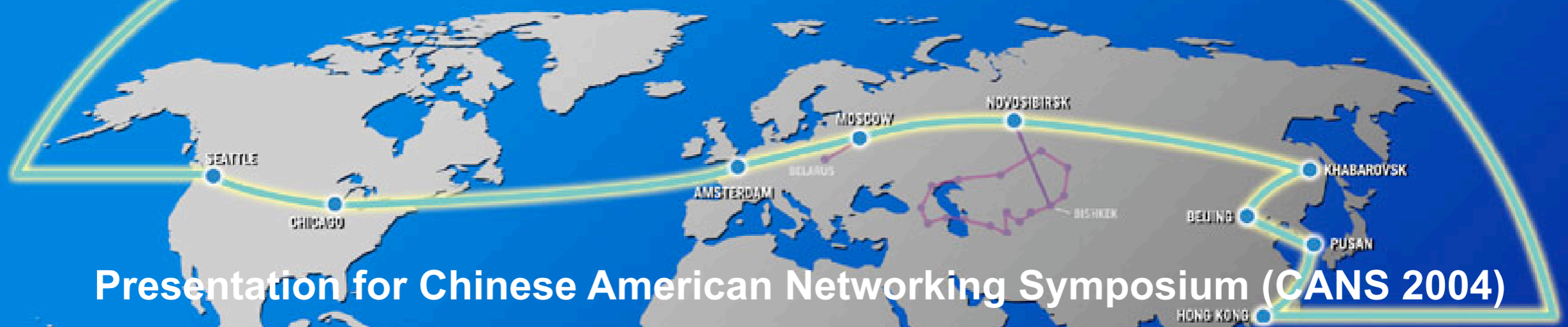


Global Ring Network for Advanced Applications Development (GLORIAD)

GLORIAD



Presentation for Chinese American Networking Symposium (CANS 2004)

December 1, 2004

Miami, Florida

GLORIAD US Investigators: Greg Cole, Natasha Bulashova
(currently in transition from NCSA to UT/ORNL)

US Sponsor: National Science Foundation

Global Ring Network for Advanced Applications Development (GLORIAD)

○ Presentation

○ Overview

○ Introduce ourselves

○ Where we are today (“Little GLORIAD”)

○ Where we’re heading



What is GLORIAD?



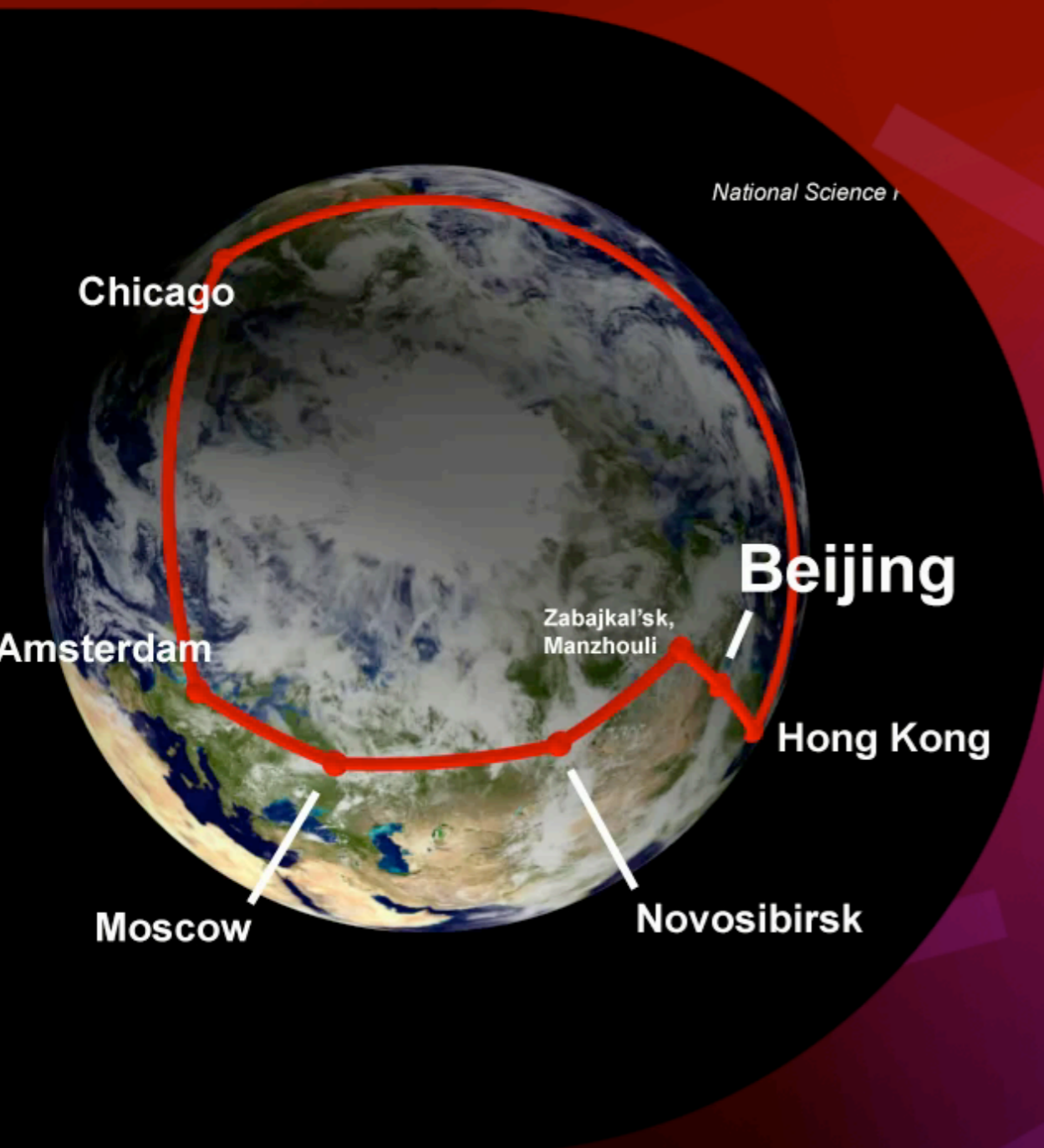
- Currently, “Little GLORIAD” is a set of OC3s (155 Mbps) between US/Starlight-Moscow and US/Starlight-Beijing and Russia-China
- Goal: 10 Gbps wavelength around northern hemisphere (filled w/good apps) by late 2005 – providing multiple GbEs (and a routed/layer-3 service); multiple 10 Gbps circuits by 2008
- A “hybrid” packet-/circuit-switched S&E network between US-Russia and US-China (and opening to other regions/countries as well)
- Program to encourage cyberinfrastructure development and improved S&E cooperation between US-Russia-China S&E communities
- Follow-on activity to NSF/MinSci-funded US-Russia NaukaNet program (1998-2004)
- Emphasis on global ring topology, hybrid network service (“GLIF model”) and integration with other S&E networks and organizations

Why GLORIAD?

GLORIAD's development is motivated by specific science community applications and designed to improve infrastructure and capabilities for S&E collaboration – with special focus on improving ties between US, Russia and China – three countries long isolated from each other

We welcome/need participation by other communities/organizations/nations

Why GLORIAD?



“As part of the international community of science, we share common concerns that reach across national borders. As we all aim to strengthen our nations’ capabilities in research, we also aim to contribute to the cumulative knowledge that lifts the prospects of people everywhere.



Rita Colwell,
former NSF
Director

This new network serves as both a physical and symbolic reminder of our common goal of solving problems and building a world of peace and prosperity.”

