T8 Company

DWDM Systems
Fiber-optic Sensors

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PhD, General Director of T8

Tokyo
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T8 focus: DWDM and fiber sensors

T8 was founded in 2004. The company has 100% of Russian capital.
T8 staff is 185 engineers and technicians, including 2 professors of MIPT and MSU and 17 PhDs.
By Q3 2016 we have deployed 65 000 km of DWDM networks – 7% of the Russian market and 22% of Rostelecom regional DWDM networks.

techup

T8 is in Top-10 of Russian Innovative companies

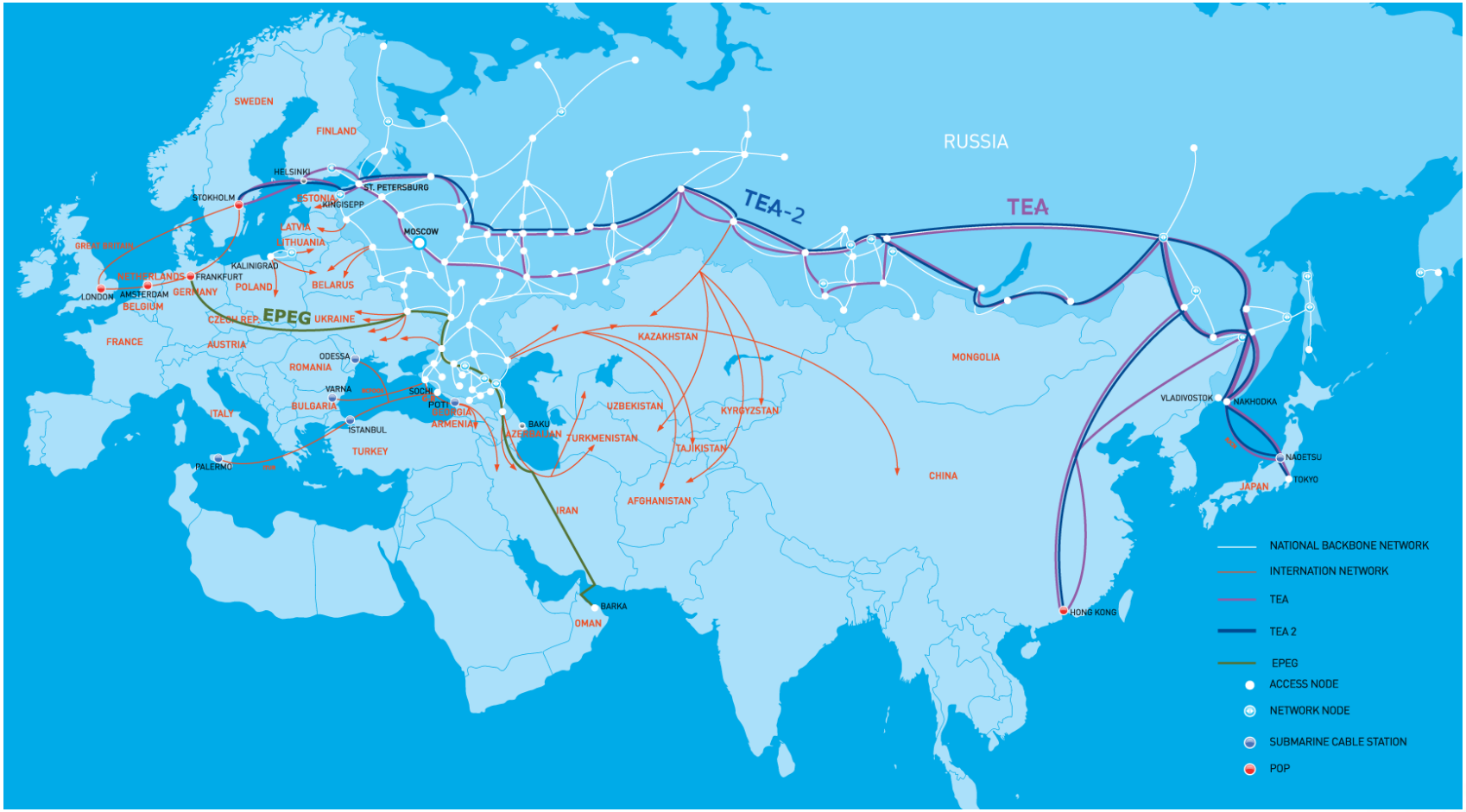
Sk Skolkovo

T8 R&D Center is a resident of Skolkovo Innovation Center.
25T DWDM project was supported by Skolkovo and won 1st place.

We already work with Japanese companies for 12 years

2016's Success: Transit Europe-Asia Project

T8 has received 30% part of $100M project.
Largest Continental DWDM Transport Project for years!



T8 activity

R&D and Manufacturing:

- DWDM systems, fiber sensors for Monitoring and Security
- Complete set of DWDM linecards up to **400G** (>70 different cards)
- Data encryption ready, R&D in quantum cryptography
- Sensors: coherent OTDR system for DAS application

Network Design, Support, Science

- Government and Private customers
- 300 DWDM designs/year, 30 finished projects/y
- 7% of Russian market
- Science research together with leading universities

We are looking for partners in Japan

Business Both Ways: 2 Import + 2 Export Projects

Import of optical chips and equipment:

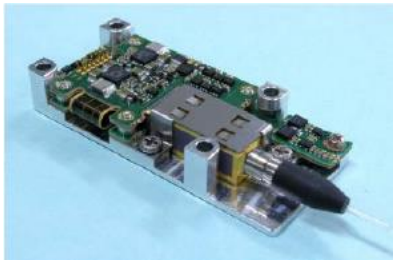
- **Semi-finished optical components for high-speed telecom: Lasers (ITLA), Receiver (ICR), Modulators.**
- **Equipment for the packaging and pigtailing of 100G+ optical fiber components: ITLA, ICR, Modulator**

Export Projects – T8 equipment

- **4Tbit/s DWDM compact transmission equipment for Data-Centers**
- **DUNAY optical sensors system (Security, Monitoring, Earthquakes prediction)**

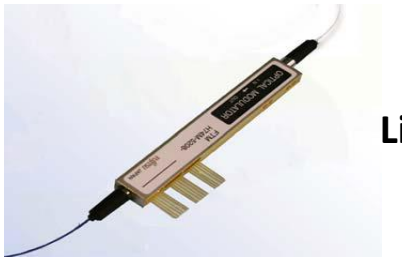
Import of optical chips and equipment

Now we buy the components mostly from USA.
Our goal is buying the optical chips and arrange the final assembling in Russia – pigtailing and packaging, while the components can be used for the government telecommunications program.



