



**Global Ring Network for Advanced
Applications Development (GLORIAD)
and Digital Divide Issues**

Global Ring Network for Advanced Applications Development (GLORIAD) and Digital Divide Issues

International ICFA Workshop on HEP Networking, Grid and Digital Divide Issues for Global e-Science, May 24, 2005

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UT-ORNL Joint Institute for
Computational Sciences (PI)**

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**NSF IRNC Cooperative Agreement
University of Tennessee
\$4.2M/5 years
Began January 1, 2005**

Animation by Chinese Academy of Sciences
Computer Network Information Center



<http://www.gloriad.org/>

tyco / Telecommunications

NSF International Research Network Connections Program (IRNC)

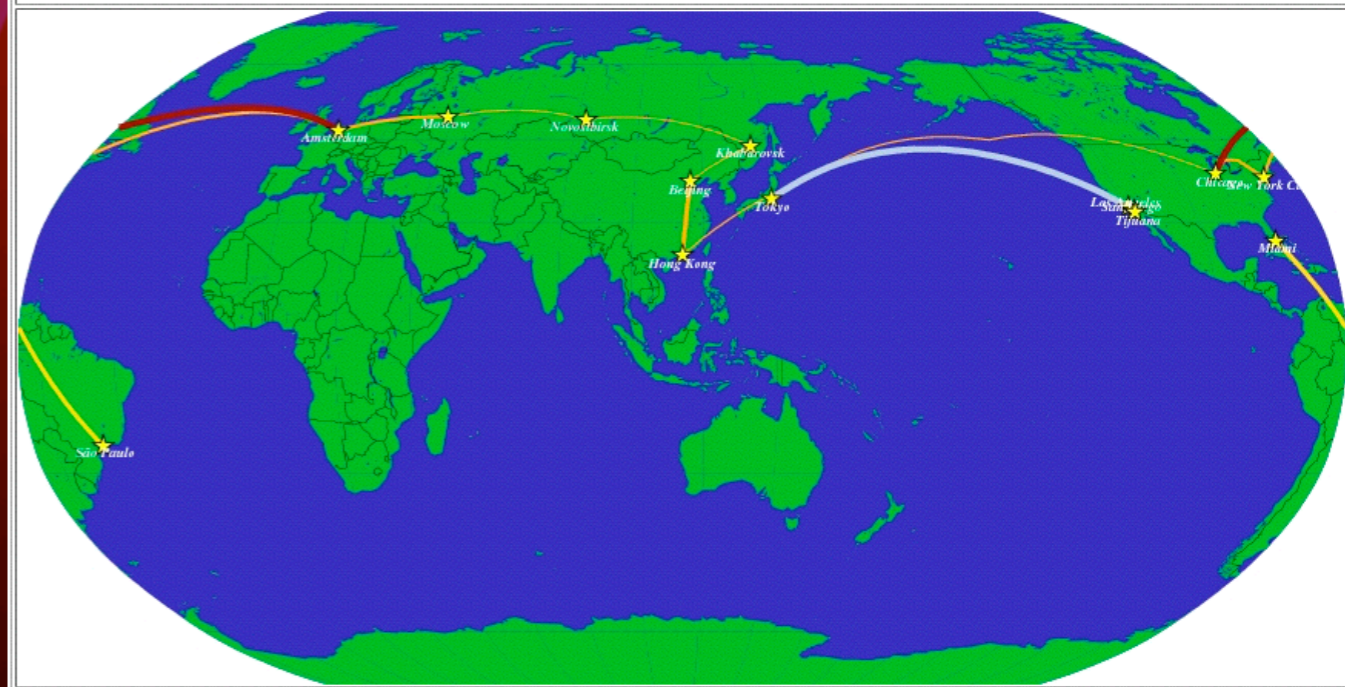
- 5 yr \$25M program to help advance international R&E network connections
- January 1, 2005 - December 31, 2009
- GLORIAD - US-Russia-China-Korea-Netherlands-Canada
- TransLight - US-Europe
- TransPAC2 - US-Japan/Asia
- WHREN - US-Latin America
- Pacific Wave - infrastructure for connections
- Follow-on to NSF HPIIS Program (1998-2004)

Global Cyberinfrastructure Inventory Map

Circuits Operational as of 2005-05-01 for Projects GLORIAD, TransLight, TransPAC2, WHREN

Entire World map centered on Hong Kong, China (Hong Kong)

Legend GLORIAD TransLight TransPAC2 WHREN



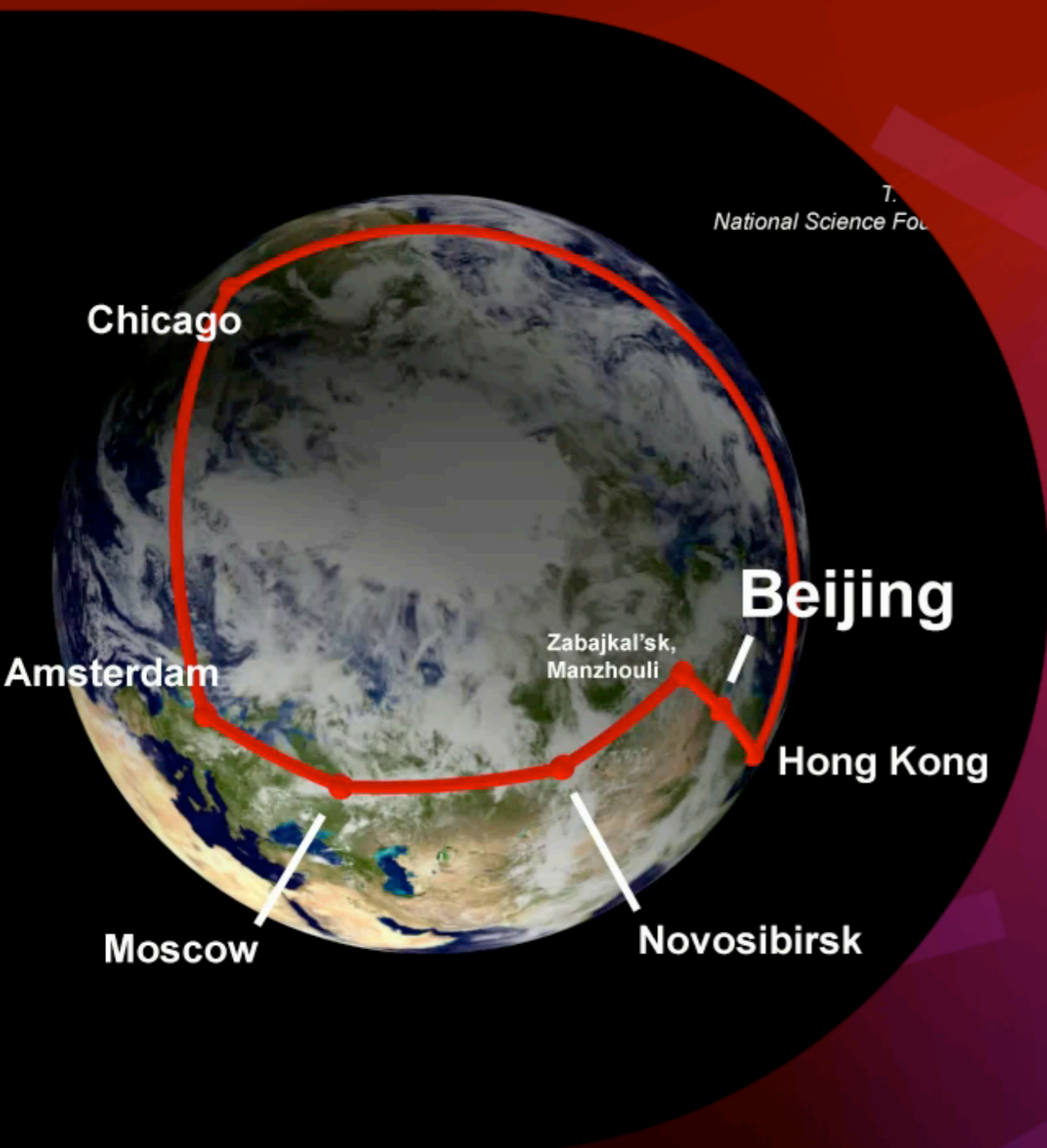
Presentation

- **Background/History**
- **GLORIAD Today, Tomorrow**
- **Partners and Networks**
- **Measurement Program**
- **Application Areas**
- **Education/Outreach Activities**
- **Challenges, Issues**

Digital Divide

- Addressing “the divide” digitally
- Addressing local community infrastructure needs
- Addressing international infrastructure needs

GLORIAD



☉ An advanced S&E network “ring” around the northern hemisphere linking scholars, scientists, educators in Russia, US, China, Korea, Netherlands, Canada and others with special network services

☉ 155/622 Mbps today, 10 Gbps in early 2006, Nx10G in 2008

☉ Hybrid circuit-(L1/L2) and packet-switched service (L3)

☉ Program to Develop/Deploy Advanced Cyberinfrastructure between partnering countries (and others) as effort to expand science, education and cultural cooperation and exchange

Why?



- Leverage jointly developed/funded/operated S&E network to expand S&E cooperation between partnering countries (with initial emphasis on US-Russia-China-Korea-Netherlands-Canada)
- To support specific S&E applications not supported well by commodity or traditional “Internet2” type networks
- To enable communities to build their own specialized networks and for short durations of time
- To provide a test-bed for advanced network research
- To encourage compatible/complementary infrastructure development in closer step

Special Applications

- Need to move a terabyte of data quickly
- Need guaranteed 1.5 Gbps for high-definition uncompressed video for two hour session
- Need carefully managed/controlled “jitter” for steering a visualization (such as a “fly-through” application)
- Need a privately managed, secure network linking partners distributed around the globe
- Need to tie together large-scale computing resources with dedicated network services

Why?



Rita Colwell,
former NSF
Director,
Dec. 2003 press
release

“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.

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



Three Principles

- **Encourage Cooperation**
- **Advance a Common Infrastructure**
- **Move control towards the User**

GLORIAD First Steps

Began With US-Russia Internet Traffic
Exchange in December, 1993
(US-China followed shortly afterwards)

From: goldstein@nsf.gov
To: mak@merit.edu
Cc: steve@cise.cise.nsf.gov, nacr@icml.icp.net,
"Dr. Alexei P. PLATONOV, Director, ROSNIROS" <plat@kiae.su>,
Spartak Belyaev <bst@bstw.kiae.su>,
"Dr. Viacheslav Shkarupin" <slava@prs.isf.kiev.ua>, ncc@ripe.net,
ccirn@csa1.lbl.gov, RICHARD KC HSIEH <HSIEH@lhc.nlm.nih.gov>,
Andrej Mendkovich <KEL2BS@vms2.uni-c.dk>, IETF@CNRI.Reston.VA.US
Subject: Routing of FSU traffic on NSFNET Backbone Service, please begin
Reply-To: goldstein@nsf.gov
Date: Thu, 02 Dec 93 15:26:35 -0500
X-Orig-Sender: sgoldste@nsf.gov

Dear Mark,

Following consideration of the issues by, and instructions received from the National Science Board, NSF asks that traffic from the countries of the former Soviet Union which satisfies the NSFNET Backbone Appropriate Use Policy guidelines be routed by the NSFNET Backbone Service, effective as (reasonably) soon as Merit can implement the changes.

Thank you,

Steve Goldstein
(for Steve Wolff)
	Program Director, Interagency & International Networking Coordination	
	Div. of Networking and Communications Research & Infrastructure	
	National Science Foundation	



Steve Goldstein
NSF Retired

US "Grandfather" of International Connections

Our Story ...

☉ Why tell it?

- ☉ explains the “why” and “how” of GLORIAD

- ☉ the experience and “lessons learned” may be useful for others involved in addressing digital divide issues

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 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

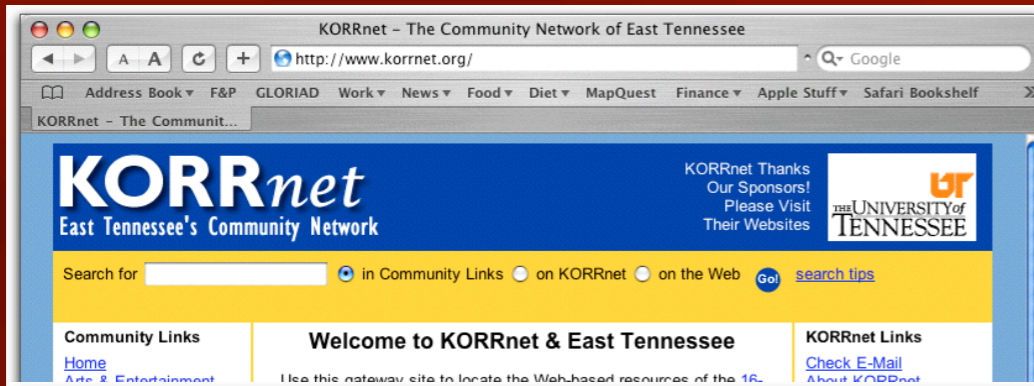
Thank you
Natasha

Computer Center,
Pushchino,
Moscow region,
Russia

History

- We “e-met” during April 1993
- US-Russia Friends & Partners program began January 1994
- Based at Univ of Tennessee and Pushchino Biological Center until 2001
- Technical 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” addressing *the divide* digitally



