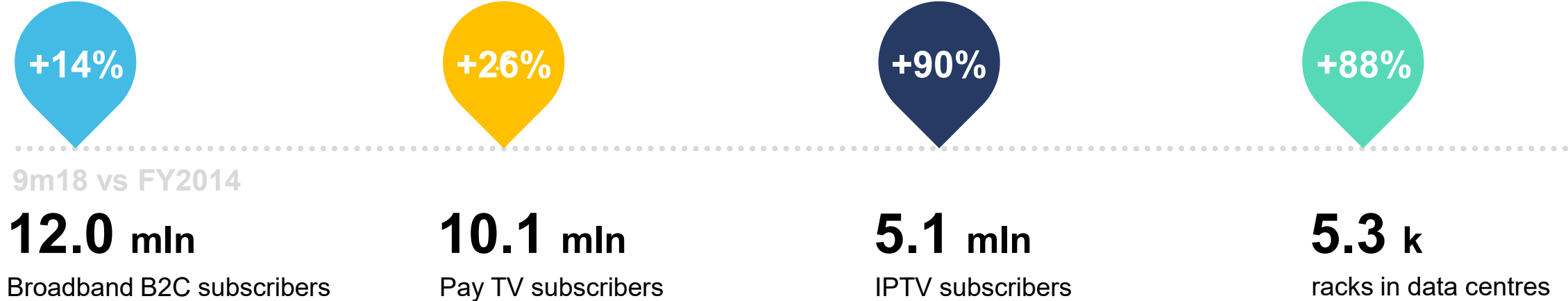




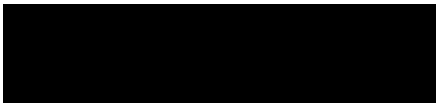
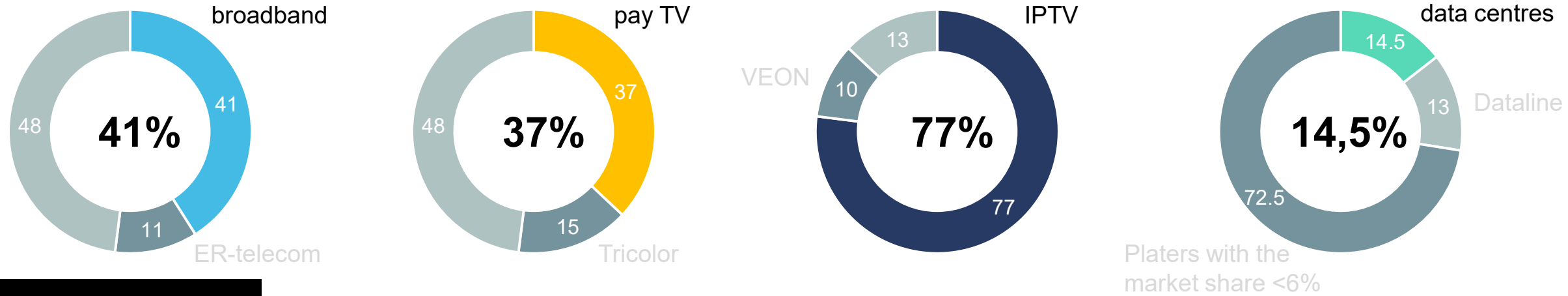
Technological partnership. Development of local R&D

Ростелеком

Leadership across core markets



Market share (1)



Network overview



Optical Transport Network

- DWDM & SDH;
- E1/STM/10GE/100GE interfaces;
- ~350 PoPs in Russia and other countries;
- 6 vendors (1 Russian), >6 NMS;
- > 100 000 km of optical fibers;
- Connections with 170 networks in 70 countries;



IP/MPLS Network

- MPLS with Traffic Engineering;
- L2 (PW, VPLS) & L3 services;
- 2 plane design (for geo-redundancy);
- ~130 PoPs (24 Core, >110 Edge nodes) in Russia and 3 on international exchanges;
- 5-level of SLA profile;
- 2 vendors, no NMS;
- ~ 12 Tb/s capacity;
- ~ 1.5 Tb/s international uplinks;
- ~ 6500 devices (WAN+MEN)

Network overview (cont.)