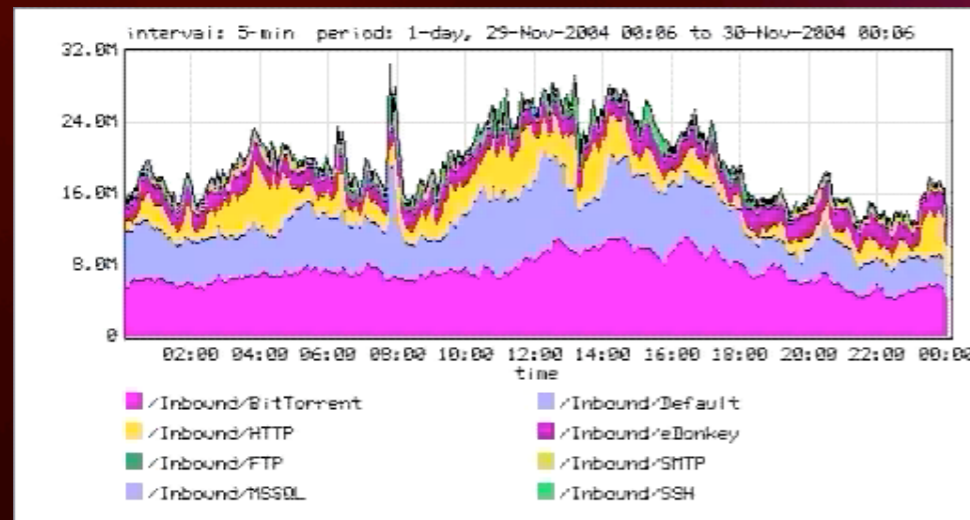
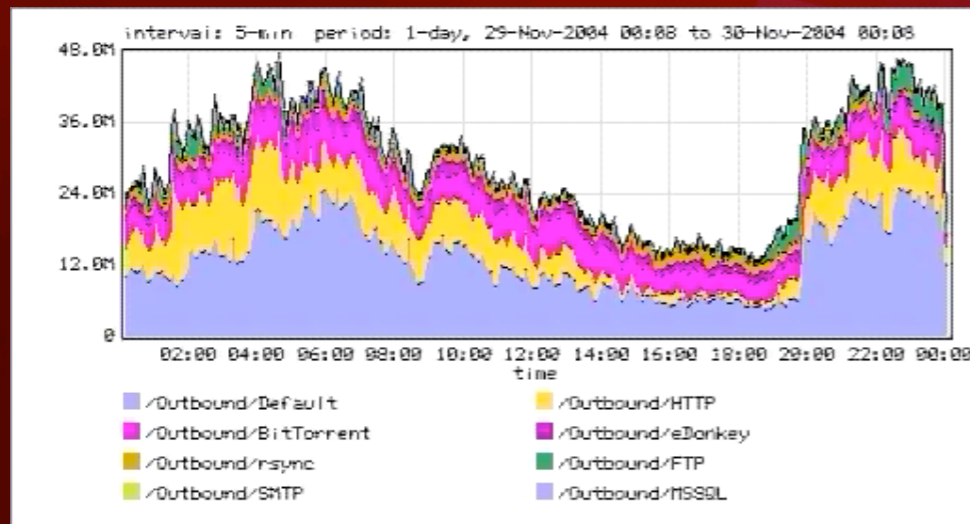
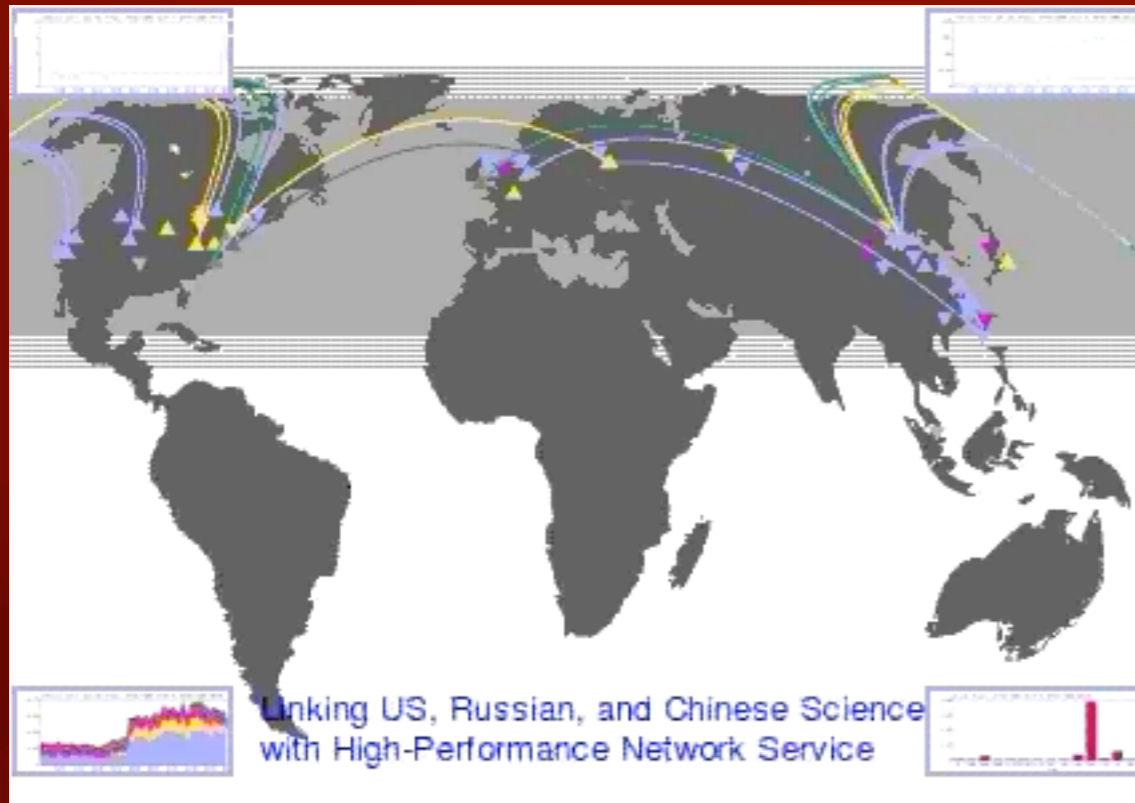
Dec. 21, 2003, NSF Press Release

Why GLORIAD?

- For much of 20th century, US, Russia (Soviet Union) and China have maintained often strained relationships
- Cooperation and understanding largely lacking ... with negative consequences
- Each has strong national S&E infrastructure
- All benefit from developing closer S&E relationships
- Networks provide useful leverage and means for encouraging cooperation
- Russia and China have rapidly growing telecomm industry and infrastructure

Serving Scientists Today

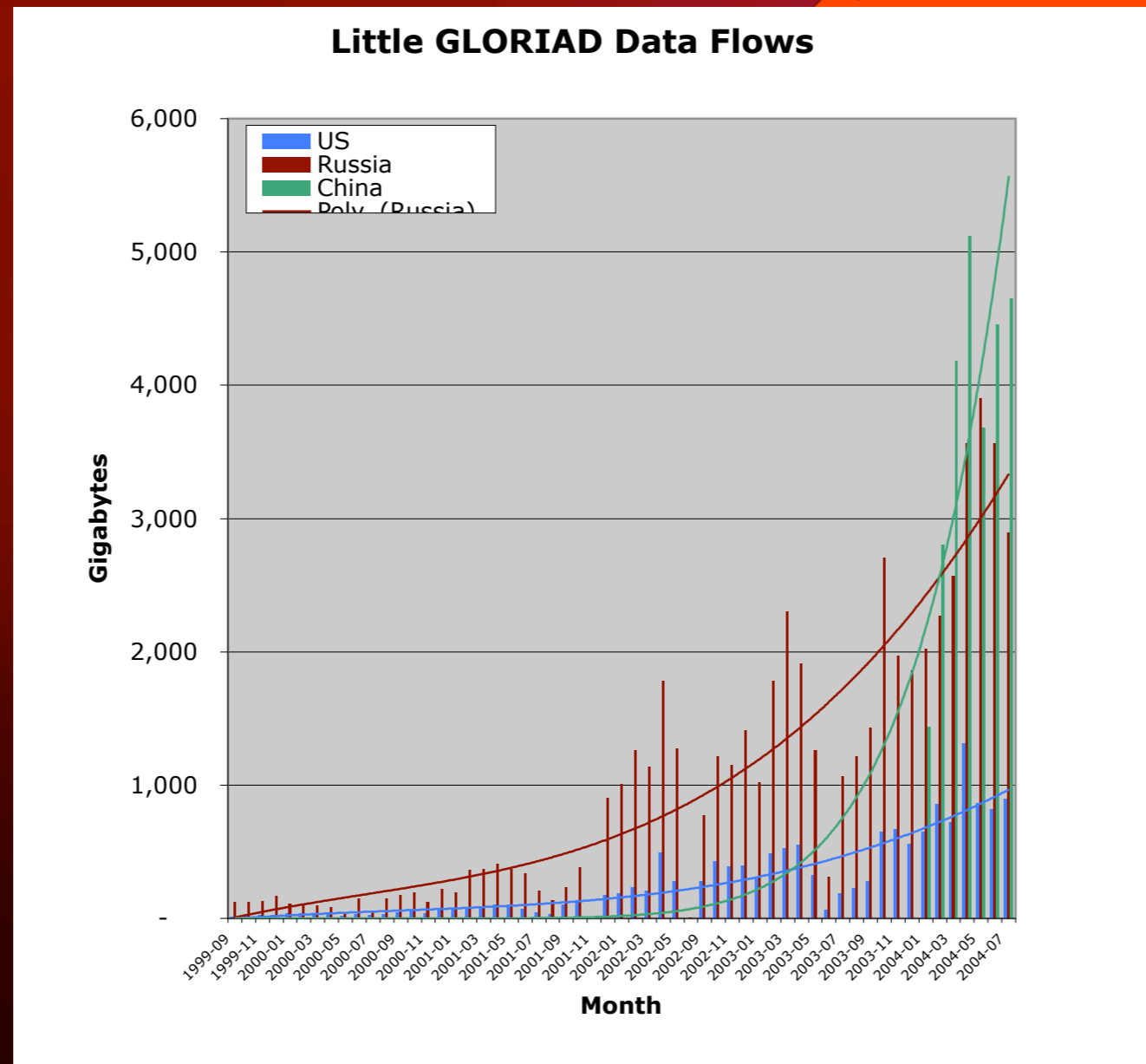
(this morning actually)



- Monitoring
- Institutional Use
- Applications Use
- Basic Performance metrics
- Network “anomalies”

Overall Traffic Growth

Gigabytes Per Month



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It all started with an email ...

From: [Natasha Bulashova \(natasha@uranus.ibioc.serpukhov.su\)](mailto:natasha@uranus.ibioc.serpukhov.su) Search Result 2
Subject: Gopher & Wais
Newsgroups: [comp.infosystems.gopher](https://www.gmane.org/gmane.comp.infosystems.gopher) View: [Complete Thread \(5 articles\)](#)
Date: 1993-04-20 12:33:46 PST [Original Format](#)

Hello All!

If you have time for decision for my problem,
please write to me

1.I install gopher1.03 with wais-8-b5 in my
machine(BSD 4.3)

2.When installing ,I haven't error

3.I create mkdir /usr/gopher-data/vkm/yeasts.doc
and set my file-data=yeasts.doc

4.I create file in /usr/gopher-data/vkm/.IndexLink
IndexLink: Type=7
Name=Yeasts Index
Host=+
Port=+
Path=7/vkm/.indexes/index

5.Then I do
Waisindex -d index -export -t para /usr/gopher-data/vkm/yeasts.doc
(ok!)

