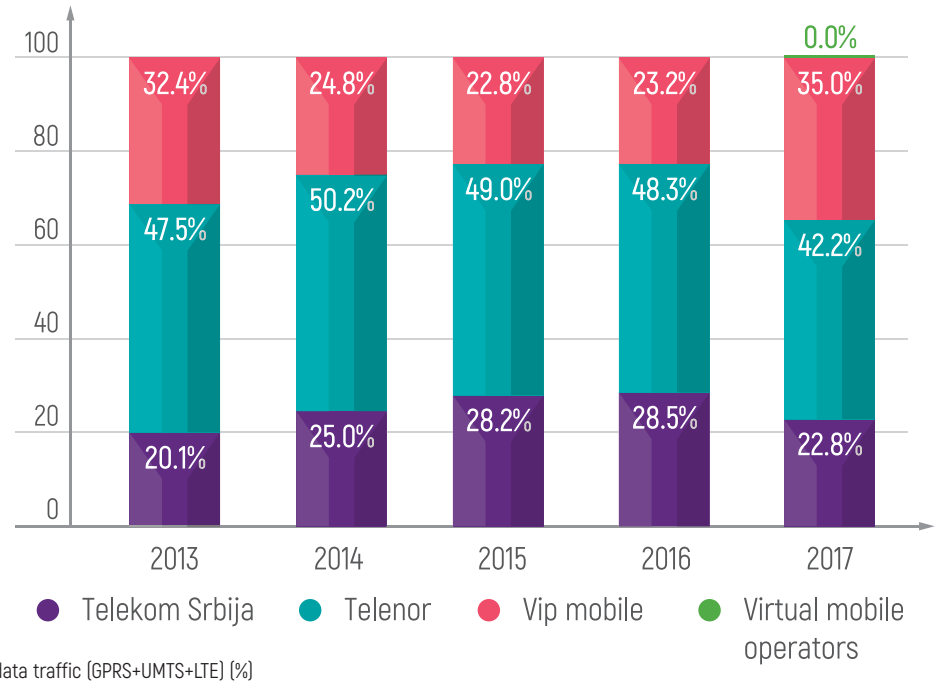
Source: **RATEL**

Figure 64. Share in the total number of sent MMS messages (%)



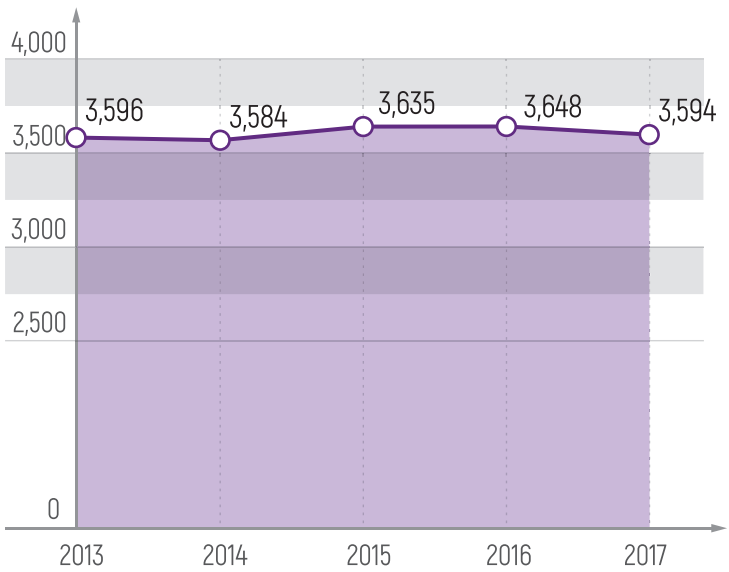
Source: **RATEL**

Figure 65. Operators' share in the total amount of transferred data (GPRS+UMTS+ LTE) (%)



* Figure 65. Share in data traffic (GPRS+UMTS+LTE) (%)
Source: **RATEL**

Figure 66. HHI values in the period 2013–2017

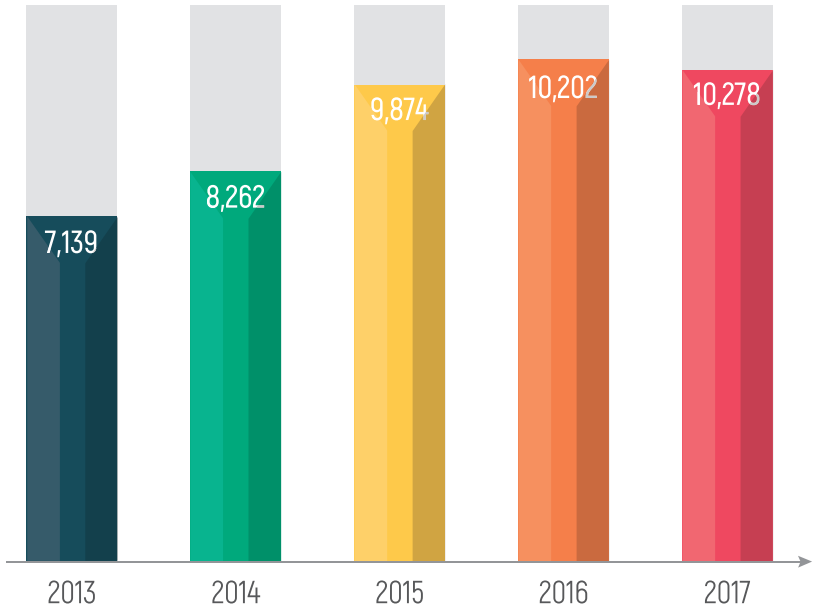


Source: **RATEL**

The competition in the mobile market can be estimated using the Herfindahl Hirschman Index (HHI). HHI is an indicator used for determining the degree of concentration of a given market and it is defined as the sum of the squares of the market shares of each individual market share. The market share was identified by the number of users.

The value of HHI for 2017 was the lowest in the last three years, indicating a lower market concentration and increase in the level competition.

Figure 67. Average number of portings on mobile network a month for each year

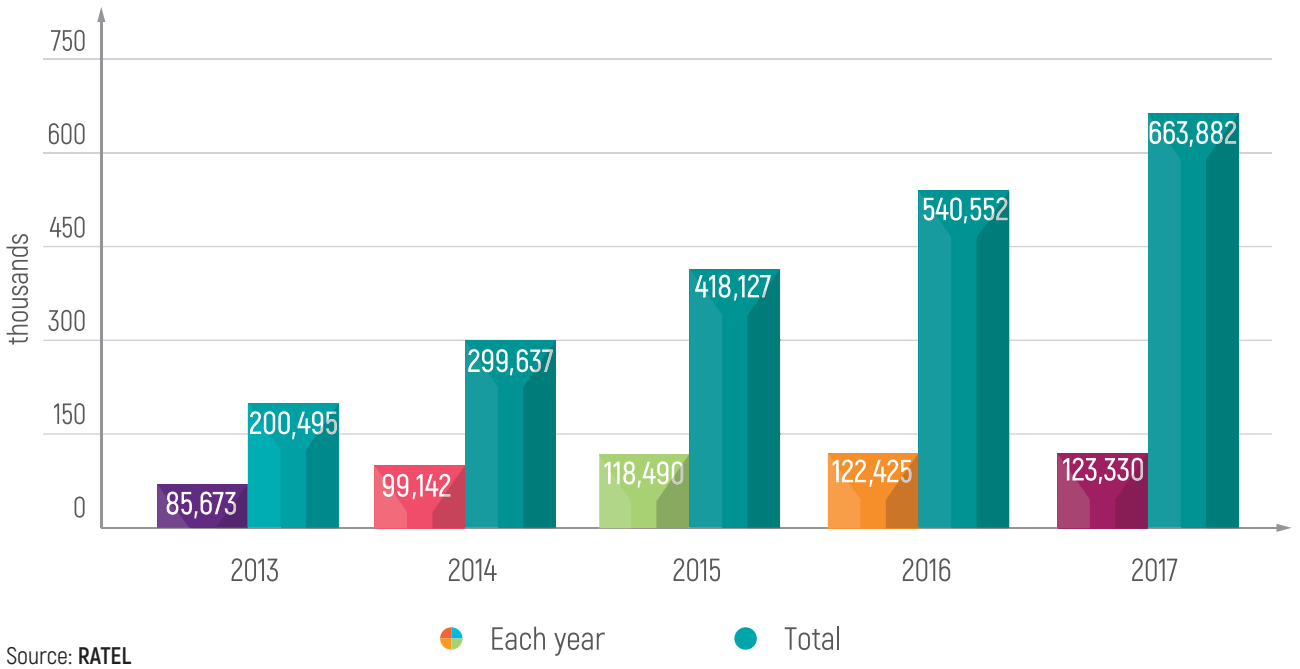


Source: **RATEL**

The average number of mobile number portings was at the same level as the year before, with an average number of portings of 10 278 a month in 2017.

In 2017 there were around 123 330 number portings on mobile networks, thus reaching the total of 663 882 portings made since the beginning of number portability service.

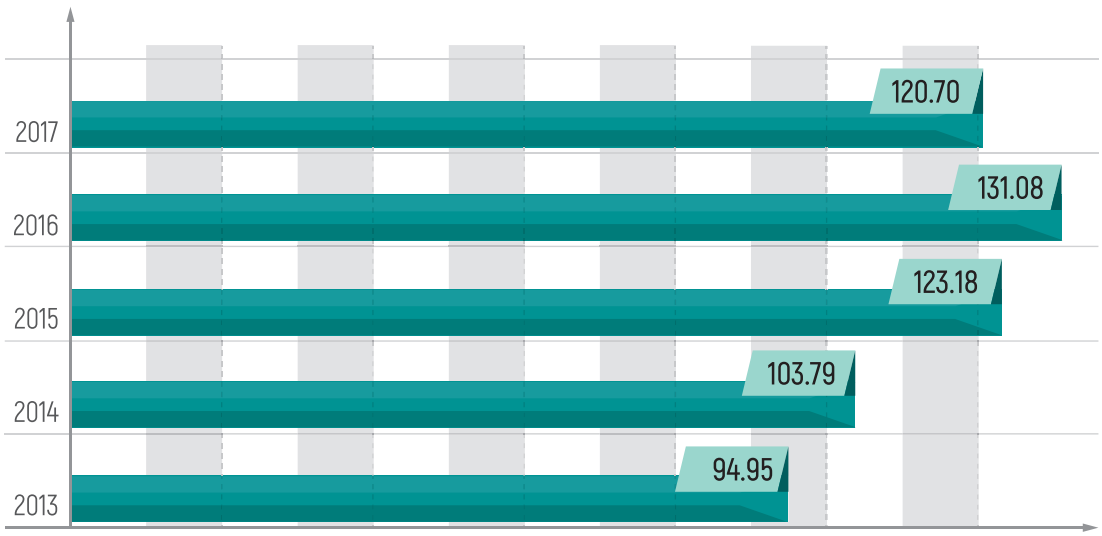
Figure 68. Number of portings on mobile network each year and in total



Source: **RATEL**

In addition to national traffic, the users also use roaming traffic abroad. Voice traffic abroad has been growing in the past years, however in 2017 there was a drop.

Figure 69. Number of roaming minutes (million)

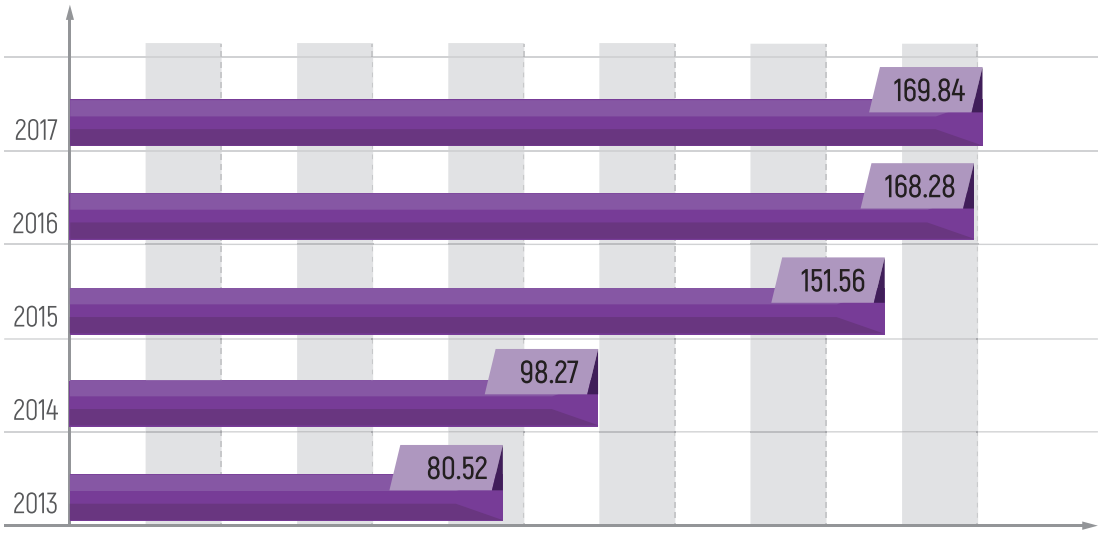


Source: **RATEL**

In addition to voice traffic, the users also use mobile internet abroad and according to the available data for 2017, there were 2 387 TB of roaming mobile broadband internet traffic made.

Beside the users of the national networks, the traffic in the territory of Serbia is also generated by foreign network subscribers, who have also increased voice service usage in the observed period.

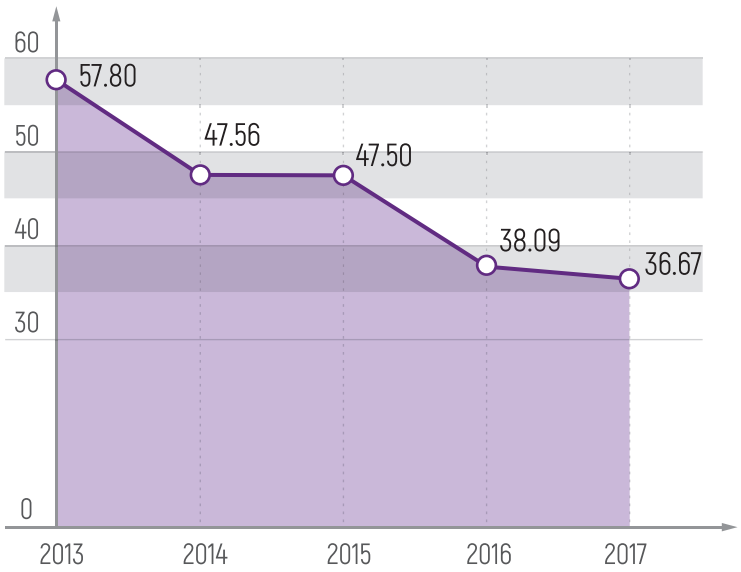
Figure 70. Number of roaming minutes made by foreign subscribers (million)



Source: **RATEL**

The revenues made from roaming, which include revenues made from outbound roaming and revenues made from inbound roaming, have been dropping in the past years.

Figure 71. Roaming revenues (mil. EUR)



Source: **RATEL**

07 REGIONAL ROAMING

Based on the Agreement on the Reduction in Roaming Fees on Public Mobile Communication Networks, signed between Bosnia and Herzegovina, Montenegro, Macedonia and Serbia, the regulated roaming fees began to be applied in the region as of 30 June 2015. The Agreement stipulates a price cap for roaming services in the signatory countries aligned with the prices laid down under Regulation (EU) No 531/2012 of the European Parliament and of the Council of 13 June 2012 on roaming on public mobile communications networks within the Union.

In order to implement the Agreement, RATEL passed a decision on gradual reduction in roaming fees (No. 1-03-021-146/14 of 25.12.2014) defining the dates and periods of application of price caps for wholesale and retail fees charged for calls, SMS, data traffic and MMS, in line with the fees under the Roaming Regulation. The retail and wholesale price caps applied during the second and third implementation phase of the Agreement are given in Figures 72 and 73.

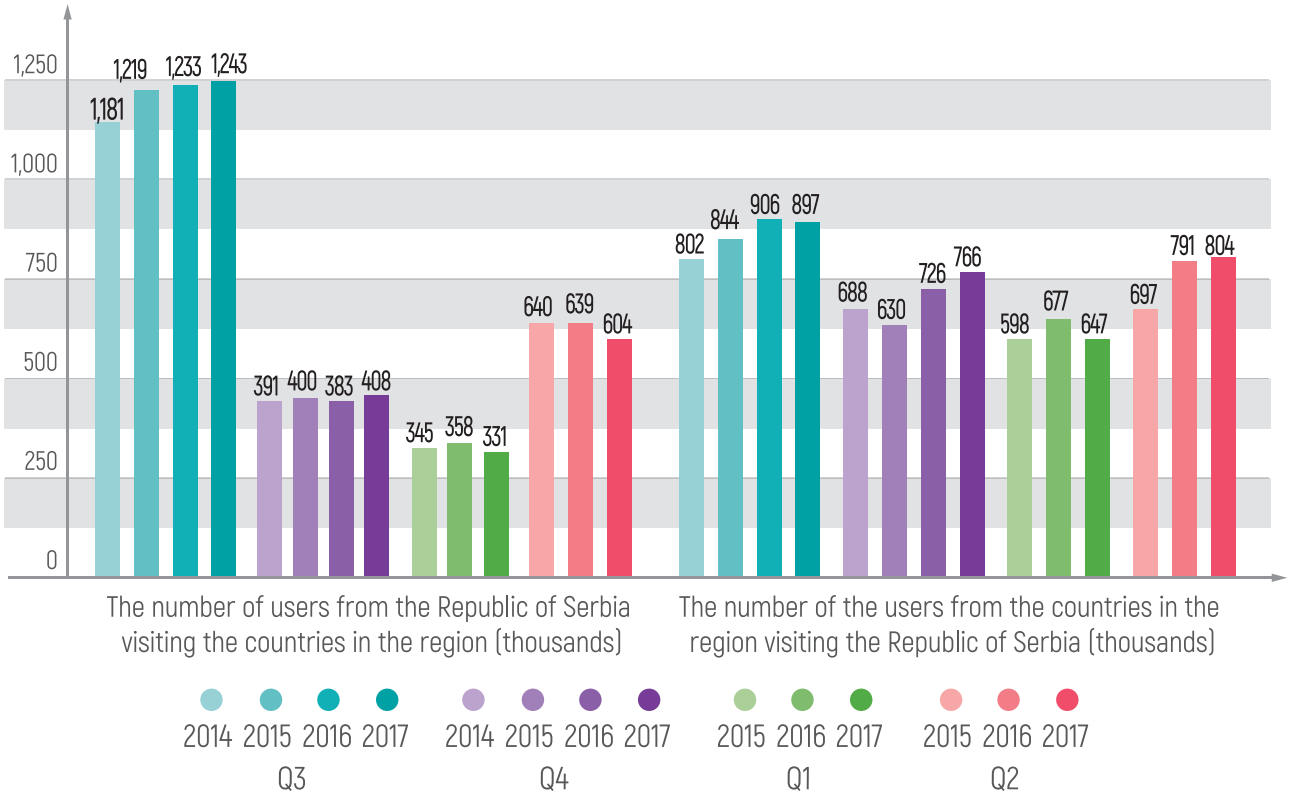
Figure 72. **Retail roaming price caps (EUR, excluding VAT) applied in the following periods, in the countries that signed the Agreement: 01.07.2016-30.06.2017 and as of 1.07.2017**

Figure 73. **Wholesale roaming price caps (EUR, excluding VAT) applied in the following periods, in the countries that signed the Agreement: 1.7.2016-30.6.2017 and as of 1.7.2017**

Comparative data for the third and the fourth quarter of 2014 and for the third and the fourth quarter of 2015, 2016 and 2017 are given below, in order to show the effects of the application of the regulated roaming tariffs.

The data on the number of users show that in the third quarter, during the holiday season, there are more people from the Republic of Serbia travelling to the countries signatories to the Agreement compared to the users from the signatory countries visiting Serbia, contrary to the situation in other quarters.

Figure 74. The number of users from the Republic of Serbia visiting the countries in the region and the number of the users from the countries in the region visiting the Republic of Serbia



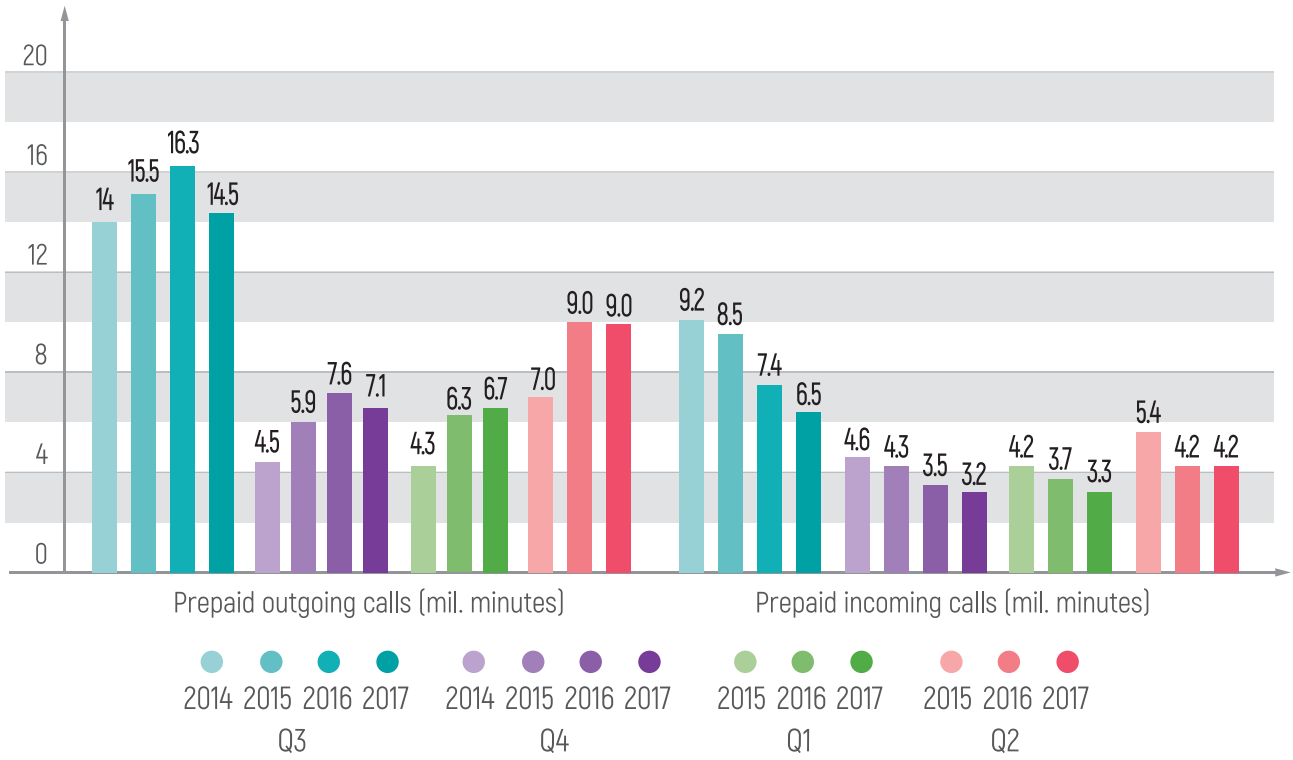
Source: **RATEL**

The overview shows the trend followed by the traffic and the revenues made from the regulated retail roaming services provided to the subscribers of the Serbian operators during their stay in other countries signatories to the Agreement.

The data include the entire traffic, i.e. the total of the traffic made without any tariff add-ons and the traffic made using tariff add-ons which are available to end users.

The comparative data show a growth in the traffic for most roaming voice services. The data given in Figure 75, which refer to the prepaid users, show a growth in the outgoing calls until 2017, when the drop in the number of prepaid users resulted in the drop in traffic and decrease in the number of minutes, with the exception of 2017 Q1, along with the drop in the incoming calls in the comparable quarters.

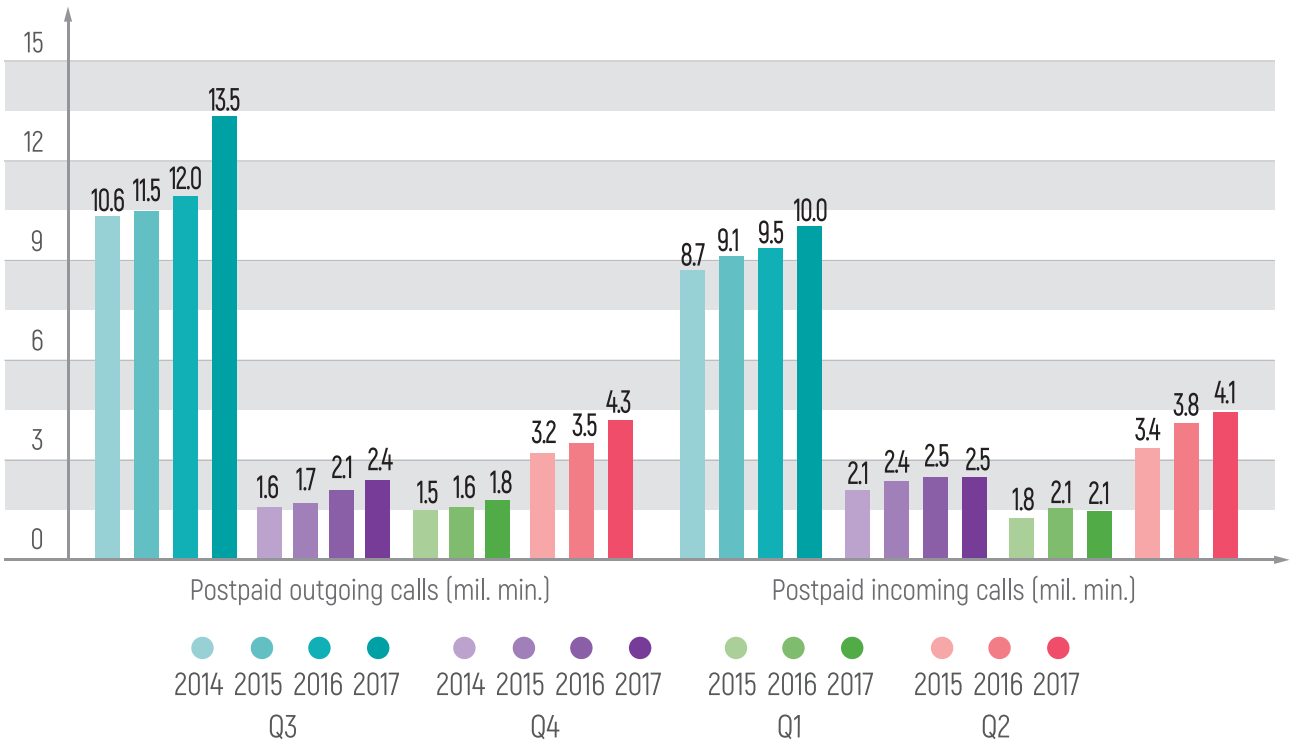
Figure 75. Roaming outgoing and incoming calls made by prepaid users in the countries signatories to the Agreement (million minutes)



Source: **RATEL**

Comparable quarterly data show a growth in both outgoing and incoming calls with postpaid users, with the exception of 2017 Q1 (Figure 76).

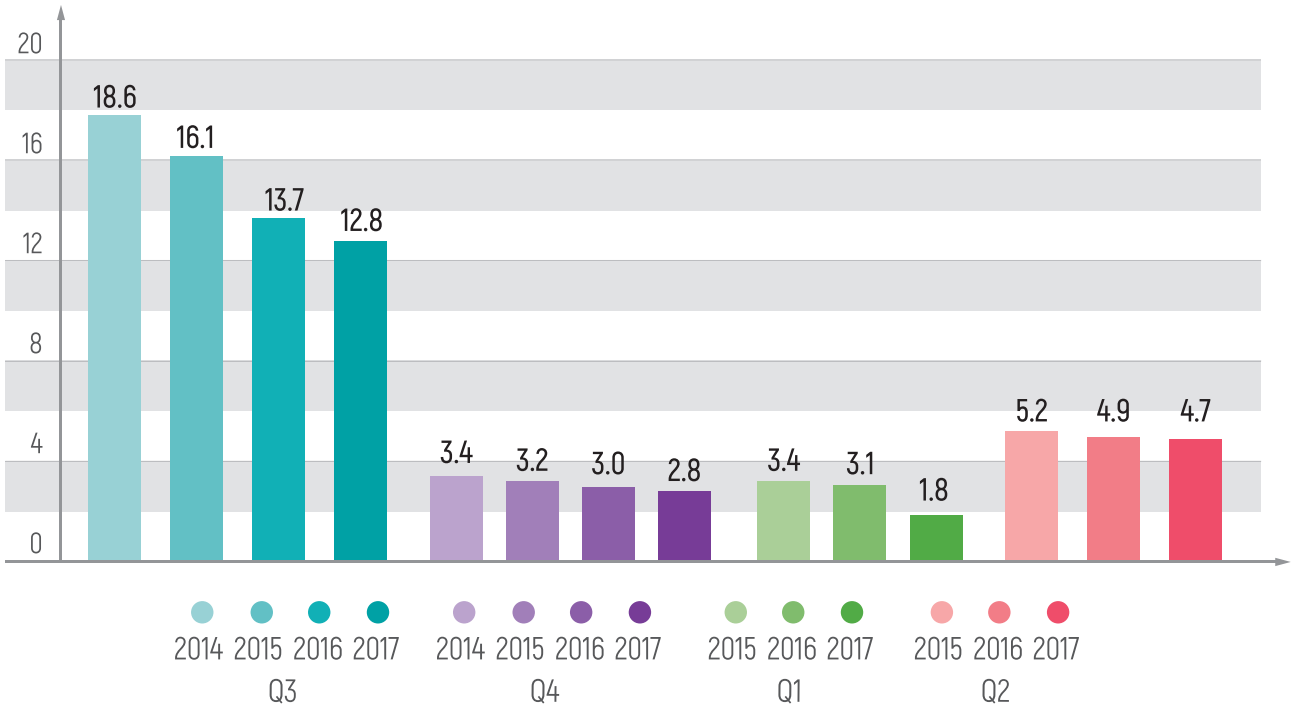
Figure 76. Roaming outgoing and incoming calls made by postpaid users in the countries signatories to the Agreement (million minutes)



Source: **RATEL**

The same as in the national market, there was a drop in roaming SMS messages (Figure 77).

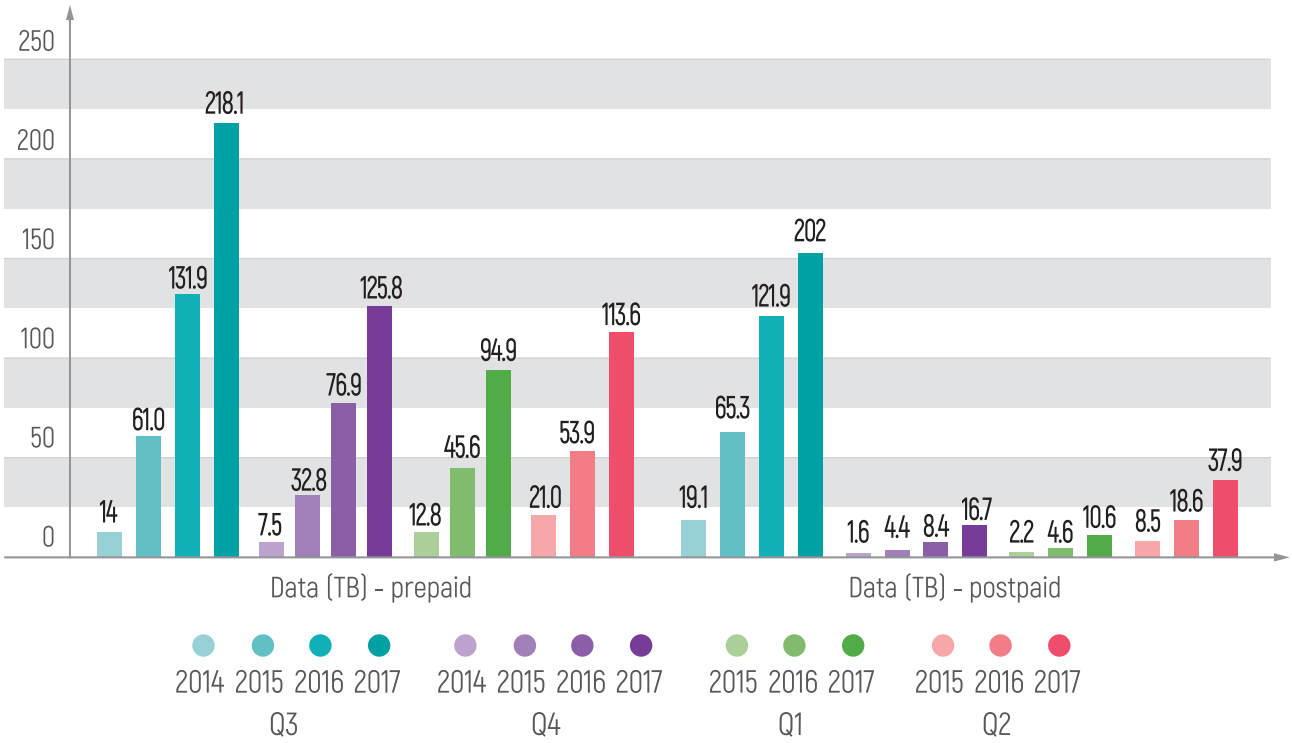
Figure 77. Number of roaming SMS messages sent in the countries signatories to the Agreement (million)



Source: **RATEL**

Roaming data transmission is the service with the biggest and significant rise with both groups of users, based on the comparable quarterly data (Figure 78).

Figure 78. Roaming data traffic made in the countries signatories to the Agreement - prepaid and postpaid (TB)



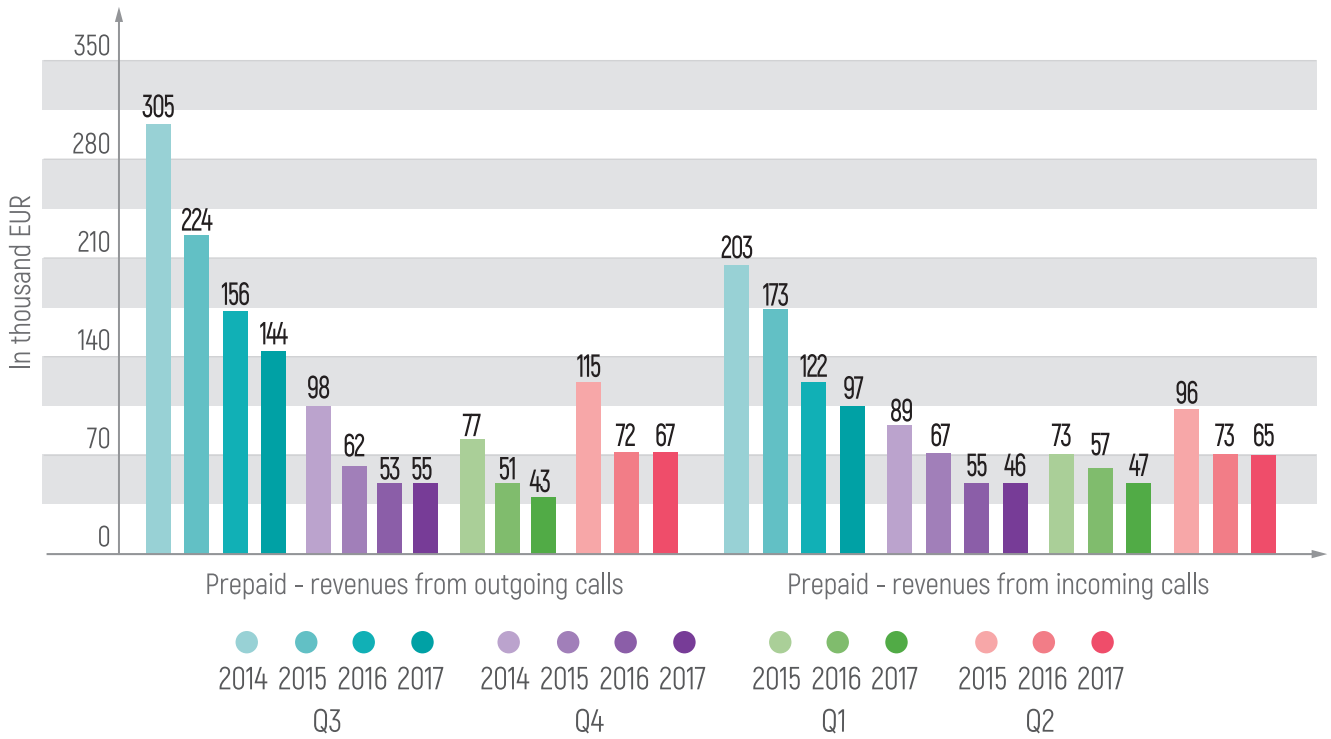
Source: **RATEL**

The absolute values concerning the observed retail service traffic show that there is the biggest traffic in the third quarter during the summer holiday season, when people travel more frequently to the countries signatories to the Agreement.

The data illustrating the trend followed by the revenues made from roaming without the revenues made from tariff add-ons are given below.

The revenues made from incoming and outgoing calls provided to prepaid users have been showing a decrease in all comparable quarters, year after year (Figure 79).

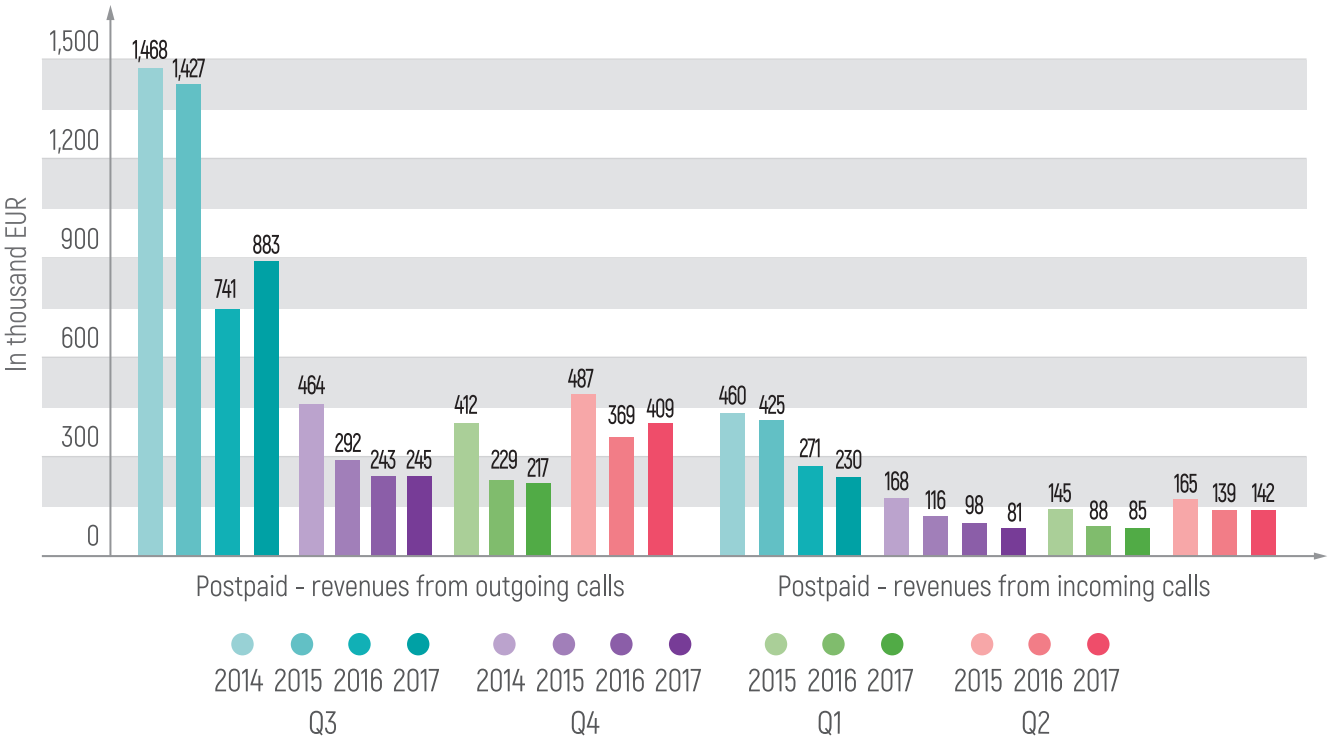
Figure 79. Revenues made from outgoing and incoming call service provided to prepaid users in the countries signatories to the Agreement (EUR thousands)



Source: **RATEL**

The revenues made from incoming and outgoing calls provided to postpaid users have shown a decrease in all comparable quarters, year after year, with the exception of 2017 Q3 and Q4, when a slight increase in the revenues from incoming calls was made, whereas in 2017 Q2 there was a slight increase in the revenues from both outgoing and incoming calls (Figure 80).

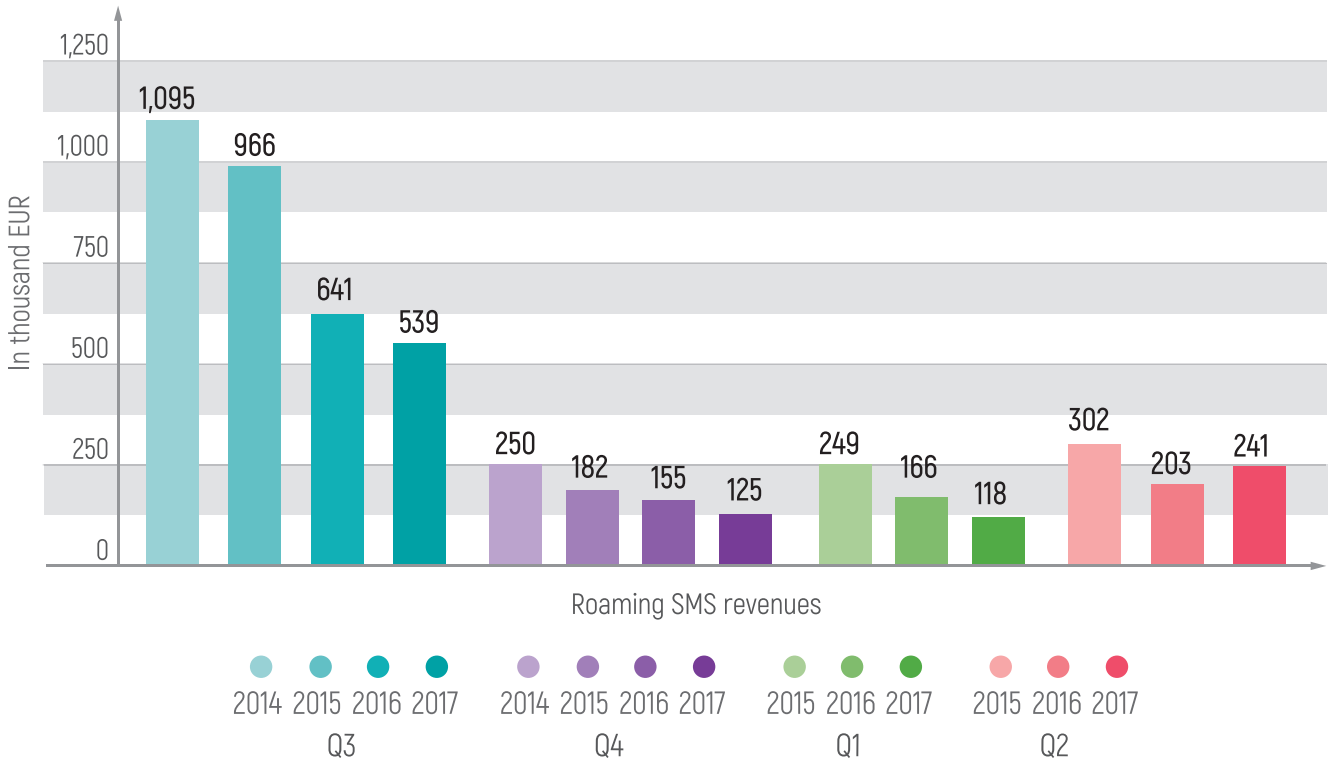
Figure 80. Revenues made from outgoing and incoming call service provided to postpaid users in the countries signatories to the Agreement (EUR thousands)



Source: **RATEL**

Revenues made from roaming SMS messages have also been dropping in the observed comparable quarters, with the exception of 2017 Q2, when a slight increase in the revenues has been seen (Figure 81).

