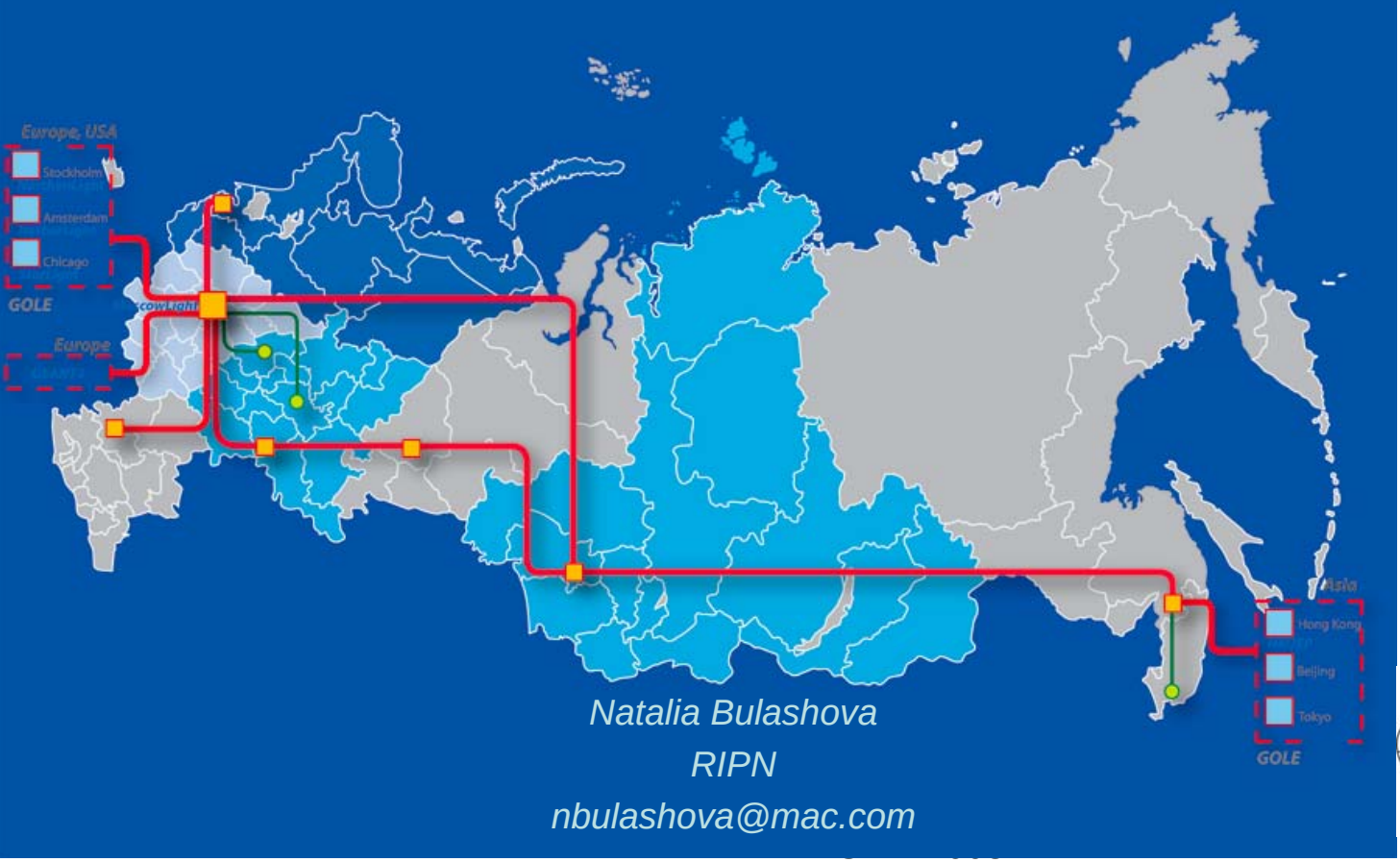
"Advanced networking infrastructure for the National Large Scale Sciences Applications.

RIPN initiative-2008

RIPN-Initiative



Natalia Bulashova

RIPN

nbulashova@mac.com

РОСНИИРОС RIPN

Russian Federation

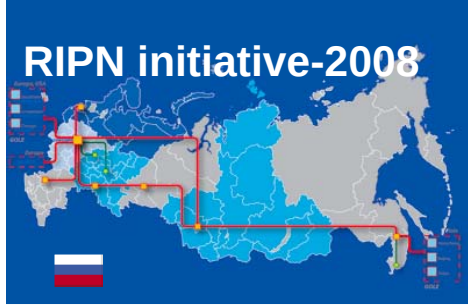
Geography

Location:
Northern Asia (the area west of the Urals is considered part of Europe), bordering the Arctic Ocean, between Europe and the North Pacific Ocean

Area:
total: 17,075,200 sq km
land: 16,995,800 sq km
water: 79,400 sq km

Climate:
ranges from steppes in the south through humid continental in much of European Russia; subarctic in Siberia to tundra climate in the polar north; winters vary from cool along Black Sea coast to frigid in Siberia; summers vary from warm in the steppes to cool along Arctic coast

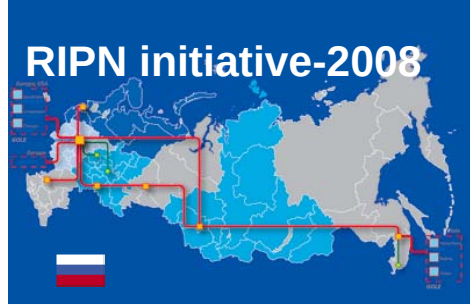
Research and Technological Trends



1. Multidisciplinary projects
   - More complex sets of data
   - Increasing need for tools and infrastructure to support this work
2. The “Data-Intensive projects”
   - Need for advanced techniques to manipulate, visualize and interpret data
   - Virtual organizations
3. Globalization
   - Development of global partnerships and platforms
   - Emphasis on internationally collaborative research
4. Interest in deriving economy and science research
   - Relationship between research and innovation
   - Collaborative partnerships

1. Network-accessible data, equipment and instrumentation
2. Peer-to-peer applications
3. Lambda grids, switched networks and lightpaths
4. Next-generation internet architectures

Mission and Task



The mission

Creating an integrated information environment in scale of the strategy of developing of the Russian Federation's information society for increasing of efficiency of a basic and applied research, building up of a research and technical potential of the country, developing of a *science innovative technologies*, providing *a global research project* participation**,** ensuring further of a *high level of accessability* to information and technologies, and increasing of quality life of a citizens in Russian Federation.

Task

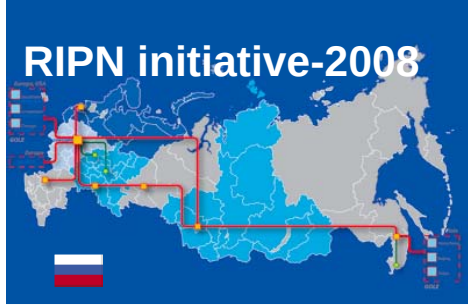
- integration of the existing science networks to create a National Advanced High Performance Telecommunication and Computation Infrastructure.

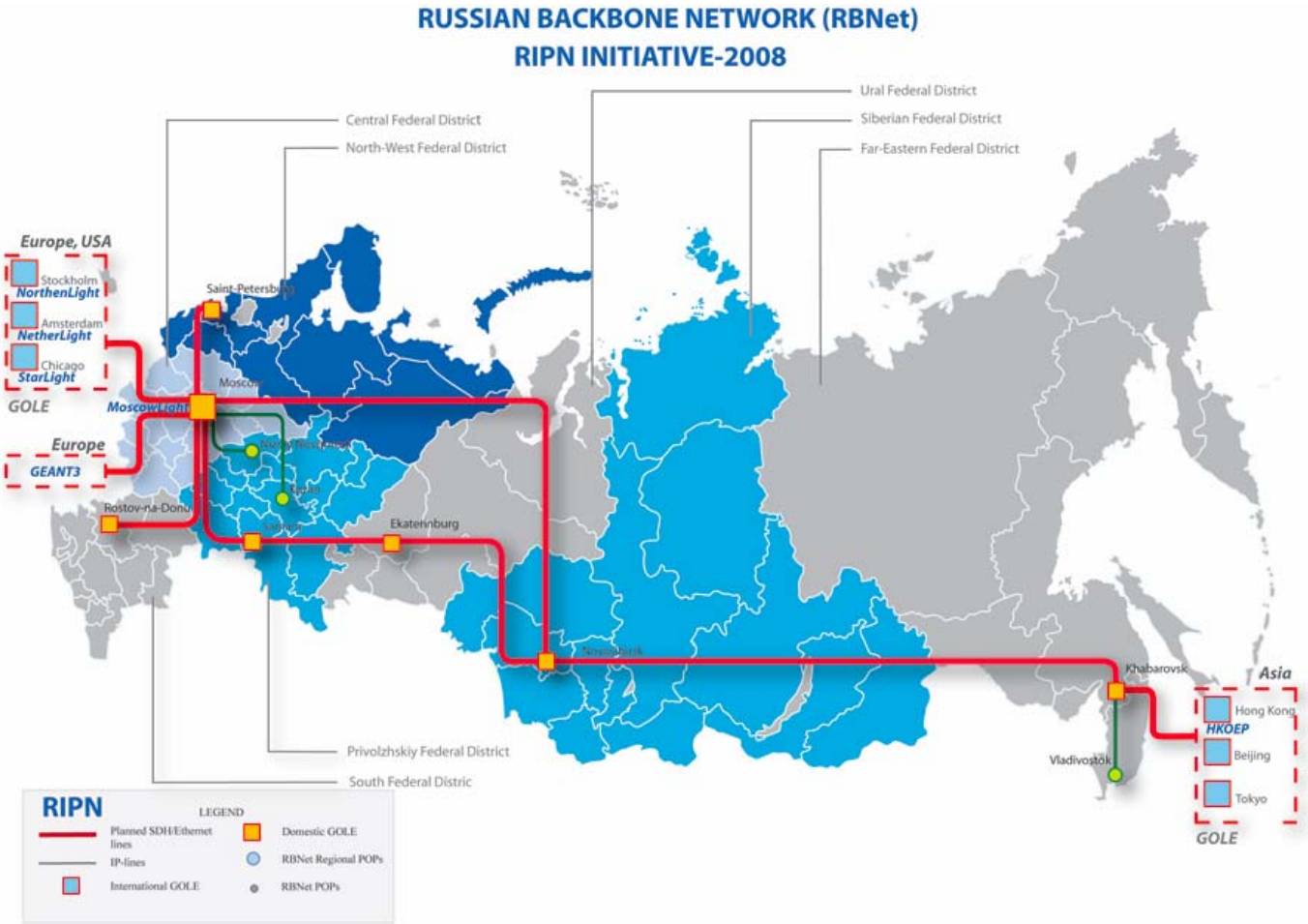
- the National e-Infrastructure will function as major Advanced Network of Nx10 Gps capacity which connected to it:

- number of a Research and Education DataCenters, High Performance Computers of Nx100 TF, as well as major scientific facility, equipment, scientific collection and structured information for conducting leading-edge research by science and research organizations, universities, industry.

.

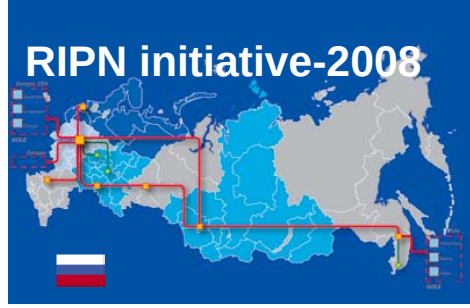
RIPN Initiative





1. Strategy development
2. Financial arrangements
3. Technical work
4. Governance work
5. Legal issues

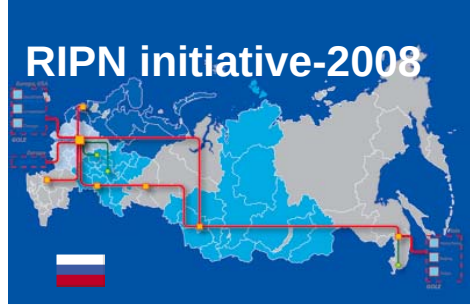
RIPN Initiative



- Supports multiple, distinct experimental and production networks
- Supports Point-to-point switched Ethernet as well as routed IP networks for universities and research centers
- Regional Optical Networks are connected to Advance Optical R&E backbone (RBnet)
- Function of Association of regional, corporate networks, universities, research organizations and leading edge technology companies
- Deploying of a national network infrastructure for:
  - advanced network research
  - next-generation computationally and data intensive network-based applications
- Providing a Global research project participation

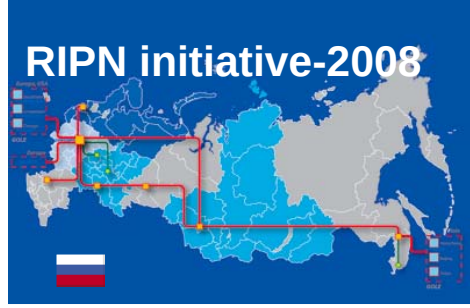
1. Strategy of development
2. Financial arrangements
3. Technical work
4. Governance work
5. Legal issues

RIPN Initiative. Steps.



1. **Strategy of development** (consolidation of the existing science networks; building of a **hybrid network** as National Advanced network infrastructure with distributed **7 National Optical Lambda Exchanges** as ROADM footprint from West to East (NOLEs: Moscow,St.Petersburg, Rostov-na-Donu, Ekaterinburg, Samara, Novosibirsk, Khabarovsk); creating of the **Association** to provide support and coordination of the work with the Region Optical Networks; cooperation and coordination with public authorities, business, and industry at the international, national and/or regional levels)
2. **Financial arrangements** (National and /or regional, as well as international levels)
3. **Technical work** (**Hybrid network** with a new generation adaptive control system and with an integrated intellectual elements to provide sustainability and security of the infrastructure)
4. **Governance work** **Association will form a** Policy development and Program implementation to optimize the use and development of Networking activities, international/trans-national access and/or service activities, joint research activities, Public awareness among public authorites, scientists, customers, partners, employees and suppliers on networking technologies for support of national innovation strategies (exhibitions, conferences, workshops, seminars, demos, personal exchanges, forums, web-sites…)
5. **Legal issues**

Russian Science and Technology



There are around *4000 organizations* in Russia involved in research and development with almost *one million personnel*. Half of those people are doing scientific research. It is coordinated by Ministry of education, science and technologies, where strategy and basic priorities of research and development are being formulated.

QuickTime™ and a decompressor are needed to see this picture.

Russian Academy of Sciences

Russian Academy of Sciences

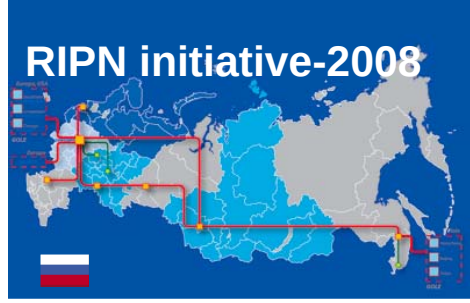
Fundamental scientific research is concentrated in Russian Academy of Sciences, which now includes hundreds of institutes specializing in all major scientific disciplines such as mathematics, physics, chemistry, biology, astronomy, Earth sciences etc.

Russian Academy of Sciences is the community of the top ranking Russian scientists and principal coordinating body for basic research in natural and social sciences, technology and production in Russia. It is composed of more than 350 research institutions. Outstanding Russian scientists are elected to the Academy, where membership is of three types - academicians, corresponding members and foreign members

Russian Academy of Sciences

QuickTime™ and a decompressor are needed to see this picture.

Russian Academy of Sciences



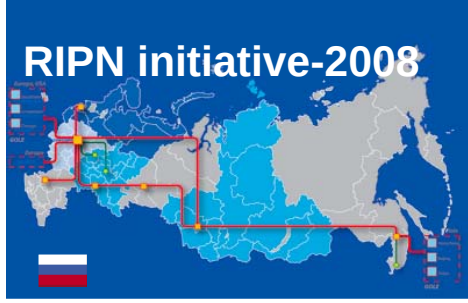
Regional Branches of RAS

1. FAR EASTERN BRANCH, RAS
2. SIBIRIAN BRANCH, RAS
3. URAL BRANCH, RAS

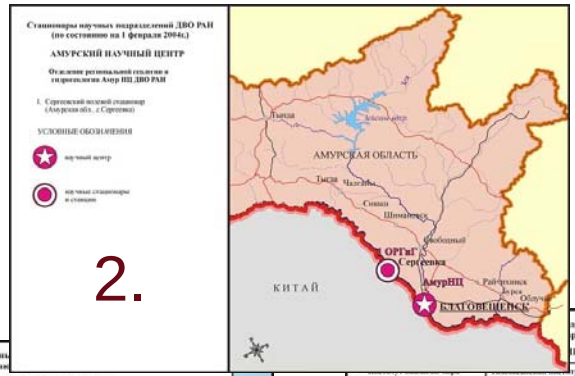
1. Division of mathematics;
2. Division of physics;
3. Division of nanotechnology and information technology;
4. Division of energy, machine engineering, mechanics and control process problems;
5. Division of chemistry and materials sciences;
6. Division of biology;
7. Division of Earth Sciences
8. Division of historical and philological Sciences;
9. Division of social Sciences;

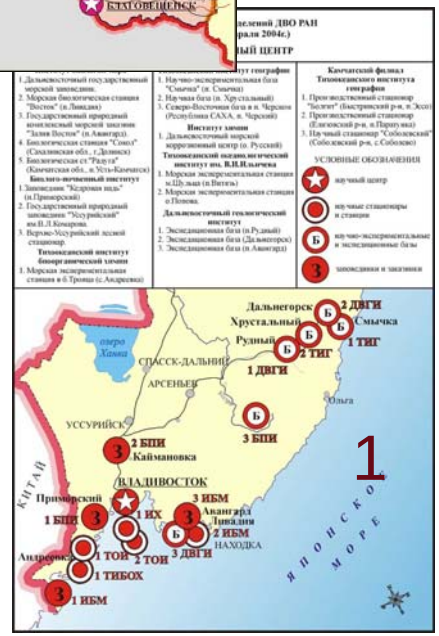
FAR East Branch, RAS

FAR EASTERN BRANCH, RAS



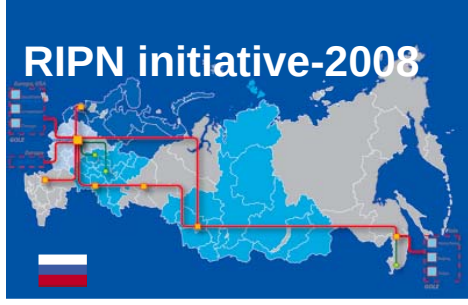
1. Primorsky Scientific Center;
2. Amur Scientific Center;
3. Khabarovsk Scientific Center;
4. Sakhalin Scientific Center
5. Kamchatka Scientific Center;
6. North-Eastern Scientific Center;





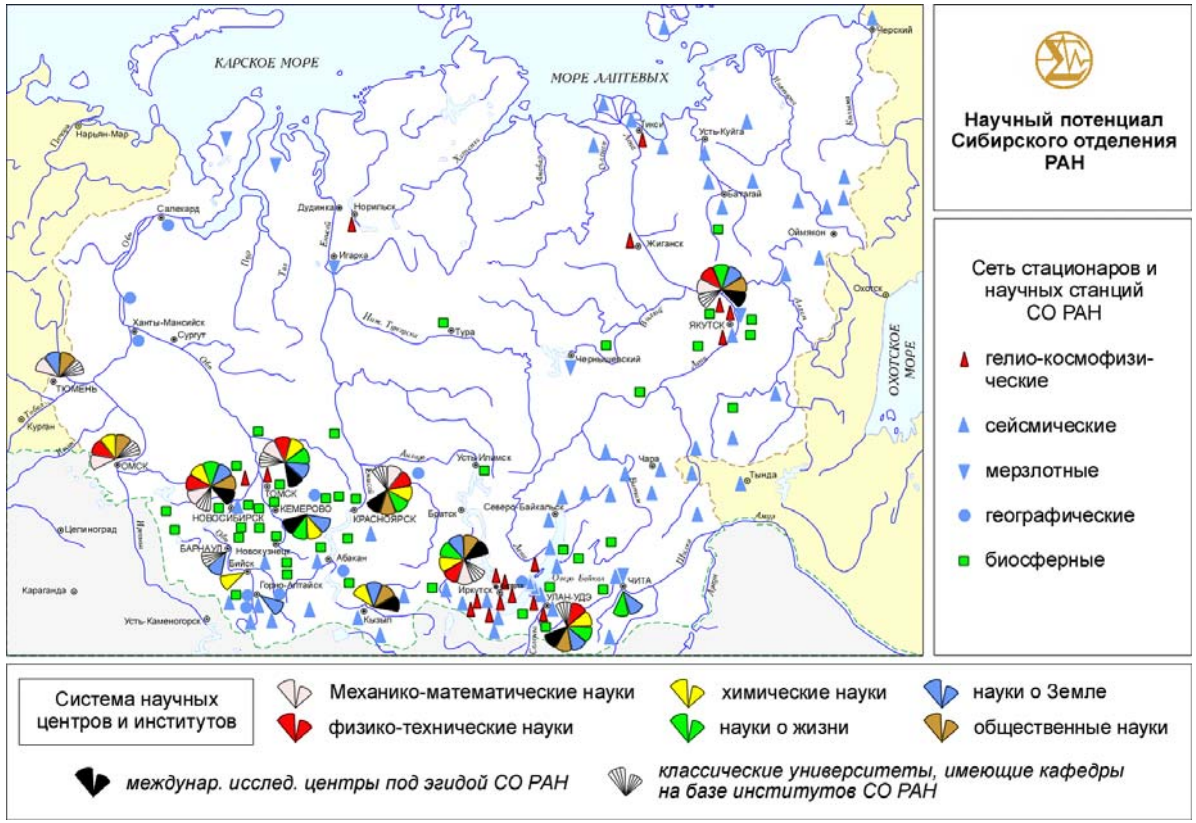
Sibirian Branch, RAS

Establish at May 18, 1957



Scientific Center of SB RAS

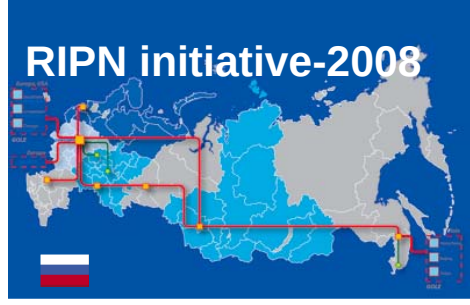
1. Novosibirsk Scientific Center
2. Buryatskiy Scientific Center
3. Irkutsk Scientific Center
4. Kemerovo Scientific Center
5. Krasnoyarsk Scientific Center
6. Omsk Scientific Center
7. Tomsk Scientific Center
8. Tumen Scientific Center
9. Yakutskiy Scientific Center



SOURCE: http://www.sbras.nsc.ru/consult/rus/index.htm

Sibirian Branch, RAS

Established at May 18, 1957



Siberian Branch of the Russian Academy of Sciences was established in 1957. The initiative originated from Mikhail Lavrentyev, Sergei Sobolev and Sergei Khristianovich. Mikhail Lavrentyev became its founding chairman. The Siberian Branch incorporates the organizations of the Russian Academy of Science located in Siberia.