Voice network

- 21.5 million total subscriber base;
- ~ 38000 PoPs;
- > 10 vendors;
- Analog/TDM/NGN telephone exchanges;

Service & MEN network

BRAS/BNG, CG-NAT:

- 4 vendors;
- ~500 devices;
- Some regions use >1 vendor;
- 7 Broadband service models across network;
- DSL/FTTB/PON subscriber base ~ 11 million;

MEN

- MPLS or L2-based networks;
- 4 vendors, no NMS;
- Lots of EoS equipment;

Data Centers

- Services: IaaS, SaaS, PaaS, Security, VPNs, Cloud Storage;
- 14 Macro DC;
- ~5 server vendors, 5 storage vendors, 2 network vendors;

NOC & Maintenance

- 3-layer organization hierarchy:
- Corporate Center -> Macro-region (8) -> Region (67);
- ~ 150 000 employees;
- Network is divided into 8 regional domains (7 macro-regions and Corporate Center);
- Each region is managing all types of networks only in his geography;
- Many monitoring systems;
- 11 time-zones and distributed “busy-hours”;

Хронология 2014-2015



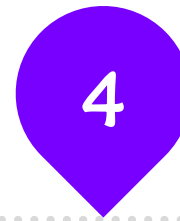
Комиссия по реализации
процессов
импортозамещения



Проектный офис
по импортозамещению



Определение
ключевых
разработок



Критерии
локализации



Закупочная
документация



Хронология 2016-2018

6

Методика оценки
(выездная)

7

Реестр
компаний

8

Участие в R&D,
лабораторные
испытания,
опытные зоны

9

Закупки с
применением
критерия
«Локализация»

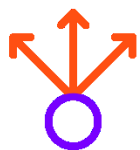
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Подготовка
Корпоративного плана
импортозамещения



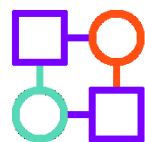
Хронология

Настоящее время



Технологическая независимость

Реализация мероприятий в части перехода преимущественно на отечественное оборудование и ПО



Технологические партнерства

Развитие ГК «Ростелеком».
Создание собственных центров компетенций



Исследования и разработки

Инвестиции в создание перспективных отечественных решений (включая электронно-компонентную базу)



Достижения 2018

Оценка компаний за
2018

30

Зарегистрированные
Заявки на оценку
соответствия Критериям
локализации


Закупки, млрд. руб.

>

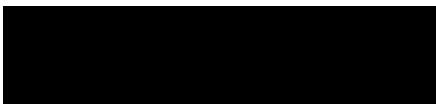
4
Опубликованные закупки с
применением критерия
«Локализация»



Документальное обеспечение




- ❖ Критерии локализации 
- ❖ Методика оценки
- ❖ Система оценки в баллах
- ❖ Механизм преференций (в части оборудования) в рамках ФЗ № 223
- ❖ Корпоративный план импортозамещения

Критерии оценки	Вид
Учредительные документы, бенефициары граждане РФ	Обязательное
ТОРП, Реестр ПО	Баллы
Исключительность прав на территории РФ	Баллы
Разработка на территории РФ	Баллы
Производство на территории РФ	Баллы
Сервисное обслуживание на территории РФ	Баллы



Достижения 2018

Корпоративный план

-  Технологическая стратегия с учетом импортозамещения
-  Долгосрочный план замены
-  Модернизация учетных систем

Пилотные внедрения



Успешное внедрение в опытно-коммерческую эксплуатацию российских IP/MPLS маршрутизаторов



Реализована первая в России пилотная зона SDN на сетях передачи данных

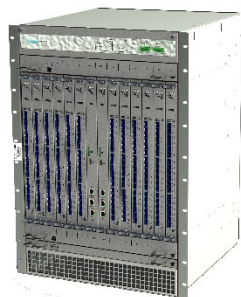


Универсальные маршрутизаторы

ME5000



- 3.0 Tbps, до 250 Gbps /slot
- 15U
- до 2 Fabric Management Cards /chassis
- до 12 Line Cards /chassis
- LC18XGE: 18x 10GBASE-R (SFP+)
- LC20XGE: 20x 10GBASE-R (SFP+)
- LC8XLGE: 4x 40GBASE-R (QSFP28), 4x 100/40GBASE-R (QSFP28)
- до 12K MPLS PW
- до 4K бридж-доменов
- до 8K сабинтерфейсов
- до 4k VRFs