6.I check search,using waissearch (ok!! find some documents)

7.I run daemon
gopherd -c -l /usr/log/infosys/gopher.log /usr/gopher-data

8.I run gopher,and I have menu:
1.Yeasts Index<?>
2.yeasts.doc

9.!!!! I want find documents with word: abla
and i can see:
Nothing available <press Return>
This is my problem!(what kind my errors and what I must do
for decision this problem)

10. then I look my file gopher.log, where are only

```
Tue Apr 20 10:31:27 1993 19939 stack.serpukhov.su:Root Connection
-- //----          --//----          :retrieved directory/vkm
```

please answer me e-mail:natasha@stack.serpukhov.su
natasha@uranus.ibioc.serpukhov.su

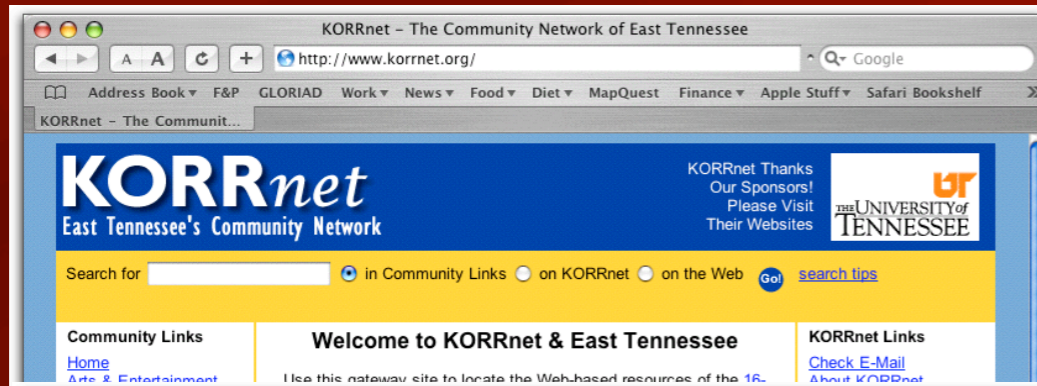
Thank you
Natasha

Computer Center,
Pushchino,
Moscow region,
Russia

History

- We “e-met” during April 1993
- US-Russia F&P project began January 1994
- Based at Univ of Tennessee and Pushchino Biological Center until 2001
- Physical networking resulted from efforts at community networking (and recognition that we never had sufficient bandwidth for what we wanted to do)
- Focus always on local communications infrastructure

“Friends & Partners”



KORRnet - The Community Network of East Tennessee

http://www.korrnet.org/

KORRnet Thanks Our Sponsors! Please Visit Their Websites

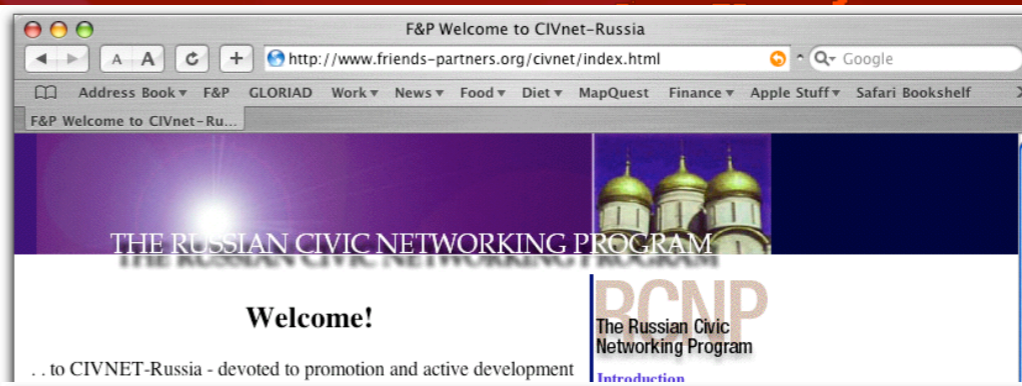
UT THE UNIVERSITY OF TENNESSEE

Search for [] in Community Links on KORRnet on the Web search tips

Community Links: Home, Arts & Entertainment

Welcome to KORRnet & East Tennessee

KORRnet Links: Check E-Mail, About KORRnet



F&P Welcome to CIVnet-Russia

http://www.friends-partners.org/civnet/index.html

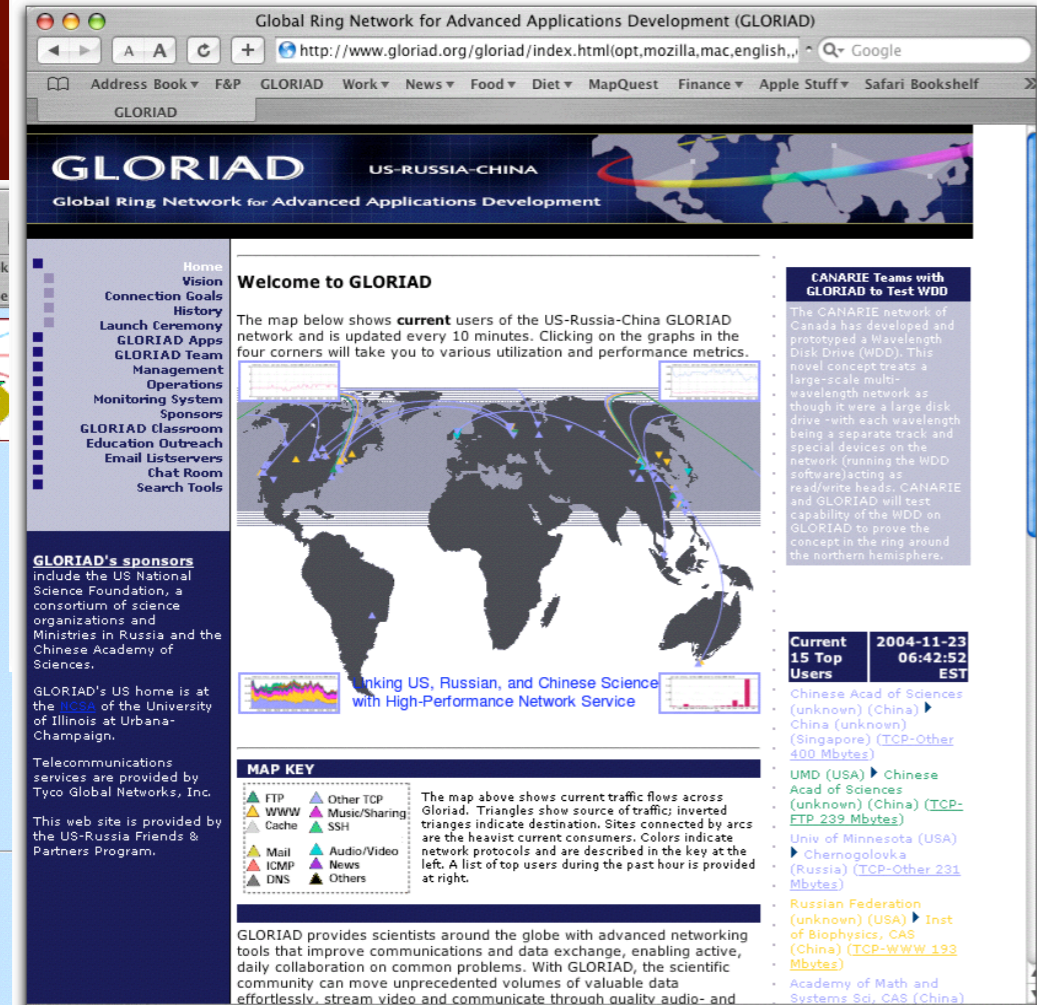
THE RUSSIAN CIVIC NETWORKING PROGRAM

BCNP The Russian Civic Networking Program

Welcome!

... to CIVNET-Russia - devoted to promotion and active development

Introduction



Global Ring Network for Advanced Applications Development (GLORIAD)

http://www.gloriad.org/gloriad/index.html

GLORIAD US-RUSSIA-CHINA

Global Ring Network for Advanced Applications Development

Welcome to GLORIAD

The map below shows current users of the US-Russia-China GLORIAD network and is updated every 10 minutes. Clicking on the graphs in the four corners will take you to various utilization and performance metrics.

MAP KEY

- FTP
- WWW
- Cache
- Mail
- ICMP
- DNS
- Other TCP
- Muse/Sharing
- SSH
- Audio/Video
- News
- Others

GLORIAD's sponsors include the US National Science Foundation, a consortium of science organizations and Ministries in Russia and the Chinese Academy of Sciences.

GLORIAD provides scientists around the globe with advanced networking tools that improve communications and data exchange, enabling active, daily collaboration on common problems. With GLORIAD, the scientific community can move unprecedented volumes of valuable data effortlessly, stream video and communicate through quality audio- and



F&P Friends and Partners : Welcome

http://www.friends-partners.org/friends/

F&P

FRIENDS & PARTNERS

Linking US-Russia Across the Internet

He who receives an idea from me receives instruction himself without lessening mine; as he who lights his taper from mine, receives light without darkening me. - Thomas Jefferson

Welcome to Friends and Partners, jointly developed by friends in the US and Russia to promote better understanding between the people of our countries. We are very glad you're visiting and hope your time here will be productive and enjoyable.

Explore the various databases, information and communications resources listed. You can search our site, participate in various discussions in the "Community Corner" and meet some new friends in the F&P chat room.

Please contact us if you need help or more information.

Born on January 19, 1994, Friends and Partners is one of the first Internet services developed jointly by citizens of the United States and Russia. Resulting from a chance meeting on the Internet (you can read our story here), it is but one of many examples of how the Internet, itself rooted in the Cold War separating our nations, can provide an effective means of bringing us together.

Friends and Partners now represents a community of people all over the world who provide information and communications services to promote better understanding, friendship and partnership between individuals and organizations of the United States (and, more broadly, "the west") and countries of the Former Soviet Union.