ITLA

ICR



Li/Nb modulator

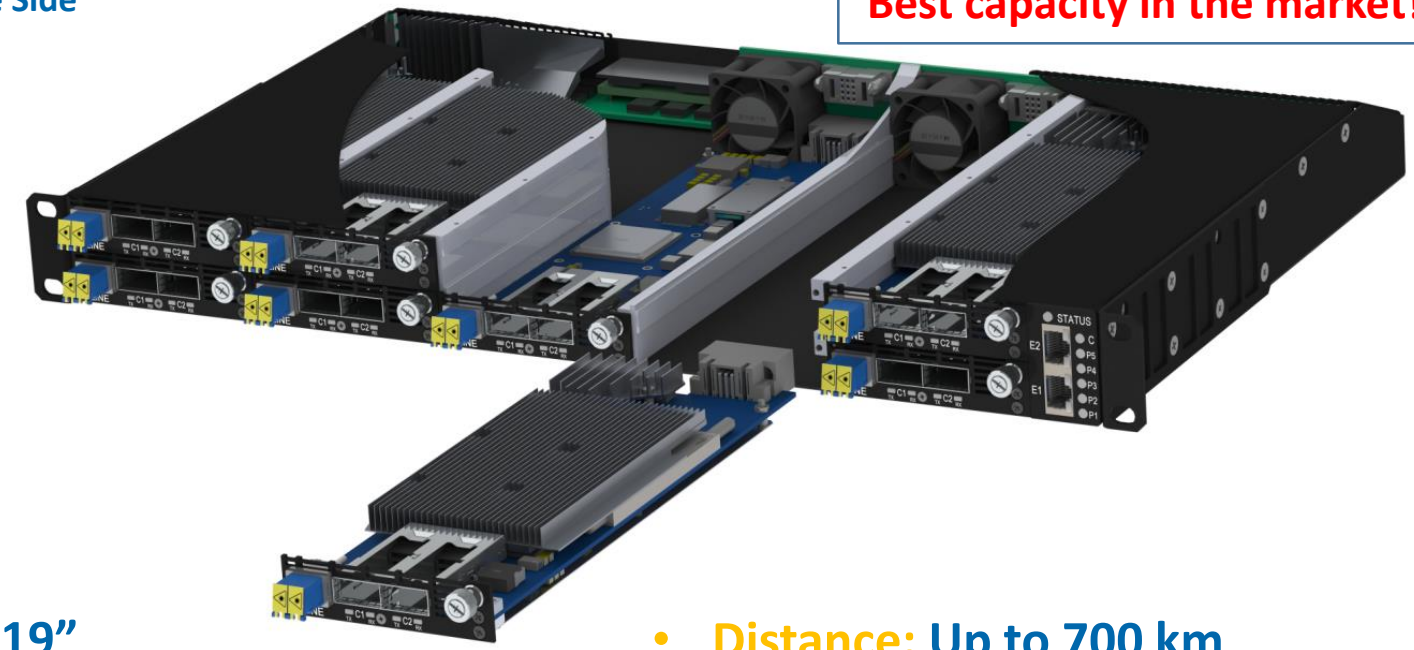
Driver

- **Optical chips: semi-finished 100G+ optical fiber components Lasers (ITLA), Receivers (ICR), Modulators**
- **Equipment for packaging and pigtailing of ITLA, ICR, Modulator, Driver**

4Tbit/s compact DWDM platform*

* 2T Client Side + 2T Line Side

Best capacity in the market!



FEATURES

- **Compact:** 1U, 19”
- **Large Capacity:** 2T line + 2T clients
- **Flexible:** 10 x 200G modules
- **Distance:** Up to 700 km
- **Cost:** Cheapest traffic per 100G
- **For:** Data-centers and telecom

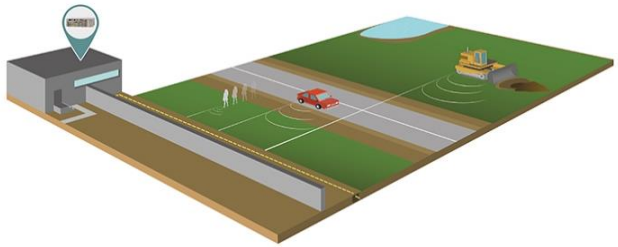
- Best ca4T capacity and T8 wants to provide the 4T Solution on WW market
- T8 is ready to sell the platform as OEM with Japanese partner
- Ready for ‘Big 4’ DCI customers (Amazon, Google, Facebook, Apple) with supporting by Japanese partner

Monitoring & Security System DUNAY

DUNAY is a distributed fiber-optic acoustic sensor (DAS) for security and monitoring

- One unit can control 50/75 km – low cost per 1 sensor
- Sampling 1m, physical resolution 20m
- Standard optical fiber as sensitive element, telecom cable, deployed in ground can be used as sensor
- Only one fiber is needed
- Independence on whether: snow, rain, fog, etc.
- Integration with security systems: video, alarms, etc.
- Easy in deployment and maintenance
- Reliability and control based on telecom standards
- Remote operation and integration with DWDM system

Possible sources of acoustic action	Max distance to OC
Moving person	10 m
Moving car	15 m
Moving truck	25 m
Moving heavy crawler machinery	150 m
Any kinds of surface and underground construction and earth works	150 m