The Siberian Branch has 33051 employees (according to the data from 01.01.2005). Of the above 24933 work in research institutions, 1909 work in scientific services and 6209 work in other services. There are 9117 researchers, of whom 58 are members of the Russian Academy of Sciences, and 72 are corresponding members, 1685 hold the degree of Doctor of Sciences and 4698 hold the degree of Candidate of Sciences.

SOURCE: http://www.sbras.nsc.ru/consult/rus/index.htm

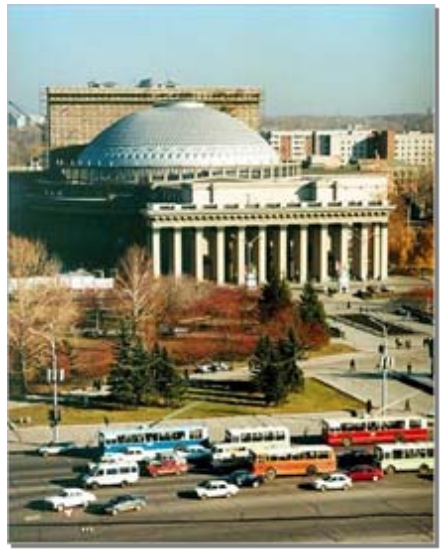
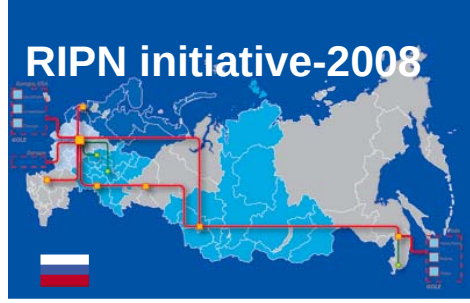


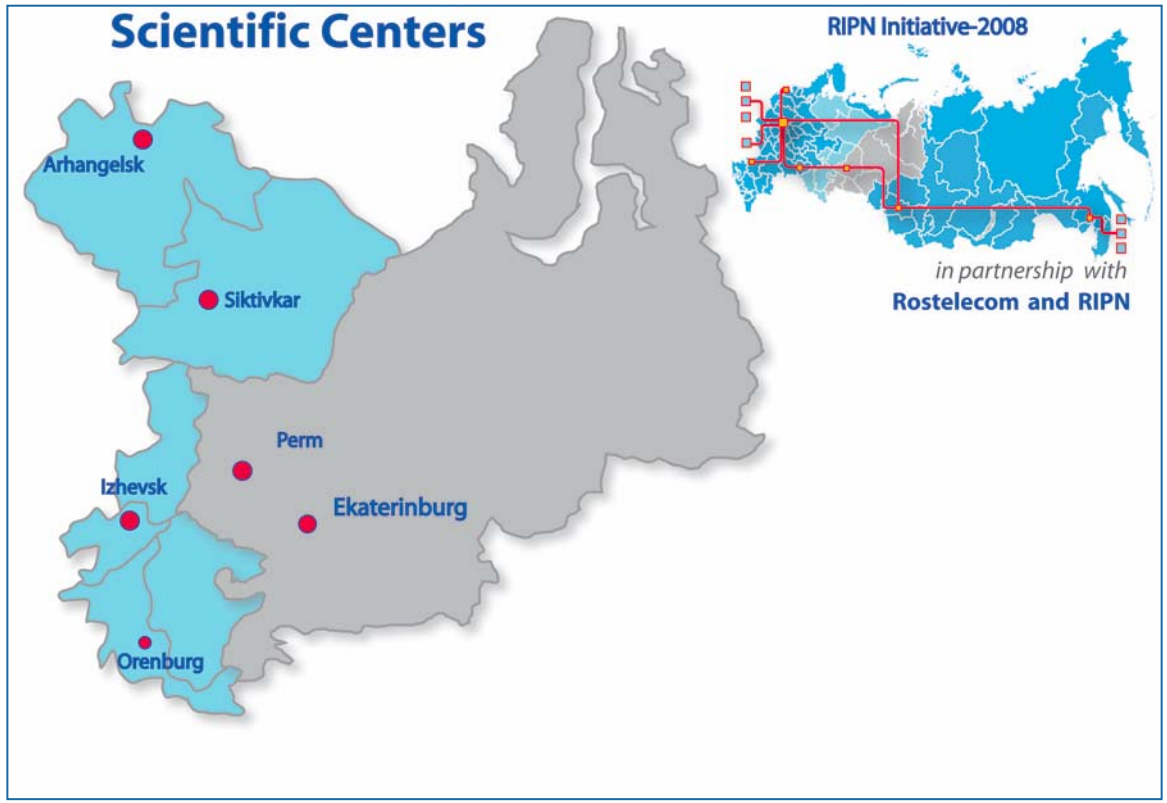
Photo: Valentin Vlasov

Ural Branch, RAS



Scientific Center of Ural RAS

1. Perm Scientific Center
2. Komi Scientific Center
3. Udmurtskiy Scientific Center
4. Chelyabinsk Scientific Center
5. Orenburg Scientific Center
6. Archangelsk Scientific Center



Picture design credit to RIPN. 2008. *NAB*

Ministry of Communication and Mass Media

• Министерство связи и массовых коммуникаций •
Российской Федерации

Igor Olegovich SCHEGOLEV

MINISTER

Deputy Ministers

Alexander A. ZHAROV

Alexey A. SOLDATOV

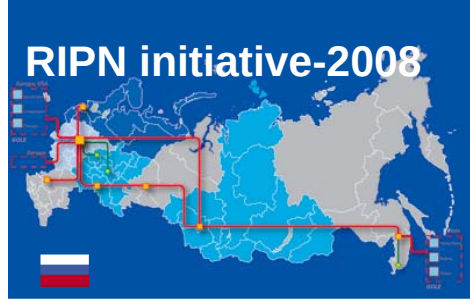
Naum S. MARDER

Dmitry S. SEVEROV

Alexander V. MASLOV

Russian Institute for Public Network

Today



Russian Institute for Public Networks (RIPN) has been founded in 1992 by the Science and Higher School State Committee of Russia, Russian Research Centre "Kurchatov Institute"

International Connection for R&E(RBnet & Runnet):

➢Channels

Moscow – Petersburg - Stockholm - Amsterdam - Chicago

Connection

NORDUnet - NorthenLight - NetherLight - StarLight

TODAY: RBnet/Runnet 10Gbps

----

a) RBnet: 1Gbps - Moscow ---L3-->Stockholm--> Amsterdam --L3-> Chicago

b) RBnet: 1Gbps - Moscow ---L2-->Stockholm--> Amsterdam --L2-> CERN

c) RBnet: 1Gbps - Moscow ---L2-->Stockholm--> Amsterdam --L2-> Chicago *- for SC008*

PLAN 2009: (RBnet: add 10Gbps)

----

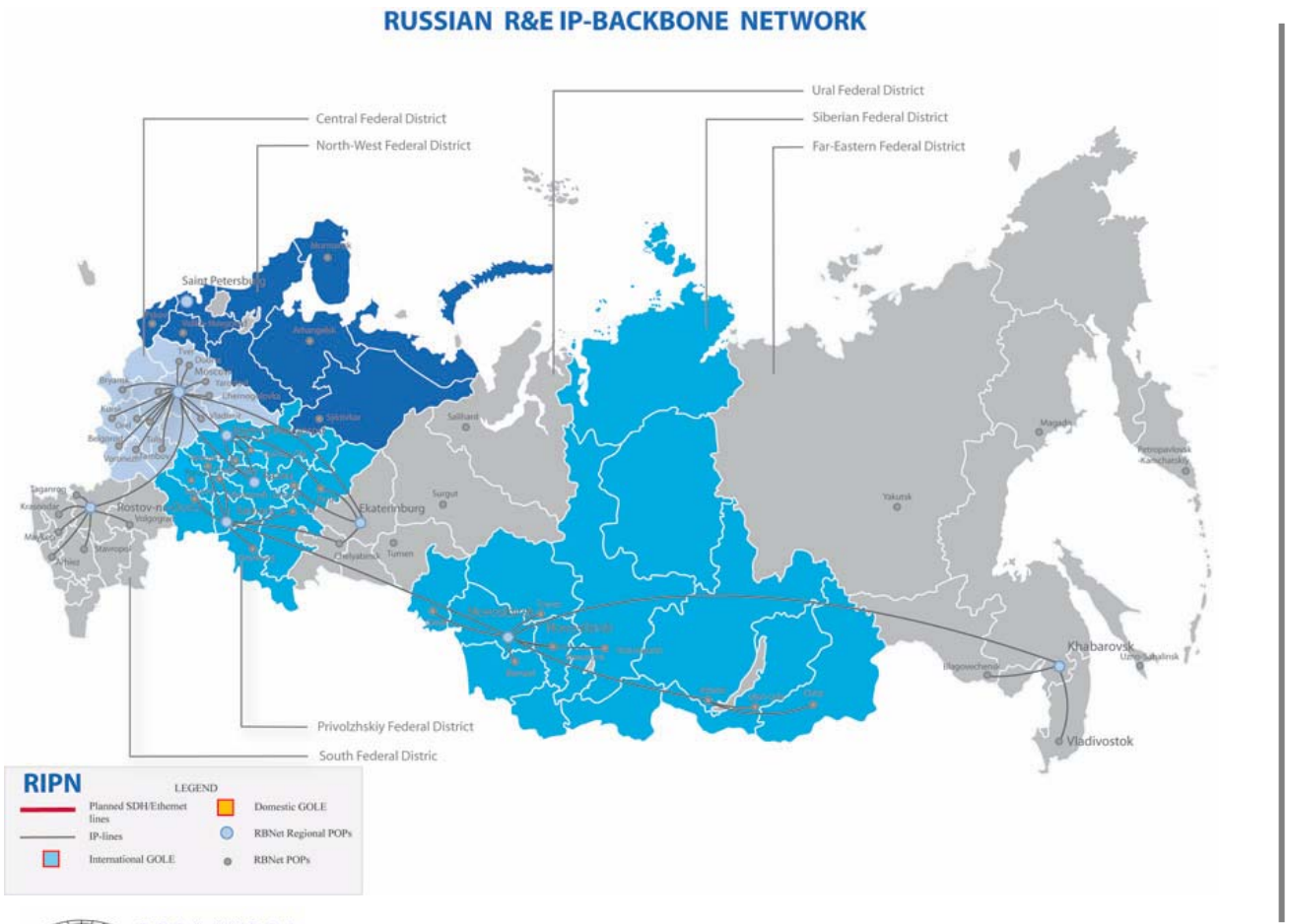
e) RBnet: 10Gbps - Moscow ---L2-->Stockholm ---L2--> Amsterdam

123182, Russia,
Moscow, Kurchatov

square, 1 (ROSNIIROS)

Russian R&E IP Backbone Network

Today:



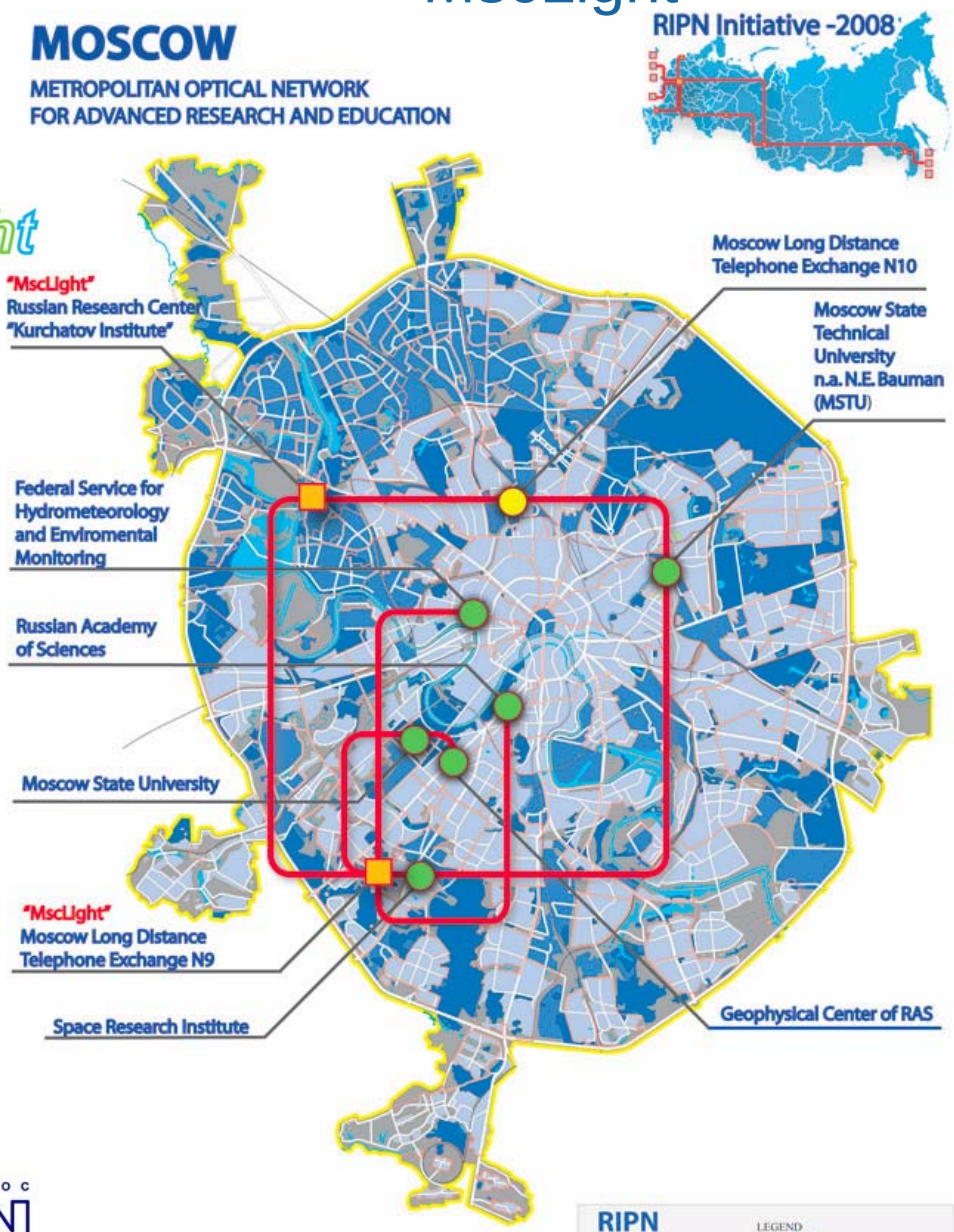
Domestic connection

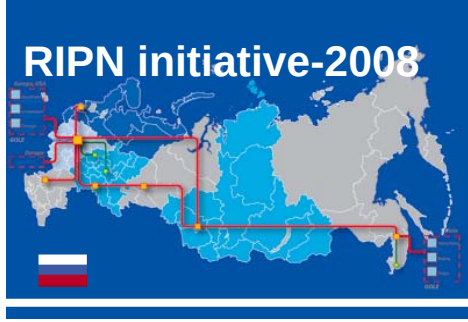
- **Constructed on R&E Russian networks RBNET/RUNNet/Rasnet**
- **2-level structure, 7 main PoPs at Russia**
- **Cover over 50 regions of Russian Federation**
- **Based on Russian optical connect providers Rostelecom/TransTeleCom**

123182, Russia,
Moscow, Kurchatov

square, 1 (ROSNIIROS)

MscLight





Locations

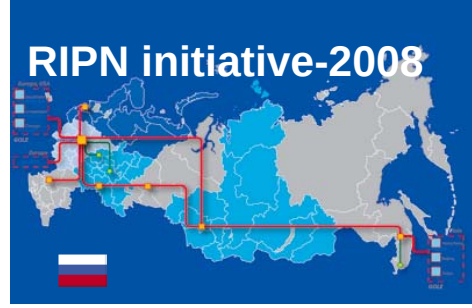
1

ROSNIIROS,
1, Kurchatov square
Moscow, Russia,123182

2

M9 Telephone Exchange, 7, Butlerov Street,
Moscow, Russia

MscLight.
Facility

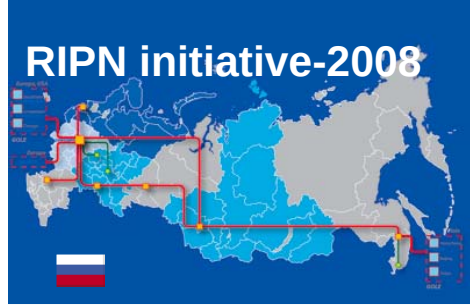


MoscowLight access system (Moscow)

123182, Russia,
Moscow, Kurchatov

square, 1 (ROSNIIROS)

MscLight.
Facility

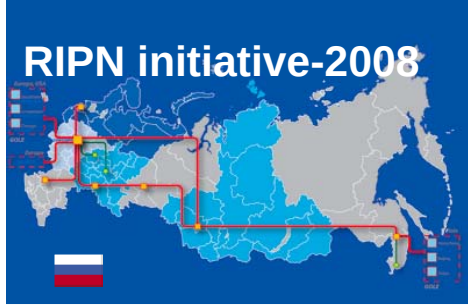


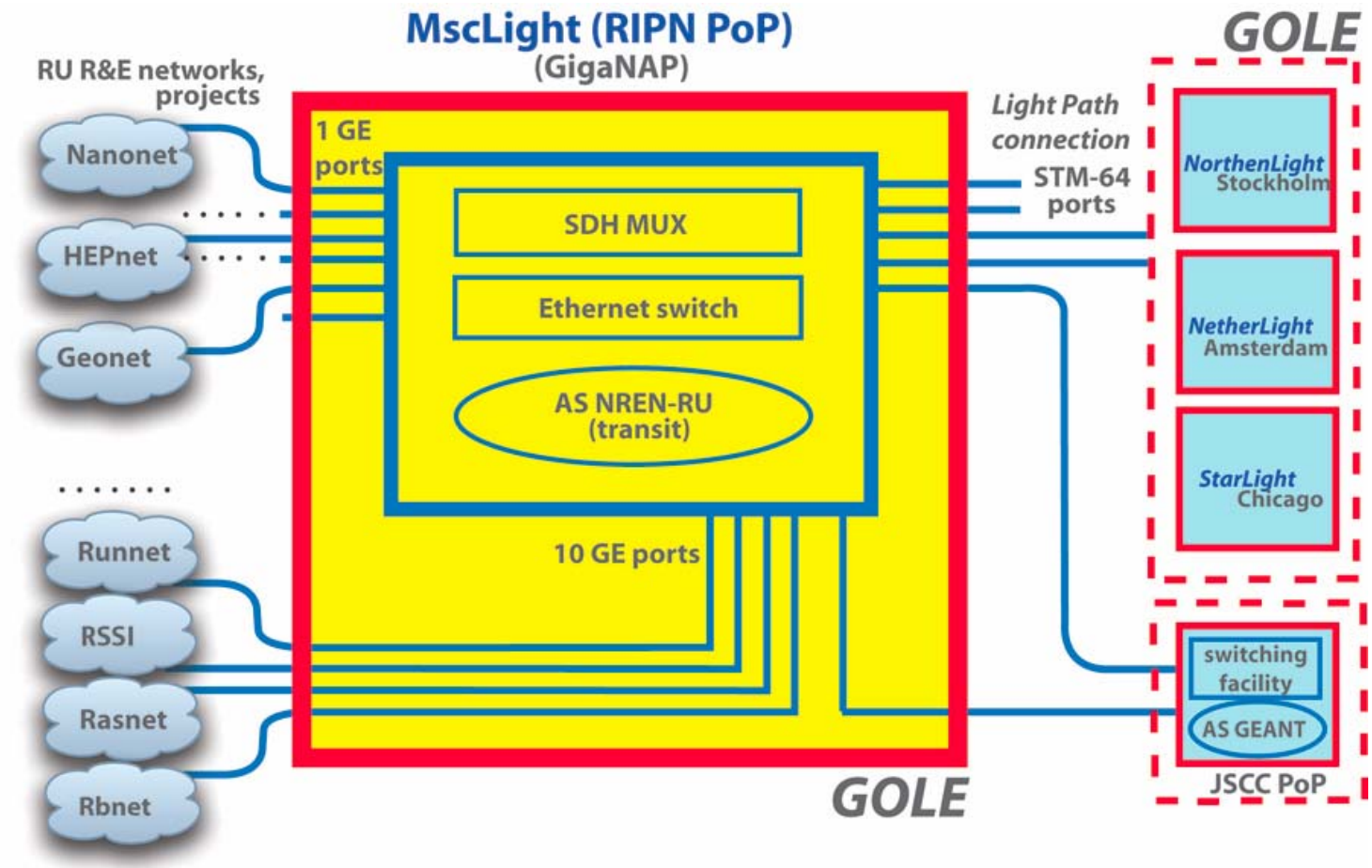
1. RBNet Network Operation Center is placed at Kurchatov Institute.
2. Datacenter "KIAEhouse" is designed professionally as telecommunication equipment housing location:
    1. Rack space in a 19" rack for router and auxiliary equipment;
    2. Backup power system;
    3. Air-conditioning;
    4. Fire protection;
    5. Closed circuit television system;
    6. Out-of-band management;
    7. 24*7 security on site ;
    8. Intelligent hands 24*7.