We wish to help others build upon the "Friends and Partners" framework -- to create and link together information on our nation's histories, our art, music, literature, and religion, our educational and scientific resources, our geography and natural resources, our languages, and our opportunities for communicating, travelling, and working together. Please help us! Additional information is available if you are interested in contributing. You can read more about our server here, and learn of a few awards and honors it has received.

This project owes any success it has realized to many, many individuals and organizations. While we cannot possibly thank everyone here, we do want to thank our sponsors: the National Science Foundation, Ford Foundation, Eurasia Foundation, US State Department, NATO, Sun Microsystems, the International Science Foundation, Esper Systems, RELARN, and Stack, Inc. We want to express special appreciation to our home institutions -- the Pushchino Institute of Biochemistry and Physiology of Microorganisms and The University of Tennessee -- who have done so much to sustain this effort.

Please sign our GuestBook and let us know your comments and suggestions.

F&P Quick Search

Main Sections

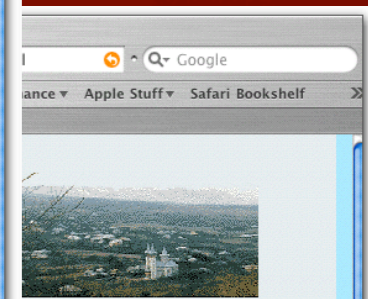
- EPLIB - Literature
- Culture
- Commerce / Business
- Education / Science
- Funding / Exchange
- Language / Cyrillic
- Life / Family
- News / History
- Telecommunications
- Tourism / Travel
- About F&P

Community Corner

- Bulletin Board
- Community Services
- Chat Room
- F&P Listserv

F&P Projects

- CIVnet-Russia
- NaukaNet
- F&P China
- F&P Romania



mission is to enhance mutual understanding between individuals and organizations of the United States (and, more broadly, "the west") and countries of the Former Soviet Union.

... to CIVNET-Russia - devoted to promotion and active development

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Launched Web-based community building project on January 19, 1994

within 48 hours, 30,000 web accesses, 360

The following map shows the founding Chinese partners involved.

The original Friends and Partners effort has helped support a community of several thousand participants, handling many million information inquiries and email exchanges. It has been designated as one of the top 30 "must see" sites on the Internet and the helpful support of such organizations as Sun Microsystems, NATO, the US State Department, the Soros Foundation (ISF), and, most recently, the Ford Foundation. Friends and Partners illustrates how the

History

- ☉ **Early days: entire South Moscow region behind a single 19.2K modem**
- ☉ **Our first grant (from NATO) enabled bandwidth increase to 256 Kbps**
- ☉ **Sun Microsystems donated workstation equipment to both teams**
- ☉ **US DOS grant for Gore-Chernomyrdin Commission meeting helped launch the project activities more broadly**



How to transfer 50M file

(Weekly: from Univ of TN to Pushchino)

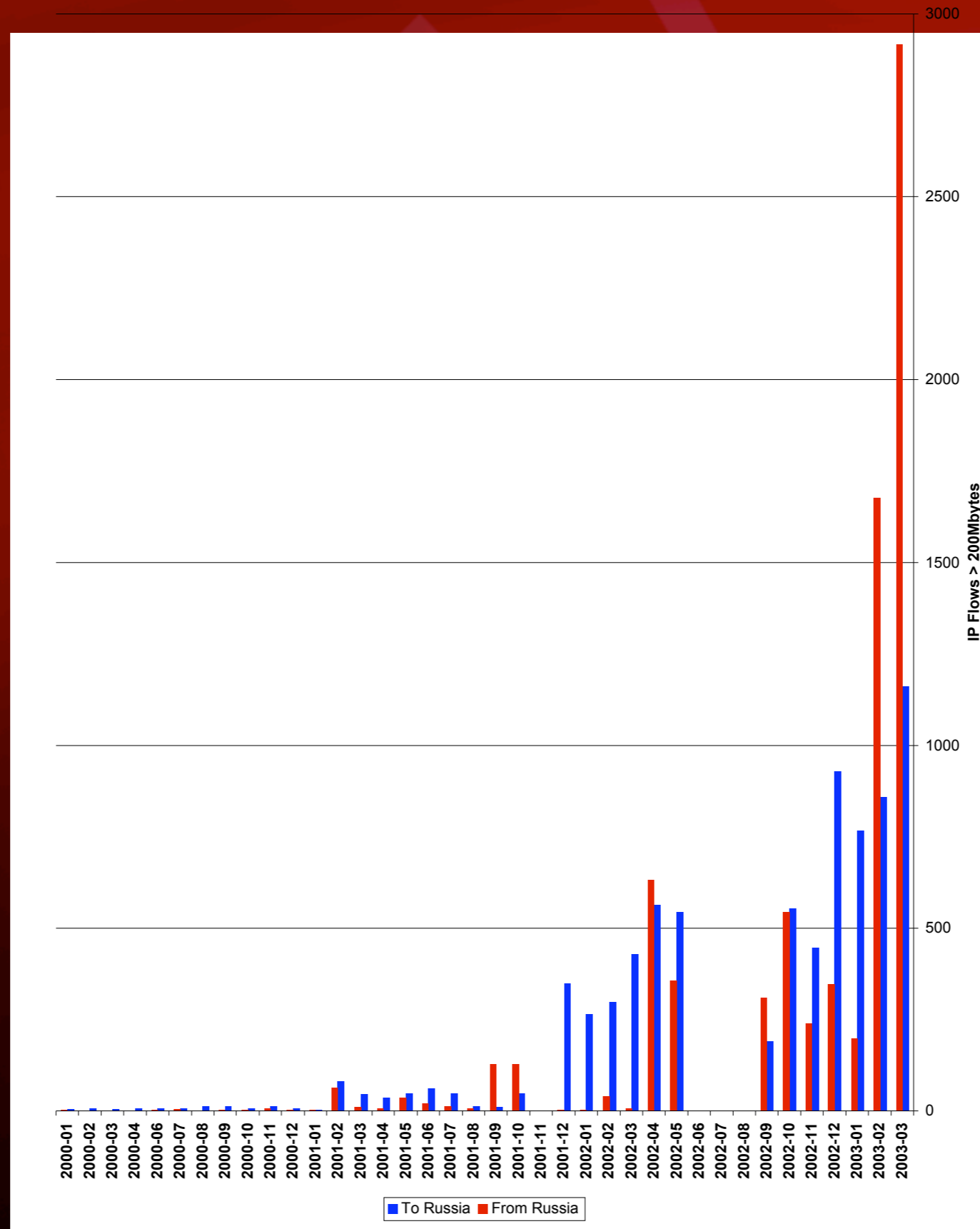
- Compress file
- UUencode it
- Split into 1000 uniform pieces
- FTP the 1000 files
- Uncompress the 1000 files
- Join into 1 file
- UUdecode it
- Uncompress it

Took all Weekend

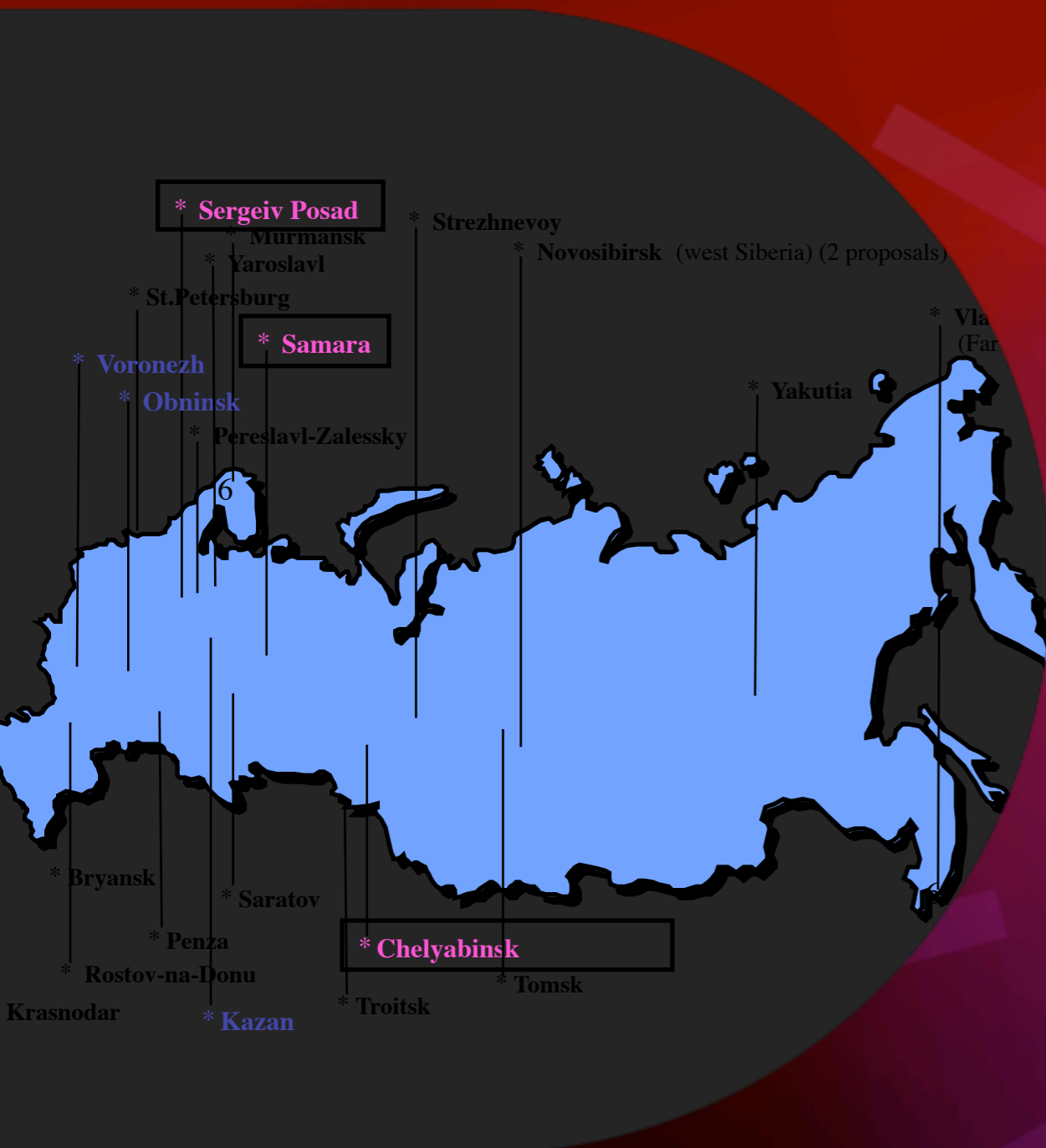
With NaukaNet, transfer is possible in a minute