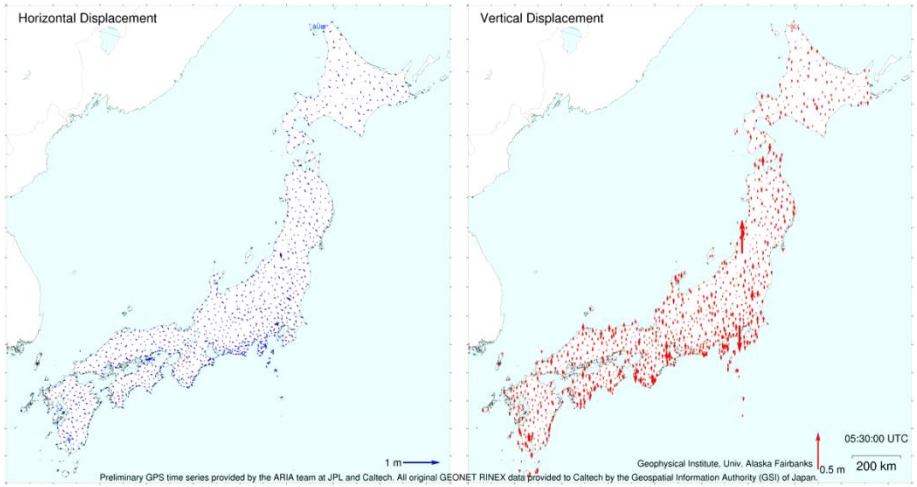


Seismic Monitoring based on Fiber Optic Acoustic Sensors

FIBER SENSORS NETWORK PROVIDES 1000 TIMES MORE DATA THAN CLASSICAL APPROACH

TODAY – 1000 Sensors

TOMORROW – 1M sensors – New quality



Japan (Tohoku-oki Earthquake, 11-Mar-2011)

- 1200 GPS stations – maximum in the world
- New approaches to visualization and analysis of the seismicity are necessary

Japan FOC Networks: >200,000 km

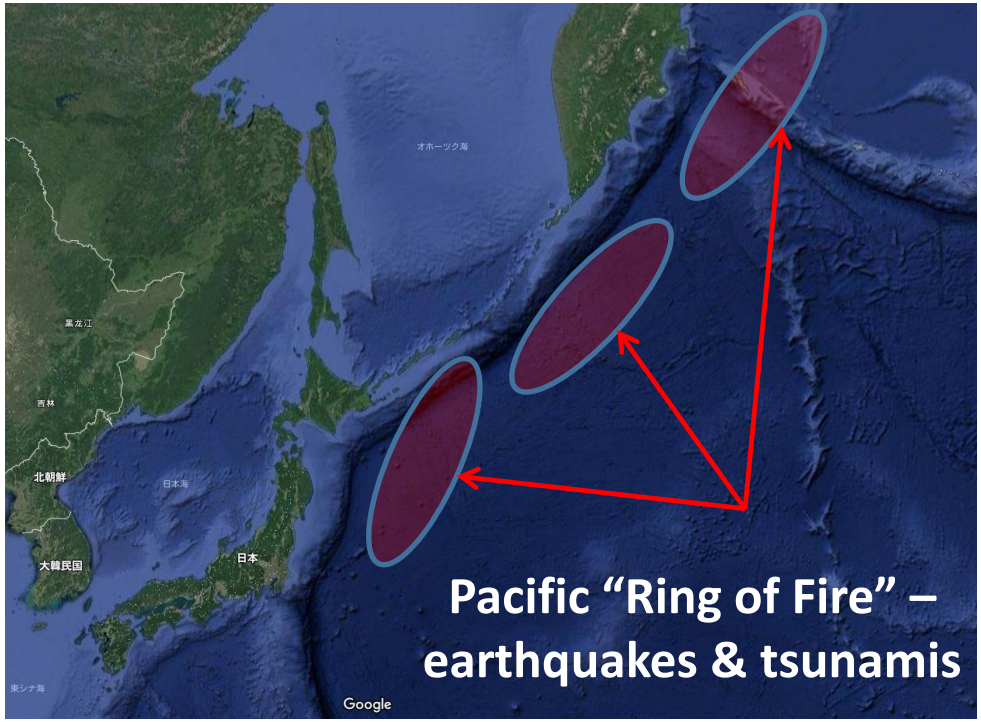
DWDM+Sensors = Sensing network equal to 10,000,000 acoustic sensors

Even 10% (10,000km) = 1M sensors

1000 times bigger monitoring network than the best existing one

Japan–Kamchatka monitoring

BIG DATA ANALYSIS ENABLES TO GET THE NEW LEVEL OF EARTHQUAKES PREDICTION



Fiber Optic Networks can be used for seismic monitoring and data exchange

Need more cooperation

Common tasks:

- Seismic and tsunami danger
- Need for development of seismicity monitoring system and real-time data exchange
- Common optical networks – common monitoring systems

Conclusion – win to win business

Import of optical chips and equipment:

- Semi-finished optical components for high-speed telecom: Lasers (ITLA), Receiver (ICR), Modulators.
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Export Projects – T8 equipment

- 4Tbit/s DWDM compact transmission equipment for Data-Centers
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Additional