KORRnet - The Community Network of East Tennessee

http://www.korrnet.org/

KORRnet Thanks Our Sponsors! Please Visit Their Websites

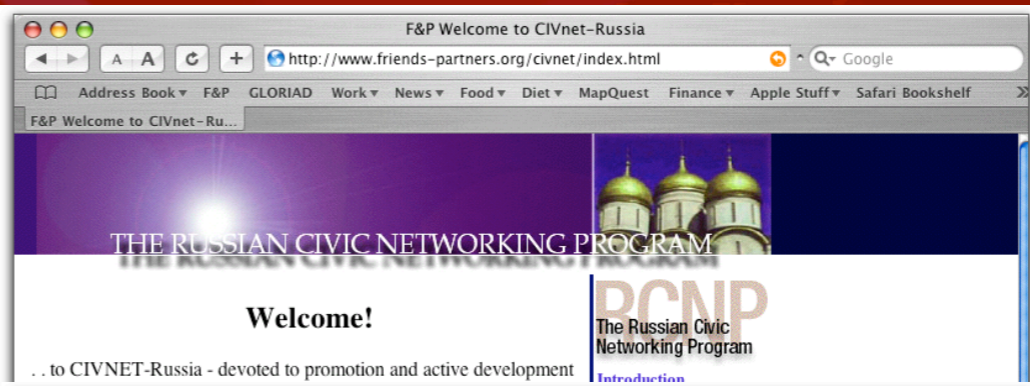
UT THE UNIVERSITY of TENNESSEE

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

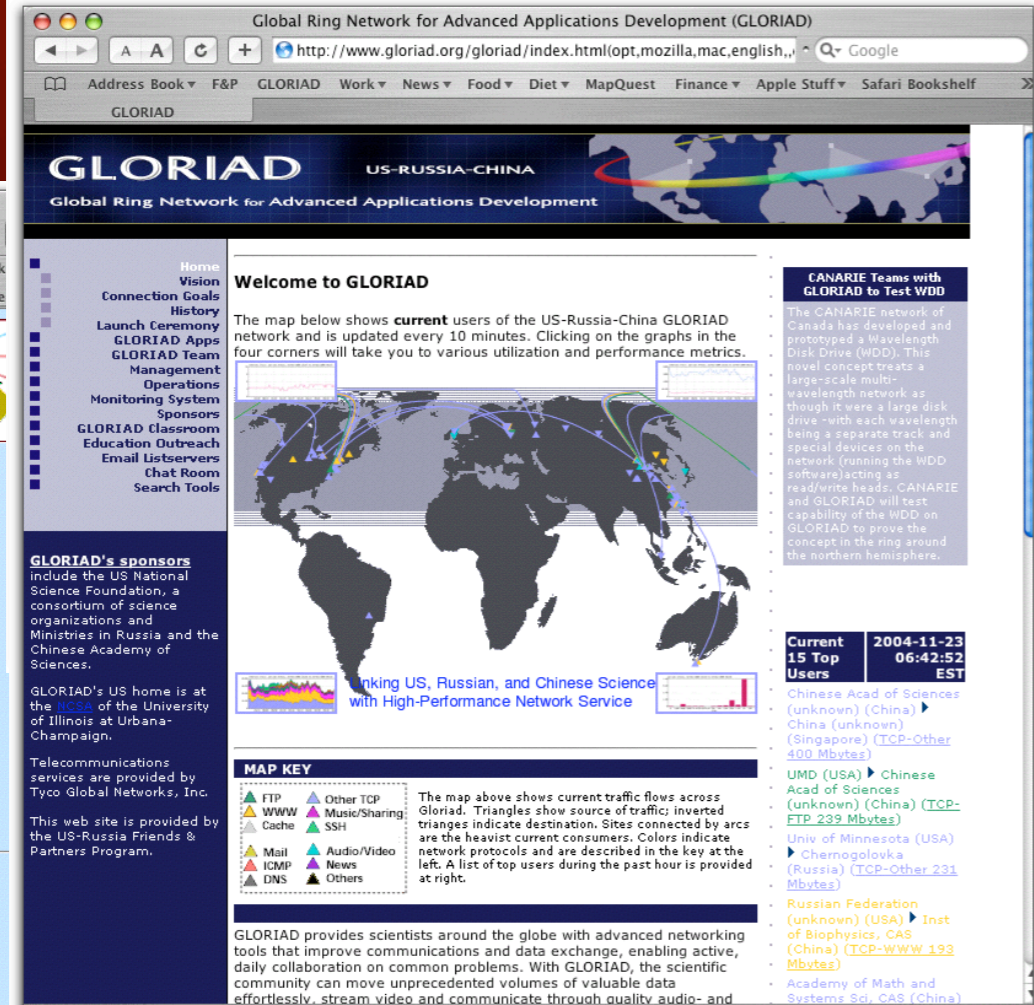
http://www.friends-partners.org/civnet/index.html

THE RUSSIAN CIVIC NETWORKING PROGRAM

BCNP The Russian Civic Networking Program

Welcome!

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



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
- MUSIC/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.

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.

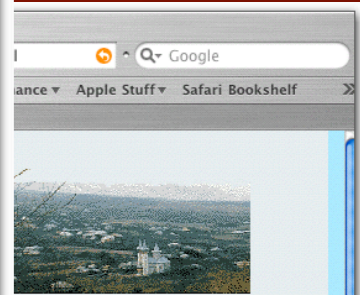
This project owes any success it has realized to many, many individuals and organizations. While we cannot possibly thank everyone here, we do want to thank our sponsors: the National Science Foundation, Ford Foundation, Eurasia Foundation, US State Department, NATO, Sun Microsystems, the International 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.

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. The concept is to create a "meeting place" where people can meet and exchange ideas of mutual interest. We also hope that this "meeting place" will be a place which to integrate much of the explosive

forms of so many initiatives on the Internet and to bring them to the world - as well as the many same goal of cooperation and friendship

an act of friendship - developed over the years - individuals separated by thousands of miles, exchanging better understanding and exchanging how new technologies might be used in projects created by the original Friends and Partners from around the world.

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

since 1994 bringing together friends from around the world with an interest in countries of the former Soviet Union.

The following map shows the founding Chinese partners involved.

within 48 hours, 30,000 web accesses, 360

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 widely recognized and honored (including designation by one Internet publisher 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 State Department grant for Gore-Chernomyrdin Commission meeting helped launch the project activities more broadly**



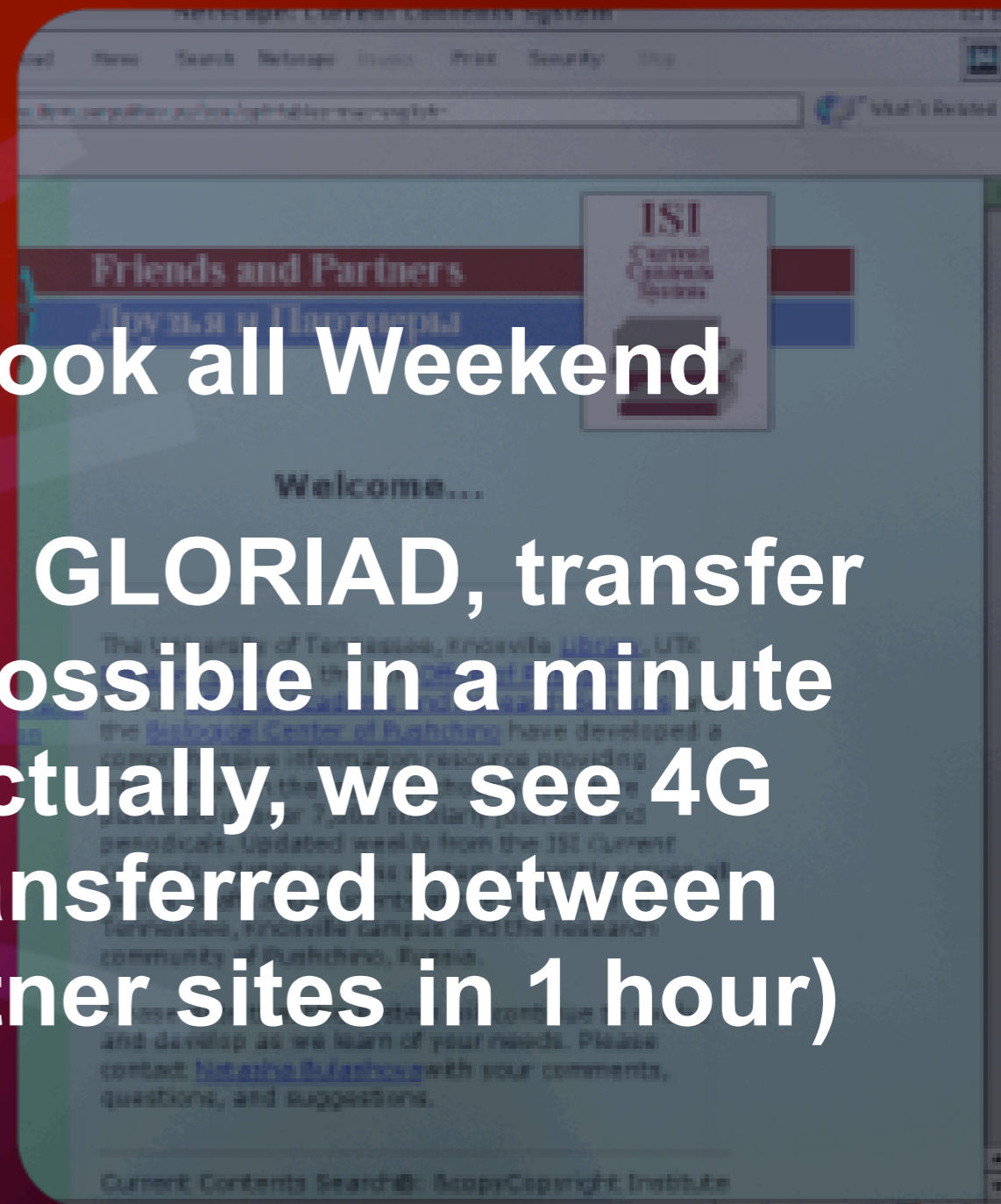
How to transfer 50M file

(Weekly: from Univ of TN to Pushchino)

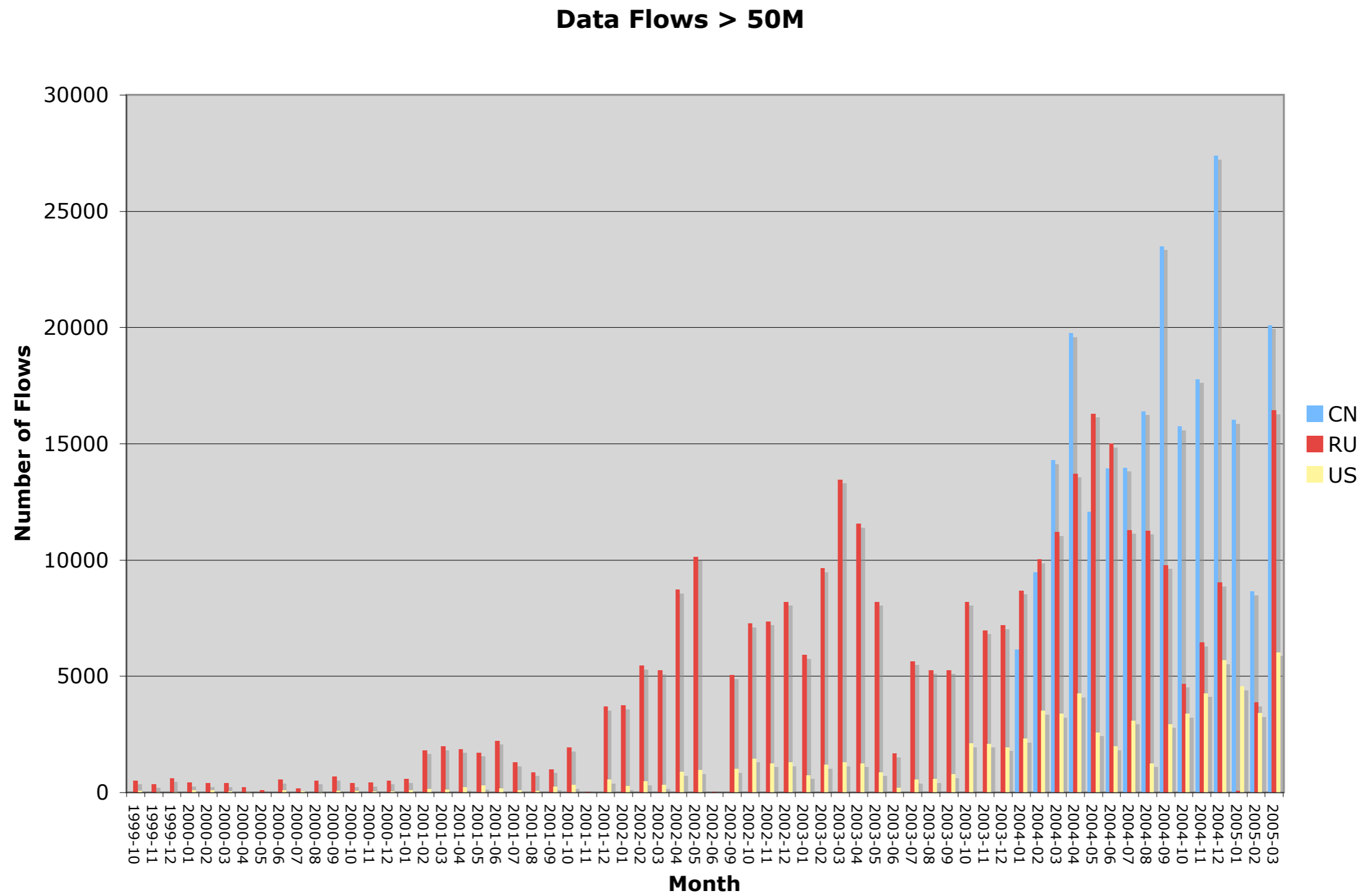
- Compress file
- UUencode it
- Split into 1000 uniform pieces
- FTP the 1000 files
- Uncompress the 1000 files
- Join into 1 file
- UUdecode it
- Uncompress it

Took all Weekend

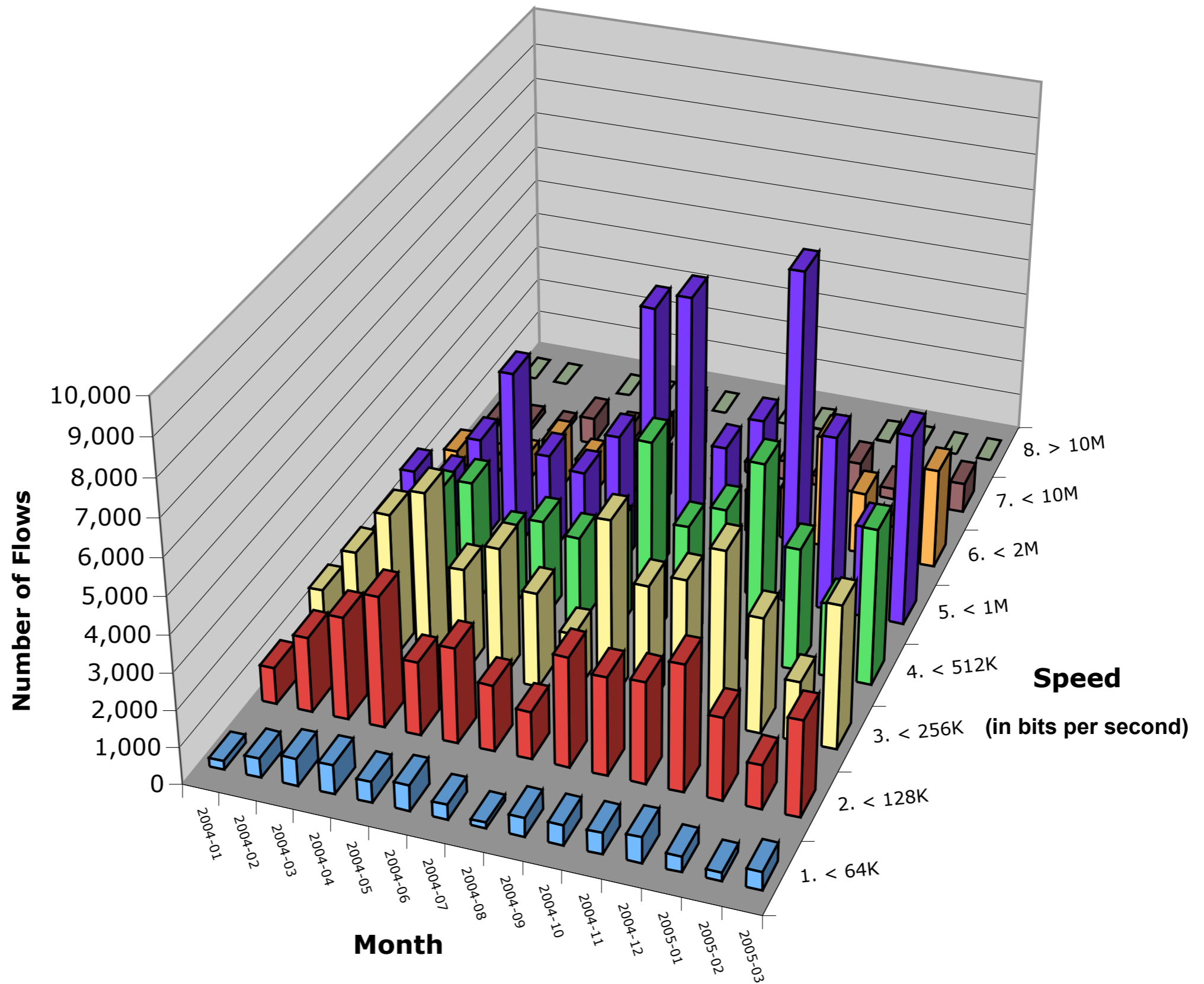
With GLORIAD, transfer is possible in a minute (actually, we see 4G transferred between partner sites in 1 hour)



