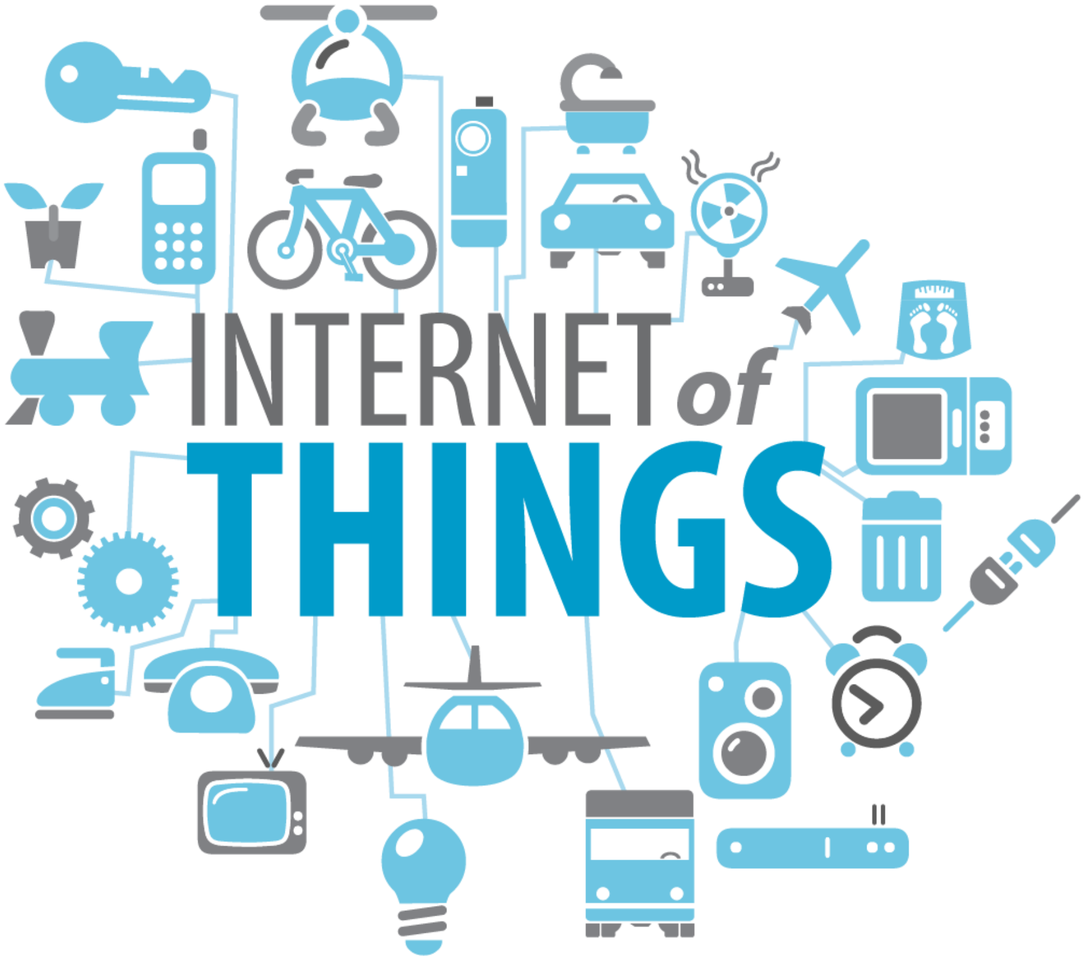
TTK

INTERNET OF THINGS IN RUSSIA

VISION OF TRANSTELEKOM

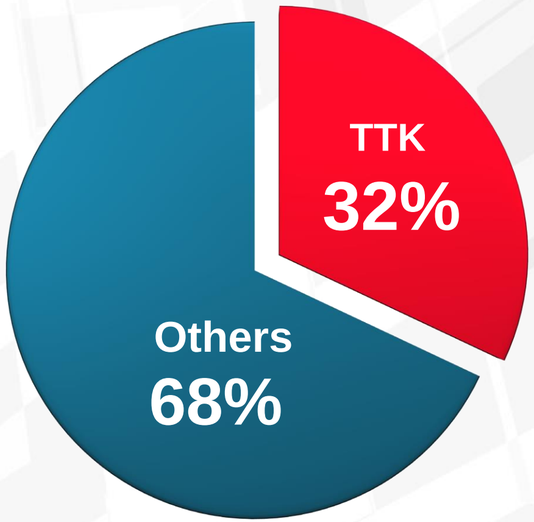


SERGEY RAZMAKHNIN

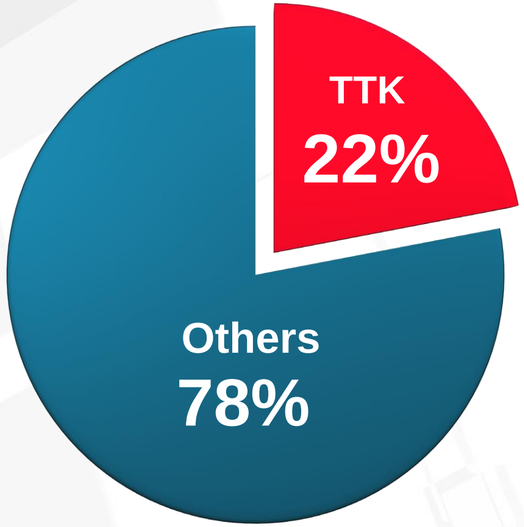
CHIEF ARCHITECT OF IoT AND TELECOMMUNICATION SOLUTIONS

