

**Customer satisfaction surveys**

Since 2017, Rostelecom has been measuring NPS (Net Promoter Score) against eleven metrics. Compared to 2017, our NPS showed growth in nine out of the eleven metrics.

In addition to NPS scores for basic products such as data and TV, we extended the survey to recently launched products, including: Smart Home, Video Surveillance, Antivirus, and Wink. This list will further be extended in 2019.

In 2018, Rostelecom adopted Heat Maps for online customer service metric monitoring and an SQM (Service Quality Management) system to measure customer service in real time. Our customers now have access to our services via social media and UGC<sup>1</sup> platforms across all macroregional branches. We have also ensured seamless inquiry routing between macroregional branches.

**Network infrastructure**

Rostelecom’s network infrastructure includes the following elements.

**Technology platform upgrade**

We see continuous upgrade and improvement of our IT systems and infrastructure as a strategic growth area. The technology platform upgrade implies an extensive expansion of the fibre network and renewal of the copper network as well as centralising the IT landscape to significantly reduce maintenance costs and improve the overall network manageability.

**Network infrastructure expansion**

Rostelecom provides transmission services for any data format via cable, radio relay, or satellite links. Our digital network is based on dense wavelength division multiplexing (DWDM) technology and covers virtually all of Russia.

In 2018, we designed, built and launched additional networks to expand our network infrastructure capabilities. We leveraged them to implement a number of large-scale projects

- > organised video surveillance at the Russian presidential election
- > constructed the Sakhalin-Kuril Islands submarine fibre-optic cable link (SFOCL)
- > connected a number of healthcare centres to fibre
- > prepared the information infrastructure for the 29th Winter Universiade in Krasnoyarsk in 2019
- > commissioned a TelcoCloud (SDN and IT security services) and vIMS<sup>2</sup>(telephony) platforms.

BACKBONE NETWORK	REGIONAL BACKHAUL NETWORK	INTERNATIONAL NETWORKS	ACCESS NETWORKS (FTTB, PON)	INTERNATIONAL POINTS OF PRESENCE
Moscow–Novorossiysk, Moscow–Saint Petersburg, and Moscow–Khabarovsk fibre lines are designed to accommodate 80 optic lines with a capacity of up to 100 Gbps each. The capacity of our backbone network increased to 20.3 Tbps.	Fibre lines connecting large population centres and linked to the backbone network. Our customers can lease Nx64 Kbps lines using flexible access multiplexers.	Our international fibre lines provide connections to Azerbaijan, Belarus, Georgia, Kazakhstan, China, Latvia, Lithuania, Mongolia, Poland, Ukraine, Finland, Sweden, Estonia, and Japan.	Rostelecom develops its access networks based on advanced GPON (gigabit-capable passive optical network) and FTTB (fibre-to-the-building) technologies that can carry the signal to a specific building and farther to a customer’s apartment or office.	Our international points of presence (POPs) are located in Stockholm, Frankfurt, Tokyo, and Hong Kong. A high-speed transit route is maintained to provide connectivity between Europe and Asia through Russia.

1. User Generated Content – any meaningful content created and posted by users in various media.  
 2. Vital Information Management System.

The high quality and reliability of our services are secured through:

- > redundancy of communications equipment and lines
- > route separation
- > setting up cross-border passages and gateways for several independent foreign operators in each relevant international market to minimise traffic loss risks and consequences of outages.

In 2018, our unified backhaul resource management system was scaled up to macroregional branches to plan, build, and manage backbone and regional backhaul networks.

### SDN/NFV solutions<sup>1</sup>

SDN/NFV solutions enable better network control and reduce operation costs.

In 2018, we started to offer services based on the TelcoCloud platform as part of our NFV project. As a result, we were able to virtualise the most popular network security services for our corporate customers.

The successful pilot operation of a regional network segment based on an SDN solution by Brain4Net was an important step in growing this segment in 2018. The project's success confirmed the technical excellence of SDN-based Metro Ethernet architecture enabling improved automation of this network segment.

### Voice ICT network

Our voice ICT network provides for telephony and traffic transfer at the local, intra-zone, domestic long-distance, and international levels; audio- and videoconferencing; Integrated Services Digital Network (ISDN) and intelligent communication network (ICN) services; virtual PBX services; and signalling traffic transfer.

In 2018, Rostelecom continued to construct combined DLDTN/IZTN/ESISLN/ECPN<sup>2</sup> nodes based on vIMS infrastructure located in each region of Russia covered by PJSC Rostelecom's network. These nodes are regional sites within the new ICT Platform we use to standardise our technical solutions and optimise our network infrastructure in line with PJSC Rostelecom's common network development principles.

### Data transport network

Rostelecom's IP/MPLS data network comprises backbone and regional data networks, and supports the delivery of a range of services, including broadband access, IPTV, and TV content management interconnection and internet traffic transit virtual private networks data centre services.