123182, Russia,
Moscow, Kurchatov

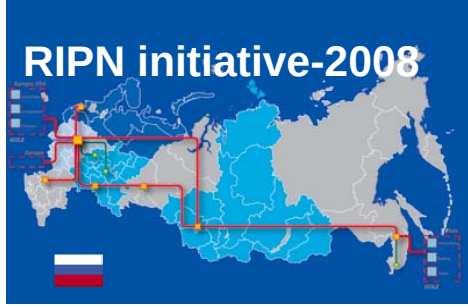
square, 1 (ROSNIIROS)

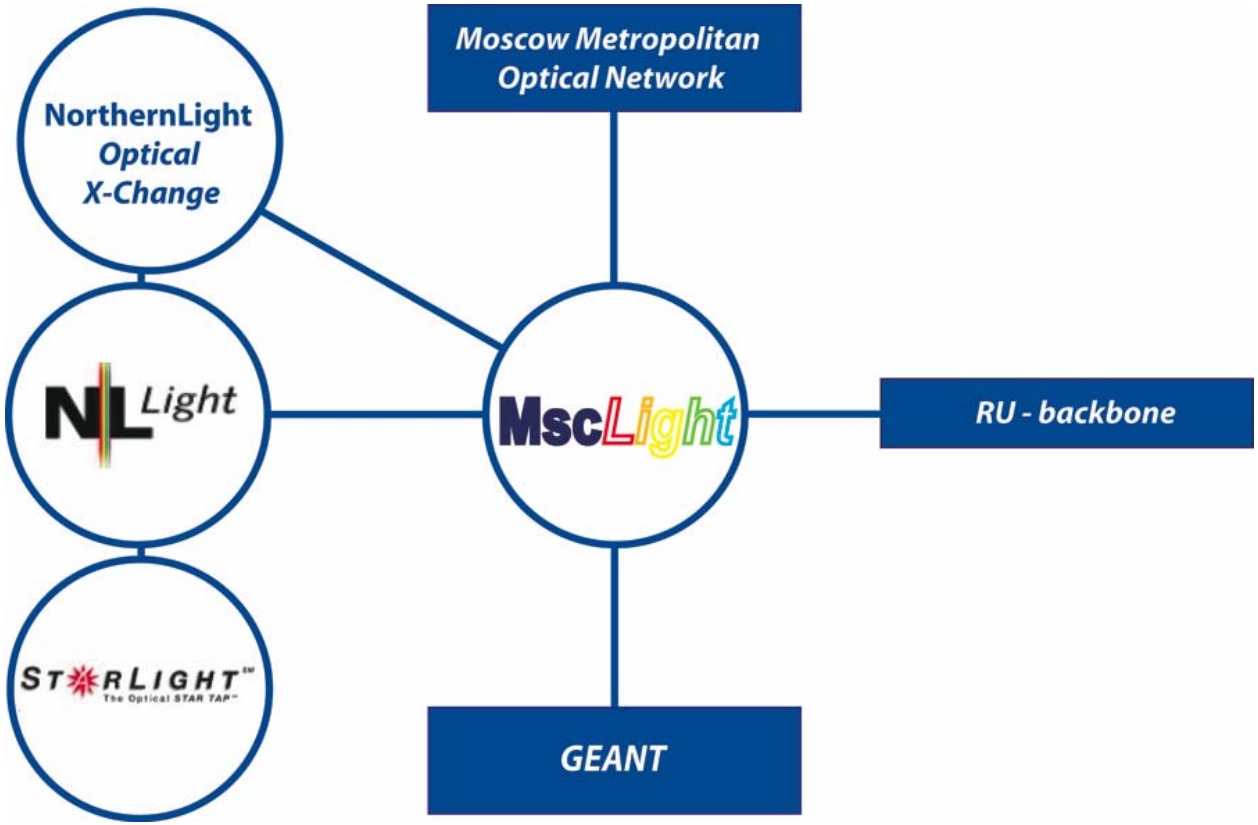
MscLight.
Equipment



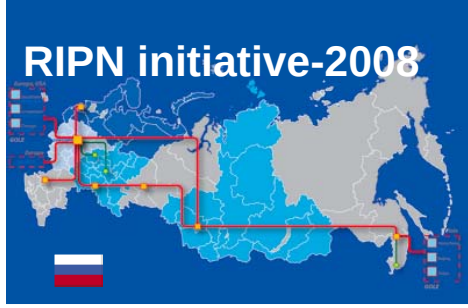


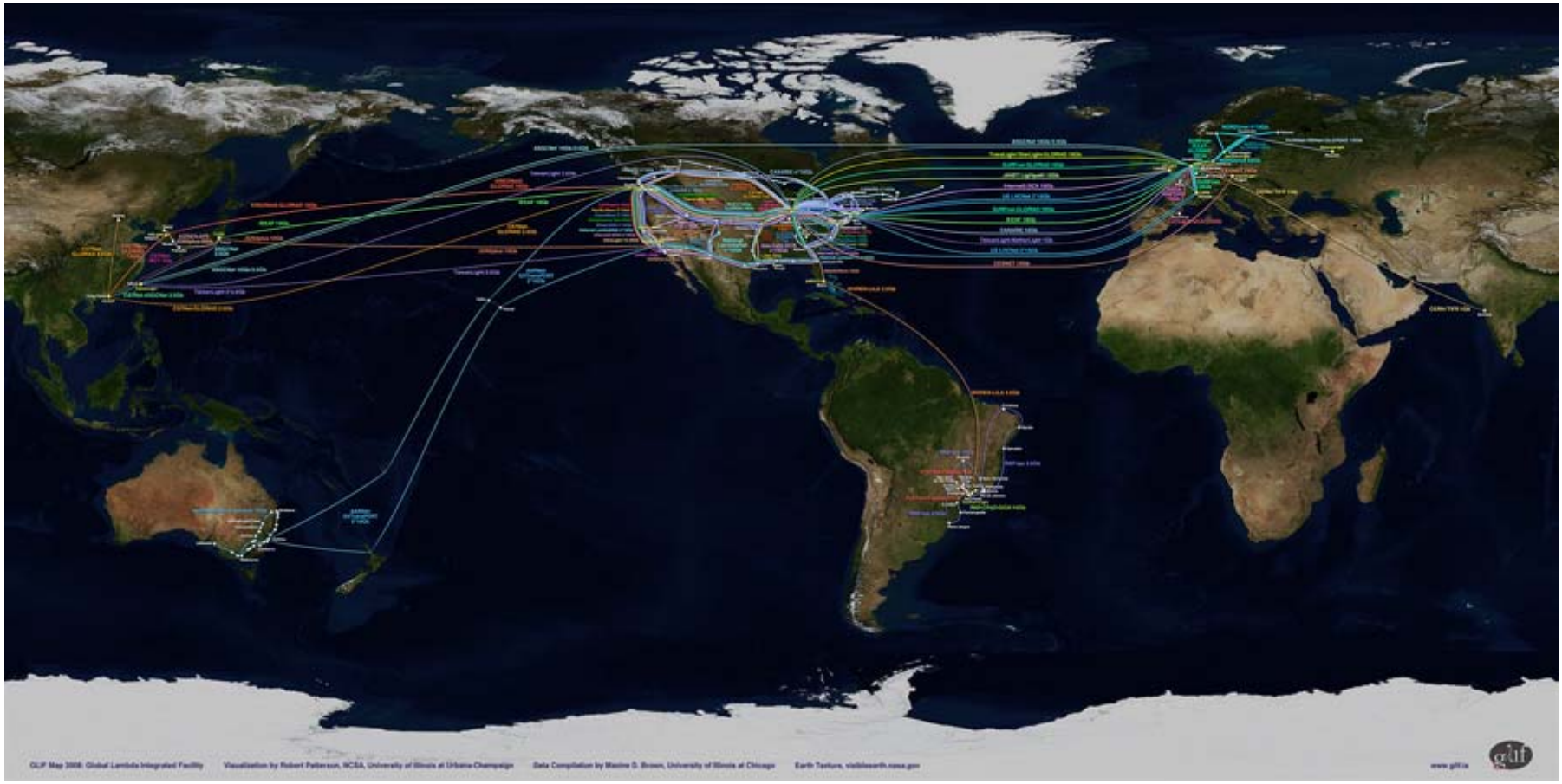
MscLight.
and connection to GLIF GOLEs



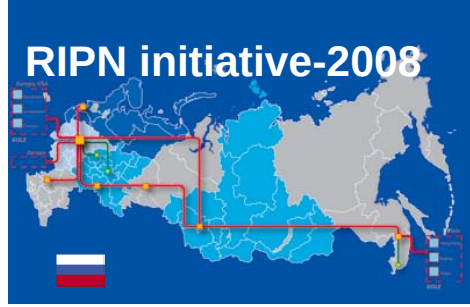


MscLight
and connection to GLIF GOLEs



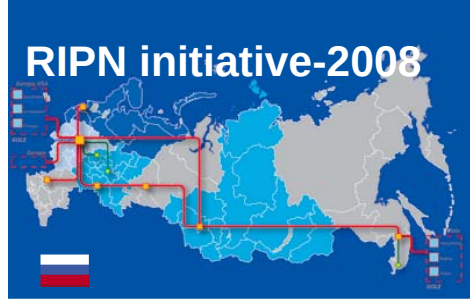


MscLight.
Summary

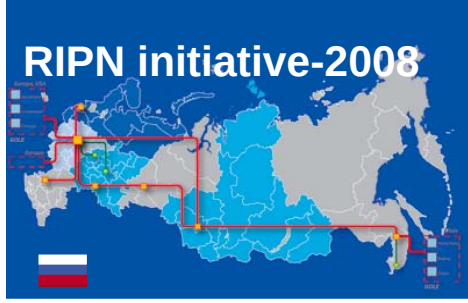


Location	1.ROSNIIROS, Kurchatov square, 1, Moscow, Russia, 123182; 2.M9 Telephone Exchange, 7, Butlerov Street, Moscow, Russia
Sponsoring Organization(s)	RIPN (ROSNIIROS)
Website	http://www.ripn.net:8080/about/en/
Service Contact	Administrative contact: admin@ripn.net Network Operations Center: noc@rbnet.ru 24 hours, 7 days per week
Interfaces	Cisco, Nortel 1000 Base-T 1000 Base-SX 1000 Base-LX 10GBASE-SX 10GBASE-LX STM-64 (Packet over SONET)
Connectivity	1 x 10 Gbps to NorthernLight (provided and operated by RIPN/Runnet, Moscow, Russia)
Charging Policy	Free of Charge

Transtelecom network
Today



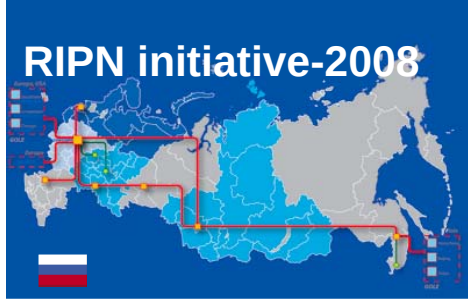
TransTeleCom network
Today

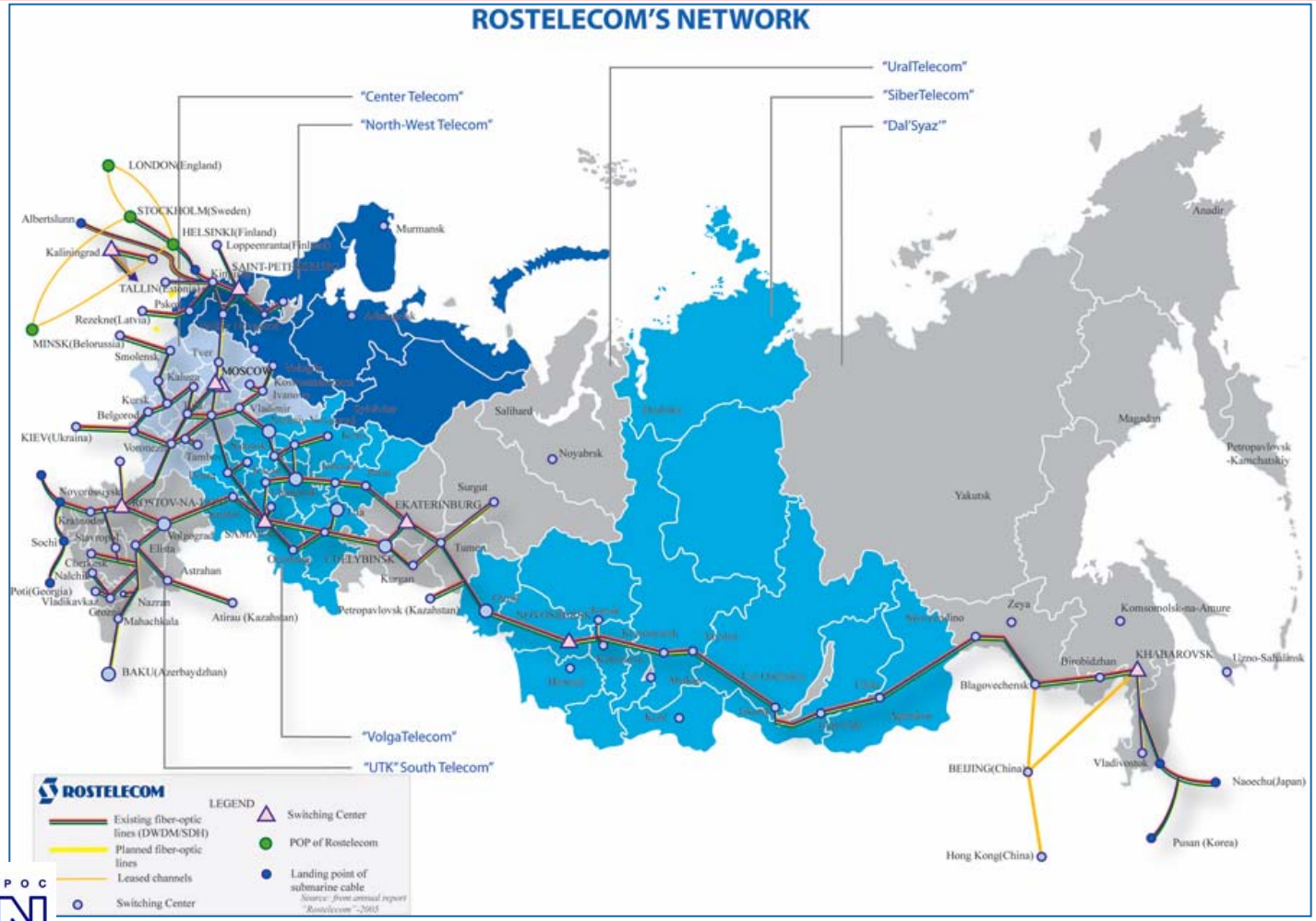


TransTeleCom was founded by Russian Railways in 1997 to build nationwide fibre optic network along extensive railroad easements in Russia. Our network stretches across Russia and internationally extends into Western Europe, China and the CIS. Network reliability is ensured by series of SDH network rings providing geographically diverse routes and selection of leading edge technology solutions from internationally recognized suppliers.

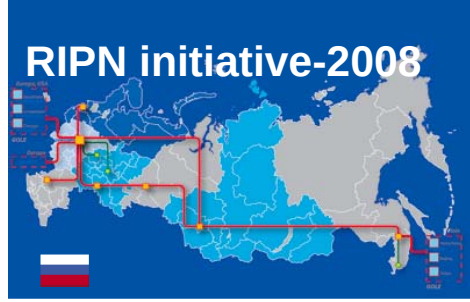
- The network stretches over **45 000** km
- More than **960 PoPs** in 71 of 89 regions of Russia
- Ability to provide telecom services for more than **90%** of the Russian population
- Only advanced technologies: **SDH, MPLS**
- High reliability of the network - **0,9993**
- International gateways with neighboring countries**:Finland, Estonia, Latvia, Kazakhstan,China,Mongolia, Lithuania (2003), Ukraine (2004)**
- International Nodes: **London** (UK); **Stockholm** (Sweden)

Rostelecom network
Today





Rostelecom network
Today



Rostelecom owns the most extensive network in Russia (over 150 000 km). From the founding date - 1993, Rostelecom acts as a "carriers carrier" for Russian Companies and as a partners for the largest international telecom operators.

Rostelecom has: points of presence across entire Russian Federation; points of presence in London, Stockholm, Frankfurt, Helsinki, New York and Hong Kong; 99% digitalized in channel-kilometers; 100% digitalized in switching capacity

Rostelecom has established direct international connections with more than 150 operators in 70 countries, participates in 25 cable systems and cooperates with approximately 600 fixed-line and mobile operators inside and outside of Russia

TEA

Rostelecom is a major provider of telecommunications services for state organizations and governmental agencies, television and radio broadcasters

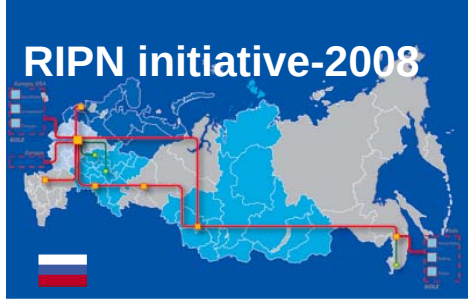
51% of voting shares owned by the statecontrolled holding company

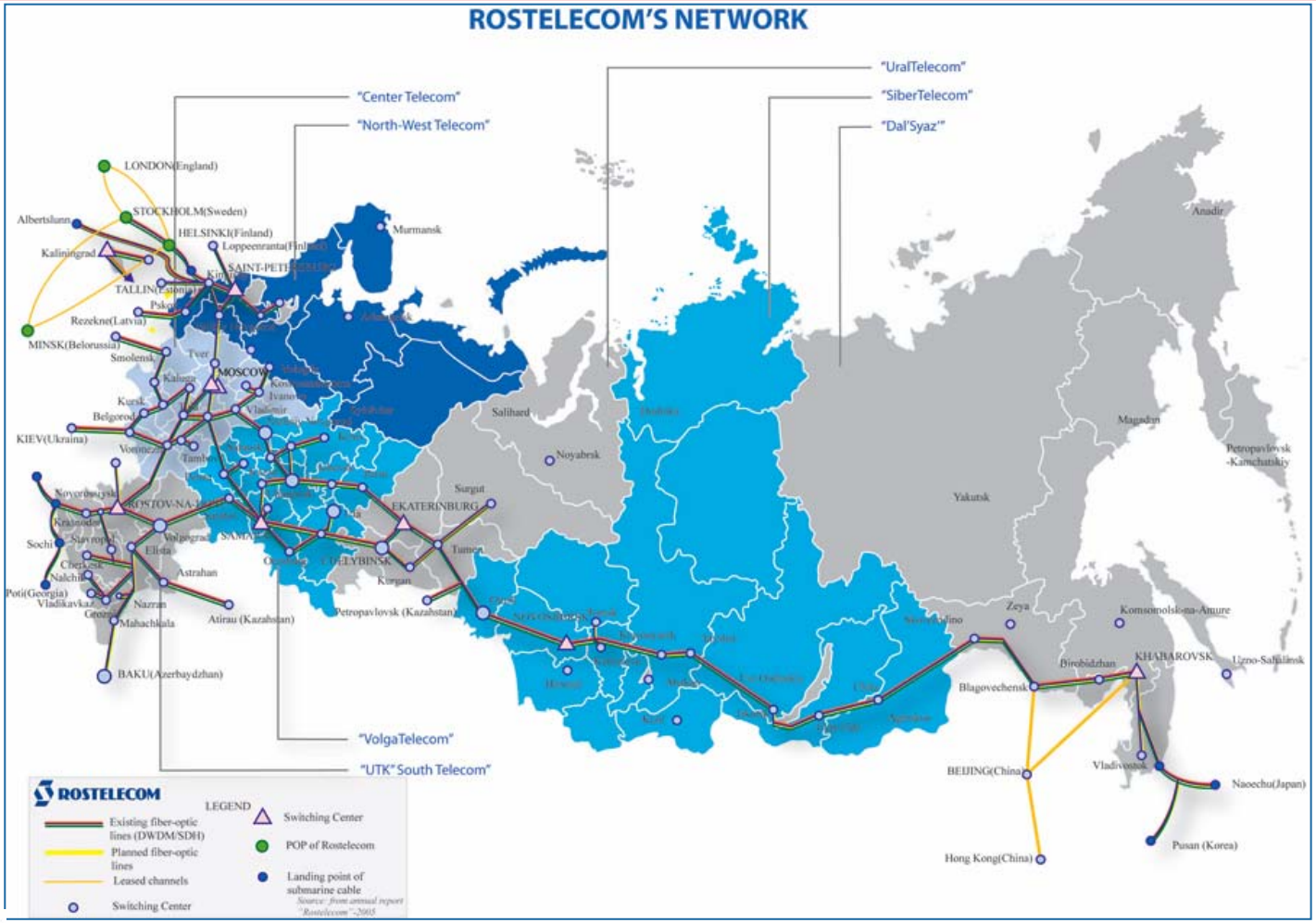
Svyazinvest

Market capitalization: USD 9.01 billon

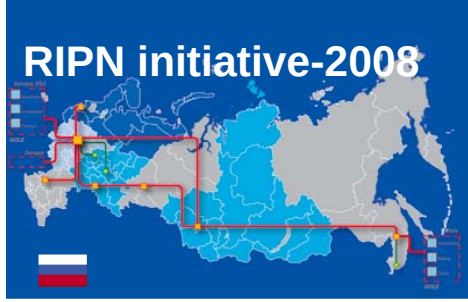
Sources: Rostelecom. Investor Presentation. August 2008