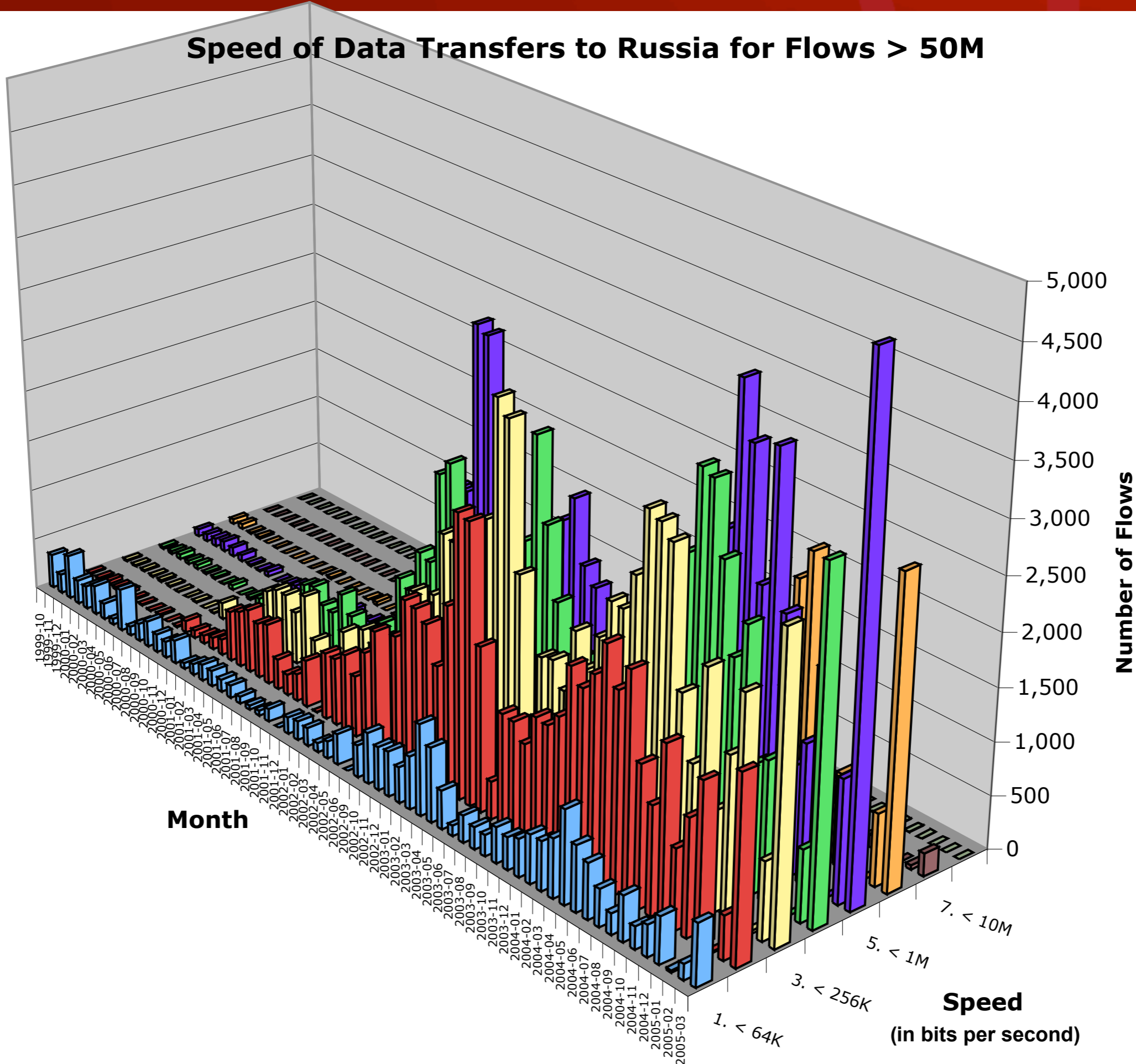
Growth in Data Flows > 50 Mbytes



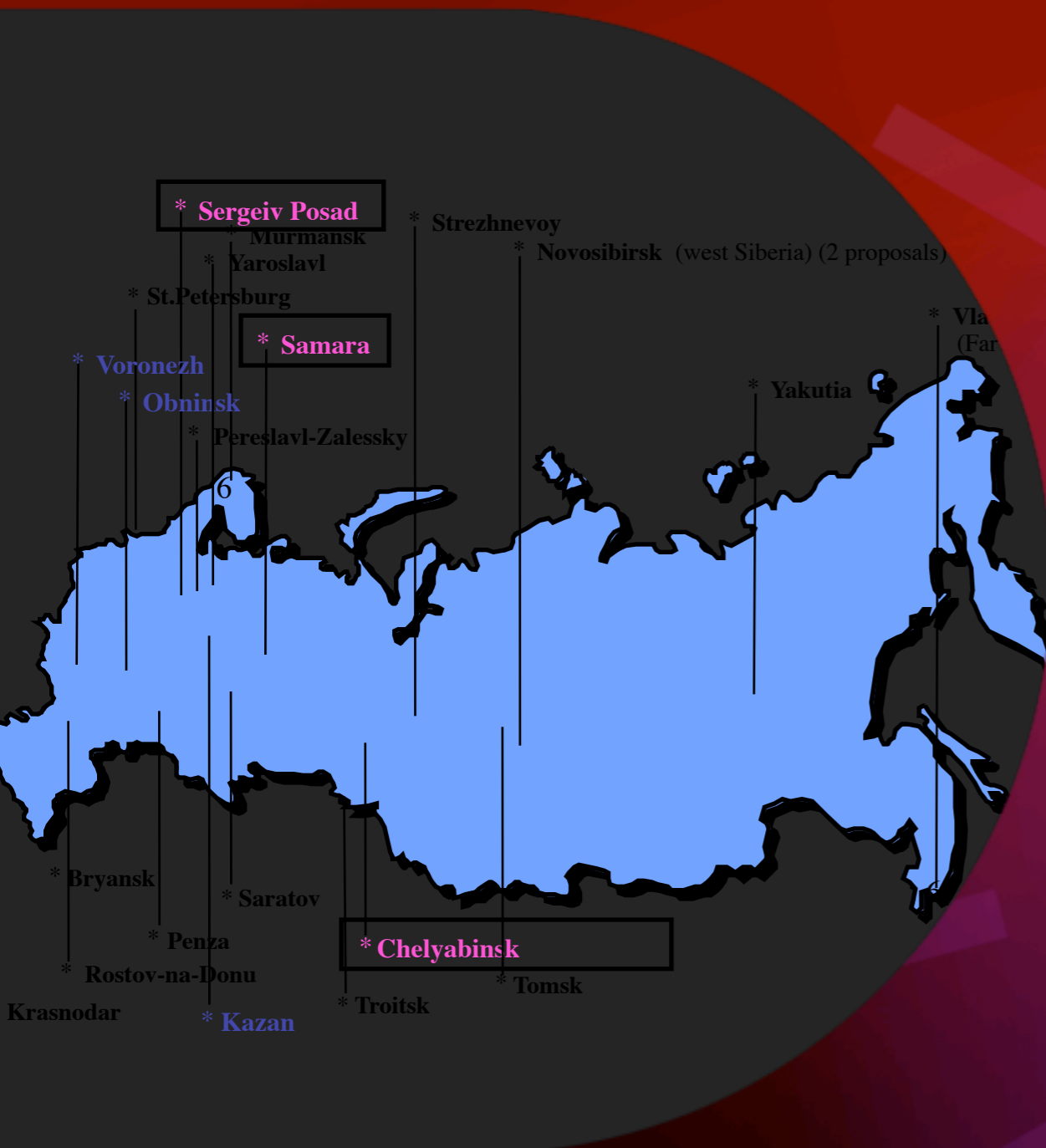
Speed of Data Transfers to China for Flows > 50M



Speed of Data Transfers to Russia for Flows > 50M



Civic Networking



- Emphasis on local infrastructure and local community development
- 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

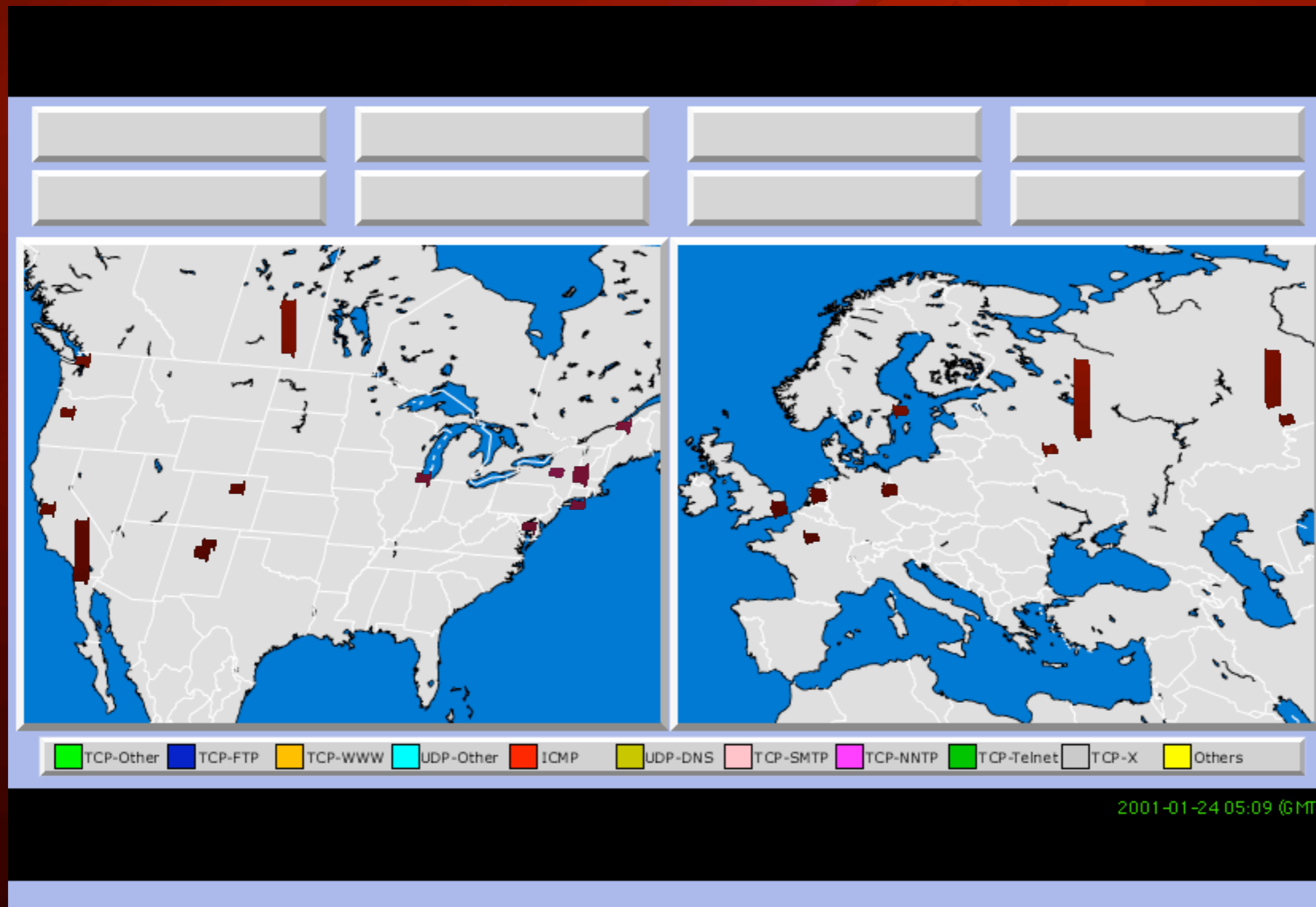
During time of F&P and CIVnet projects (mid-1997), we began working on high performance connectivity between US and Russia, applying for funding under the NSF High Performance International Internet Services (HPIIS) program.

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

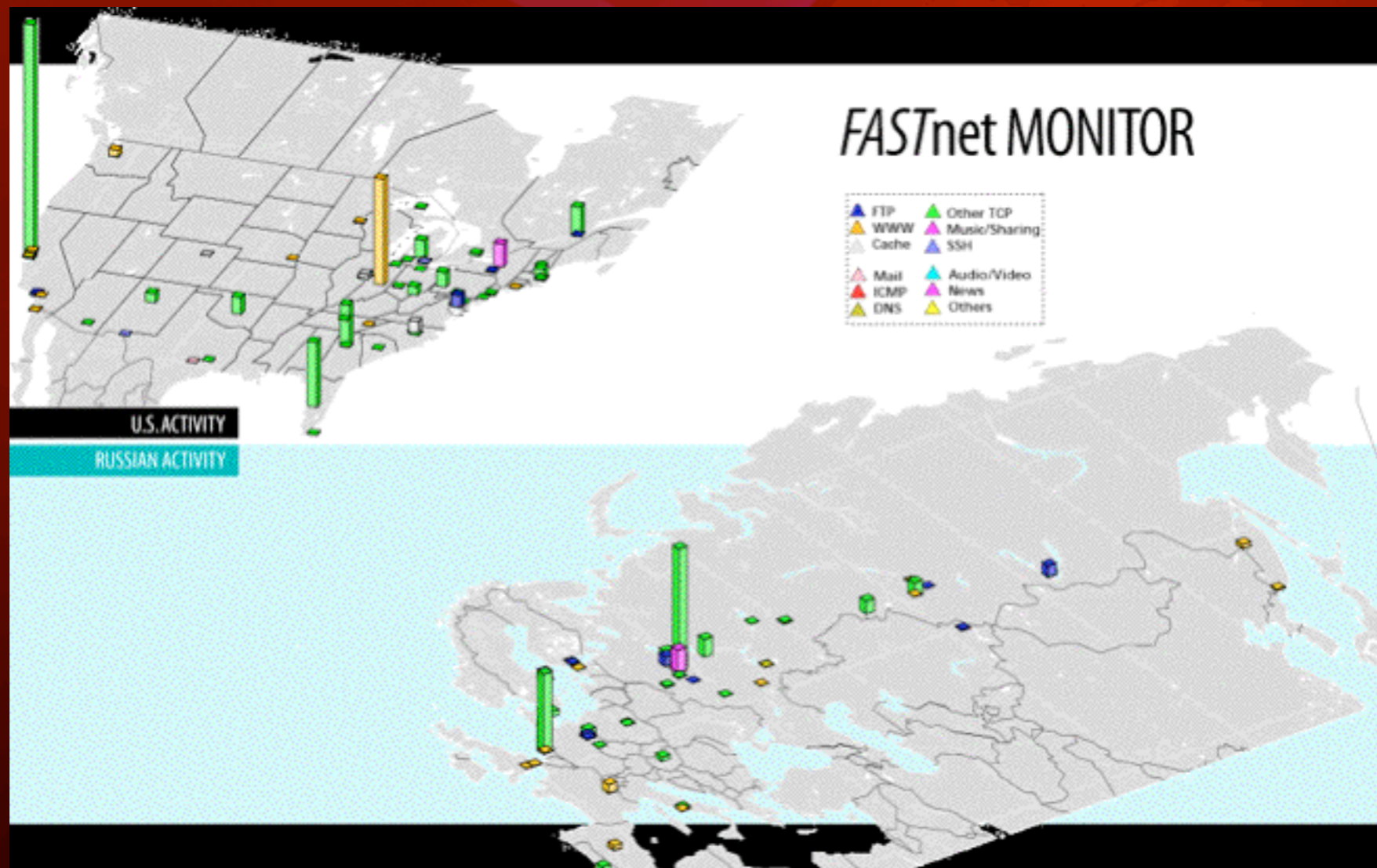
GLORIAD HISTORY

Began as the US-Russia 6 Mbps MIRnet Program in 1998, Limited Primarily to Moscow/region