In 2018, our IP/MPLS backbone network capacity was increased by 31% to 20.3 Tbps.

TABLE 9. SEGMENTS OF THE VOICE ICT NETWORK

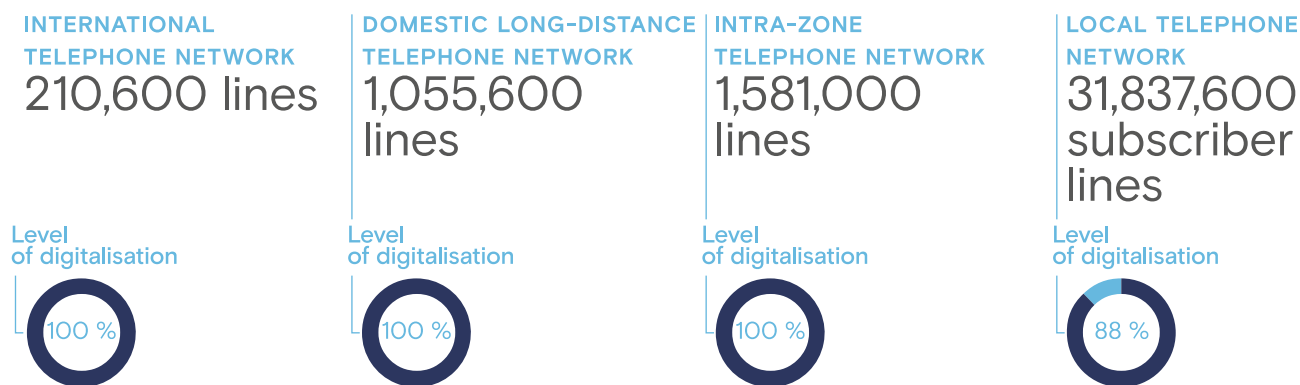
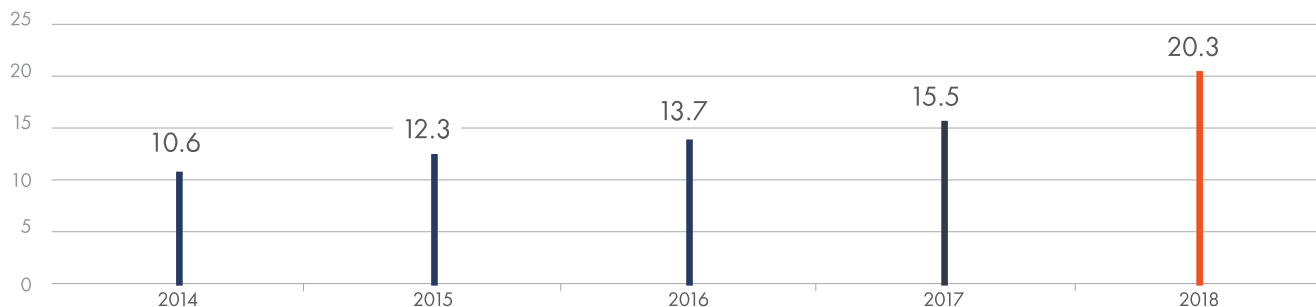


TABLE 10. LOCAL TELEPHONE NETWORK DIGITALISATION, %

2014	2015	2016	2017	2018
82	84	86	87	88

1. SDN (software-defined network) is a data network where the network control plane is separated from the forwarding plane and is directly programmable. NFV (network function virtualisation) is a concept of network architecture virtualisation at the network node level.  
 2. Domestic long-distance transit node/inter-zone transit node/end system and intermediate system local node/emergency call processing node.  
 3. IP/MPLS (multiprotocol label switching) is a technology that enables fast packet switching in multiprotocol networks through labelling.

FIG. 33. IP/MPLS BACKBONE NETWORK CAPACITY, TBPS



**Access networks**

In 2018, Rostelecom continued to upgrade its access networks to provide customers with high-quality digital services through advanced fibre technology.

We offer fast and stable internet access, as well as access to any other digital services, for both private customers and all other customer groups.

We have launched a number of projects to support this commitment. Our special project, Bridge, is designed to upgrade our last mile infrastructure through replacing copper networks with advanced fibre access solutions. We seek to maximise our disposal proceeds while cutting operating expenses on network infrastructure maintenance through releasing redundant property and reducing property maintenance costs. As part of the Bridge

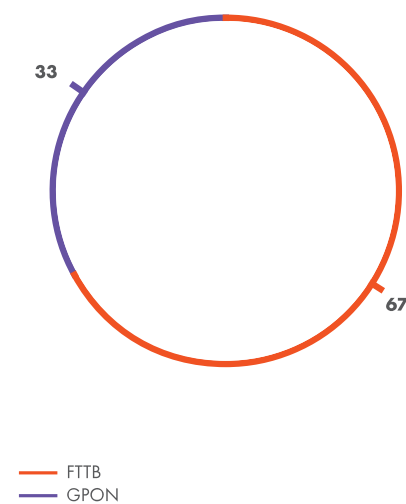
project in 2018, we migrated 37,200 telephone ports to VoIP<sup>1</sup> and launched four new VIMS<sup>2</sup> Edge sites in Irkutsk, Krasnoyarsk, Chelyabinsk, and Saint Petersburg.