NaukaNet Growth: IP Flows > 200M



Civic Networking



- Emphasis on local infrastructure
- Began 1994 in US, 1996 in Russia
- \$700K from Ford & Eurasia Foundations
- Six Operating CIVnets in Russia; KORRnet in East Tennessee
- Now working on CIVGrid program

Early Beginnings of GLORIAD

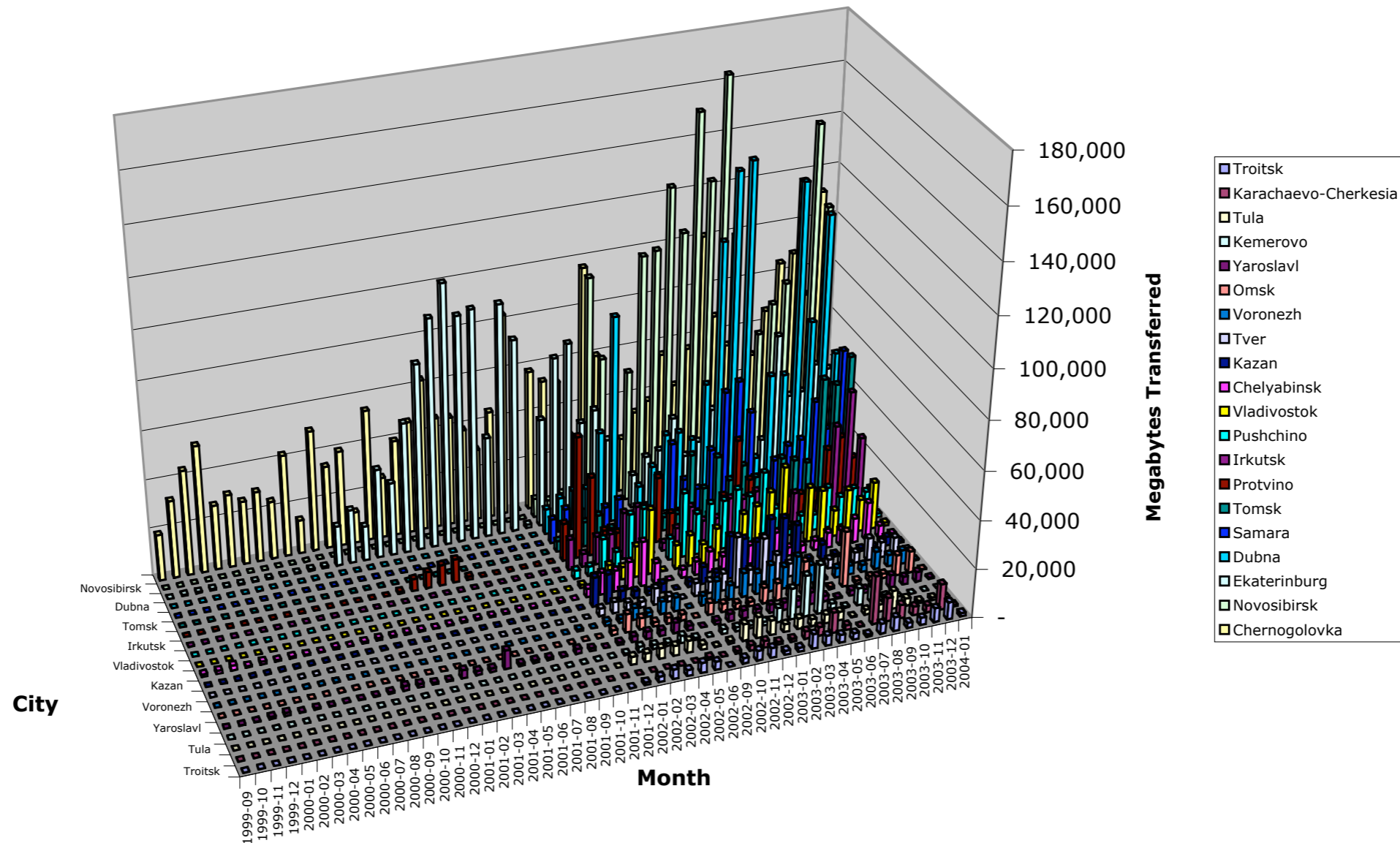
During time of F&P and CIVnet projects (mid-1997), we began working on high performance connectivity between US and Russia, applying for funding under the NSF HPIIS program.

HPIIS subsequently funded MIRnet as well as the larger Eurolink and TransPAC projects

Purpose of MIRnet was to broadly connect S&E network infrastructure between Russia and US

Regional Access to MIRnet/Naukanet/ GLORIAD in Russia

Russian Cities Using NaukaNet (top 20 minus Moscow)



Transition Time

As the MIRnet/NaukaNet program began to draw to a close in 2002, we began thinking of how to extend/expand. We wanted to:

- **Keep going ...**
- **Extend access from Russian Far East to US**
- **Bring China science community in as partner**
- **Dramatically expand connectivity/bandwidth across Russia**
- **Introduce the developing “GLIF” paradigm/model to our partners in Russia and China**
- **Help address network needs of international ITER program**

In December 2002, we signed agreement with Russian and Chinese partners to develop GLORIAD – first step: “Little GLORIAD”

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Little GLORIAD



- Little GLORIAD became operational on January 9, 2004 (Tyco OC3 links Chicago-Moscow, Chicago-Beijing); launched in Beijing January 12, 2004
- Moscow-Beijing OC3 (across Russia-China border) became operational in July, 2004. Ring complete.
- Proposal submitted to NSF IRNC program June, 2004
- Meeting hosted by Netherlands partners in September, 2004 – US, Russian, Chinese, Korean, European partners attend
- News of NSF review in September, 2004
- Moved project from NCSA to UT/ORNL in summer/fall, 2004
- Meeting with Canadian partners in November, 2004
- HKLight launched by CAS/CNIC November 23, 2004
- Preparing for (hopeful) December start of “Big GLORIAD”

U.S. Partners



- **Russia: Kurchatov Institute (Acad. Evgeny Velikhov), Russian Academy of Science, Ministry of Education and Science, Agencies of Communications and Atomic Energy, Moscow State University (Evgeny Velikhov)**
- **China: Chinese Academy of Sciences (Dr. Baoping Yan, Computer Network Information Center CNIC)**
- **Other partners in Amsterdam, Korea, Canada**
- **Telecommunications: Tyco Global Networks**