GLORIAD HISTORY

Transitioned to the US-Russia 45 Mbps FastNet Program in Dec. 2001, and then the 155 Mbps NaukaNet in 2002



Transition Time

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

- **Dramatically expand connectivity/bandwidth across Russia**
- **Keep going ...**
- **Extend access from Russian Far East to US**
- **Bring Chinese science community in as partner**
- **Introduce the developing “GLIF” networking 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 (Acad. Evgeny Velikhov) and Chinese (Dr. Mianheng Jiang) partners to develop GLORIAD – first step: “Little GLORIAD”

Little GLORIAD



- ☉ Agreement signed by Velikhov, Jiang, Cole in December 2002
- ☉ 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
- ☉ NSF Grant funded December 2004, “Big GLORIAD” program begins in US on January 1, 2005

1996: Local Networking



1998: Int'l Networking



1994: Community Building



2004: GLORIAD Launch

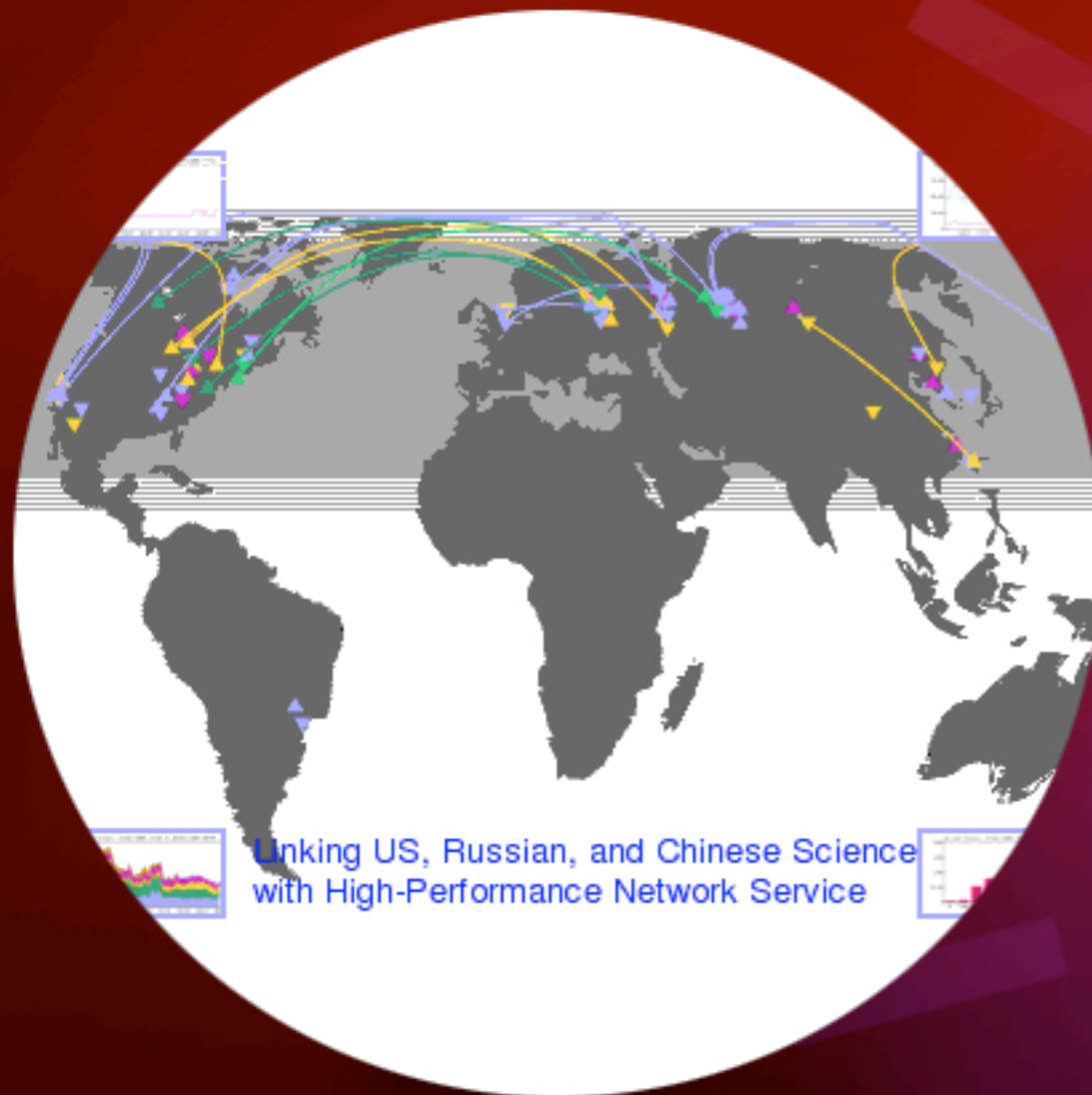
When/How?

- April 1993: that first email ...
- 1994: US-Russia Community-networking effort called "Friends & Partners" begins
- 1996: US-Russia "Civic Networking" begins (focus on local infrastructure)
- 1998: US-Russia "MIRnet/NaukaNet" begins (high performance international)
- 2002: Work begins on GLORIAD
- 2004: "Little GLORIAD" launched
- 2005: January 1 - GLORIAD begins

Presentation

- Background/History
- **GLORIAD Today, Tomorrow**
- Partners and Networks
- Measurement Program
- Application Areas
- Education/Outreach Activities
- Challenges, Issues

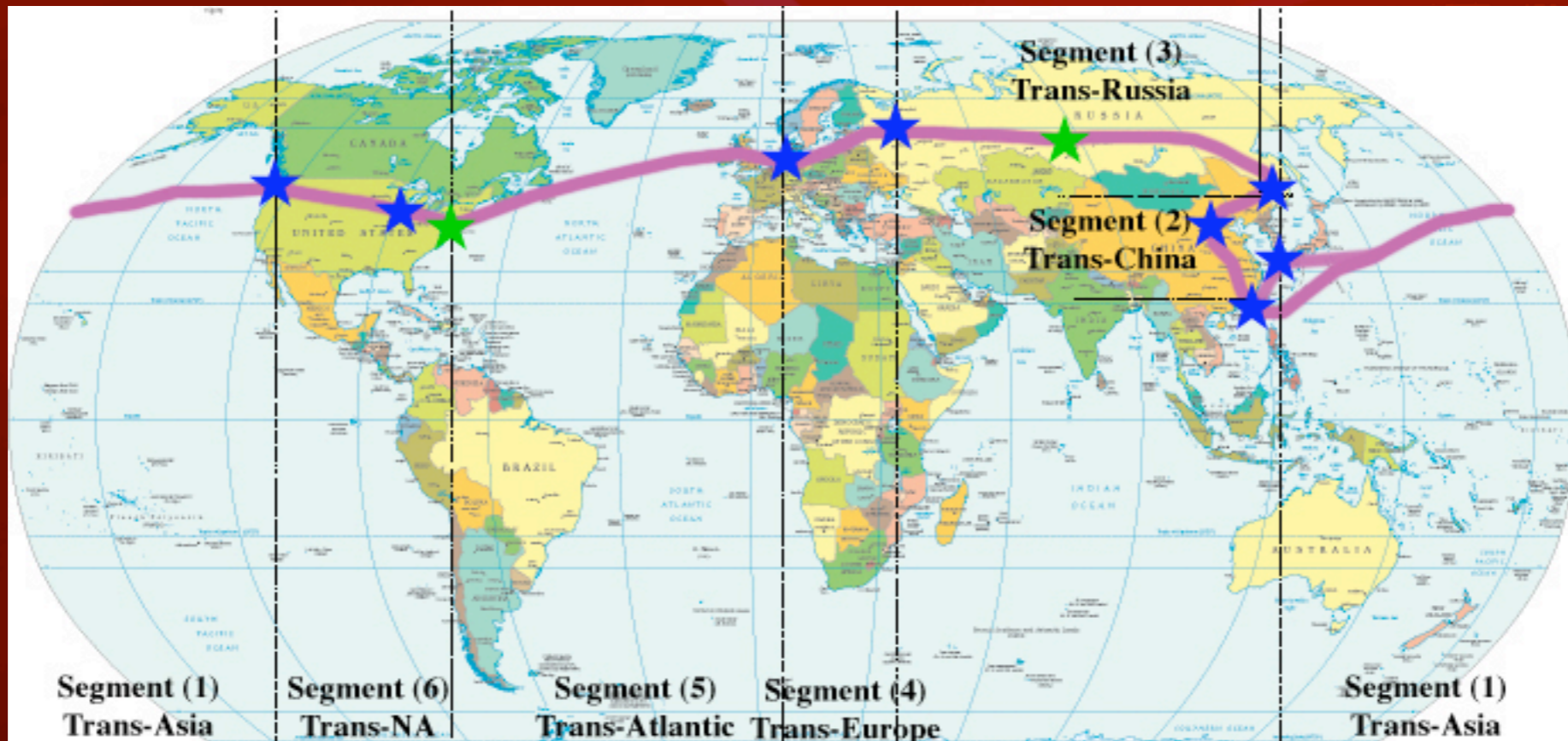
GLORIAD TODAY



- 155/622 Mbps Circuits Around Northern Hemisphere providing L3 service
- 622 Mbps Moscow-AMS-NYC
- 1 GbE NYC-Chicago (CANARIE)
- 155 Mbps Chicago-Hong Kong
- 2.5 Gbps Hong Kong-Beijing
- 155 Mbps Beijing-Khabarovsk-Moscow
- This year: 2.5 Gbps US-China link, 10 Gbps US-Korea-China link in July, 10 Gbps US-AMS and US-China circuits in January, 2006

The GLORIAD Network Topology

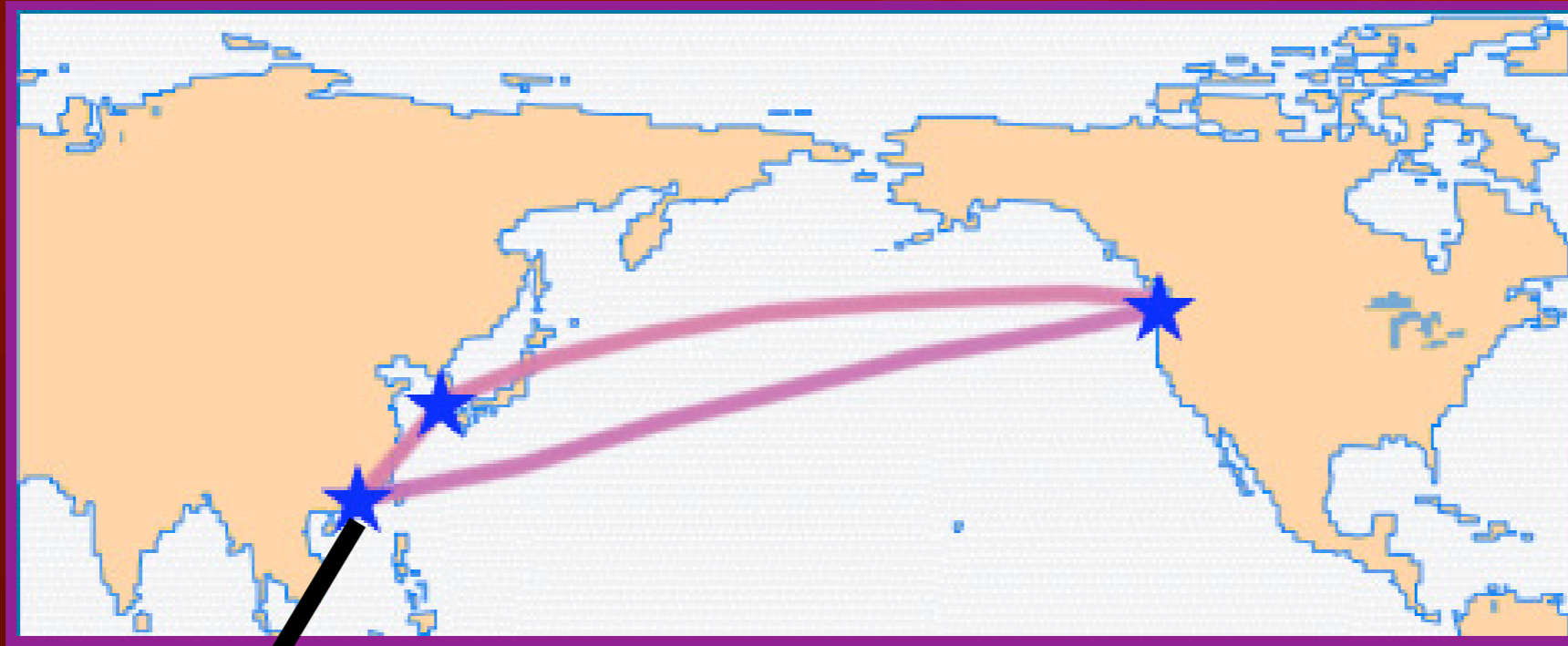
Current, Years 1-5



Segment	Current	Year 1	Year 2	Year 3	Year 4	Year 5
1 - Trans-Asia	155 Mbps	2.5 Gbps (US-China), 10 Gbps (US-Korea-China)	2 x 10 Gbps (US-China, US- Korea-China)	2 x 10 Gbps	N x 10 Gbps	N x 10 Gbps
2 - Trans-China	2.5 Gbps (155 Mbps, Beijing- Khabarovsk)	2.5 Gbps	1 x 10 Gbps	2 x 10 Gbps	N x 10 Gbps	N x 10 Gbps
3 - Trans-Russia	155 Mbps	155 Mbps	622 Mbps	1 x 10 Gbps	N x 10 Gbps	N x 10 Gbps
4 - Trans-Europe	622 Mbps	622 Mbps	622 Mbps	2 x 10 Gbps	N x 10 Gbps	N x 10 Gbps
5 - Trans-Atlantic	622 Mbps	1 Gbps	1 x 10 Gbps	2 x 10 Gbps	N x 10 Gbps	N x 10 Gbps
6 - Trans-North America	155 Mbps (Asia- Chicago), GbE NYC-Chicago (via CANARIE)	10 Gbps, Seattle-Chicago- NYC	10 Gbps, Seattle-Chicago- NYC	2 x 10 Gbps	N x 10 Gbps	N x 10 Gbps

Trans-Pacific Portion (Segment 1)

(illustrating Hong-Kong–Seattle and Hong-Kong–Pusan–Seattle paths)



Hong Kong Light (HKLight) Open Exchange Point
Other exchange points include Starlight (Chicago),
Pacific Wave (Seattle), Netherlight (Amsterdam),
RussiaLight (Moscow)

GLORIAD Network

Today: 5/23/2005

Beijing-Khabarovsk (Russia)-
Novosibirsk, 155 Mbps

Chicago-Hong Kong, 155 Mbps
(Tyco Contract)