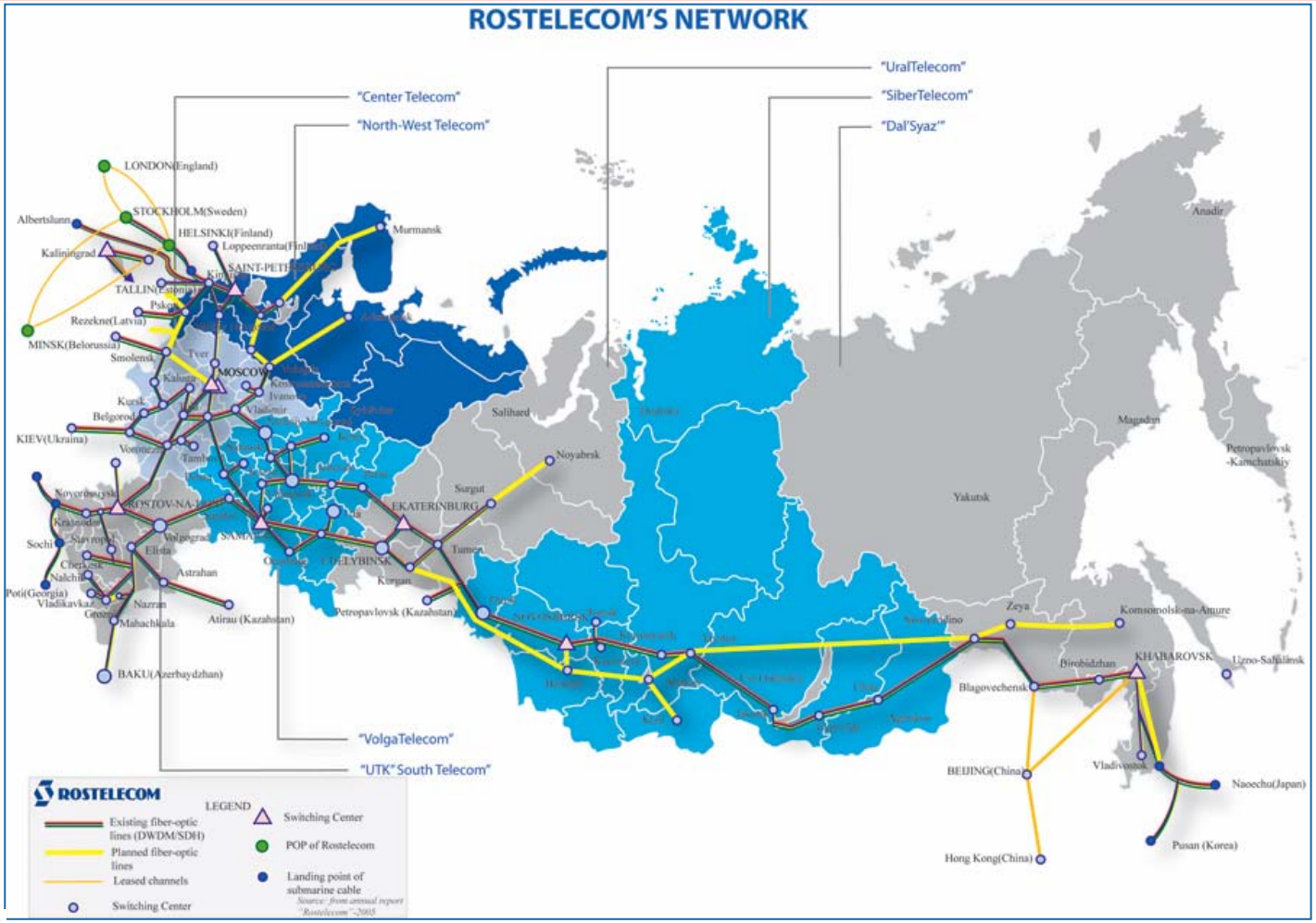
Rostelecom network
Today



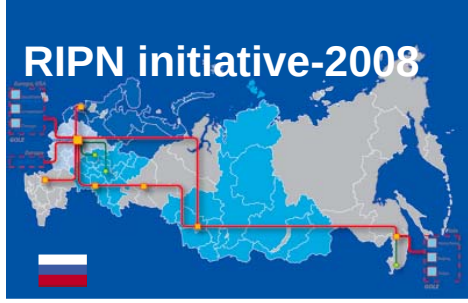


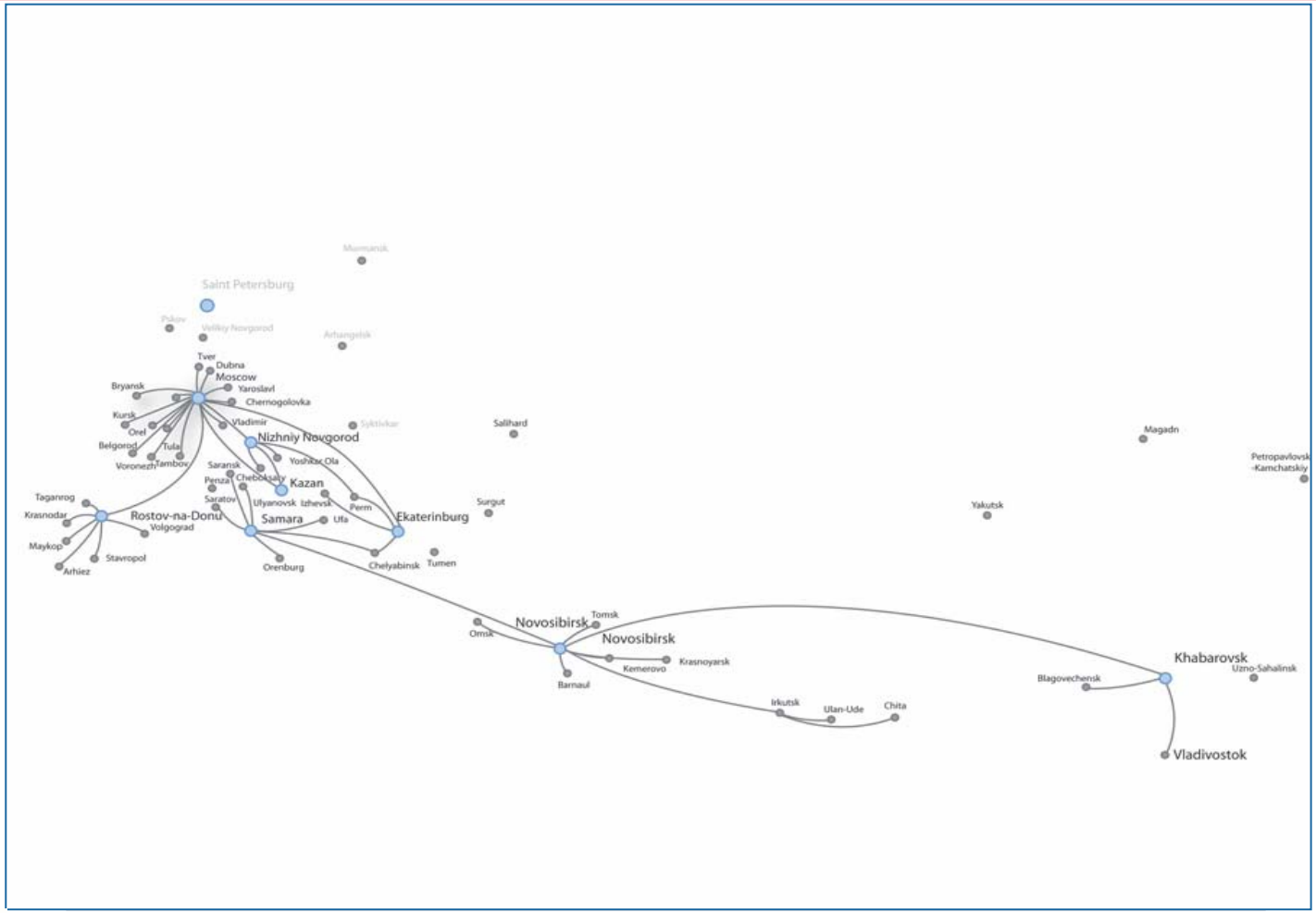
Rostelecom network
Plan



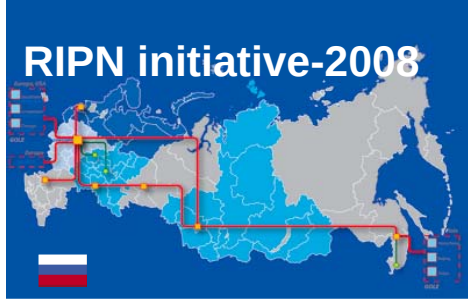


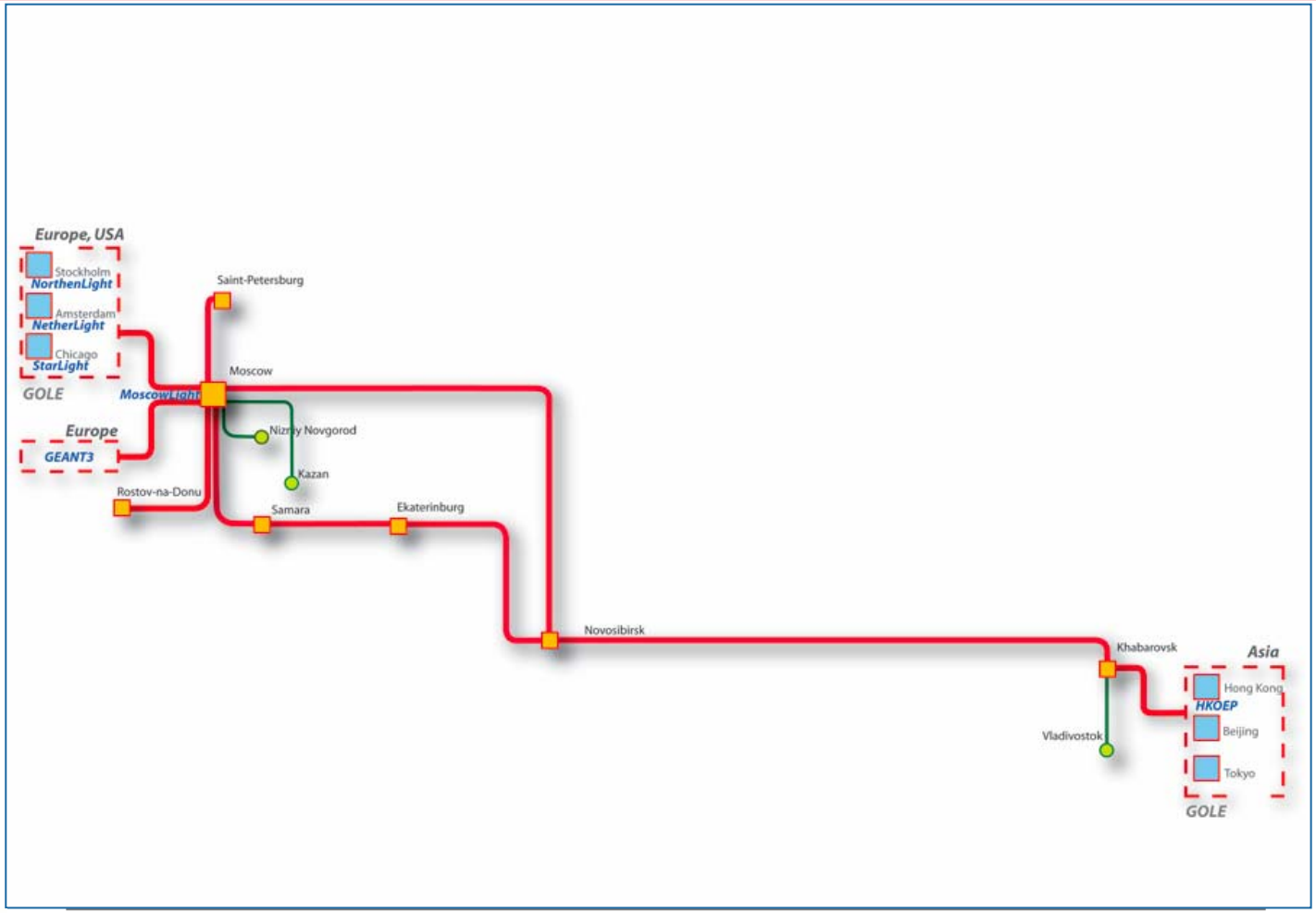
Russian R&E
IP Backbone Network



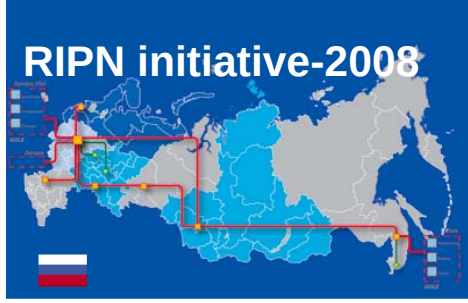


Russian R&E
Optic Backbone Network.
RIPN-Initiative-2008



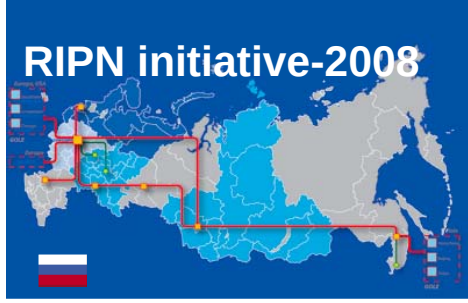


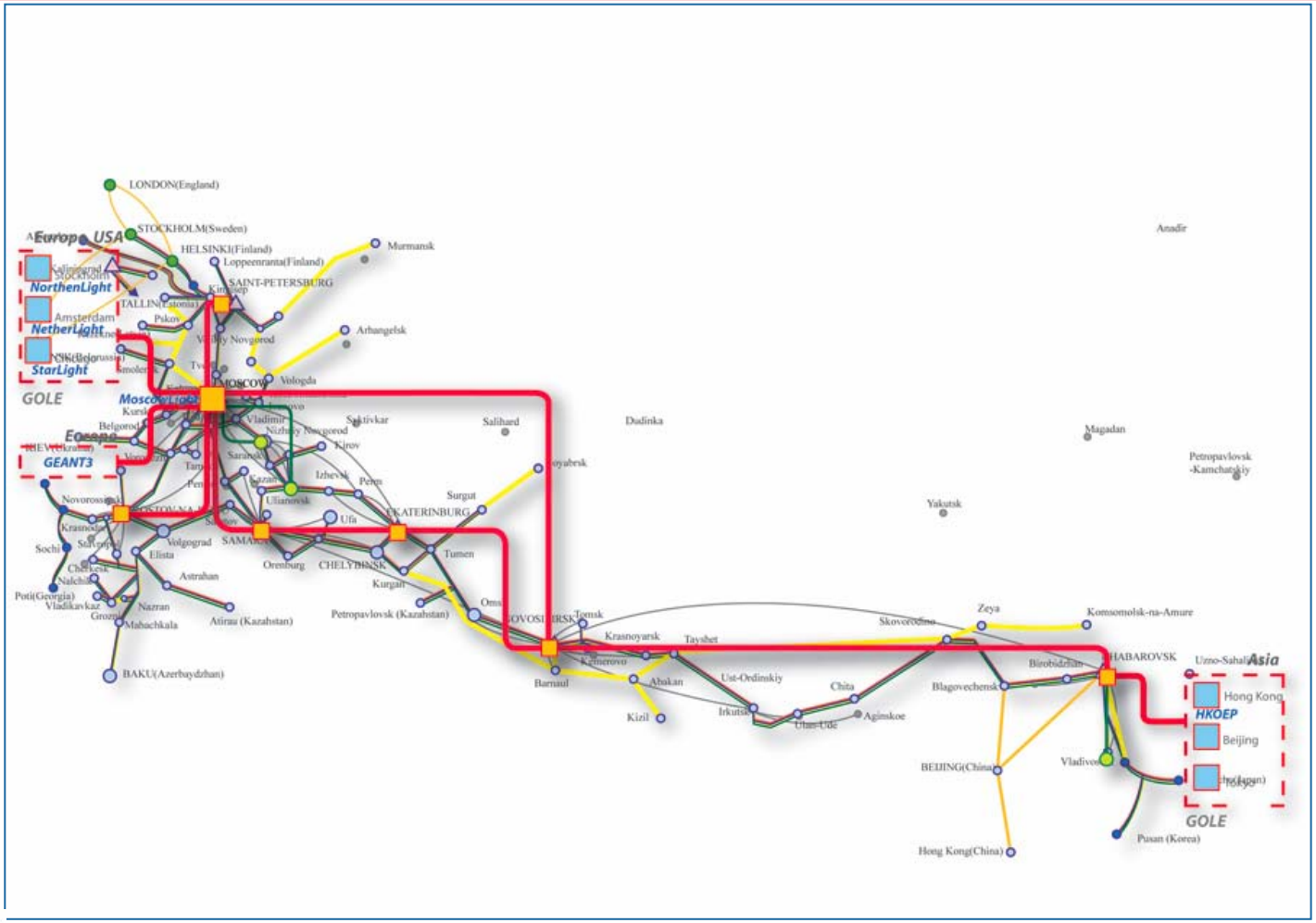
Russian R&E
IP and Optic Backbone Network.
RIPN-Initiative-2008



ROSTELECOM and Russian R&E IP and Optic Backbone Network.

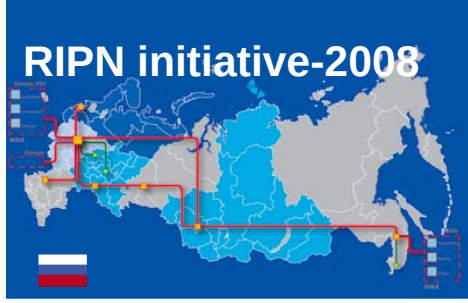
RIPN-Initiative-2008

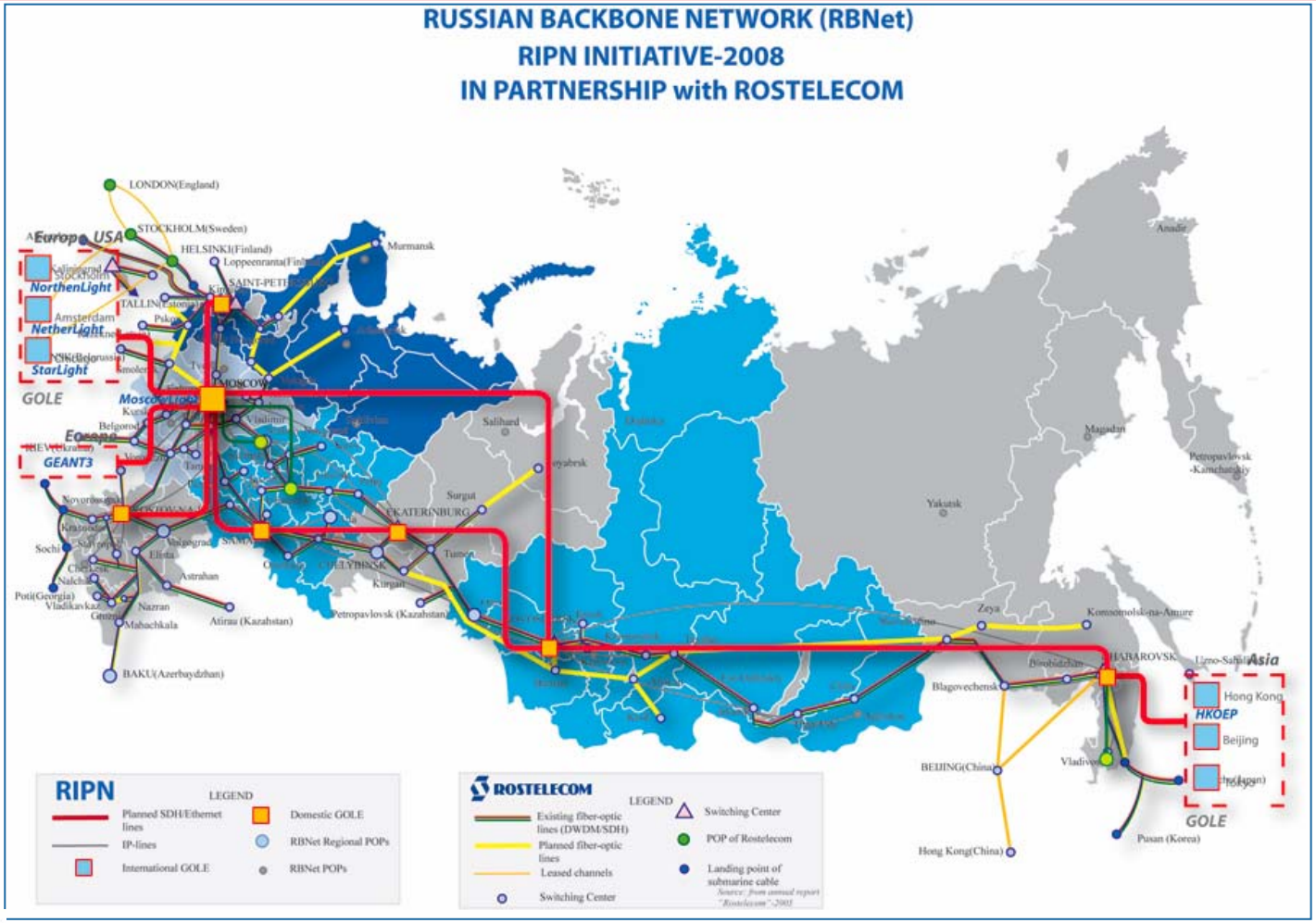




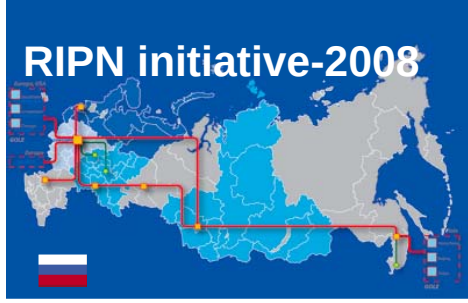
ROSTELECOM and Russian R&E IP and Optic Backbone Network

RIPN-Initiative-2008

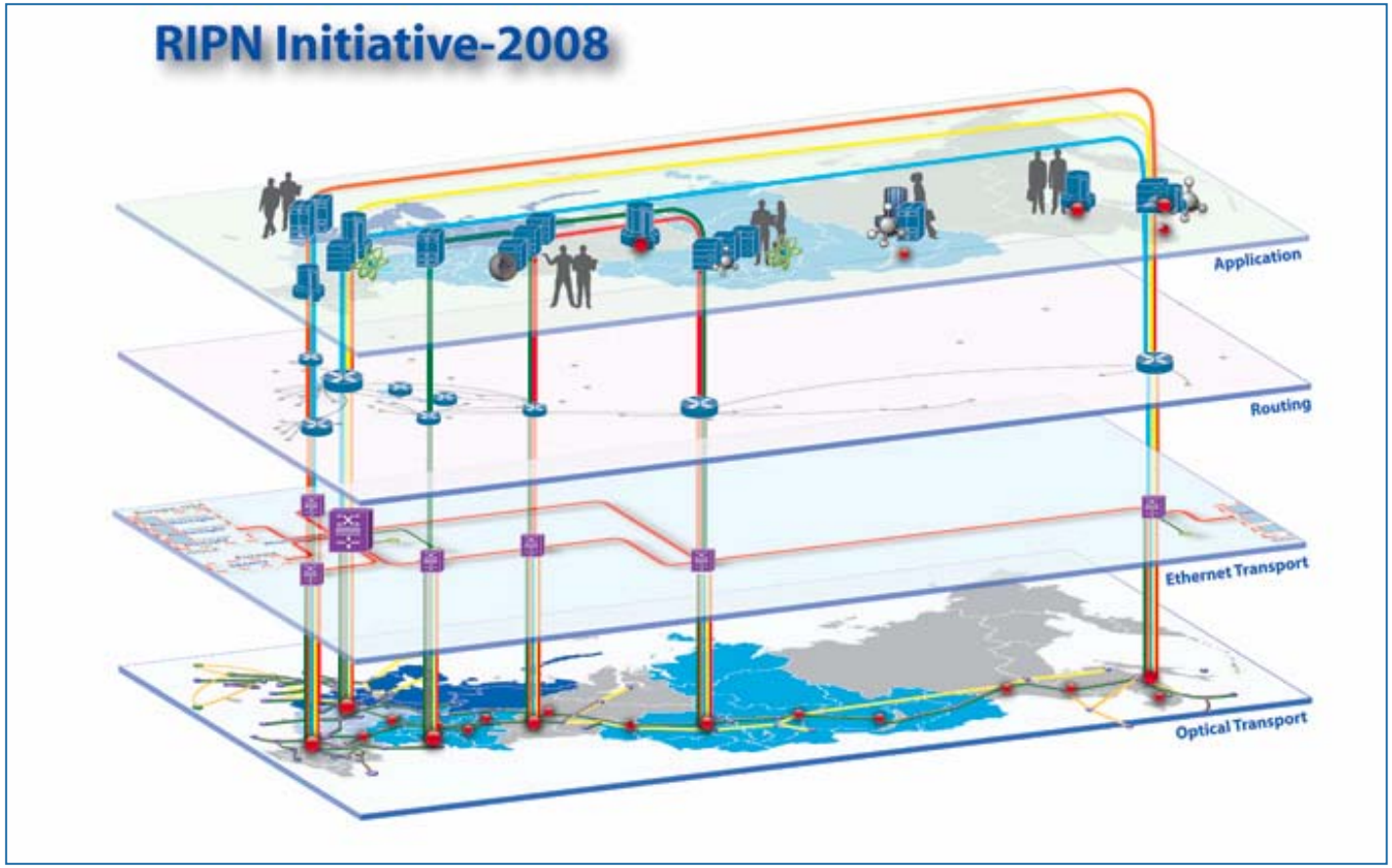




RIPN in partnership with ROSTELECOM.