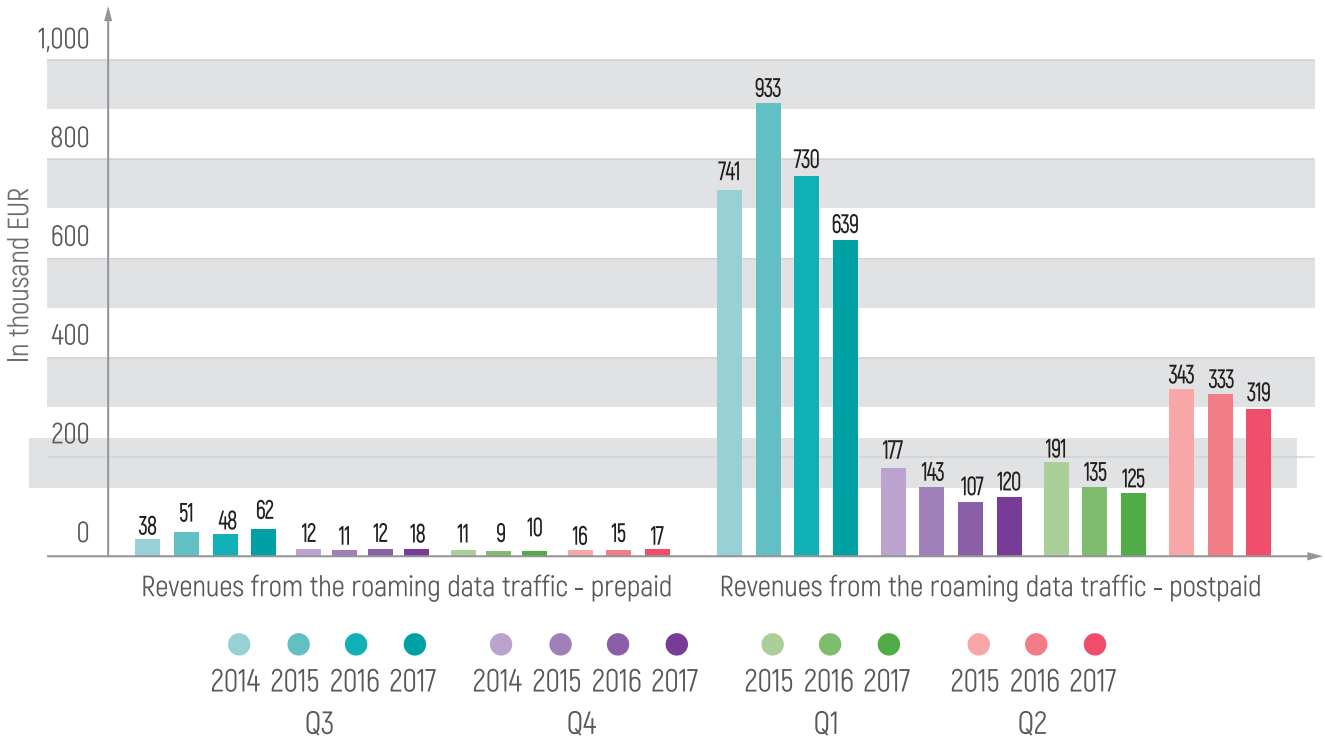
Figure 81. Revenues made from roaming SMS messages in the countries signatories to the Agreement (EUR thousands)



Source: **RATEL**

The revenues made from the roaming data traffic increased in all four quarters of 2017, compared with the comparable quarters the year before. There was a growth in case of postpaid users in Q4 2017 compared with the same quarter of the previous year. In other observed quarters of 2017, the revenues made from postpaid users showed a drop, compared with the comparable quarters the year before (Figure 82).

Figure 82. Revenues made from the roaming data traffic in the countries signatories to the Agreement – prepaid and postpaid (mil. EUR)



Source: **RATEL**

The absolute values concerning the revenues made from the observed retail services show that the biggest revenue was made in the third quarter, during the summer holiday season, when people travel more frequently to the countries signatories to the Agreement.

08 INTERNET SERVICES

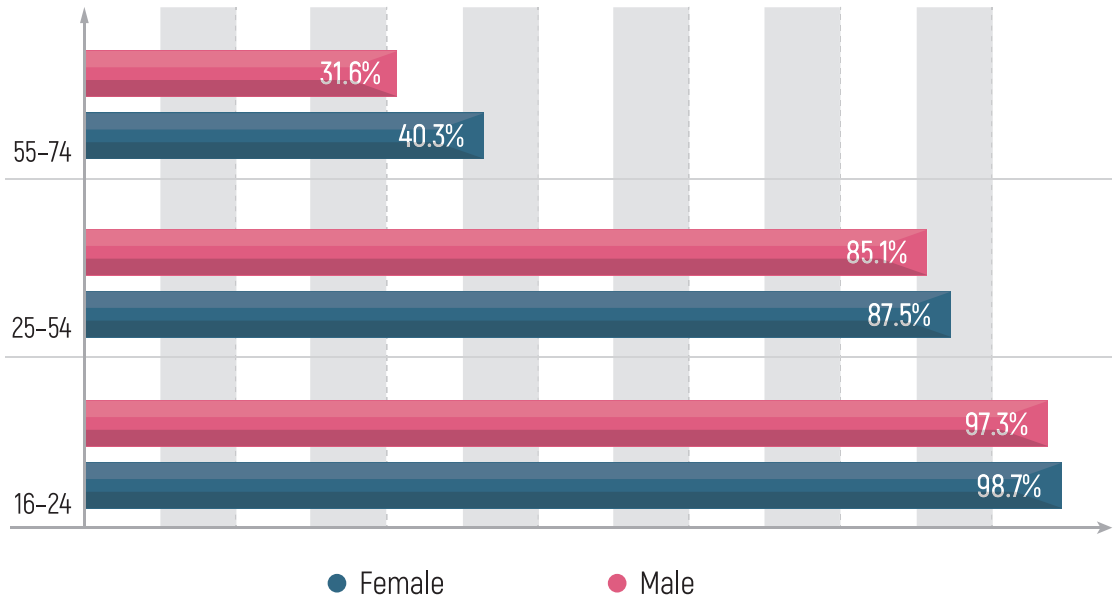
The Internet market in Serbia has been experiencing a significant growth for years, which continued to a somewhat smaller extent in 2017. In addition to the rise in the total number of users, a change occurred in the structure of the service packages offered, in terms of increase of the number of high-rate packages and changes in terms of infrastructure used for service provision, namely the increase of the number of broadband users of optical access technologies. However, even though the users of optical access technologies showed the biggest increase in terms or percentage, the share they have in the total number of fixed broadband users was only 5% in 2017.

According to the survey on ICT usage by individuals, households and business, carried out in 2017 by the national Statistical Office on the sample of 2800 households and 2800 individuals, **seven out of ten persons in Serbia have used the Internet in the past three months**[3].

The Internet was used most by the youngest population (16 – 24 years). In this user group there is no difference between genders as far as Internet usage is concerned. Compared with 2016, the share of respondents who have an account on the social networks such as Facebook and Twitter slightly increased from 90.3% to 90.6%. The survey showed that the older age group (25-54 years) used the Internet less. The smallest share of Internet users is in the oldest group, comprising individuals between the age of 55 and 74 years. This group also displays the greatest discrepancy between genders regarding the usage of Internet, however it decreased from 9.2% in 2017 to 8.7% in 2017 (Figure 83).

3 Data taken from the publication "Usage of information and communication technologies in the Republic of Serbia, 2017", Statistical Office of the Republic of Serbia, 2017.

Figure 83. Mobile broadband users distribution

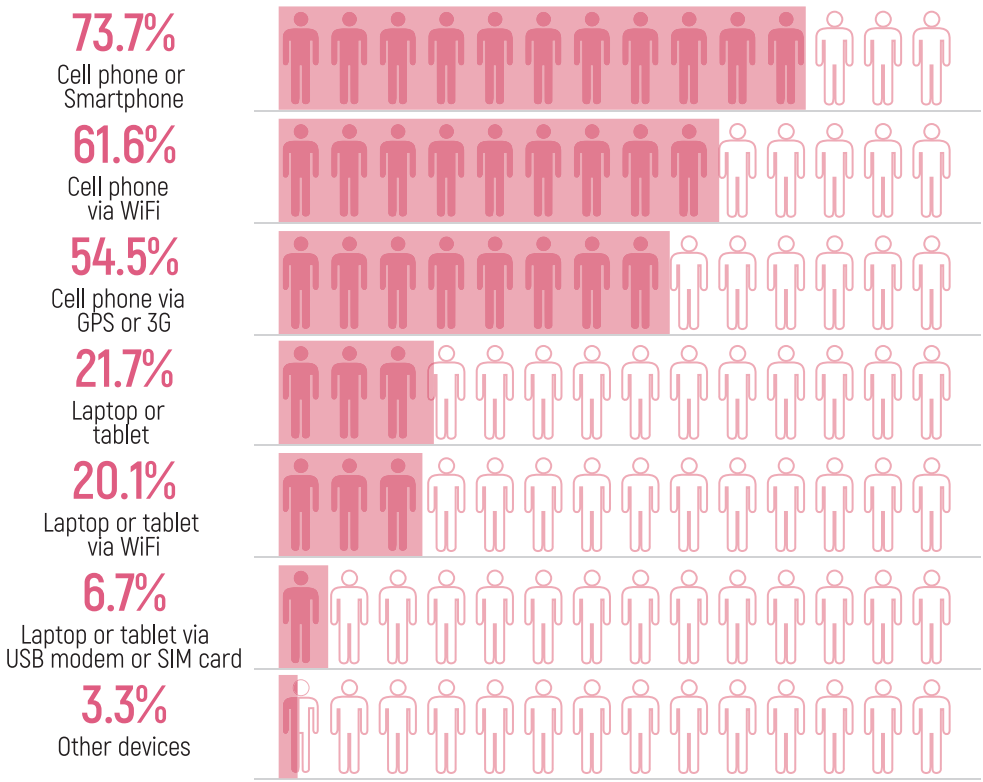


Source: **Statistical Office of the Republic of Serbia**

Internet access has become a constant in our everyday life, and its importance for the development of economy and society in general is immense. Ubiquitous connectivity is necessary either for work or for social networking. This is reflected both in the user habits and in the devices used for this purpose.

73.7% of the respondents use a Smartphone for the Internet access outside home or work, which is particularly characteristic for the younger population (25-34 years old) since more than 87% of them are using Smartphone for the Internet access (Figure 84).

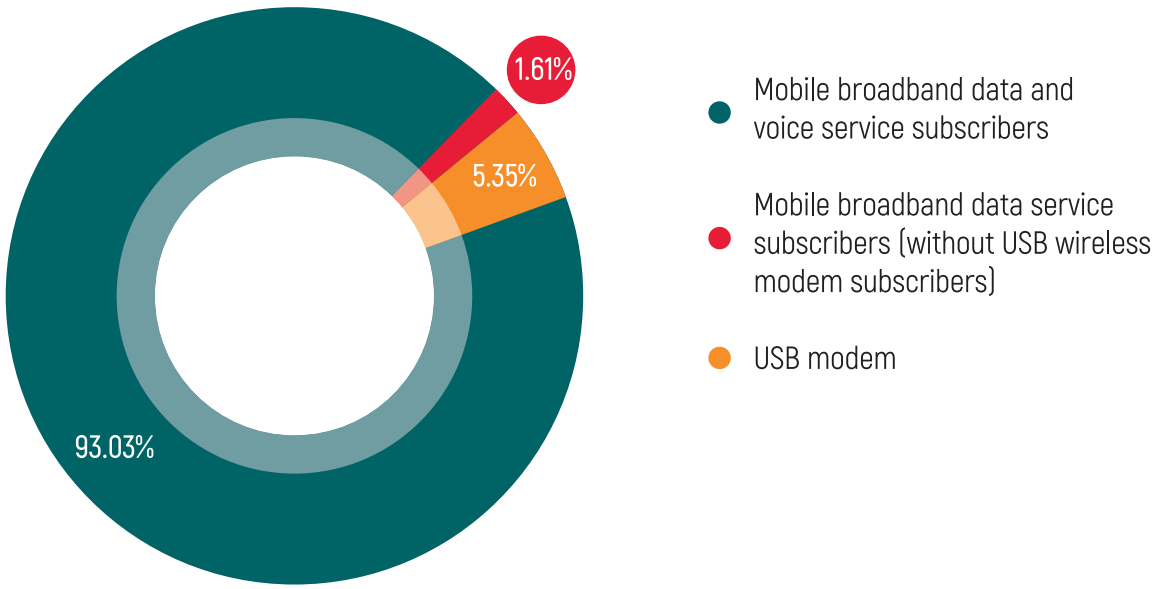
Figure 84. Devices used for the Internet access outside home/work



Source: **Statistical Office of the Republic of Serbia**

The rising usage of mobile phones for the Internet access is reflected in the constant rise of the users of the mobile Internet service provided in 2017 by three mobile operators: Telekom Srbija, Telenor and Vip mobile and one virtual mobile operator - Globaltel.

Figure 85. Mobile broadband users distribution

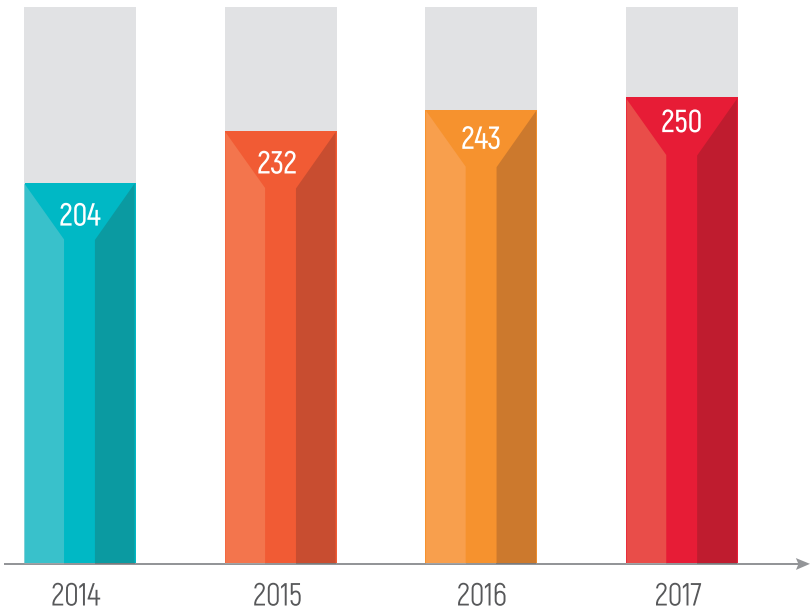


Source: **RATEL**

The total number of active mobile broadband users in 2017 was 5.4 million, including the subscribers of mobile broadband data and voice service, data service only and subscribers using USB wireless modem for the Internet access, which is an increase by more than 5% compared to 2016, when the number of users was around 5.1 million.

The number of M2M subscriptions increased as well, amounting to 250 thousand in 2017, which is by 3% more than the previous year.

Figure 86. Number of M2M subscriptions (thousand)

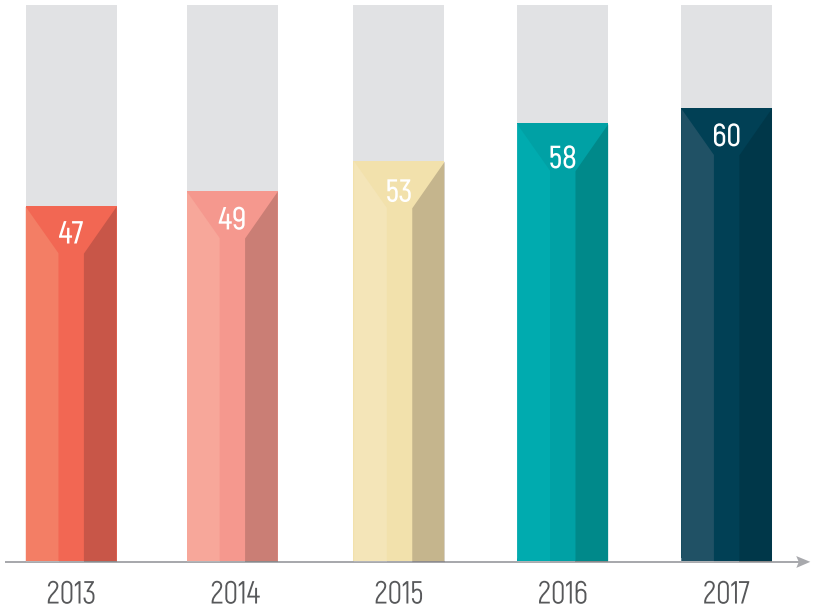


Source: **RATEL**

The increase in the number of users resulted in the increase in the traffic volume, which doubled compared with the previous year, amounting to 97 million GM on an annual level in 2017 for the entire UMTS and LTE traffic (the traffic includes mobile Internet users, via cell phones and modems), where, as expected, LTE traffic increased the most, as much as seven times.

The best sold mobile Internet package for private postpaid users offered 15 GB of data transmission at the price of 1299 dinars.

Figure 87. The number of fixed broadband internet subscribers per 100 households



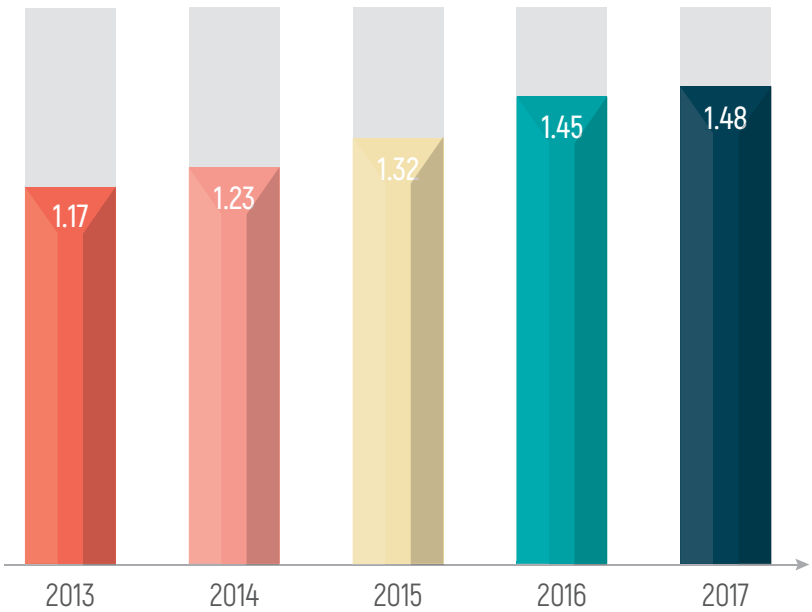
Source: **RATEL**

In 2017, six out of ten households (59.52%) had fixed broadband.

There were 192 registered ISPs for broadband service in 2017 in Serbia.

The total number of fixed broadband subscribers in 2017 was 1.48 million, which is a 2% increase compared with the previous year (Figure 88).

Figure 88. The total number of subscribers of fixed broadband Internet access (million)



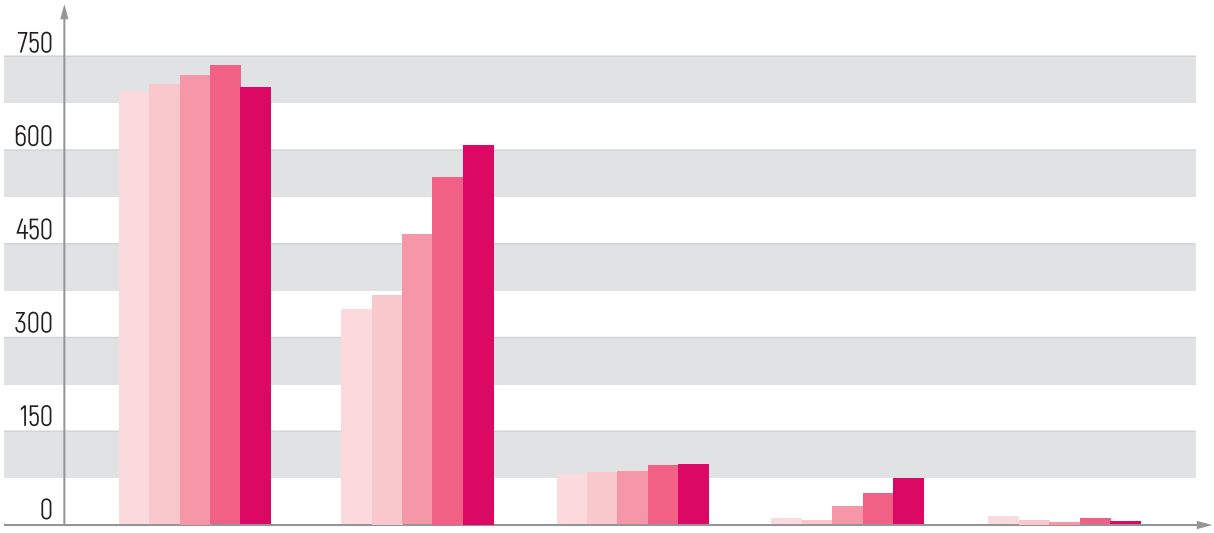
Source: **RATEL**

In terms of technology used, based on the available data, the biggest percentage increase of 50% was seen in the number of users with FTTH or FTTB Internet access, however this number is still relatively low, corresponding to 5% of the total number of users. The number of users with cable modem grew by 8%, the number of users with fixed wireless access grew by 1.5%, whereas the number of users of xDSL decreased by 5%. However, xDSL subscriber structure changed signifi-

cantly with a significant increase of the number of users of VDSL technology, that account for 36% of the total number of xDSL users, due to greater demand for packages with bigger throughput.

xDSL remains to be the most used access technology with 47% of the total number of users, followed by coaxial cable infrastructure with 41% of users (Figure 89).

Figure 89. The share of broadband subscribers by access technology (thousand)



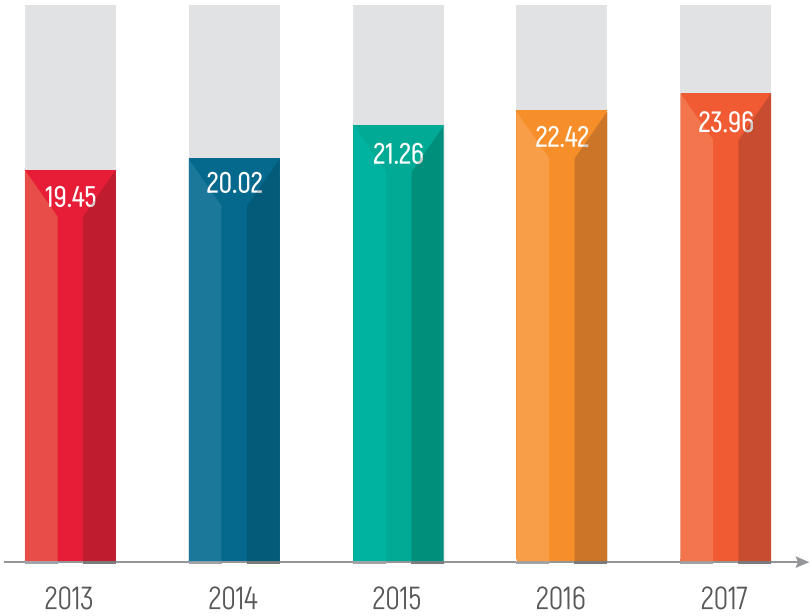
	xDSL	Cable	Wireless	FTTH/B	Other*
2013	693.65	375.33	79.88	11.52	13.53
2014	715.84	410.82	83.64	9.52	6.49
2015	724.16	475.97	87.57	30.53	2.29
2016	737.25	561.94	93.14	50.16	7.99
2017	701.00	606.62	94.49	75.15	3.50

*Eternet, LAN...

Source: **RATEL**

The increase in the number of subscribers is also reflected in the increase in the revenues from fixed broadband Internet access of nearly 7% in respect to 2016. (Figure 90).

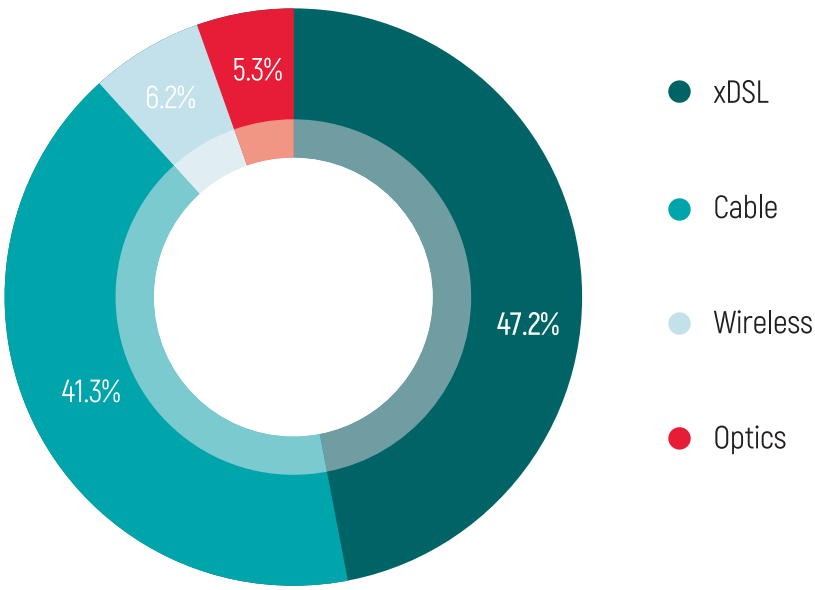
Figure 90. Revenues from fixed broadband Internet access (billion)



Source: **RATEL**

The structure of revenues made from fixed broadband access follows the subscriber structure, with a slightly bigger share of xDSL and cable, with 47.2% and 41.3%, respectively, whereas the share of wireless access was 6.2% and the share of optical cables 5.3% (Figure 91).

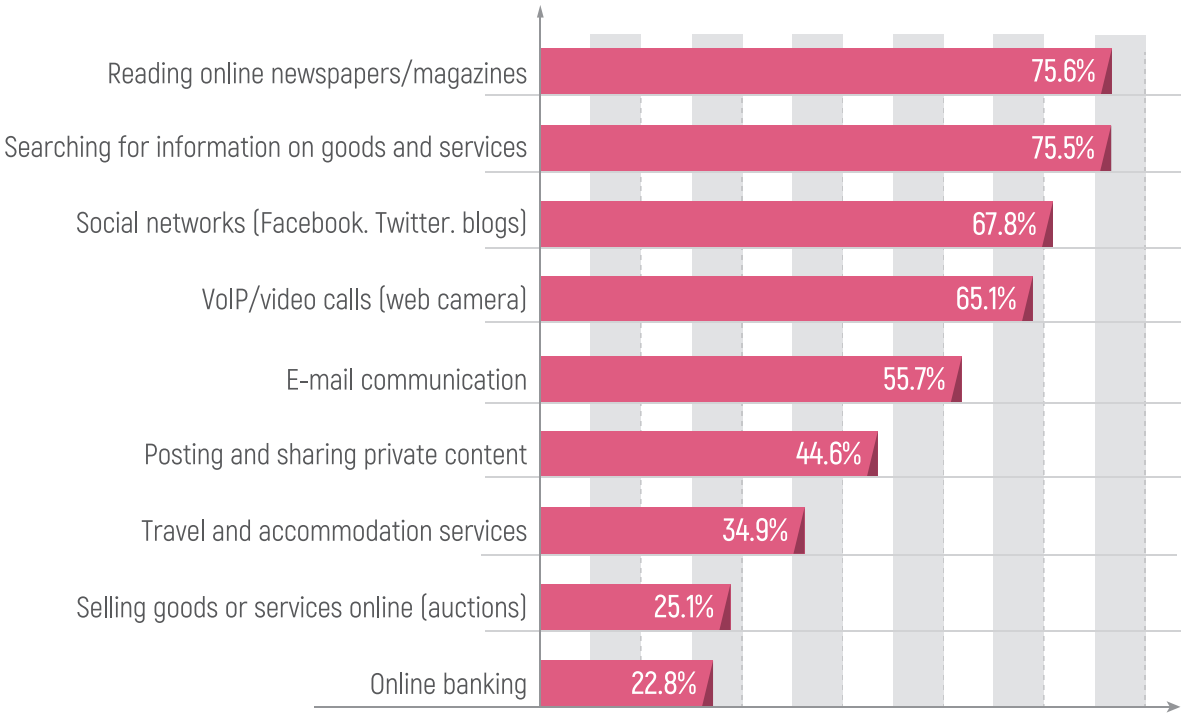
Figure 91. The structure of revenues made from fixed broadband, by access technologies



Source: **RATEL**

The Internet was used mostly for online newspaper and magazine reading (75.6%) and looking up the information on goods and services (75.5%), as well as for participation in social networks such as Facebook and Twitter (67.8%).

Figure 92. Types of Internet usage for private purposes

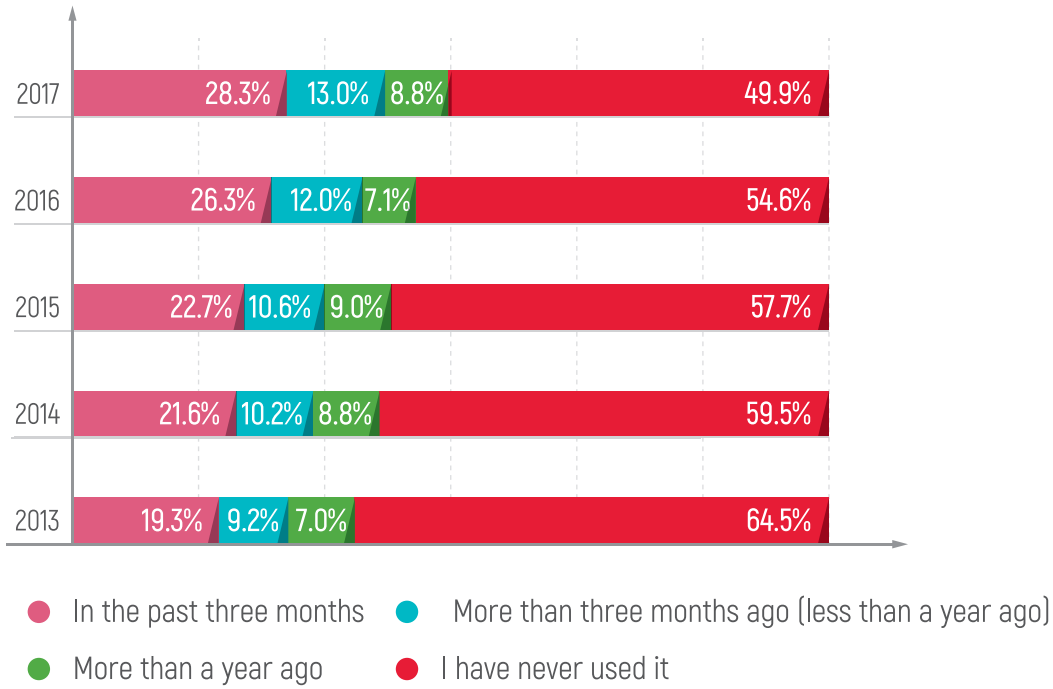


Source: **Statistical Office of the Republic of Serbia**

In 2017, more than 1.6 million people purchased or ordered goods and/or services online.

Online purchase of goods and/or services is growing and the number of persons that made an online purchase was increased by over 180 000 in respect to the previous year. 28.3% of the respondents have ordered goods or services online in the last three months, whereas 49.9% of persons have never used the Internet for these purposes. The change in habits of the individuals regarding the online purchase in the last 5 years can be seen in Figure 93.

Figure 93. Ordering/purchasing goods or services online



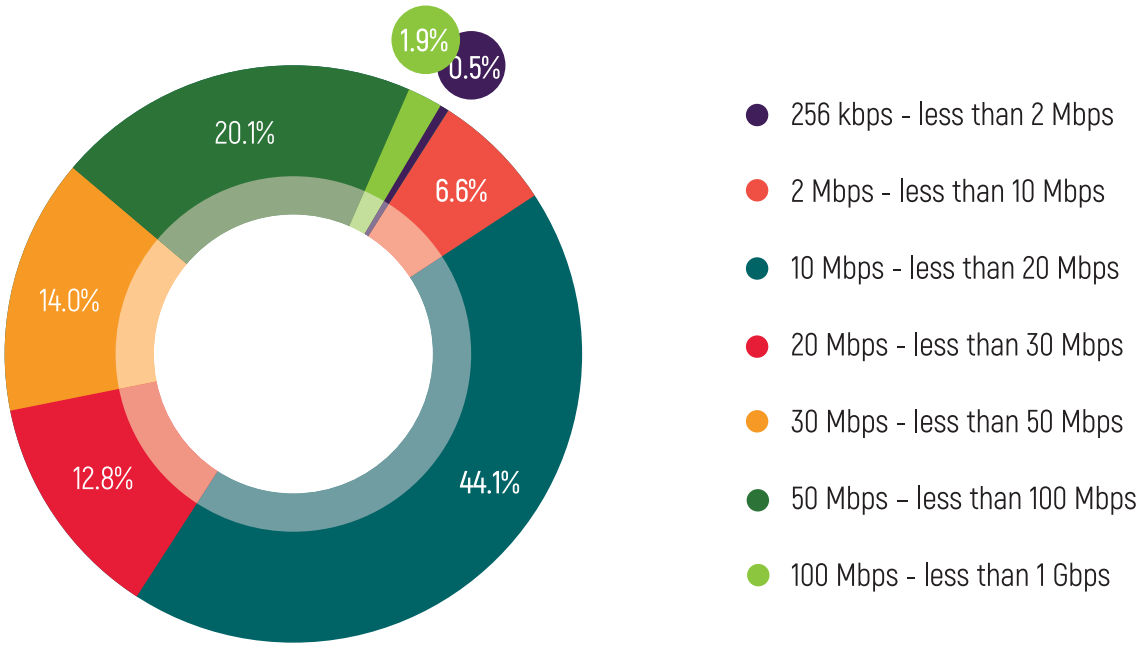
Source: **Statistical Office of the Republic of Serbia**

Changes in user habits, increased number of users accessing video streaming services, along with the increase in the number of device used to access the Internet at the same time have resulted in the change of the package structure and the increase in the traffic volume.

As for fixed broadband access, the same as the previous year, Internet packages offering 10 Mbps were the most sold, at the price ranging between 750 and 2000 dinars.

According to the available data, in 2017 over 44% of fixed broadband users used the packages of at least 10 Mbps but less than 20 Mbps and more than 20% of users used the packages of at least 50 Mbps but less than 100 Mbps.

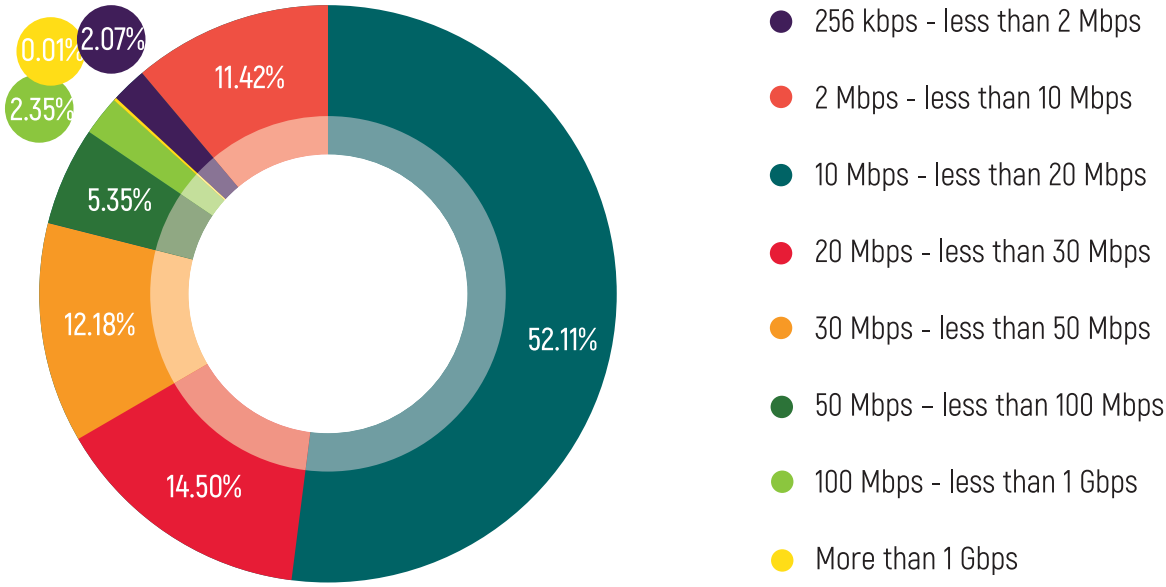
Figure 94. Share of the fixed broadband subscribers, according to access rate



Source: **RATEL**

The share of the fixed broadband subscribers according to access rate influenced the amount of the average bill for fixed broadband Internet, which amounted to 1370 dinars for private users and 4878 dinars for business users in 2017. Access rates for business users, defined under the user contract with the ISP, are given in Figure 95.

Figure 95. Share of business fixed broadband subscribers, according to access rate



Source: **RATEL**

Out of the total number of companies with Internet connection, 80.4% have their own website, mainly with the purpose of providing the description of goods or services and price lists (93.0%), the possibility to view contents in customized mode (85.6%) and the possibility for consumers to get acquainted with the products (73.4%).

Social networks are becoming increasingly important for the businesses. During 2017, nearly 39.2% of the companies used social networks, such as Facebook, LinkedIn, Xing or Yammer, for business purposes. Multimedia websites for information sharing, such as Youtube, Flickr, Picassa (14.6%) and company blogs such as Twitter (9.5%), were also widely used.

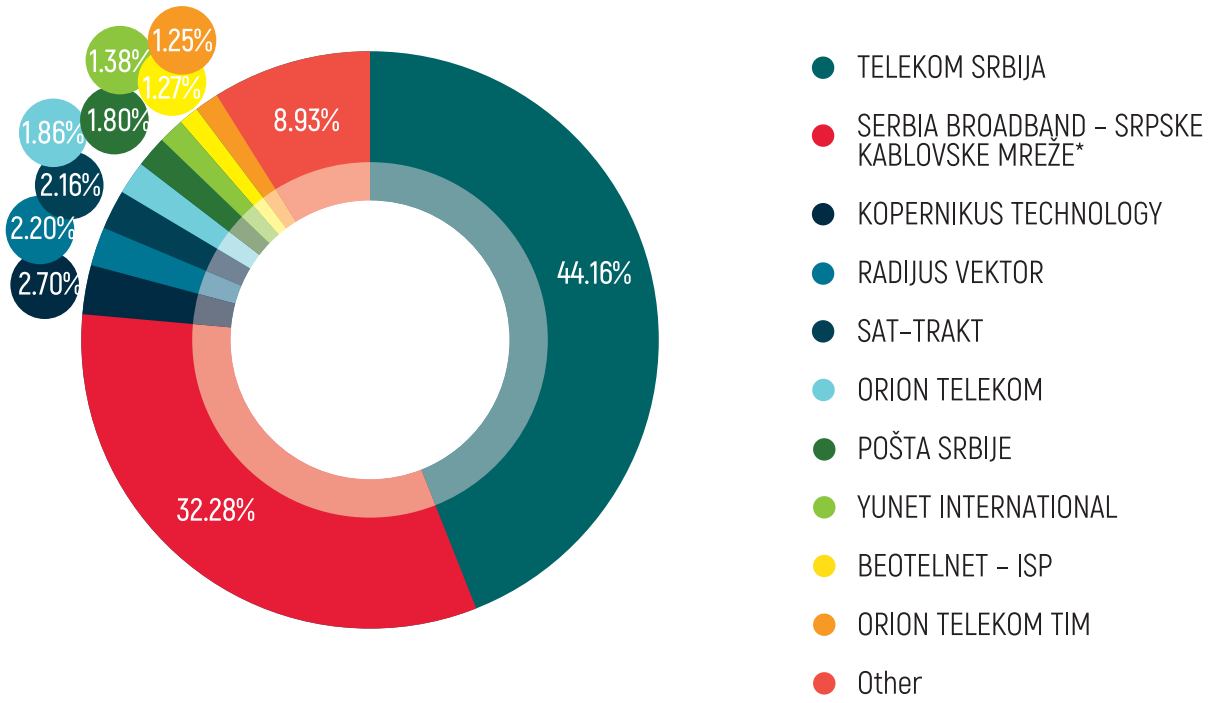
The number of companies paying for cloud service, accessed via Internet for the purpose of software usage, data storage etc, remained 9.3%, the same as the previous year.

The change in the package structure in favour of higher access rates and the increased number of devices used for the Internet access within the same household, resulted in the increased traffic volume. Based on the available data, the assessed total traffic made by fixed broadband in 2017 was

around 977 million GB. The assessed international link capacity was approximately 458 thousand Mb/s and the leased international link capacity (lit/equipped) was around 1.65 million Mb/s.

Telecommunications Company "Telekom Srbija" remains to be the largest operator of fixed broadband in the Republic of Serbia in 2017, with a market share of 44% in terms of the number of subscribers. Other ISPs that should be mentioned are: SBB with a share of 32%, Kopernikus technology, Radijus vektor, Sat-Trakt, Orion telekom, PE "Pošta Srbije", Yunet International, Beotelnet ISP and Orion telekom, each of them holding a significantly smaller share compared to Telekom Srbija and SBB. Together, these 10 operators hold 91% of the Serbian ISP market in terms of number of subscribers.

Figure 96. Market share of the leading ISPs in 2017



*Includes also the data for I.KOM that has been formally merged with SBB in early 2018.