We make DWDM projects already >12 years

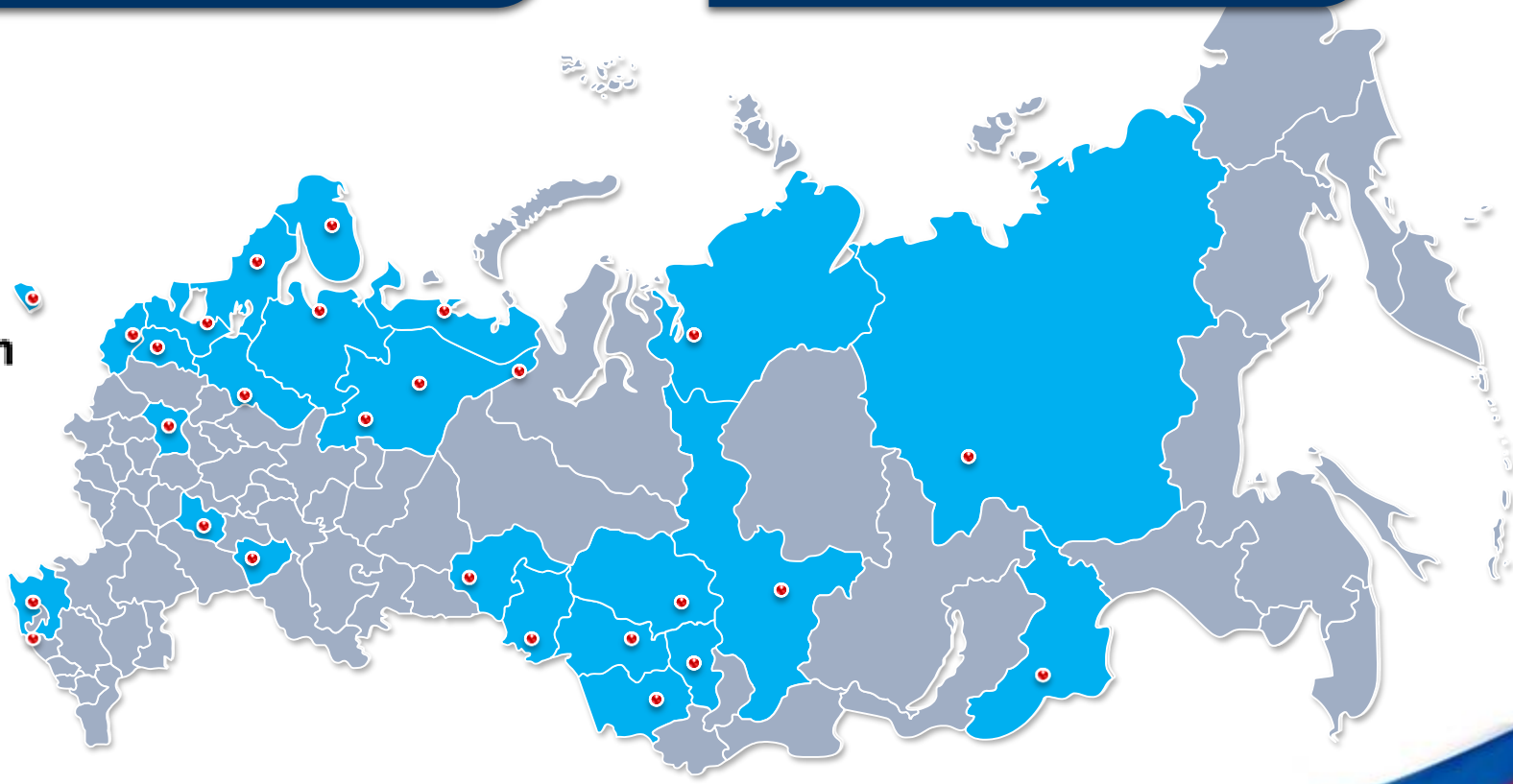
12 000 km

of 100G networks on VOLGA since 2013

> 65 000 km

of DWDM networks since 2004

Rostelecom
More possibilities



Customers & References

GAZPROM INTERNATIONAL

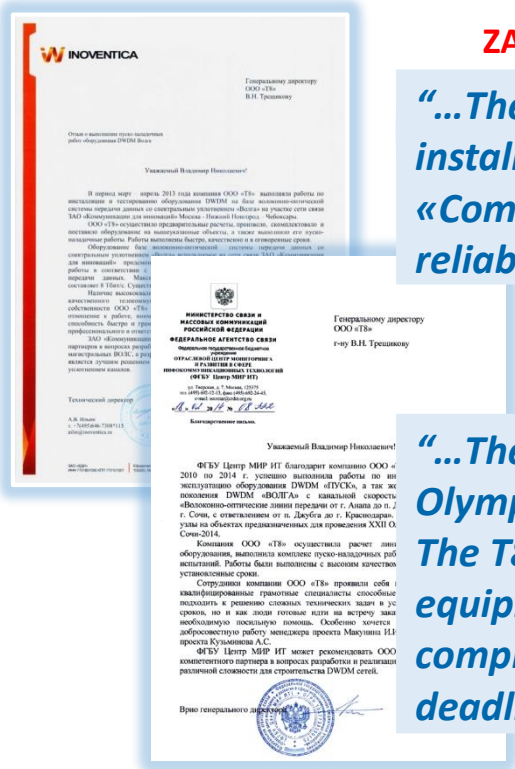
Rostelecom

DOMODEDOVO MOSCOW AIRPORT

SBERBANK By your side

Rutube

sochi.ru 2014



ZAO "Communications for innovations"

"…The equipment based on fiber optic DWDM system «Volga» was installed on the telecommunication network of ZAO «Communications for innovations» and have proved its high reliability and excellent performance

FGBU Center MIR IT

100G

"…The telecom network was built to connect objects of XXII Winter Olympic Games in Sochi in 2014.
The T8 company performed the calculation of the network, delivery of equipment, commissioning and start-up of the network. All tasks were completed with high quality, in full scope and in accordance with deadlines…"

International Suppliers & Partners

FUJITSU

NTT Electronics

FITEL
FURUKAWA ELECTRIC

ofs
A Furukawa Company

FINISAR

BROADCOM.
Connecting everything®

NeoPhotonics

PMC

Inphi®
Think fast.