ME5100



- 20x10GBASE-R (SFP+)
- CPU Broadcom XLP308, 1500MHz, 8GB RAM
- 200 Gbps, 300Mpps
- до 250K MAC
- FIB 1M
- до 12K MPLS PW /slot
- до 4K бридж-доменов
- до 4K сабинтерфейсов
- до 4k VRFs



ME5200



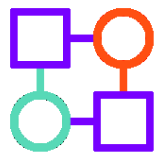
- 32x10GBASE-R (SFP+), 4x 100/40GBASE-R (QSFP28)
- CPU Broadcom XLP308, 1500MHz, 8GB RAM
- 800 Gbps, 720Mpps
- FDB 750K MAC, FIB 4M
- до 12K MPLS PW /slot
- до 8K бридж-доменов
- до 8K сабинтерфейсов
- До 4k VRFs



Маршрутизаторы входят в состав серии ME5000 и имеют единообразное программное обеспечение и интерфейсы управления. ME5100 поддерживают весь набор функций, имеющийся на маршрутизаторах серии – IPv4/IPv6-маршрутизацию, иерархический QoS, маршрутизацию IP Multicast, а также MPLS-сервисы второго и третьего уровней.

Достижения 2018

ЭКБ



Поддержка разработок
на российской
электронно-компонентной
базе

Квантовые коммуникации



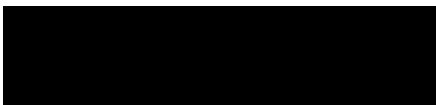
Опытная зона М10-Сколково




Магистральные сети

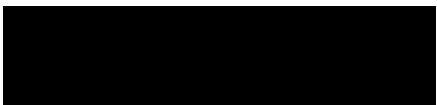


Многоузловые сети



Service Model

Internet, IP-transit	L1 and "dark fiber"	VPN (L2, L3)	Voice & VAS (vPBX, IN, ...)
IPTV (incl. OTT)	MVNO (host operator Tele2)	Cloud (xaaS)	Smart Home
IIoT	Security (Anti-Ddos)	Security Operation Center + 6 Security Services	 Quantum Key Distribution as a Service



Industry trends

Telecommunications, basic communication services



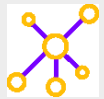
Satellite

- Reduction of the cost of manufacturing and launching of satellites
- Increasing network throughput



Artificial Intelligence

- Using flexible program network management using AI technologies



Optical Network

- Increasing network throughput
- Increasing the proportion of heavy content



5G

- Closer spacing of basic stations
- Growth of the of communications share through OTT services



Internet of Things

- Growth in the number of IoT device connections
- Growth of the volume of generated and transmitted data



LPWAN

- Growth in the number of IoT device connections
- GrMainstream use of cheap sensors to monitor the state of objects and the environment
- owth of the volume of generated and transmitted data

Industry trends

Cyber Security



Artificial Intelligence

- Automation of part of analysts' work and reduction of the number of false alarm signals of cybersecurity systems



Cloud

- Using cloud-based managed security services (MSS), migration to MSSP service model and outsourcing



Internet of Things

- Growth of the number of incidents on critical infrastructure and the cost of eliminating their consequences



Cryptography

- Strengthening the importance of cryptographic information protection



Blockchain

- Increasing the complexity of data compromise and enhancing cyber stability of information systems



Mobile Platforms

- Permutation of a vector of attacks on user devices, strengthening control and protection of organization perimeter

Risks and problems of information security

1

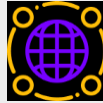
Growth of the volume and speed of information transmission



- Toughening requirements to information security
- Increased key load

2

Distributed computer systems



- Crypto currency mining infrastructure
- Theft of user computing resources by malware

3

Quantum computer



- Compromise of **all** common asymmetric cryptographic algorithms and protocols on their basis (DH, RSA, ECDSA TLS / SSL, HTTPS)
- Reduction of the strength of symmetric crypto algorithms