Advanced Networking infrastructure for the National Large scale science application.



Science Projects

- RGRID
- SKIF-GRID
- DEISA
- eEarth
- ATLAS
- CMS
- AMS
- IMIS
- DIMOL
- SABR
- THORPEX
- IDEAS
- IVOA
- LHCB
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- ITER
- LCG
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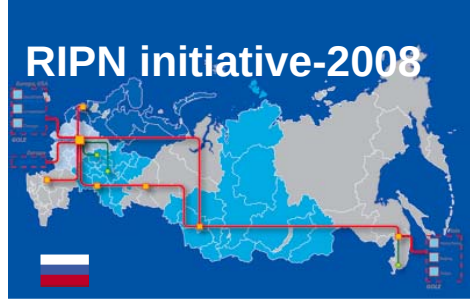
- EGEE

RIPN in partnership with ROSTELECOM. Layer 1

Advanced Networking infrastructure for the National Large scale science application.



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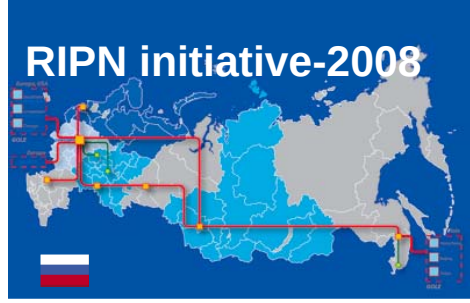
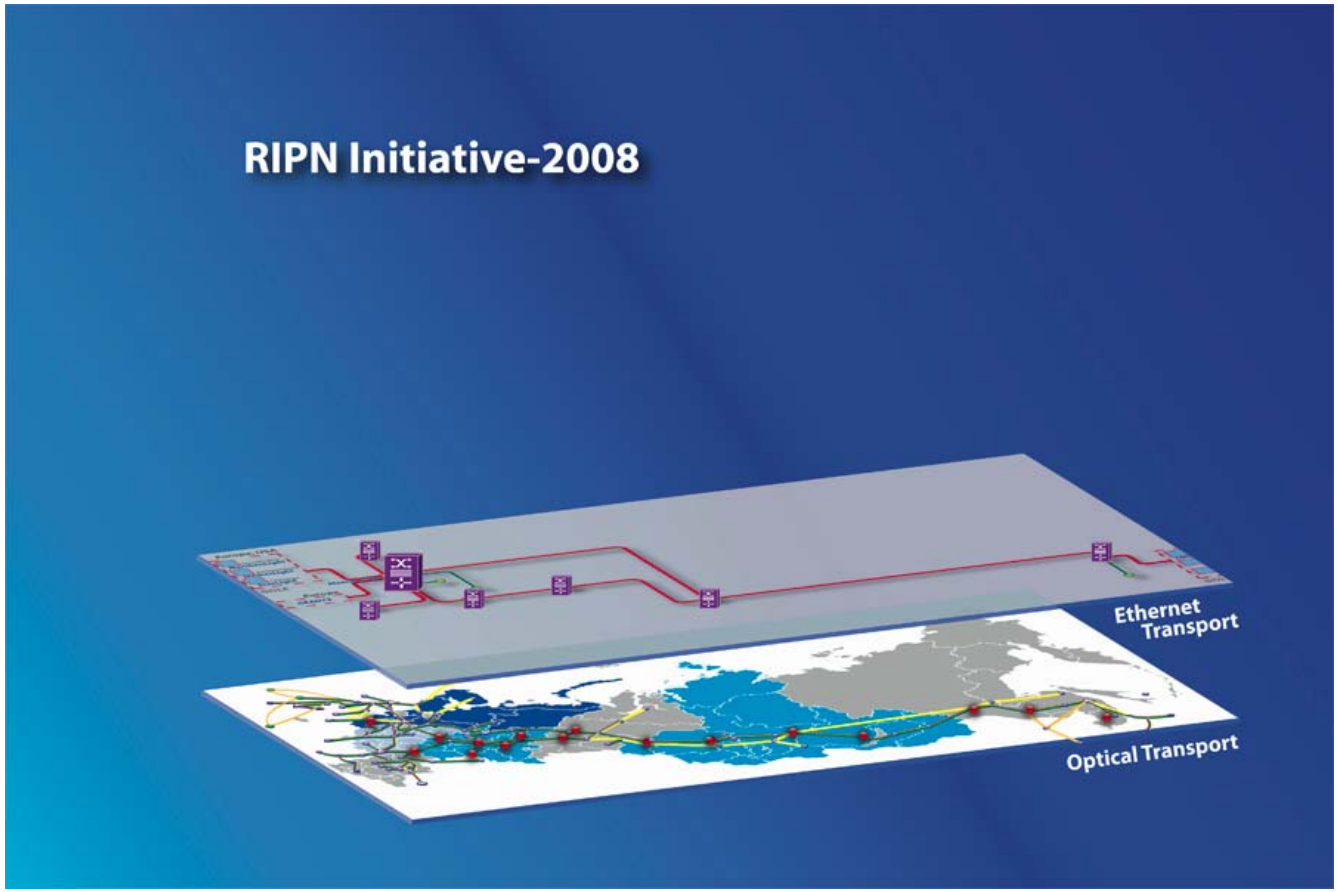
RIPN in partnership with ROSTELECOM. Layer 2

Advanced Networking infrastructure for the National Large scale science application.





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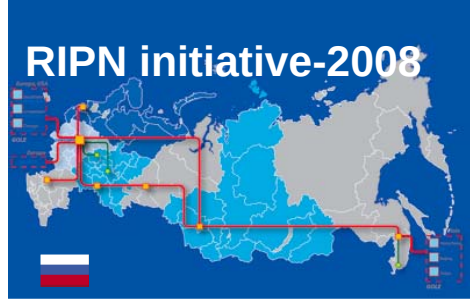
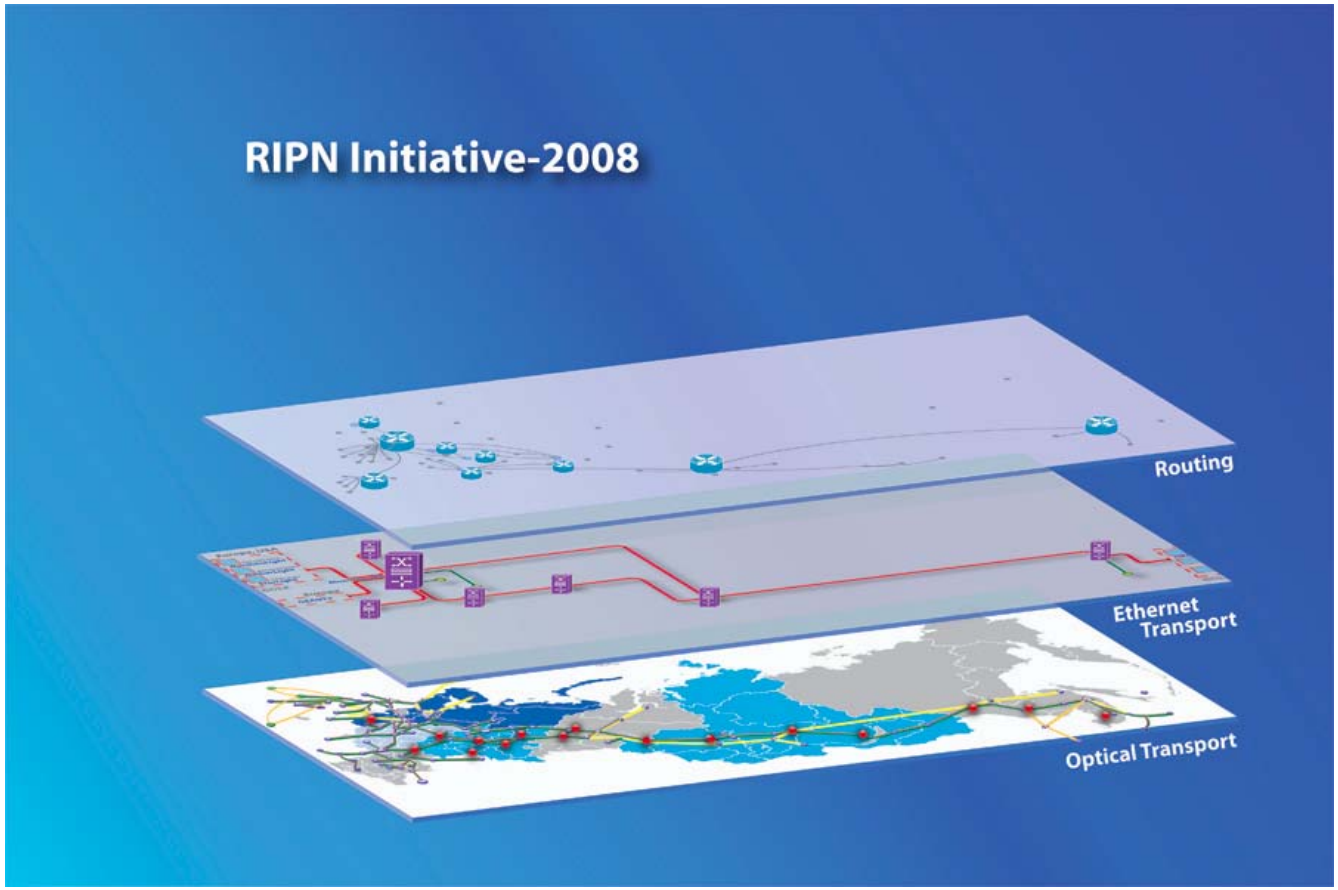
RIPN in partnership with ROSTELECOM. Layer 3

Advanced Networking infrastructure for the National Large scale science application.





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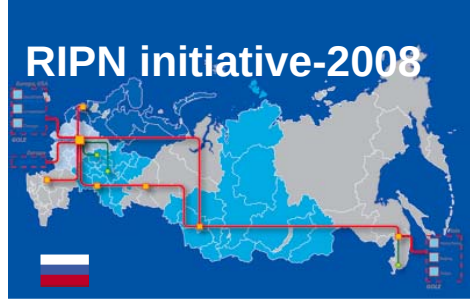
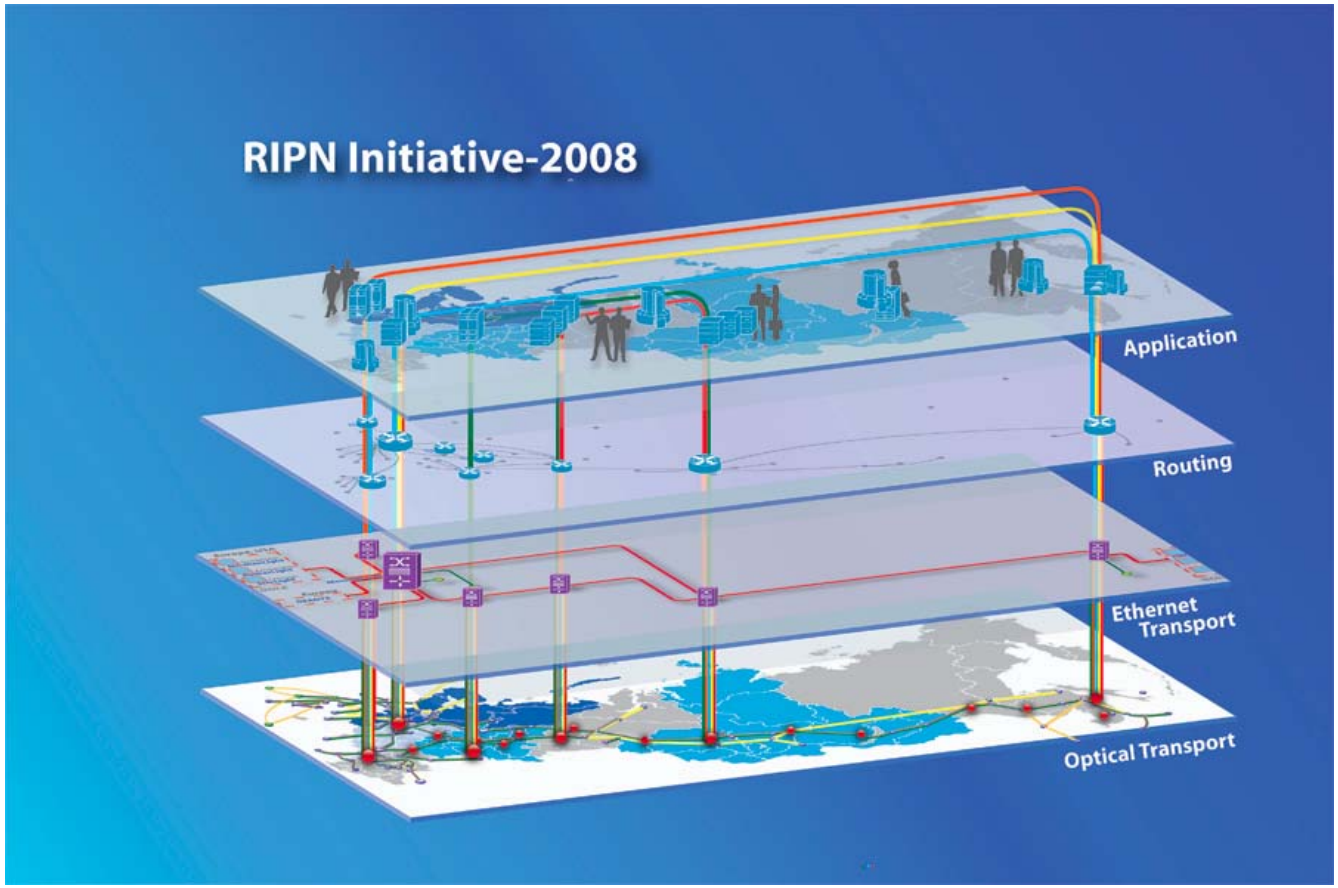
RIPN in partnership with ROSTELECOM. Layer 4

Advanced Networking infrastructure for the National Large scale science application.





Science Projects

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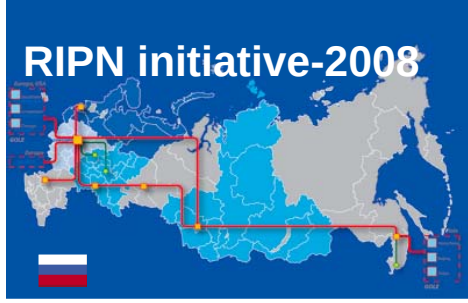
RIPN in partnership with Regions.



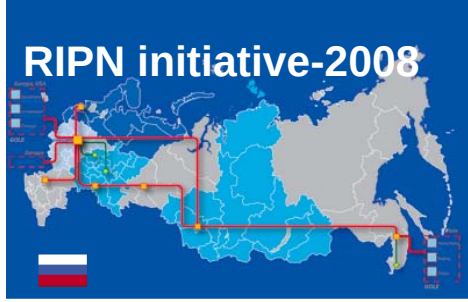
Russian Federation is a country of **widely** distributed scientific, industrial and urban centers.

It's strategically important to build the **partnership with regional government**, business, regional research networks and institutions across the country to provide Russian researchers with a state-of-the-art network infrastructure to support advanced collaboration within Russia and around the world.

Organizing a **process** of **disseminating and developing of the** advanced networking technologies in a Regions

RIPN in partnership with Regions. Moscow Region. NOLE Cities

Advanced Networking infrastructure for the National Large scale science application.

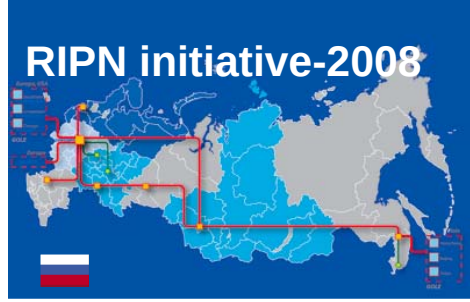


City	Research Organization	University
Moscow region	1041	583
Moscow	1200	767
St.Petersburg	2071	458
Ekaterinburg	171	109
Novosibirsk	46	92
Rostov-na-Donu	189	89
Khabarovsk	30	34
Samara	169	114
Kazan	180	69
Nizniy Novgorod	95	97
Vladivostok	46	173

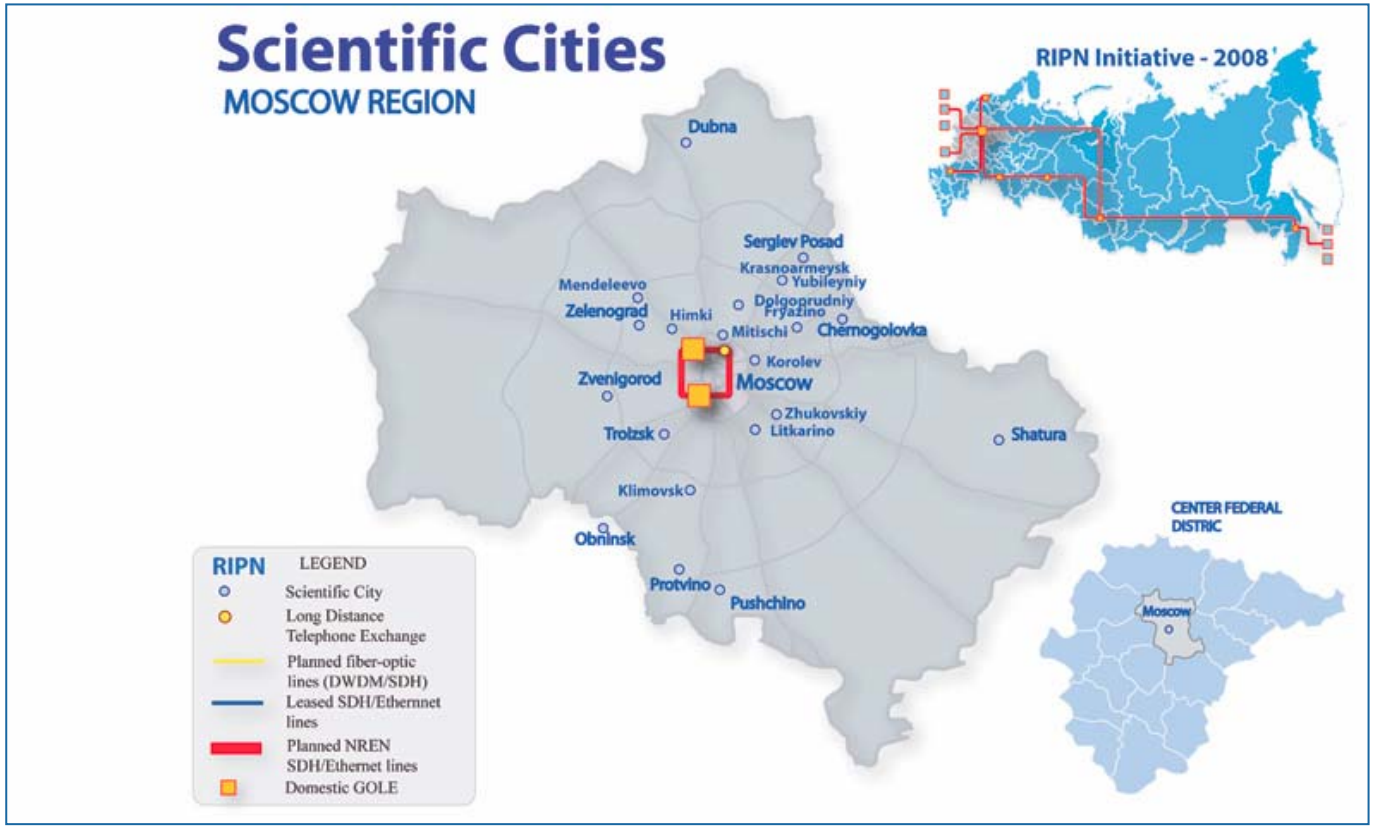
Source: http://www.yellow-pages.ru

RIPN in partnership with Regions. Moscow Region.

Advanced Networking infrastructure for the National Large scale science application.