OCLARO

MARVELL®

Texas Instruments

TeraXion

Accelink

NISTICA

CORNING

2016's Success: Transit Europe-Asia Project

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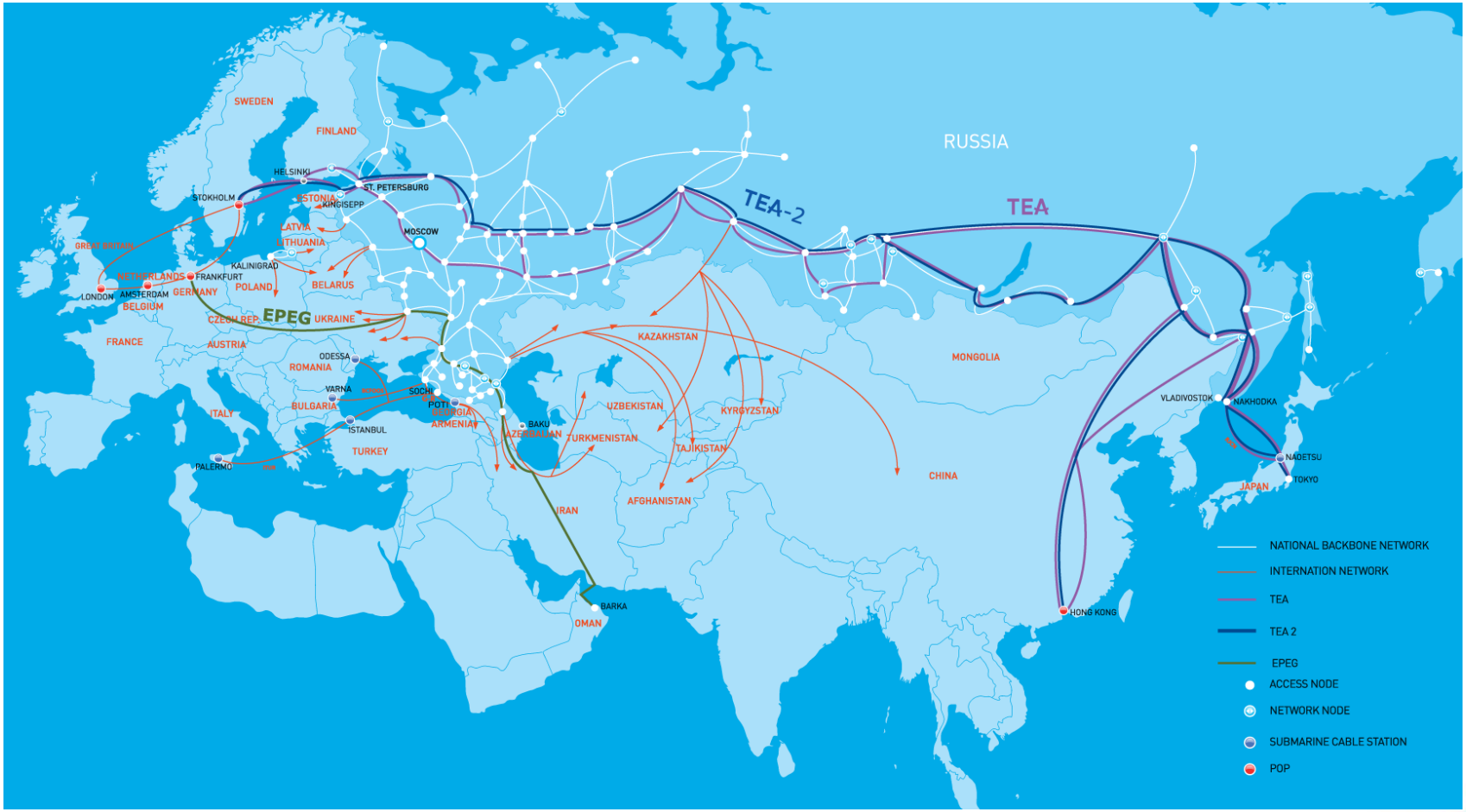
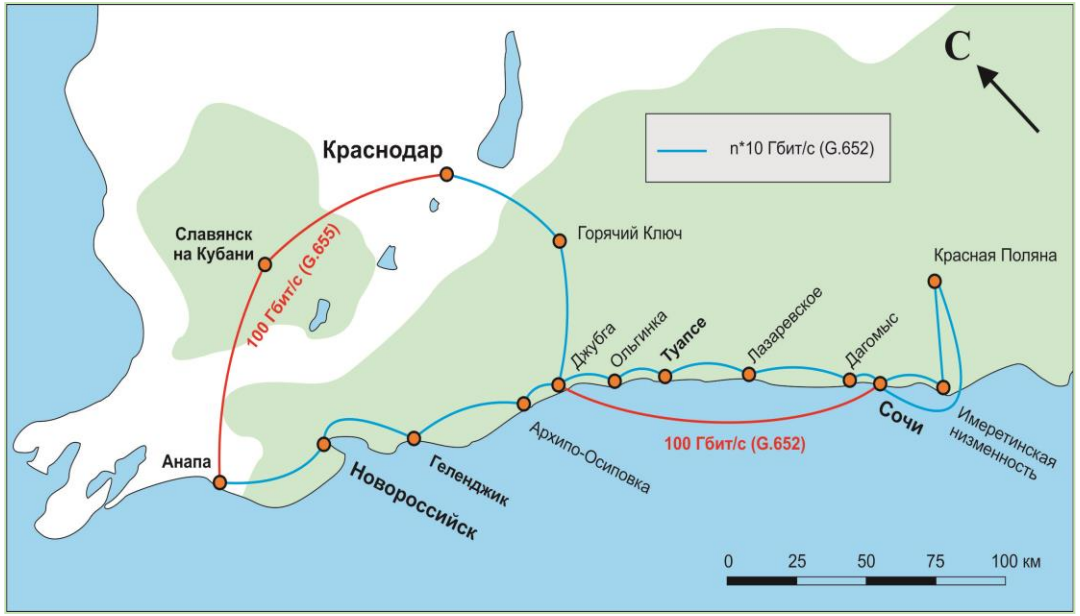
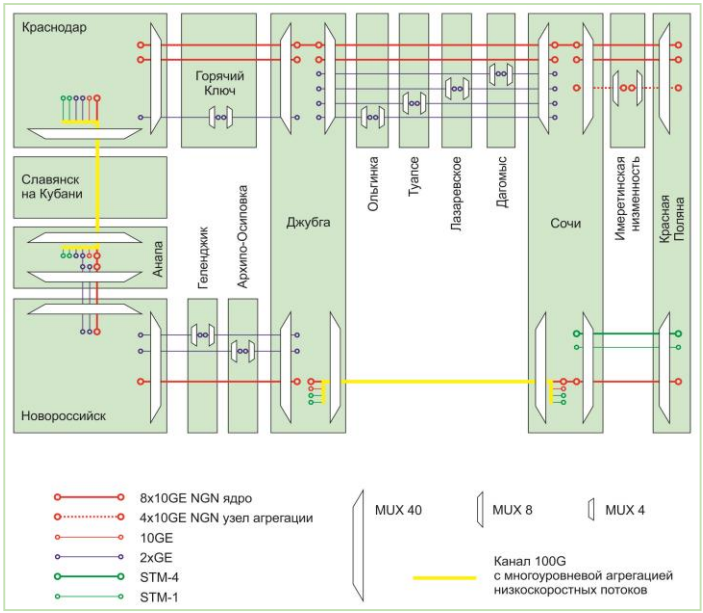