TRANSTELEKOM MARKET POSITION IN RUSSIA

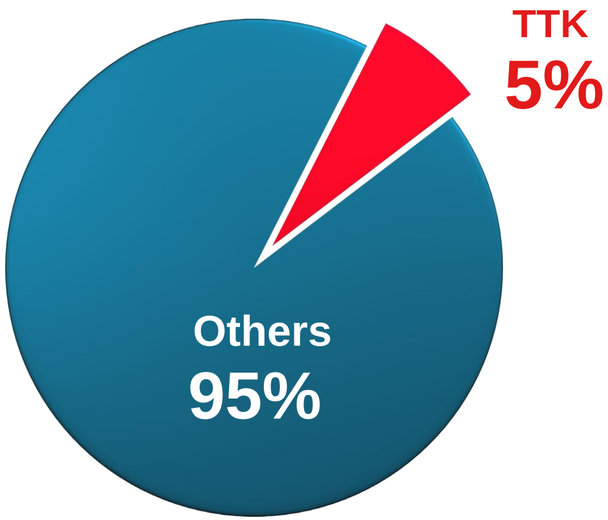
Wholesale Data



B2B/B2C

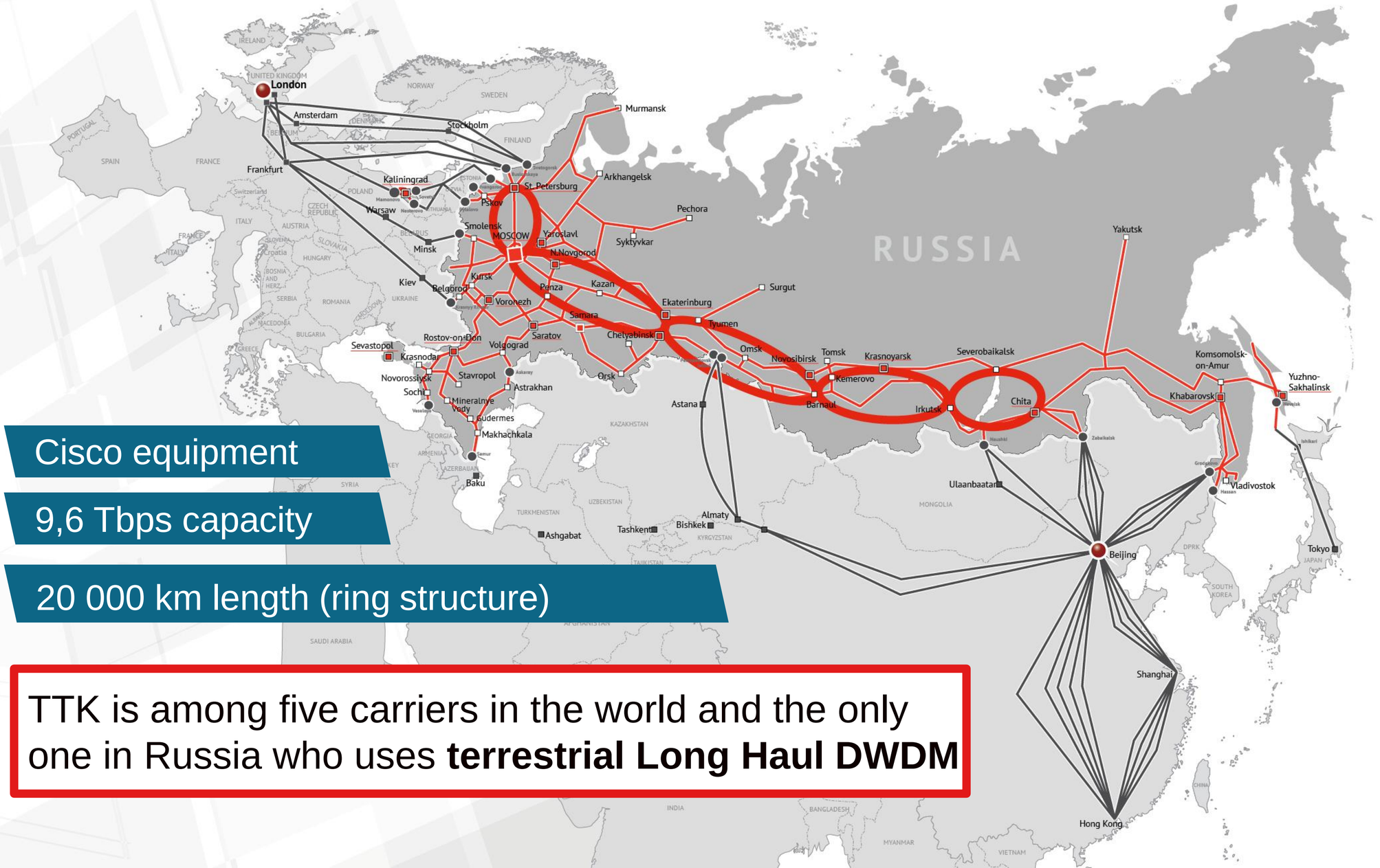


Broadband



Transtelekom(TTK) is one of the top five carriers in Russia

FOUNDED IN 2014, LH DWDM BASED ON 5 CIRCUITS



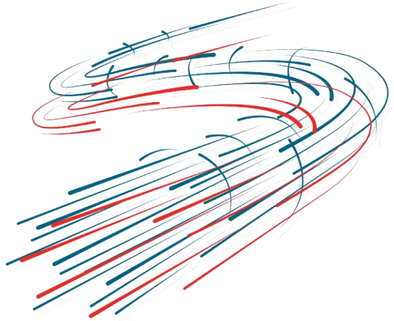
Cisco equipment

9,6 Tbps capacity

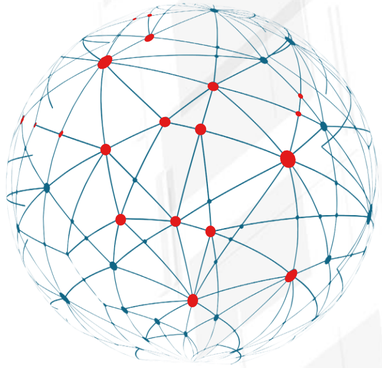
20 000 km length (ring structure)