Russian Federation have 73 Scientific Cities, and 28 of them are located in Moscow Region



Moscow

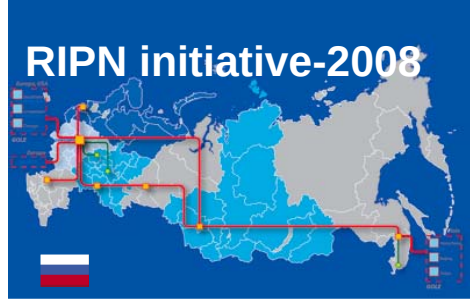
Universities	583
Research Organization	1041

Moscow Region

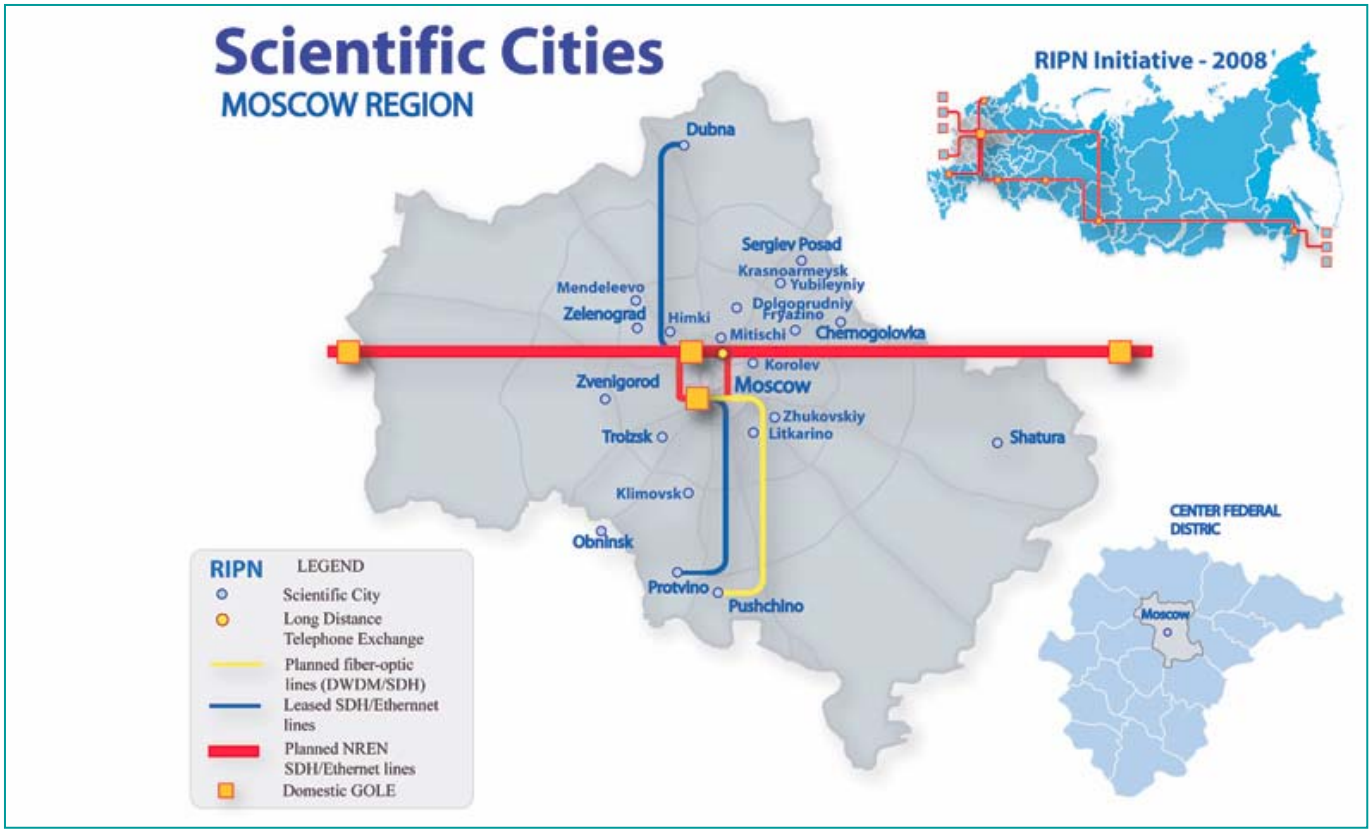
Universities	1200
Research Organization	767

RIPN in partnership with Regions. Moscow Region. *High Energy Physics*

Advanced Networking infrastructure for the National Large scale science application.



Moscow

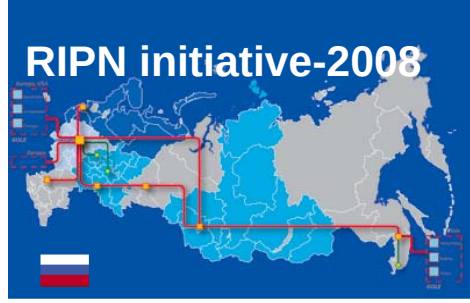


Russia in World-wide LHC Computing Grid

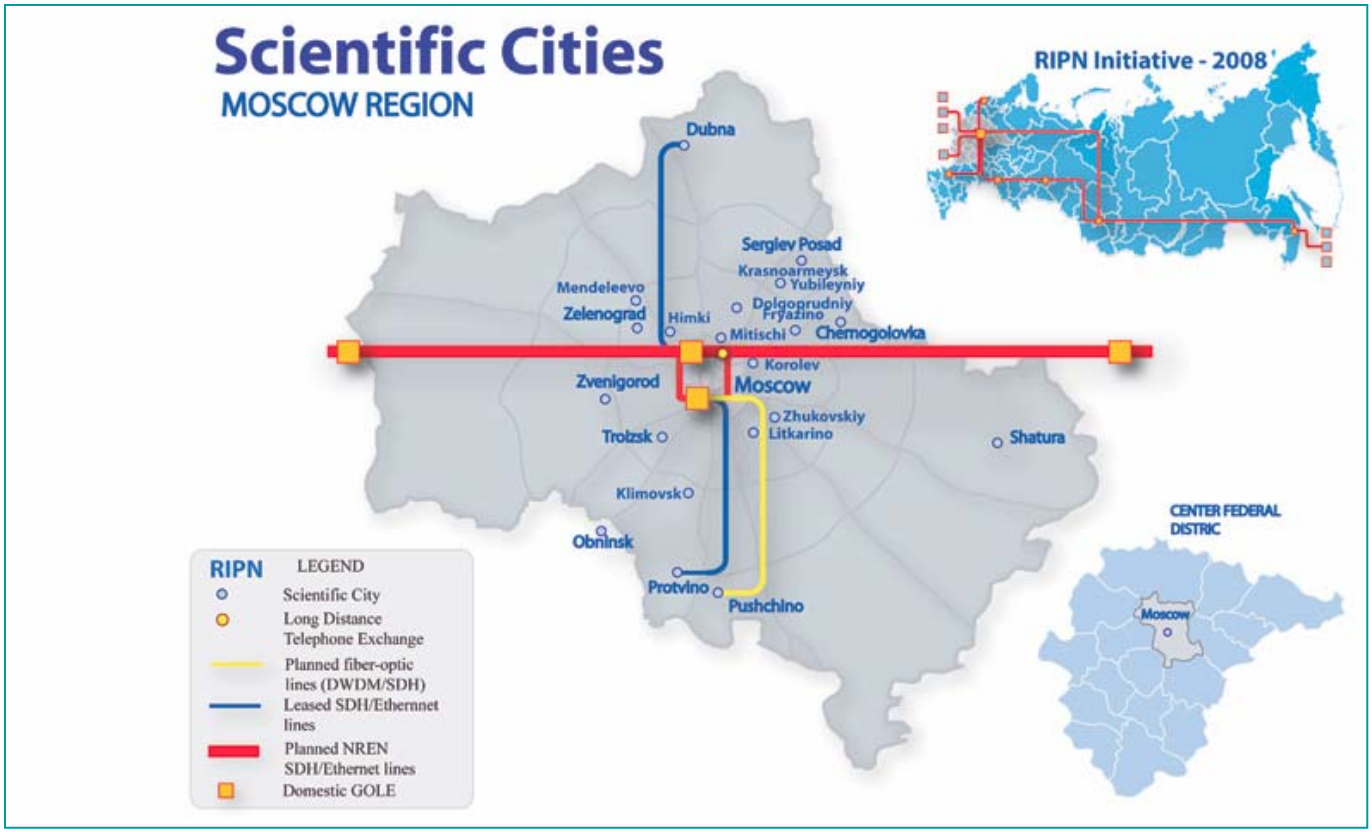
Moscow (plans 10Gps)	**ITEP, RRC KI, SINP MSU, …LPI, MEPhI**
Protvino (plans 1Gbps)	**IHEP**
Dubna (plans 10Gbps)	**JINR**
Novosibirsk (100Mbps now)	**BINP**
Troisk (100Mbps now)	**INR RAS**
Gatchina (Plans 1 Gbps)	**PNPI**
S-Peterburg 1Gbps now	**SPbSU**

RIPN in partnership with Regions. Moscow Region. *High Energy Physics*

Advanced Networking infrastructure for the National Large scale science application.



Moscow



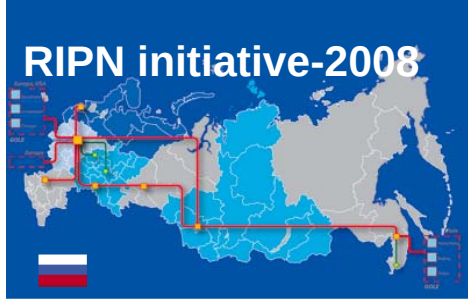
RDIG

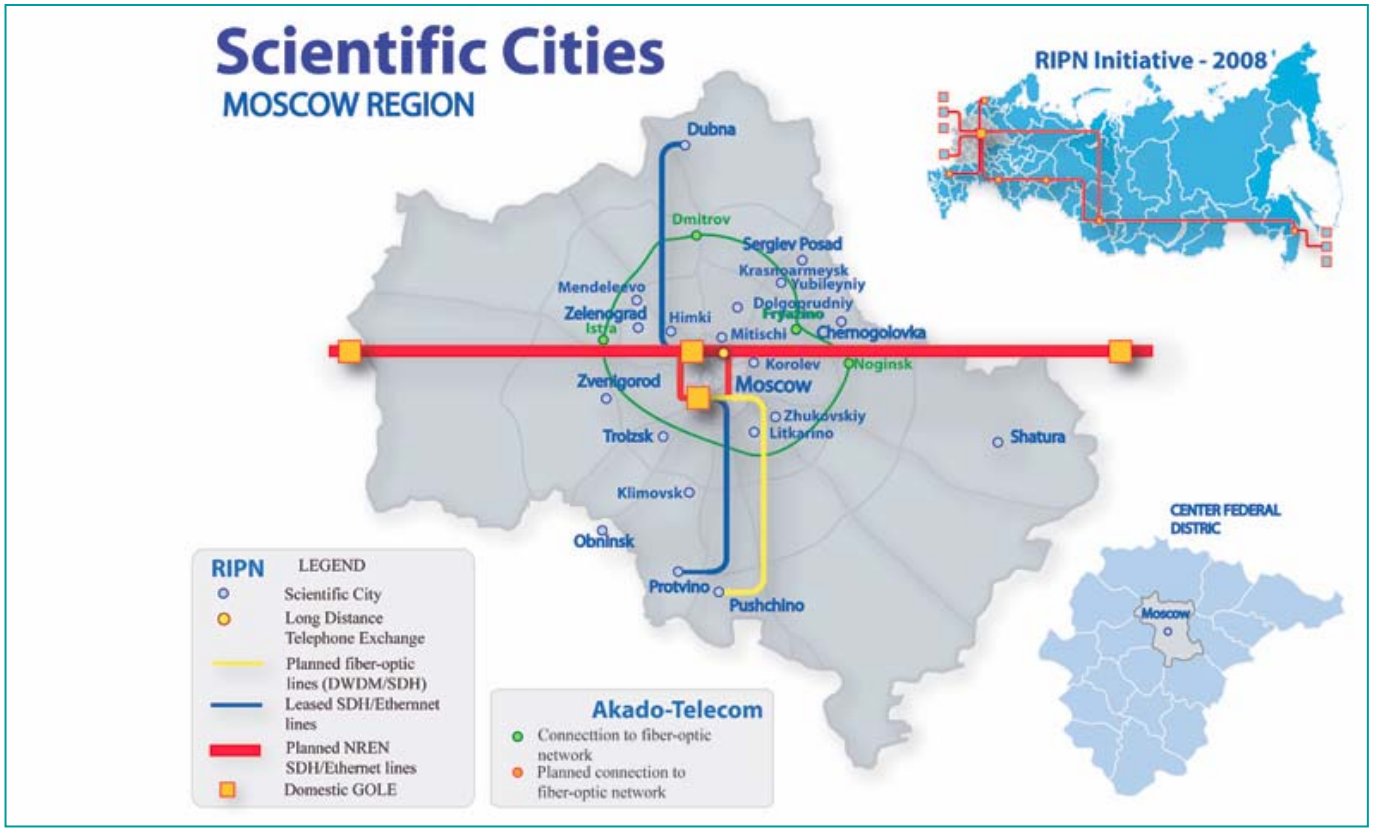
The Russian consortium RDIG (Russian Data Intensive Grid, http://www.egee-rdig.ru) was established in September 2003 to create a Grid infrastructure for the intensive processing of research data.

Such infrastructure has been requested by Russian scientists to be able to participate in experiments in High Energy PhysicsLHC experiments (http://www.cern.ch/LHC), and in Biomedicine and Earth Science as two other pilot applications.

RIPN in partnership with Regions. Moscow Region. *Acado's existed optical network.*

Advanced Networking infrastructure for the National Large scale science application.



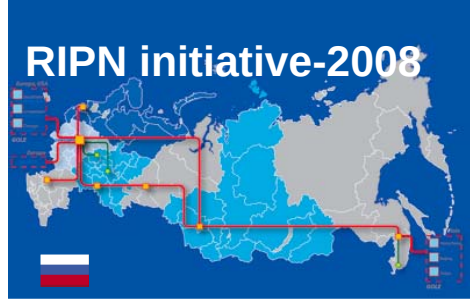


In Moscow Region there is a tendency for Research organizations/or Scientific cities to constructing, buying, or renting "dark Fiber".

In Moscow Region there are many telecommunication companies that have had or is constracting own opticl channels.

RIPN in partnership with Regions. Moscow Region. *Acado's planed optical network*

Advanced Networking infrastructure for the National Large scale science application.

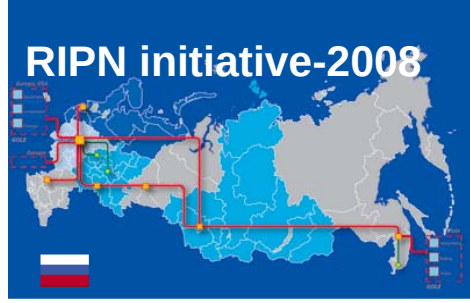


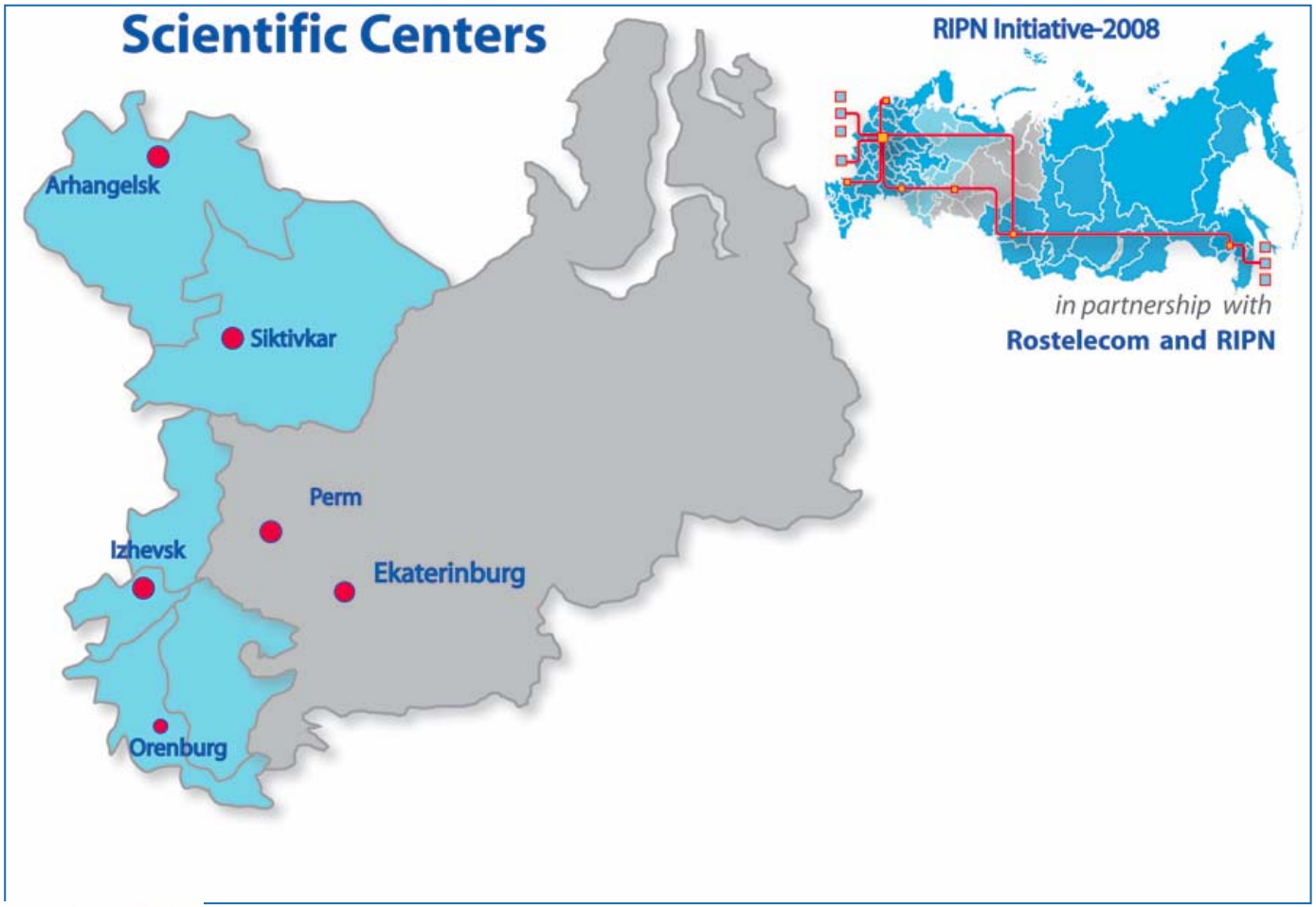
Example: "AkadoTelekom" The Telecommunication company of Moscow Region and the technological leader on the telecommunication market.

"AkadoTelekom" provides all spector of modern telecommunication services based on the own fiber-optical network with length more then 18 000 km

RIPN in partnership with Regions. URAL Region. Scientific Centers.

Advanced Networking infrastructure for the National Large scale science application.





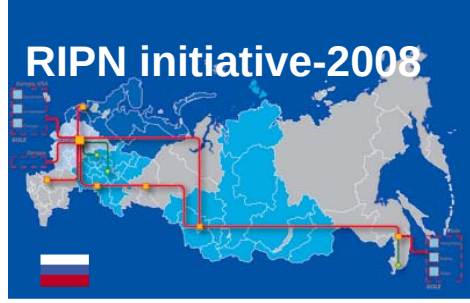
Ural Branch, RAS have 38 research institutions, large scientific library, supporting research and design organization, establish Scientific Centers at Ekaterinburg, Siktivkar, Izevsk, Perm, Chelyabinsk, Arhangelsk and Orenburg.

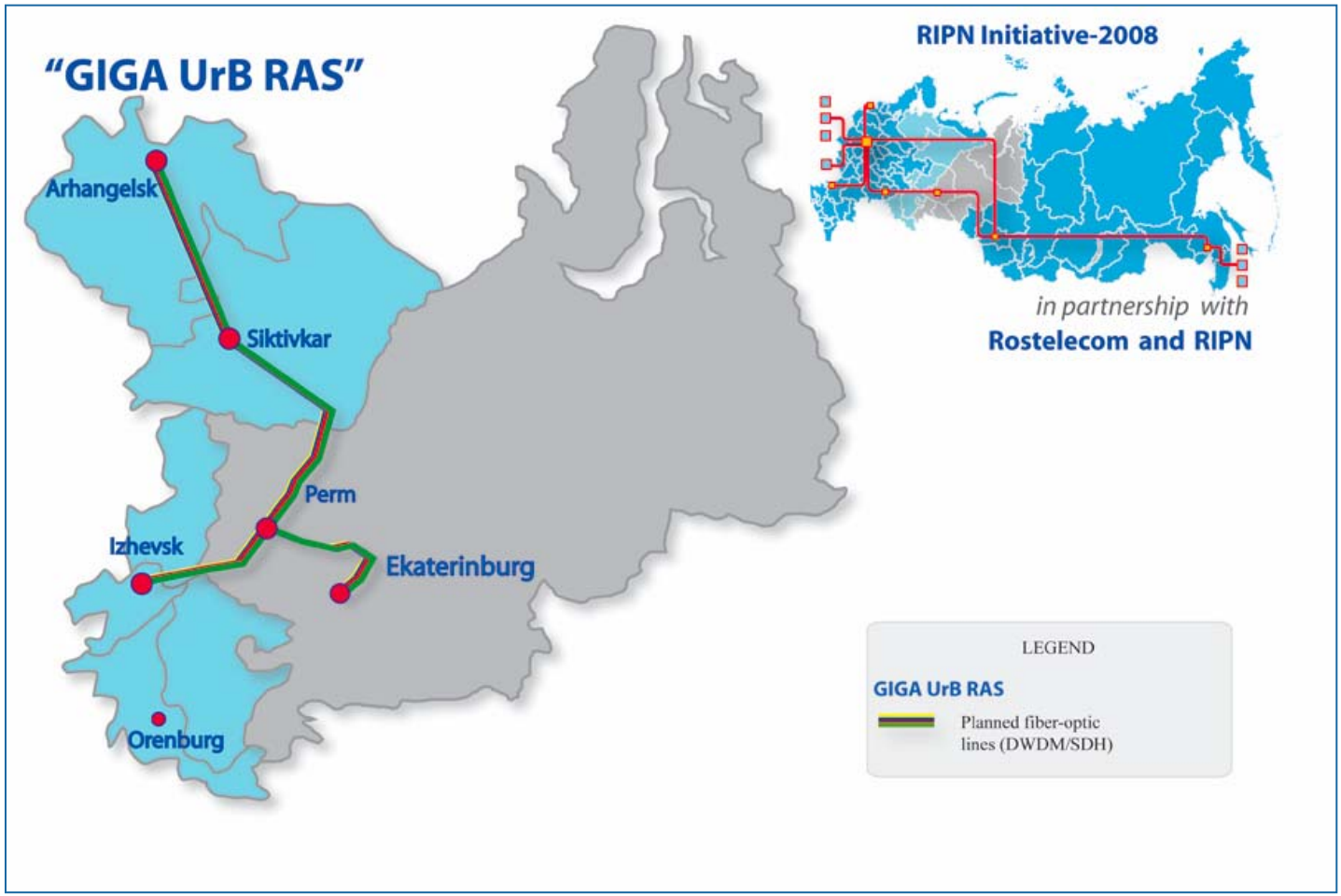
Ural Branch, RAS has 3600 researchers. 590 hold the degree of Doctor of Sciences and 1750 hold the degree of Candidate of Sciences. 31 are members of the Russian Academy of Sciences, and 58 are corresponding members.