Sochi 2014 Olympic Games DWDM Network

T8's 100G Network successfully operated during Sochi 2014 Olympics





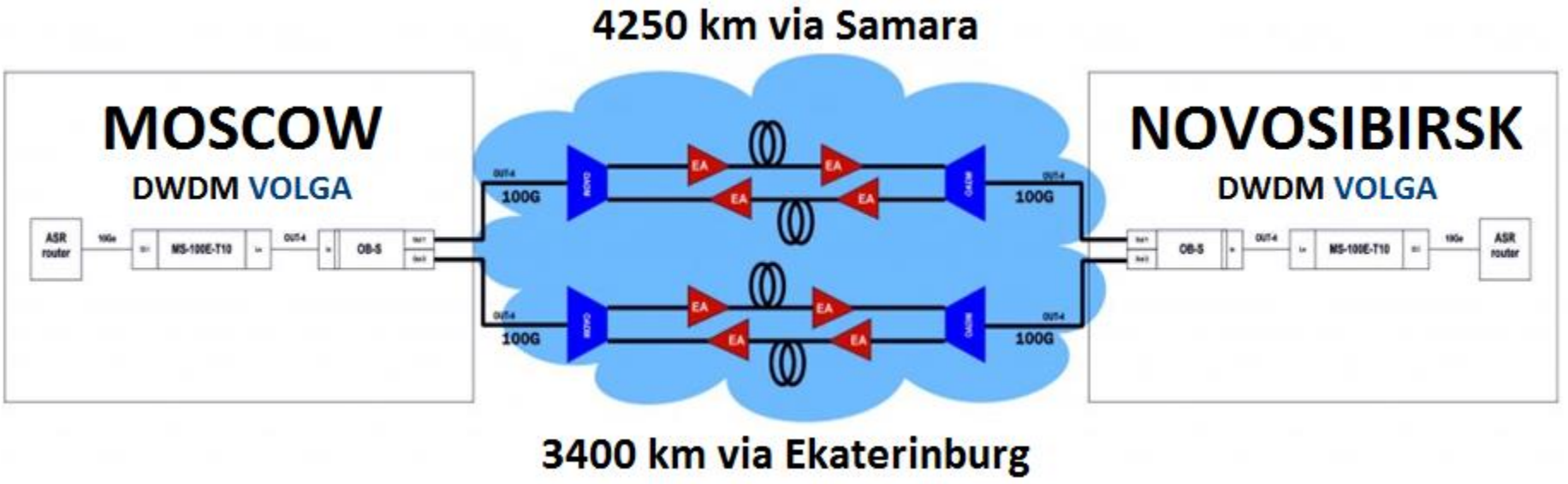
‘The Longest’ Success: Moscow-Novosibirsk

4250 km: 100G Transmission, no regeneration, no DCMs!

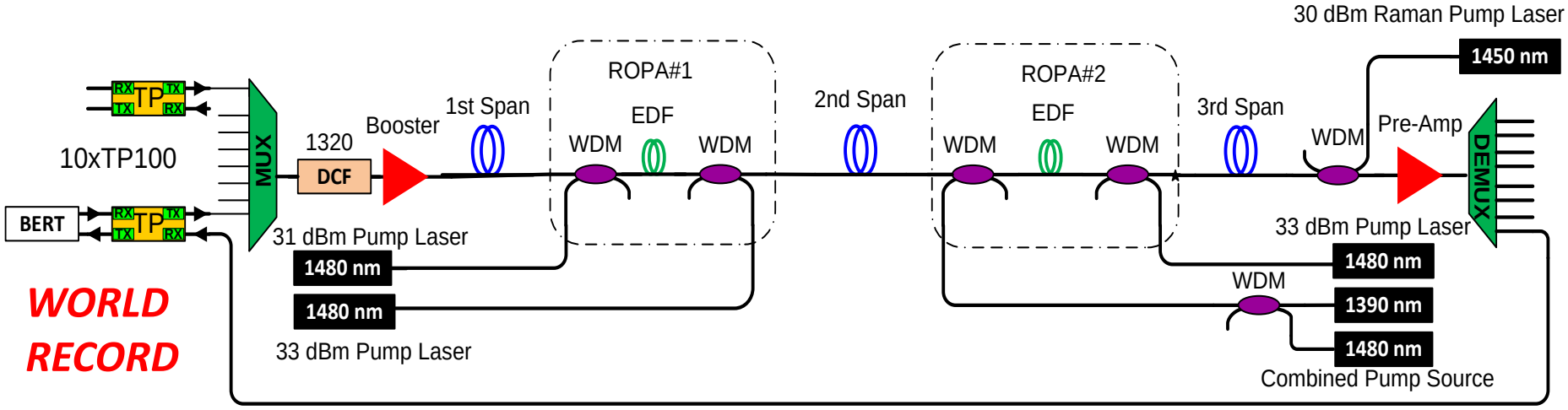
- Moscow-Samara-Novosibirsk: 4250 km with OSNR margin 7 db
- Moscow-Ekaterinburg-Novosibirsk: 3400 km with OSNR margin 8,5 dB

Tested redundancy <50 ms

TTK



One span transmission 10x100G via 500km



One span transmission – signal “jump” without electricity in middle-points

RAMAN and ROPA are used to increase reach

Interesting for lines in desert, between islands

DWDM Platform VOLGA

We produce
400G / 100G
40G / 10G / 2,5G

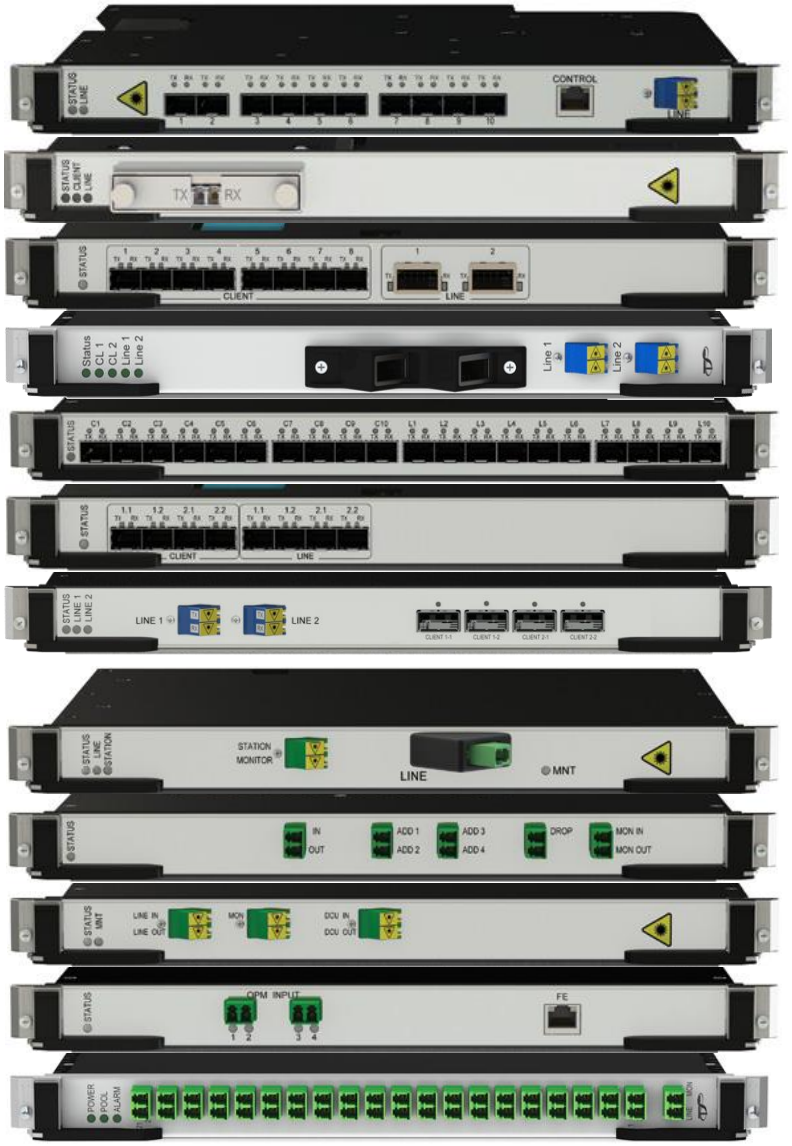
19,2 Tbit/s
400G – 48 channels
100G – 96 Channels