TTK is among five carriers in the world and the only one in Russia who uses **terrestrial Long Haul DWDM**

TTK



- TTK owns one of the largest fiber optic cable networks in Russia – **75.000 km**

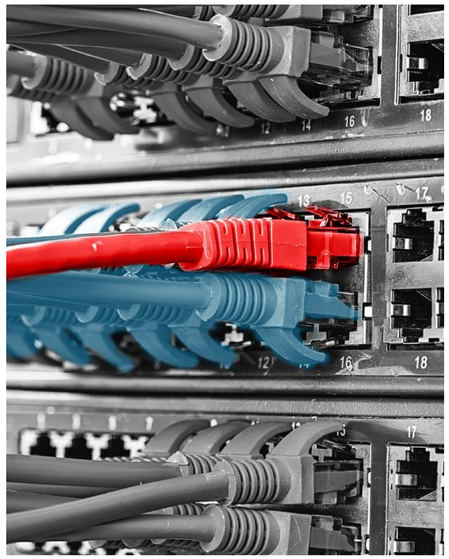


- TTK has its own nodes in **London, Frankfurt, Stockholm, Hong Kong, Tokyo**

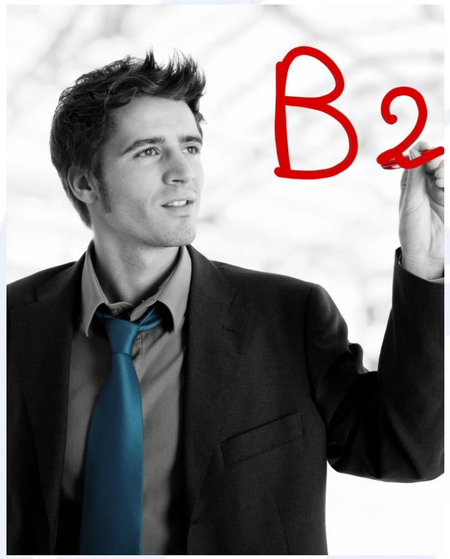
- TTK is currently the **Telecom Bridge between Asia & Europe**: 20% of the capacity between China & Europe has been moved from submarine cables to TTK's network over the last 12 years (40% of this capacity currently goes through Russia)

- SLA - **99,8%**

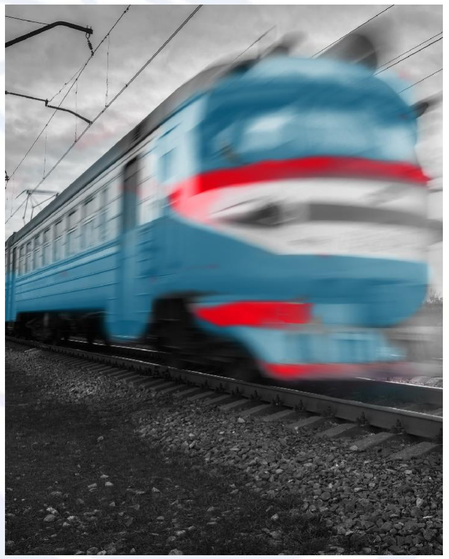
TTK STRATEGY 2021 KEY POINTS



- To improve the backbone network stability and to reduce latency and costs using **100G Ultra Long Haul DWDM technology**



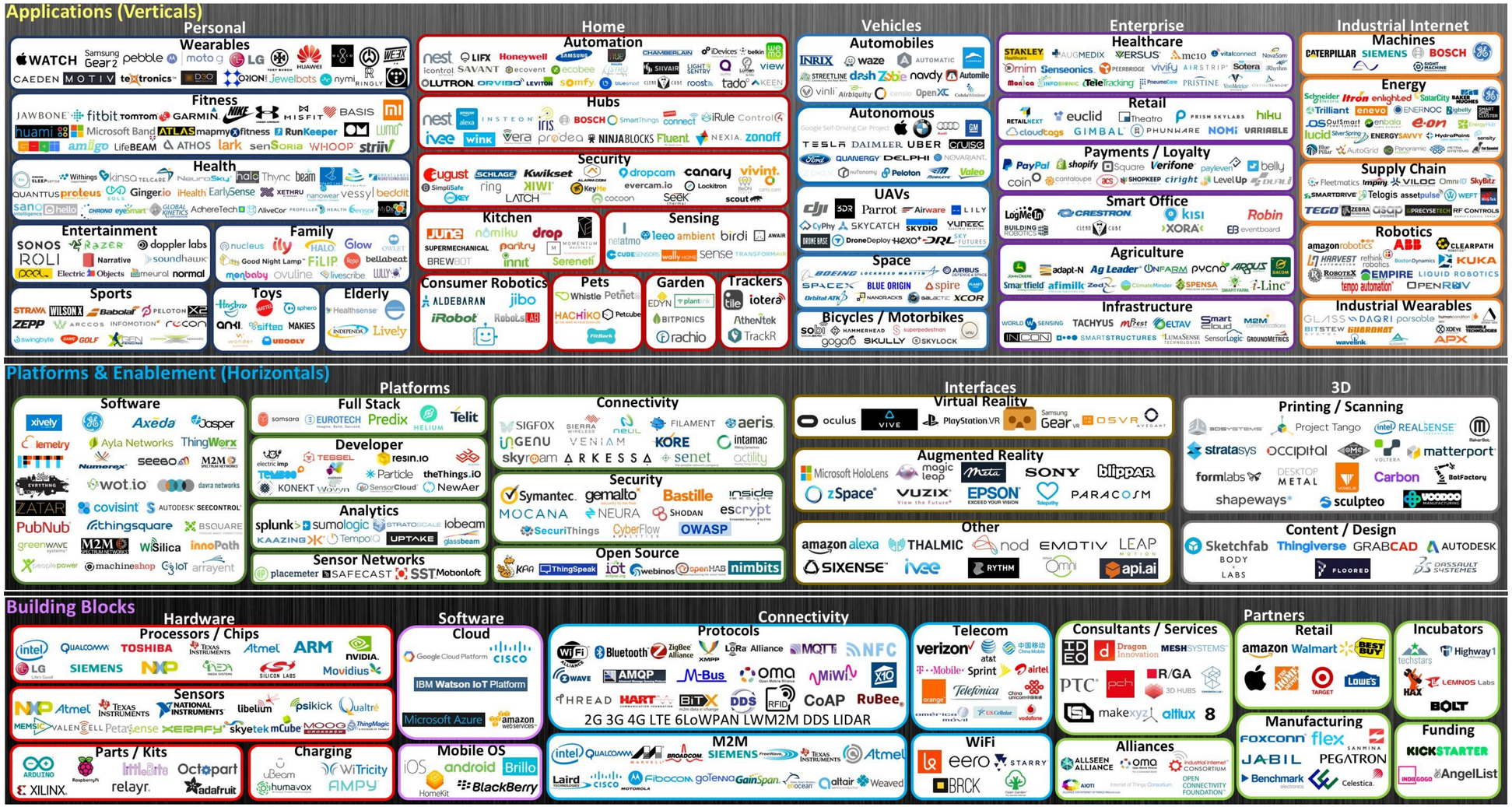
- To enhance products for B2B and B2C by creating **partners programs**