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Partners

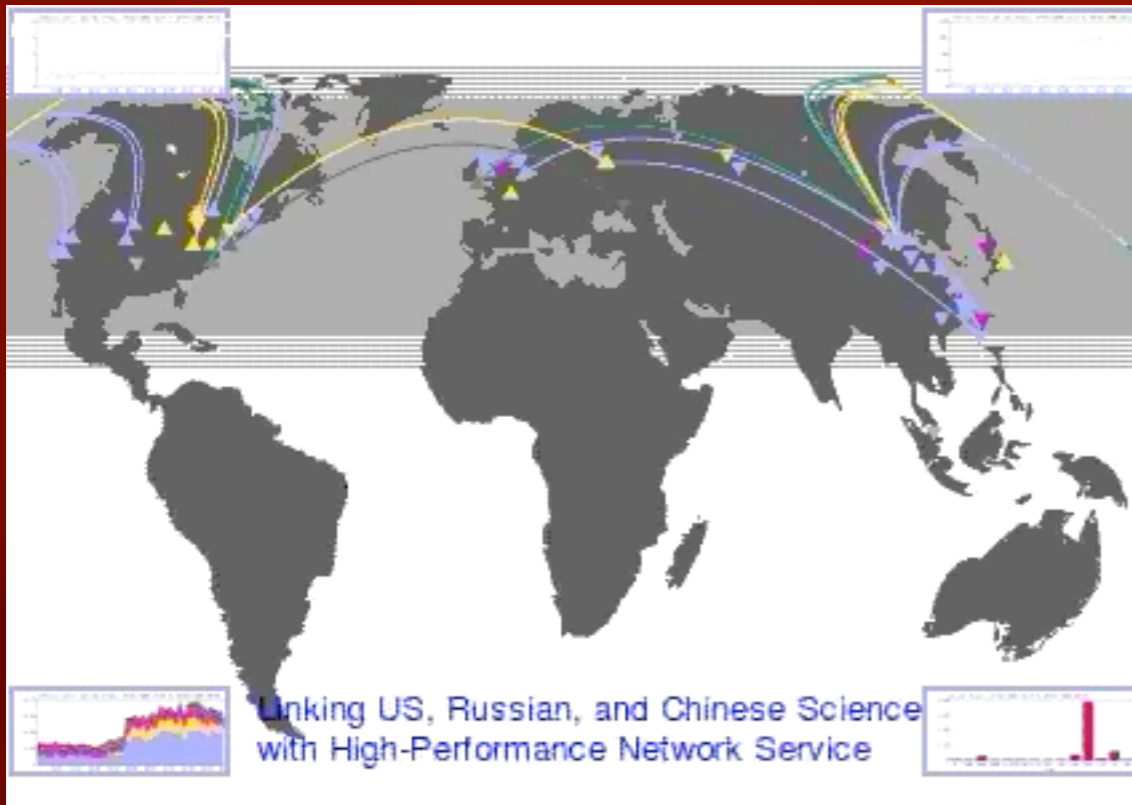


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Partners



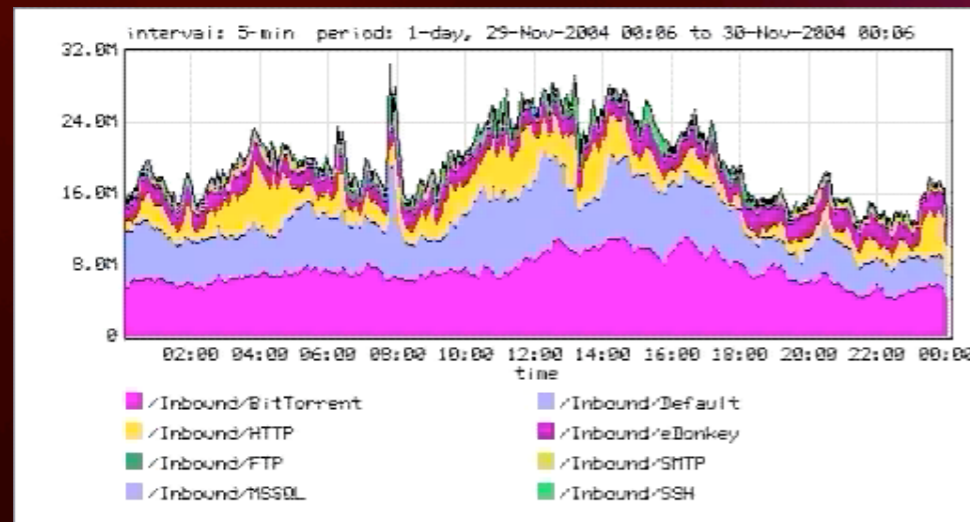
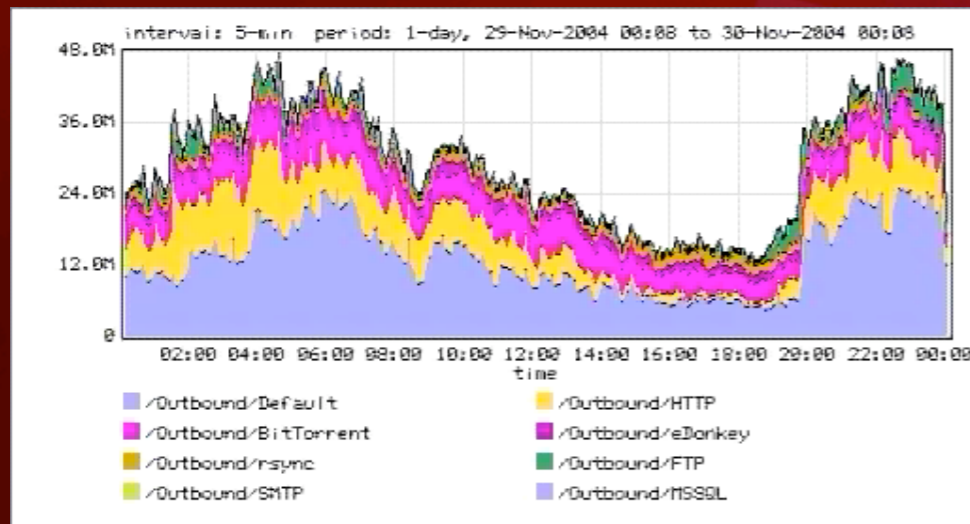
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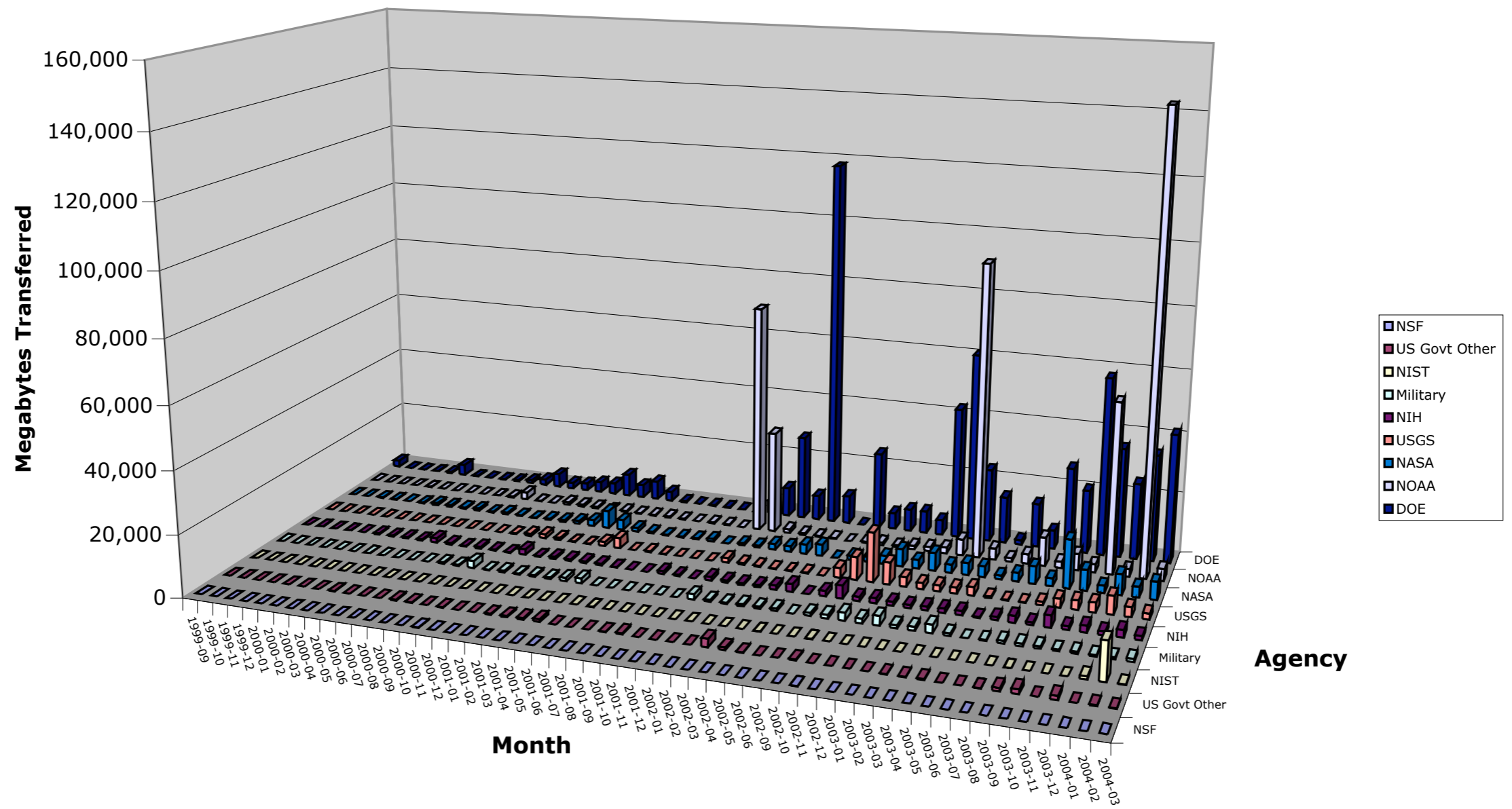
Serving Scientists Today

(this morning actually)

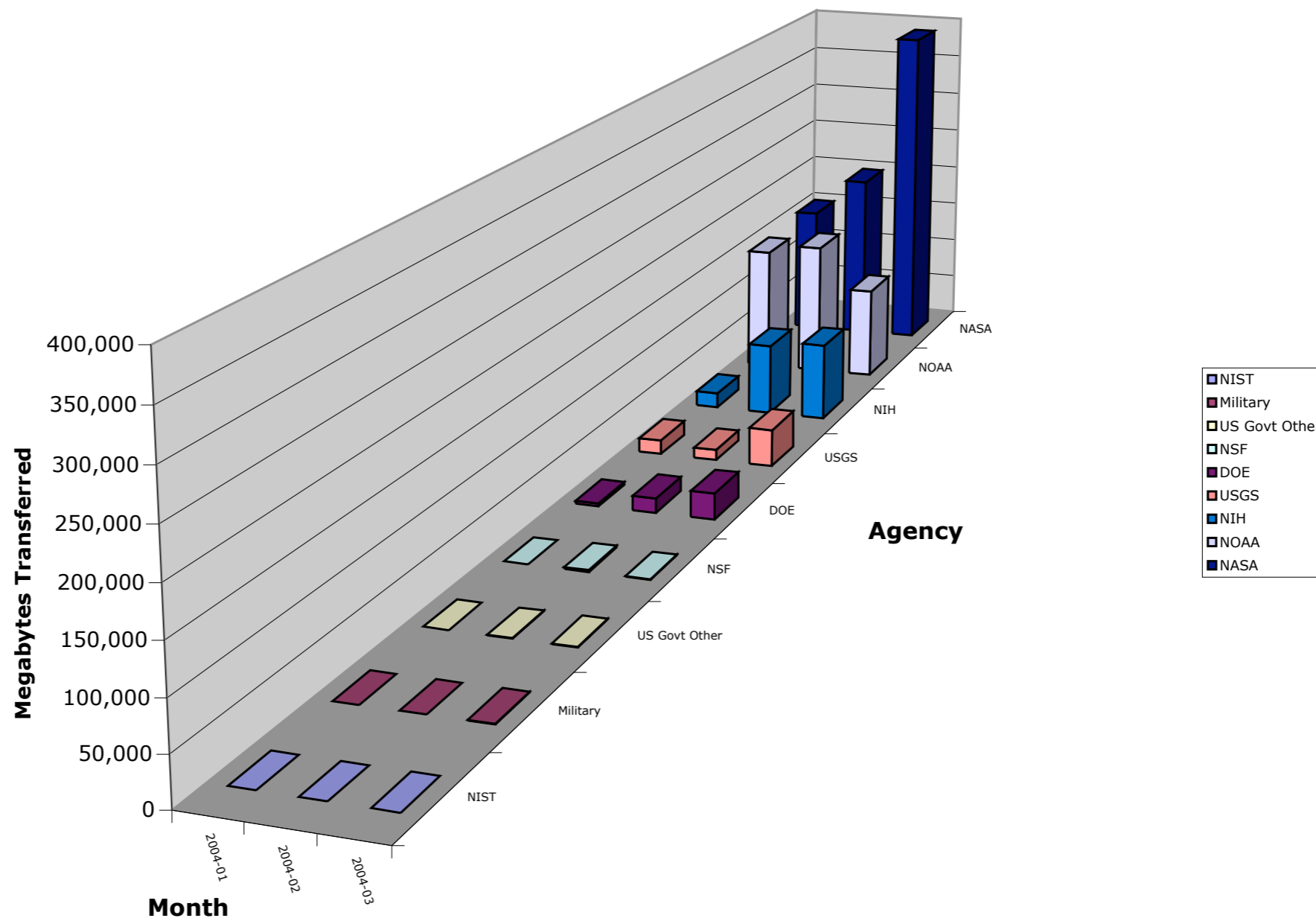
- ☀ Monitoring
- ☀ Institutional Use
- ☀ Applications Use
- ☀ Basic Performance metrics
- ☀ Network “anomalies”