DWDM Platform VOLGA

Optimized for 400G & 100G
Powerful and cost effective
Transmission and OTN Cross-Connect

- Capacity up to 19,2 Tbits (48x400G)
- Up to 2,8 Tbps in a single chassis
- Transponders/Muxponders for 400/100/40/10/2.5G
- Any Clients from 2Mbps to 100Gbps
- Flexible FPGA based solution
- Support Data Encryption
- EDFA, Raman, Hybrid optical Amplifiers
- ROADM: WSS 1x1, 1x2, 1x4, 1x9
- Dual PS/Control System
- 4 types of chassis: 10/6/3/1U, 300mm depth

Optical Units of VOLGA Platform



Transponders and Muxponders from 2,5 Gbps to 400 Gbps

Optical Units MUX/DEMUX EDFA, RAMAN, ROADM, ROPA

Over 70 UNITS

to meet all customer requirements fast development and customization

400G Muxponder – FlexRate/FlexGrid

Multiplex and transmit 4x100G Ethernet via 400G DWDM

Cheapest Traffic

Flexrate – Distance/Speed balance
OSNRt = 18.1 dB (2x200G, 2DP-16QAM)
14.7 dB (2x150G, 2DP-8QAM)
10,2 dB (2x100G, 2DP-QPSK)

400G vs 100G: simple as 2X2=4

- Bandwidth growth on 2 times up to 19,6Tb
- Cost reduction for 1x 100G Channel in 2 times
- Distance reduction in 4 times up to ~700 km

100G Transponder & Muxponder –*"workhorse"*

Transponder TS-100E – transmit 100G Ethernet in DWDM OTN OTU4E

Muxponder MS-100E – multiplex and transmit 10ch x 10GE, STM-64, OTU2, FC

- Long distance coherent solution
- Cost effective solution
- Line Interface OTU4, 120 Gbit/s
- Modulation format DP-QPSK
- Error Correction SoftFEC 15%
- Tunable C-band Laser
- Up to 96 channels, 50 GHz
- Electronic Dispersion Compensation up to 128 000 ps/nm (8000 km SMF)
- OSNRr = 12,5/11dB

Compact 100G DWDM system 10*10 Gbps *

Features

1. Cost-effective
2. Compact 1U DWDM
3. Using in 19” Rack, width 300 mm
4. NMS+EMS control
5. Dual power consumption
6. Fast installation

Technical parameters:

- Transmission of 10 client signals 10GE, STM-64, OTU2, Fiber Channel
- Line interface OTU4, 120 Gbit/s
- Coherent modulation format DP-QPSK
- Tunable laser in C-band
- Up to 96 channels, 50 GHz spacing
- Error correction SoftFEC
- Electronic dispersion compensation up to 128 000 ps/nm
- OSNRr = 11/12.5 dB

* The system can be equipped with any optical transport from VOLGA product line: Transponders/Muxponders 400/100/40/10/2.5 Gbps, EDFA, RAU and ROADM.

World Records by T8 in 100G

Transmission 100G
at 4000 km
in 80-channels
DWDM System
2012

Transmission
at 500 km on speed
10*100 Gbit/s
in one span
2012

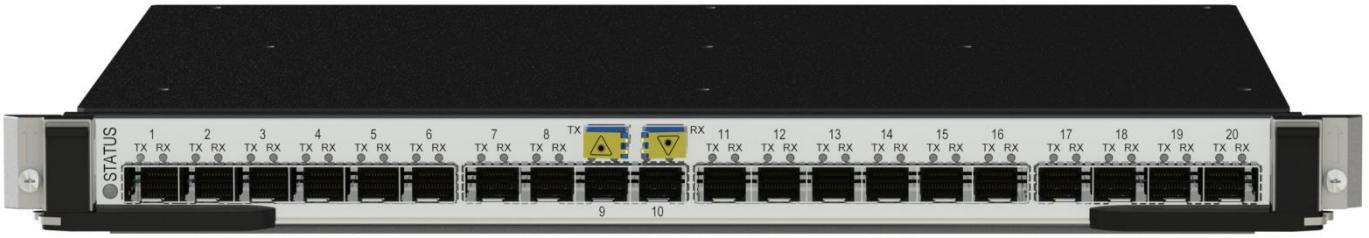
CORNING

МИНКОМСВЯЗЬ
РОССИИ

ofs
A Furukawa Company

ROADMAP. 200G Muxponder*

Now we have 2.5G / 10G / 40G / 100G / 200G / 400G



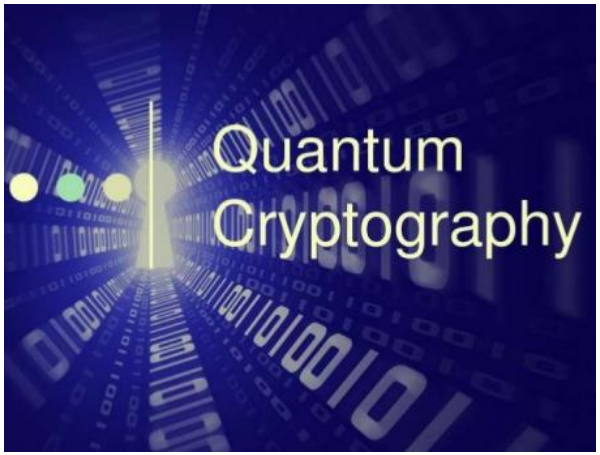
Muxponder MS-200 – multiplex and transmit 20ch x 10GE, STM-64, OTU2, FC