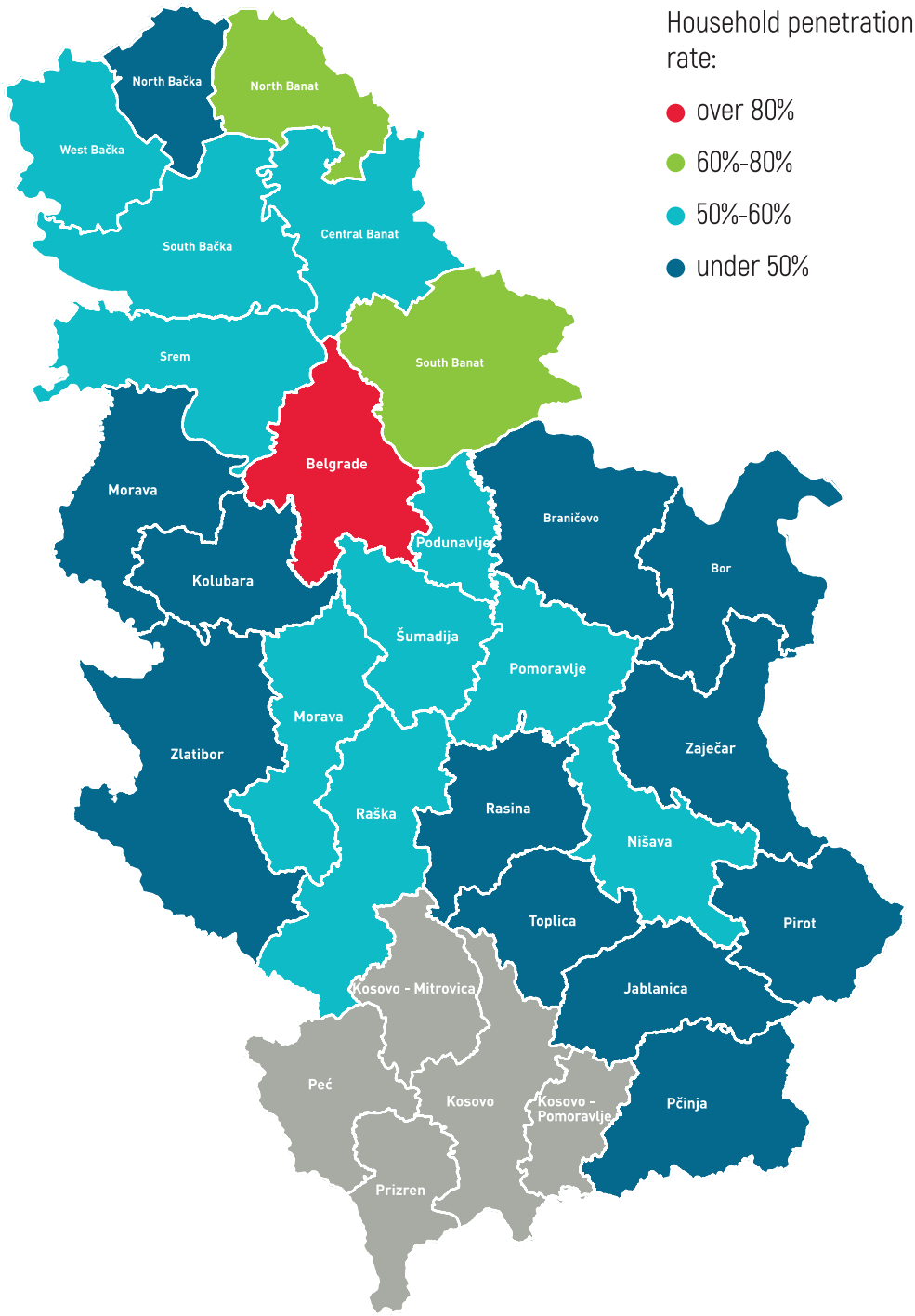
Source: **RATEL**

Table 13 shows the data on the Internet household penetration by districts.

Table 13. Penetration by districts

District	Number of households	Total number of subscribers	Household penetration rate (%)
Belgrade	606 433	508 545	83.86
South Bačka	223 653	171 544	76.70
North Bačka	71 416	44 068	61.71
South Banat	101 503	60 590	59.69
Šumadija	97 096	56 158	57.84
Srem	105 031	59 322	56.48
Nišava	128 303	72 093	56.19
Podunavlje	64 155	35 812	55.82
Raška	90 515	49 910	55.14
Morava	72 867	39 932	54.80
Central Banat	68 866	36 830	53.48
Pomoravlje	71 478	35 772	50.05
West Bačka	68 888	34 443	50.00
Braničevo	59 776	29 637	49.58
Bor	45 970	22 640	49.25
Mačva	100 136	48 926	48.86
Kolubara	58 973	28 116	47.68
Zlatibor	94 434	43 235	45.78
Pčinja	49 918	22 730	45.53
North Banat	56 800	25 114	44.21
Rasina	77 270	34 015	44.02
Pirot	34 036	14 515	42.65
Jablanica	66 740	27 386	41.03
Toplica	31 184	12 342	39.58
Zaječar	42 445	16 512	38.90

Figure 97. Internet penetration by districts



The list of 10 municipalities/cities with the biggest number of Internet service subscribers, considering the number of households, is given in Table 14 below. The analysis was based on processing the data collected from 135 ISPs.

Table 14. List of 10 municipalities/cities with the biggest number of subscribers

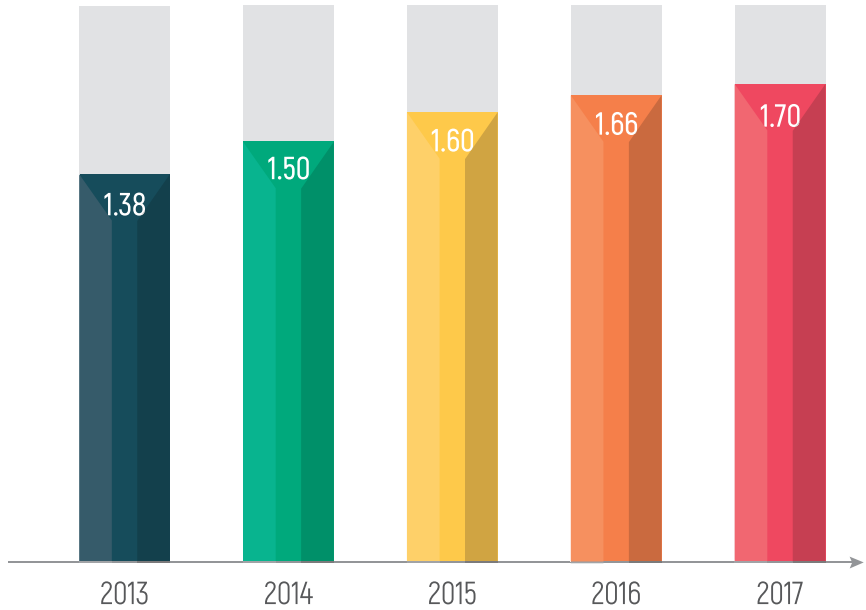
Municipalities/Cities	Number of households	Total number of subscribers	Penetration (%)
Novi Sad	128 876	121 281	94.11
Belgrade	606 433	508 545	83.86
Temerin	9 188	6 558	71.38
Novi Pazar	24 090	16 469	68.36
Pančevo	43 144	29 136	67.53
Požarevac	24 806	16 632	67.05
Čajetina	5 136	3 437	66.92
Subotica	54 070	35 481	65.62
Niš	89 903	58 719	65.31
Vršac	17 769	11 498	64.71

MEDIA CONTENT DISTRIBUTION

In 2017, there were 83 registered media content distribution operators providing service via cable distribution network (coaxial, hybrid and optical), copper pairs, satellite distribution network and wireless network. As of 2016, a new media content distribution service is available – paid terrestrial television, broadcasted via the network of terrestrial transmitters in the DVB-T2 standard. For the usage of this service, an indoor antenna and a set-top box are required. For the provision of this service on the market of the Republic of Serbia a company "Antena TV" LLC has been registered since 2016.

The total number of subscribers of the media content distribution service in 2017 was 1.70 million, which represents an increase by 2.4% compared to the previous year, mostly due to the increase of CDS service subscribers. Approximately 962 thousand subscribers used the service of media content distribution within service package (bundled service), most often coupled with the service of broadband Internet access and/or fixed telephony.

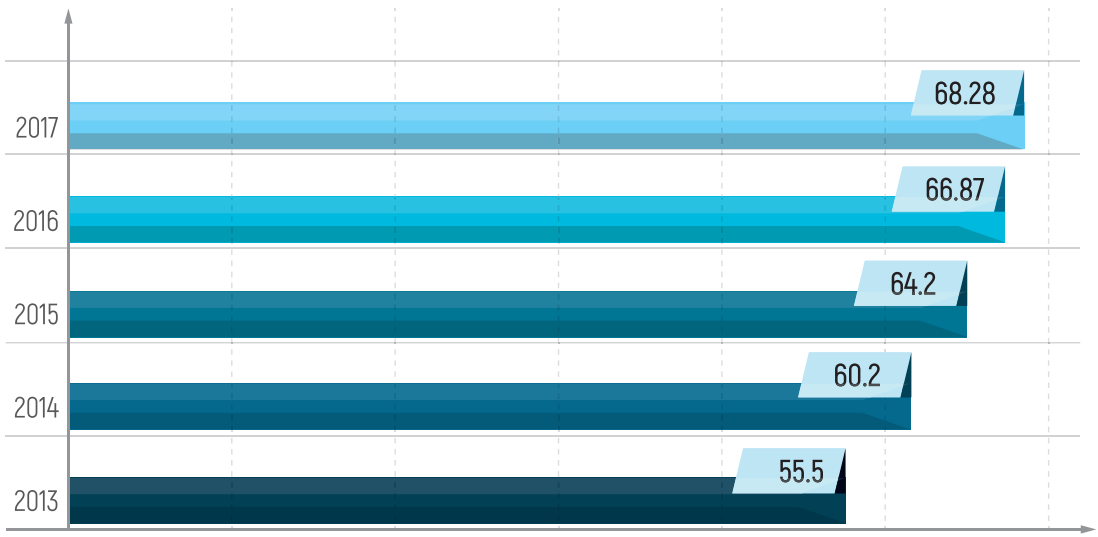
Figure 98. **Total number of subscribers (in million)**



Source: **RATEL**

Penetration is 24.13% in terms of total number of inhabitants and 68.28% in terms of that of households.

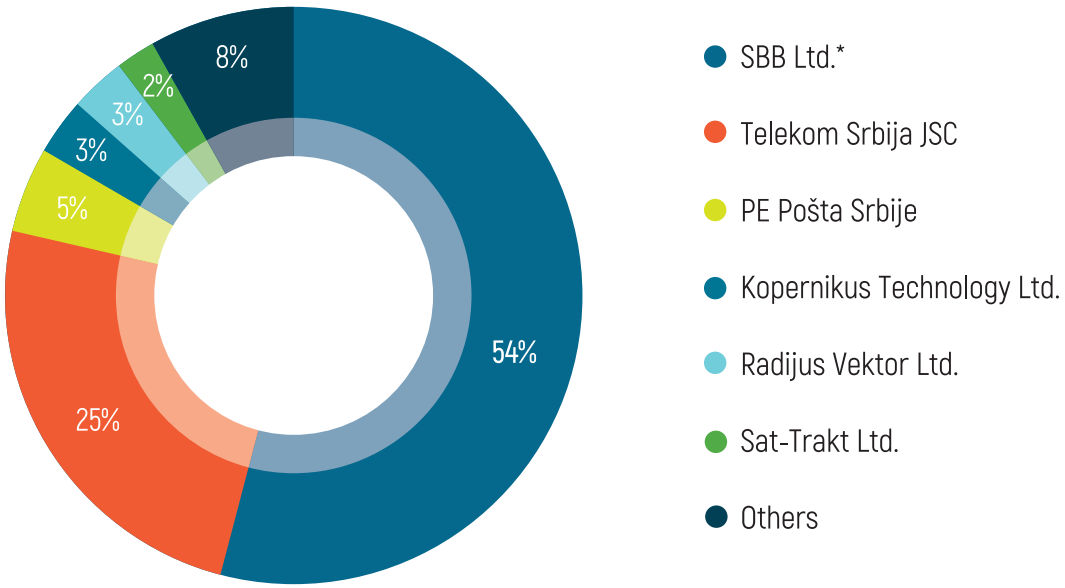
Figure 99. **Number of subscribers per 100 households (in %)**



Source: **RATEL**

The largest media content distribution operator in the Republic of Serbia during 2017 has remained Serbia Broadband – Srpske kablovske mreže Ltd. (SBB Ltd.), with a market share of 54%, in terms of number of subscribers, including the data of I.KOM oeprator Ltd, which was merged with SBB Ltd at the beginning of 2018. Telekom Srbija JSC has accounted for around 25% of the market share in 2017, whereas Public Enterprise "Pošta Srbije", Kopernikus tehnology Ltd, Radijus vektor Ltd. and Sat-Trakt Ltd, in terms of number of subscribers, have accounted for a joint market share of 90% pertaining to media content distribution.

Figure 100. Market share of leading operators in 2017

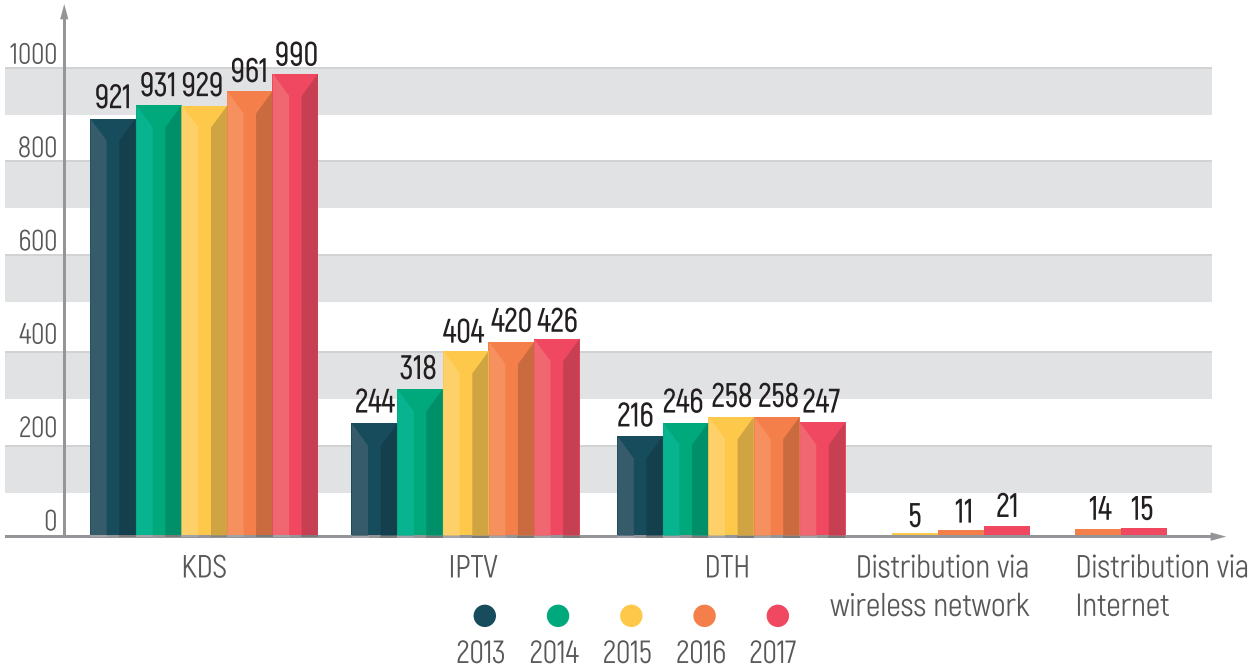


* Data referring to SBB Ltd. include also the data of I.KOM Ltd. merged on January 3, 2018.

Source: **RATEL**

Media content distribution via cable distribution systems (CDS) has continued to be dominant in 2017, with around 990 thousand subscribers, which is an increase by 3% compared to the previous year. The number of IPTV subscribers via copper pair network is on the increase as well, by approximately 1.5% compared to the previous year, whereas the number of DTH subscribers has dropped by approximately 4%. number of media content distribution subscribers via wireless network has increased as well, with around 21 thousand in 2017, accompanied by an increasing number of media content distribution subscribers via Internet, amounting to approximately 15 thousand.

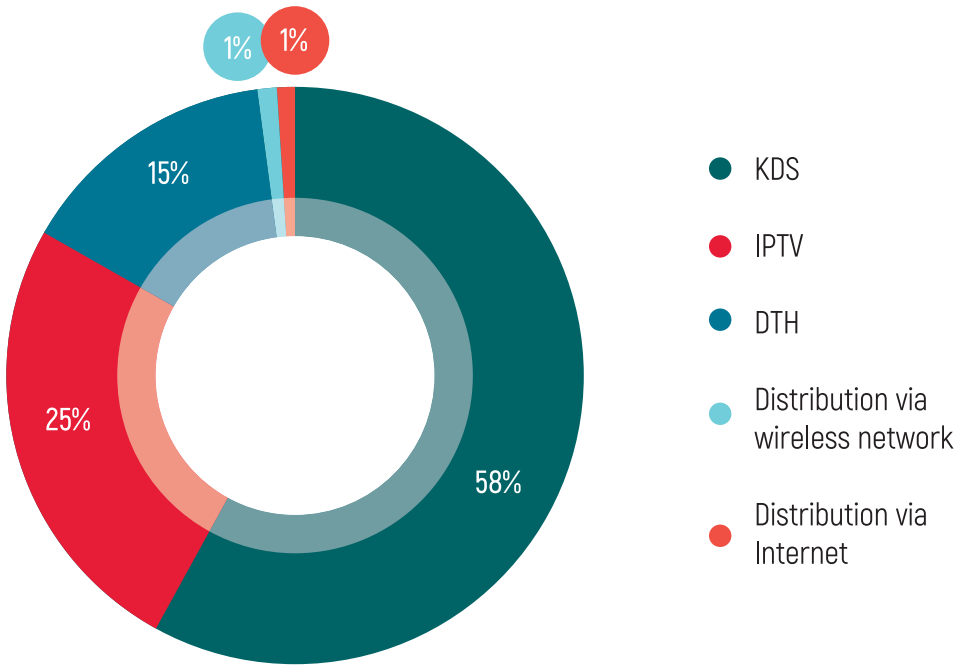
Figure 101. Number of subscribers of the most popular types of media content distribution (in thousand)



Source: **RATEL**

The percentage share of subscribers by the type of distribution, regarding the most popular types of distribution during 2017 has not changed substantially, while the subscribers of other types of distibution slightly increased their share from 1.5% to 2% compared to the previous year. More precisely, those are subscribers of distribution via Internet that account for 0.86% and subscribers of wireless network distribution that account for 1.26% of the total number of subscribers, including the subscribers of paid terrestrial television, which is a new service on the observed market as of 2016 and has reached in 2017 almost 12 thousand subscribers.

Figure 102. Share of subscribers by type of distribution in 2017

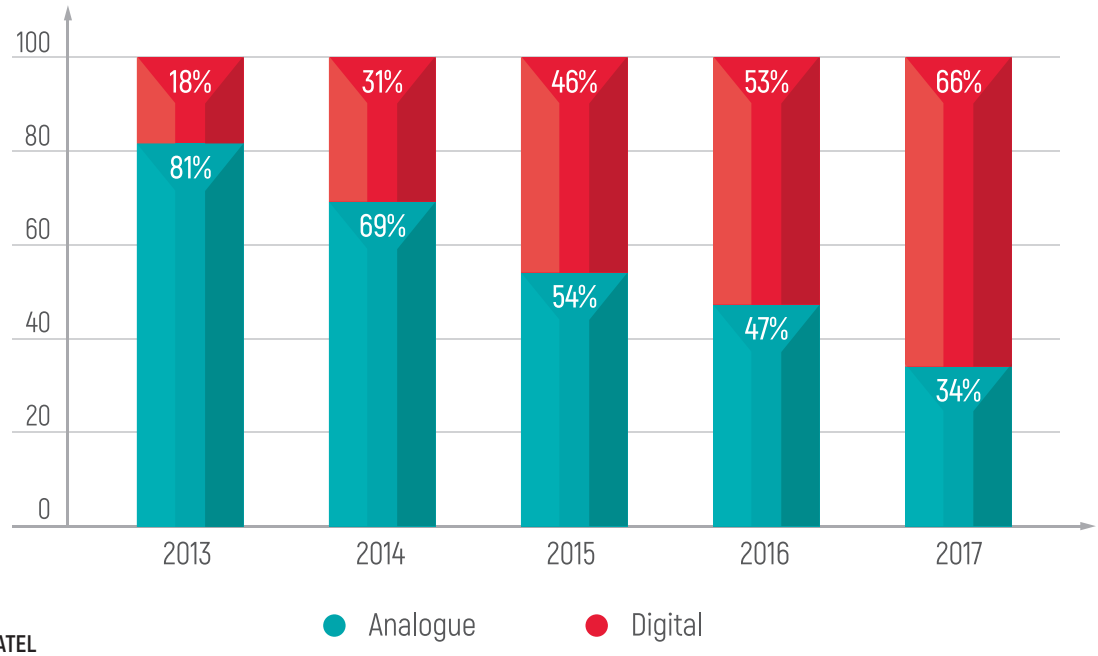


Source: **RATEL**

In 2017, the number of subscribers following the media content in digital format have for has almost doubled compared to the number of subscribers of the analogue cable TV, which means that the users' preferences have changed and that the digitalization of cable networks is in its full development.

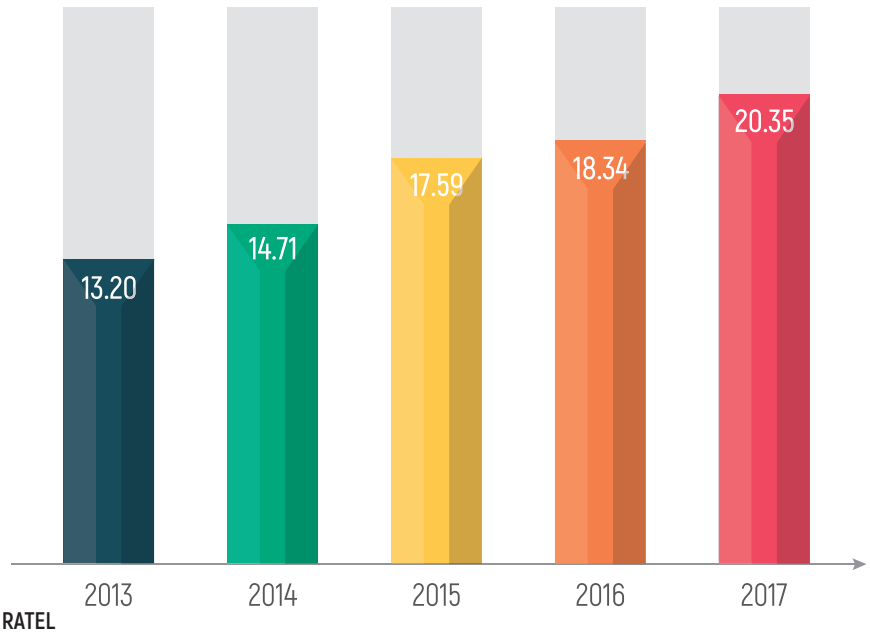
Digital cable distribution enables users to watch content in high resolution (HD), as well as to have numerous additional services, while simultaneously the analogue to digital distribution switchover is being encouraged by the operators' diverse promotional activities.

Figure 103. **CDS subscribers**



Source: **RATEL**

Figure 104. **Revenue trends on media content distribution market (in billion dinars)**

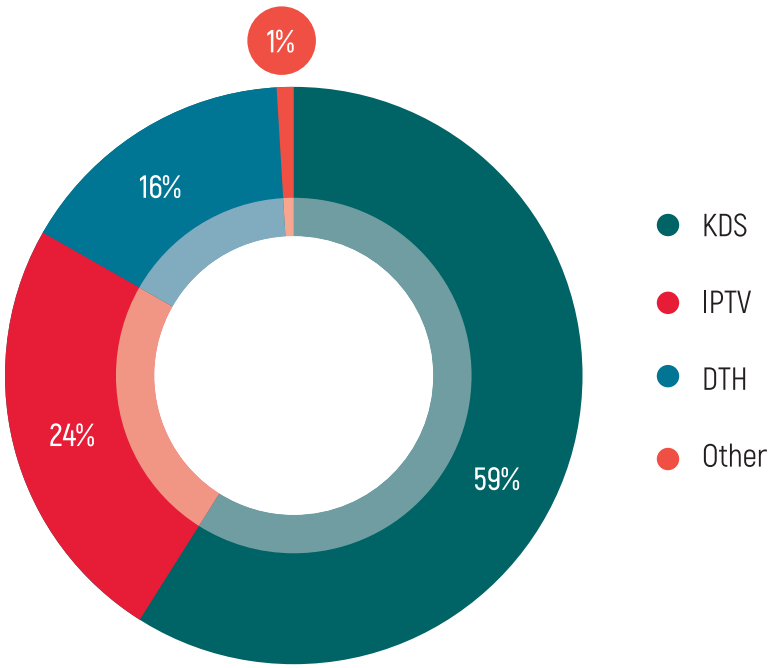


Source: **RATEL**

The total income of media content distribuion operators in 2017 amounts to 20.35 billion dinars and is by almost 11% higher compared to the previous year.

The share of revenues by the type of distribution has not changed in 2017 compared to the previous year. CDS accounts for the biggest share in the revenues from the media content distribution (59%), followed by IPTV (24%) and DTH (16%). Other revenues in the observed market (revenues from distribution via Internet and from distribution via wireless network including revenues from paid terrestrial television) participate with approximately 1%.

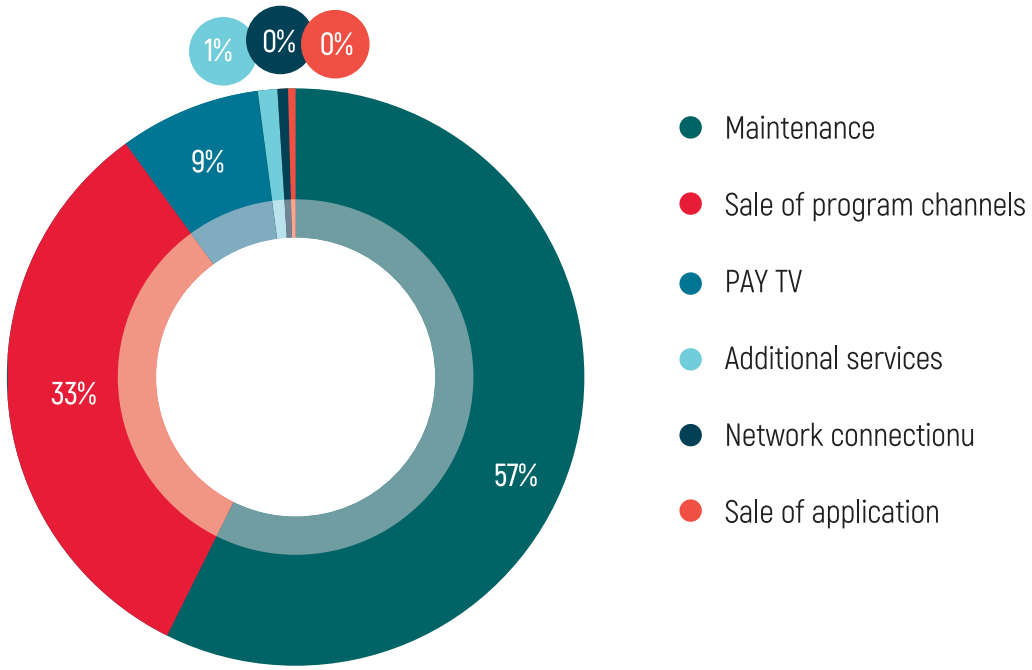
Figure 105. Structure of revenues from media content distribution in 2017



Source: **RATEL**

The revenues from network maintenance and sale of program channels, representing an income from the sale of own program channels to other operators, account for 90% of the total income, as shown in Figure 106. Network connection charges account for negligible portion (0.37%) of the total revenues. The reason for such a low share is the fact that the majority of operators do not charge for this service during promotional offers or if entering in a 12-month/24-month user contract. Revenues from other services including income from additional paying program packages, i.e. PAY TV service, account for 9% of the total revenues. Additional service income includes revenues from video on demand, rewind service, program recording etc, which altogether account for around 1% of the total revenues in 2017. Revenues pertaining to the sale of TV watching application refer to the application that is sold independently of the distribution service, and for which there is no user's agreement, account for 0.13%, a rather negligible portion of the total income.

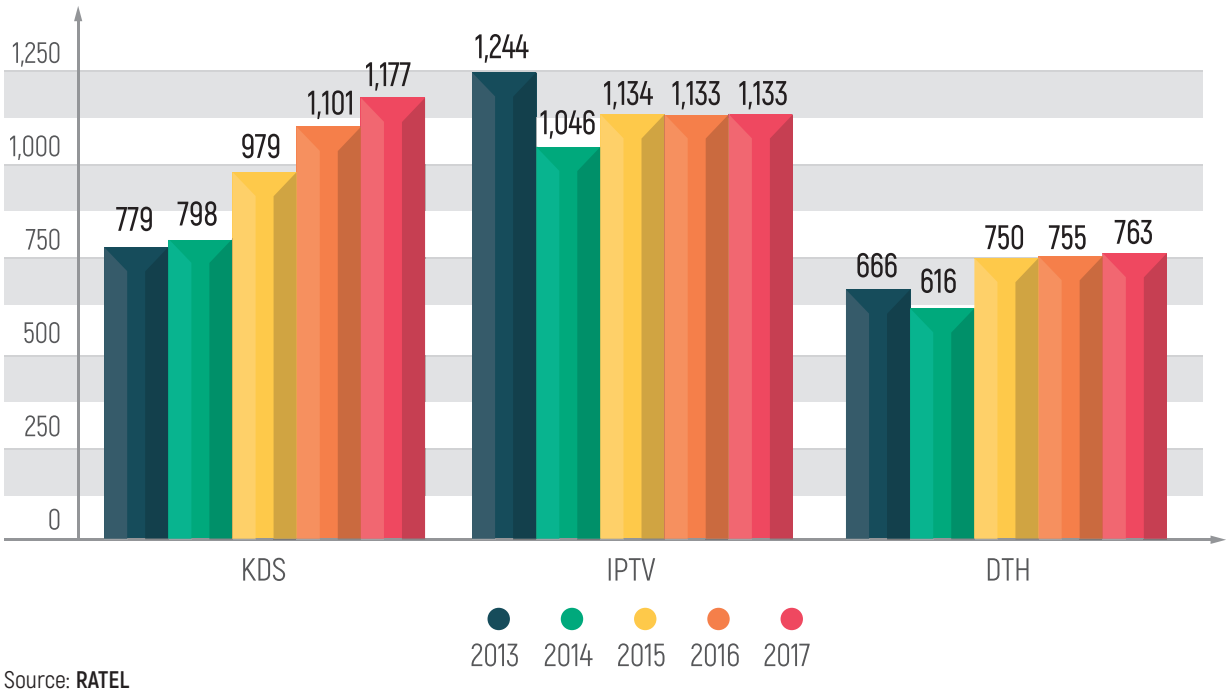
Figure 106. **Share of revenues from media content distribution in 2017**



Source: **RATEL**

In 2017, the average monthly subscription for basic analogue CDS package was 937 dinars, against 1302 dinars for digital CDS. The average subscription for basic IPTV package has remained on the approximately same level compared to the previous year, amounting to 1133 dinars, whereas the average monthly subscription for DTH has slightly augmented to 763 dinars.

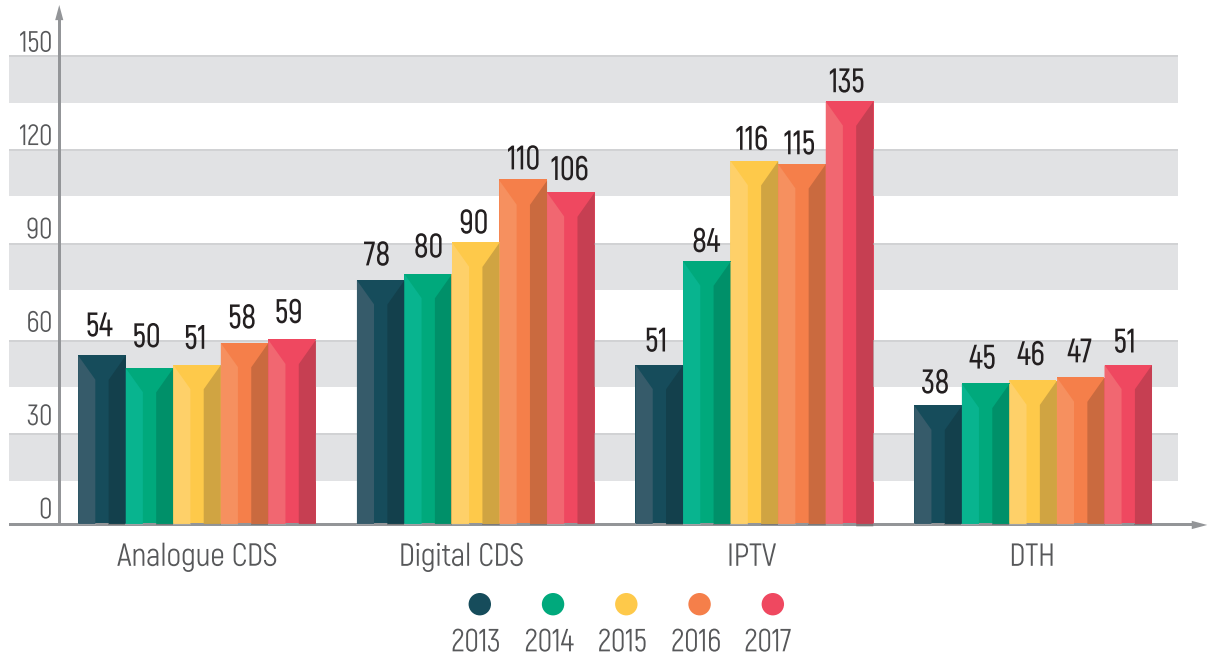
Figure 107. Average monthly subscription for basic package of the most popular types of distribution (in RSD)



Source: **RATEL**

The average number of TV programs in the basic package in 2017, for different types of distribution, has ranged from 59 in case of analogue CDS, to 135 in case of IPTV. There is still a big disproportion between the number of basic package programs of analogue and those of digital CDS, which is one of the means operators use to stimulate subscribers to switch to digital distribution of media content.

Figure 108. Average number of TV programs in basic package of the most popular types of distribution



Source: **RATEL**

In addition to basic package programs included in monthly subscriptions, users can opt for additional, usually thematic channels with additional subscription. These program packages, beside programs from their regular offer already included in the subscription, also contain additional educational, sport-related, film or entertainment and other additional HD programs. According to the available data, in 2017, these programs were followed by more than 459 thousand subscribers.

Additional services available to the subscribers of digital CDS and IPTV include VoD (video on demand), rewind service, recording of the content, interactive TV guide, parental control, watching content on mobile devices and other. According to the available data, in 2017, operators realized over 157 million requests for an additional service (around 166 requests annually per subscriber), out of which over 5 million requests for the VoD service, i.e. 6 requests per subscriber annually.

For distribution service subscribers to be able to watch media content in digital format (irrelevantly from the network they are connected to – cable, telephony, wireless) on various TV devices, for each one of those they need an additional receiver (set-top box), which is paid additionally. During 2017, more than 260 thousand subscribers were renting the additional receiver.

In addition to the distribution service, it is also possible

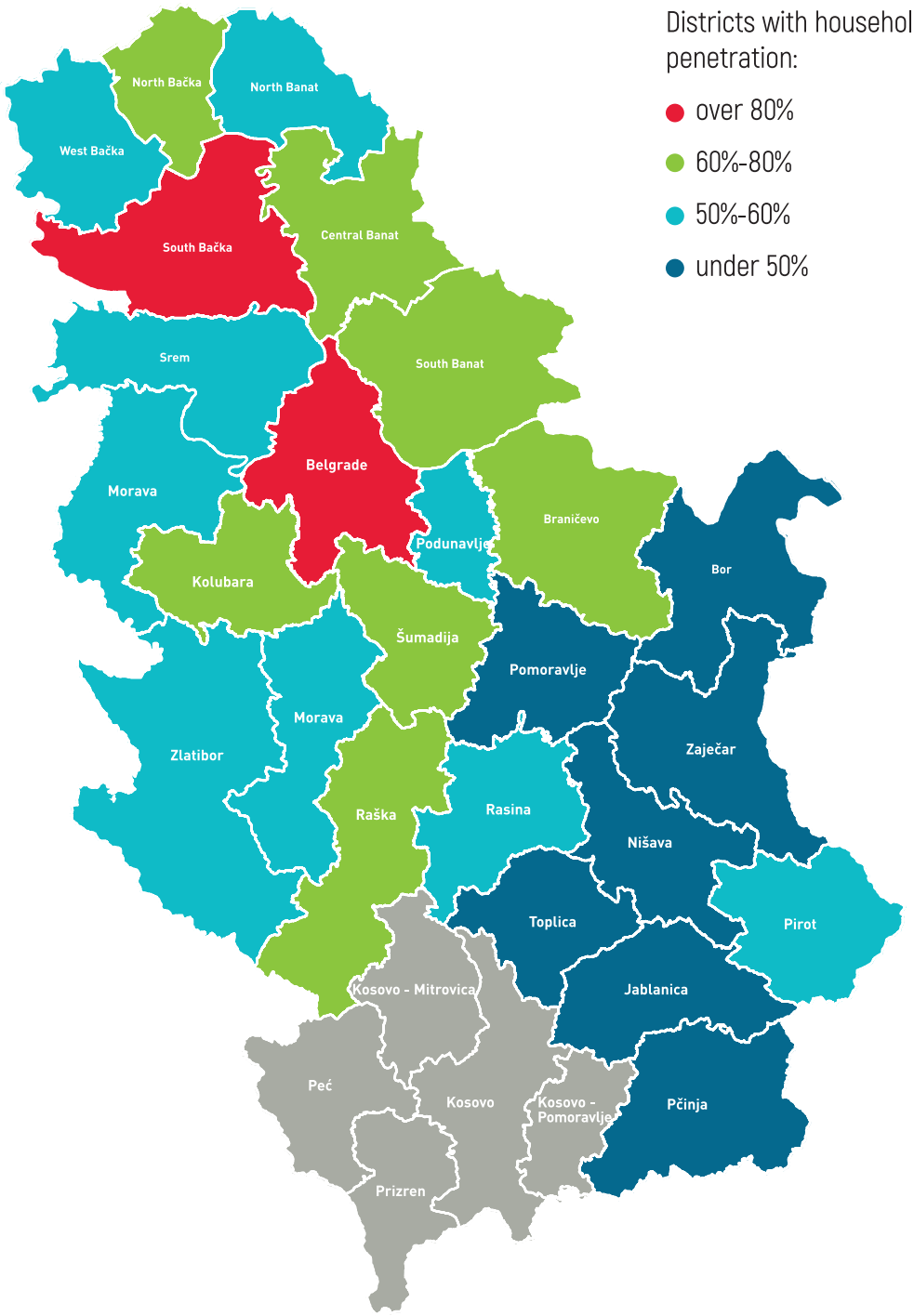
to follow certain TV content on mobile devices, using different applications, without connecting oneself to the distribution network and without entering into subscriber agreement with the operator. The application user is not obliged to pay monthly subscription, while the application itself is usually activated by means of an sms, charged at a previously set rate. This rate actually represents the fee for the usage of the application during a certain, usually shorter period of time.

Table 15 provides data on the penetration of subscribers of media content distribution per household, on a district level.

Table 15. Subscribers of media content distribution service by districts

District	Number of households	Total number of subscribers	Penetration per household (%)
City of Belgrade	606433	553879	91.33
South Bačka	223653	193296	86.43
Šumadija	97096	67876	69.91
Central Banat	68866	47895	69.55
North Bačka	71416	49170	68.85
Braničevo	59776	39406	65.92
South Banat	101503	66581	65.60
Kolubara	58973	36667	62.18
Raška	90515	55608	61.44
North Banat	56800	34049	59.95
Mačva	100136	59811	59.73
Srem	105031	61718	58.76
West Bačka	68888	40439	58.70
Podunavlje	64155	37373	58.25
Rasina	77270	43682	56.53
Morava	72867	39899	54.76
Zlatibor	94434	48497	51.36
Pirot	34036	17260	50.71
Nišava	128303	63841	49.76
Bor	45970	22676	49.33
Toplica	31184	14883	47.73
Pomoravlje	71478	33903	47.43
Jablanica	66740	29303	43.91
Zaječar	42445	18286	43.08
Pčinj	49918	20819	41.71

Figure 109. Media content distribution by districts in the Republic of Serbia



BUNDLED SERVICES

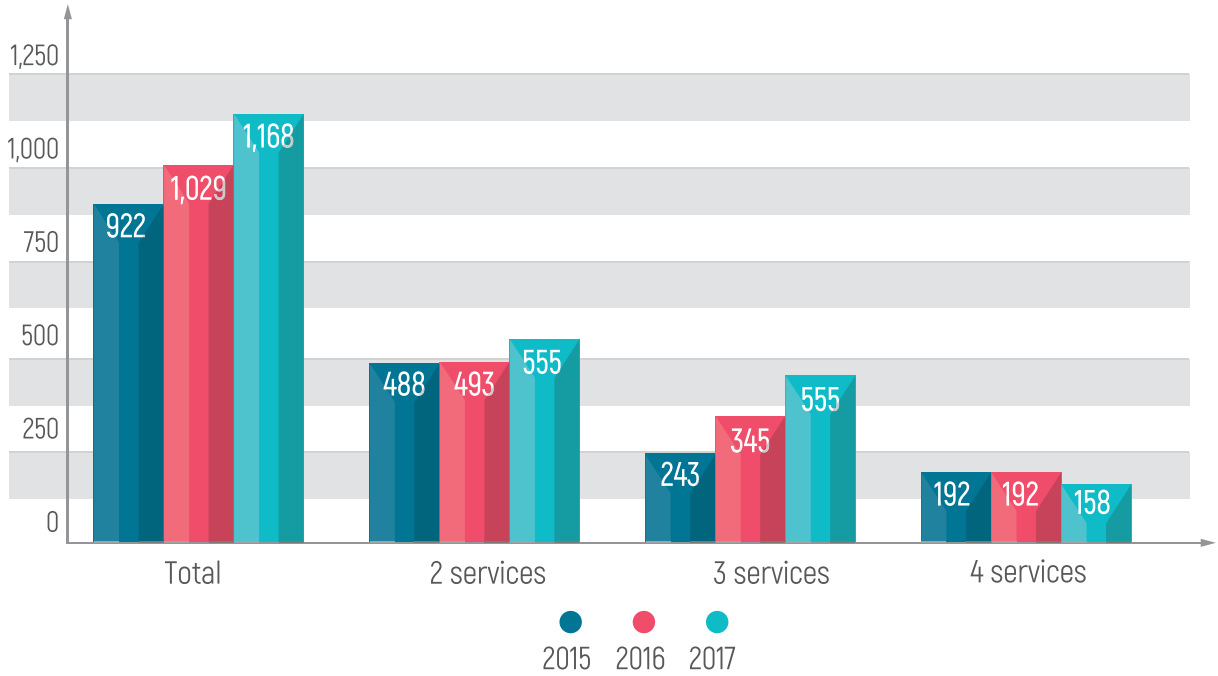
Bundled services are commercial offers of two or more services at a flat rate, which is lower than the sum of individual prices for each of the services sold individually. On the electronic communications market, service packages (bundled services) are the result of the horizontal integration, enabling operators to use the same network and thus provide more different services on the retail market (horizontally integrated operators), such as fixed telephony, fixed broadband Internet access, media content distribution, mobile telephony and mobile broadband Internet access. In that way, the operators are able to reduce some costs and attract new subscribers, regardless of whether they use their own or another operator's network for the provision of retail services. Bundling services into packages also makes it possible for the operators as independent market players to offer their services together, in a unique package containing services otherwise non-existent individually in their standard offer.