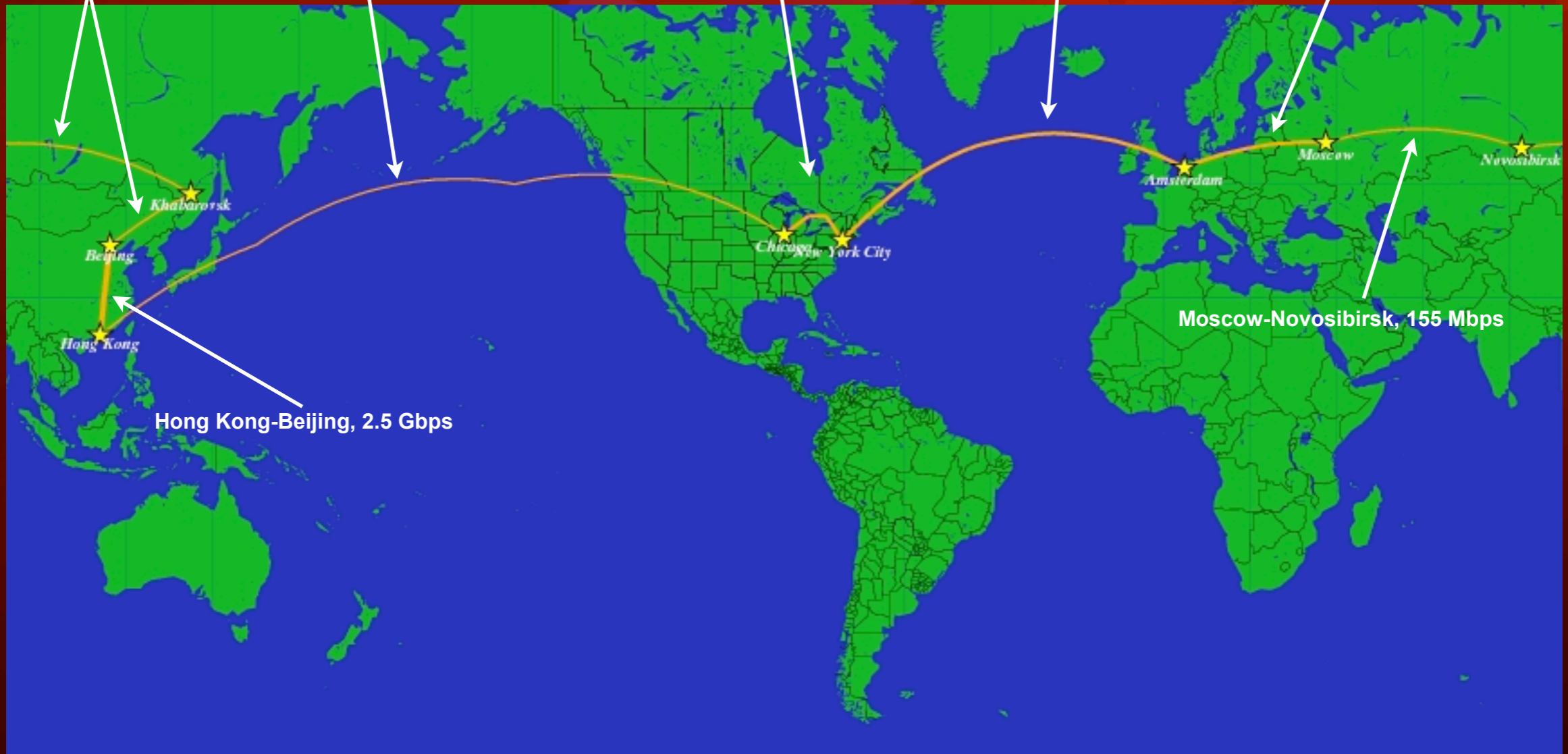
Chicago-NYC, 1 Gbps
(CANARIE Contribution)

NYC-Amsterdam, 622 Mbps
(Tyco Contribution)

Amsterdam-Moscow, 622 Mbps

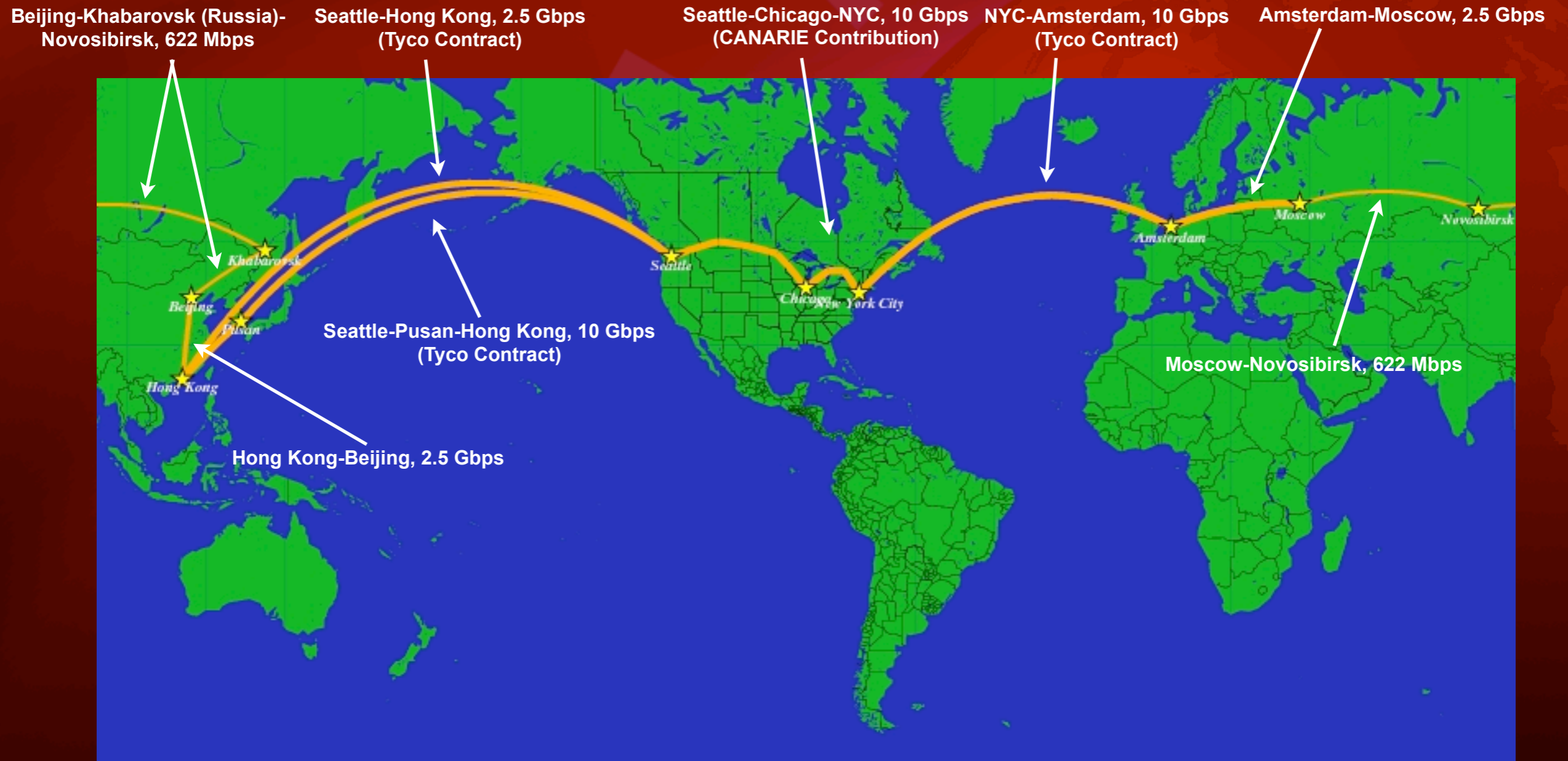
Moscow-Novosibirsk, 155 Mbps

Hong Kong-Beijing, 2.5 Gbps



GLORIAD Network

Date: 3/1/2006



GLORIAD Network

Date: 3/1/2007

Beijing-Khabarovsk (Russia)-
Novosibirsk, 10 Gbps

Seattle-Hong Kong, 10 Gbps
(Tyco Contract)

Seattle-Chicago-NYC, 10 Gbps
(CANARIE Contribution)

NYC-Amsterdam, 10 Gbps
(Tyco Contract)

Amsterdam-Moscow, 10 Gbps



Architecture Motivation

- General S&E Applications – needs met by “best effort” routed infrastructure (but minimize congestion/packet loss)
- Specialized Applications requiring high capacity, low-latency and/or controlled jitter (i.e., dedicated end-to-end circuits)
- Network research/experimentation testbed
- Backup/protection services for partnering S&E networks

Network Design

- Using MSPP devices (i.e., Ciena CoreDirector, Cisco ONS 15454, etc.), provide own L1 infrastructure
- Use UCLP to enable user community (and applications) to dynamically provision their own circuits across the core (and end-to-end where possible)
- Use N x GbE for layer-3 routed infrastructure (GLORIAD just received its own AS number)
- Take advantage of ring topology for network reliability and for network experimentation
- Big emphasis on monitoring: (1) utilization, (2) performance, (3) security

Network Operations

Planning
“distributed NOC”

Deploying own
trouble ticketing
system (integrated
with monitoring
sub-systems)

ID	Client Name	Issue Description	Staff	Status	Created
008135	Louise McKay	General Information	Gillespie-Norder, Marcia A.	Closed	2000-04-07 10:41:52 AM
008133	Keith Pilcher	OTHER	Gillespie-Norder, Marcia A.	Closed	2000-04-07 10:39:43 AM
008132	Bob Massengill	OTHER	Gillespie-Norder, Marcia A.	Closed	2000-04-07 10:14:33 AM
008170	arevels	E-mail Client Configuration	Cross, Adam	Closed	2000-04-07 10:00:07 PM
008169	Connie Gillespie	AIM Problem	Cunningham, Michael TANK	Closed	2000-04-07 09:48:58 PM
008167	Paulette Hammond	OTHER	Cunningham, Michael TANK	Closed	2000-04-07 08:50:12 PM
008166	kend	User Cancel	Cross, Adam	Closed	2000-04-07 08:15:56 PM
008164	kend	User Signup	Cross, Adam	Closed	2000-04-07 07:43:10 PM
008163	Gary Marks	OTHER	Cunningham, Michael TANK	Closed	2000-04-07 07:26:21 PM
008160	Kieth Pilcher	Cannot Connect at all	Cunningham, Michael TANK	Closed	2000-04-07 06:44:37 PM
008159	Dorothy Hayes	User Signup	Cunningham, Michael TANK	Closed	2000-04-07 06:15:03 PM
008157	Ron Nolcken	E-mail Client Configuration	Gillespie-Norder, Marcia A.	Closed	2000-04-07 03:57:37 PM
008156	Ed Nicholson	Internet Explorer Setup	Gillespie-Norder, Marcia A.	Closed	2000-04-07 03:48:55 PM
008154	Walt Bigney	Cannot Connect at all	Gillespie-Norder, Marcia A.	Closed	2000-04-07 03:14:04 PM
008153	gmarks	OTHER	Gillespie-Norder, Marcia A.	Closed	2000-04-07 03:11:10 PM
008152	Octavia Mallory	User Signup	Gillespie-Norder, Marcia A.	Closed	2000-04-07 03:05:29 PM

Working Groups / Governance

30+ Working Groups
Dealing with:

Networking Issues

Monitoring/Security
Issues

Science Disciplines

Project Management

Education/Outreach
Programs

www.gloriad.org mailing lists - Admin Links

Welcome!

Below is the collection of publicly-advertised [Mailman](#) mailing lists on [www.gloriad.org](#). Click on a list name to visit the configuration pages for that list. To visit the administrators configuration page for an unadvertised list, open a URL similar to this one, but with a '/' and the list name appended. If you have the proper authority, you can also [create a new mailing list](#).

General list information can be found at [the mailing list overview page](#).

(Send questions and comments to mailman@gloriad.org.)

List	Description
Engineering	GLORIAD Engineering List
glo-amp	GLORIAD Active Measurement Working Group
glo-ast	GLORIAD Astronomical Sciences Working Group
glo-atm	GLORIAD Atmospheric Sciences Working Group
glo-ca	GLORIAD Central Asia Working Group
glo-cls	GLORIAD Classroom Working Group
glo-com	GLORIAD Computational Sciences Working Group
glo-eng	GLORIAD Engineering List
glo-exe	GLORIAD Executive Board Listserver
glo-hep	GLORIAD High Energy Physics Working Group
glo-htv	GLORIAD High Definition Stream TV Working Group
glo-itr	GLORIAD ITER/Fusion Energy Working Group
glo-med	GLORIAD Medical/Health Sciences Working Group
glo-mon	GLORIAD General Monitoring Activity Working Group
glo-nnp	GLORIAD Nuclear Non-Proliferation Working Group
glo-noc	GLORIAD Network Operations Center List
glo-pr	GLORIAD Public Relations Working Group
glo-sec	GLORIAD Security Working Group Listserver

Presentation

- Background/History
- GLORIAD Today, Tomorrow
- **Partners and Networks**
- Measurement Program
- Application Areas
- Education/Outreach Activities
- Challenges, Issues

Who in Russia?

- Acad. Evgeny Velikhov, President, Kurchatov Institute, Academician-Secretary, Russian Academy of Sciences
- Ministry of Science & Education, Agency of Communications, Agency of Atomic Energy, Moscow State University, Joint Supercomputing Center
- Russian Backbone Network (RBNNet)

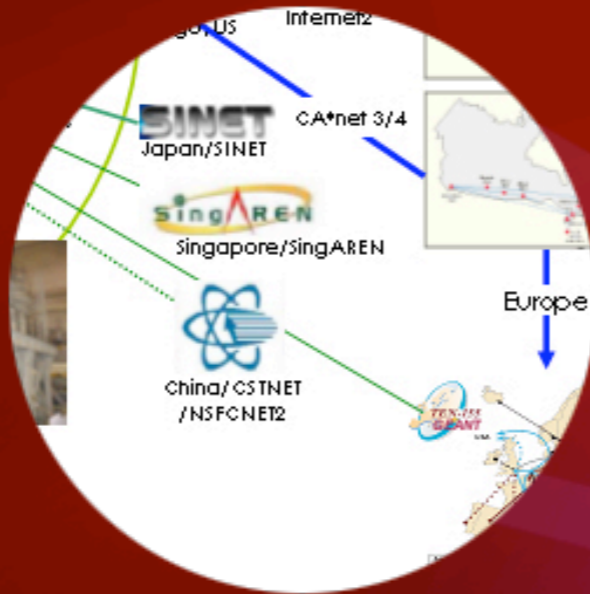


Who in China?



- ☉ Dr. Mianheng Jiang, Vice President, Chinese Academy of Sciences, Telecomm/IT Developer (signatory of first GLORIAD agreement)
- ☉ Dr. Baoping Yan, Director, Computer Network Information Center (CNIC), Chinese Academy of Sciences. Directs all GLORIAD activities in China
- ☉ China Science & Technology Network (CSTnet)

Who in Korea?



- Dr. Young-Hwa Cho, Director, Korea Institute of Science and Technology Information (KISTI)
- Dr. Jysoo Lee, Director, Supercomputing Center, KISTI
- Dr. Ok-Hwan Byeon, Dongkyun Kim, Minsun Lee, KREONet2, KISTI
- Korea Research Education Network (KREONet)

Who in Europe?

- ☉ Kees Neggers, Executive Director, SURFnet, Amsterdam, The Netherlands
- ☉ Erik-Jan Bos, Chief Network Engineer, SURFnet, Amsterdam, The Netherlands
- ☉ SURFnet, Netherlight Network



Who in Canada?

☉ Bill St. Arnaud, Senior Director,
Advanced Networks, CANARIE

☉ Rene' Hatem, Thomas Tam, Chief
network engineers, CANARIE

☉ CANARIE



Who in USA



**Oak Ridge
National
Laboratory**

- Greg Cole and Natasha Bulashova, Research Director/Research Scientist, UT-ORNL Joint Institute for Computational Sciences, PI/Co-PI, NSF GLORIAD Agreement
- Anita Colliate Howard (Research Assoc.), John Lankford (Network Architect/Engineer), Lyn Prowse-Bishop (Exec. Asst), 2 REU students (coming), Ana Preston, Predrag
- Sponsor: National Science Foundation (~\$9.5M since 1998), Other sponsors of US-Russia work: NATO, Sun Microsystems, US State Department, Ford Foundation, Eurasia Foundation, US AID
- Many other partners: Harvey Newman (Chief Science Advisor) (~ 40 other scientists/educators/others on advisory groups), Starlight, Pacific Wave, others
- Networks: National Lambda Rail, ESnet, NASA R&E Networks, Internet2/Abilene (peering), Federal Networks, etc.