4

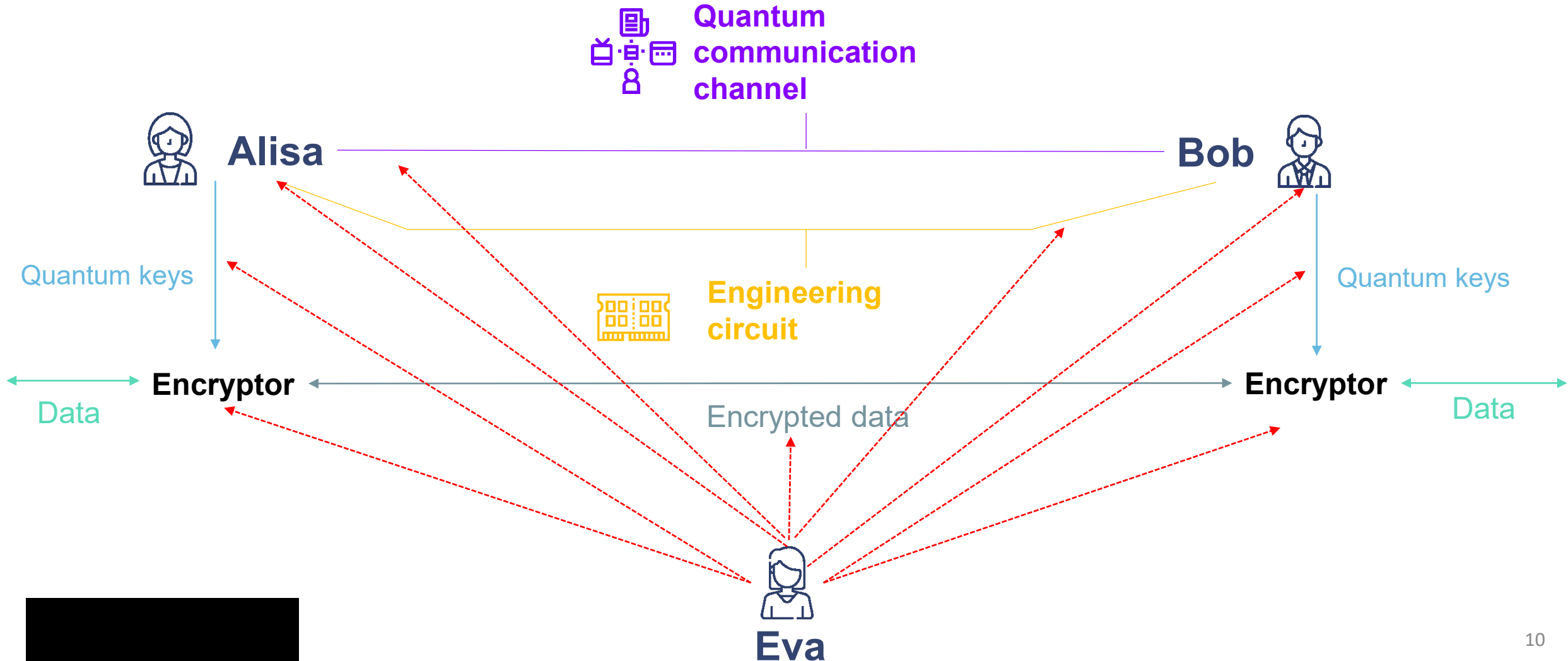
Human factor



- Security of keys is based on organizational measures, as there are no technical solutions to reduce the risk of the “human factor”

Quantum key distribution system

QKD to protect information



Global Experience of QKD use

China

National Quantum Network

Largest quantum infrastructure in the world

- Total length – 2,000 km.
- Year of introduction – 2016-2017
- 32 secure nodes
- Connected networks – in 4 major cities
- Consumers – government agencies, financial and energy sector