During last several years, the sale of bundled electronic communications services has marked constant growth, due to the benefits they provide to end-users, such as lower prices and simpler purchase and payment procedures for a whole set of services, through one single registration and one single account.

In the Republic of Serbia, beside 2-service (double-play) or 3-service (triple-play) packages made up of different combinations of fixed telephony services, broadband Internet and media content distribution, there are also 4-service (quadruple-play) packages that include also mobile telephony service, while on the EU level an initiative has been launched for the introduction of a 5-service package including mobile broadband Internet, normally offered separately from the voice service via mobile network.

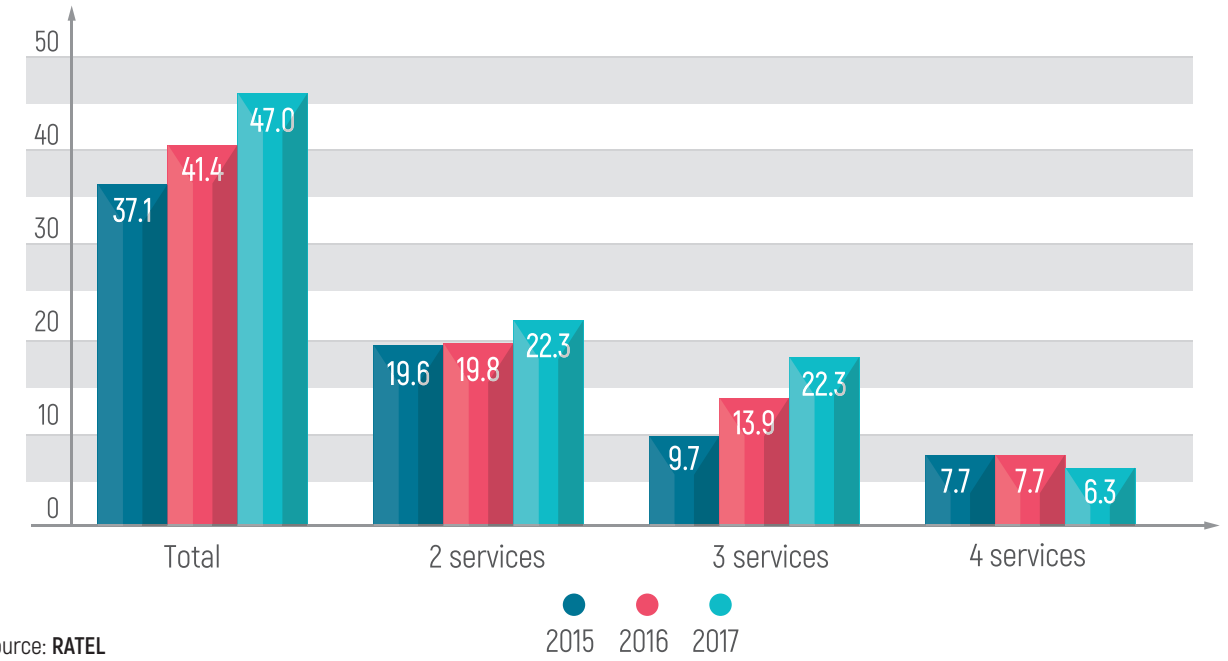
Based on the available data, on the market of the Republic of Serbia, bundled services are offered by around 40 operators, out of which 17 offer 3-service packages, whereas since the second half of 2017, 4-service packages have not been available to new users. The number of bundled service subscribers in 2017 was over 1.16 million, marking a growth by almost 14 % compared to the previous year. The highest growth (32%) relates to the number of triple-play package subscribers, while the number of double-play service packages grew by 13% compared to 2016.

Figure 110. Number of bundled service subscribers (in thousand)



In 2017, the pentration of bundled services by the number of households was around 47%.

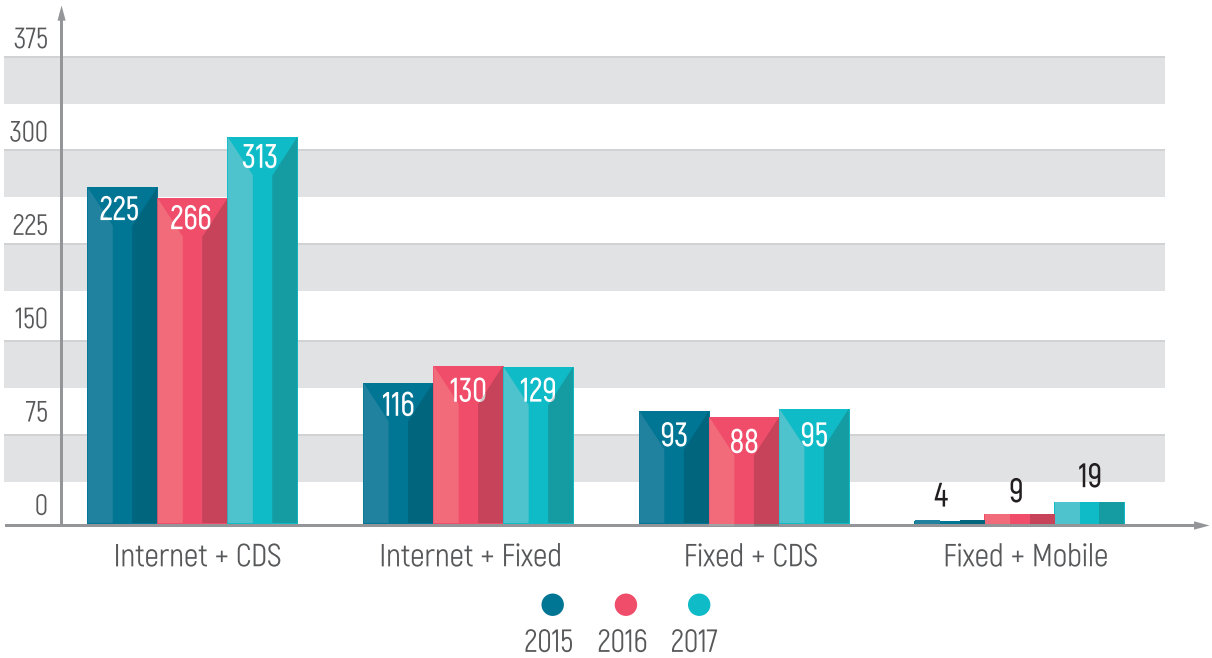
Figure 111. Bundled service penetration by the number of households (%)



Source: **RATEL**

The majority of 2-service package subscribers used bundled service offering broadband Internet access and media content distribution. Figure 112, showing the number of double-play service subscribers by types of included services, indicates that in 2017 the number of subscribers of broadband Internet access and media content distribution has increased by 18%, while the number of subscribers of packages including mobile telephony has more than doubled, although still at a very low level. The number of subscribers of packages containing media content distribution and fixed telephony has increased by approximately 8%, whereas the number of subscribers of packages with broadband Internet access and fixed telephony has gone to a slight decrease during 2017 compared to the previous year.

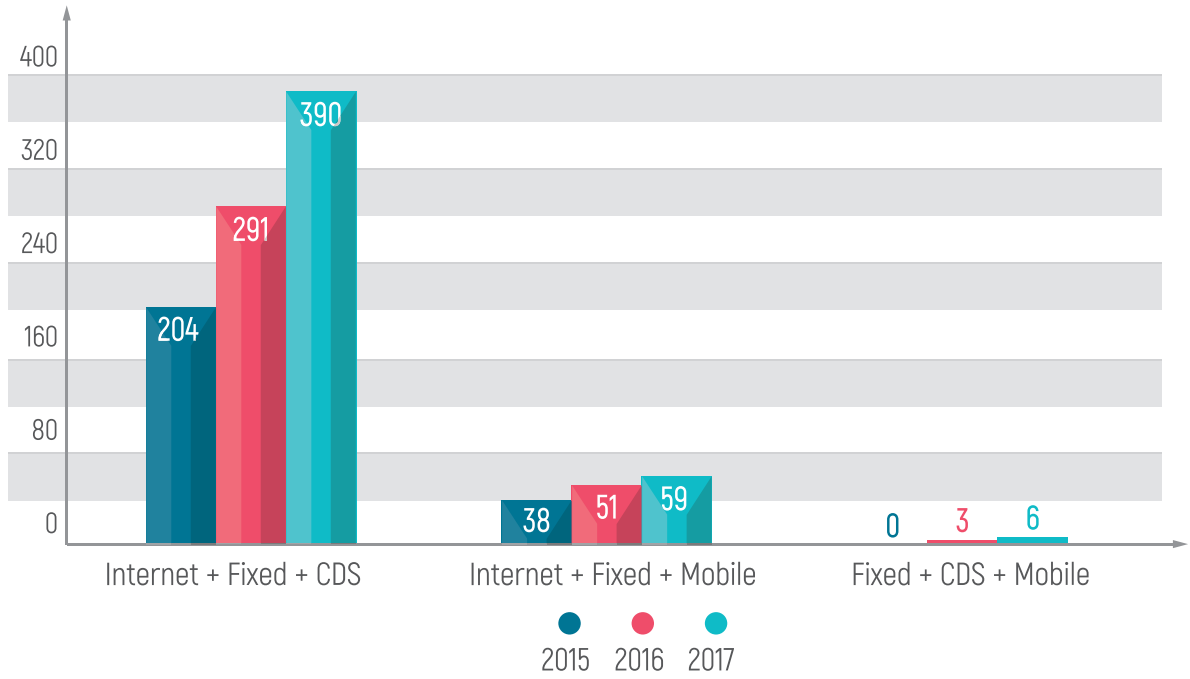
Figure 112. Number of 2-service package subscribers (in thousand)



Source: **RATEL**

The best selling 3-service package is bundled service including broadband Internet access, fixed telephony and media content distribution. This package has seen an increase of subscribers by 34%. As of 2016, triple-play packages offering fixed telephony, media content distribution and mobile telephony are present on the market. Compared to 2016, the number of triple-play subscribers has doubled in 2017, however still remaining at a low level.

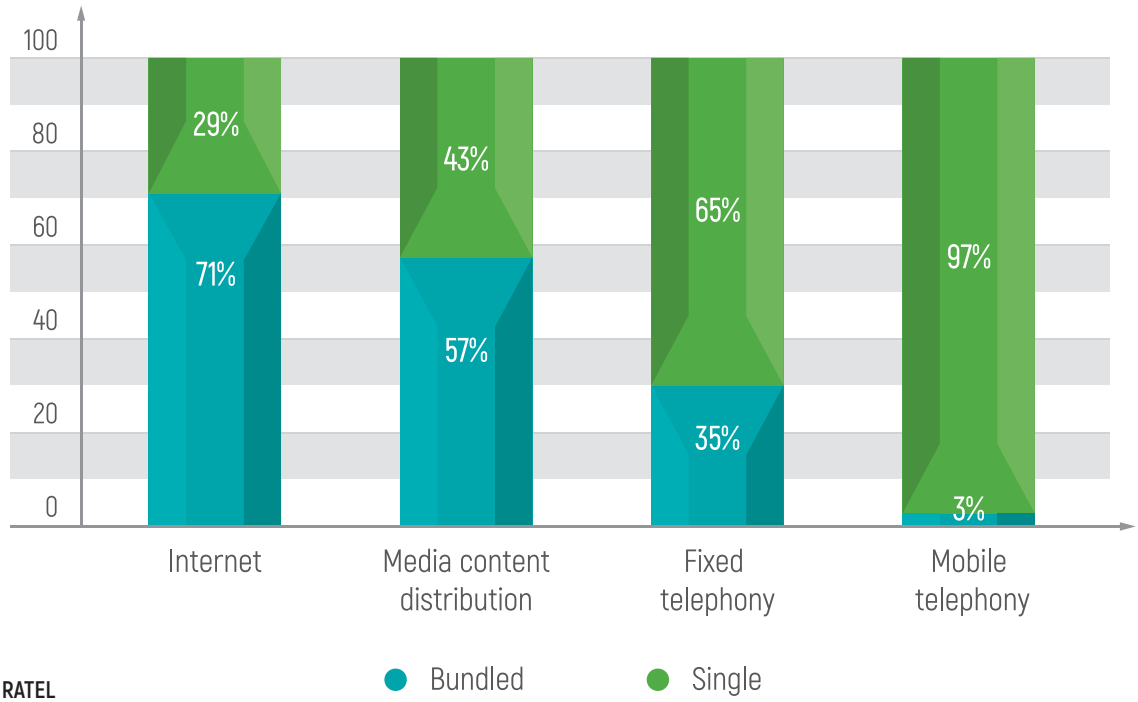
Figure 113. Number of 3-service package subscribers (in thousand)



Source: **RATEL**

Compared to the previous year, the number of subscribers purchasing broadband Internet access, media content distribution and fixed telephony as bundled service, has marked significant increase, while the situation regarding the mobile telephony service has remained unchanged. The best selling service within the package is still the service of broadband Internet access, used in bundled mode by over a million subscribers in 2017. The next on the list is the service of media content distribution, used in package by half of its subscribers (around 960 thousand), while the least popular service is that of mobile telephony, offered in a bundle with other services by one single horizontally integrated operator on the territory of the Republic of Serbia, however not available any more as part of offer.

Figure 114. Share of single and bundled services purchased by subscribers in 2017

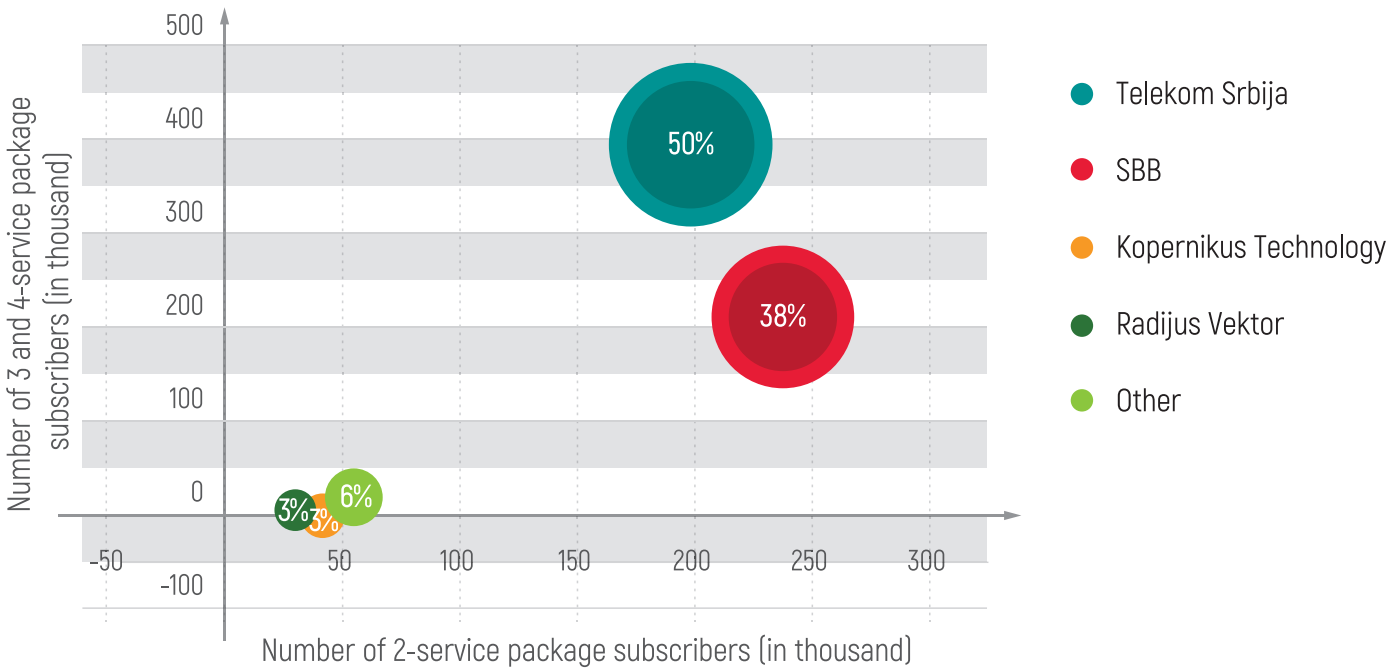


Source: **RATEL**

In the majority of cases, subscribers purchase the service of broadband Internet access from the same operator whose service of media content distribution or service of fixed telephony they are already using. For that reason, the service of broadband Internet access is most usually purchased in package, since thus the subscribers have the opportunity to pay less and have simpler procedures regarding registering and bill payment (for example, instead of several subscriber agreements for each individual service they purchase, only one package contract is signed with the operator; instead of various separate bills for each individual service, only one package bill is received etc).

Most of the operators on the market act individually, offering in their packages services they already provide to their subscribers. There are certain forms of joint offers on the market, including services from other operators, but these joint offers come with separate subscriber agreements and separate bills for end-users, so they cannot be considered bundles services. The share of operators measured by the number of bundled service subscribers is shown in Figure 115.

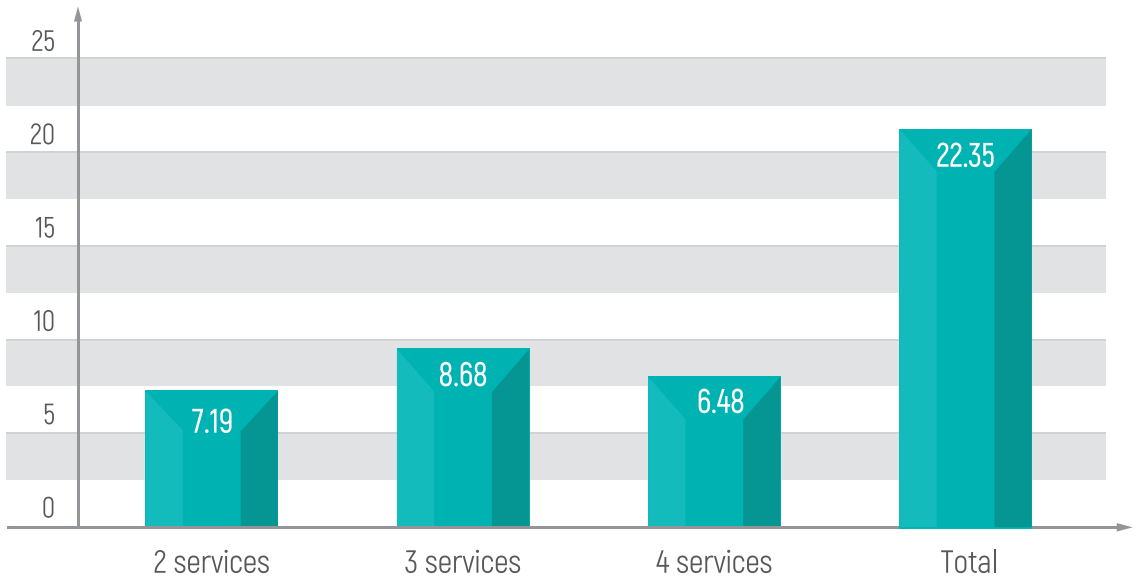
Figure 115. Share of operators by number of bundled service subscribers in 2017



Source: **RATEL**

By selling bundled services in 2017, the operators earned an income of around 22 billion dinars, the most of which (around 8.7 billion dinars) is due to the sale of triple-play bundles, while the sale of quad-play packages accounted for the smallest income share (around 6.5 billion dinars).

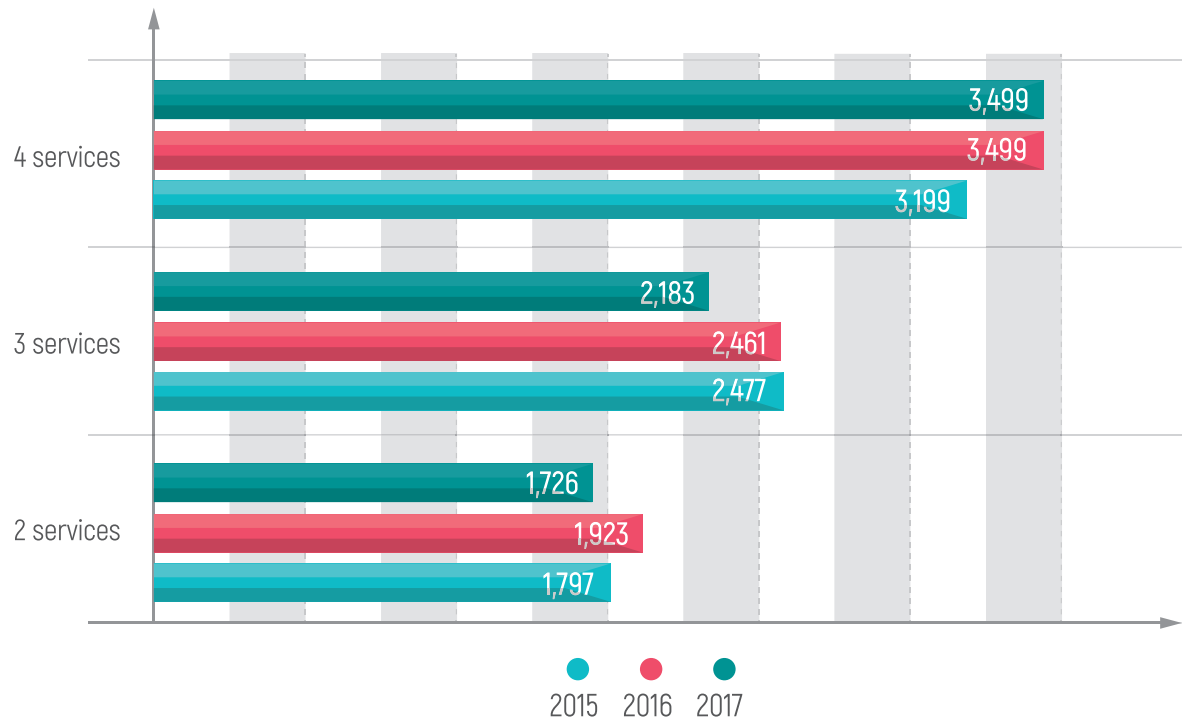
Figure 116. Earned income from sale of bundled services in 2017 (in billion RSD)



Source: **RATEL**

Monthly subscriptions for the best selling packages in 2017 ranged between 750 dinars for the cheapest package and 4000 dinars for the most expensive one, depending on the operator and the package content. These amounts are smaller compared to the previous year, except in case of 4-service bundles, which are no longer available to the new users. Operators often offer bundled services at promotional prices (considerably lower than the regular ones) during certain time spans and with a 12 or 24-month contract. Monthly subscriptions differ depending on the program package (basic channel package, additional services, additional media content), Internet speed, free minutes in fixed telephony and mobile telephony package included in the bundled service. The average subscription amounts for the best selling bundled services in the Republic of Serbia are given in Figure 117.

Figure 117. Average amounts of monthly subscription for the best selling bundled services (in RSD)



Source: **RATEL**

11 VALUE ADDED AND MESSAGING SERVICES

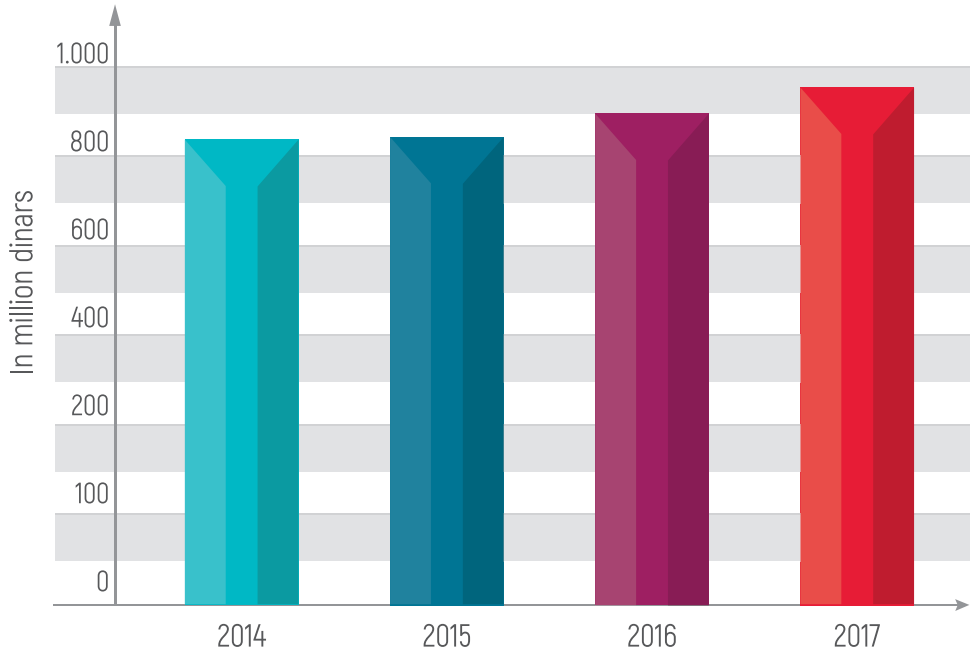
The Law on Electronic Communications and Rulebook on general terms and conditions for electronic communication activity ("Official Gazette of RS", no. 38/11) have created administrative possibility for messaging and value added service (VAS) providers to be registered in the register of operators managed by RATEL, in line with the legal competences.

In 2017, there were 58 operators in the register of public communication networks and services registered for value added service provision, most of them being registered for message transmission service, as well. These operators provide services through fixed and mobile network operators, the users of these networks being able to access value added services by means of public numbering (090Xabcdef and 0780abcdef) for value added voice transmission and internal numbering of mobile operators for value added messaging (SMS, MMS).

Messaging and value added service provided by the operators may be divided, according to purpose, into: televoting, advertising, entertainment, children entertainment, humanitarian aid, adult entertainment, lottery, SMS notification, marketing bulk messages, goods and services payment and other.

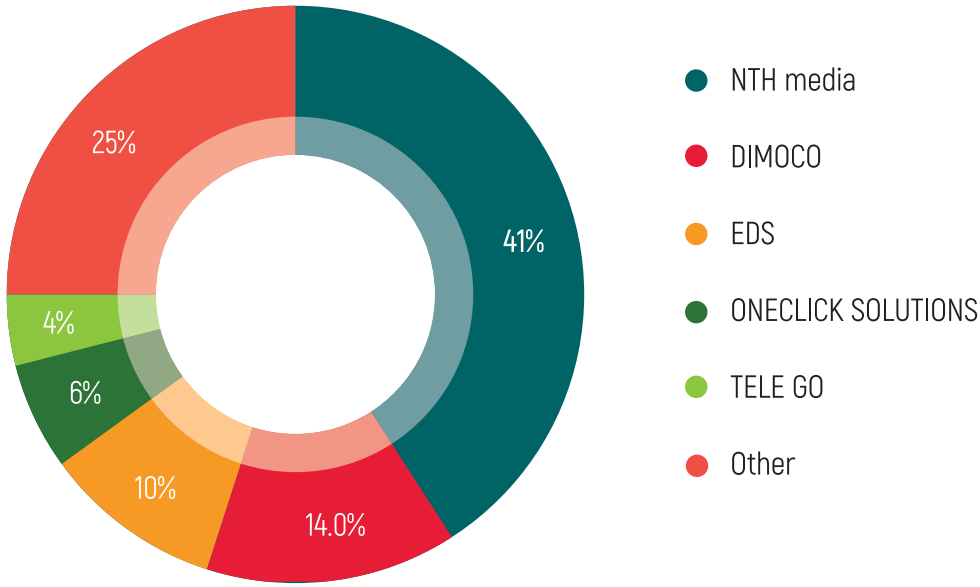
Annual revenues for the period 2014-2017 pertaining to the above services are given in Figure 118. Service provision accounts for the total income of around 900 million dinars. In 2017, the revenues in this market, according to the data collected by RATEL, amounted to approximately 990 million dinars, which means the operators' income increased by almost 6% compared to the previous year. It should be noted that part of the revenues, made from network usage, traffic billing and collecting, go to network operators, based on commercial contracts between network operators and messaging and value added service providers.

Figure 118. Annual revenues 2014 – 2017



According to the available data provided to RATEL by the operators, three operators with the largest revenues from messaging and value added service provision in 2017, were: NTH Media LLC, DIMOCO SERBIA and Entertainment Media Group LLC, with the total share of 65 % of the value added service market.

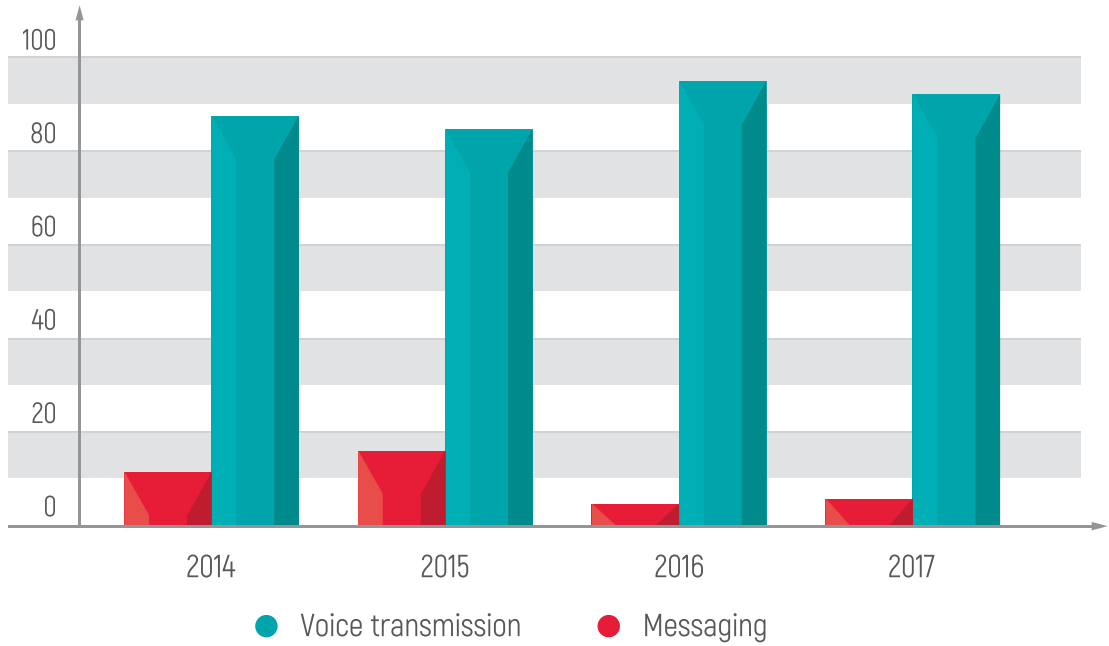
Figure 119. Market share of messaging and value added service operators by revenues made from these services



Value added service market is fully competitive. Figure 120 shows market share of VAS providers (VASPs) according to revenues made. However, it should be noted that the revenues are divided between VASPs, network operators and content creators.

Around 93.5% of the total revenues made by the operators in 2017 are revenues from messaging service (SMS, MMS) and VAS messaging, and the rest of the revenues comes from voice VAS. Technology that enables easier and better data processing for SMS and MMS and the expansion of direct electronic marketing have led to a significant increase in the revenues made from messaging and value added services. In addition, large-scale usage of smart phone devices has decreased the users' interest for VAS realized by voice transmission or SMS messaging, which particularly affects voice VAS.

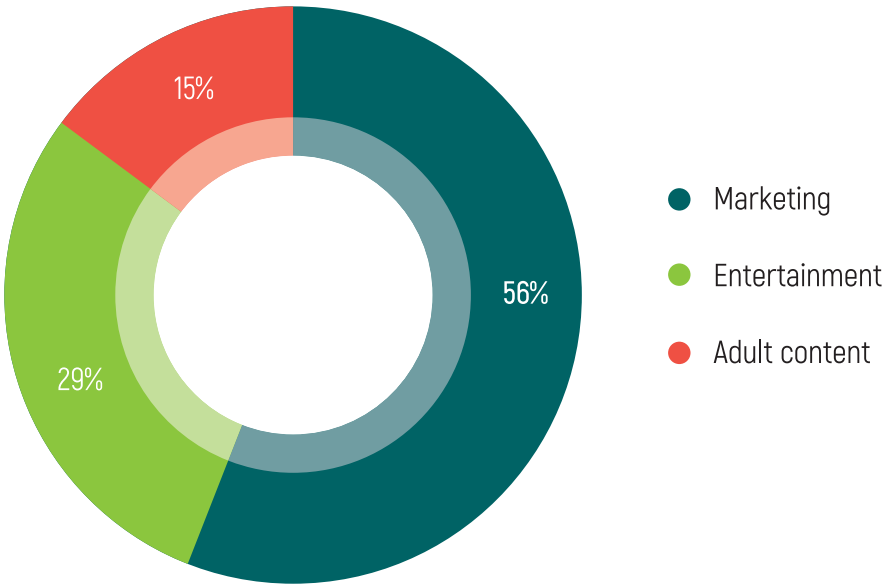
Figure 120. Market share by type of VAS, by revenues made in 2014, 2015, 2016 and 2017



For the purpose of VAS voice transmission, the operators were assigned 540 numbers, which is 20 numbers less than the previous year.

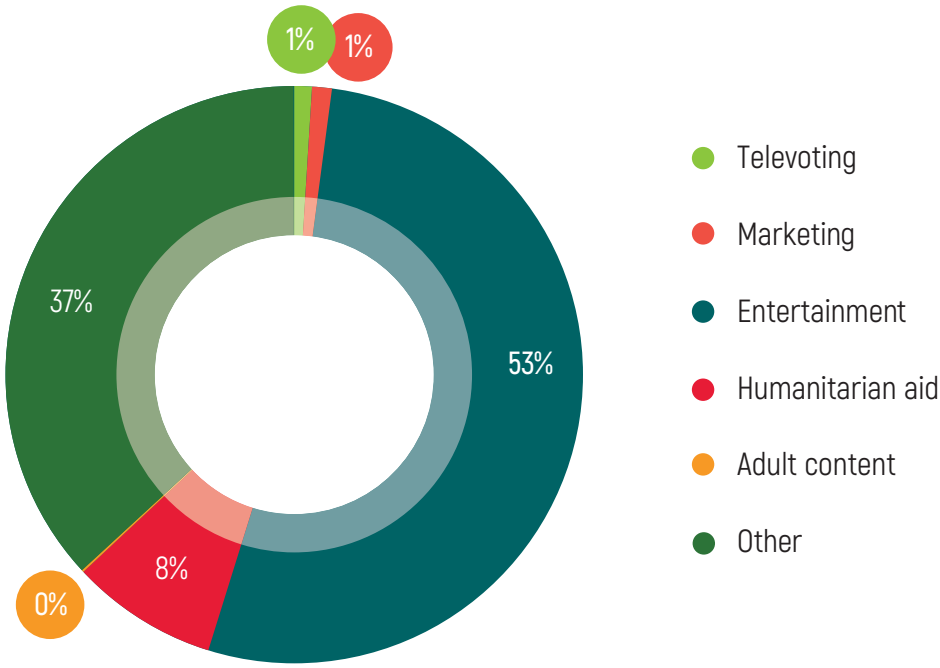
In 2017, voice value added service provision accounted for over 112,000 minutes of traffic, and the share by type of voice VAS is given in Figure 121.

Figure 121. Share of minutes by type of voice VAS in 2017



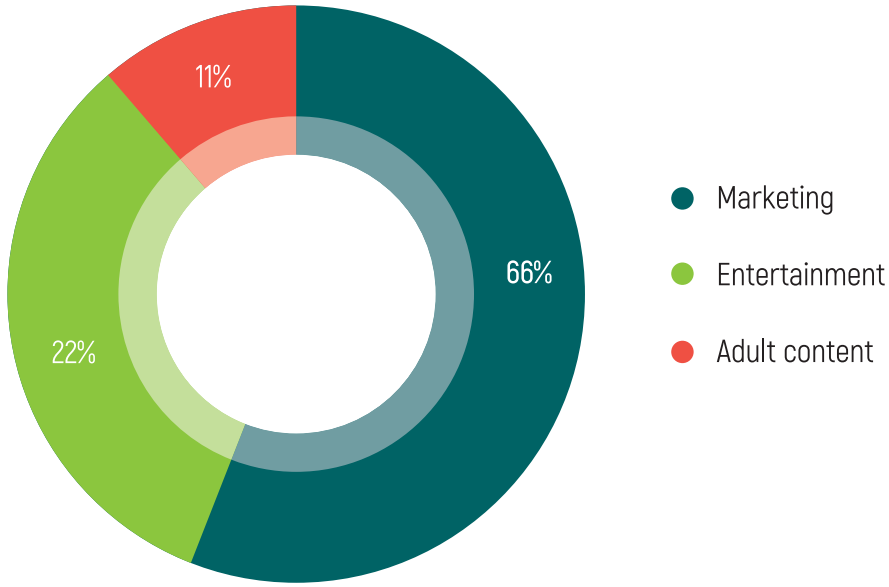
Messaging value added services accounted for 39 million messages and the share by type of VAS is given in Figure 122. Messages labelled as "other" make up 37%, since they do not fall into a standard set of VAS, but concern different information or notifications, taxi orders or queries (on exchange rates etc.) and payment of goods and services.

Figure 122. Share of realized VAS messages by purpose in 2017



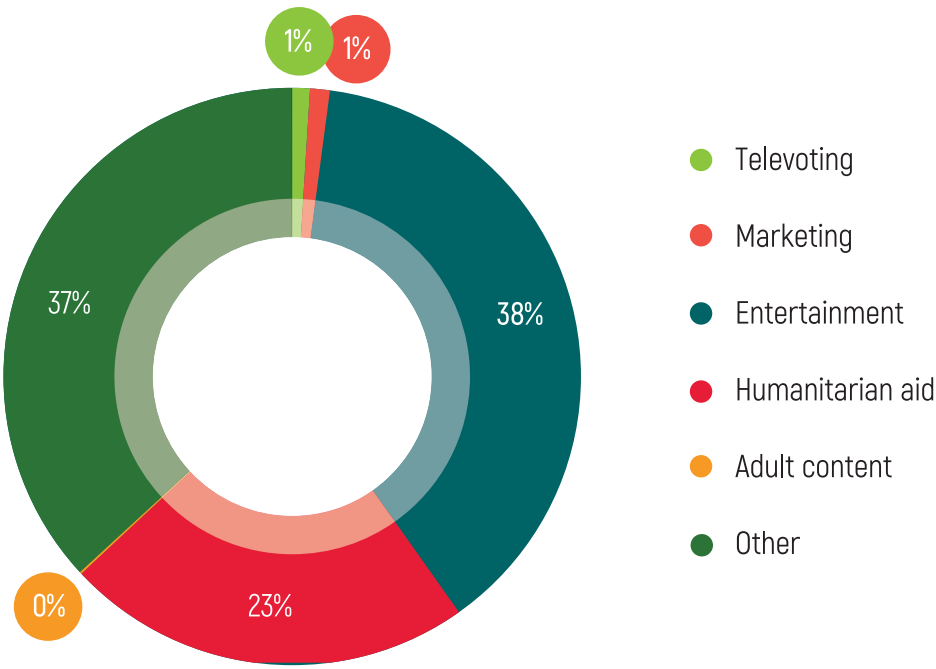
Revenues from voice VAS amount to around 59 million dinars and the share by purpose is given in Figure 123.

Figure 123. Share of voice VAS revenues, by purpose in 2017



Revenues from messaging VAS amount to around 900 million dinars and the share by purpose is given in Figure 124.

Figure 124. Share of messaging VAS revenues, by purpose in 2017



MONITORING OF ELECTRONIC COMMUNICATIONS NETWORK AND SERVICE QUALITY PARAMETERS

Monitoring of quality parameters for electronic communication services and networks is performed pursuant to the Rulebook on quality parameters for publicly available electronic communication services and monitoring of electronic communication activity ("Official Gazette" of RS, nos. 73/11 and 03/14).

The Rulebook stipulates quality parameters for the following electronic communication services:

- *public voice service on the public telephone network at a fixed location,*
- *public voice service provided via Internet (VoIP),*
- *public services on the public mobile communications network,*
- *broadband access,*
- *media content distribution;*

and for the following networks:

- *public mobile communications networks,*
- *public fixed wireless telecommunications networks (CDMA).*

The electronic communication operators are required to provide, at least once a year, upon RATEL's request, a report on the values of the quality parameters for services and/or networks, on appropriate forms for each service or network. RATEL also performs monitoring of quality parameters for services and networks, compliance with technical and other requirements and performance of the electronic communication activity, in accordance with the Law on Electronic Communications, the aforementioned Rulebook on quality parameters for publicly available electronic communication services and other bylaws and positive regulations.

RATEL maintains an up-to-date database on the quality of the public communication networks and services. In addition, the operators are required, pursuant to Article 106 of the Law on electronic communications, to make their terms and conditions, including the minimum quality of service provision, publicly available in a suitable manner, so as to inform the users on the values of the quality parameters used for measuring the electronic communication QoS.

The reports on the values of quality parameters for elec-

tronic communication services and networks for the previous year were submitted to RATEL by the operators within the prescribed deadline, till March 15, 2018. Verification of the collected quality parameters data is planned during this year. The operators that fail to submit the required reports are subject to penal measures provided for in the Law.

Average values of quality paramenters for electronic communications services and networks for the period 2015–2017

Table 16 shows the number of the operators of electronic communications networks and services that submitted their network and service parameters in a report corresponding to each of the above years. In comparison to the previous years, the number of operators providing service of broadband Internet access has declined, whereas the number of operators providing media content distribution has significantly increased.

Table 16. Number of operators which submitted reports

	2015	2016	2017
Operators providing voice service on the public telephone network at a fixed location	9	18	18
Operator providing voice service provided via Internet (VoIP)	16	23	22
Operators providing services on the public mobile communication network	3	4	4
Operators providing broadband access	134	128	114
Operators providing media content distribution	62	57	99

Average supply time for electronic communications services

For all electronic communications services, the average time from the instant of a valid service order being received to the instant a working service is made available for use, during last year was less than 5 days. The shortening of the average supply time is noticeable compared to the previous years, especially for the voice service on the public telephone network at a fixed location (Table 17).