Who Ties it Together?



- Tyco Global Networks: Trans-Atlantic and Trans-Pacific Provider; is both important service provider and research partner since the beginning of GLORIAD

- Russia: RosTelecomm

- China: China Netcom

- North America: CANARIE

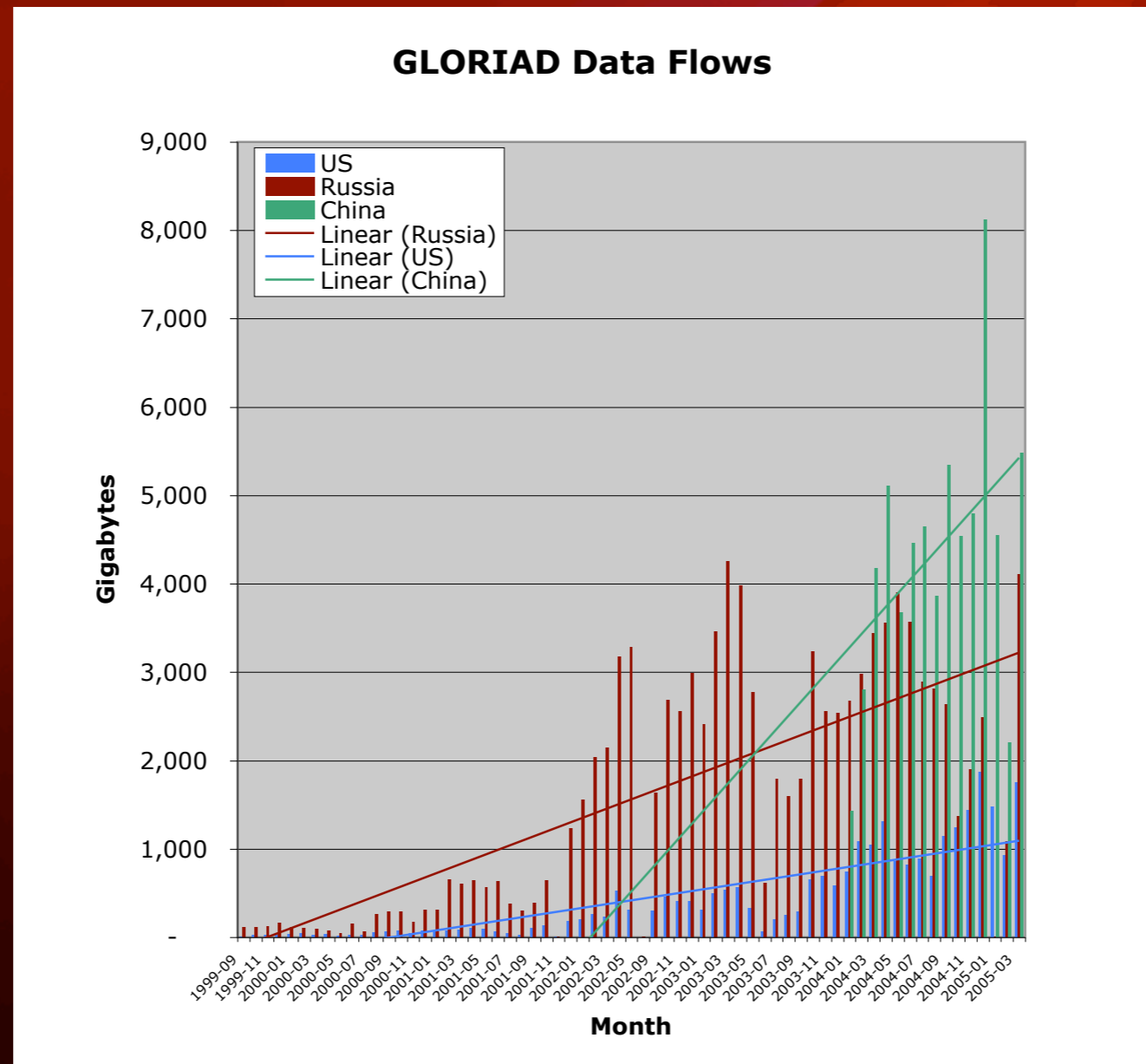
Presentation

- Background/History
- GLORIAD Today, Tomorrow
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- **Measurement Program**
- Application Areas
- Education/Outreach Activities
- Challenges, Issues

Monitoring Program

- Utilization Monitoring (netflow-based, circuit up-time, utilization, institutional and application reporting, MonALISA)
- Performance Monitoring (Intl AMP Mesh w/NLANR)
- Security Monitoring (BRO box in Chicago for research)

Overall Traffic Growth



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

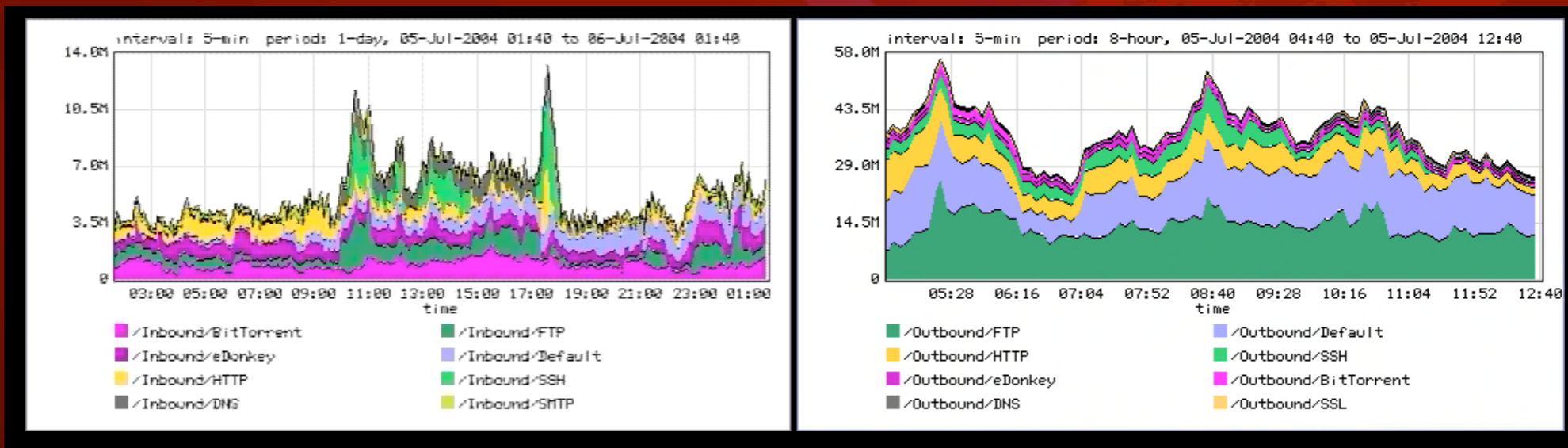
to Russia

<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
Institute 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

GLORIAD Application Utilization Monitoring System (using Packeteer Boxes)



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

AMP (One-way) Measurements to Russia



MEASUREMENT & NETWORK ANALYSIS

"amp-naukanetnwu russia results"

[\[NLNAR\]](#) [\[AMP\]](#) [\[Monitors\]](#) [\[route summary\]](#) [\[summary graph\]](#) [\[site info\]](#)

Site Name - Graph	Min (ms)	Mean (ms)	Max (ms)	Stddev (ms)	Loss (%)	Stats from
bmstu	147.00	149.59	173.00	1.51	0.42	2005/3/9
ccas	145.00	151.20	322.00	14.61	1.39	2005/3/9
chg	146.00	148.62	209.00	2.61	1.32	2005/3/9
chph-ras	0.00	0.00	0.00	0.00	100.00	2005/3/9
core-gw-3-se-0-3-1-mtts-ksu	0.00	0.00	0.00	0.00	100.00	2005/3/9
dvo	262.00	276.96	513.00	16.78	6.18	2005/3/9
earth-crust-irk	0.00	0.00	0.00	0.00	100.00	2005/3/9
freeNet	145.00	145.86	179.00	1.19	1.25	2005/3/9
friends-partners	147.00	149.68	229.00	4.77	7.15	2005/3/9
gpi	145.00	158.24	477.00	34.47	2.01	2005/3/9
gpntb	147.00	149.11	450.00	8.25	3.06	2005/3/9
ihep.su	147.00	150.16	168.00	2.02	0.35	2005/3/9
iitp	0.00	0.00	0.00	0.00	100.00	2005/3/9
ikia-ircache	144.00	145.05	168.00	1.12	0.62	2005/3/9
ioc-ac	145.00	146.66	202.00	2.17	4.31	2005/3/9
ipmce	0.00	0.00	0.00	0.00	100.00	2005/3/9
ippe-obninsk	155.00	242.33	3227.00	165.72	10.69	2005/3/9
iskran-iip	145.00	148.11	192.00	1.72	0.49	2005/3/9
itep	144.00	146.60	237.00	7.13	0.97	2005/3/9
ivep-khv	731.00	944.14	1753.00	188.55	1.67	2005/3/9
jinr	148.00	155.30	273.00	14.49	0.49	2005/3/9
keldysh	146.00	148.36	187.00	3.16	3.82	2005/3/9

kiae	146.00	152.56	274.00	10.02	1.74	2005/3/9
krasn	192.00	547.68	1079.00	280.42	2.22	2005/3/9
kubsu	168.00	172.78	213.00	3.78	0.90	2005/3/9
lebedev	147.00	149.70	161.00	1.81	0.49	2005/3/9
mipt	145.00	149.76	375.00	8.27	1.32	2005/3/9
mpei-ac	146.00	149.21	291.00	7.08	3.89	2005/3/9
nsc	0.00	0.00	0.00	0.00	100.00	2005/3/9
pfu	146.00	169.07	386.00	37.40	7.71	2005/3/9
pmc	146.00	152.02	224.00	7.04	0.49	2005/3/9
psn	155.00	176.03	439.00	34.03	2.57	2005/3/9
radio-msu	145.00	148.05	167.00	2.39	0.56	2005/3/9
relarn	0.00	0.00	0.00	0.00	100.00	2005/3/9
rssi	144.00	145.64	267.00	4.88	1.18	2005/3/9
rsuh	145.00	148.03	179.00	2.51	2.57	2005/3/9
sgu	163.00	240.47	909.00	109.12	10.00	2005/3/9
sinp-msu	145.00	146.81	176.00	1.53	1.63	2005/3/9
siobc-ras	147.00	157.51	336.00	21.22	1.11	2005/3/9
smr	161.00	163.64	185.00	2.48	1.39	2005/3/9
stankin	0.00	0.00	0.00	0.00	100.00	2005/3/9
tversu	0.00	0.00	0.00	0.00	100.00	2005/3/9
unn	150.00	163.63	316.00	19.51	1.11	2005/3/9
urc-ac	181.00	828.43	2362.00	535.89	7.22	2005/3/9
usu	0.00	0.00	0.00	0.00	100.00	2005/3/9
vigg	150.00	222.85	741.00	43.09	20.56	2005/3/9
vspsu	182.00	463.21	1771.00	255.60	9.65	2005/3/9
vsu	157.00	173.38	286.00	14.48	1.04	2005/3/9
x-atom	150.00	161.36	517.00	25.24	8.33	2005/3/9

Generated at Thu Mar 10 01:08:16 2005.

[Top](#) last modified: 10 Mar 2005 Tony McGregor Comments, questions are welcome: [Feedback](#)

AMP Measurements to Moscow BMSTU



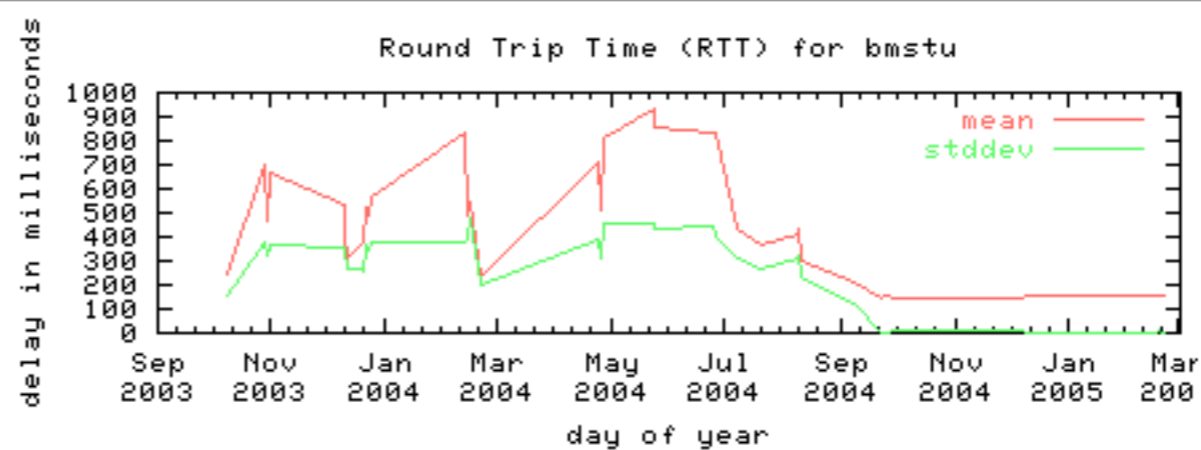
RTT And Loss Measurements

amp-ru-bmstu from amp-naukanetnwu

[\[NLANR\]](#) [\[AMP\]](#) [\[monitors\]](#) [\[amp-naukanetnwu\]](#) [\[reverse\]](#) [\[src info\]](#)

[Fill in all graphs](#)

Long Term average per day



Presentation

- Background/History
- GLORIAD Today, Tomorrow
- Partners and Networks
- Measurement Program
- **Application Areas**
- Education/Outreach Activities
- Challenges, Issues