* Final stage of development

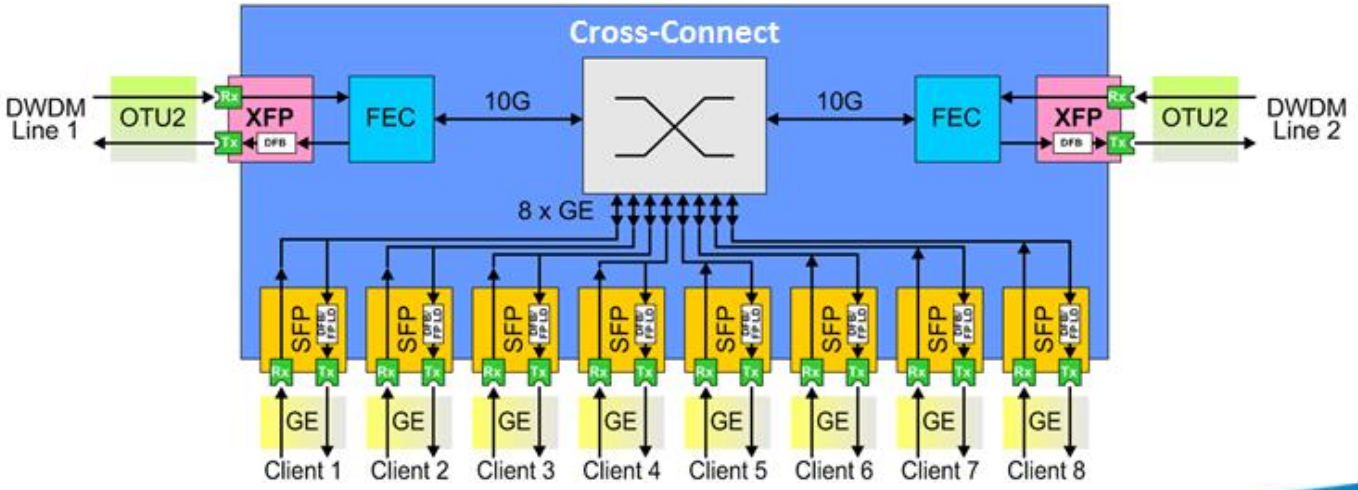
FEATURES OF THE SOLUTION

- Transmission of 20 client signals of 10GE, STM-64, OTU2, Fiber Channel
- Line interface 200 Gbit/s , 16 QAM
- Tunable laser in C-band
- Error correction SD-FEC
- OSNRr = 17 dB

FPGA based 10G + Data Encryption



- 8 clients - GbE, STM-1/4/16
- OTN X-connect, SuperFEC
- Data encryption with open code, FPGA based
- Tunable C-band laser, high optical performance
- R&D - quantum key transmission



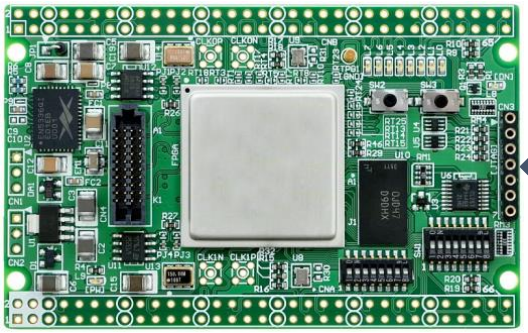
Data Encryption based on OTN protocol

Clients: 1-10G Ethernet, SDH, FC, etc

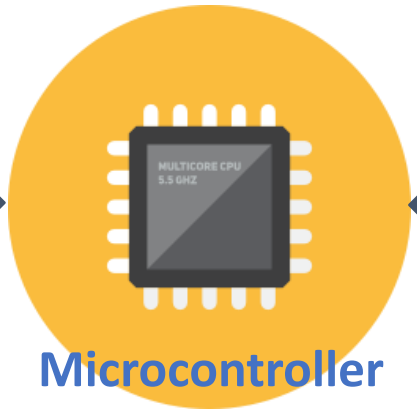
Encryption+SuperFEC in standard OTN OTU2e

Clients: 1-10G Ethernet, SDH, FC, etc

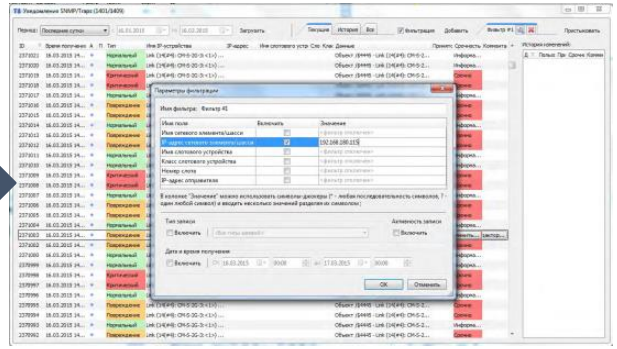
Standard DWDM equipment can be used for transmission encrypted channel



FPGA



Microcontroller



NMS software

FPGA, Microcontroller, NMS software can be checked for information security

Training & Education

- We lead regular scientific and technical workshops on the basis of our laboratory
- Joint work with leading Russian universities: MIPT, MSU, MTSU
- Complete course of DWDM systems:
  - ✓ DWDM-systems study book
  - ✓ Lectures in PPT
  - ✓ Laboratory works
  - ✓ Laboratory set-ups
  - ✓ We publish scientific articles and specialized literature

T8 ALLOWS TO EDUCATE/TRANSFER OF THE TECHNOLOGY TO OUR INTERNATIONAL PARTNERS & UNIVERSITIES

Opportunities with T8

- Our goal is to help of the Development of Telecommunications in the country to provide customers a good quality of telecom services.

High quality of communications
gives a pulse to the progress of society.

- Fiber Optic Sensors allow to increase pipeline security, safety of bridges, State border, etc.
- Integration of Fiber Optic Sensors + DWDM Systems allow to get the new quality of earthquakes' prediction.
- We are open to partnership and fruitful cooperation.

Thank you for attention!

You can find more on www.t8.ru