SOURCE: http://www.uran.ru/

RIPN in partnership with Regions. URAL Region. GIGA UrB RAS.

Advanced Networking infrastructure for the National Large scale science application.





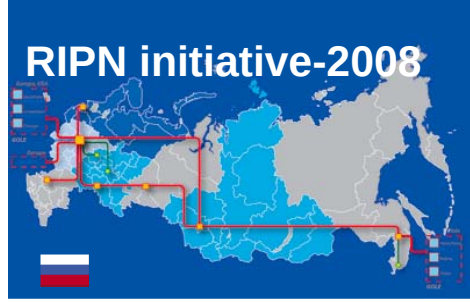
"GIGA Ur RAS" Initiative is oriented toward of using **"dark optical fiber"** for interconnecting Scientific Centers of Ural Branch, RAS.

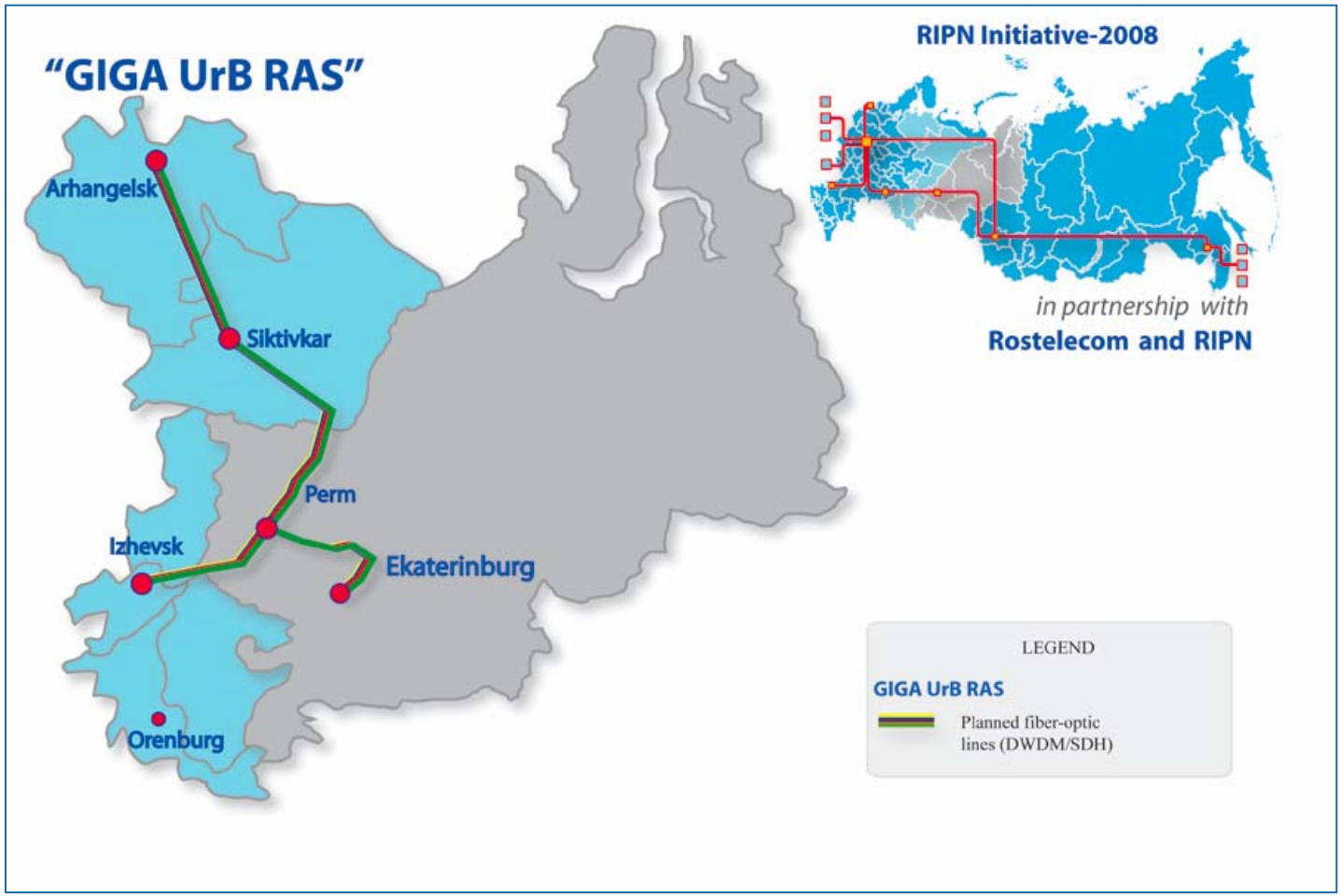
The goal of the program is to interconnect the POPs of the optical networks of the **Scientific Centers at Ekaterinburg, Perm, Izhevsk, Siktivkar, and Arkhangelsk.**

The project will provide **1200 kilometers of dark optical fiber** between 5 Scientific Centers of Ural Branch, RAS. The architecture of the network implies of using IP and Gigabit Ethernet.

RIPN in partnership with Regions. URAL Region. GIGA UrB RAS.

Advanced Networking infrastructure for the National Large scale science application.





The **Financial** support is provided by the **Regional Program** of The Ural, RAS

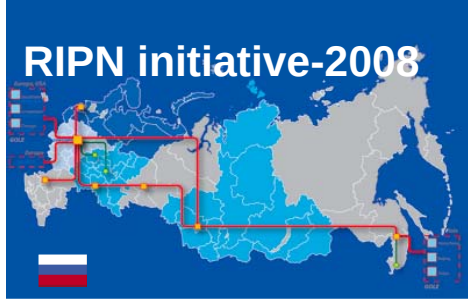
The **coordination** of the work is carried out by Joint Science Committee on Mathematics, Mechanics, and Informatics

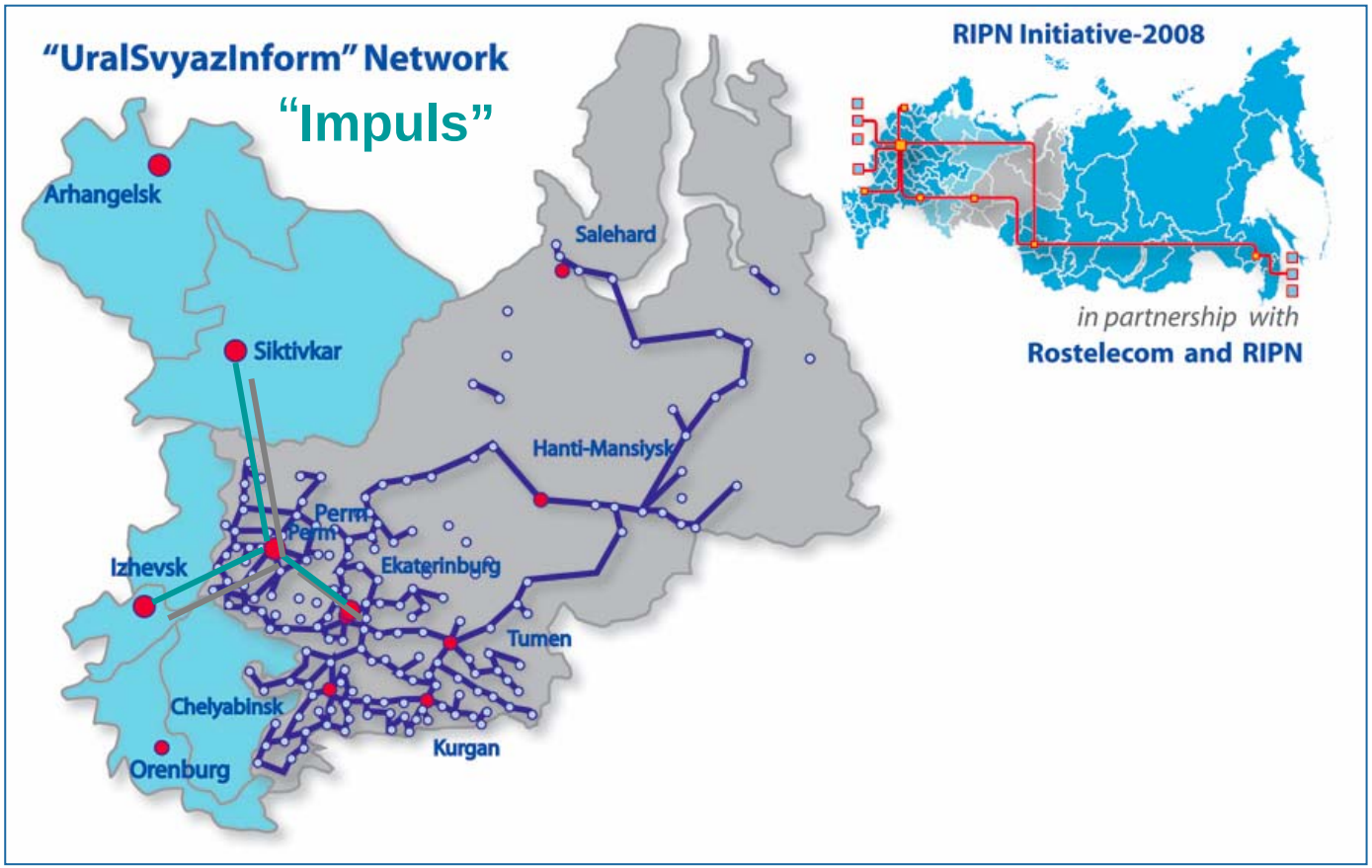
The mission of The **Regional Program** is to provide sustainability of cyberinfrastructure of Ural Branch, RAS.

RIPN in partnership with Regions.

URAL Region. UralSvyazInform existed Network.

Advanced Networking infrastructure for the National Large scale science application.





Federal District and Perm Krai (region)

Territory — 1.9 mln sq. km

Population — 15.3 million (9% of Russia's population)

Urban population — 80%.

Gross regional product in 2005 — US$ 108.3 billion (21% of Russia's total)

Oil (65% of national oil resources / 6% of world reserves)

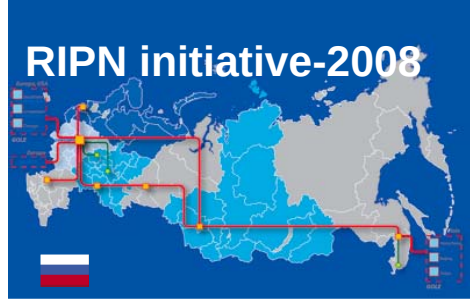
Gas (95% of national reserves / 26% of world reserves)

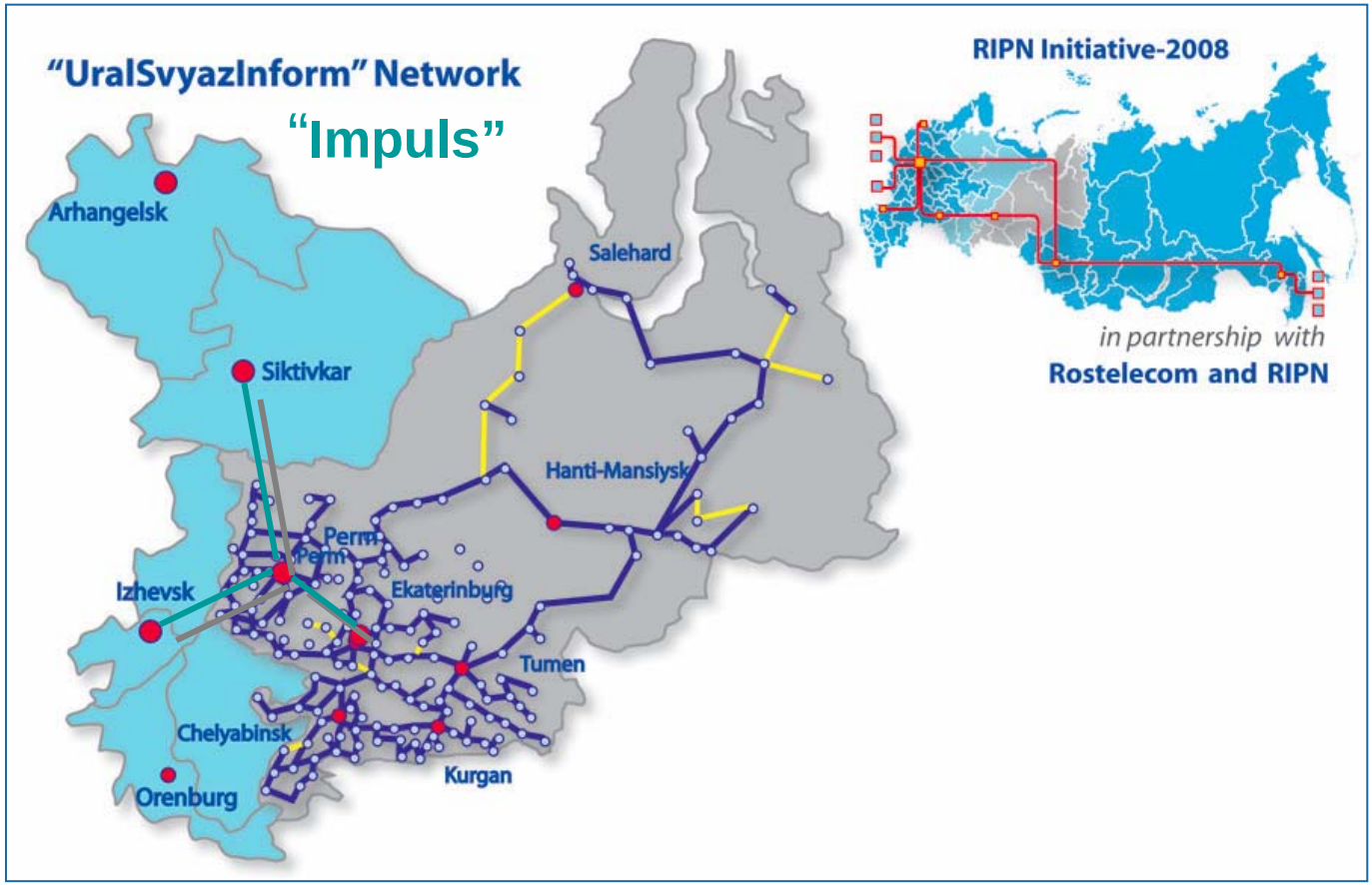
Sources:http://www.usi.ru/

RIPN in partnership with Regions.

URAL Region. UralSvyazInform Planed Network.

Advanced Networking infrastructure for the National Large scale science application.





Quick Facts

Name Uralsvyazinform, Open joint-Stock Company

The leading carrier of telecommunications services in the Urals region;

Number of employees — 26.7 thousand;

Market capitalization — USD 2.3 billion.

Regional company (in Perm):

Name "Impuls"

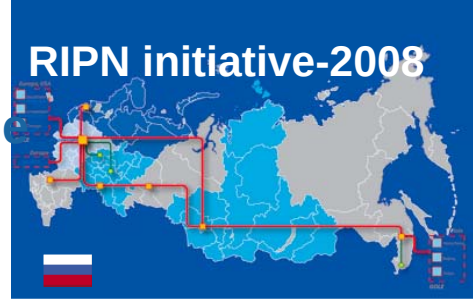
(construction fiber optic channels, telecommunication

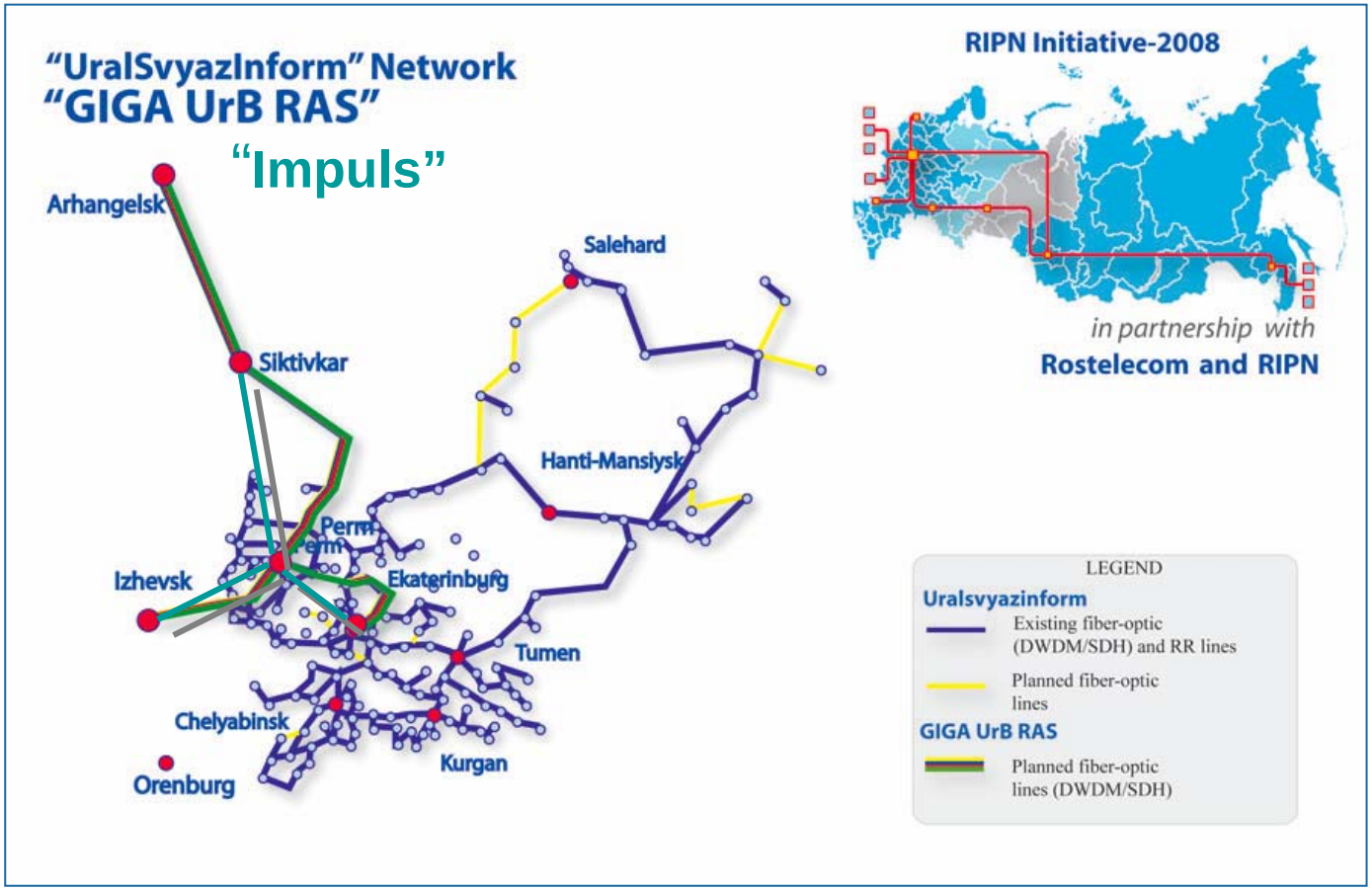
Sources:http://www.usi.ru/

RIPN in partnership with Regions.

URAL Region. UralSvyazInform and GIGA Initiative backbone

Advanced Networking infrastructure for the National Large scale science application.





"Dark fiber" (~1200 km) to connect five Scientific Centers:

- Arhangelsk
- Siktivkar
- Izhevsk
- Perm
- Ekaterinburg

RIPN in partnership with Regions.