- To deliver **digital services** to railroad passengers and corporate customers

- To enter **the Internet of Things** growing market, including the number of railroad sensors

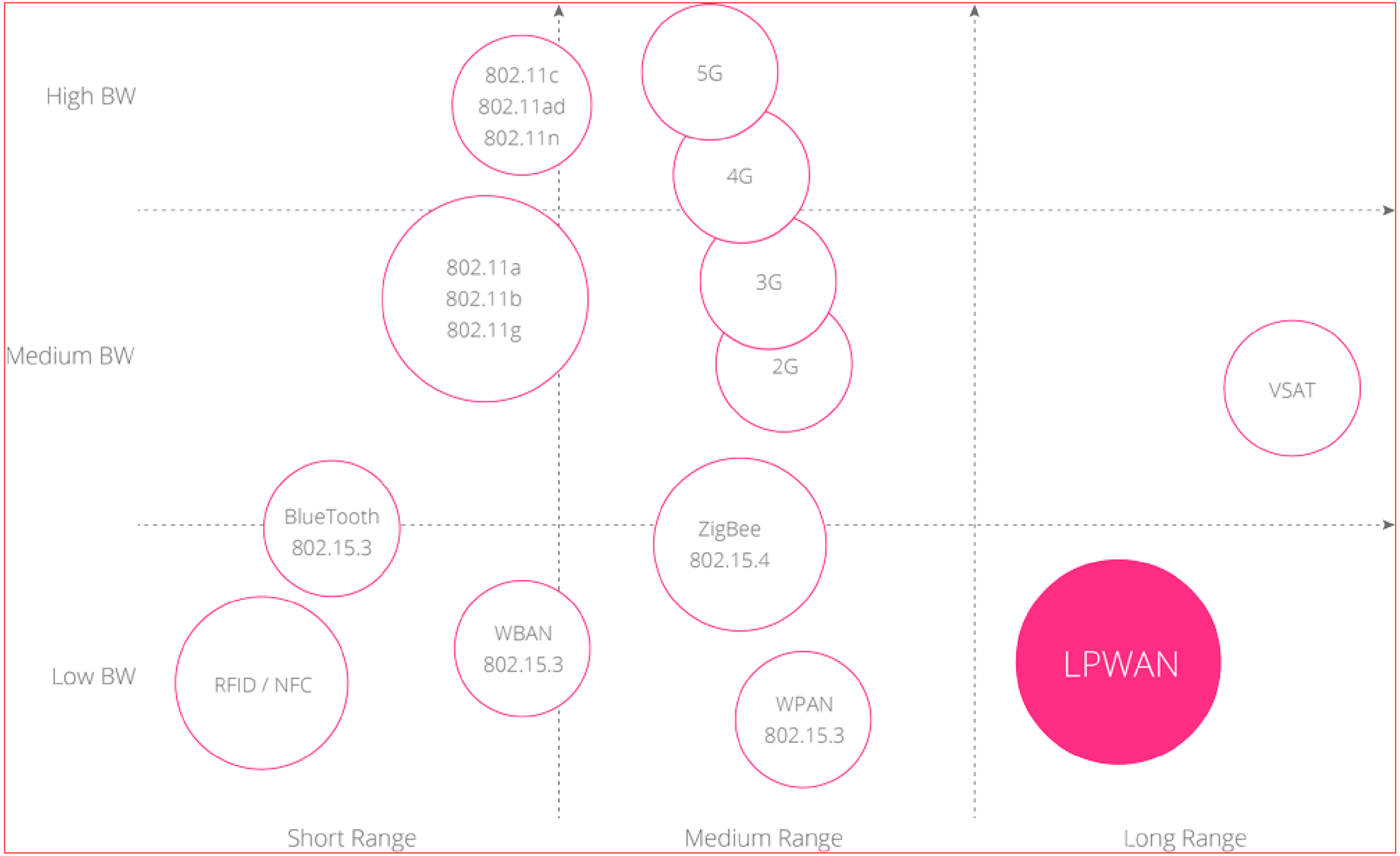
IOT LANDSCAPE



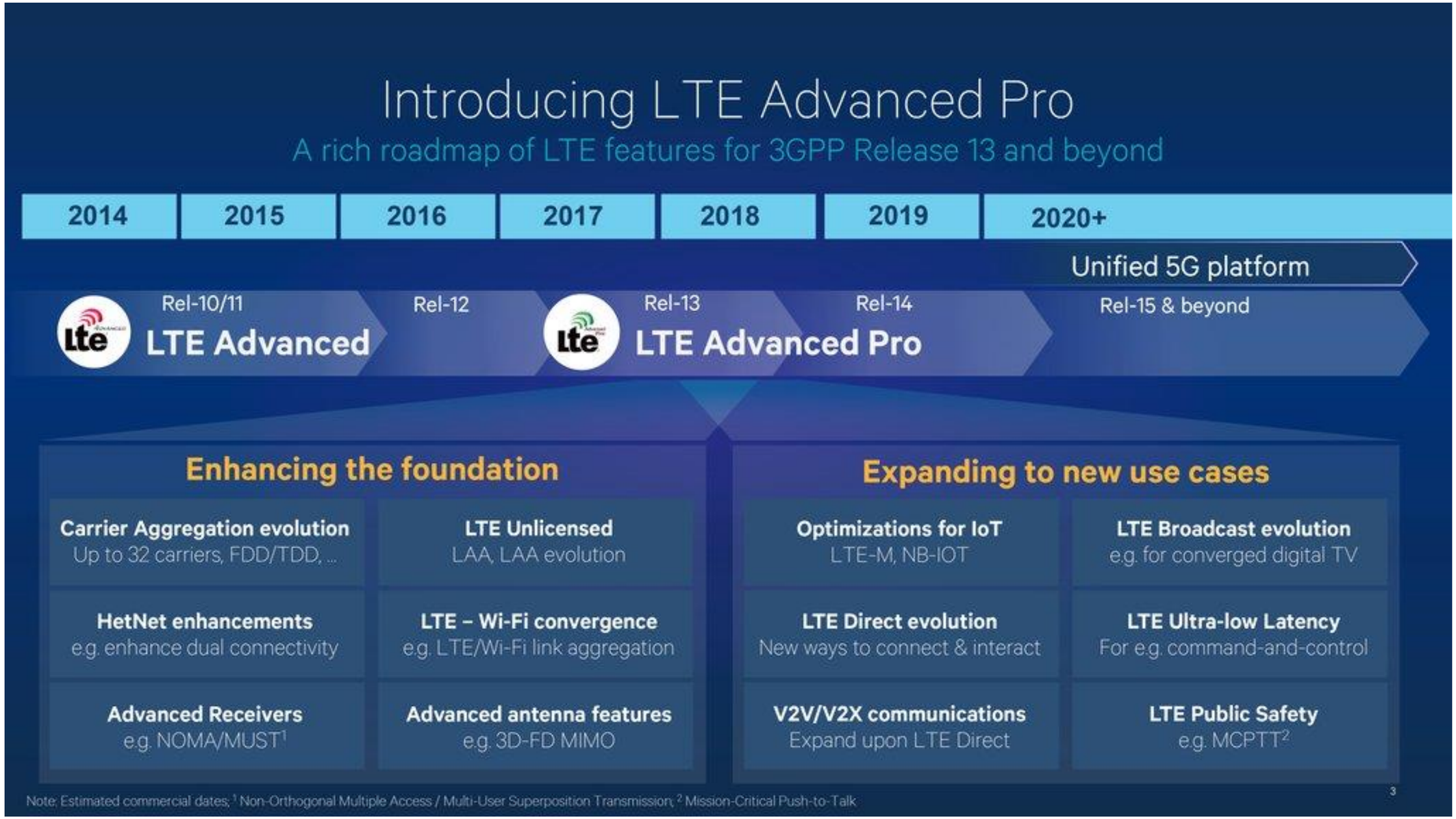
IOT ARCHITECTURE

5 level model of IoT	Level description
5. **End-to-end services** (client-side applications)	Business scenarios of using IoT for freight and passenger transportation, railway and transportation infrastructure management, traffic safety, staff activity automation, increasing passenger loyalty, improving the quality of service
4. **Platform** (application for data processing and visualization) Platform Management | Application Integration | Security | Device Management | Data analysis | Connectivity | Data Management	Aspects of Security, Identification, Verification, Management, Trusted Environment
3. **Aggregation layer** (receiving and storing data from peripheral devices)	Standards and protocols of data aggregation
2. **Transport Network** (data transfer from peripheral devices)	Capabilities of existing and plaining wire and wireless networks
1. **Periphery devices** – sensors, metering devices… (hardware)	All available commercial contact and contactless sensors

CURRENT WIRELESS TECHNOLOGIES FOR TRANSPORT NETWORK



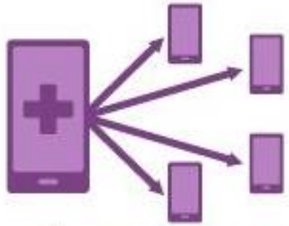
EVOLUTION OF 3GPP STANDARDS



EVOLUTION OF 3GPP STANDARDS

Release 12
D2D platform for consumer and public safety use cases

Discovery of 1000s of devices/services in ~500m



Reliable one-to-many communications (in- and out-of-coverage)*

Release 13
Expanded D2D discovery and D2D communications

More flexible discovery such as restricted/private[1] and inter-frequency

Device-to-network relays[2]