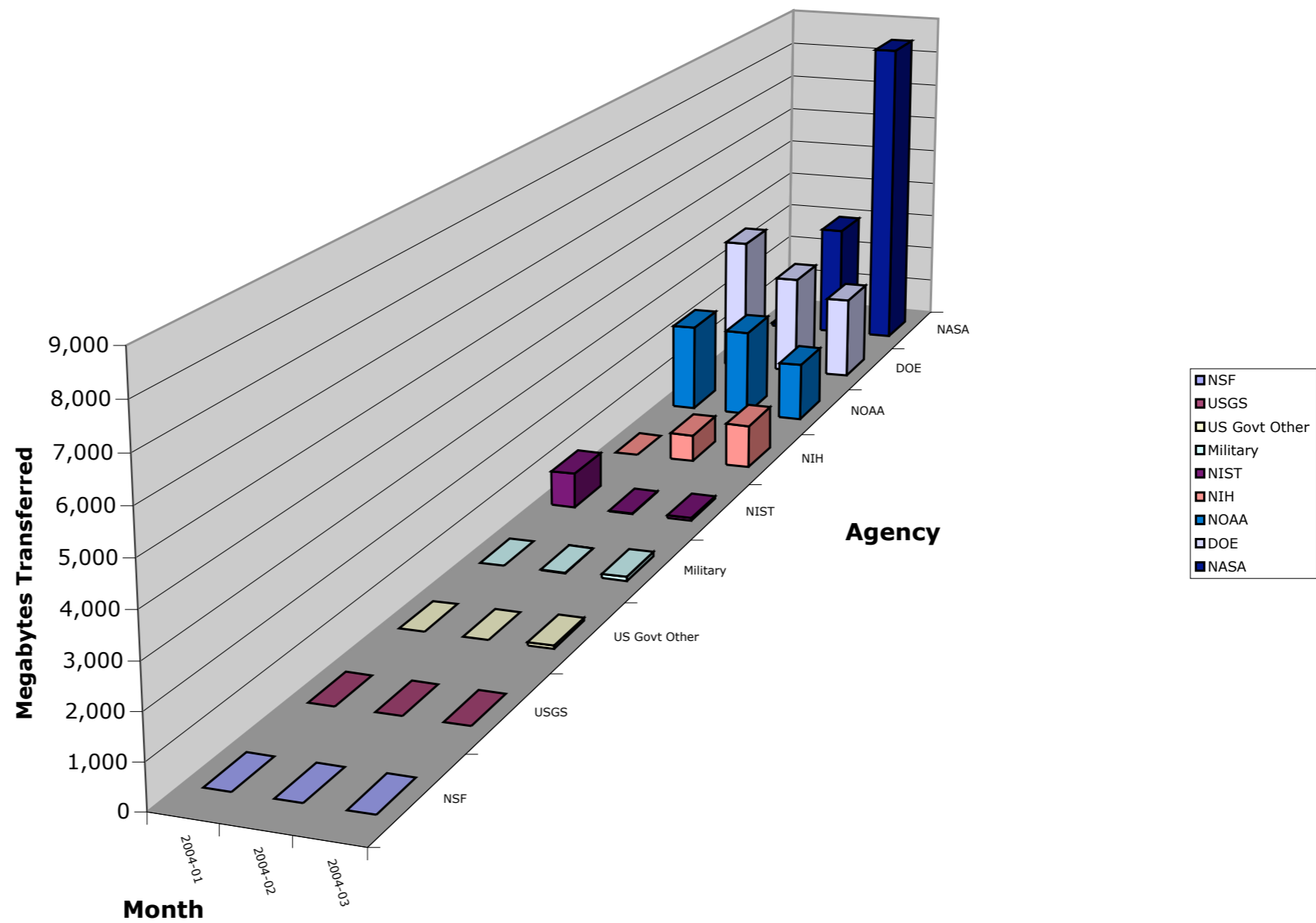
Top US Govt Agencies Receiving Data from Russia via GLORIAD



Top US Govt Agencies Supplying Data to China via GLORIAD



Top US Govt Agencies Receiving Data from China via GLORIAD



GLORIAD Traffic from China

January, 2004

to Russia

<i>Institution</i>	<i>City</i>	<i>Megabytes</i>	<i>% Total</i>
Moscow State University	Moscow	6,407	8.13
FREEnet Web	Moscow	6,050	7.68
Joint Institute for Nuclear Research (Dubna)	Dubna	4,861	6.17
Bauman Moscow State Tech Univ	Moscow	3,412	4.33
FREEnet		2,575	3.27
Institute for Information Transmission Problems	Moscow	2,491	3.16
Tomsk Education Network	Tomsk	2,337	2.96
Joint Institute for Nuclear Research (Dubna)	Dubna	2,193	2.78
nsc.ru (Novosibirsk)	Novosibirsk	2,007	2.55
Institute for High Energy Physics (Protvino)	Protvino	1,946	2.47
troitsk.ru	Troitsk	1,432	1.82
Kurchatov Inst	Moscow	1,336	1.69
nsk.ru (Novosibirsk)	Novosibirsk	1,274	1.62
Russian Academy of Sciences	Moscow	1,024	1.30
Russian Space Science Internet	Moscow	814	1.03
Institute of Theoretical and Experimental Physics	Moscow	754	0.96
Kurchatov Inst	Moscow	744	0.94
RELARN	Moscow	730	0.93
Ural State University	Ekaterinburg	680	0.86
Krasnoyarsk Science Center	Krasnoyarsk	675	0.86
Moscow Technical Univ of Communications & Informatic	Moscow	670	0.85
Other		34,400	43.64
Total		78,811	100.00

to US

<i>Institution</i>	<i>City</i>	<i>Megabytes</i>	<i>% Total</i>
U of Illinois Urbana-Champaign	Urbana	8,072	12.69
Columbia University	New York	7,660	12.05
Princeton University	Princeton	4,087	6.43
U of Michigan	Ann Arbor	3,112	4.89
U of Chicago	Chicago	2,044	3.21
U of Tennessee, Knoxville	Knoxville	1,913	3.01
National Oceanic and Atmosphere Administration	Suitland	1,844	2.90
U of Colorado Boulder	Boulder	1,800	2.83
Rochester Inst of Tech	Rochester	1,450	2.28
U of Maryland	College Park	1,406	2.21
Univ of Georgia-Athens	Athens	1,367	2.15
Georgia Inst. Of Technology	Atlanta	1,359	2.14
University of Hawaii	Honolulu	1,167	1.84
Fermi National Laboratory	Batavia	1,158	1.82
Univ of Delaware	Newark	1,130	1.78
Colorado State University	Fort Collins	1,044	1.64
U of Illinois Chicago	Chicago	960	1.51
U of Oklahoma	Norman	948	1.49
Natl Inst of Standards and Tech	Boulder	828	1.30
Boston University	Boston	755	1.19
Oak Ridge Natl Lab	Oak Ridge	672	1.06
Other		18,831	29.58
Total		63,608	100.00