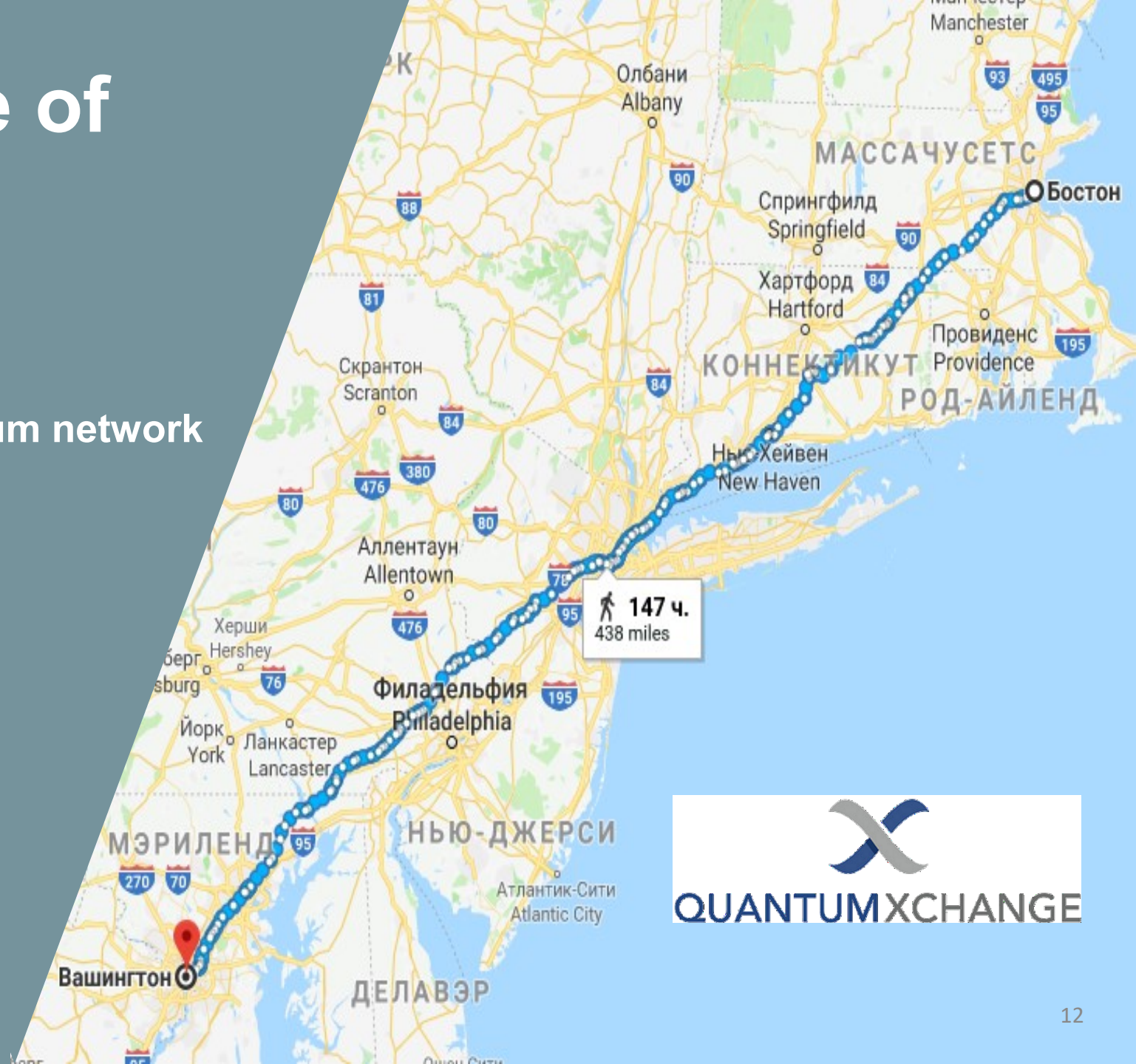


Global Experience of QKD use

USA. Quantumxchange

The world's first commercial quantum network

- Services by the quantum cryptography pattern as a service
- **Total length** ~700 km.
- **Year of creation** – 2018
- **Connected networks** in financial centers on the North-Eastern coast of the United States
- **Consumers** – financial sector



Rostelecom Quantum Communications Project

Strategic goal of the project:

Creation of a system for management of quantum networks and provision of communication services on their basis.

Project Objectives:



study of fundamentally new system solutions in terms of appearance, composition, functional purpose, structure of information security systems of a new generation using quantum communications;



testing and demonstrating the capabilities of modern quantum networks to a wide range of consumers;



development of a set of functional and technical requirements for quantum cryptography systems for operation on Rostelecom networks and for provision of services to customers;



development of functional and technical requirements for a platform to manage distributed multi-user quantum communication networks of the operator level;



technical and economic feasibility study of creation of a quantum network management system

Key Results and Conclusions

1

The technology becomes more mature, exiting the lab stage, and better streamlined and improved to be acceptable for telecom operators;

2

Growing demand for automation of encryption key delivery, more stringent data transmission channel requirements, arrival of innovative techniques to ensure security of information transmission will continue to push forward further development of this technology development;