Release 14 and beyond
Multi-hop communication and more use cases

Additional D2D communication capabilities

Proposed for vehicle-to-vehicle (V2V) and beyond

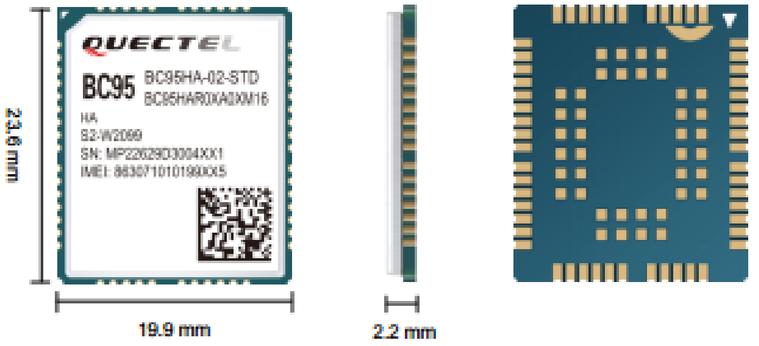
COMPARATION OF USING 3GPP PROTOCOL

	LTE-Evolution	Narrowband Solutions		Next Generation
	LTE-M Rel-13	**NB-LTE Rel-13**	**EC-GSM Rel-13**	**5G**
Range (Outdoor)	< 11 km	< 15 km	< 15 km	< 15 km
MCL	156 dB	164 dB	164 dB	164 dB
Spectrum	Licensed (7-900 MHz)	Licensed (7-900 MHz)	Licensed (8-900 MHz)	Licensed (7-900 MHz)
Bandwidth	1.4 MHz or shared	200 kHz or shared	2.4 MHz or shared	shared
Data Rate	<1 Mbps	<150 kbps	10 kbps	<1 Mbps
Battery Life	>10 years	>10 years	>10 years	>10 years
Availability	2016	2016	2016	2025

EXAMPLES OF NB-IOT MODULES

Quectel BC95

Compact NB-IoT Module with Ultra-low Power Consumption



General Features

Frequency Band	BC95-B8: 900MHz BC95-B5: 850MHz BC95-B20: 800MHz
Package	LCC
Pin Number	94
Supply Voltage Range	3.1V~4.2V Typical: 3.6V
Operation Temperature	-40°C ~ +85°C
Dimension	19.9 × 23.6 × 2.2mm
Weight	1.6g
AT Command	3GPP Rel-13 and enhanced AT commands
Download	UART, Over the Air*

Electrical Characteristics

Output Power	23dBm
Sensitivity	-129dBm
Power Consumption	Sleep: 5uA Idle: 6mA

Interfaces

USIM	× 1
UART	× 2
ADC*	× 1
RESET	× 1
Antenna	× 1

MAIN BUSINESS CASES OF USING IOT NETWORKS

Scaling up in performance and mobility

Scaling down in complexity and power

LTE Advanced	LTE Cat-0	LTE-M	NB-IoT
>10 Mbps	Up to 1 Mbps	10s of kbps up to 1 Mbps	Up to 10s of kbps
n x 20 MHz	20 MHz	~1 MHz narrowband	~200 kHz narrowband
Today+	Release 12	Release 13 & beyond	Release 13 & beyond