GLORIAD: more than a network



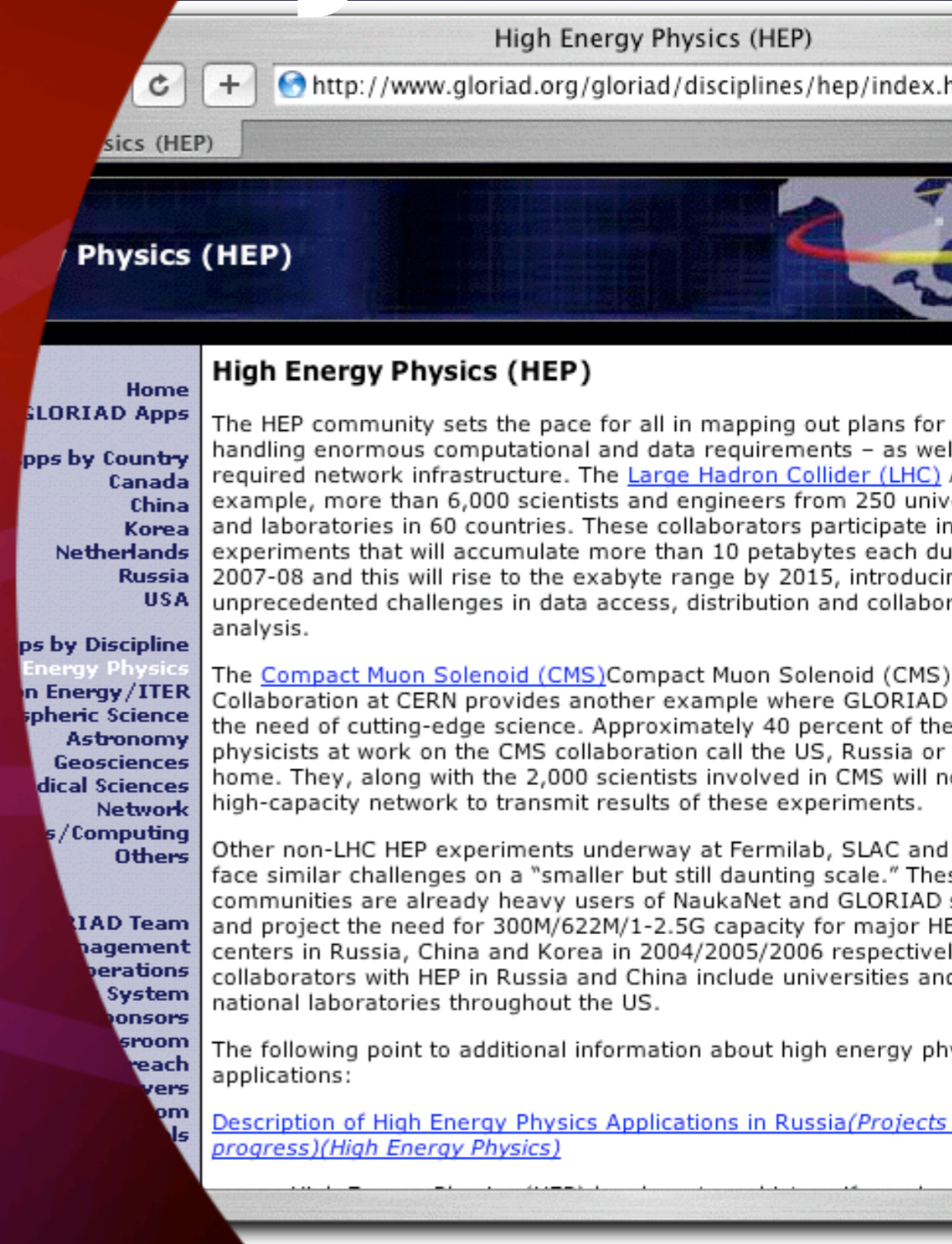
- ☉ Serving ITER, High Energy Physics, Astronomy, Atmos. Sciences, Earth Sciences, Bio Sciences, Telemedicine, Materials Sciences and many others
- ☉ Serving humanities and social sciences
- ☉ Serving Nuclear Non-Proliferation, Materials Protection, Anti-Terrorism, International Security
- ☉ Serving Educators: Edu-Cultural Digital TV Channel, Intl Science Fairs, Junior Achievement, "Simple Words", Virtual Museums
- ☉ Serving Advanced Networking: Wavelength Disk Drive, IPv6, Collaboration Infrastructure

Driving Disciplines

- High Energy Physics
- Fusion Energy Physics/ITER
- Astronomy
- Earth Sciences
- Atmospheric Sciences/THORPEX
- GRIDS/Computational Resources
- Network Research

High Energy Physics

- Most immediate driver for international high performance S&E networking
- Large Hadron Collider (LHC) experiments will begin generating petabytes of data in 2007-2008, exabytes by 2015
- Community has developed international infrastructure for sharing data for shared analysis
- Heaviest single community user of GLORIAD today (40% of traffic some days)
- Propose need for GbEs immediately



The screenshot shows a web browser window displaying the High Energy Physics (HEP) page on the GLORIAD website. The browser's address bar shows the URL <http://www.gloriad.org/gloriad/disciplines/hep/index.h>. The page title is "High Energy Physics (HEP)". The main content area features a navigation menu on the left with links such as "Home", "GLORIAD Apps", "Apps by Country" (listing Canada, China, Korea, Netherlands, Russia, USA), "Apps by Discipline" (listing Energy Physics, Fusion Energy/ITER, Atmospheric Science, Astronomy, Geosciences, Medical Sciences, Network, and Computing), "GLORIAD Team", "Management", "Operations", "System", "Sponsors", "Classroom", "Reach", "Layers", and "Tools". The main text area is titled "High Energy Physics (HEP)" and contains several paragraphs of text. The first paragraph 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 need for a high-capacity network. The second paragraph discusses the Compact Muon Solenoid (CMS) Collaboration at CERN, highlighting the need for cutting-edge science and the involvement of scientists from the US, Russia, and other countries. The third paragraph discusses other non-LHC HEP experiments underway at Fermilab, SLAC, and other facilities, noting the need for high-capacity network capacity. The fourth paragraph provides a link to additional information about high energy physics applications in Russia.

High Energy Physics (HEP)

<http://www.gloriad.org/gloriad/disciplines/hep/index.h>

High Energy Physics (HEP)

Home
GLORIAD Apps

Apps by Country
Canada
China
Korea
Netherlands
Russia
USA

Apps by Discipline
Energy Physics
Fusion Energy/ITER
Atmospheric Science
Astronomy
Geosciences
Medical Sciences
Network
Computing
Others

GLORIAD Team
Management
Operations
System
Sponsors
Classroom
Reach
Layers
Tools

High Energy Physics (HEP)

The HEP community sets the pace for all in mapping out plans for handling enormous computational and data requirements – as well as the required network infrastructure. The [Large Hadron Collider \(LHC\)](#) is an example, more than 6,000 scientists and engineers from 250 universities and laboratories in 60 countries. These collaborators participate in experiments that will accumulate more than 10 petabytes each during 2007-08 and this will rise to the exabyte range by 2015, introducing unprecedented challenges in data access, distribution and collaborative analysis.

The [Compact Muon Solenoid \(CMS\)](#) Compact Muon Solenoid (CMS) Collaboration at CERN provides another example where GLORIAD addresses the need of cutting-edge science. Approximately 40 percent of the physicists at work on the CMS collaboration call the US, Russia or their home. They, along with the 2,000 scientists involved in CMS will need a high-capacity network to transmit results of these experiments.

Other non-LHC HEP experiments underway at Fermilab, SLAC and other facilities face similar challenges on a "smaller but still daunting scale." These communities are already heavy users of NaukaNet and GLORIAD and project the need for 300M/622M/1-2.5G capacity for major HEP centers in Russia, China and Korea in 2004/2005/2006 respectively. Collaborators with HEP in Russia and China include universities and national laboratories throughout the US.

The following point to additional information about high energy physics applications:

[Description of High Energy Physics Applications in Russia\(Projects in progress\)\(High Energy Physics\)](#)

Fusion Energy

International Thermonuclear Experimental Reactor

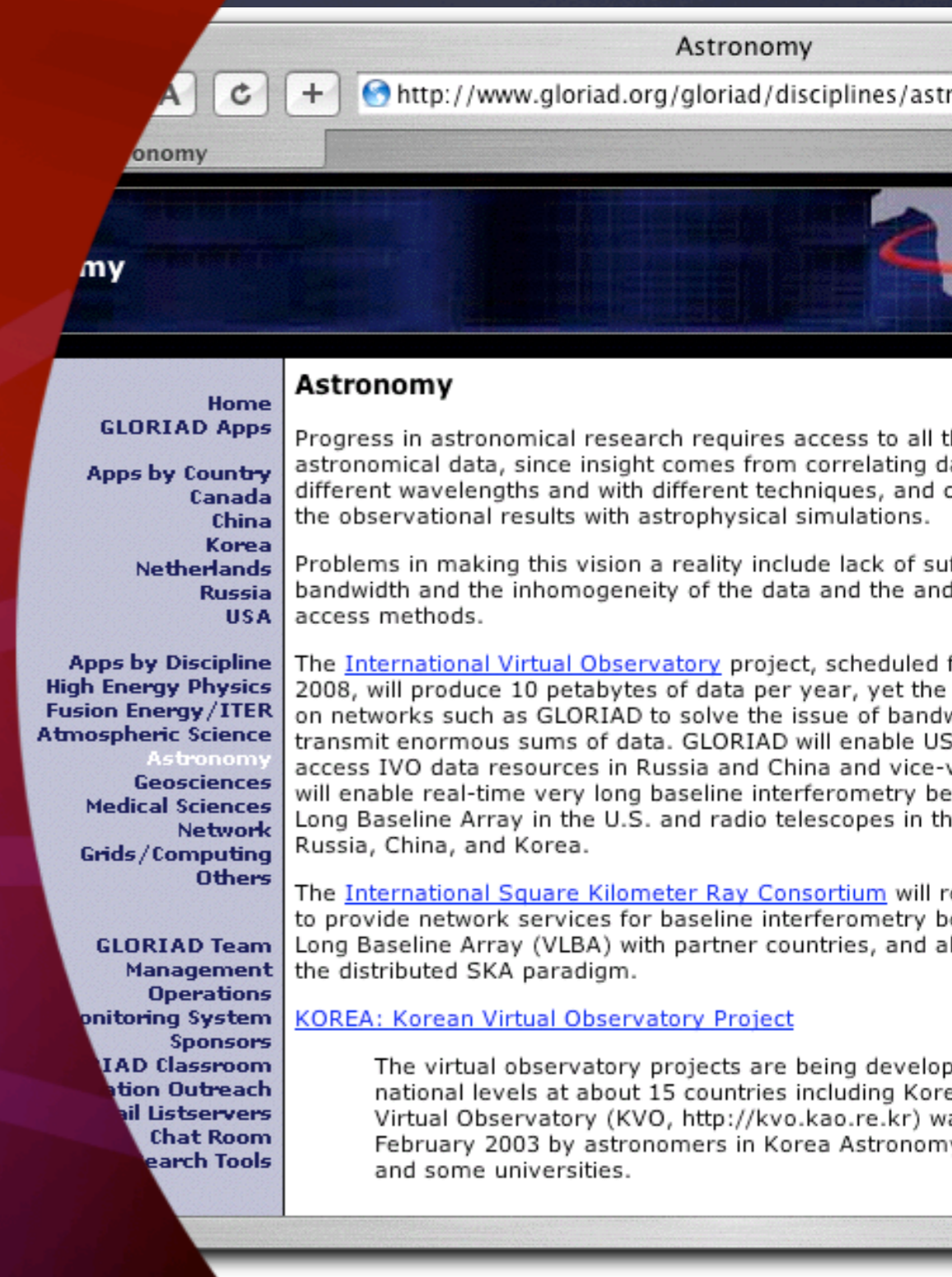
- ☉ GLORIAD motivated, in part, to help serve ITER community (US, Russia, China, Korea, Europe, Japan)
- ☉ \$Multi-billion construction to begin when site decision is made (either France or Japan); #1 science/facility priority for US Department of Energy
- ☉ Will require GbE around GLORIAD ring initially; 10G circuit by 2008
- ☉ Heavy user of computational resources (at ORNL), need to cooperatively control experiments remotely, massive data storage and transmission requirements



GLORIAD/ITER-Grid Meeting,
December 21, 2003

Astronomy

- International Virtual Observatory Project (involving US, Russia, China, Korea, Europe, others) proposes generation of 10 petabytes of data annually
- International Very Long Baseline Interferometry (VLBI) involves very high capacity network access to radio telescopes in Netherlands, US, Russia, China, Australia, elsewhere; network access to require multiple DWDM wavelengths

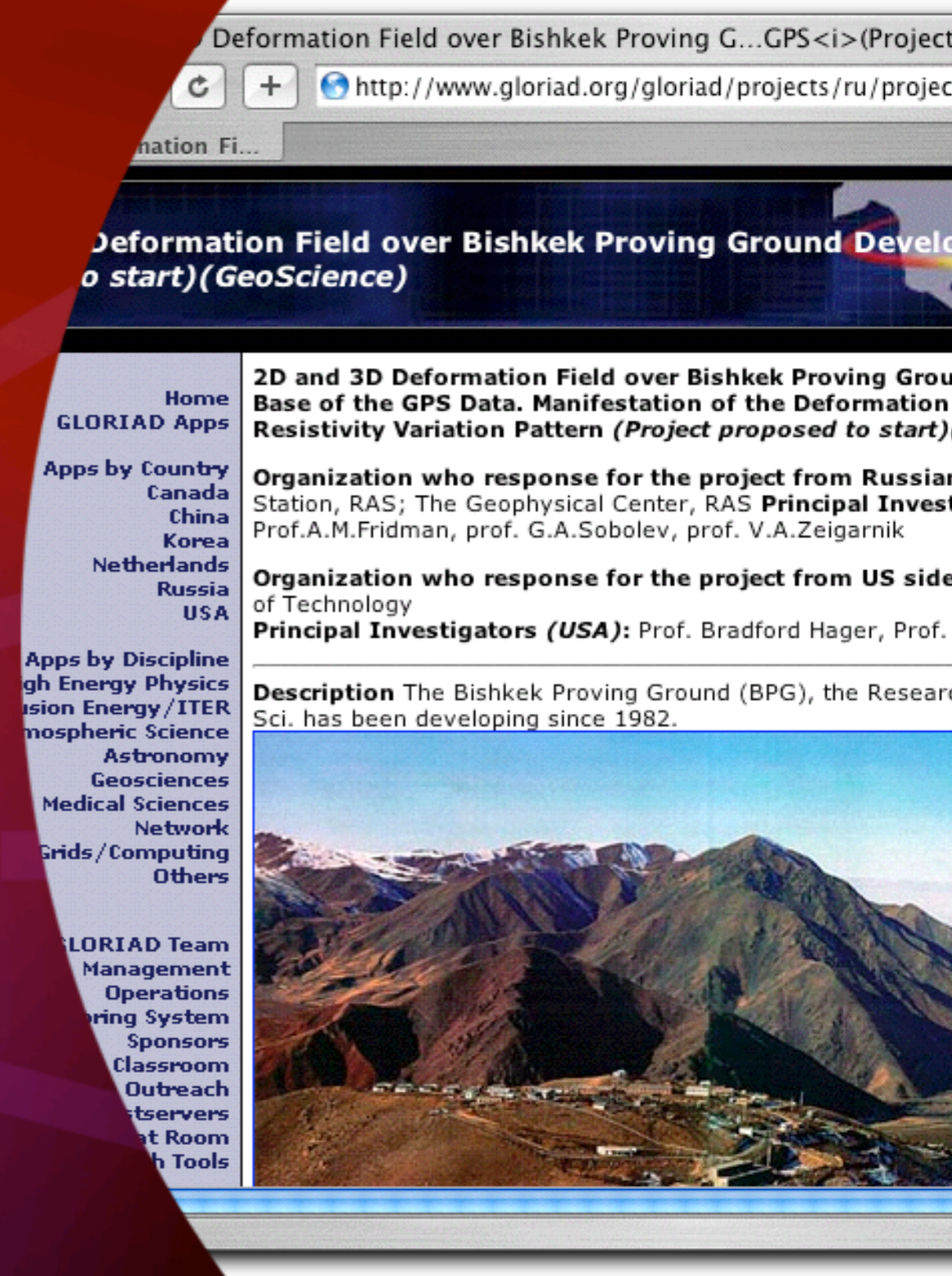


Earth Sciences

US, Russia, China, Canada together comprise large percentage of earth's surface and already have large domestic infrastructure for sensing seismic activity, atmospheric conditions, environmental conditions, satellite-based imagery coverage, etc.

GLORIAD proposes to ensure higher capacity/easier data sharing between major earth science initiatives – seismic monitoring, satellite imagery, environmental monitoring, forestry/wildfire studies, etc.