Table 17. Average supply time for service

	Propisana vrednost	2015	2016	2017
Voice service on the public telephone network at a fixed location	10 days for 50% new connections a year	9.7	5.6	4.4
Voice service provided via Internet (VoIP)	8 days for more than 95% requests	5.0	2.5	2.5
Broadband access service	8 days for more than 95% requests	3.3	3.5	3.1
Media content distribution service	8 days for more than 95% requests	3.3	3.2	2.6

Customer complaints about quality of electronic communications services

During 2017, the percentage og users' complaints about quality of electronic communications services was in average less than 6% for all types of services. The highest percentage of complaints (6.14%) was about the broadband access quality. The time needed for the resolution of users' complaints (applicable for 80% of the complaints) was less than 2 days for all electronic communications services, whereas user complaints about voice service provided via Internet (VoIP) were resolved in the fastest way, for less than a day. For all electronic communications services, the percentage of users' complaints about the correctness of bills was less than 1% (Table 18).

Table 18. Users' complaints and complaint resolution

		Prescribed value	2015	2016	2017
Voice service on the public telephone network at a fixed location	Percentage of user complaints about quality of service	0.5%	10.0%	2.4%	2.4%
	Resolution time for user complaints for 80% of the complaints (days)	10.0	1.6	1.6	1.1
	Percentage of user complaints about bill correctness	≤1%	0.5%	0.3%	0.92%
Voice service provided via Internet (VoIP)	Percentage of user complaints about quality of service	-	2.3%	3.0%	2.73
	Resolution time for user complaints for 80% of the complaints (days)	1.0	0.8	0.8	0.72
	Percentage of user complaints about bill correctness	≤1%	1.4%	0.3%	0.13%
Services on the public mobile communications network	Percentage of user complaints about quality of service	-	4.4%	1.5%	1.88%
	Percentage of user complaints about bill correctness	≤1%	0.1%	0.1%	0.12%
Broadband access service	Percentage of user complaints about quality of service	-	6.8%	5.2%	6.14%
	Resolution time for user complaints for 80% of the complaints (days)	1.0	1.1	1.1	1
	Percentage of user complaints about bill correctness	≤1%	0.8%	0.7%	0.42%
Media content distribution service	Percentage of user complaints about quality of service	-	4.7%	6.3%	4.5%
	Percentage of user complaints about bill correctness	≤1%	0.8%	0.7%	0.7%

Parameters of operator's contact services

The shortest response time of an operator's contact service during last year was for the voice service on the public telephone network at a fixed location and amounted to 27 seconds.

Response time in contact centers during 2017 remained at the appoximately same level as in 2016, namely in contact services of the operators providing voice service on the public telephone network at a fixed location and operators providing service on the public mobile communications network. Notably shorter was the operator's response time in the broadband access support service, compared to the previous year (Table 19).

Table 19. Response time for operator's contact services (Call Center) (seconds)

	2015	2016	2017
Voice service on the public telephone network at a fixed location	50	22	27
Voice service provided via Internet (VoIP)	31	46	68
Services on the public mobile communications network	52	28	29
Broadband access service	72	94	40
Media content distribution service	30	31	30

Quality parameters for voice service on the public telephone network at a fixed location

The ratio of all unsuccessful calls, including the percentage of unsuccessful calls in fixed network within and ouside of the local exchange, percentage of unsuccessful national calls from fixed network to mobile operators and other fixed operators, as well as percentage of unsuccessful international calls was 0.53% in 2017, meaning that the decreasing trend of uncuccessful calls has continued (Table 20).

Table 20. Quality parameters for voice service on the public telephone network at a fixed location

	Parameter definition	Prescribed value	2015	2016	2017
Unsuccessful call ratio (all calls)	Percentage of call attempts to an existing user, which failed due to system failure or no capacities available. The case where the called party (B-Number) is busy or not responding is not regarded as a failed call.	≤1%	1.00%	0.76%	0.53%
Supply time for call (average time for national calls)	Time between selecting the two last digits of the subscriber's number and call verification signal.	< 3s	2.8	3.2	3.33

Quality parameters for services on the public mobile communications network

Four operators provide reports including quality parameters for public services on the public mobile communications network:

- Telekom Srbija,
- Telenor,
- VIP Mobile,
- GLOBALTEL,

whereas, during 2016, GLOBATEL was registered as a virtual mobile operator.

Measurement of quality parameters for services on the public mobile communications network, which should correspond to average values measured for the peak traffic hour in a 7-day week, was carried out in the 50th week of 2017, between the 11th and 17th of December 2017 (Table 21).

Table 21. Quality parameters for public mobile services

	Parameter definition	Prescribed value	2015	2016	2017
Call Setup Success Rate for GSM mobile network (Call Setup Success Rate)	Percentage of call attempts to an existing user, which failed due to system failure or no capacities available. The case where the called party (B-Number) is busy or not responding is not regarded as a failed call	≤1%	1.00%	0.76%	0.53%
Call Setup Success Rate for UMTS mobile network (Call Setup Success Rate)	$CSSR = \frac{\text{successful call attempts}}{\text{all\_call attempts}} * 100\ [\%]$	> 98% at UMTS network level	99.27%	99.40%	99.42%
Telephony Setup Time for GSM network	Time for connection setup from the moment user activates sending function.	-	5.32s	6.51s	6s
Telephony Setup Time for UMTS network	Time for connection setup from the moment user activates sending function.	-	5.12s	5.72s	5s
DL Throughout for Packet Interactive in GSM and UMTS mobile networks	Average throughput towards user (DL) for packet interactive.	> 128 Kb/s	4.9 Mb/s	4.9Mb/s	5.6Mb/s
DL Throughout for Packet Interactive in LTE mobile network	Average throughput towards user (DL) for packet interactive.	-	-		35.7Mb/s

Network load for GMS and UMTS network voice traffic

Measurement of quality parameters for mobile communications networks, which should correspond to average values measured for the peak traffic hour in a 7-day week, was carried out in the 50th week of 2017, between the 11th and 17th of December 2017 (Table 22).

Table 22. Network load for GMS and UMTS network voice traffic

		2015	2016	2017
GSM voice traffic	mean value of network load for GSM network voice trafic, Erlang/TRX	1.9	1.7	1.53
UMTS voice traffic	mean value of network load for UMTS network voice trafic, Erlang/TRX	1.5	1.6	1.76

Values of quality parameters for public fixed wireless telecommunications networks (CDMA)

The report on the CDMA network quality consists of the coverage overview in 5 districts in Srbija: Pčinja District, Jablanica District, Raška District, Pirot District and Zlatibor District.

The reports on the CDMA network coverage by district have been provided by:

- Telekom Srbija,
- Orion telekom.

The lowest prescribed CDMA network coverage of the populated localities in districts needs to be 40% for the transmission signal power above -94 dBm. Operator Telekom Srbija fulfilled the criteria for the network coverage set under the licence for public fixed wireless telecommunications network and voice service, package data transmission and simultaneous voice and data transmission in all the districts concerned. Over the years, the CDMA coverage has not increased, since the demand for this service is dropping, causing the operators to stop developing services in the above CDMA networks. Operator Orion telekom fulfilled CDMA network coverage criteria in Pčinja District, while this operator's CDMA network base stations in other mentioned disticts were not in function at the time of drafting of this report.

Benchmarking of mobile communications networks

RATEL's strategy aims to encourage additional investments and further development of telecommunications market by fostering competition, cost-effectivness and efficiency of mobile communications, and to inform users in a reliable and neutral way on the quality of mobile networks in Serbia. For that very reason, RATEL has undertaken first comprehensive benchmarking of mobile communications networks belonging to the following operators: Telekom Srbija, Telenor and Vip mobile.

The purpose of mobile network benchmarking is an objective parallel testing of QoS in mobile networks, from users' point of view, by measuring KPI quality parameters (Key Preformance Indicators). Benchmarking measurements were realized during September and October 2017 and as of this year they represent an integral part of RATEL's regular activities.

Benchmarking measurements were carried out in 35 big and small cities and along 10,000 km of roads in the Republic of Serbia. During the campaign, more than 6,000 calls and 100,000 data transfer sessions were performed, on all mobile networks and all available technologies (2G, 3G, 4G).

The measurement included:

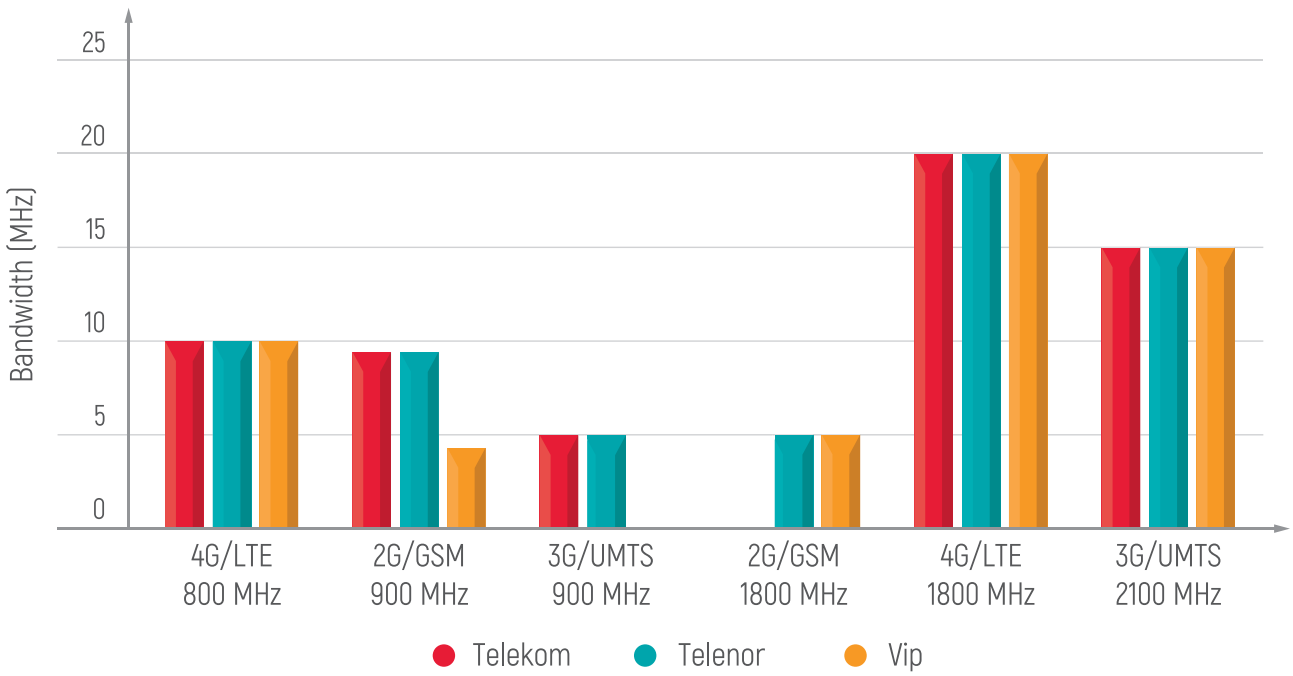
- radio parameter measurements for 2G/3G/4G technologies,
- measurement of KPIs for voice service and data transfer service.

Since benchmarking of mobile networks was carried out in September and October 2017, the measured and calculated values of quality parameters, including final results, refer only to that period.

Radio parameters for 2G/3G/4G technologies

Radio frequency bands used by operators during benchmarking are shown in Figure 125.

Figure 125. Radio frequency bands used by operators during benchmarking campaign



2G/GSM: All three operators used radio frequency band 900 MHz. Radio frequency band 1800 MHz was used by Telenor and Vip mobile.

3G/UMTS: All three operators used radio frequency band 2100 MHz. Radio frequency band 900 MHz was mostly used by Telenor and to a lesser extent by Telekom Srbija.

4G/LTE: Radio frequency bands 800 MHz and 1800 MHz were used by all three operators. Telekom Srbija and Vip mobile used the both frequency bands in all categories, while Telenor mostly used 800 MHz band for small cities and roads. Telekom Srbija and Vip mobile predominently used 20 MHz bandwidth channel for data transfer tests, in all categories, while Telenor mostly used 10 MHz bandwidth channel for the same purpose.

The use of Carrier Aggregation (or CA – combination of multiple carriers with aim to achieve higher data transfer rate) depends on network configuration and on the quantity of sent data during the test. In big cities, Telenor used LTE carrier aggregation for 20% data transfer tests, Vip mobile for 7% and Telekom Srbija for 4%. In small cities, carrier aggregation was used significantly less – by Telekom Srbija not at all, by Telenor for approximately 2% and by Vip mobile for around 6%. Only a few samples with carrier aggregation were detected along the roads.

Radio parameters for 2G/3G/4G technologies

Within the performed benchmarking, Vip mobile had the best total result, due to its extraordinary achievements in small cities. In big cities and along the roads, Telenor and Vip mobile had similar results, with Telenor showing a slight advantage and the difference between the two operators' final results being negligible. Therefore, the quality of both of the operators can be deemed comparable, with exceptions in regard of quality only for certain services in certain locations (Table 23).

All three mobile operators achieved lesser results than expected concerning voice transmission service. All KPI values for voice service tests were on the levels that need to be improved:

- Call Success Rate – CSR was below 97%,
- Call Setup Time was usually longer than 5 seconds,
- Average value of MOS parameter regarding voice signal quality was below 3.5,
- Hihg percentage of samples with unsatisfactory MOS parameter values (MOS<2.3; voice signal quality considered unacceptable by users).

Vip mobile and Telenor had similar performance regarding voice service realization, with Vip mobile offering the largest service availability and Telenor having the shortest average set up time.

All mobile operators provided to their users much better quality regarding data transfer than voice service. Vip mobile and Telenor had the best performance in data transfer tests. Despite the fact that Telenor massively used carrier aggregation (CA) and had higher radio signal levels than the two other operators, it usually used 10 MHz bandwidth channel for realization of the majority of data transfer services and did not prevail in this testing category. Telekom Srbija's mild results in data transfer tests are due to non-availability of these services and high percentage of samples with small data transfer rate along the roads. Telenor showed better results than Vip mobile in web browsing tests, while Vip mobile was more successful in data transfer tests. As regards YouTube tests, both Telenor and Vip mobile had similar performance.

Table 23. **Measurement results during benchmarking campaign**

			Telekom	Telenor	Vp
VOICE TESTS	Large Cities	Voice - Call Success Rate - Success / All [%]	94.52%	93.98%	97.25%
		Voice - Avg Call Setup Time [s}	6.80	5.00	5.40
		Voice - Avg MOS	3.35	3.50	3.42
		Voice - MOS < 2.3 [%]	7.30%	4.65%	4.93%
	Small Cities	Voice - Call Success Rate - Success / All [%]	96.04%	96.75%	98.32%
		Voice - Avg Call Setup Time [s}	7.50	4.80	5.30
		Voice - Avg MOS	3.35	3.51	3.46
		Voice - MOS < 2.3 [%]	7.03%	3.90%	4.76%
	Roads	Voice - Call Success Rate - Success / All [%]	92.97%	93.06%	92.01%
		Voice - Avg Call Setup Time [s}	7.10	4.70	6.20
		Voice - Avg MOS	3.23	3.45	3.39
		Voice - MOS < 2.3 [%]	10.65%	6.28%	6.72%

			Telekom	Telenor	Vp
FDTT HTTP Capacity Transfer - Download	Large Cities	FDTT HTTP DL - Session Success Rate - Success / All [%]	99.67%	100.00%	99.74%
		FDTT HTTP DL-Avg Data Rate [Mbps]	35.84	34.96	46.01
		FDTT HTTP DL - Data Rate < 4 [Mbps] [%]	3.26%	1.38%	1.11%
	Small Cities	FDTT HTTP DL - Session Success Rate - Success / All [%]	99.56%	99.89%	99.89%
		FDTT HTTP DL - Avg Data Rate [Mbps]	34.91	21.38	45.84
		FDTT HTTP DL - Data Rate < 4 [Mbps] [%]	2.68%	1.10%	0.33%
		FDTT HTTP DL - Session Success Rate - Success / All [%]	97.65%	99.25%	98.84%
		FDTT HTTP DL-Avg Data Rate [Mbps]	23.06	22.27	32.74
		FDTT HTTP DL - Data Rate < 4 (Mbps] [%]	12.01%	9.32%	2.73%

			Telekom	Telenor	Vp
FDTT HTTP Capacity Transfer - Upload	Large Cities	FDTT HTTP UL - Session Success Rate - Success / All [%]	99.93%	100.00%	99.93%
		FDTT HTTP UL - Avg Data Rate [Mbps]	20.39	18.32	25.72
		FDTT HTTP UL - Data Rate < 2 [Mbps] [%]	9.44%	3.04%	3.49%
	Small Cities	FDTT HTTP UL - Session Success Rate - Success / All [%J	99.89%	100.00%	100.00%
		FDTT HTTP UL - Avg Data Rate [Mbps]	16.44	14.48	23.32
		FDTT HTTP UL - Data Rate < 2 [Mbps] [%]	13.70%	1.87%	3.85%
	Roads	FDTT HTTP UL - Session Success Rate - Success / All [%]	99.31%	99.24%	99.32%
		FDTT HTTP UL - Avg Data Rate [Mbps]	9.54	12.71	14.72
		FDTT HTTP UL - Data Rate < 2 [Mbps])%]	35.09%	12.62%	7.56%

			Telekom	Telenor	Vp
HTTP File Transfer - Download	Large Cities	HTTP DL 3MB - Session Success Rate - Success / All [%]	99.05%	99.81%	99.75%
		HTTP DL 3MB - Avg Session Time [s]	1.88	1.94	1.67
		HTTP DL 3MB - Avg Data Rate [Mbps]	19.45	16.71	19.57
		HTTP DL 3MB - Data Rate < 4 [Mbps] [%]	2.69%	1.54%	0.95%
	Small Cities	HTTP DL 3MB - Session Success Rate - Success / All f%]	99.36%	100.00%	99.89%
		HTTP DL 3MB - Avg Session Time [s]	1.84	2.32	1.62
		HTTP DL 3MB - Avg Data Rate [Mbps]	20.18	13.71	19.55
		HTTP DL 3MB - Data Rate < 4 [Mbps] [%]	2.27%	2.03%	0.43%
	Roads	HTTP DL 3MB - Session Success Rate - Success / All [%]	92.29%	97.90%	94.28%
		HTTP DL 3MB - Avg Session Time [s]	3.45	3.62	2.05
		HTTP DL 3MB - Avg Data Rate [Mbps]	15.70	12.98	17.31
		HTTP DL 3MB - Data Rate < 4 [Mbps] [%]	8.55%	11.84%	1.87%

			Telekom	Telenor	Vp
HTTP File Transfer - Upload	Large Cities	HTTP UL 1MB-Session Success Rate - Success / All [%]	99.43%	99.43%	99.43%
		HTTP UL 1MB-Avg Session Time [s]	1.80	1.24	1-43
		HTTP UL 1MB - Avg Data Rate [Mbps]	9.45	10.36	8.73
		HTTP UL 1MB - Data Rate < 2 [Mbps] [%]	8.81%	2.89%	4.02%
	Small Cities	HTTP UL 1MB-Session Success Rate-Success/All [%]	98.50%	100.00%	99.58%
		HTTP UL 1MB - Avg Session Time [s]	1.98	1.18	1.40
		HTTP UL 1MB-Avg Data Rate |Mbps]	8.53	9.32	8.53
		HTTP UL 1MB - Data Rate < 2 [Mbps] [%]	10.10%	1.27%	4.33%
	Roads	HTTP UL 1MB-Session Success Rate-Success/All [%]	92.24%	97.18%	94.17%
		HTTP UL 1MB - Avg Session Time [s]	3.50	2.37	1.85
		HTTP UL 1MB-Avg Data Rate |Mbps]	6.64	7.90	7.68
		HTTP UL 1MB - Data Rate < 2 [Mbps] [%]	26.75%	13.58%	7.03%

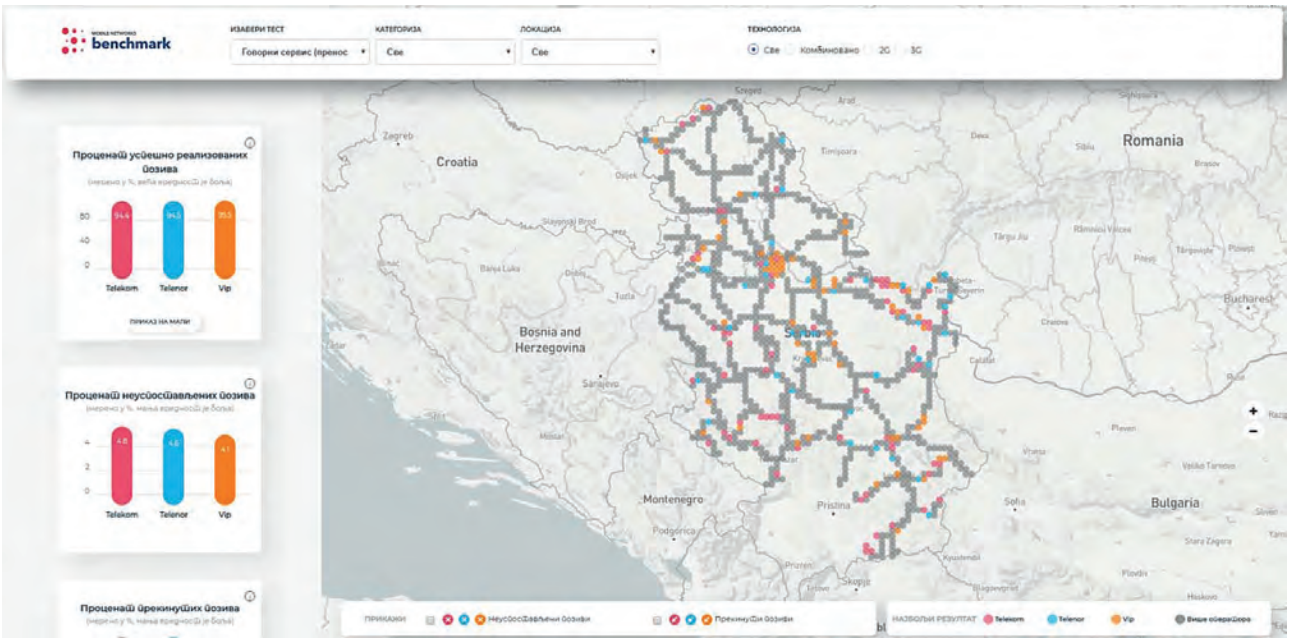
			Telekom	Telenor	Vp
HTTP Browsing tests	Large Cities	Browsing - Liveweb - Session Success Rate - Success / All [%]	99.0%	99.7%	99.3%
		Browsing - Liveweb - Avg Session Time [s]	3.63	3.90	3.74
		Browsing - Reference Page - Session Success Rate - Success / All [%]	99.2%	99.9%	99.8%
		Browsing - Reference Page - Avg Session Time [s]	1.34	1.35	2.10
	Small Cities	Browsing - Liveweb - Session Success Rate – Success / All [%]	98.0%	98.9%	99.4%
		Browsing - Liveweb - Avg Session Time [s]	3.60	3.85	3.55
		Browsing - Reference Page - Session Success Rate - Success / All [%]	98.6%	100.0%	99.9%
		Browsing - Reference Page - Avg Session Time [s]	1.24	1.32	1.59
	Roads	Browsing - Liveweb - Session Success Rate – Success / All [%]	91.4%	97.0%	96.8%
		Browsing - Liveweb - Avg Session Time)s]	3.85	3.96	3.67
		Browsing - Reference Page - Session Success Rate - Success / All [%]	92.9%	97.2%	96.3%
		Browsing - Reference Page - Avg Session Time [s]	1.65	1.73	1.83

			Telekom	Telenor	Vp
YouTube HD tests	Large Cities	YouTube HD - Session Success Rate - Success / All [%]	98.71%	99.35%	99.16%
		YouTube HD - Time to first picture [s]	1.90	1.75	1.73
		YouTube HD - Playout without interruptions [%]	96.53%	97.57%	95.95%
		YouTube HD-AvgVMOS	3.89	3.91	3.89
	Small Cities	YouTube HD - Session Success Rate-Success/All [%]	99.12%	99.23%	99.46%
		YouTube HD - Time to first picture [s]	1.88	1.75	1.81
		YouTube HD - Playout without interruptions [%]	95.44%	97.45%	97.81%
		YouTube HD-AvgVMOS	3.88	3.91	3.88
	Roads	YouTube HD - Session Success Rate - Success / All [%]	91.13%	96.55%	95.48%
		YouTube HD -Time to first picture [s]	2.34	2.11	1.90
		YouTube HD - Playout without interruptions {%]	89.53%	91.03%	95.68%
		YouTube HD - Avg VMOS	3.77	3.81	3.86

After the benchmarking measurement had been completed and the results of mobile network quality measurements had been processed and analyzed, an interactive portal for comparative view of mobile operators' network quality in the Republic of Serbia was set up.

At the end of 2017, the portal was published on RATEL's Internet web page (Figure 126) and is available to end users in Serbian and English, at: **http://benchmark.ratel.rs**

Figure 126. Layout of Benchmarking interactive portal



RATEL NetTest: testing of Internet connection quality

As of May 2016, RATEL enabled the users of Internet access services and Internet services in public fixed and public mobile communications networks to measure QoS of broadband Internet access, by means of RATEL's application NetTest (Figure 127).

Slika 127. **RATEL's NetTest application logo**

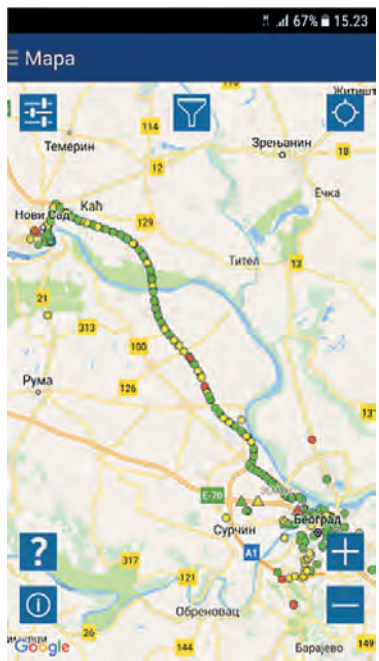
Testing of Internet connection in public fixed communications networks can be done by using the application available on the RATEL website: **https://nettest.ratel.rs**

Testing of Internet connection in public mobile communications networks can be done by using the application for Android and iOS mobile devices downloaded free of charge from Google Play Store and Apple App Store.

The purpose of RATEL NetTest application is to provide transparent and comprehensive information regarding users' Internet connection quality. It measures connection from user's device (PC, tablet, mobile terminal) to a measuring server. Measuring server is situated in the immediate proximity of the Internet exchange point (IXP) connected to major service operators, representing an independent and optimal location which is not favoring any of the connections.

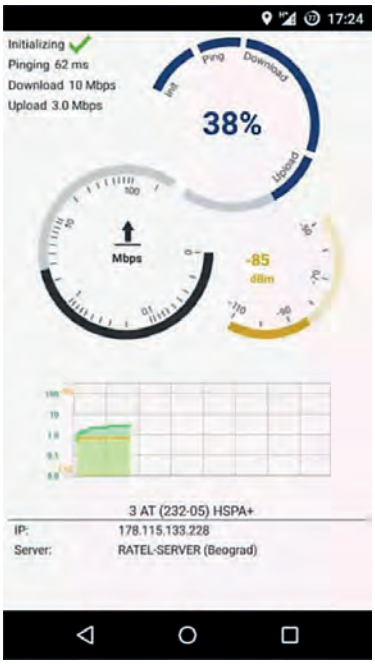
Figure 128. **Mobile application start page**

Figure 129. **Map view of performed tests**



RATEL NetTest application offers to its users the possibility to test quality and speed of current Internet connection (Figure 128). At the same time, the results of other users who performed the testing can be compared on the map of Serbia (Figure 129). This feature enables comparative analysis of Internet service providers, depending on the location or type of Internet access (fixed/ mobile). Color scale red/yellow/green serves as a visual indicator of the connection quality level for the majority of Internet services (Figure 131). This scale does not refer to the technology used, however extremely high speeds in mobile networks can only be achieved by means of certain technologies, such as LTE (4G).

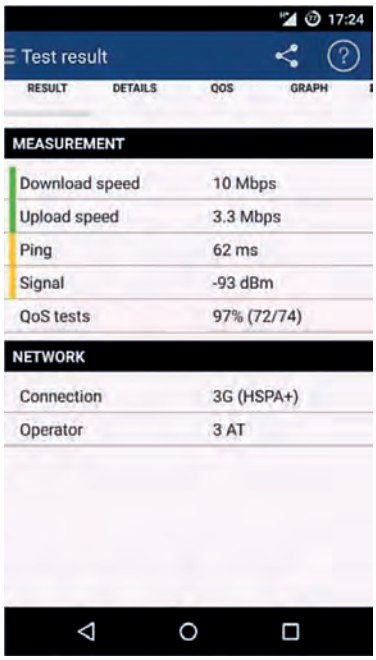
Figure 130. Internet connection testing



By means of RATEL NetTest application, the following quality parameters of Internet connection can be tested (Figure 130.):

- data download speed: measurement from measuring server to user,
- data upload speed: measurement from user to measuring server,
- latency,
- packet loss,
- signal quality (RxQual, Ec/Io, RSRQ) and signal strength (RSSI, RSCP, RSRP), if a mobile terminal is used.

Figure 131. Test results



RATEL follows the EU regulations in electronic communications and takes an active part in the work of BEREC (Body of European Regulators for Electronic Communications) and its expert WGs, among other in expert WG dealing with net neutrality and QoS. At the moment, BEREC is in the process of acquiring tools for measurement of Internet access and Internet service quality, that will be made available to users by European regulatory bodies for electronic communications.

As a next step, RATEL will adapt and conform its own tools for measurement of Internet access and Internet service quality, RATEL NetTest, to BEREC's tools technical specification that will be used for the same purpose, in order to be in line with other European regulatory bodies and be able to perform quality result analysis and comparison to the results obtained in Europe.

ELECTRONIC COMMUNICATIONS INFRASTRUCTURE INTENDED FOR COMMON USE

RATEL maintains an updated database on type, availability and geographic location of capacities that may be subject to demand for common use and access. Operators of public electronic communications networks are entitled to require shared usage of another operator's or third person's electronic communications infrastructure, when needed for the purpose of a competitive, cost-effective and efficient performance of electronic communications activities.

The shared use of infrastructure in the Republic of Serbia is defined in the Law on Electronic Communications („Official Gazette of RS", nos. 44/10, 60/13 – CC and 62/14, hereinafter: the Law) and Rulebook on the manner of collection and publication of the data on type, availability and geographic location of the electronic communications network's capacities („Official Gazette of RS", no. 66/15, hereinafter: the Rulebook).

Pursuant to Article 52 od the Law, the Agency shall keep an updated database on the type, availability and geographic location of capacities which may be subject to shared use and access (hereinafter: the Capacity database).

The Agency adopted the Rulebook in July 2015. It prescribes creation of the records of the electronic communications network capacities which may be subject to shared use, in the form of an aggregated database.

Pursuant to Article 5 of the Rulebook, the Agency shall be responsible for creation, maintenance and funding of the Capacity database, including definition of the manner of data provision (access, interfaces and protocols).

The Capacity database was created in June 2016. Coordination with operators was established and data input into the database was enabled, by web access or through automatic data exchange systems.

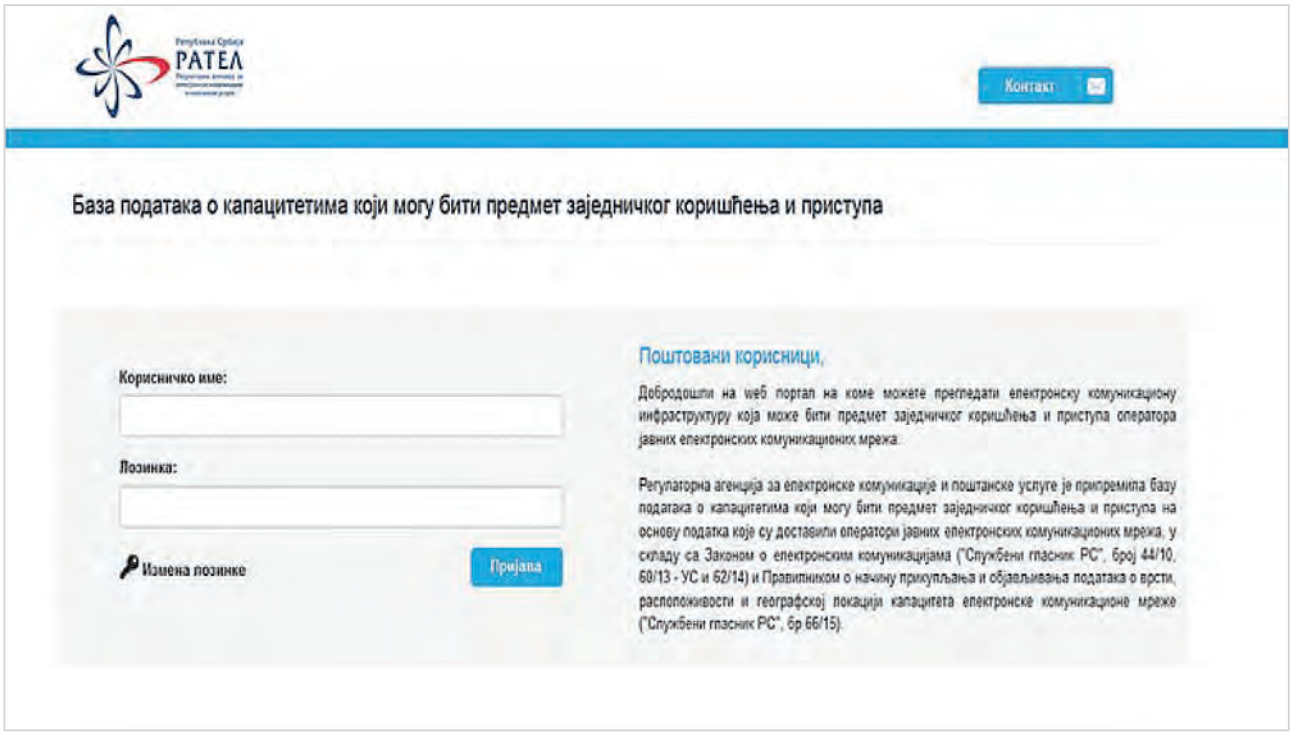
In case of constructing a new infrastructure subject to shared use and access, the operators are obliged to subimt all required data within 15 days from the beginning of the use of infrastructure and to update their data at least once in 3 months, should any changes in the infrastructure occur.

The data on electronic communications network refer to electronic communications network cable canalization and antenna masts.

During 2017, the operators provided data on more than 1400 antenna masts and over 10,000 cable canalization elements. A web – GIS application for end users (operators of electronic communications networks) has been made available on RATEL's Internet page, along with registration instructions. There is a choice between read access and read/record access. The read access is available to all registered electronic communications operators, whereas the read/record access is reserved only to electronic communications operators with recorded infrastructure lease service.

The users can access the application by means of a user name/password combination, Figure 132.

Figure 132. Access to Capacity database web - GIS application



The Web – GIS application includes standard tools for map operation, such as (Figures 133 and 134):

- Switching on/ switching off of layers;
- Zooming;
- Measurement of distance/ surface;
- Definition of coordinates in different coordinate systems;
- Selection of data using spatial inquiries/ selection of areas by hand;
- Selection of a large number of data through free ArcGIS online service (satellite footages, topographic maps, street networks etc.)

Figure 133. Use of standard tools – measurement of surface by hand

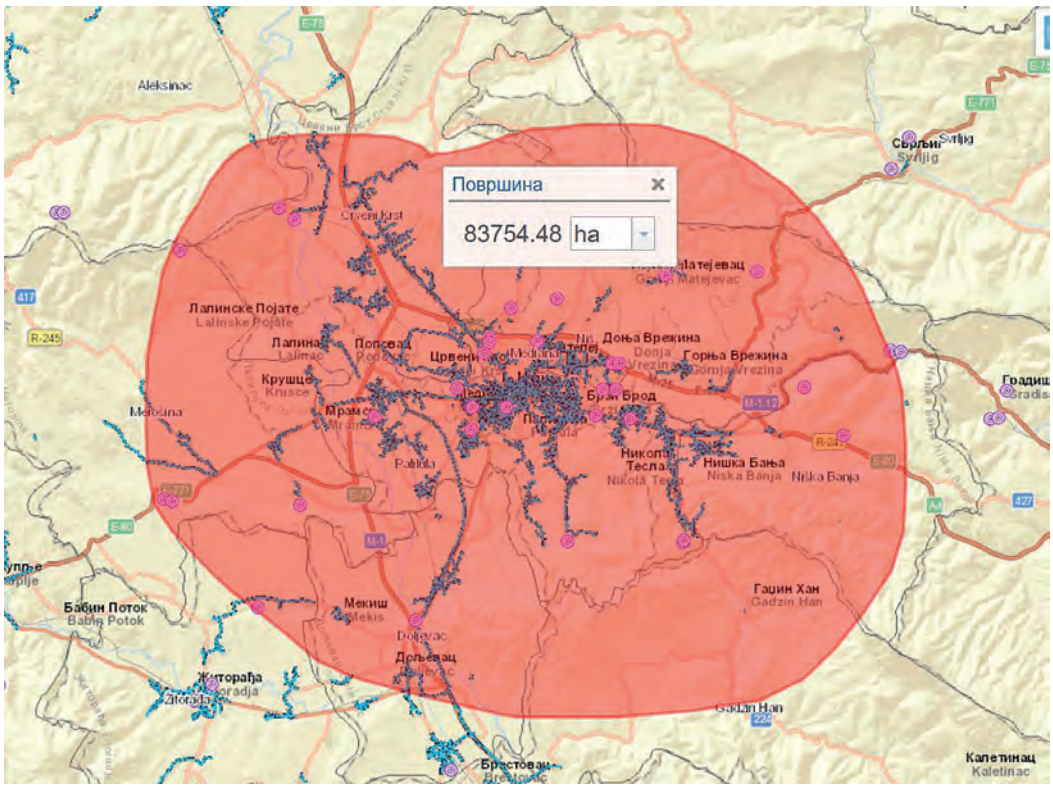


Figure 134. Use of standard tools – measurement of distance

Cable canalization of electronic communications networks subject to lease

Based on Annex 1, EKMI1 Form of the Rulebook, data on cable canalization to be collected are the following (Figures 135 and 136):

- Name of operator (owner)/ locations/ routes;
- WGS84 coordinates of important positions (start/end, node);
- Route length/ geodetic footage;
- Cable type;
- Information on cable canalization (type of pipes/ number of pipes on the route/ type of cable shaft/ number of shafts on the route);
- Type of data transmitting equipment (optional);
- Capacity for lease/ unused capacity;
- Data on cable instalments (optional);
- Cable ending in the facility (optional).

Figure 135. Cable details

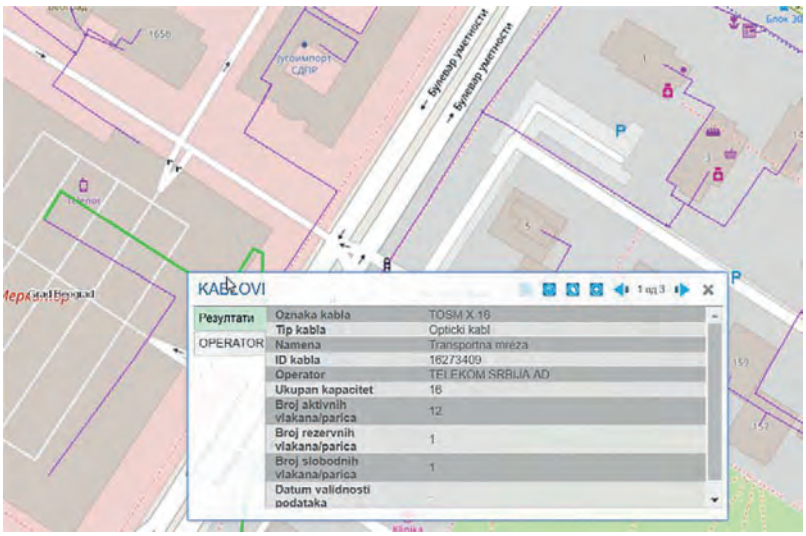
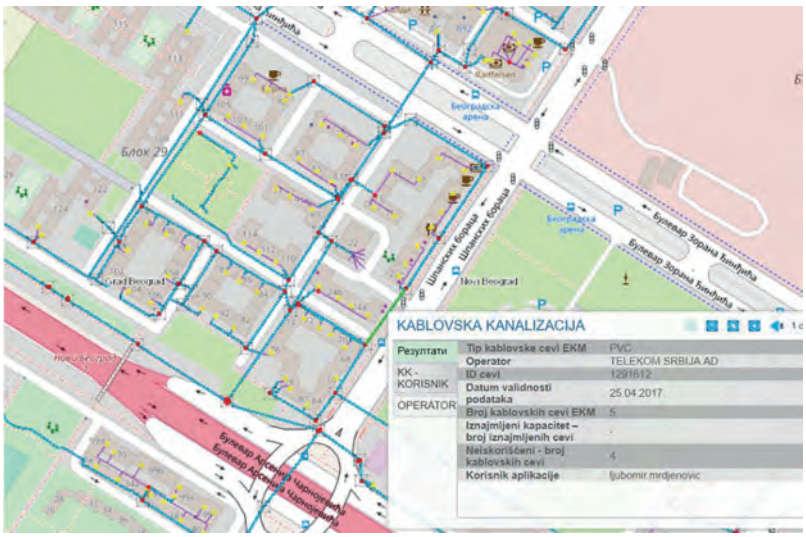


Figure 136. Cable canalization segment details



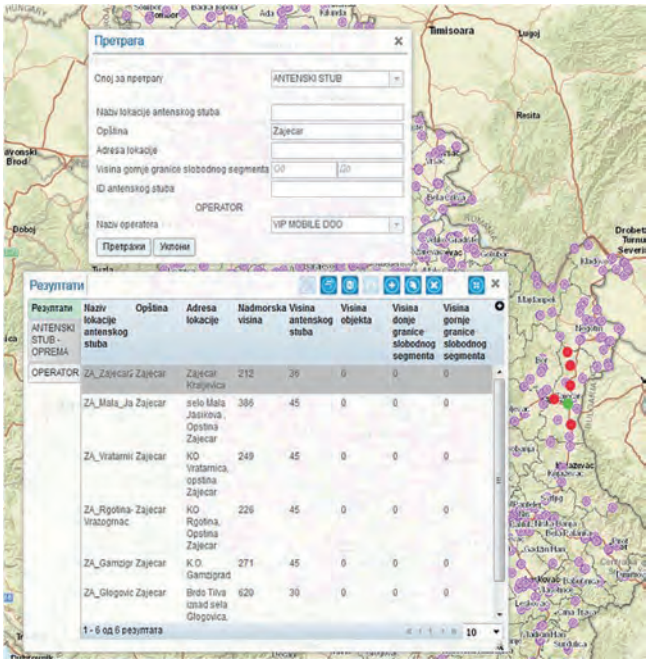
Antenna masts and equipment

Based on Annex 2, EKMI2 Form of the Rulebook, data on antenna masts and equipment to be collected are the following (Figures 137 and 138):

- Name of operator (owner);
- Location of antenna mast;
- Mast construction;
- Shape of mast base/ dimensions of mast base (m);
- Mast height (m);
- Facility height in meters (if antenna mast is mounted on a facility);
- Information regarding free space on the mast (length of the free segment/ azimuth range available for mounting);
- Mounted equipment (type/ free capacity) – if subject to lease.