Sample use cases


Mobile


Video security


Wearables


Object Tracking


Utility metering


Environment monitoring


Connected car

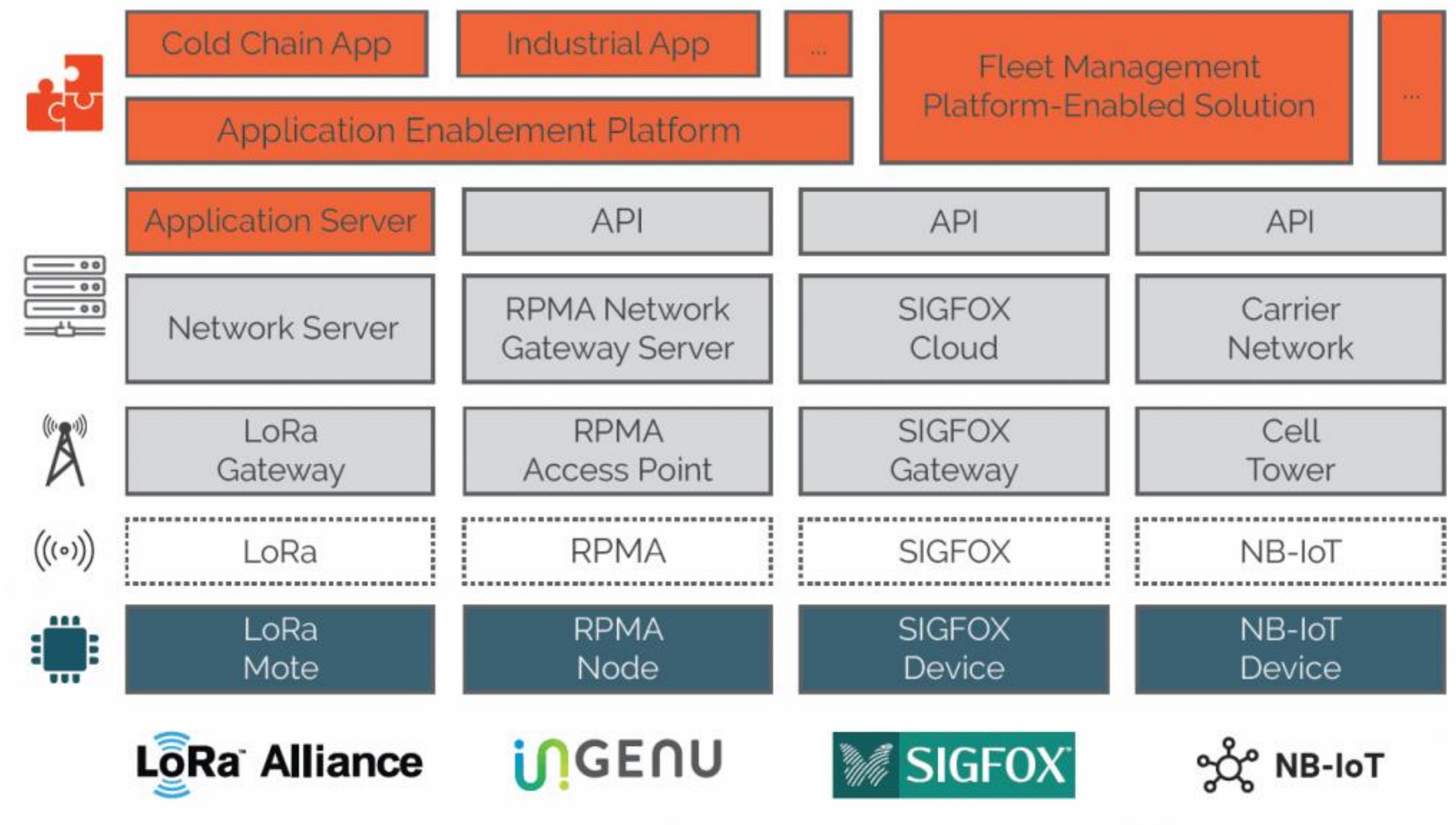

Energy Management


Connected healthcare


City infrastructure


Smart buildings

ANOTHER APPROACH OF LPWA



COMPARASION LORA PROTOCOL AND 3GPP PROTOCOLS

	LoRa / LoRaWAN	Sigfox	NB-IoT	LTE-M	RPMA	Weightless-P	Symphony Link
Origin	France	France	USA (Global)	USA (Global)	USA	UK	USA
Proprietary or open	LoRa – proprietary LoRaWAN - open	Net – proprietary Devices – open	Open	Open	Proprietary	Open	Proprietary
Cellular	No	No	Yes	Yes	No	No	No
Spectrum	Unlicensed	Unlicensed	Licensed	Licensed	Unlicensed	Unlicensed	Unlicensed
Range, km	urban: 2-5 rural: 15	urban: 3-10 rural: 30-50	urban: 1-5 rural: 10-15	urban: 2-5	urban: 1-3 rural: 25-50	urban: 2	urban: 2-5 rural: 15
Speed, uplink / downlink	50 kbps / 50 kbps	300 bps / –	250 kbps / 250 kbps	1 Mbps / 1 Mbps	634 kbps / 156 kbps	100 kbps / 100 kbps	100 kbps / 100 kbps
Power consumption	●●●	●	●	●●●	●●	●	●●
Security	●●	●●	●●●	●●●	●●●	●●●	●●●
Availability of devices	●●	●●●	●●	●	●●	●	●●
Price*	●●	●	●●	●●●	●●●	●	●●
Areas of application	Precision farming, manufacturing automation, pipeline monitoring	Predictive maintenance, capacity planning, demand forecasting	Electric metering, manufacturing automation, retail PoS	tracking objects, wearables, energy management, utility metering, city infrastructure	Digital oilfield, connected cities, usage-based insurance, agriculture	Smart grid, healthcare, automotive, smart cities, asset tracking	Industrial control systems, lighting control, alarm systems
Supporting companies	IBM, Semtech, Cisco, HP, Orange, Kerlink, Actility	STMicroelectronic, Texas Instruments, Atmel, Silicon Labs	Huawei, Ericsson, Qualcomm, Vodafone	Verizon, AT&T, Nokia	Ingenu	Accenture, Sony Europe, uniik, ARM, Telensa	Link Labs

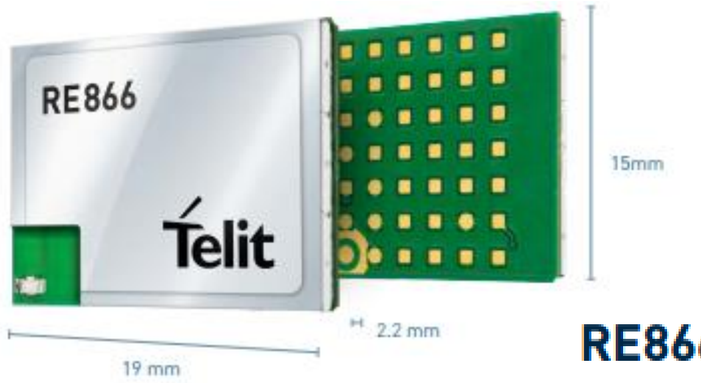
EXAMPLES OF LORA MODULES

RE866 Series

Ultra Low Power BLE and LoRa® Combo module

LoRa® Embedded

Bluetooth Low Energy



Key Benefits

- LoRa Alliance certified module: LoRaWan1.02 class A/ C and B.
- Bluetooth v5 qualified module
  - BLE 5 GATT Central/Peripheral, TIO (SPP like) with free source codes
  - Fully compatible with Bluemod+S42 /S50 modules
  - 101dB budget link
- Integrated antenna for BLE, External antenna for SUB-GHZ
- Pin to Pin compatible with NE866 (Telit NB1module)
- AES-128 security and Embedded Secured Element for future uses
- Ultra-low power usage schemes – Allows years of use on a single battery.
- Upgradable firmware – Prepare for the future with access to feature and security updates.
- NFC handover simplifies device pairing and connection setup.
- UART eDMA/PPI (faster UART speed / lower power consumption)
- CE, RED, FCC/IC
- Temperature (operating) -40°C to +85°C