GLORIAD Traffic from Russia

January, 2004

to China

<i>Institution</i>	<i>City</i>	<i>Megabytes</i>	<i>% Total</i>
China (unidentified)		9,075	65.78
Chinese Academy of Sciences (general)	Beijing	1,392	10.09
China Education and Research Network		324	2.35
Academy of Math and Systems Science, CAS	Beijing	303	2.19
Institute of Software, CAS	Beijing	77	0.56
Lanzhou, China, CAS	Lanzhou	12	0.09
Library of Chinese Academy of Sciences	Beijing	10	0.07
China Academy of Sciences		9	0.06
Institute of Zoology, CAS	Beijing	7	0.05
Institute of Automation, CAS	Beijing	5	0.04
Institute of Mechanics, CAS	Beijing	4	0.03
China Internet Network Information Ctr, CAS	Beijing	4	0.03
Beijing Institute of System Engineering, CAS	Beijing	4	0.03
Institute of Physics & Chemistry, CAS	Beijing	4	0.03
Guangzhou Institute of Chemistry, CAS	Guangzhou	3	0.02
Institute of Hydrobiology, CAS	Beijing	2	0.02
Institute of Atmospheric Physics, CAS	Beijing	2	0.02
Institute of Computing Technology, CAS	Beijing	2	0.01
Institute of Microbiology, CAS	Beijing	1	0.01
Institute of Chemistry, CAS	Beijing	1	0.01
Institute of Biophysics, CAS	Beijing	1	0.01
Other		2,555	18.50
Total		13,797	100.00

to US

<i>Institution</i>	<i>City</i>	<i>Megabytes</i>	<i>% Total</i>
Fermi National Laboratory	Batavia	13,256	2.90
U of Michigan	Ann Arbor	12,467	2.73
Purdue University - W Lafayette	West Lafayette	12,333	2.70
Stanford University	Los Angeles	11,680	2.56
U of California San Diego	La Jolla	11,478	2.51
Mass. Inst. of Technology	Cambridge	9,338	2.04
Georgia Inst. Of Technology	Atlanta	9,232	2.02
Princeton University	Princeton	8,862	1.94
Brookhaven National Laboratory	Long Island	7,911	1.73
Jefferson Lab	Newport New	7,238	1.58
Boston University	Boston	6,912	1.51
U of Pennsylvania	Philadelphia	6,557	1.44
U of California Los Angeles	Los Angeles	6,171	1.35
New York University	New York	5,667	1.24
Univ of California Davis	Davis	5,566	1.22
State U of NY at Buffalo	Buffalo	5,450	1.19
Iowa State University	Ames	5,287	1.16
Michigan State University	East Lansing	5,239	1.15
Rochester Inst of Tech	Rochester	5,216	1.14
U of S California	Los Angeles	5,110	1.12
Carnegie Mellon University	Pittsburgh	5,006	1.10
Other		291,133	63.67
Total		457,111	100.00

GLORIAD Traffic from US

January, 2004

to Russia

<i>Institution</i>	<i>City</i>	<i>Megabytes</i>	<i>% Total</i>
Moscow State University	Moscow	172,059	12.05
Chernogolovka Science Center	Chernogolovk	168,853	11.83
Russian Space Science Internet	Moscow	94,352	6.61
Russian Academy of Sciences	Moscow	82,351	5.77
nsc.ru (Novosibirsk)	Novosibirsk	72,436	5.07
Radio Moscow State University Network	Moscow	71,069	4.98
smr.ru (Samara)	Samara	64,951	4.55
Joint Institute for Nuclear Research (Dubna)	Dubna	45,694	3.20
Bauman Moscow State Tech Univ	Moscow	30,960	2.17
RELARN	Moscow	25,500	1.79
FREEnet Web	Moscow	24,028	1.68
Institute for High Energy Physics (Protvino)	Protvino	23,603	1.65
irk.ru (Irkutsk)	Irkutsk	20,222	1.42
Russian IR Cache	Moscow	18,548	1.30
Tomsk Education Network	Tomsk	17,226	1.21
nsk.ru (Novosibirsk)	Novosibirsk	16,862	1.18
Tomsk State University	Tomsk	15,375	1.08
Instiute for Information Transmission Problems	Moscow	15,100	1.06
Saratov State University	Saratov	15,024	1.05
Ural Branch of the Russian Academy of Science	Ekaterinburg	11,852	0.83
Kurchatov Inst	Moscow	11,758	0.82
Other		410,050	28.70
Total		1,427,873	100.00

to China

<i>Institution</i>	<i>City</i>	<i>Megabytes</i>	<i>% Total</i>
Chinese Academy of Sciences (general)	Beijing	317,151	41.38
Institute of Atmospheric Physics, CAS	Beijing	139,011	18.14
Natl Astronomical Observatory, CAS	Beijing	100,627	13.13
China (unidentified)		65,672	8.57
Institute of Hydrobiology, CAS	Beijing	61,506	8.02
Institute of Computing Technology, CAS	Beijing	11,036	1.44
Library of Chinese Academy of Sciences	Beijing	7,660	1.00
Guangzhou Institute of Chemistry, CAS	Guangzhou	7,448	0.97
Academy of Mathematics and Systems Science, CAS	Beijing	6,820	0.89
Institute of Software, CAS	Beijing	6,678	0.87
Academy of Preventive Medicine, CAS	Beijing	5,049	0.66
Institute of Computational Math and S/E Computing, CA	Beijing	4,551	0.59
Institute of Zoology, CAS	Beijing	4,399	0.57
Institute of Biophysics, CAS	Beijing	4,169	0.54
Lanzhou, China, CAS	Lanzhou	3,829	0.50
Institute of Automation, CAS	Beijing	3,706	0.48
Institute of Theoretical Physics, CAS	Beijing	2,437	0.32
Institute of Microbiology, CAS	Beijing	2,128	0.28
Institute of Mechanics, CAS	Beijing	1,929	0.25
China Academy of Sciences (other)		1,840	0.24
China Internet Network Information Ctr, CAS	Beijing	1,192	0.16
Other		7,596	1.00
Total		766,435	100.00

Global Ring Network for Advanced Applications Development (GLORIAD)

○ Presentation

○ Overview

○ Introduce ourselves

○ Where we are today (“Little GLORIAD”)

○ Where we’re heading



GLORIAD: Plans



**GLORIAD/ITER-Grid Meeting,
December 21, 2003**

- “Little GLORIAD” is just a first step towards much larger network/program
- “Big GLORIAD” proposed to begin in December 2004/January 2005
- Goal: Wavelength (10 Gbps) around the northern hemisphere (same path as Little GLORIAD) by late 2005 with multiple circuits by years 4-5 of project
- “Hybrid” circuit-switched and routed architecture to service broad S&E communities but provide dedicated services to communities and users with unique/heavy requirements
- Note: GLORIAD’s international architecture requires work on domestic infrastructure also
- Primary GLORIAD nodes: Starlight/Chicago, Netherlight/Amsterdam, RussiaLight/Moscow, Khabarovsk, Beijing; HKLight/China, Busan, Seattle/Los Angeles, back to Starlight/Chicago
- Primary science communities include ITER/Fusion Energy, High Energy Physics, Astronomy/NVO, Atmos. Science, Geosciences, Bioinformatics, Computer Science (grid/middleware development), Telemedicine, nuclear materials protection, others
- Big emphasis on educational and cultural outreach

Application Areas

The image displays a collage of overlapping browser windows from the GLORIAD website, showcasing various application areas. Each window features a navigation menu on the left and a main content area with text, images, and links. The application areas include:

- High Energy Physics (HEP):** Discusses the HEP community's role in mapping out plans for handling enormous computational and data requirements, mentioning the Large Hadron Collider (LHC) and the Compact Muon Solenoid (CMS).
- Fusion/ITER:** Describes the advanced capabilities for GLORIAD to enable the fusion energy science community to remotely operate and participate in experiments and ITER simulations.
- Astronomy:** Highlights progress in astronomical research requiring access to all the world's astronomical data, mentioning the International Virtual Observatory project.
- THORpex (Project in progress) (Atmospheric Science):** Focuses on the Observing-system Research and predictability experiment (THORpex).
- 2D and 3D Deformation Field over Bishkek Proving Ground (GeoScience):** Discusses the development of a GPS-based deformation field over the Bishkek Proving Ground.
- Networking:** Details network experimentation, specifically Wavelength Disk Drives (WDD).
- International Medical Information System (IMIS, Medical Science):** Describes the creation of IMIS to facilitate medical consultations and data exchange.
- Other Applications:** Lists other science disciplines supported by the GLORIAD network, including nuclear materials protection and materials accounting.

Each window also includes a sidebar with navigation options such as 'Home GLORIAD Apps', 'Apps by Country' (Canada, China, Korea, Netherlands, Russia, USA), and 'Apps by Discipline' (High Energy Physics, Fusion Energy/ITER, Atmospheric Science, Astronomy, Geosciences, Medical Sciences, Network, Grids/Computing, Others). Some windows feature 'View GLORIAD Animation' buttons and 'Slideshow of GLORIAD Launch Ceremony' sections.

Outreach, Extension and Education Activities

- **HKLight Open Exchange Point**
- **Central Asian and Western Eurasian networking opportunities**
- **GLORIAD Classroom**
- **EduCultural Channel**
- **Collaboration Infrastructure (Cisco IP Telephony and HEP/VRVS)**
- **“Simple Words” Contest**
- **“Junior Achievement” Partnership**
- **Virtual Science Museum of China**

Collaboration Opportunities

- GLORIAD network architecture, design, services
- Monthly/weekly “challenges”
- Project/program governance, planning
- Network/performance measurement and monitoring
- Network research and network security
- Wavelength Disk Drive (WDD)
- User Controlled LightPath
- Collaboration Infrastructure
- “GLORIAD Classroom”
- IPv6 work
- EduCultural Channel
- Simple Words, Virtual Museum, Junior Achievement
- Community Networking



This is all made possible by ...

- **NSF (6+ years of support) and our other sponsors in Russia, China (and others)**
- **Our wonderful partners in Russia, China, Korea, Netherlands, Canada**
- **US partners - UT/ORNL, NCSA, UT/ORNL (again), Starlight partners: Tom, Joe, Maxine; Harvey Newman, Steve Goldstein, Tom Greene, Aubrey Bush, Yves Poppes, Jim Olson, Mike Rieger, Bill Marra (Tyco), partners at US govt agencies**

**For more information, contact {gcole,natasha}@gloriad.org
Visit: <http://www.gloriad.org/>, <http://www.friends-partners.org/>**

Thank you!