Figure 137. Antenna mast data

Figure 138. Antenna mast data



POSTAL SERVICES MARKET

In 2017, the volume of postal services in the Republic of Serbia increased by 4%, compared to the past four years during which postal volumes were in decline. In the EU countries, the volume of postal services has been in decline for many years now and it is likely that this trend will continue to grow.

During 2017, in the Republic of Serbia approximately 322 million postal services were realized, which is by 11 million more than 2016.

In 2017, there were in average 130 delivered postal items per household, i.e. 45 items per inhabitant.

Postal services in the Republic of Serbia generated during 2017 an income of almost 18 billion dinars, i.e. over 152 million EUR, representing approximately 0.4% of the projected GDP (4.465 billion dinars[4]).

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On December 31, 2017, 59 commercial service operators, including public postal operator - PPO (PE „Pošta Srbije"), had authorization to provide postal services. During 2017, another 8 authorizations were issued to new postal operators, whereas two authorizations were revoked.

During 2017, 25 operators provided domestic express services, 2 operators provided international express services, 6 operators provided both international and domestic express services and 26 operators provided courier services. Limited number of operators performing exclusively courier services, although with valid authorization, discontinues periodically their services, making longer or shorter breaks in their activities, which is recorded in the Register of postal operators' authorizations. This segment displays also the largest oscillation in terms of number of active postal operators.

Within the postal industry of the Republic of Serbia there are 18,609 employees, which makes 0.94% of the total number of employees in the Republic of Serbia (projection 1,977,357 employees[5]).

Like in previous years, the employed at auto-transport companies (drivers) such as AD „Niš ekspres" and „Autoprevoz Kikinda" were not included in the total number of employees (18,609), nor were the employees of logistic companies such as Gebrüder Weiss, Mi- Išped, etc).

4 RSO
5 RSO

Table 24. **Employees in postal industry 2013-2017**

	2013	2014	2015	2016	2017
PPO	15,115	15,015	14,965	14,868	14,980
Other postal operators	2,464	2,615	2,751	3,096	3,629
TOTAL	17,579	17,630	17,716	17,964	18,609

The PPO employs 80% of the total number of postal employees and the private sector the remaining 20%. Compared to 2016, the number of employees has increased by 1.4%, whereas in the PPO that number has dropped by 0.6%. Private operators had an increase in the number of employees by 12.5% (Table 24).

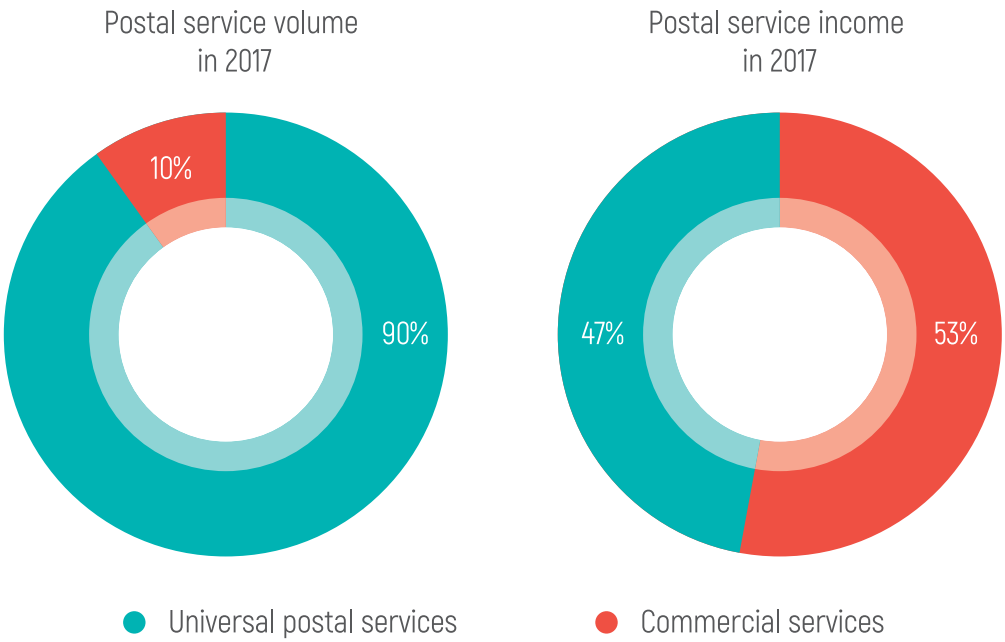
In 2017, the volume of universal postal service (UPS) was around 291.4 million, while the volume of commercial services amounted to approximately 31 million, i.e. 9.6% of the total volume of services (Table 25).

Table 25. **Postal services market in 2017**

TYPE OF SERVICE	Volume in thous.	Income in thous. din.	VOLUME	INCOME
	2017	2017	%	%
UPS	291,362	8,473,298	90.4	46.9
Commercial services	30,928	9,605,197	9.6	53.1
TOTAL	322,290	18,078,495	100	100

Despite being dominant in the total volume of the provided postal services, UPS with a share of over 90.4%, generates smaller income than commercial services (Figure 139). This change on the postal market was first observed in 2016 and the trend has continued in 2017 as well.

Figure 139. Shares in volume and income of UPS and commercial postal services in 2017



Since RATEL started to analyze postal markets in the Republic of Serbia, the volume of commercial services has been on a constant rise, following the corresponding trends in all EU countries. Only in 2017, commercial services in Serbia have grown by 14%.

Trend benchmarking of volume and income from UPS and commercial services

Universal postal service (UPS) is provided by PPO (PE „Pošta Srbije"), the exclusive license owner, while commercial services are provided by all postal operators.

UPS is, by definition, a service of general interest consisting of several postal services provided continuously on the entire territory of the Republic of Serbia. This service must comply with the set quality, therefore universal service provider (USP) must meet certain quality standards. UPS is provided at affordable prices and under equal conditions for all users, without discrimination.

UPS includes collection, sorting, transport and delivery of the following items:

- letter-post items up to 2 kg,
- cecograms up to 7 kg (in domestic traffic, UPS is provided without postal charge),
- letters in court, administrative and offence procedures,
- collection, transmission and payment of postal money orders.

UPS also includes parcel service:

- collection, sorting, transport and delivery of parcels up to 10 kg in domestic postal traffic,
- collection, sorting and transport of parcels up to 10 kg in international postal traffic (outbound),
- sorting, transport and delivery of parcels up to 20 kg in international postal traffic (inbound).

Universal service is set by the Law as a service of general interest, regardless of the type of network industry and therefore, the legislator is obliged to establish the mechanisms of provision of this service category.

European and global postal sector practice has shown that UPS represents a burden to USPs, so a continuous search for new models of UPS funding and elaboration of the existing ones is constantly under way.

In the Republic of Serbia, the Law foresees funding of UPS from the scope of reserved services. Reserved services represent an exclusive right of the PPO.

Reserved service limits are set by RATEL. The determined limit is 100g in terms of weight and threefold the amount of the postal charge for a first-weight category letter and the fastest transmission level, in terms of price.

Reserved postal services in domestic and international postal traffic include the following services:

- collection and/ or sorting and/ or transport and/ or delivery of all letter-post items (including recorded items) up to set limits per weight and price,
- collection and/or transmission and/or payment of money orders,
- collection and/ or sorting and/ or transport and/ or delivery of letters in court, administrative and offence procedures,
- collection, sorting, transport and delivery of addressed direct mail,
- collection, sorting, transport and delivery of notifications on day and time of voting.

Reserved services are the most numerous UPS category, with share of 98.1% (in 2016 with 97.6%).

Within reserved services, letters up to 20 g are dominant and account for 91.15% of UPS (in 2016 this share was 90.3%), whereas the share of items 20-100 g is 6.91%, (last year it was 7.3%).

Compared to year 2016, the largest growth was observed in non-registered letters (around 3%), which are also the most represented items.

In 2017, there was an increase in money orders (2%), court letters (6%) and addressed direct mail (4%).

Even though the share of UPS parcels accounts for 0.2%, in 2017 value added (insured) parcels grew by 86%.

The biggest drop in services during 2017 was recorded in items with small volume within UPS: insured COD letters (17%), printed matter (8%) and post cards (6%).

In the total revenue generated from PPO's postal services, reserved services account for 73.6% (out of which letter-post services 65.2% and money odrers 8.4%), while non-reserved services participate with 5.1% and commecrial services with 21.3%.

In the UPS income, letters up to 20g participate with 86%, from 20g to 100g with 9.5%, i.e. 95.5% of the income is generated from reserved services.

In the UPS based revenue, the largest growth is generated by registered printed matter (30.5%), recorded delivery letters (5.9%) and court letters (5,8%), whereas the biggest drop in income is recorded in insured COD letters (14.1%), special delivery or cumbersome parcels (12.6%) and insured parcels (10%).

Commercial postal services include provision of express services, courier services and parcel services outside the UPS domain.

Express services are postal services that include collection, sorting, transport and delivery of recorded express items in the shortest delays, both in domestic and international postal traffic.

Courier services are postal services that include collection, transport and delivery of recorded postal items directly from sender to recipient, without sorting, with one same worker-courier performing collection, transport and delivery.

Commercial parcel service include parcels outside UPS, namely:

- collection and/ or sorting and/ or transport and/ or delivery of parcels over 10 kg in domestic postal traffic,
- collection and/ or sorting and/ or transport of parcels over 10 kg in international postal traffic (outbound),
- sorting and/ or transport and/ or delivery of parcels over 20 kg in international postal traffic (inbound).

In the service structure of operators providing commercial services, the largest share is that of domestic express services, which account for 97% of all commercial services and participate in income with 82% (Table 26). The average price of these services in 2017 was approximately 266 dinars, which is by 4 dinars less than in 2106. These services have shown a continuous drop in average price since 2010.

International express services participate in the volume of services with only 2%, however they generate over 17% of the total revenues. The average express service price has grown since 2010, with exception of 2016, when a drop by approximately 1.86% was recorded. In 2017 the average service price is 2,840 dinars, which is by 87 dinars more compared to the last year's average price. Courier services, with their price of 320 dinars, have a 0.7% share both in volume and income (Table 26). The price of these services grows constantly. Compared to 2016, the average price of the fastest postal service has increased by 6 dinars.

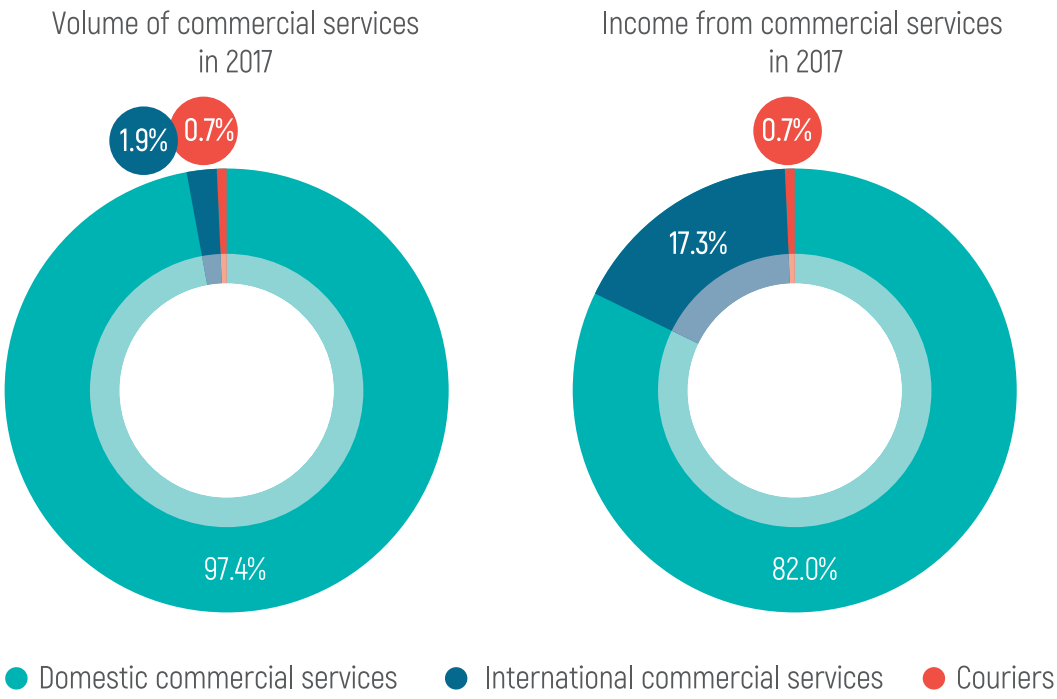
Commercial services have seen an increase in income by 12%, with generated 9.6 billion dinars. Domestic express services account for the largest increase in revenues (12%). International express services have grown by 8% and courier services made an increase in income by over 12%

Table 26. **Structure of commercial services in 2017**

TYPE OF SERVICE	VOLUME	INCOME	VOLUME	INCOME
	in thous.	in thous. din.	%	%
Domestic commercial services	30,123	7,877,414	97.4	82
International commercial services	594	1,660,482	2	17
Courier services	210	67,301	0.7	0.7
TOTAL	30,928	9,605,197	100	100

Structure of private operators' services by volume and income is shown in Figure 140.

Figure 140. **Share in volume and income of commercial services in 2017**



Trend of commercial service volume and income shares in the Republic of Serbia in the last five years is given in Table 27.

Table 27. Trend of commercial service shares in %

TYPE OF SERVICE	2013		2014		2015		2016		2017	
%	VOLM	INCD	VOLM	INCD	VOLM	INCD	VOLM	INCD	VOLM	INCD
Domestic commercial services	94.7	75.1	95.6	76.7	96.0	76.0	96.3	76.7	97.3	82
International commercial services	3.4	23.5	3.1	22.2	2.9	23.1	2.8	22.4	2.0	17.3
Courier services	1.9	1.4	1.3	1.1	1.1	0.9	0.9	0.9	0.7	0.7
TOTAL	100	100	100	100	100	100	100	100	100	100

Like in previous years, in 2017 domestic express services account for the largest growth in commercial service domain (over 14%). This continuous increase trend is reflection of an increased economic activity, resulting from GDP growth.

In 2017 there was an increase in volume of services in international traffic by more than 5%, as well as in courier services by 12%.

The data provided by the operators in 2017, as part of annual questionnaires and monthly reports, regarding volume of express items in domestic traffic, were analyzed in respect of weight, in the following manner:

- items up to 500 g,
- items 500 g - 2 kg,
- items 2 kg - 10 kg,
- items over 10 kg.

In the weight category up to 500 g the items were divided according to content to items containing documents and items containing goods, a feature harmonized with ERGP (European Regulators Group for Postal Services) recommendations and the IPP (Integrated Product Plan) proposition of the Universal Postal Union (UPU)

Table 28. **Structure of domestic express service volume by weight**

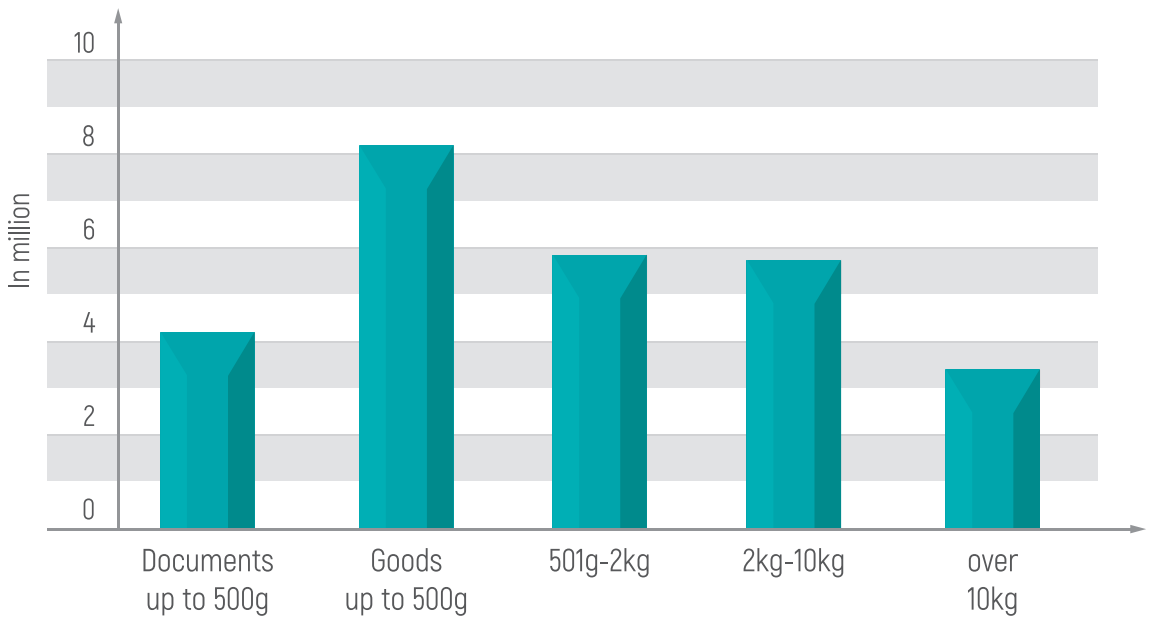
	Express items in domestic postal traffic in thousand						Total of express items		Total volume
	Items up to 500 g		Up to 500g total	501g-2kg	2-10kg	Over 10kg			
	Documents	Goods					Documents	Goods	
Volume	4,656	8,830	13,487	6,338	6,211	3,965	4,656	25,344	30,000
%	15.52	29.43	44.95	21.13	20.70	13.22	15.52	84.48	100

The goods prevail in total domestic express service volume in the ratio 6:1.

Items up to 500 g make up almost half of the total domestic express service volume, 2/3 of which are goods and 1/3 documents.

Over 41% of items in domestic traffic are express items between 500 g and 10 kg.

Figure 141. **Structure of domestic express service volume by weight**

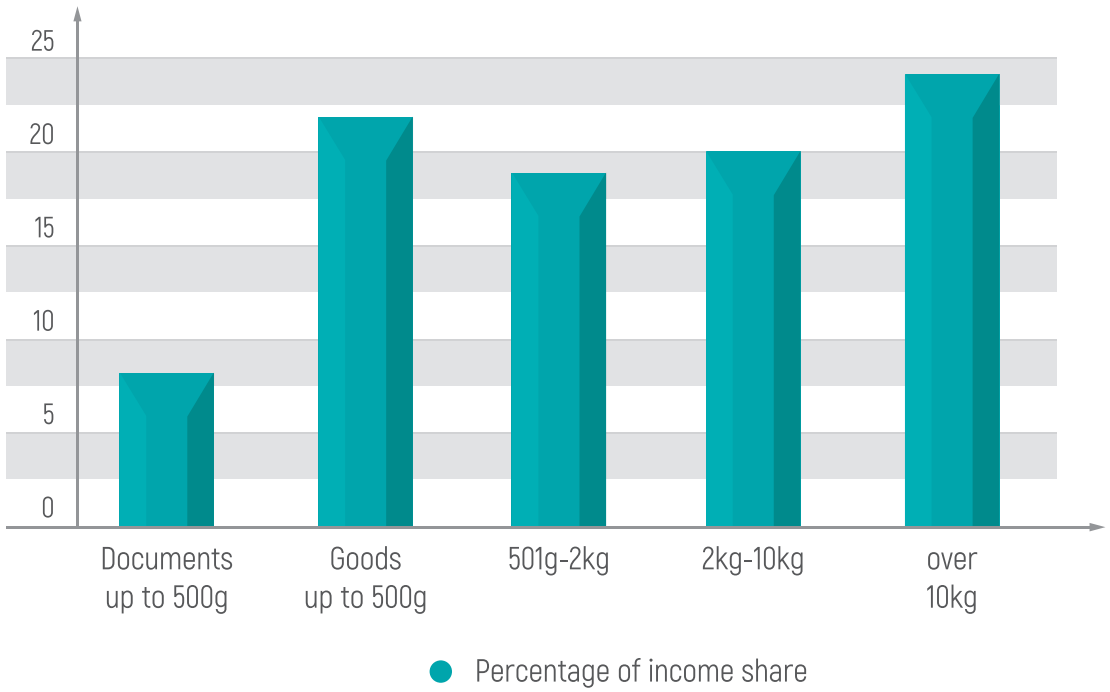


Within domestic express service, items up to 500 g have the biggest share of over 32% (Table 29, Figure 142).

Table 29. Share of domestic express service income by weight

	Express items						Total of express items		Total
	Items up to 500 g		Up to 500g total	501g-2kg	2-10kg	Over 10kg			
	Documents	Goods					Documents	Goods	
%	10.14	22.51	32.64	20.04	21.77	25.55	10.14	89.86	100

Figure 142. Share of domestic express service income by weight



Postal service market in 2017

Since 2010, when RATEL started to monitor postal markets in the Republic of Serbia, the share of commercial services has risen from less than 4% of the total volume of services and 37% of the total income in 2010, to 9.6% of the volume and as much as 53.1% of the total revenues.

Table 30. **Postal service market in 2017**

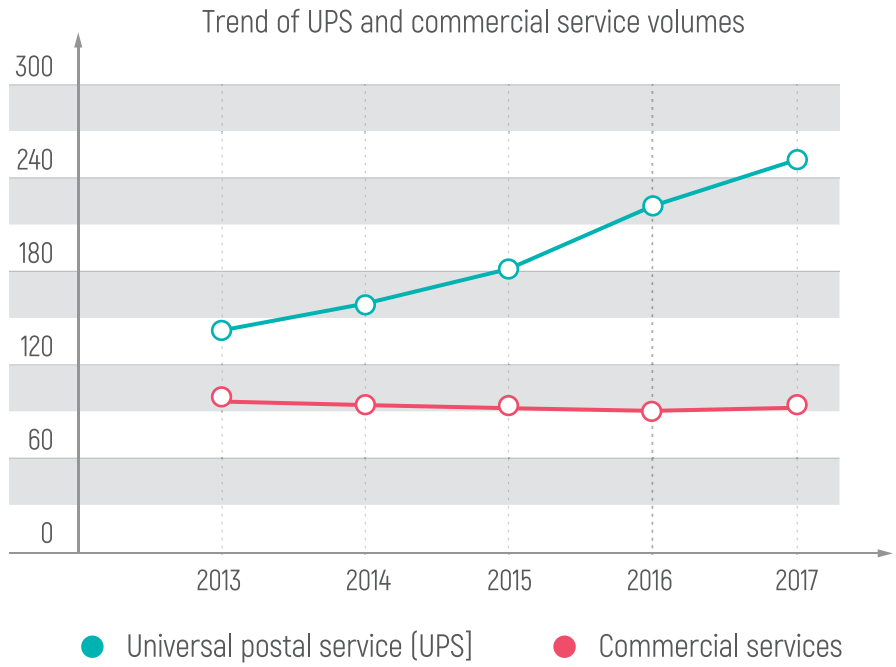
TYPE OF SERVICE	2013		2014		2015		2016		2017	
%	VOLM	INCD	VOLM	INCD	VOLM	INCD	VOLM	INCD	VOLM	INCD
UPS	94.5	53.1	93.7	52.6	92.6	51.4	91.2	48.7	90.4	46.9
Commercial services	5.5	46.9	6.3	47.4	7.4	48.6	8.8	51.3	9.6	53.1
TOTAL	100	100	100	100	100	100	100	100	100	100

Table 31 and Figure 143 show the trend of postal service volume in the last five years.

Table 31. **Volume of UPS and commercial postal services 2013-2017**

TYPE OF SERVICE	VOLUME in thous. units					Volume growth/ drop in %			
	2013	2014	2015	2016	2017	14/13	15/14	16/15	17/16
UPS	308,923	301,542	291,399	283,488	291,362	-2	-3	-3	3
Commercial services	18,104	20,350	23,228	27,186	30,928	12	14	17	14
TOTAL	327,026	321,892	314,627	310,674	322,290	-2	-2	-1	4

Figure 143. Trend of UPS and commercial service volumes

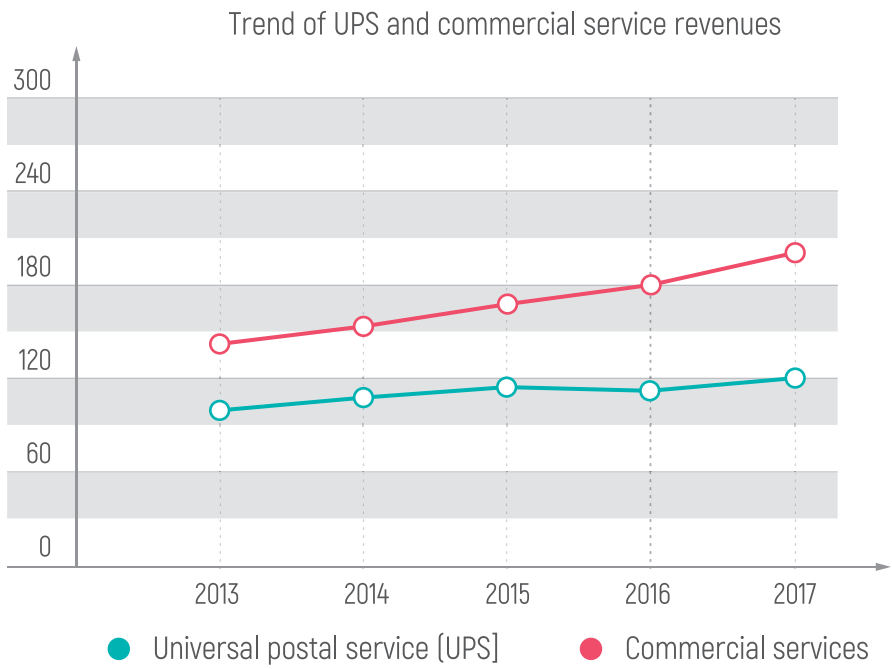


In 2017, the total generated postal income was higher by 7.4% than that of the previous year. In the observed period, the UPS based income grew by 3.4%, whereas the commercial service revenues have been constantly rising, with a growth rate of over 11%. In comparison to previous years, the UPS generated income has been growing less (with exception of year 2016 when an income drop was recorded), while the growth rate of commercial services income has remained on the similar level (Table 32, Figure 144).

Table 32. Volume of UPS and commercial services 2013-2017

TYPE OF SERVICE	INCOME in million dinars					Volume growth/ drop in %			
	2013	2014	2015	2016	2017	14/13	15/14	16/15	17/16
UPS	7,245	7,871	8,264	8,197	8,473	9	5	-0.8	3.4
Commercial services	6,396	7,099	7,809	8,639	9,605	11	10	10.6	11.2
TOTAL	13,641	14,970	16,073	16,836	18,078	10	7	4.7	7.4

Figure 144. Trend of UPS and commercial service revenues



Since 2016, the commercial postal services, as highly profitable services, have generated more than 50% of the total postal revenues, with a 9 times smaller share in UPS. These data can serve as an indicator of a non-adequate pricing in the UPS scope. For a more detailed analysis of UPS costs, full application of separate cost accounting, verified by an independent auditor is necessary.

Overview of postal markets in the EU based on ERGP report [6]

The ERGP (European Regulators Group for Postal Services), in cooperation with national regulators, prepares annual overviews of the postal market, for the European Commission needs (EC).

For the sake of an easier monitoring, the totality of EU markets is devided in 4 areas:

- Western countries (AT, BE, DE, DK, FI, FR, IE, LU, NL, SE, UK),
- Eastern countris (BG, CZ, EE, HR, HU, LT, LV, PL, RO, SI, SK),
- Southern countries (CY, EL, IT, MT, PT),
- non- EU countries (CH, FY, IS, NO,RS).

In that sense, ERGP has drafted a report on basic European market indicators in order to identify trends and main policies of market development for the period 2013-2016.

In Table 33, an average annual postal volume rate on the EU market for 2013-2016 is shown.

Table 33. Total volume of postal services: average annual change (2013-2016)

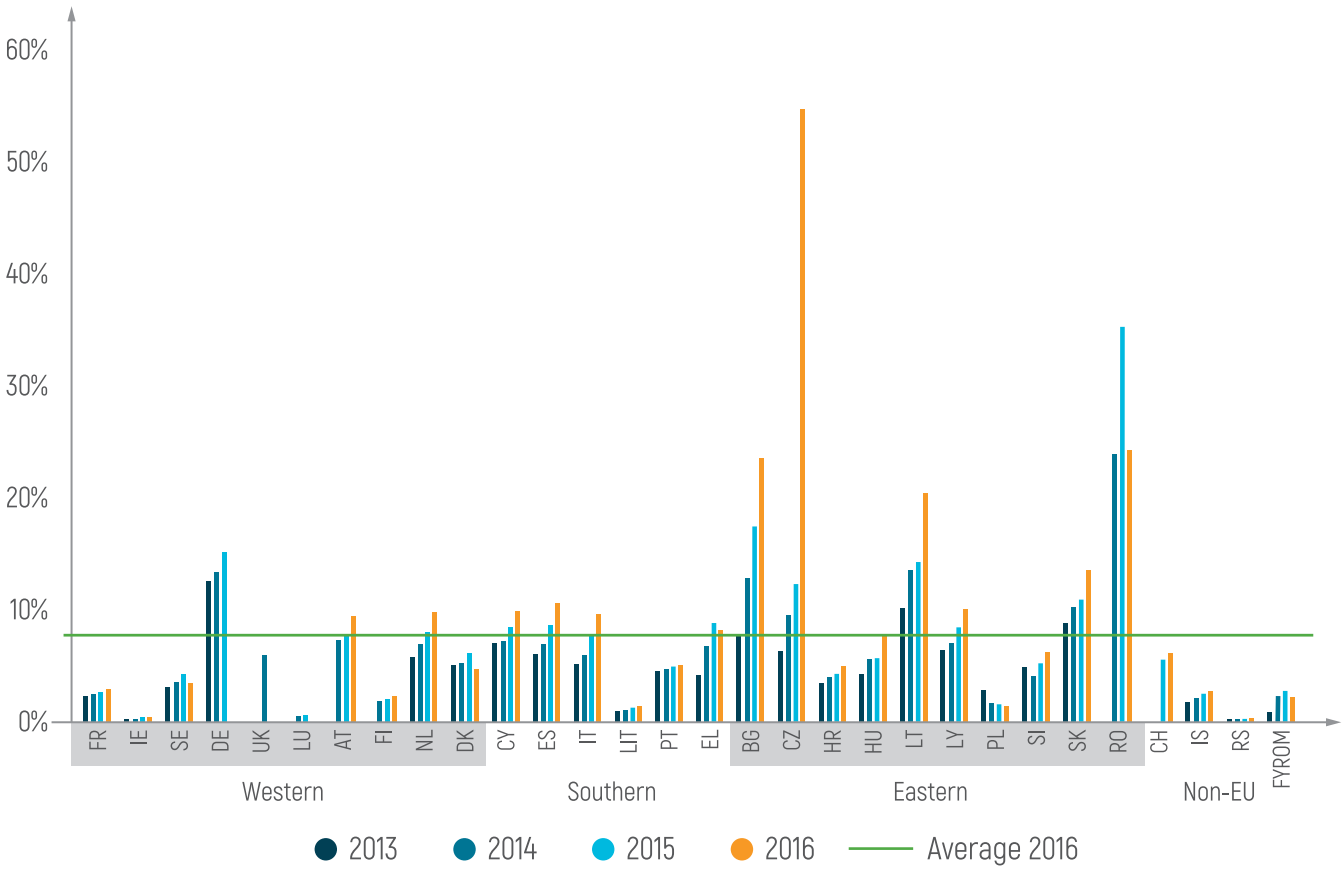
	Average annual change
1. Total volume of postal services	-2.3%
1.1 Volume of letter-post services	-4.7%
1.2 Volume of parcel services	23.6%

In the observed period, total volume of services dropped by 2.3% on a yearly basis, as a result of the drop in the volume of the most numerous (letter-post) services by 4.7%, which however did not manage to get covered by the simultaneous growth of parcel volumes by 23.6%, represented in the total volume of services by 7.7% (in 2016).

Parcel share in the income has incresased from 30% to 35%, in the 2013-2016 period (Figure 145).

6 ERGP (17) 36 B - Flash of the ERGP Report on core indicators for monitoring the European postal market
ERGP PL (17) 35 B - Flash of the ERGP Report on the quality of service, consumer protection and complaint handling

Figure 145. Parcel share in total volume of postal services



The total income has increased by 0.9% between 2013 and 2016. Letter-post service generated income dropped by 1.8%, while parcel service generated income grew by 5.6% on an annual basis (Table 34).

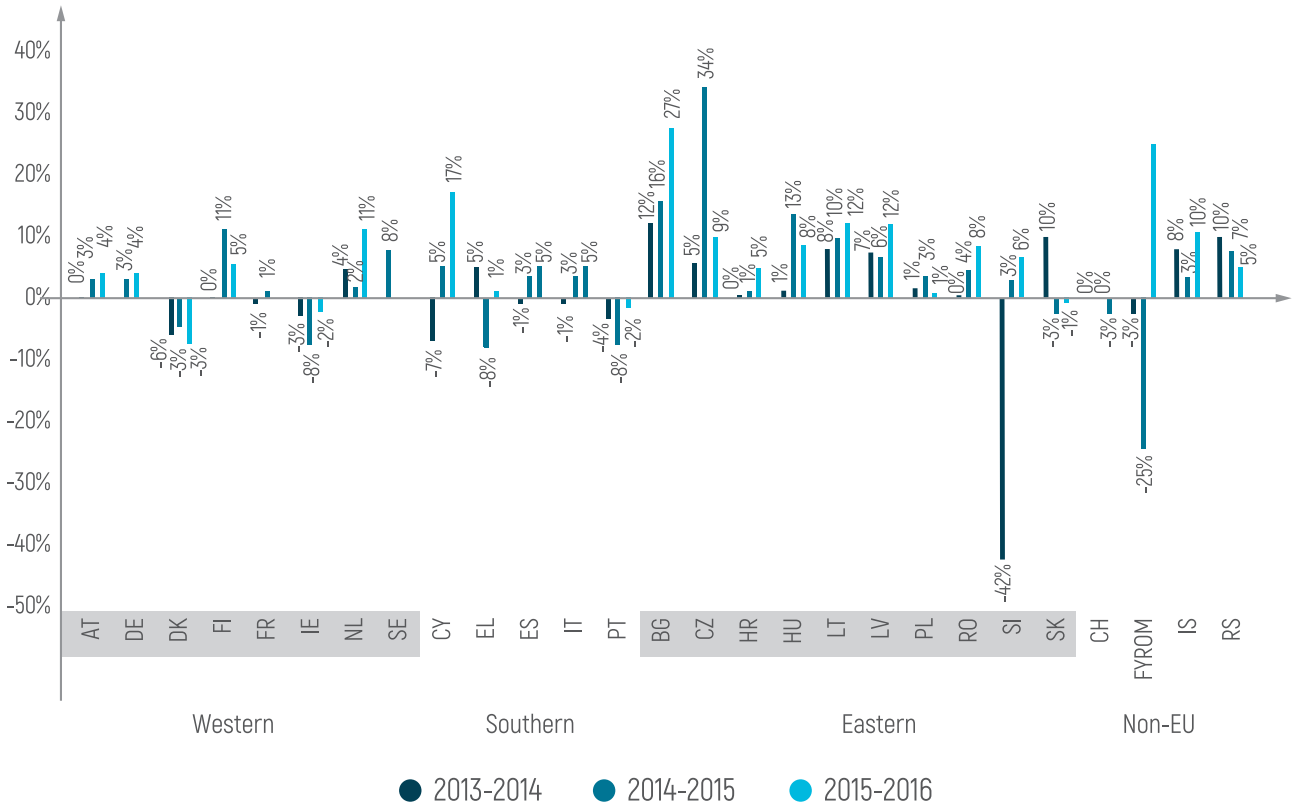
Decrease in the letter-post revenues was compensated for by the growth in parcel service income, taking into account the price-ratio between service categories, structure and prices.

Table 34. Total postal service income: average annual change (2013-2016)

	Average annual change
1. Total income from postal services	0.9%
1.1 Income from letter-post services	-1.8%
1.2 Income from parcel services	5.6%

On the single EU market, oscillations are visible and refer to changes in respect of income throughout the years. Income trend is shown in Figure 146.

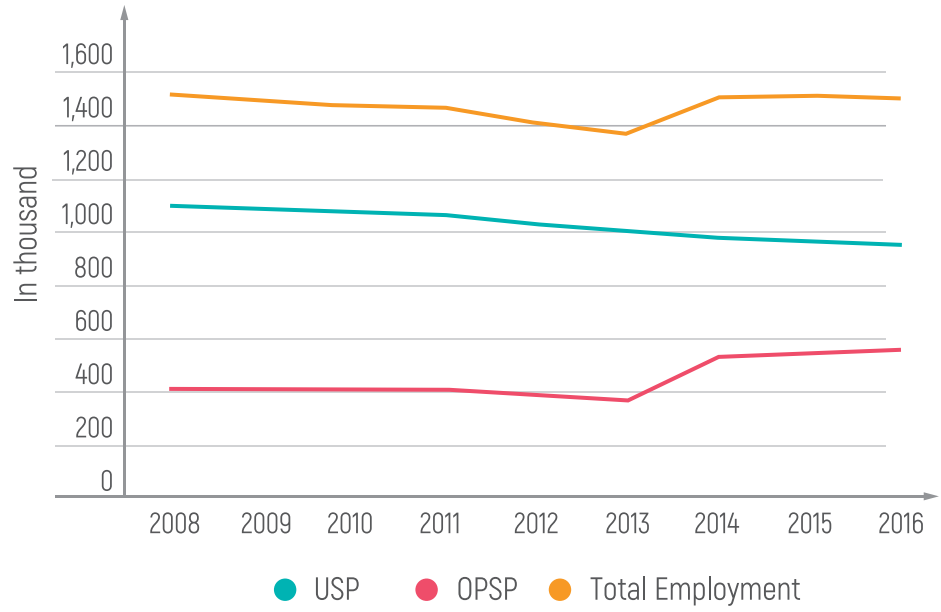
Figure 146. Income changes throughout years from 2013 to 2016



The total number of employees at the designated USP operator and other postal service providers on the EU countries postal market has dropped by 0.7% between 2008 and 2016.

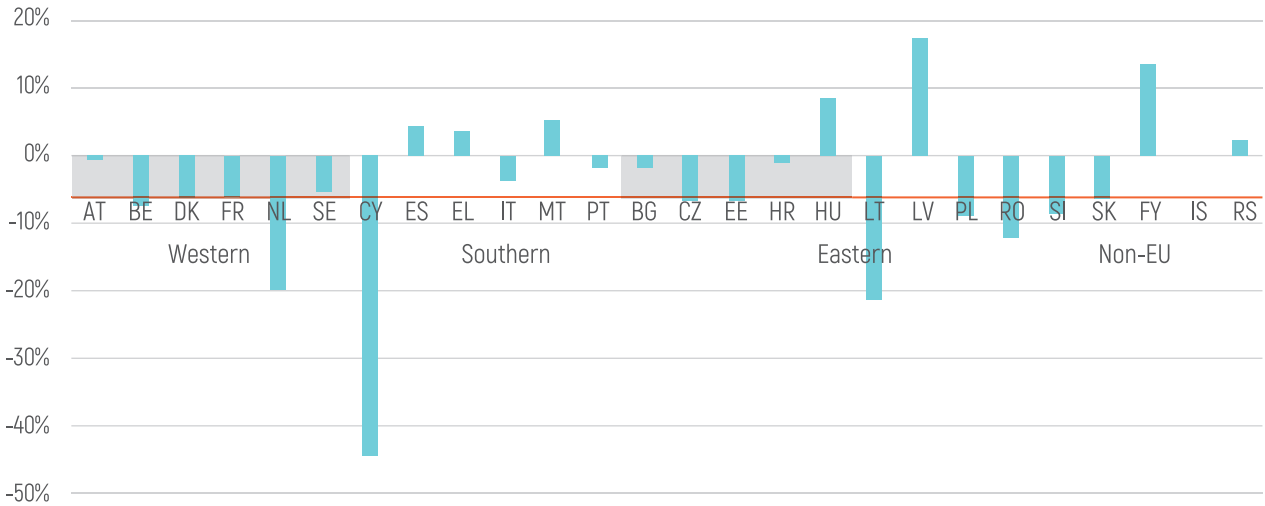
The drop in the number of employees at the designated USP operator has decreased by 13.8%, against an increase in the number of employees (by 34.1%) at other operators (Figure 147).

Figure 147. Number of employees at PPO and other operators during 2008-2016



Between 2013 and 2016, the total number of employees has dropped in average by 4.3% (Figure 148).

Figure 148. Change in number of employees during 2013-2016



Changes in regulatory framework[7]

The EU members are in the process of preparation of a regulation on cross-border parcel delivery services, the adoption of which is expected in autumn 2018. Having in mind that 97/67/EC Directive deals mainly with letter-post related topics, the new regulation would be an addition regarding cross-border parcel delivery, which is already recognized as having an important and positive link with e-commerce.

It has been observed that consumers on the EU market restrain from buying products from other EU member countries, on account of high delivery costs.

For that reason, an initiative was launched to elaborate a regulation which would:

- enable individual consumers and retailers to access affordable quality service on the entire EU territory,
- ensure equally affordable quality service in rural areas,
- enable access to reliable information on service providers on the entire EU territory,
- increase market efficiency,
- harmonize regulatory control on the whole market,
- encourage market competition.

For the purpose of regulatory harmonization, RATEL has adapted accordingly its report drafting.