RE866 Series

Product Features

- Bluetooth® Low Energy Specification V5
  - Terminal I/O peripheral and GATT peripheral role
  - Generic GATT client and Server handling for 4 concurrent links (3 in central role and 1 in peripheral role)
- LoRa Modulation : Chirp Spread Spectrum, FSK, GFSK
- Data Rate: 250 bps – 50 kbps
- LoRaWan 1.02
- Over the air update

Environmental

- LGA pads
- Integrated BLE ceramic Antenna
- Length x Width x Height: 19x15x2.2 mm
- Temperature range: -40°C to +85°C

Interfaces

- UART: 9600 bps – 921600 bps (asynchronous)
- Other interfaces: I²C, SPI, PWM, ADC
- GPIOs: Up to 15

Electrical & Sensitivity

- Bluetooth® Low Energy
  - Transmit Power: -20 to +4dBm
  - Receiver Sensitivity: -96 dBm
  - Max power consumption in transmission: 7.5 mA
- LoRa®
  - Max Tx Power: 14 dBm or up to 19dBm in PA boost mode
  - Receiver Sensitivity: Up to -138 dBm (SF 12, 125KHz bandwidth)
- Power supply: 1.8V to 3.6V
- Power consumption:
  - Transmission mode: <40 mA@25mW
  - Receive mode:10 mA
  - Standby: <2µA
  - Sleep: <1µA

Approvals

- Bluetooth Qualification 5
- LoraWan certified
- RED, FCC, IC

IoT in "Digital Economy of the Russian Federation“

PLAN OF ACTIVITIES in the direction of "Information Infrastructure“ program "Digital Economy of the Russian Federation“

04.01.009.	Creation of narrowband wireless communication networks "Internet of things" in the territory of the Russian Federation		Date
04.01.009.001.	**Development of the Concept of construction and development of narrowband wireless communication networks "Internet of things" in the territory of the Russian Federation and a plan for its implementation**	Разработка Концепции построения и развития узкополосных беспроводных сетей связи "Интернета вещей" на территории Российской Федерации и плана ее реализации	**05.2018**
04.01.009.002.	**Defined a list and an assessment of the capabilities of the domestic industry for the production of equipment for the creation of narrowband wireless communication networks "Internet of things"**	Определен перечень и проведена оценка возможностей отечественной промышленности по производству оборудования для развития узкополосных беспроводных сетей связи "Интернета вещей"	**01.2019**
04.01.009.003.	**Pilot projects implementations of narrowband wireless communication networks of the Internet of Things in the Russian Federation in 5 key sectors of the economy**	Реализованы пилотные проекты построения и внедрения узкополосных беспроводных сетей связи "Интернета вещей" в Российской Федерации в 5 ключевых отраслях экономики	**03.2020**
04.01.009.004.	**Development of a set of measures to improve the technical regulation of narrowband wireless communication networks "Internet of things" in the territory of the Russian Federation**	Разработка комплекса мер по совершенствованию технического регулирования узкополосных беспроводных сетей связи "Интернета вещей" на территории Российской Федерации	**12.2020**
04.01.009.005.	**Development of the draft Concept for the development of narrowband communication networks based on LPWAN technology for the collection of telemetric information on the transport infrastructure**	Разработка проекта Концепции развития сетей узкополосной связи по технологии LPWAN сбора телеметрической информации на транспортной инфраструктуре	**12.2018**
04.01.009.006.	**Conditions have been created for the development of a narrowband communication network based on LPWAN technology, defined radio frequencies for deploying the network, regulatory legal acts**	Созданы условия для развития сети узкополосной связи, построенной по технологии LPWAN, в том числе определены радиочастоты для разворачивания сети, приняты нормативные правовые акты	**12.2018**
04.01.009.007.	**A schedule was developed for covering the priority objects of transport infrastructure with narrowband communication networks for the collection of telemetric information using LPWAN technology. The executors and sources of funding have been determined**	Разработан план-график покрытия приоритетных объектов транспортной инфраструктуры сетями узкополосной связи сбора телеметрической информации, построенной по технологии LPWAN. Определены исполнители и источники финансирования	**10.2018**
04.01.009.008.	**Communication networks based on domestic LPWAN technology are deployed on priority objects of transport infrastructure with the possibility of using domestic equipment specified in the milestone 04.01.009.002**	Сети связи на базе отечественной технологии LPWAN развернуты на приоритетных объектах транспортной инфраструктуры с возможностью использования отечественного оборудования, определенного в вехе 04.01.009.002	**12.2020**

BASIC SCENARIOS OF CREATION IOT NETWORKS IN RUSSIA

№1: Nb-IoT

- further decrease in the cost of the Nb-IoT modems and the cost of updating the LTE core network
- evolutionary update of base stations, creation of coverage areas by Nb-IoT network by the biggest operators

№2: LPWAN - Lora

- evolutionary construction of LoRa networks in the framework of projects with corporate customers
- access to the market of new regional operators

№3: Creation of the federal operator of the Internet of things

- creation of a regulatory framework to ensure the construction of a LPWAN network throughout Russia
- new player's entrance to the market

EXAMPLES OF USING IOT IN TRANSPORT AND RAILWAY INDUSTRY

Rolling stock:

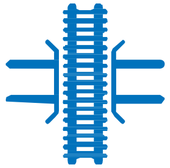
- maintenance of rolling stock according to actual technical condition
- “digitization” of old locomotives

Wagons:

- remote online monitoring conditions of passenger wagons

Freight transportation :

- controlling conditions of freight wagons and transported goods
- control conditions and route of containers



Railway infrastructure:

- remote control of the status of switches, electric drives
- track condition monitoring
- smart illumination of tracks, stations, tunnels
- monitoring of icing for stations, rails, force of storm wind, snow cover level
- energy efficiency, metering devices

Passenger Transportation :

- “digitization" of the passengers movement
- analysis of transports flows

TTK

THANK YOU!