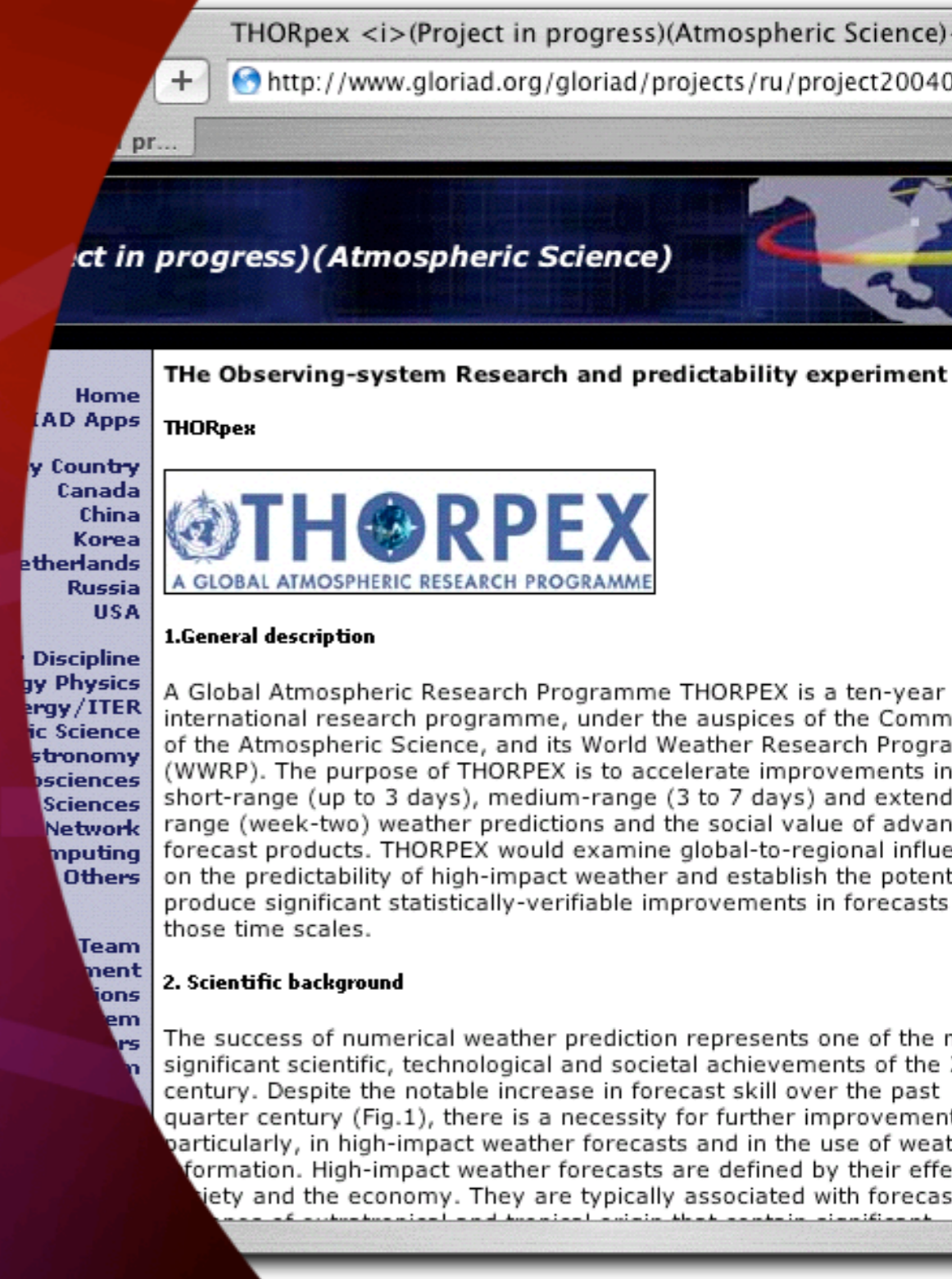
Special emphasis in GLORIAD on extending access to Central Asia generally and to the Bishkek Geologic Proving Ground specifically



The screenshot shows a web browser window with the address bar displaying <http://www.gloriad.org/gloriad/projects/ru/project>. The page title is "Deformation Field over Bishkek Proving Ground Development (to start) (GeoScience)". The main content area features a navigation menu on the left with links for "Home", "GLORIAD Apps", "Apps by Country" (listing Canada, China, Korea, Netherlands, Russia, USA), "Apps by Discipline" (listing High Energy Physics, Fusion Energy/ITER, Atmospheric Science, Astronomy, Geosciences, Medical Sciences, Network, Grids/Computing, Others), and "GLORIAD Team" (listing Management, Operations, Training System, Sponsors, Classroom, Outreach, Servers, Chat Room, Tools). The main text on the page reads: "2D and 3D Deformation Field over Bishkek Proving Ground Base of the GPS Data. Manifestation of the Deformation Resistivity Variation Pattern (Project proposed to start)". Below this, it lists the "Organization who response for the project from Russian side" (Station, RAS; The Geophysical Center, RAS) and "Principal Investigators (Russia)" (Prof. A.M. Fridman, prof. G.A. Sobolev, prof. V.A. Zeigarnik). It also lists the "Organization who response for the project from US side" (of Technology) and "Principal Investigators (USA)" (Prof. Bradford Hager, Prof. ...). A "Description" section states: "The Bishkek Proving Ground (BPG), the Research Station, Sci. has been developing since 1982." At the bottom of the page, there is a photograph of a mountainous landscape with a small settlement at the base.

Atmospheric Sciences

- Programs include general atmospheric modeling, climate change studies, weather prediction, etc.
- Data transmission requirements requiring GbE+ (also enormous shared computational and data storage)
- Special emphasis on International THORPEX program – established in 2003 as a 10-year global atmospheric R&D program – emphasis on mitigating effects of natural weather-related phenomena by providing much more accurate 1-14 day forecasts.



THORpex <i>(Project in progress)</i>(Atmospheric Science)


<http://www.gloriad.org/gloriad/projects/ru/project20040>

Project in progress)</i>(Atmospheric Science)

Home
AD Apps
Country
Canada
China
Korea
Netherlands
Russia
USA
Discipline
Astronomy
Physics
Energy/ITER
Science
Sciences
Network
Computing
Others
Team
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THE Observing-system Research and predictability experiment

THORpex



1.General description

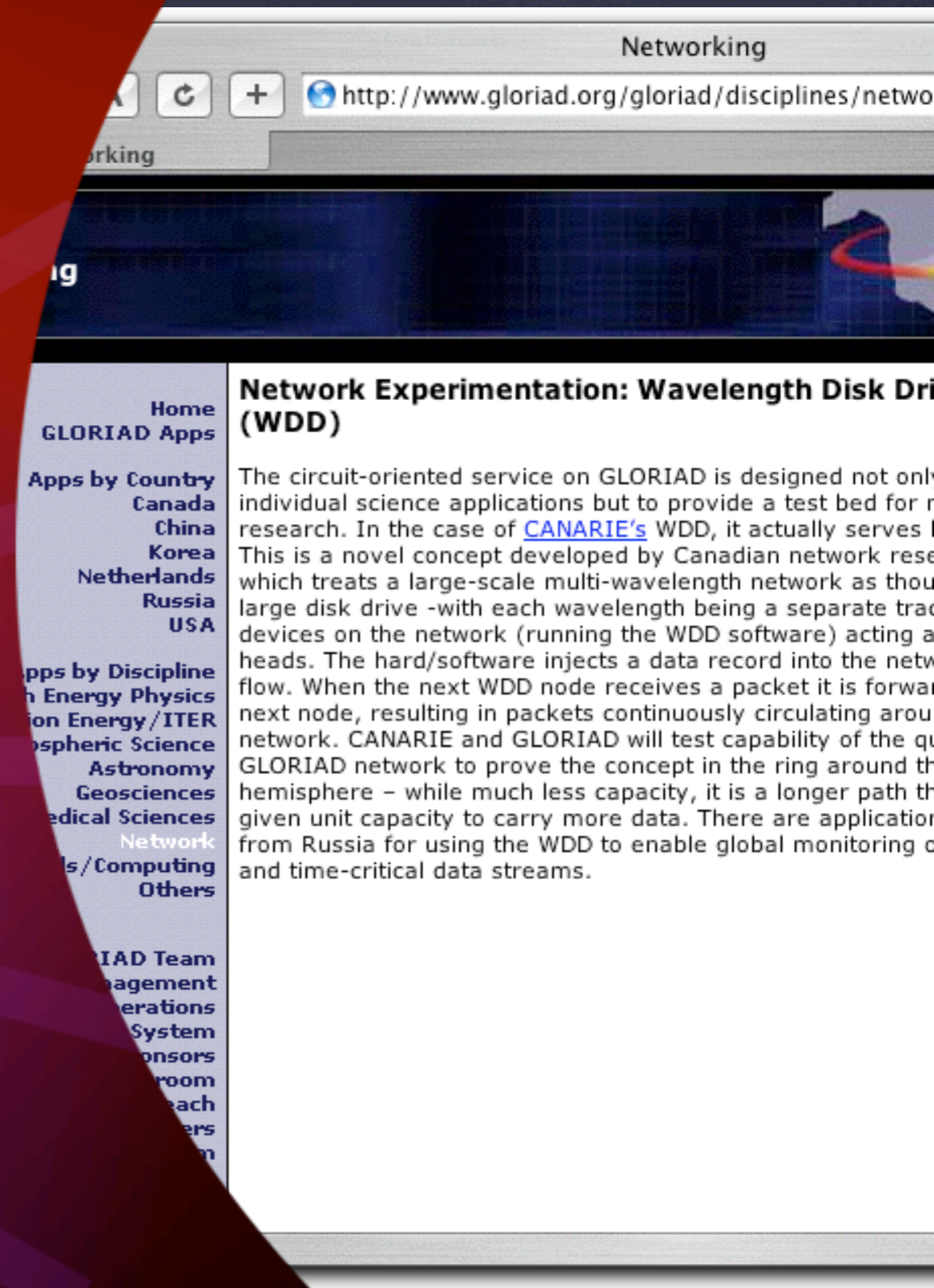
A Global Atmospheric Research Programme THORPEX is a ten-year international research programme, under the auspices of the Commission of the Atmospheric Science, and its World Weather Research Programme (WWRP). The purpose of THORPEX is to accelerate improvements in short-range (up to 3 days), medium-range (3 to 7 days) and extended range (week-two) weather predictions and the social value of advanced forecast products. THORPEX would examine global-to-regional influence on the predictability of high-impact weather and establish the potential to produce significant statistically-verifiable improvements in forecasts at those time scales.

2. Scientific background

The success of numerical weather prediction represents one of the most significant scientific, technological and societal achievements of the 20th century. Despite the notable increase in forecast skill over the past quarter century (Fig.1), there is a necessity for further improvement, particularly, in high-impact weather forecasts and in the use of weather information. High-impact weather forecasts are defined by their effect on society and the economy. They are typically associated with forecasts of subtropical and tropical origin that contain significant

Network Research

- With its hybrid architecture, GLORIAD will provide an experimental “sandbox” for network researchers – enabling experimentation without putting production services at risk
- One proposed project is the Canadian Wavelength Disk Drive (WDD) – treating a service across the GLORIAD ring as a “disk drive” – circulating data around the earth with “readers” and “writers” at various locations – useful for data needed by international parties at approximately the same time
- Another is the Canadian User Controlled Lightpath (UCLP)



Other Areas of Collaboration

- Grids and Shared use of Computational Resources
- Network Security
- Materials Science (ORNL's SNS)
- Bioinformatics/Bioengineering
- Telemedicine (US-Russia effort in cancer research)
- Nuclear Materials Protection and Non-proliferation programs
- Emergency Response
- Joint Anti-terrorism Programs

The screenshot displays the GLORIAD website interface. At the top, the browser address bar shows the URL <http://www.gloriad.org/gloriad/projects/ru/project20040621>. The page title is "Medical Information System (IMIS, DIMOL) (Project in progress) (Medical Science)".

The main content area features a sidebar with a navigation menu including: "Discipline", "High Energy Physics", "Fusion Energy/ITER", "Astronomy", "Geosciences", "Medical Sciences", "Network", "Grids/Computing", and "Others". Below this is a "GLORIAD Team Management Operations Monitoring System Sponsors" section, followed by "GLORIAD Classroom Education Outreach Email Listservers Chat Room Search Tools".

The main text area contains a paragraph describing the IMIS system: "In Russian Federation there has been created a hard-and-software complex DIMOL by the developers of the Russian research Center 'Kurchatov Institute' in cooperation with the Scientific and Practical center of Intervening Cardiology. The DIMOL complex is intended for automation of medical procedure processes in cardiological clinics. Such complex has been working during more than five years at the Scientific and Practical center of Intervening Cardiology in Moscow."

Below the text is a photograph of four men in suits standing in a laboratory setting, with the caption: "Fig.1. Author of the project DIMOL. From left to right: Gnedenko V.G., Faineberg E.M., Iosseliani D.G., Velikhov E.P." The photo is titled "Авторы проекта DIMOL".

Further down, there is a section titled "Other Applications" and another titled "Other Areas". The "Other Areas" section lists supported disciplines: "nuclear materials protection and materials accounting and control, next generation optical network research and design, use of the ORNL-sited Spallation Neutron Source, nanomaterials, bioinformatics, bioengineering, telemedical applications, and various educational programs."

At the bottom right, there is a "Slideshow of GLORIAD Launch Ceremony" section with a small image and text: "A quicktime-based slideshow of the opening ceremony for the GLORIAD network is available here." Below this is a link: "More information about the launch ceremony is available."

Presentation

- Background/History
- GLORIAD Today, Tomorrow
- Partners and Networks
- Measurement Program
- Application Areas
- **Education/Outreach Activities**
- Challenges, Issues

Education & Outreach

- Central Asian and Western Eurasian networking extension
- GLORIAD Classroom
- EduCultural Channel
- Collaboration Infrastructure (IP Telephony Network (using Cisco donation) and HEP/VRVS)
- “Simple Words” Essay Program
- “Junior Achievement” Partnership
- Virtual Science Museum of China
- “Great Wall” Society Programs
- Electronic Cultural Atlas Initiative

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Challenges

- Funding
- Multi-Cultural Issues, Challenges
- Security Issues
- Political Issues
- “Network Politics”
- Institutional Support of International Project

Year 1 Plans

- **Grand Opening Ceremony, New Operating Agreement**
- **Complete Architectural Plans, Landing Sites/Equipment Deployment, New Circuits (Amsterdam, Moscow, Hong Kong, Pusan)**
- **Governance Structure, Working Groups Operational**
- **GLORIAD Classroom**
- **EduCultural Channel**
- **Collaboration Infrastructure Deployed (IP Telephony, VRVS Reflectors)**
- **BRO Box deployed, integrated with router**
- **New Monitoring System (using Packeteer/Netflow product)**
- **New Web Site**
- **“Simple Words” Pilot in US**

This is all made possible by ...

- NSF (6+ years of support) and our sponsors in Russia, China, Korea (and others)
- Our partners in Russia, China, Korea, Netherlands, Canada
- US partners - UT/ORNL (Homer Fisher, Bill Snyder), NCSA, UT/ORNL (again), Jim Olson, Mike Rieger, Bill Marra (Tyco), Starlight partners: Tom, Joe, Maxine; IRNC partners, Harvey Newman, Steve Goldstein, Tom Greene, Aubrey Bush, Yves Poppes, partners at US govt agencies (and many, many others)
- Email, the Internet, Trans-oceanic/continental circuits, “Friends and Partners”

Global Ring Network for Advanced Applications Development (GLORIAD) and Digital Divide Issues

International ICFA Workshop on HEP Networking, Grid and Digital Divide Issues for Global e-Science, May 24, 2005

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Computer Network Information Center



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