7 ERGP Proposal for a regulation of the European Parlament and of the Council on the Cross-border parcel delivery services, 2016

Analysis of impact of gradual liberalization on postal markets

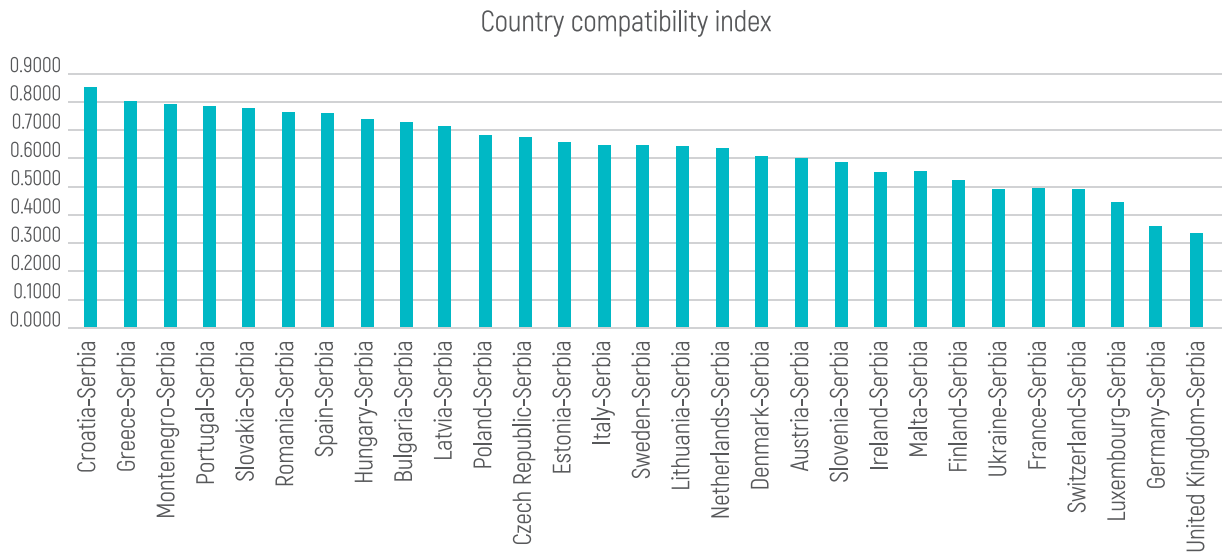
In 2017, RATEL carried out research entitled „Analysis of the impact of gradual liberalization on postal markets".

During the comparison of the postal market in the Republic of Serbia with postal markets in the EU and the surrounding countries, a correlation index with comparable markets was calculated. The volume of domestic letter-post items, international parcels, GDP, number of inhabitants, number of letter-post items per capita and postal charge for a first-weight category letter (source: UPU, EuroStat, ERGP and World Bank database) were used as input data.

Higher values of correlation index reflect greater similarities between postal markets in the observed contries. Final output of all parameters resulted in a country compatibility index, as displayed in Figure 149.

8 The analysis is publicly available at: **https://www.ratel.rs/en/page/studies**

Figure 149. **Country ranking by compatibility index**



In the observed group of countries, the markets in Croatia, Greece, Montenegro, Portugal and Slovakia are most comparable to the market in the Republic of Serbia (Table 35).

Table 35. **Total volume of postal services: average annual change (2013-2016)**

Countries	Compatibility index
Croatia - Serbia	0.8440
Greece - Serbia	0.7987
Montenegro - Serbia	0.7922
Portugal - Serbia	0.7783
Slovakia - Serbia	0.7745

The UPS scope, as defined in UPU regulations, is identical both in Serbia and the compared countries.

Croatia

On the Croatian market, Croatian Post, as a designated operator, performs its activities on a fully liberalized market. Until 2013, the volume of letter-post items was in decline, only to start to grow following the liberalization. This trend continued until 2016. The volume of parcels has been similar to that of letters, so it can be concluded that liberalization had positive effects on the volume of postal items in general.

Greece

Hellenic Post, as a Greek designated operator, has been providing services on a fully liberalized market in since 2013. The volume of letter-post items was dropping, and the trend has continued after liberalization as well. The volume of parcels had also been in decline for a long time, with exception of the 2014, when there was a significant increase by almost 50%, which could be seen as the result of parcel market liberalization.

Montenegro

Postal market in Montenegro was liberalized in 2013, with Post of Montenegro as designated operator. The volume of letter-post items has been constantly rising. The volume of parcels has been growing as well, except for the year 2016, when a slight drop in the volume was recorded.

Portugal

Portugal Post, a designated operator since 2011, performs its activities on a liberalized market. Even after the liberalization, the volume of letter-post items continued to drop. The volume of parcels has been in a constant decrease as well, both before and after the abolition of the reserved area.

Slovakia

Slovak Post is a designated UPS operator and, as of 2012, it has been operating on a totally liberalized market. Up to 2012, the volume of letter-post items was in decline, only to begin to grow further on. Before and after the liberalization, parcel volumes were dropping, and a significant increase was not observed until 2015.

According to the study, one of the conclusions is that in the majority of countries, during the period before liberalization, the volume of letter-post items was dropping, remaining unchanged even after the liberalization. The volume of parcels before the liberalization was in decline, whereas after the liberalization it started to grow, which could be explained as one of the positive effects of market liberalization.

QUALITY OF UNIVERSAL POSTAL SERVICE PROVISION IN 2017

During 2017, RATEL adopted Rulebook on changes and amendments to the Rulebook on quality parameters for the provision of postal services and on the minimum quality standards for the provision of universal postal service ("Official Gazette" of RS, no. 098/2017). An independent letter-post item transmission time measurement in the duration of two and a half months was prescribed for the years 2017 and 2018.

In its 2017 UPS quality report, the PPO submitted notification about a completed two-month independent letter-post item transmission time measurement. In the conclusion, it was noted that the measurement had not been conducted adequately, since the independent organization tasked with transmission time measurement had failed to comply with the technical specification requirements. Therefore, the results obtained during the measurement cannot be deemed valid.

As a result, the UPS quality assessment continues to be carried out pursuant to an internal PPO document, Methodology for QoS monitoring in postal traffic (hereinafter: the Methodology).

The quality was analyzed according to data gathered as measurement results based on the PPO Methodology and data from RATEL's questionnaire, including the following indicators:

- availability of postal services,
- transmission and delivery speed and reliability,
- security of items,
- efficiency of complaint handling,
- service users' satisfaction and availability of information, etc.

Availability of universal postal service

The availability of postal services is assessed based on the territorial accessibility of post offices, postal letter boxes, working hours of post offices, availability of postal office counters and delivery of items (Table 36).

Table 36. **Availability of post offices and letter boxes**

Postal network capacities	Year						Trend (%)				
	2012	2013	2014	2015	2016	2017	14/13	14/13	15/14	16/15	17/16
Number of post offices	1499	1489	1478	1491	1516	1530	-0.67	-0.74	0.88	1.68	0.92
Number of letter boxes	2087	2072	2052	2000	1964	1958	-0.72	-0.97	-2.53	-1.80	-0.31

The growth trend of post offices has continued, from 1478 post offices in 2014 to 1530 in 2017. In 2017, compared to 2016, another 14 post offices were opened, increasing their number by 0.92%, whereas the number of letter boxes dropped by 6, e.i. by 0.31%. Post office accessibility, on the other hand, has improved in quality.

As far as the letter boxes are concerned, their number has been declining for several years now. Compared to 2012, the number of letter boxes has decreased by 129, i.e by almost 6.6%. Even though the decline in the number of letter boxes may suggest the drop in the quality of service in this segment, the fact is that the number of letters that are inserted in letter boxes is decreasing on a yearly basis, so the decrease in the number of letter boxes is to the great extent justified.

On the other hand, pursuant to Article 13 of the Rulebook on conditions of the commencement of the postal service activity, adopted by the line ministry („Official Gazette of RS", No. 51/10), the USP must also provide at least 2000 letter boxes as a means of postal network for the collection of non-recorded postal items. As the total number of letter boxes in 2017 was 1958, it is clear that the PPO has not fulfilled the above requirement. Taking into account a constant decrease in the volume of letters that get inserted in letter boxes, both nationally and globally, the justifiability of this requirement can be questioned.

The average number of inhabitants per post office is 4697, which is by approximately 4.4% more than the European average (around 4500 inhabitants per post office). Due to the high population density in the city of Belgrade, there are less post offices per inhabitant (8000 inhabitants per post office) there. Post offices in Belgrade, on the other hand, have bigger service provision capacities, which, to a certain extent, eliminates the impact of more inhabitants than the Serbian average being served by one post office.

Working hours of post offices

One of the criteria of quality of postal service access are the working hours of post offices, showing the time (how many hours a day) during which the post offices are available to their customers.

Out of 1530 post offices, 1002 (65%) belong to rural, while 528 post offices (35%) to urban areas. The analysis of these post offices' working hours has shown the following:

- out of 1002 post offices in rural areas, 926 (92.4%) serve customers up to 7 hours a day, 62 post offices (6.2%0) work from 7 to 12 hours a day, 2 post offices (0.2%) work more than 12 hours a day, whereas 12 post offices (1.2%) serve customers around the clock, e.i. 24 hours a day.
- out of 528 post offices in urban areas, 178 (33.7%) serve customers up to 7 hours a day, 336 post offices (63.6%) work from 7 to 12 hours a day, while 14 post offices (2.7%) work more than 12 hours a day

Availability of postal counters

The availability of postal counters to customers regarding the provision of universal postal service is determined by measuring the waiting time of customers in line.

During 2017, the average waiting time of customers in front of the counter for the collection of letter-post items was 5.63 minutes, which is by 1 minute shorter compared to the value measured last year. The PPO asserts that the criterion of counter availability is satisfactory, having in mind the limit value of less than 10 minutes defined in the internal PPO regulations is in accordance with the current regulations.

Availability of the delivery of postal items

The Postal Directive prescribes delivery of postal items at least 5 days a week, to be organized by the USP, with possible exceptions determined by the regulator. On the EU postal market, these exceptions concern up to 10% of the population, and only in countries with specific geographic configuration. The law in the Republic of Serbia also prescribed a 5-day delivery, i.e. every working day, with possible exceptions.

The availability of the postal item delivery is not possible to assess with accuracy, since the PPO has continued (in 2017 as well) to provide information on the number of inhabitants and households, and not the data required in the questionnaire (volume of postal items on local, larger and largest delivery areas). Instead of these data, the PPO has kept providing information on the percentage of postal address codes (PACs) on local, larger and largest delivery areas, which is not relevant for the analysis of this quality parameter.

Table 37. Volumes of inhabitants and households per delivery area

Delivery area	Number of inhabitants	Number of households	% inhabitants	% households
Local	4,869,585	1,969,148	67.74	68.10
Larger	1,580,511	607,393	21.99	21.01
Largest	738,047	314,847	10.27	10.89
Total	7,188,143	2,891,388	100.00	100.00

The analysis of the data on the population and number of households per delivery area shows that more than 68% inhabitants and households are covered by every-day delivery (Table 37). In larger delivery areas, there are around 22% of inhabitants and 21% of households, covered by a 2-day or 3-day delivery a week. More than 10% of inhabitants and households are situated in the largest delivery areas, having one delivery per week.

Based on these data, it can be concluded that around 32% of inhabitants and households do not receive their postal items on a daily basis, i.e. are not covered by the legal provision of an every-day UPS delivery.

This figure highlights the fact that in the Republic of Serbia far more inhabitants than in any of the EU member countires are not covered by daily delivery (the largest percentage limit is prescribed in Croatia and is 10%)

Speed and reliability of postal items transmission and delivery

Speed and reliability of transmission and delivery of postal items in the Republic of Serbia are measured by means of transmission and delivery times of domestic non-recorded letter post items and international priority and air letter-post items. Delivery standards for the domestic traffic are prescribed by RATEL and in the international postal traffic, delivery standards are prescribed by the Universal Postal Union (UPU) or by the Association of European Public Postal Operators (PostEurop).

The international standard prescribed by UPU is J+5 for 80% of items, while PostEurop prescribed the speed indicator J+3 for at least 85%, e.i. reliability indicator J+5 for at least 97% of items.

For the measurement results of the transmission times to be valid and comparable, the EN 13850 standard for *Postal Services - Quality of Services - Measurement of the transit time of end-to-end services for single piece priority mail and first class mail* has been presribed. This standard defines preparation, manner of screening and analysis of the obtained data. The prerequisite for obtaining quality data is a continious screening of the transmission times, organized by an independent body that cannot be influenced by PPO.

As in November and December 2017, a two-month independent screening was conducted, which could not be accepted by the PPO as valid, an AMQM system of measurement of transmission times results were included in the final analysis. In the AMQM (Automatic Mail Quality Measurement) system, postal items are sent and received by the PPO employees, i.e. internal panellists, which can give rise to the suspicion of lack of impartiality during the process.

Table 38. Transmission times in domestic letter-post traffic

Delivery standards	Domestic traffic Independent screening				AMQM			Standard up to 2015	EN 13850 for 2016
	2011	2012	2013	2014	2015	2016	2017		
D+1	78.18%	79.93%	82.27%	71.81%	71.05%	77.66%	67.12%	/	80%
D+2	96.05%	96.46%	95.86%	93.63%	93.58%	95.04%	89.52%	90%	85%
D+3	98.57%	98.84%	98.74%	99.14%	97.82%	98.21%	95.56%	98.50%	90%
D+5	99.85%	99.87%	100%	100%	99.47%	99.56%	/	99.50%	

Table 39. Transmission times in international letter-post traffic

Delivery standards	International traffic							Prescribed standard
	PostEurop							
	2011	2012	2013	2014	2015	2016	2017	
D+3	60.25%	63.70%	66.50%	67.95%	56.20%	58.45%	48.10%	85%
D+5	87.60%	90.25%	92.50%	87.50%	83.35%	87.90%	82.94%	97%

If the transmission times are observed in continuity, regardless of the manner in which they were set (independent measurement or internal screening), it can be concluded that, when the realized results D+2 and D+3 were within set targets, and the deadline D+1 (77.66%) was close to the targeted 80%, the results in 2017 came out significantly worse, especially in respect of D+1 standard (Table 38). The same applied to the results for D+2 and D+3, even though they were within set targets.

The provided data regarding international postal items show that, during 2017, there was a deterioration in the transmission times, which is a logical consequence of bad results of domestic transmission times. The shown percentage values in Table 39 refer to incoming items and are significantly better than the results referring to outgoing items (D+3 - 43.26% and D+5 - 67.42%). Based on these data, it is obvious that the quality of transmission times is not on a satisfactory level, since domestic quality is an inseparable part of international transmission times, therefore it cannot be considered separately.

Security of items

An overview of the number of lost, rifled and damaged postal items during the period 2012 – 2017 is shown in Table 40.

Table 40. **Lost, rifled or damaged items in domestic traffic**

TYPE OF ITEM	2012	2013	2014	2015	2016	2017
REGISTERED LETTERS						
- lost per 100,000 items	10	10	8	7	8	9
- rifled or damaged per 100,000 items	0	0	0	0	0	0
INSURED LETTERS						
- lost per 100,000 items	0	0	1	0	0	1
- rifled or damaged per 100,000 items	0	0	0	0	0	0
PARCELS						
- lost per 100,000 parcels	1	1	0	0	0	0
- rifled or damaged per 100,000 parcels	3	2	1	0	0	0
MONEY ORDERS						
- lost per 100,000 items	0	0	0	0	0	0
SECURITY LEVEL OF ITEMS	0.009	0.009	0.007	0.006	0.007	0.008

The analysis of the data showed an increase in the number of lost registered items during 2017 (in 2016, 8 out of 100,000 items were lost, against 9 lost items in 2017). Registered items being the most numerous recorded postal items, the increase in the number of lost registered items automatically reflected in a deteriorated security level of all postal items (0.008% e.i. 8 items lost out of 100,000), compared to 2016, when the volume of lost items was 0.007%.

Table 41. Paid indemnities by type of postal item

Table 41. **Paid indemnities by type of postal item**

Domestic postal traffic	2013		2014		2015		2016		2017	
	no.	dinars	no.	dinars	no.	dinars	no.	dinars	no.	dinars
Registered items	1,061	665,728.86	591	415,066.00	452	349,982.00	433	347,304.00	542	419,212.00
Insured items	6	9,978.00	18	31,036.00	5	10,262.00	3	5,371.00	3	3,896.00
Parcels	9	23,334.51	8	9,451.50	3	28,592.00	5	6,857.05	4	14,844.00
Money ordres	1	900	0	0	3	6,140.00	0	0.00	0	0.00
TOTAL	1,077	699,941.37	617	455,553.50	463	394,976.00	441	359,532.05	549	437,952.00

UIn domestic postal traffic, the year 2017 saw an increase by almost 18% in paid indemnities compared to 2016.

In international traffice, damages were paid for 14 items, identical as in 2016. The total amount of paid indemnities was decreased by 57%, from 144,265.00 dinars in 2016, to 62,423.00 dinars in 2017. Despite the same number of items, the amount in 2017 was smaller because of the changed item structure. For example, in 2016, the amount of 95,999.00 dinars was paid for the for 5 insured letters only, whereas in 2017 no insured letter damages were paid at all. Also, in 2016, damages for 3 parcels in the amount of 33,003.00 dinars were paid, against 24,529.00 dinars paid in 2017, while 10 registered letters accounted for indemnities in the amount of 37,894.00 dinars in 2017, against 26,243.00 dinars, paid in 2016.

Efficiency of complaint handling

Customers submit their complaints to PPO in oral and written form (hard copy or e-mail). During 2017, 71 written complaints were filed, which is by 35% less than in 2016. By means of the PPO's online contact service, 13083 enquiries were made (objections, questions, complaints etc.), which is a 26% increase compared to 2016. Growth trend of complaints has continues, pointing to the fact of an increased awareness of the customers, better information and augmentation in the number of communication channels (directly at the post office, by phone, in writing or by means of website) through which complaints can be submitted.

The majority of complaints referred to the delivery of items, whreas the least number of complaints referred to the counter service (insufficient number of counters, long waiting in line for money transactions etc.), which could not be regarded as postal service related complaints in a strict sense.

In 2017, customer complaints in domestic traffic usually got resolved in 4 days on average, which is by 1 day longer than in 2016. However, the total realization of damage payments was reduced by 1 day, from 14 to 13 days (Table 42).

Table 42. **Average time for complaint resolution, realization and payment of indemnities**

Year	Complaint resolution (in days)	Damage resolution (in days)	Payment of indemnities (in days)	Total for resolution and indemnity payment (in days)
2014	4	7	5	12
2015	4	7	6	13
2016	3	10	4	14
2017	4	9	4	13

Delays for international postal items are considerably longer, taking into account the fact that complaint procedures need to be carried out in at least two countries

Service users' satisfaction and availability of information

In its annual QoS report, the PPO has regularly informed RATEL about the level of service users' satisfaction and the availability of information on products and services. The research on the level of service users' satisfaction and the availability of information is carried out by means of an internal survey on customers' opinions, whether they be natural or legal persons. The measured parameters such as: reliability, speed, assortment, price and manner of service provision were commonly highly rated.

CONCLUSION

Taking into account the overall analysis of the reached quality levels of the UPS provision, the following can be concluded:

- decrease trend of letter box volumes has continued, leading the total number of letter boxes below the legally prescribed minimum, calling for this discrepancy to be resolved,
- the PPO does not provide crucial data, such as volumes of items on local, larger and largest delivery areas, based on which a more realistic picture could be made regarding the exceptions from the legally prescribed obligation (5-day delivery). The results obtained in internal measurement by means of AMQM system (Automatic Mail Quality Measurement) show that, in 2017, there was a deterioration of transmission times, in particular as regards items with delivery standard D+1,
- there was a slight deterioration in the segment of overall security of postal items, accompanied by change in postal item structure resulting in an improved security level of parcels, same security level (as in 2016) of insured items and deteriorated security in the segment of registered items,
- complaint handling procedure was reduced by 1 day,
- the PPO has recently made available to its users multiple ways to post an observation, ask a question or file a complaint (electronically, by phone, by website, in writing, directly at the post office).

Complaints regarding commercial services

Table 43 shows the structure of complaints regarding domestic commercial services. The majority of complaints were filed on account of being rifled or damaged, followed by those on account of loss, whereas the least complaints referred to transmission time overrun (transmission times are set under special terms and conditions of postal service performance by postal operators).

Ungrounded complaints account for 33% of the total number of complaints regarding domestic commercial services.

Table 43. Structure of complaints regarding domestic commercial services

Total number of complaints filed	Ungrounded	Resolved as:			Indemnity
		Loss	Rifled and damaged	Deadline expiration	Amount (in thous.]
(1=2+3+4+5)	2	3	4	5	6
28,321	9,563	2,082	14,972	1,704	102,200

In 2017, there were 483 complaints in international commercial service traffic, out of which the operator recorded over 70% as ungrounded.

Quality of service, user protection and complaint handling in the EU

ERGP report on quality is based on market facts[9] in 33 ERGP member countries for 2016 and shows current experiences regarding quality of service, end user satisfaction and complaint handling.

There are five key issues regarding quality of service and user satisfaction that are being analyzed:

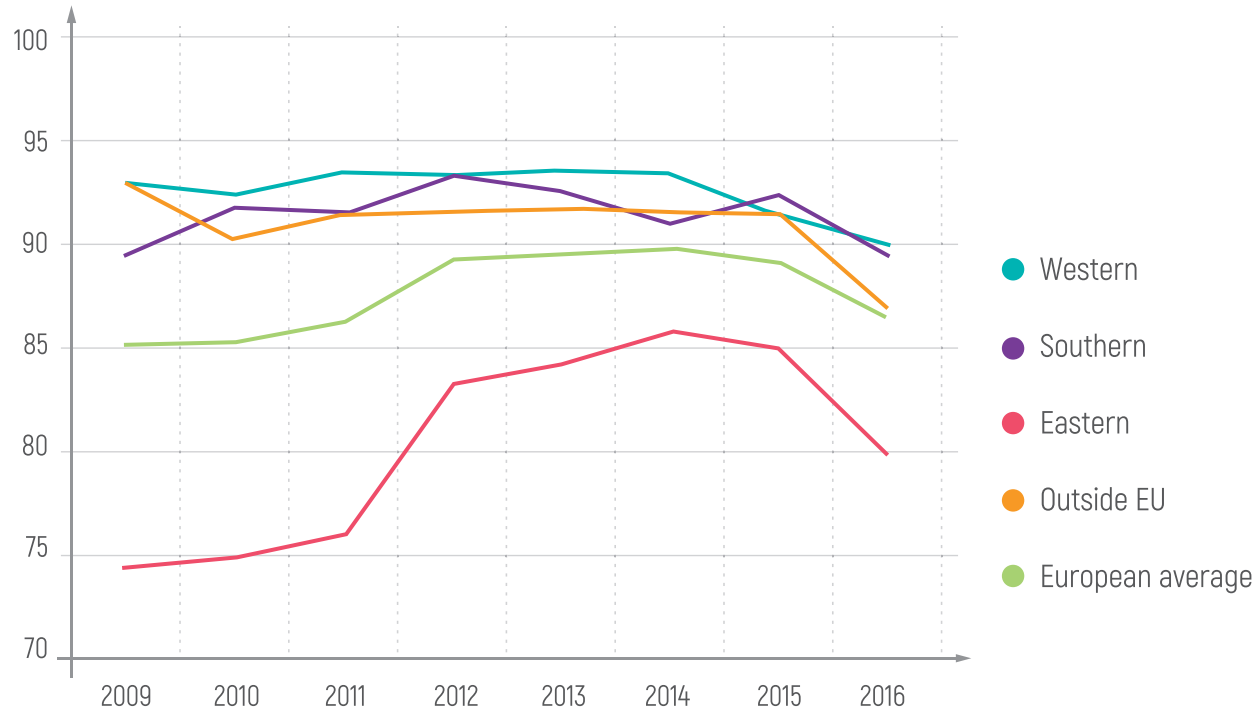
1. quality of service screening, taking into account transit times, accuracy and reliability of service,
2. frequency of collection and delivery,
3. access points,
4. measurement of user satisfaction,
5. research of user needs.

In 2016, 29 countries used EN 13850 standard for measurement of priority letter transit transmission times. Figure 150 shows a relative stability of the quality of priority mail (D+1) in 2019-2016. The exceptions are Eastern European countries, with quality related results considerably inferior to the others. Despite that, in these countires also a quality growth was observed in 2012.

It is noticeable that the achieved service quality level is comparable in the Western Europe, Southern Europe and non-EU countries. However, a drop in quality was observed in Western European countries from 2014 to 2016. The USPs have been adapting to the constant decrease in letter-post item volumes since 2008, resulting in countinuous efforts made by USPs to improve their own efficiency and effectiveness, and above all, to reorganize their postal network.

9 The ERGP data for 2017 are not published until the end of 2018.

Figure 150. Average values of priority letter QoS (D+1)



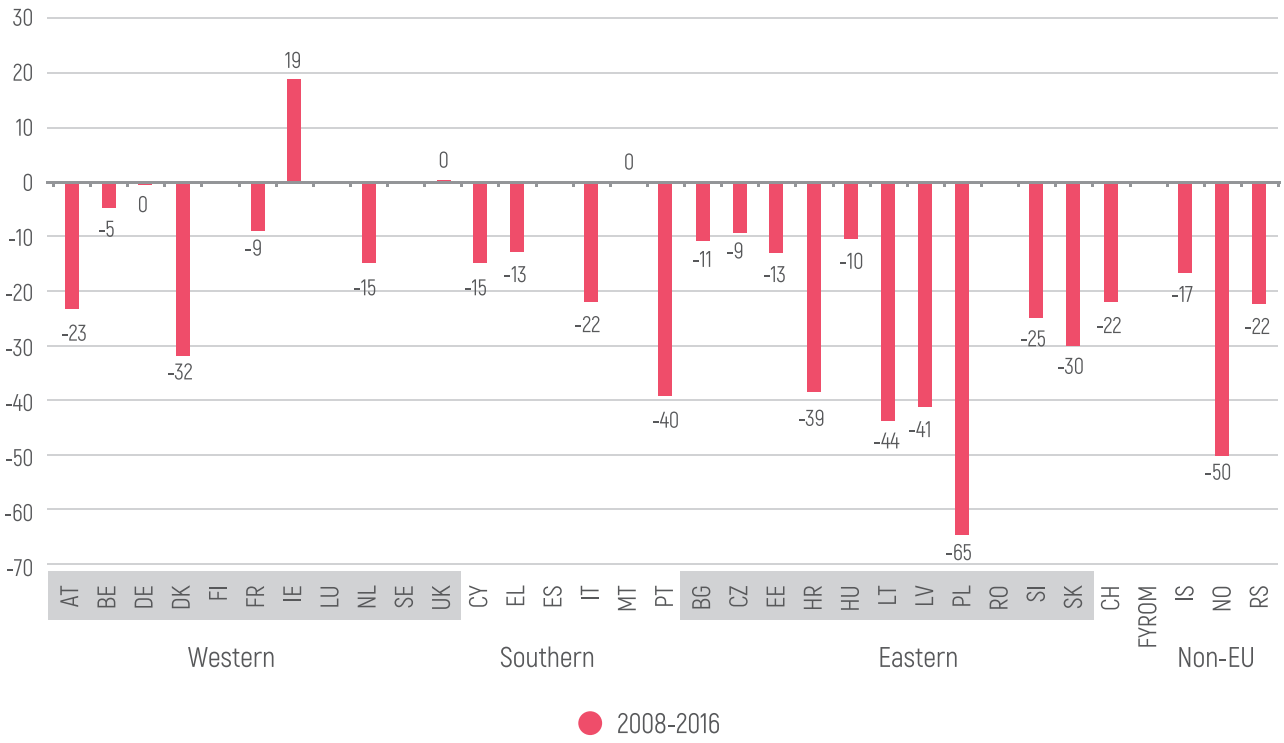
Western: BE, DE, DK, FI, FR, IE, LU, NL, SE, UK; Southern: CY, EL, IT, MT, PT;
Eastern: BG, CZ, EE, HR, HU, LT, LV, PL, RO, SI, SK; Outside EU: EU: CH, IS, NO

Only a few countries have defined their regulatory targets for non-priority letters in respect of QoS measurement methodology. Ten countries used EN 14508 standard, whereas 6 countries used EN 13850 standard for measurement of transmission quality of non-priority mail.

For measurement of transmission times for parcels, different methodologies were used. Four countries used CEN's technical report TR 15472, 6 countries used EN 13850 standard, while 9 countries used another methodology.

When it comes to postal network access points, Figure 151 shows changes in the volume of postal letter boxes from 2008 to 2016. In the observed period, a drop in the number of letter boxes has been recorded in almost all of the countries.

Figure 151. Change in number of letter boxes 2016/2018 shown in %



16 CYBER SECURITY

Fast ICT development introduced digitalization era in our every-day life and social stream management. Two of the foremost benefits of digitalization are data access and data storage. Data storage and processing are no longer dependent on local computers and memory, but, due to much larger capacity requirements and lower costs, rely on the virtual space, so-called „cloud". There is virtually no IC resource that cannot be stored on the cloud: memory, applications, tools and services.

The majority of devices we use are connected to the Internet via wireless access – PCs, tablets, smartphones, cameras, cars, IoT (Internet of Things). Digitalization has facilitated execution of every-day activities and improved business and education sectors. Each user generates digital trace data of around 20,000 logs a month, depending on what they watched or where and what they bought. In this way a private user data library is created. This, as well as all saved personal data, documents, photographs, intellectual property create limitless possibilities for a brand new type of crime, more lucrative than drug trafficking – the cyber crime. According to a McAfee study, cyber crime consumes more than 600 billion dolars a year worldwide and this figure only continues to grow, due to an ever spreading capability of hackers and the rise of cryptocurrencies, guaranteeing the anonymity of perpetrators. The technology development progresses at such a fast pace, that it is virtually impossible to develop adequate protection mechanisms or regulation measures. Hackers' strenght is manifested in their potential to organize in groups with large membership, they are active on the so-called Dark web, they exchange information, use common tools and methods to attack individuals, companies, banks and electronic payment systems. For that reason, all society and community members must unite and work together to find solutions.

By adoption of the Law on Information Security ("Official Gazette of RS" Nos. 6/16 and 94/17), (hereinafter "the Law"), first steps are made for the key service providers to take appropriate technical and organizational measures to manage risk their operational networks and information systems are exposed to. The Law stipulates the competence of the Regulatory Agency for Electronic Communications and Postal Services in coordinating and conducting the tasks of the National Center for Prevention of Security Risks in ICT Systems (National CERT).

According to the research of the European Union Agency for Network and Information Security (hereinafter: ENISA),

carried out in period December 2016 – December 2017, dealing with the top 15 IT threats in 2017, including the data obtained from the Special Prosecutor's Office for High-Tech Crime of the Republic of Serbia, National CERT made an overview of cyber security threats in 2017 (Table 44).

Information security worldwide

Table 44. **Comparative overview of carried out and recorded cyber threats and cyber attacks in 2016 and 2017**

Top threats 2016	Trend 2016	Top threats 2017	Trend 2017	Change in ranking
1. Malware	↑	1. Malware	→	→
2. Web based attacks	↑	2. Web based attacks	↑	→
3. Web application attacks	↑	3. Web application attacks	↑	→
4. DoS	↑	4. Phishing	↑	↑
5. Botnets	↑	5. Spam	↑	↑
6. Phishing	→	6. DoS	↑	↑
7. Spam	↓	7. Ransomware	↑	↑
8. Ransomware	→	8. Botnets	↑	↓
9. Insider threats	→	9. Insider threats	→	→
10. Data loss, damage, theft and manipulation	↑	10. Data loss, damage, theft and manipulation	→	→
11. Exploit kits	↑	11. Data breach	↑	↑
12. Data breach	↑	12. Identity theft	↑	↑
13. Identity theft	↓	13. Confidential data leakage	↑	↑
14. Confidential data leakage	↑	14. Exploit kits	↓	↓
15. Cyber espionage	↓	15. Cyber espionage	↑	→

TREND: ↓ DECLINING, → STABLE, ↑ INCREASING
RANKING: ↑ GOING UP, → SAME, ↓ GOING DOWN

Source: **ENISA**

1. Malware

In 2017, malware was the most detected cyber threat. Antivirus softwares detected more than 4 million attacks on a daily basis, i.e. over 700 million in the first quarter last year, while hundreds of malware solutions are available on the black market. There were 1.3 million mobile device malwares in the first and second quarters of 2017, with 1.5 million in the third quarter of 2016. Unrelated to the drop in the volume of recorded cases, a rise in the number of sofisticated attacks has been observed.

In the previous year occured an abuse of confidential tools supposedly developed in the US homeland security services, that were subsequently used for WannaCry and NotPetya attacks.

The identified malware features are the following: increased number of infections not requiring the device user's „click"; script execution by means of the tools already installed on the victim's device; network infection using special worm features; wipers (wiping the hard drive of the computer it infects); script-based malware hidden in potentially unwanted programs (PUPs); increase of malware through adware; vulnerability of hardware firmware; hybrid attacks (combination of 2 attack methods, with the aim to conceal the real activity); use of short-lived domain generating algorithms (DGAs) to avoid black lists, generating over and over new domains, staying unidentified over long periods of time; attacks on delivery-chains (for example by inserting a malware code in a legitimate company software used mainly by system administrators for Windows log analysis, causing all users to become infected while downloading software from vendors' sites).

In the first quarter of 2017, legal persons detected far more malwares than in the same period last year. Compared to 2016, the share of this type of attack increased from 37% to 46%. The number of trojans also grew, from 23% in the previous year, to 30% in 2017, whereas the so-called worm attacks decreased from 25% to 6%.

An increase in malware dedicated to Mac and Linux OS has also been observed. In the first quarter of 2017, the number of malware has doubled compared to 2016, with the focus on Linux systems. During the second quarter of 2017, MAC users experienced more malware attacks than during the whole 2016. Still, malware targets Windows users the most, with these attacks on the rise by 55% (in Januar 2017) and by 75% (in July 2017).

2. Web-based attacks

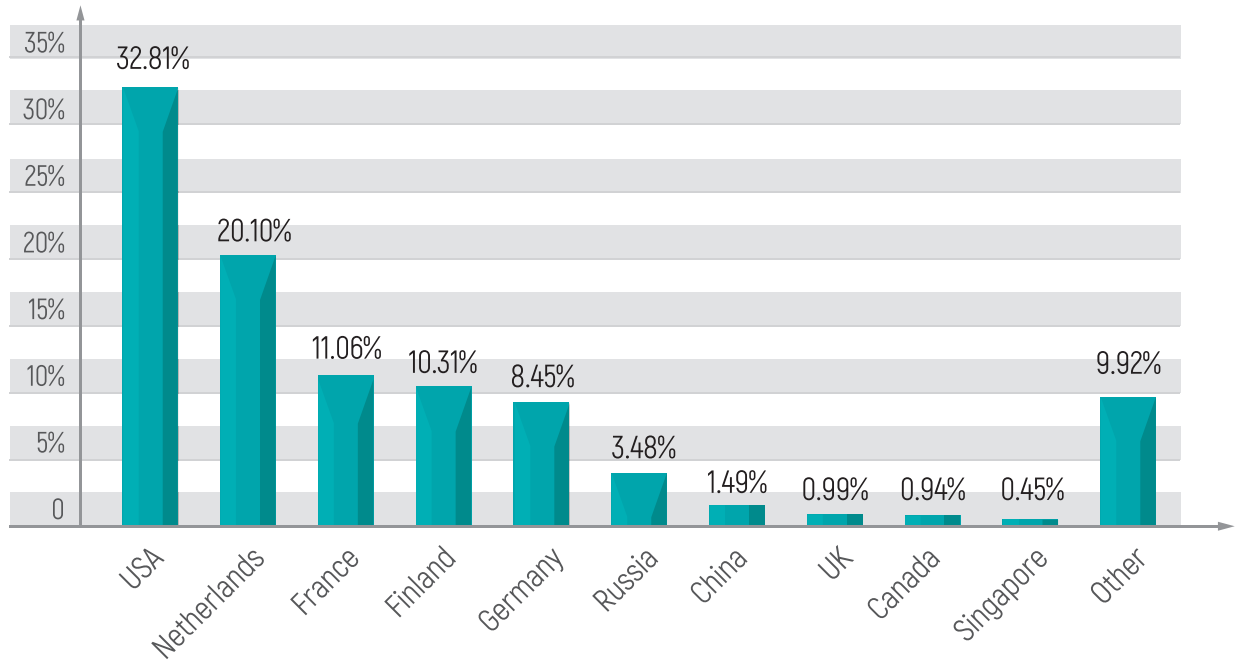
This type of attack is directed towards web-oriented systems and services (browsers, websites, web service and web application components). These types of attacks most commonly include: web browser exploits, web server and web service exploits, drive-by attacks, water-holing, redirection and man-in-the-browser. They are often combined with malware and their growth trend in 2017 shows that they are likely to reach the number of malware threats.

During download of web content, 58% of malware have been distributed, whereas 48% of threats have reached the browser due to a wanted or accidental content download from the Internet. In the first quarter of 2017, 79,209,775 URL addresses were identified as malware, while in the second quarter 33,006,783 malware URL addresses were identified. More than 50% of all cyber attacks rely on web-oriented technologies, whereas 38% of the attacks use browsers or Adobe Flash and Oracle Java add-ons, reaching thus 50% of the attack incidence.

Figure 152 shows statistical distribution of web-based attacks by country, for the second quarter of 2017.

The trend of this type of attack is on the rise.

Figure 152. Statistical distribution of web-based attack sources by country, Q2 2017



Source: **ENISA**

3. Web application attacks

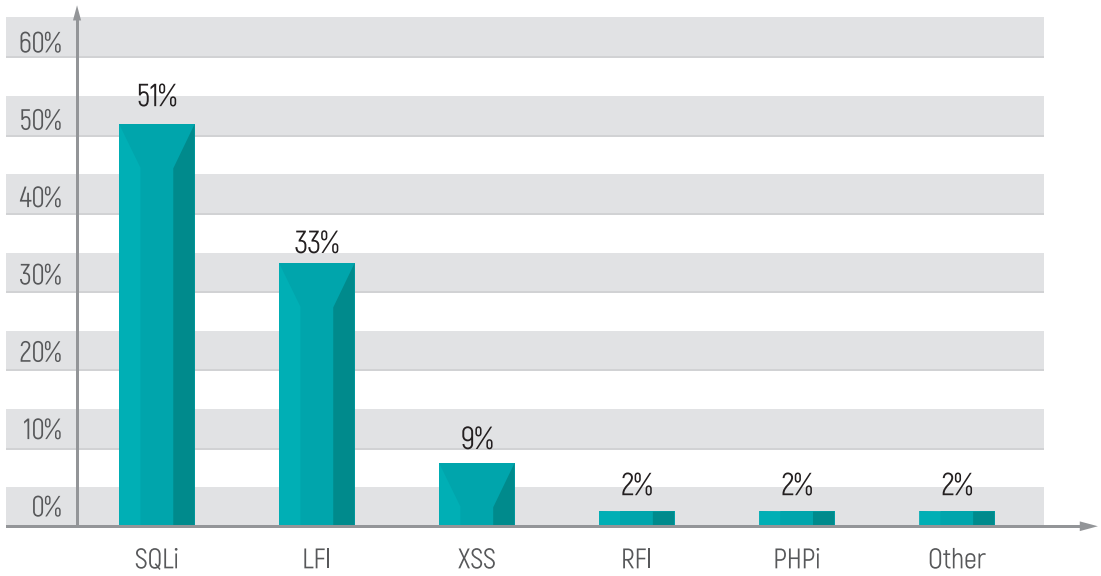
Web application attacks are mostly directed against available web and mobile applications and web services. The usual targets are government and financial institution applications, such as those developed in Wordpress and Magneto environment or other.

The leading position belongs to SQL Injection attack, followed by XSS (39% in the first quarter 2017), which increased by 166% compared to the data from 2012. Vulnerability of CMS solutions and their wide-spread application ranked this type of attack as third on the list (WordPress containing CMS accounts for 70% market share), enabling hackers' access to approximately 2 million websites (Figure 153).

Web application attacks decreased in the first quarter of 2017, compared to the fourth quarter of 2016. In the USA, the number of attacks grew by 20% and that of SQL Injection attacks dropped by 15%. Out of the total number of reported attacks, 30% are web application related, whereas 93% of the attacks were carried out by organized criminal groups for financial benefits.

The trend of this type of attack is increasing.

Figure 153. Web application attacks by type



Source: **ENISA**

4. Phishing

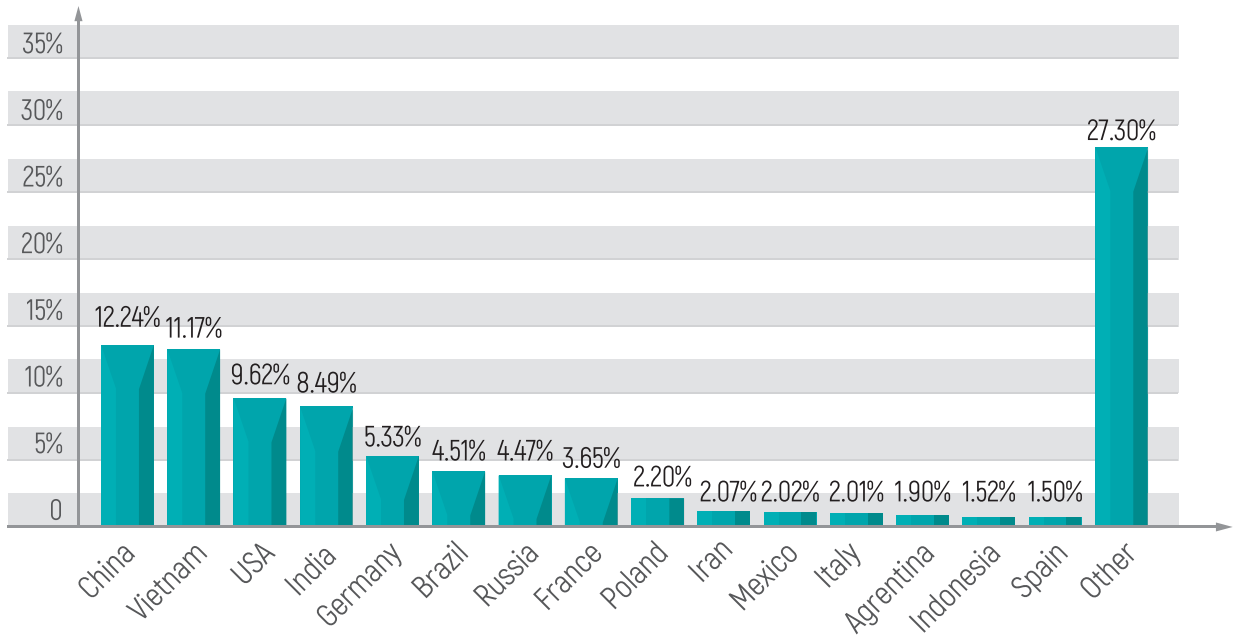
Phishing is a cyber attack which primarily uses social engineering to mislead its victims. It is connected with botnet, malware, web kits attacks, and cyber espionage.

According to recorded data, in 2017 phishing campaigns improved both in terms of frequency and sophistication level. Each month, an average of 1,385 million phishing sites had been created, whereas in May 2017, a total number of 2.3 million web sites with average life-span of barely 4-8 hours. During the third quarter of 2017, the majority of phishing/ spam was detected in September (59.56% of the total e-mail traffic), while during Christmas and New Year holidays that number was much higher.

Countries that most usually host websites for phishing purposes are China, Vietnam, USA and India (Figure 154).