URAL Region. UralSvyazInform, GIGAUrB RAS, RIPN-Initiative

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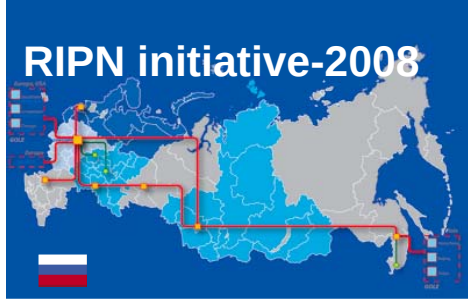
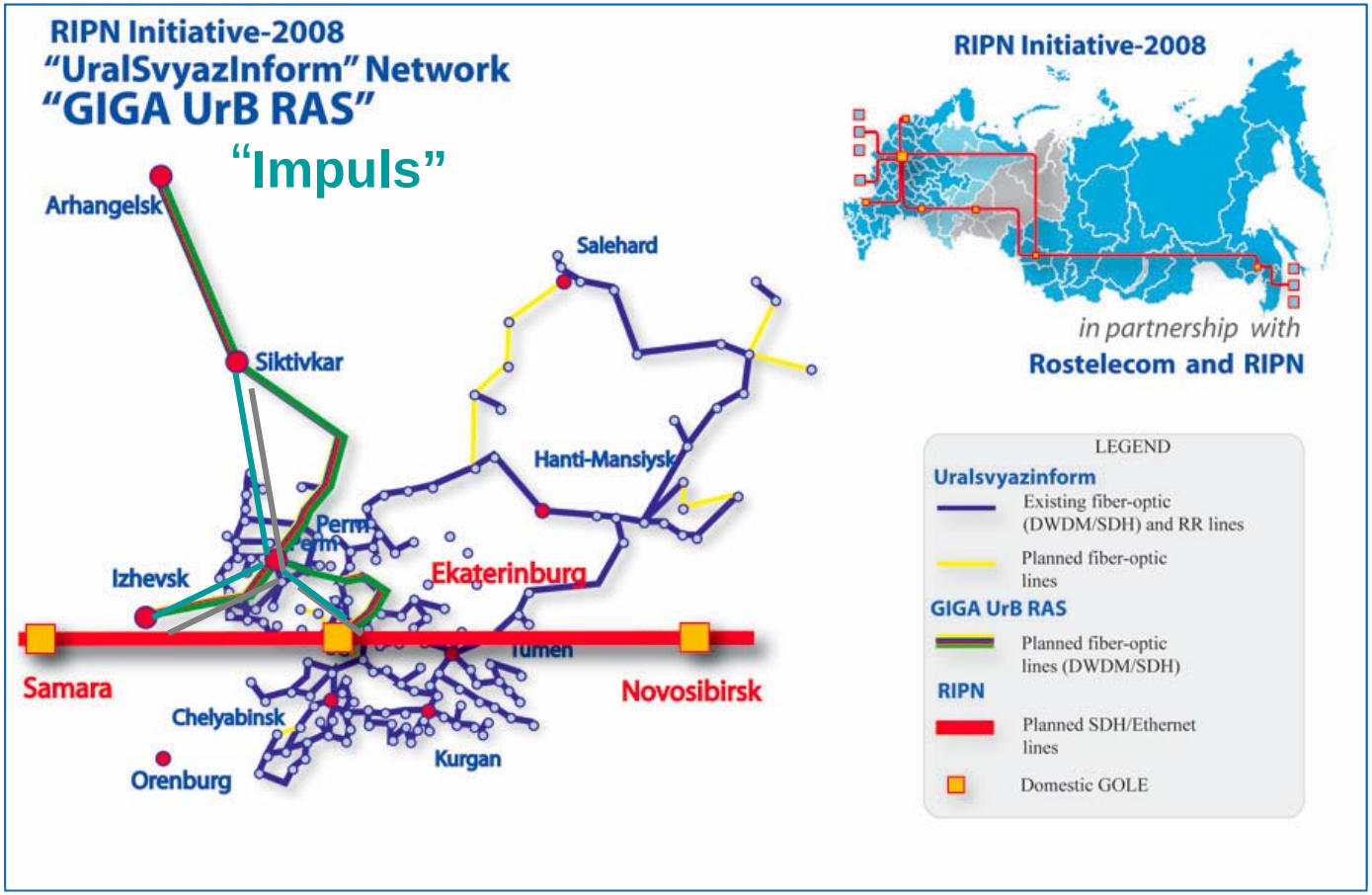


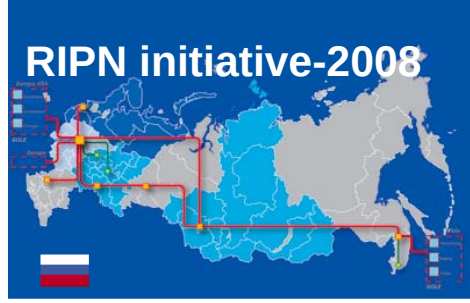


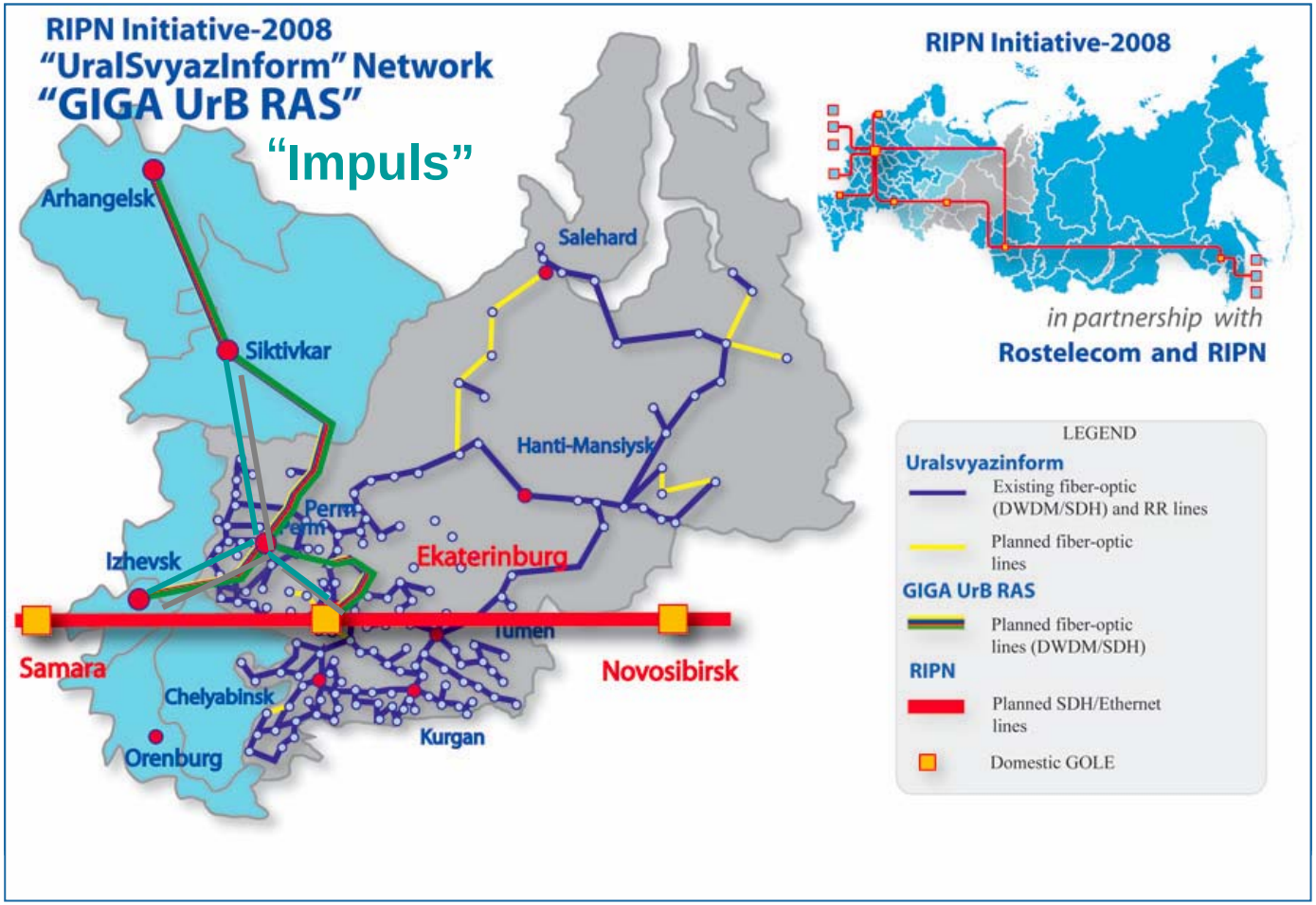
National Advanced High Performance Telecommunication Network (RIPN-Initiative) in partnership with Regional Networks is the basis for National e-Infrastructure

RIPN in partnership with Regions Network.

URAL Region. UralSvyazInform, GIGA UrB RAS, RIPN-map

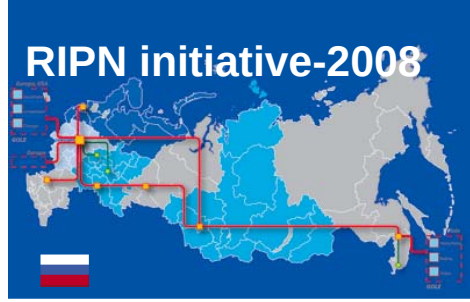
Advanced Networking infrastructure for the National Large scale science application.





The National Advanced High Performance Telecommunication Network connects a number of Universities, Research and Education DataCenters, High Performance Computers, as well as major scientific facilities, equipment, scientific collections and structured information to conduct leading-edge research

TEA (Rostelecom) and EurasiaHighwy (TransTeleCom)



TEA (Rostelecom)

Round trip delay	
Helsinki - Tokyo	137 ms
Helsinki- Beijing	141 ms
Helsinki- Hong Kong	169 ms
Stockholm -Hong Kong	176 ms
Availability End to End	99%

The agreement of construction and then servicing of the Russia- Japan CableSystem with capacity of 640 Gbps was signed by Rostelecom and KDDI in the end of 2006. The NEC Corporation has become a contractor of the Cable System. It is invested about $42,800,000 in the new network.

The length of the sea CableSystem between Nahodka (Russia) and Naoacsu (Japan) is about 1,800km, and the starting capacity will be 30 Gbps.

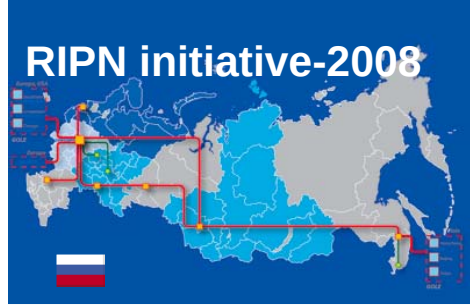
In July of 2008 Rostelecom and KDDI have completed the Cable System under Japan sea.

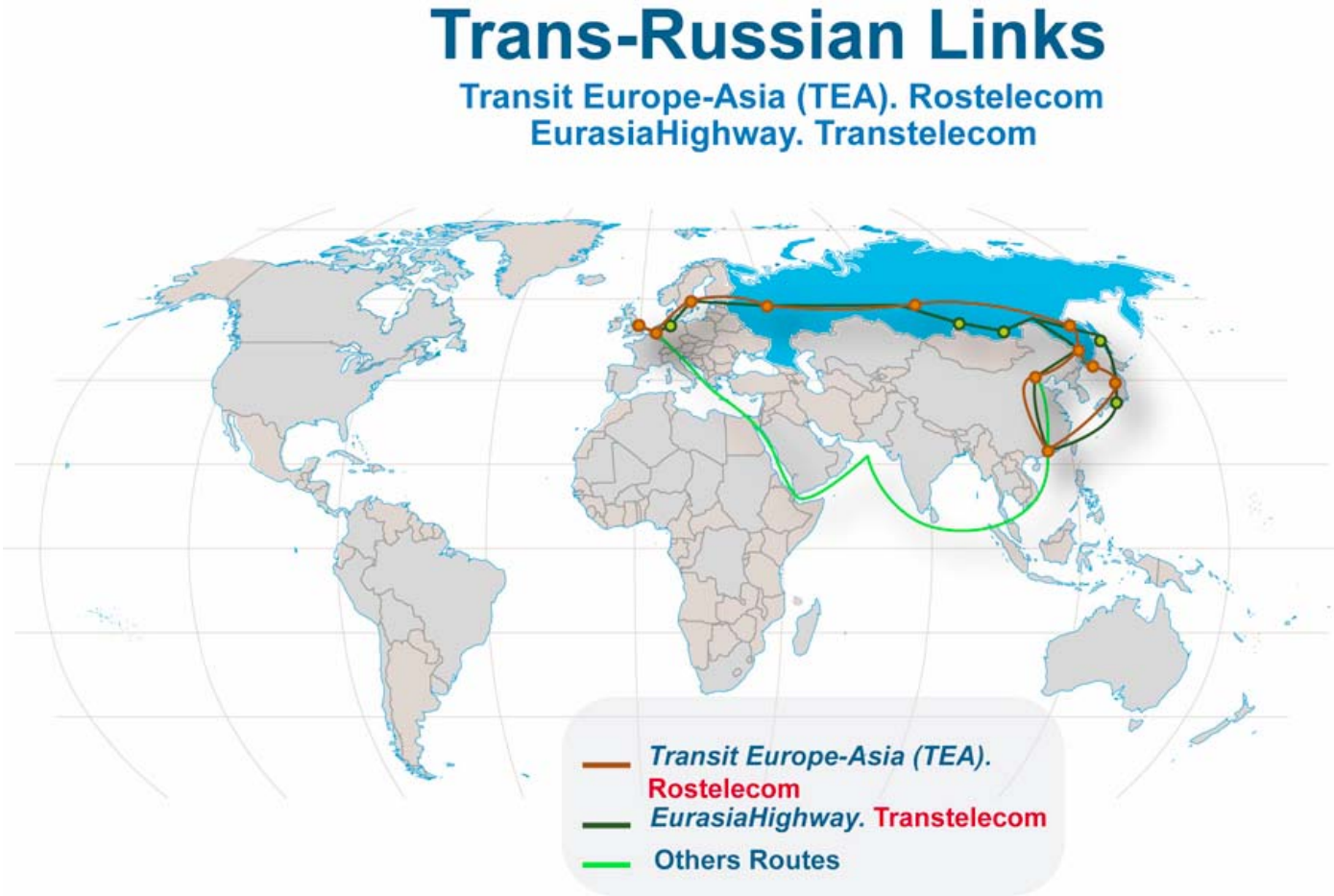
EurasiaHighway (TransTeleCom)

The Russian TransTeleCom Company and Japanese NTT Communications (NTTCom) have started commercial use of the undersea fiber-optical cable system Hokkaido-Sakhalin Cable System (HSCS) on the route between Nevelsk(Sakhalin, Russia) and Isicari (Hokkaido, Japan).

The length between Sakhalin and Hokkaido is 570 kilometers with capacity of 640 Gbps. the total investments into the project is about $50,000,000.

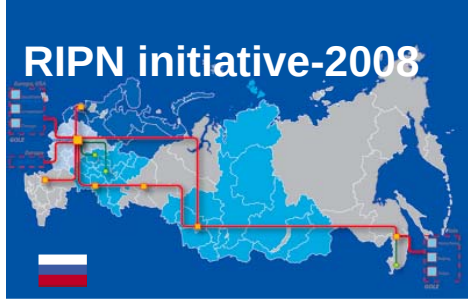
Advantages of Trans-Russian Link

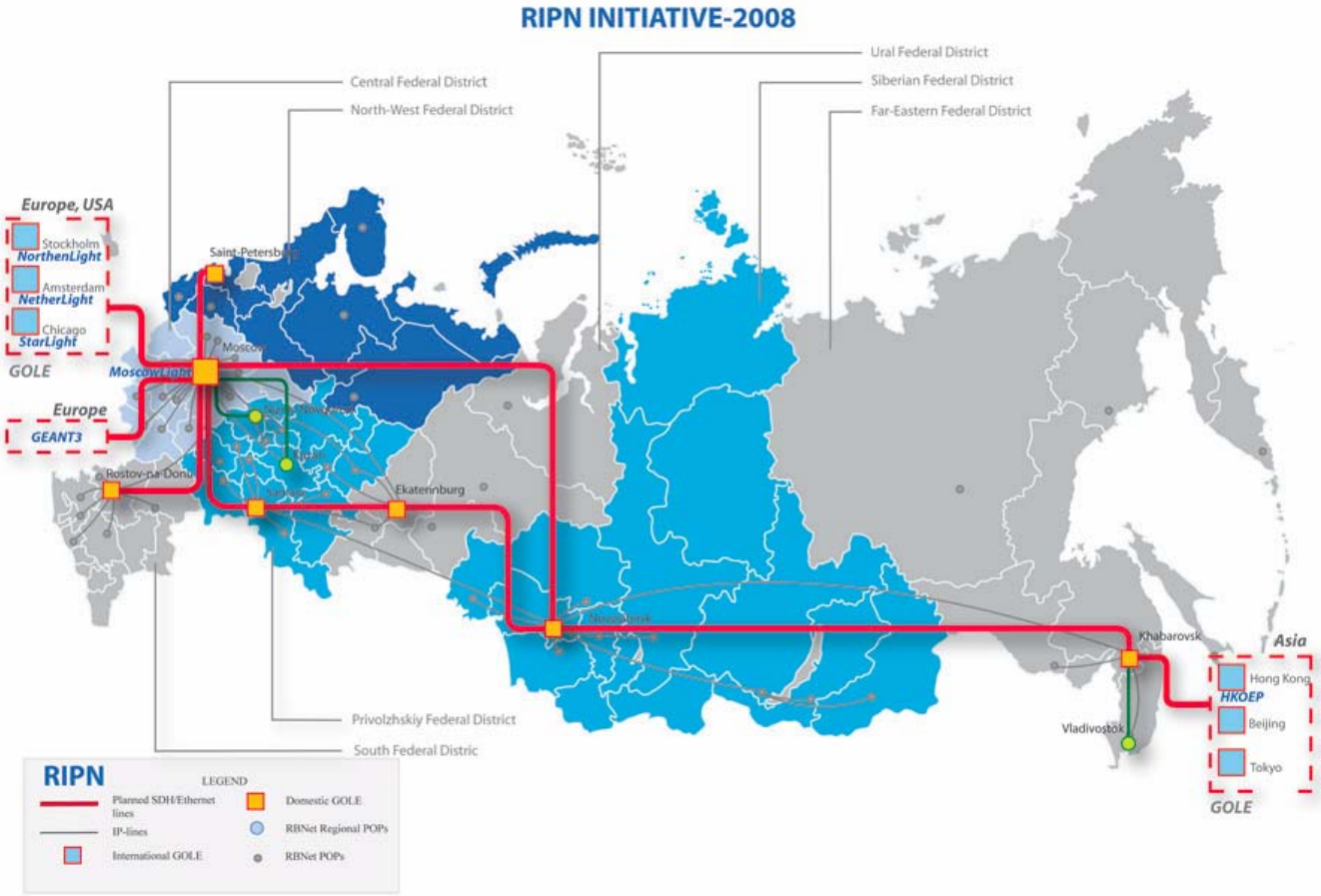




Transit via territory of Russia is *the shortest* route between Europe and Asia

Russian Institute for Public Network
RIPN - Initiative

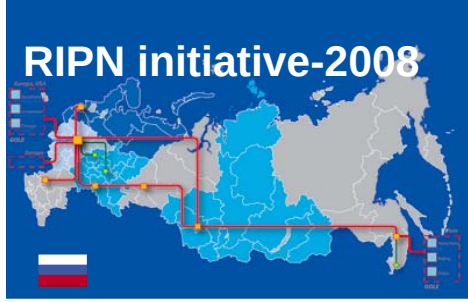




- RIPN Initiative-2008
- Connect to Open Exchange at Hong Kong, Tokyo

  we are looking for peering contacts at Open Exchange. You are welcome!
- Provide transit for Asian Networks to EU via Russia

RIPN - Initiative



- Supports multiple, distinct experimental and production networks
- Supports Point-to-point switched Ethernet as well as routed IP networks for universities and research centers
- Regional Optical Networks are connected to Advance Optical R&E backbone (RBnet)
- Function of Association of regional, corporate networks, universities, research organizations and leading edge technology companies
- Deploying of a national network infrastructure for:
  - advanced network research
  - next-generation computationally and data intensive network-based applications
- Providing a Global research project participation

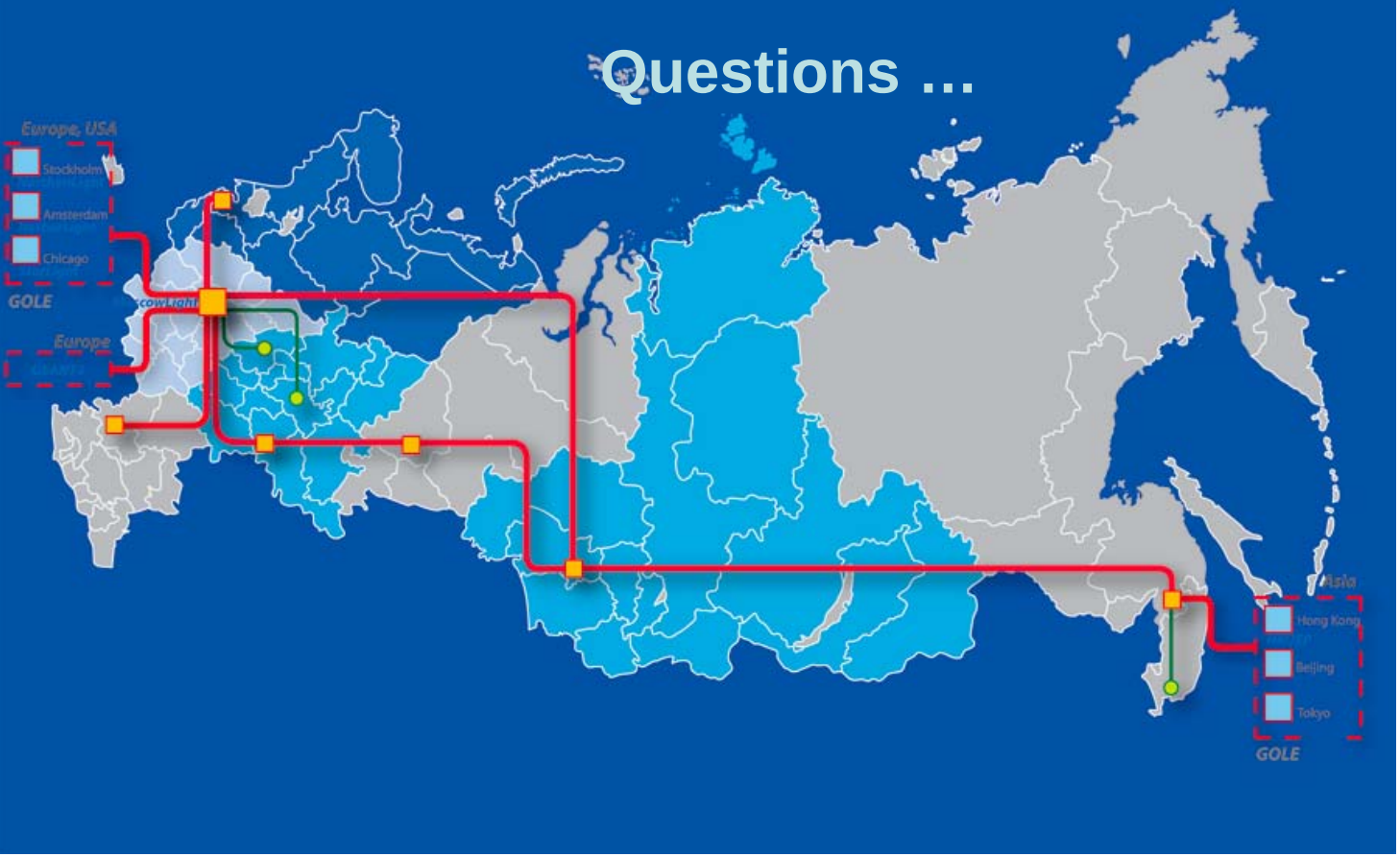
1. Strategy development
2. Financial arrangements
3. Technical work
4. Governance work
5. Legal issues

"Advanced networking infrastructure for the National Large Scale Sciences Applications.

РОСНИИРОС RIPN

Thank you for your attention!

Questions …



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