Since 2014, Rostelecom has been successfully operating its Hermes platform designed to automate network design and construction processes. According to Hermes data, 14,900 km of fibre were constructed in 2018 to connect B2B customers.

We maintain a focus on constructing access networks for social infrastructure facilities while bringing high-speed internet access to small communities. Examples of such projects include Bridging the Digital Divide and connecting healthcare centres across the country to the internet. A total of 8,200 communities and 8,900 healthcare centres were connected by installing 59,000 km and 37,900 km of fibre, respectively, within these projects in 2018.

We expanded our access networks, with 35.0 million households passed with fibre as at the end of 2018, up by 1.7 million from 2017, including 1.2 million households connected to FTTB and 0.5 million households to GPON.

FIG. 36. HOUSEHOLDS BY ACCESS TECHNOLOGY AS AT 1 JANUARY 2019, %



1. VoIP – Voice over Internet Protocol or IP telephony.

2. vIMS(virtual IP-multimedia subsystem) is a function of the network core responsible for transmitting multimedia data (over the IP).

FIG. 34. HOUSEHOLD COVERAGE BY TECHNOLOGY IN 2014-2019, MILLION HOUSEHOLDS

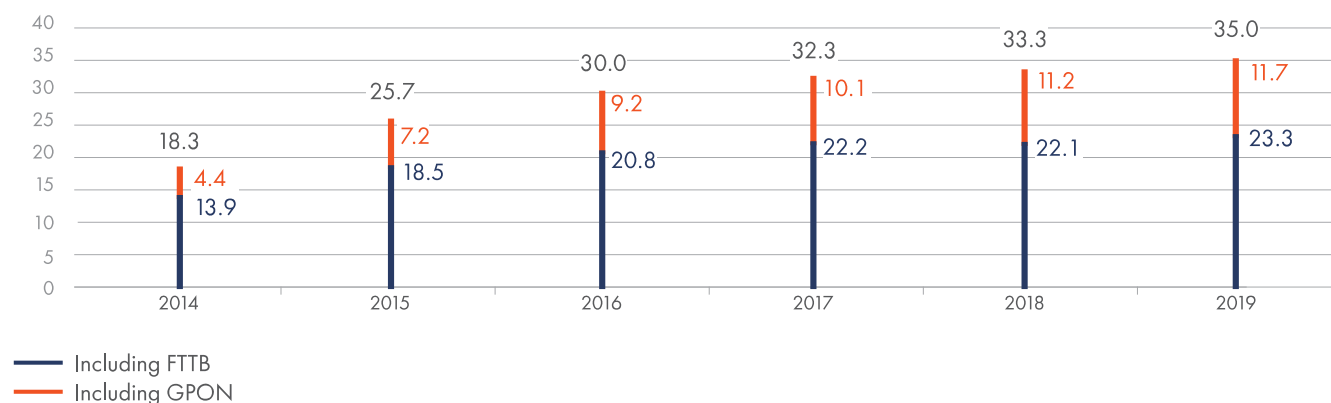
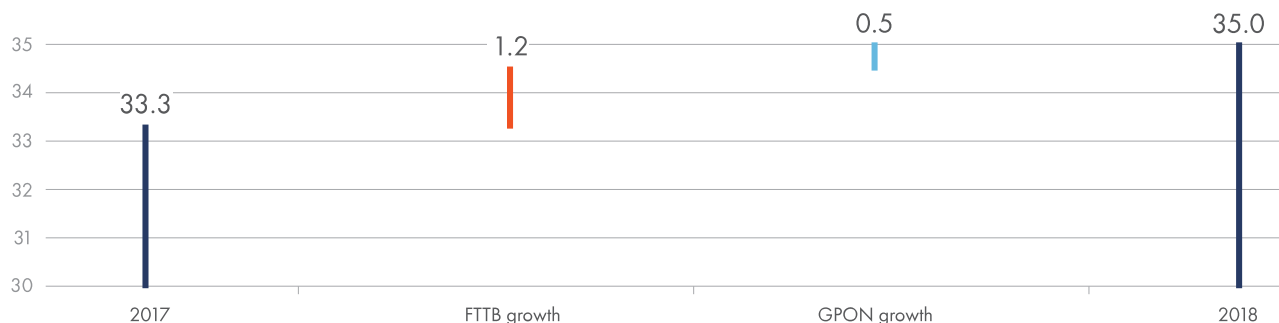


FIG. 35. HOUSEHOLD COVERAGE IN 2017-2018, MILLION HOUSEHOLDS



**Submarine cables**

Submarine cables provide additional connectivity between Russia and other markets to expand and upgrade Rostelecom’s international telecommunications capacity. Rostelecom has an indefeasible right of use in the Fibre-Optic Link Around the Globe global project links between UK-Middle East-Japan and South-East Asia-Middle East-Western Europe. As the owner of core capacities in international submarine FOCLs, Rostelecom holds a 67% stake in the Georgia-Russia link and 50% in the Russia-Japan link.