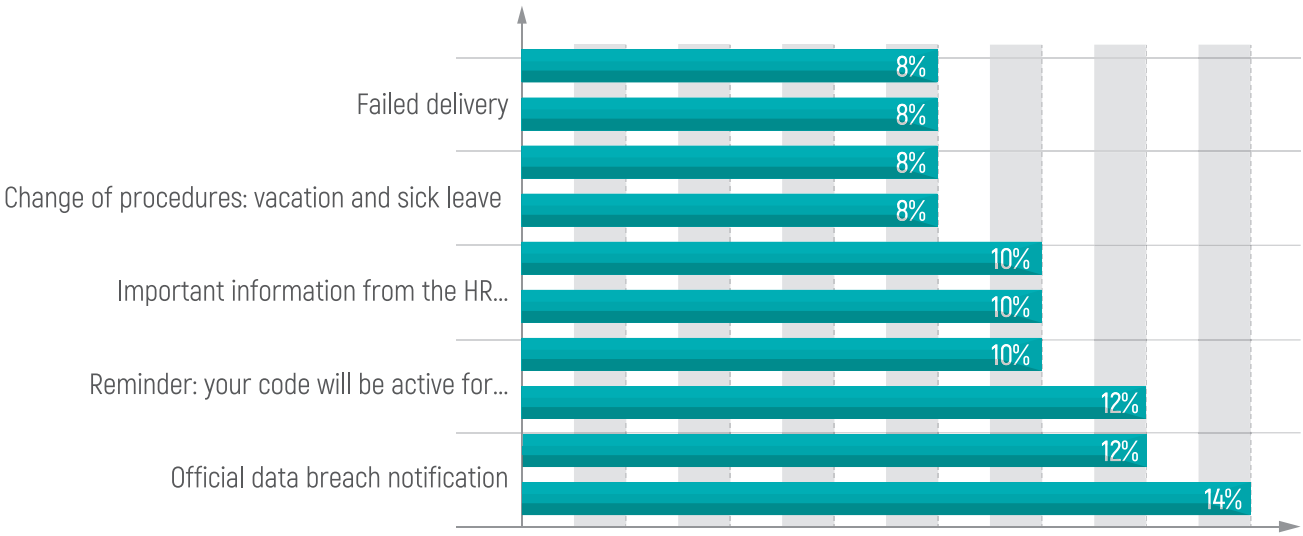
The trend of this type of attack is increasing.

Figure 154. Countries that host websites for phishing purposes



Source: **ENISA**

Figure 155. Usual e-mail subject lines users click on



Source: **ENISA**

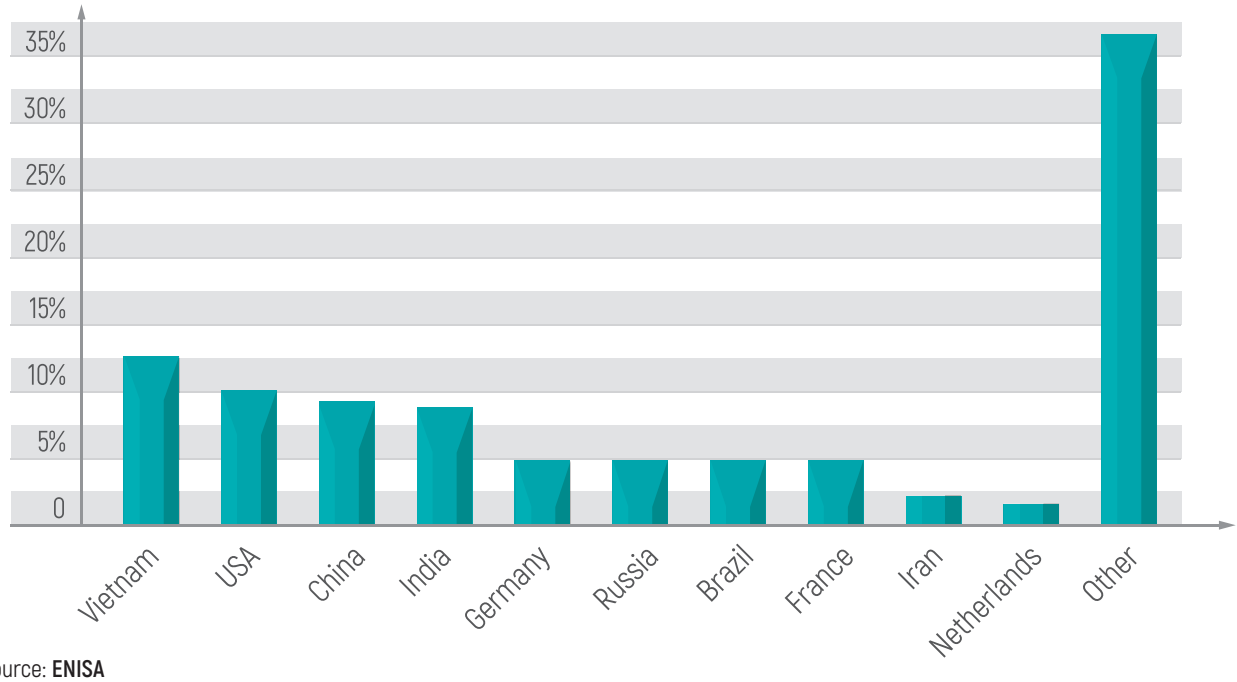
5. Unsolicited messages (Spam)

Since the beginning of the Internet, spam has been the most frequent and resilient among cyber attacks. Spam is the main carrier of malware, via malware attachments and URLs. Main sources of unsolicited messages, by country, are shown in Figure 156.

In the fourth quarter of 2017, the average daily number of spam messages was 454 billion, or 85% of the total recorded daily e-mail traffic. In the first quarter of 2017, the number was only 55.9%. Around 88% of spam messages are sent by botnets, 91% contain some kind of URL, while 66% are linked to farmaceutical products.

The trend of this type of attack is increasing.

Figure 156. Countries – main sources of unsolicited messages



Source: **ENISA**

6. Denial of Service - DoS

Denial-of-service attacks (DoS) and especially distributed denial-of-service attacks (DDoS) remain a great danger to all types of businesses with online market presence.

During 2017, over 33% organizations experienced a DDoS attack, while in 2016 the number was only 16%. Of all recorded DDoS attacks in the second quarter of 2017, 74% included two types of attack. Approximately 53% of the attacks were used to conceal other attacks such as malware, data leakage or theft and network scanning. The country with the largest number of originating attacks is China (60%), with the USA being the most exposed to attacks (90%). The majority of the identified C&C (Control&Command) servers is located in South Korea (66.5%).

The most concerned is gaming industry (80%), while in term of business size, 20% account for small businesses, 33% for medium-sized and 41% for big companies.

The trend of this type of attack is increasing.

7. Ransomware

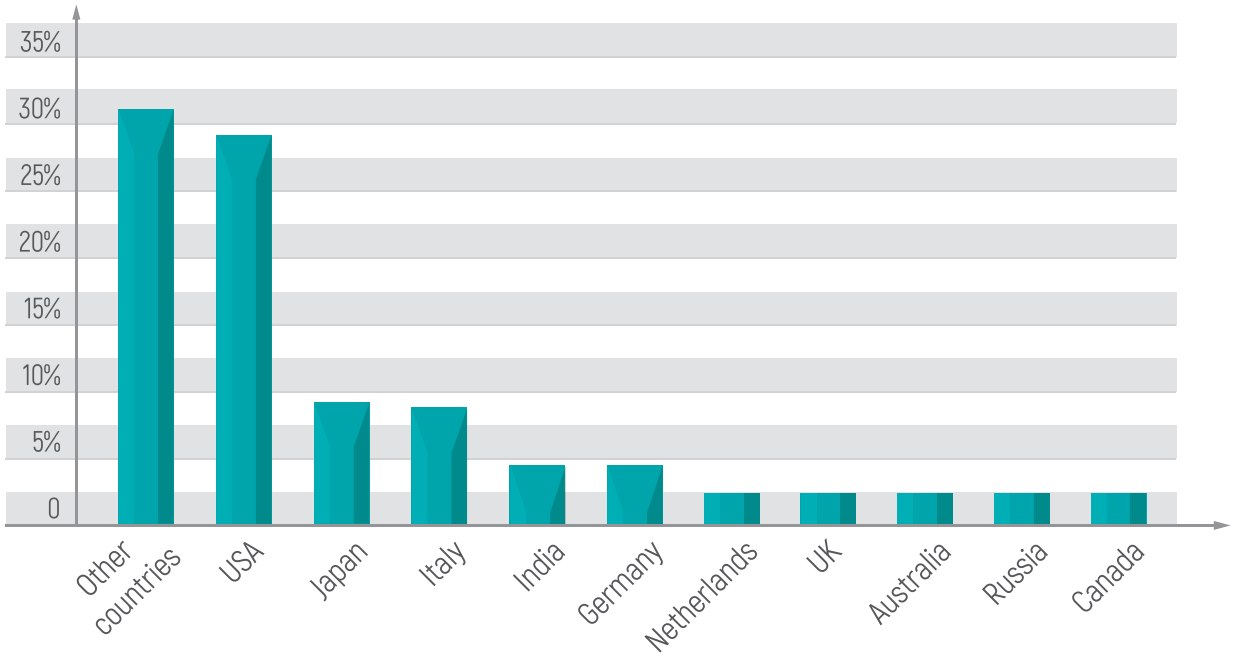
Ransom malware, i.e. ransomware is a type of cyber attack with an ever growing profitability. Approximately 60% of successful ransom payments are the result of ransomware activity, whereas other types of scam and malicious software account for the remaining 40% of the profit.

In the first quarter of 2017, 6 out of 10 payments were ransom-related, while 4.3 times more ransomware types were identified than in the first quarter of 2016. 71% of the companies were attacked and infected, around 50% of phishing messages in the first quarter were ransomware-related and 66% of ransomware infections in the first quarter were delivered via RDP (Remote Desktop Protocol). The average ransom amount increased to 1077 USD, whereas 1 out of 5 companies that paid ransome never got their data back. 72% of the infected companies had not have access to their data for two or more days, while global damage amounted to over 5 billion USD.

Countries with the most frequently detected ransomware attacks are shown in Figure 157.

The trend of this type of attack is increasing.

Figure 157. Countries with most frequently detected ransomware attacks



Source: **ENISA**

8. Botnets

IoT Botnets have been considered second most important cyber threat in 2017, following the massive Mirai attackt, which occured at the end of 2016, where the DYN provider's DNS service was compromised. it is estimated that, during 2017, another 8.4 billion devices were connected to the Internet. The majority of these devices can be extremely vulnerable to botnet DDoS attacks.

Since November 2017, the most attacked countries have been: China, India, Russian Federation, Brazil, Vietnam, Argentina, Iran, Thailand, USA and Indonesia.

The trend of this type of attack is increasing.

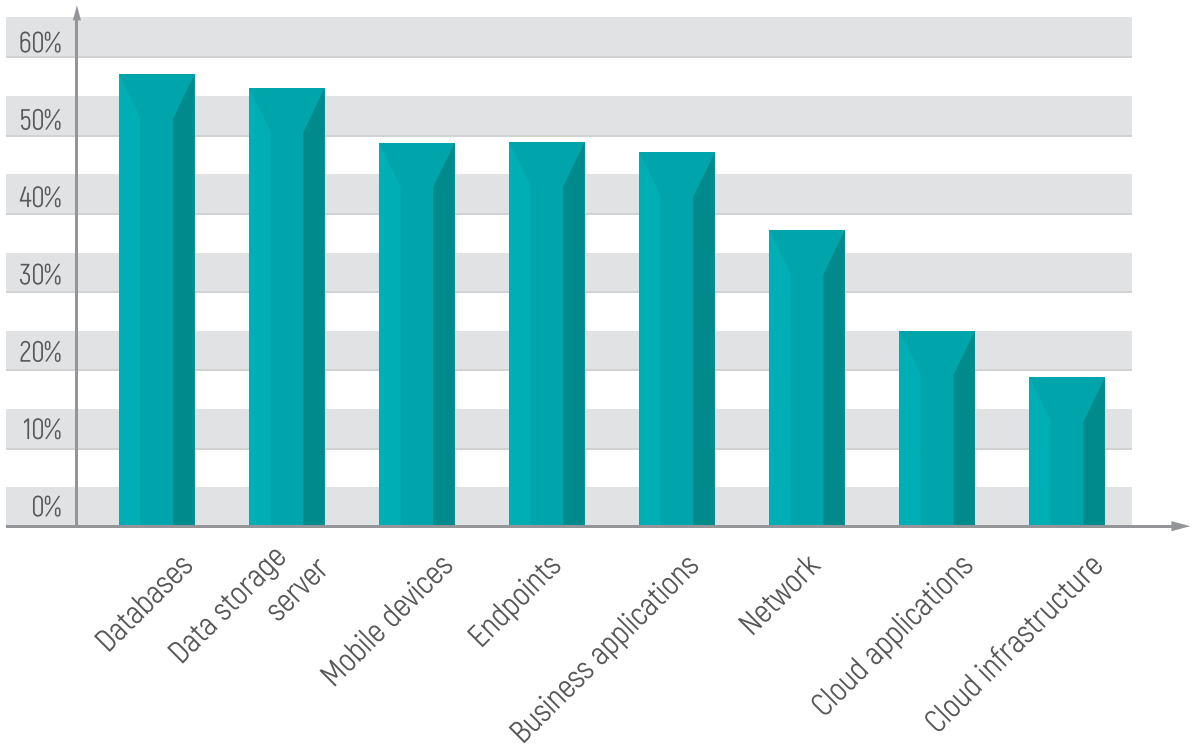
9. Insider threat

Insider threats refer to individuals who can abuse their privileges in an organization. This type of cyber attack has been a major risk in government institutions, since it is difficult to discern malicious activities from regular ones (Figure 158).

Top threat are managers with access to sensitive information (60%), consultants (57%) and other employees (51%), as shown in Figure 159. In 60% of the cases, the information is stored only to be abused in a future period and sometimes with the aim to found a competitor company (15%). Health care system was most threatened in 2017, while the research results have shown that 29% of the reported incidents were identified as a malicious action within organizatiion or were the result of an unintentional error. The research has shown that approximately 59.2% of patients' health records were compromised in one way or another, while 53% of the examinees confirmed that in their organizations such attack took place.

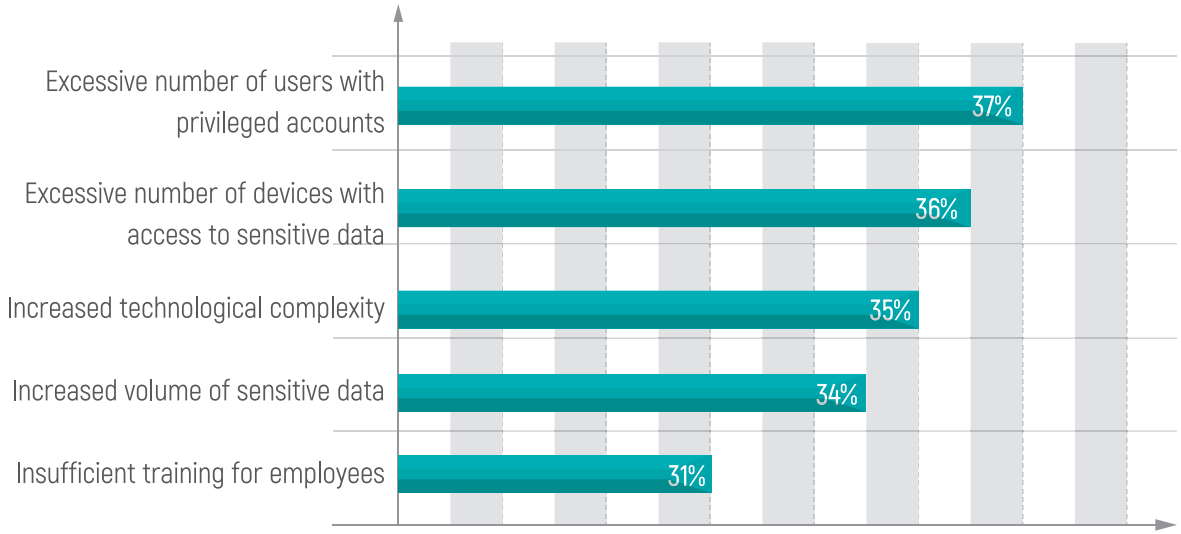
The trend of this type of attack is increasing.

Figure 158. **Information goods susceptible of insider abuse**



Source: **ENISA**

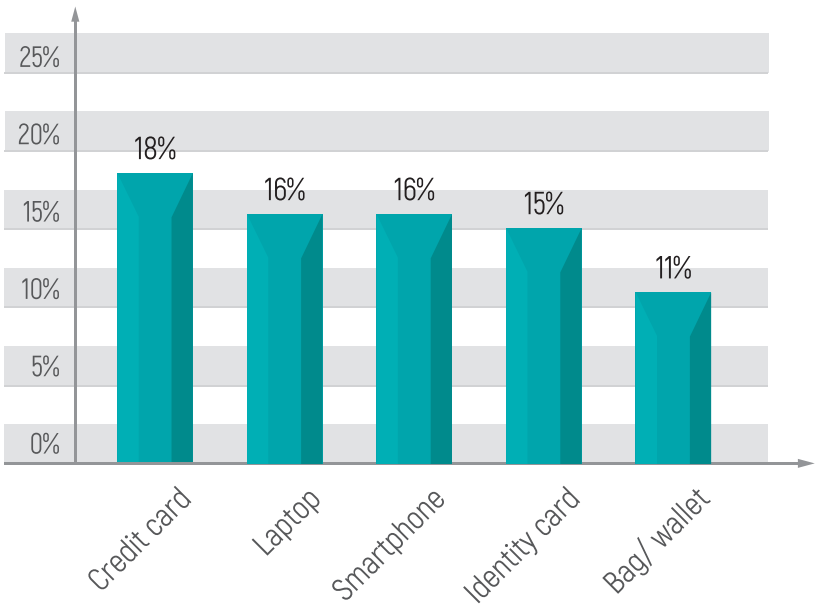
Figure 159. Most common causes of inside threats



Source: **ENISA**

10. Data loss, damage, theft and manipulation

Figure 160. Objects lost by individuals during last 12 months



Source: **ENISA**

Despite not representing directly a cyber threat, loss, damage, theft and manipulation of data are one of the biggest causes of data compromise.

In the first half of 2017, 18% of data security threats were caused by accidental data loss. In average, a person loses 1.24 objects a year, with less than half of the number never being found. During last year, 70% of individuals lost their data storage device and 7.5% lost their laptop (Figure 160). Currently only 41% of companies have adopted policy regarding data encryption. The ever-growing number of IoT and mobile devices as well as cloud computing have lead to more data exposure in terms of cyber security concerns.

The trend of this type of attack has remained stable (with a minimum increase).

11. Data breach

In 2017, the data breach was, in most of the cases, the result of weak, stolen or cracked passwords and the attacks were mostly directed against government institutions.

The number of confirmed successful attacks increased by 25%, while approximately 60% of the data were stolen for lucrative purposes. The majority of attacks were directed against the state administration and military (8.1%), educational institutions (7.4%) and healthcare system (34%). 61% of the victims were companies with less than 1000 employees, whereas around 95% of phishing attacks were successful and resulted in data breach.

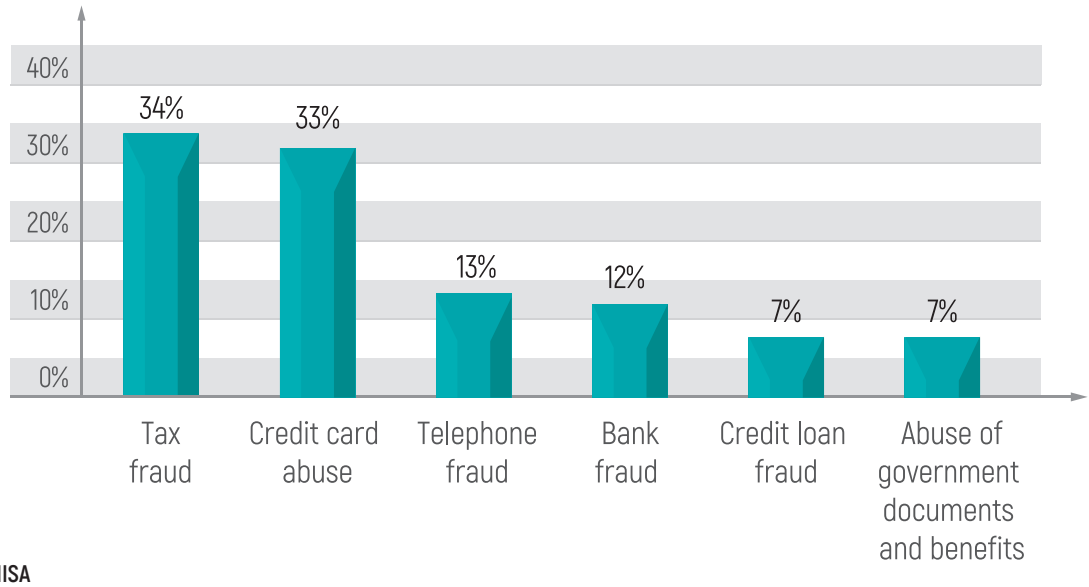
The trend of this type of attack is increasing.

12. Identity theft

Identity theft has a purpose to obtain confidential information and personal data such as: first and last names, address, contact information, credentials, financial data, health record data and similar (Figures 161 and 162). This type of attack is constantly growing and has expanded in 2017 almost beyond control. In the UK, around 500 identities are stolen on a daily basis.

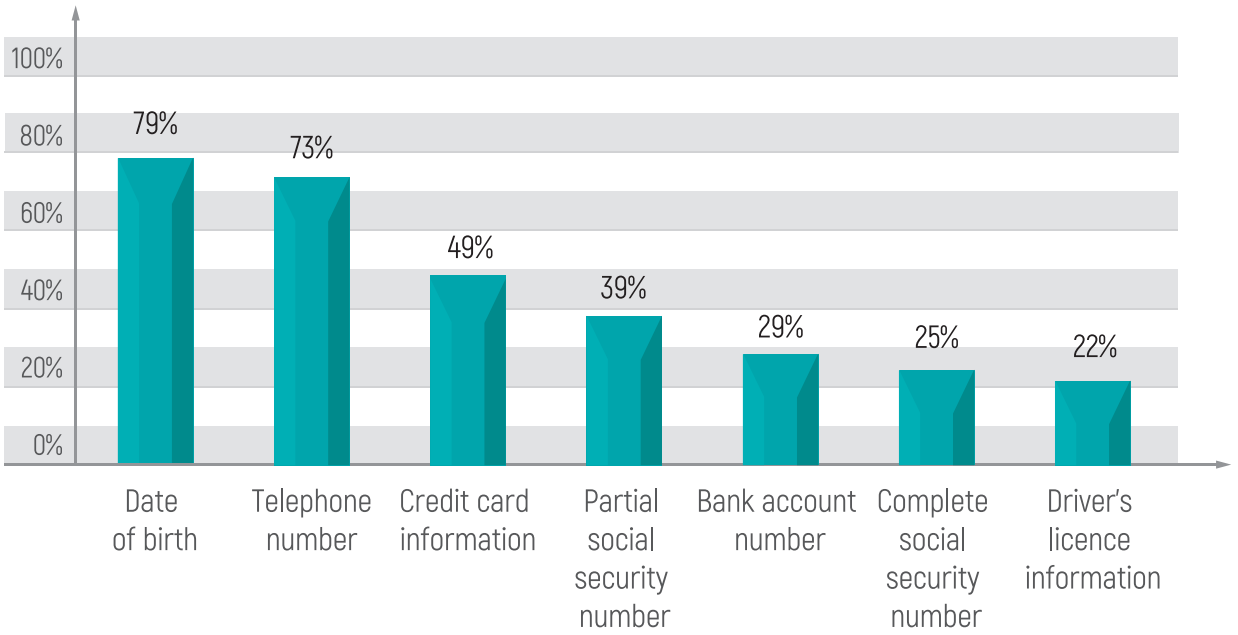
The trend of this type of attack is increasing.

Figure 161. **Cases of loss during last 12 months**



Source: **ENISA**

Figure 162. Type of exposed information



Source: **ENISA**

13. Disclosure of confidential information and data

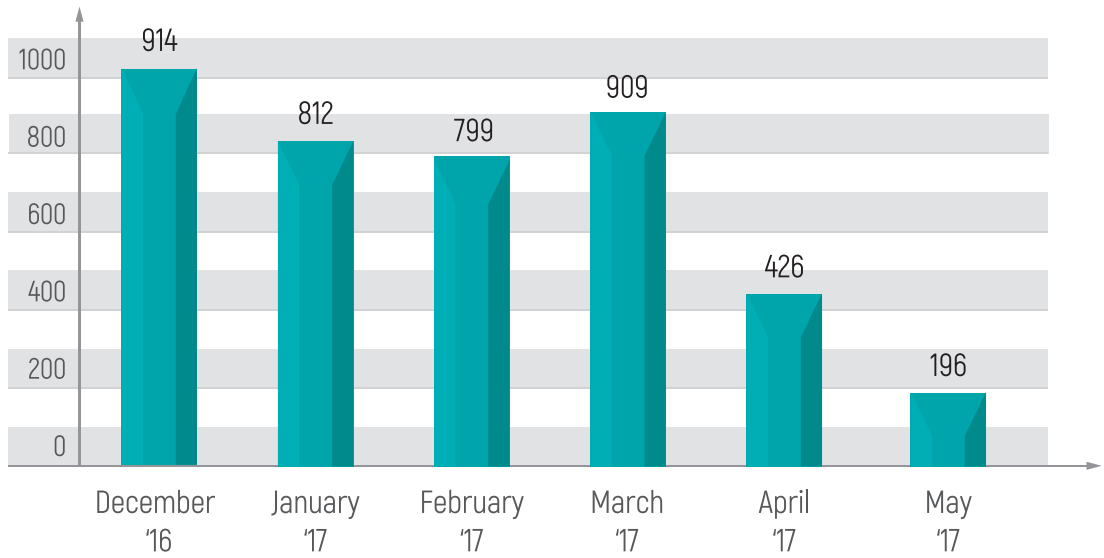
One of the largest cyber threats in 2017 was disclosure of confidential information and data, from personal data collected by giant Internet companies and online services, to business information stored in company databases. This made approximately 78% of social network participants consider to deactivate their accounts.

In May 2017, two days before the presidential elections in France, hackers obtained 9 GB of e-mails belonging to the ruling political party. In June, 198 million of American voters' personal data were disclosed and to telephone numbers, names and PIN codes of more than six million users were made publicly accessible on Verizon Cloud. The cause was a configuration error, while the attack was carried out during nine days in a row.

14. Exploit kits

Exploit kits are collections of toolkits which used to attack websites via malicious campaigns, by identifying and abusing browser's or web app's vulnerabilities (Figure 163). The most exploited vulnerabilities are Java- and Adobe Flash-related.

Figure 163. Number of RIG Exploit Kit visits from Dec. 2016 – May 2017



Source: **ENISA**

15. Cyber espionage

In 2017, cyber espionage has been considered as one of the most serious threats to legal persons, with 20% of the American companies having experienced this type of attack and 20% of global organizations having identified this type of threat as the most critical one.

Information security in the Republic of Serbia

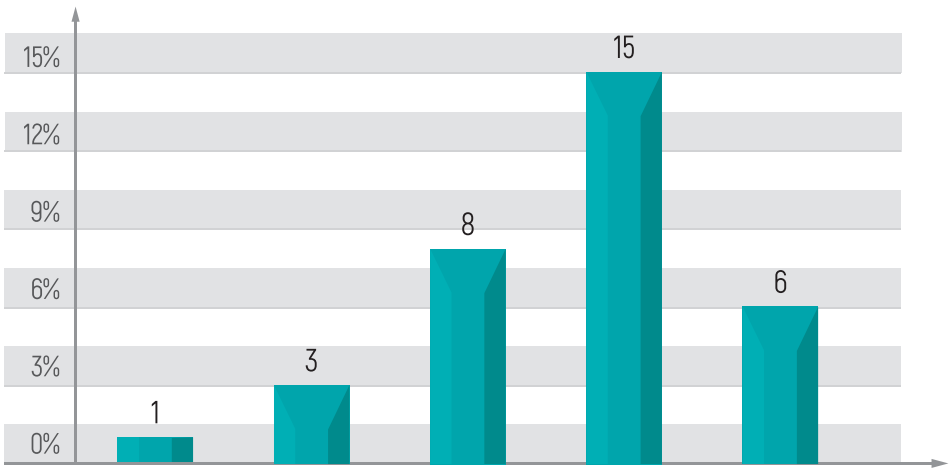
A legally prescribed obligation of all IC system operators is to inform the authorized body on incidents in IC systems that could severely disrupt the information security. No such incidents were recorded in 2017. Other incidents compromising the ICT security, where existed reasonable doubt that a criminal activity had been involved, have been reported pursuant to the provisions of the appropriate Law and bylaws, or forwarded to the Special Prosecutor's Office for High-Tech Crime.

In 2017, the total of 2371 criminal charges were filed with the Special Prosecutor's Office for High-Tech Crime by the victims of criminal acts, unlike in 2006, when only 9 charges were laid. The number of criminal charges for committed crimes against cyber security in 2017 is shown in Figure 164.

During 2017, the Special Prosecutor's Office issued investigation warrant against four individuals, carried out investigation and evidence collecting procedures in case of 82 individuals, submitted indicting proposals against 40 individuals, issued an indictment for one individual, filed a request for collection of necessary data against 125 individuals and made agreements on confession with 20 indicted individuals.

Within its authorization and competence, RATEL monitors and analyzes on a regular basis all types of threats and attacks on the information security in the Republic of Serbia. For the first time this year, a research on digital literacy of Serbian citizens and their online security was carried out.

Figure 164. Number of criminal charges in cases of threatened cyber security in 2017



Source: **Special Prosecutor's Office for High-Tech Crime**

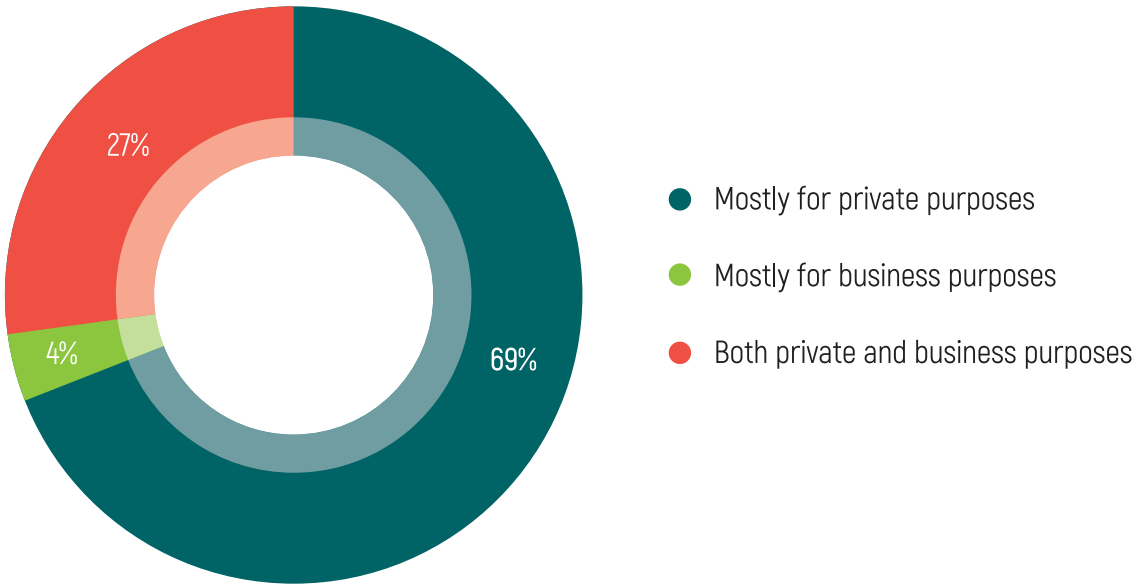
The research included 2025 examinees, out of which 61.4% are Internet users. All of our country's regions were equally represented. The majority of examinees (73%) live in urban areas, while the remaining 27% live in rural areas.

Regarding the education structure: - 44% completed secondary school, 15% have vocational college, 22% are university graduates and the rest are skilled and semi-skilled workers.

The age structure is: between 19 and 30 years - 23%, between 31 and 40 years - 20%, between 41 and 50 years - 22%, between 51 and 60 years - 22%. 5% of the examinees are between 15 and 18 years old and 8% are above 65 years of age.

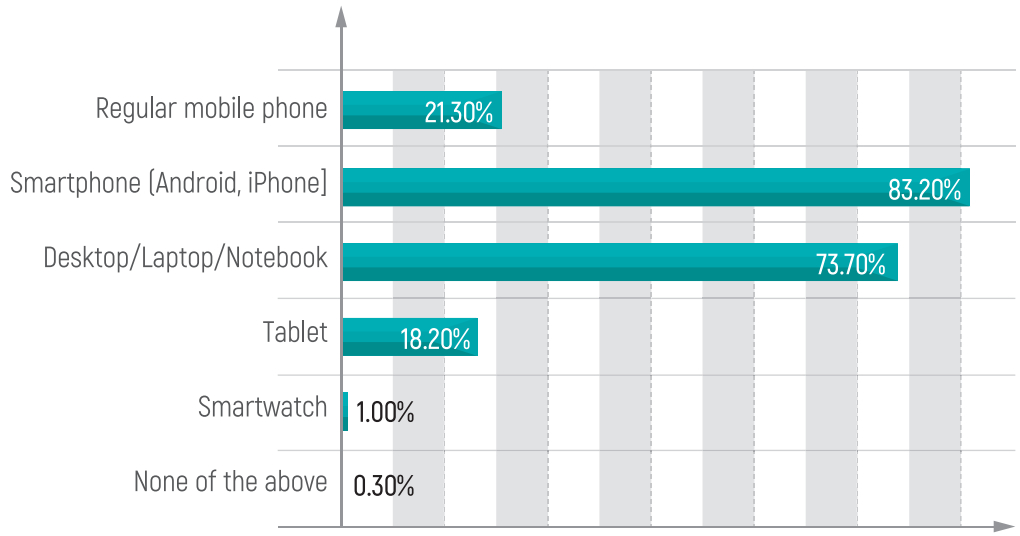
The majority of users (68.5%) use Internet for private purposes. Slightly over a quarter (27.2%) use Internet both for private and business purposes and merely 4.3% use it only for business (Figure 165).

Figure 165. **Purpose of Internet use**



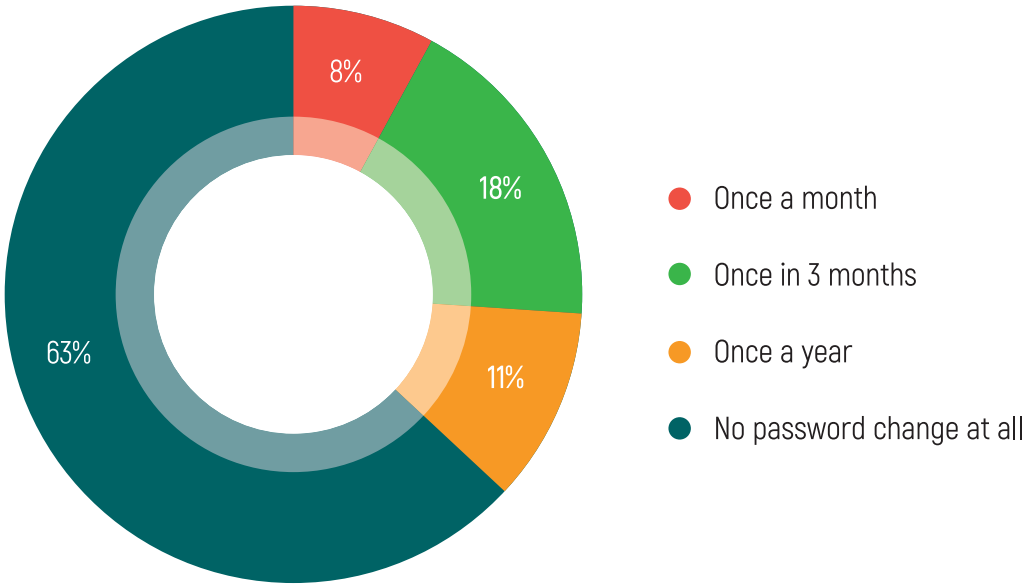
Source: **RATEL**

Figure 166. **Share of devices for Internet access**



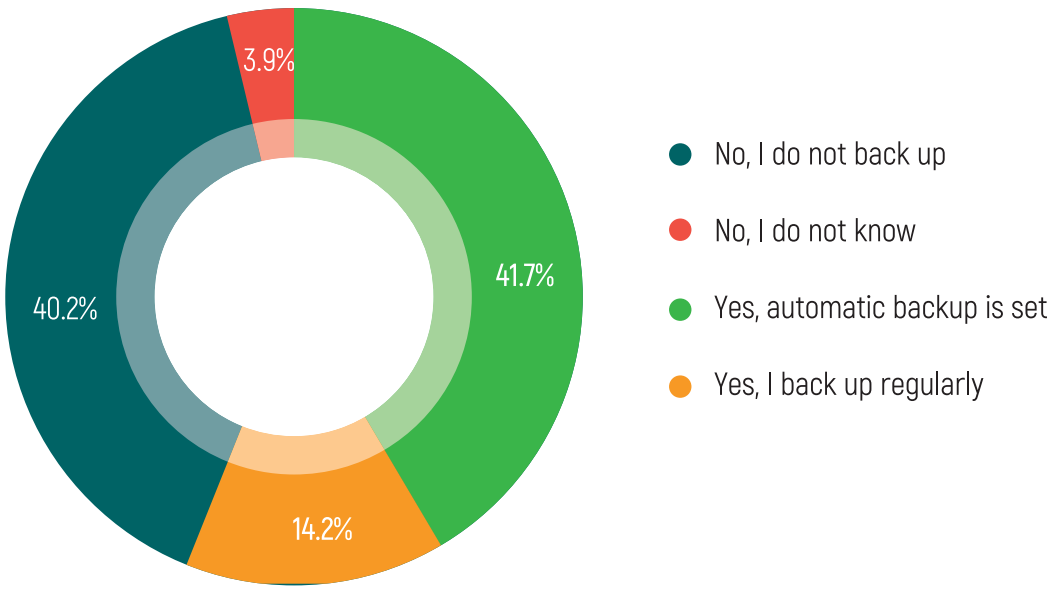
57.7% of the examinees had their PC and mobile device protected by a password. Out of that number, 63.2% of users do not change their password at all, while only 8% do it on a monthly basis (Figure 167).

Figure 167. Frequency of password change on computers and mobile devices by users

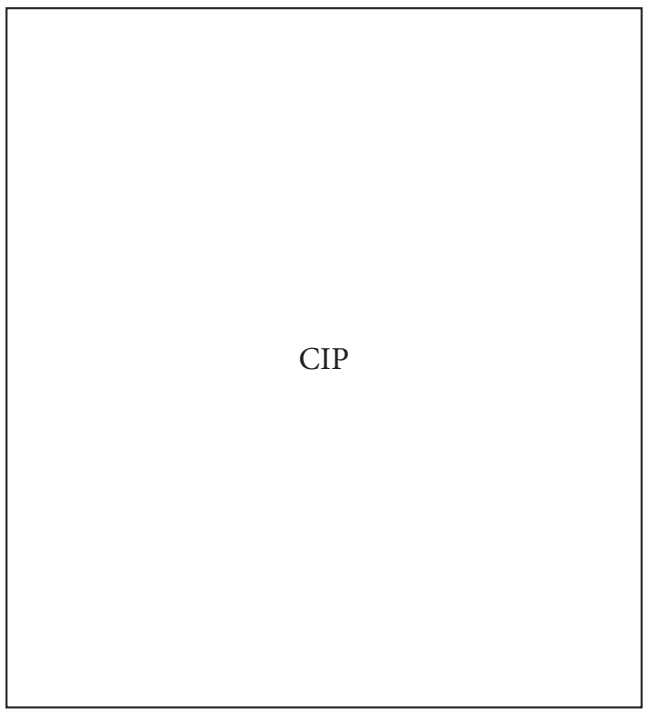


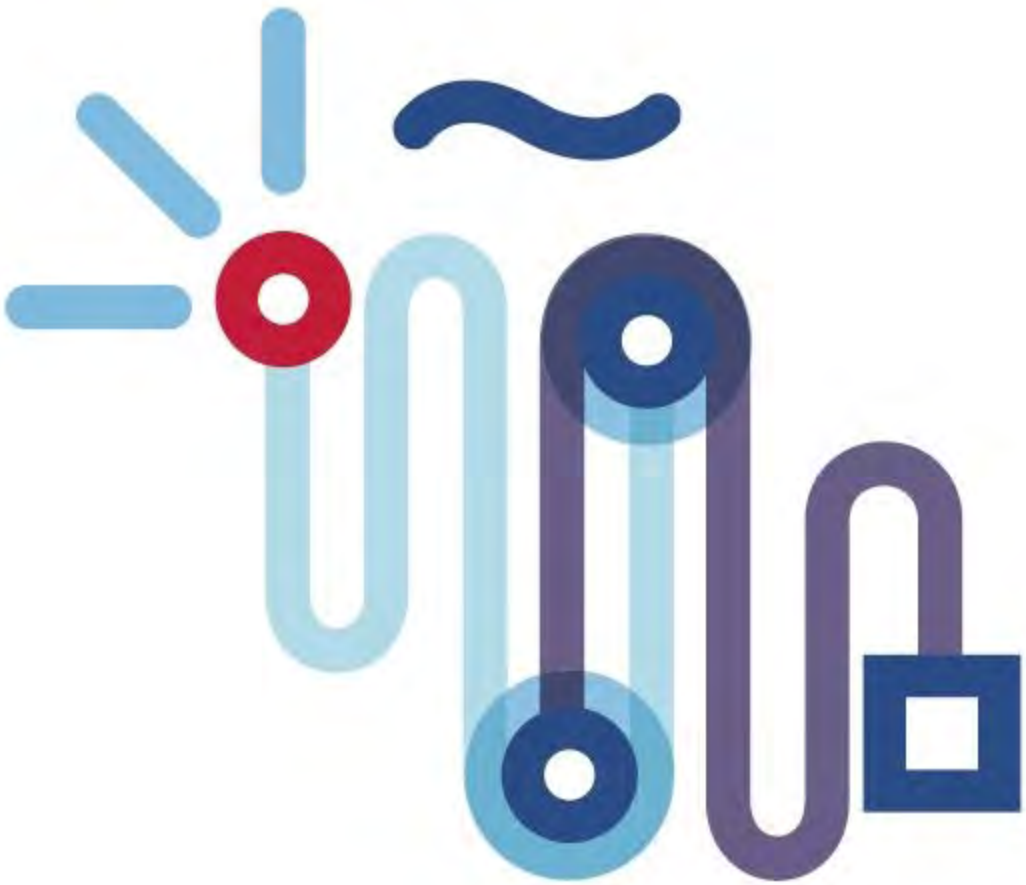
41.7% of the citizens automatically back up their data, against 14.2% who do it manually. As much as 40.2% of Internet users do not back up their data (Figure 168).

Figure 168. Data backup



Source: **RATEL**


CIP



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