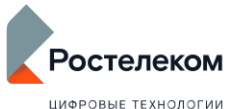
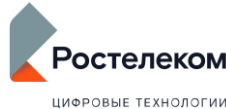











3

Responses to the arising challenges should be sought by joining efforts within the framework of the National Technology Initiative and action lines of the National Program Digital Economy;

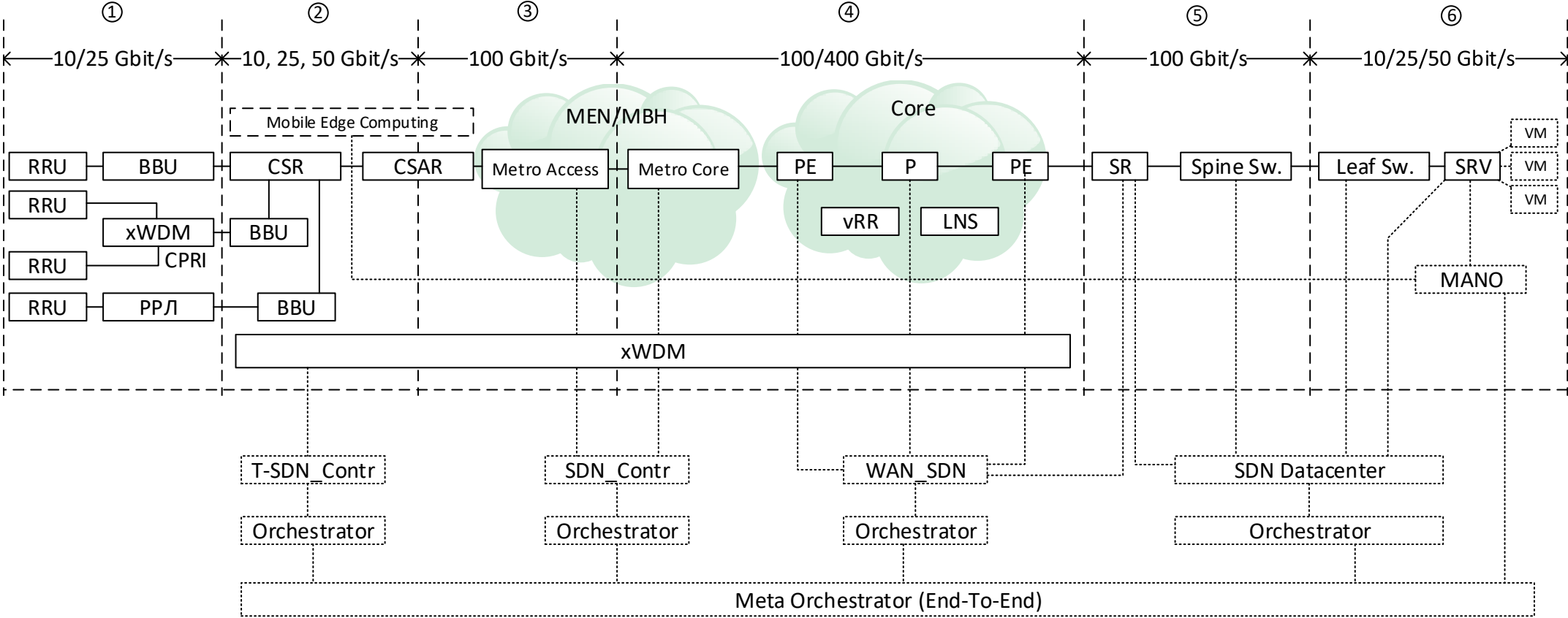
4

Holistic approach and implementation of the roadmap for the required scientific and technology lines of development will give new impact to the technology development

Карта разработок ГК «Ростелеком»

	Оборудование	Программное обеспечение
Оборудование IP	 	   
SDN/NFV	 	   
Облака		  
СХД	 	
Мобильная платформа		
«Большие данные»		
«Интернет вещей»		 

Перспективы развития



CSR – Cell Site Router
 CSAR – Cell Site Aggregation Router

SR- Service Router
 Spine and Leaf – switches in Clos topology
 SRV – Servers

———— Physical Connection
 Logical Connection



Technological Partnership Department

Ростелеком

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