In December 2018, Rostelecom completed the construction of the Yuzhno-Sakhalinsk-Kurilsk-Yuzhno-Kurilsk-Krabozaodskoye Submarine FOCL as part of the federal targeted programme, Socioeconomic Development of the Kuril Islands (Sakhalin Region) for 2016-2025. The submarine fibre link spanning over 766 km offshore and 65 km onshore uses 40 Gbps DWDM equipment with an OSN Optix 880 multiplexing system. We have also built points of presence integrating the island-based infrastructure of the Kuril Islands with the interlinked communications network of mainland Russia.

**Satellite communications**

Rostelecom’s backbone satellite network complements its terrestrial digital network by connecting hard-to-reach locations with no access to FOCLs. In a number of areas, satellite communications also serve to back up land infrastructure.

Utilisation of our satellite communications network in areas along our backbone lines has been gradually decreasing as we continue commissioning submarine FOCLs to connect Magadan and Petropavlosk-Kamchatsky. In 2018, Rostelecom upgraded its satellite links in the Kamchatka Territory, Magadan Region, and other hard-to-access areas.

### TV infrastructure development

In 2018, Rostelecom continued to develop its TV infrastructure, including upgrading its interactive TV platform and launching the new Wink video service and other new products.

The software and hardware upgrade of the interactive TV IPTV/OTT infrastructure completed during the year enabled us to ensure technical readiness for IPTV, OTT, and Freeview services.

During the year, we deployed a new version of the DRM Verimatrix system and a new centralised CAS Conax Contego solution.

In September, Rostelecom launched a new video service, Wink, offering access to interactive TV from any device or network. We also launched our DVB-C Hotel TV product and a 4K (UHD) broadcasting system. 35 new TV channels were added to the network.

During the year, we connected 27 sites of Federal State-Owned Enterprise Russian Television and Radio Broadcasting Network (RTRN) to receive signals of TV channels with statutory public access. As a result, we have considerably improved the quality of TV channels broadcast within our Interactive TV service package.

### Mobile networks

Rostelecom cooperates with Russian operators of terrestrial mobile networks to extend the range of high-quality network services, including national and international roaming.

As at the end of 2018, the Company was routing international calls for 754 mobile networks in 203 countries. Rostelecom continues to build up its mobile network capacity across Russian regions.

### IT infrastructure expansion

In 2018, Rostelecom focused on enhancing the performance of its IT function, including improvements to IT architecture and optimisation of internal and external business processes.

#### Streamlining the IT landscape

As part of streamlining the IT landscape, Rostelecom has been implementing its strategic Target OSS/BSS Architecture Programme (the Basis programme). In 2018, we redesigned the programme to expand its functionality and launch new projects, including at macroregional branches.

#### Ensuring transparency and agility

In late 2017 and early 2018, we launched a number of critical initiatives to enhance the performance of our IT function, including:

- › transforming IT function capabilities
- › optimising procedures for cooperating with the IT function
- › increasing transparency into decision making and external communications of the IT function
- › educating external stakeholders about the IT function's activities
- › adapting a new IT culture, including through creating a specialised IT cluster, applying advanced methods, and developing a plan for building a digital community within the organisation to improve agility in finding and adopting new solutions.

### Developing the information environment to improve customer relations

To use data more effectively, the Group has launched its Single Reporting and Master Data Management Framework programme, which provides for improvements to the data storage centre as well as to customer and reference data management.

In 2018, the Group made progress on all major areas of the programme. Specifically, we reduced data submission times, integrated the basic functionality to harmonise customer data, and launched a reference data unification process.

### Human capital development

With a headcount of 129 thousand employees, Rostelecom Group ranks among Russia's largest employers. Rostelecom views human capital development as a top strategic priority. Achieving the Group's long-term goals requires a high level of engagement and satisfaction as well as opportunities for professional and personal growth of each employee.

We are committed to building a working environment that encourages talent development. Customising all processes and services around the employee and his or her interests is a key focus area for us. Considering Rostelecom's strategic goals and trends in the labour market, the Group has been focusing on strengthening its HR brand, integrating Generation Z into business processes, and enhancing labour productivity.