The GLORIAD/Taj Federated Model of Community-focused Cyberinfrastructure: Towards Global *Collaboration Infrastructure*

An update for the JET, October 19, 2010

Greg Cole, Principal Investigator
NSF Agreement Establishing GLORIAD/Taj
Jun Li, Dongkyun Kim, Jerry Sobieski, Co-PIs

(parts of presentation prepared with Joe Mambretti and credits to Erik-Jan Bos and Kees Neggers)

GLORIAD-US Update

Tuesday, October 19, 2010

Organization and Funding Issues

- NSF Funding
  - Grant in August 2009 for Taj development (2009-2011) ($2.3m)
  - Cooperative Agreement (IRNC2/ProNet) in August 2010 for GLORIAD Future Development (2010 - 2015) ($5.6M)
- New Center established at University of Tennessee
- New Staff
- Move to office in Washington, DC

Thank you
GLORIAD/Taj-U.S. Team



Susie Baker
Research Leader



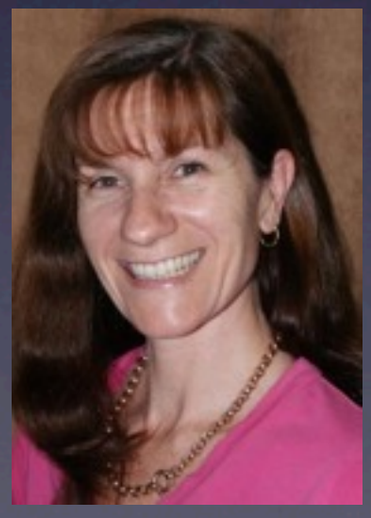
Predrag Radulovic
Chief Network Engineer



Anita Colliatie
Assistant Director



Kim Summerfield
Program Manager



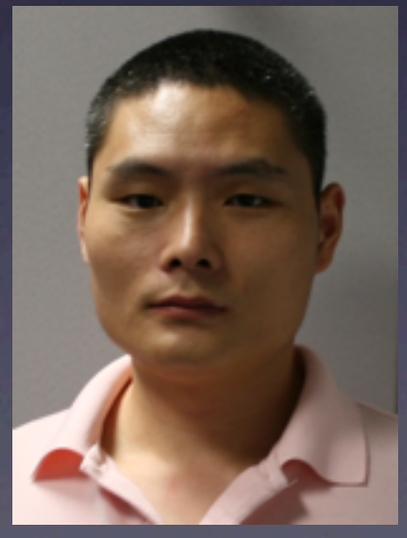
Lyn Prowse-Bishop
Executive Assistant



Harika Tandra
Software Engineer



Greg Cole
Principal Investigator



Hui Li
Visiting Engineer, CNIC



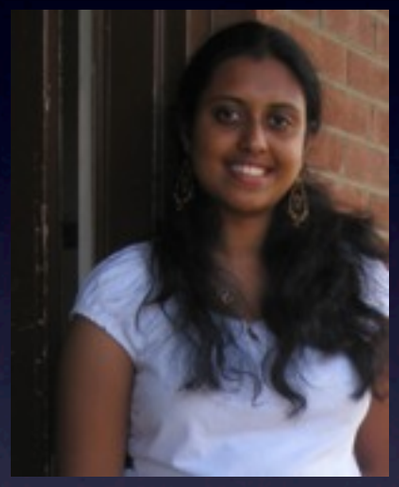
Zhang Lei
Visiting Engineer, CNIC

Thank you
GLORIAD/Taj-U.S. Team

Graduate Research Assistants



Naveen Vallabhaneni



Ashwini Chegu



Nate Freeman



Kartheek Bodanki



Anuradha Bulusu



Krishna Chaitanya

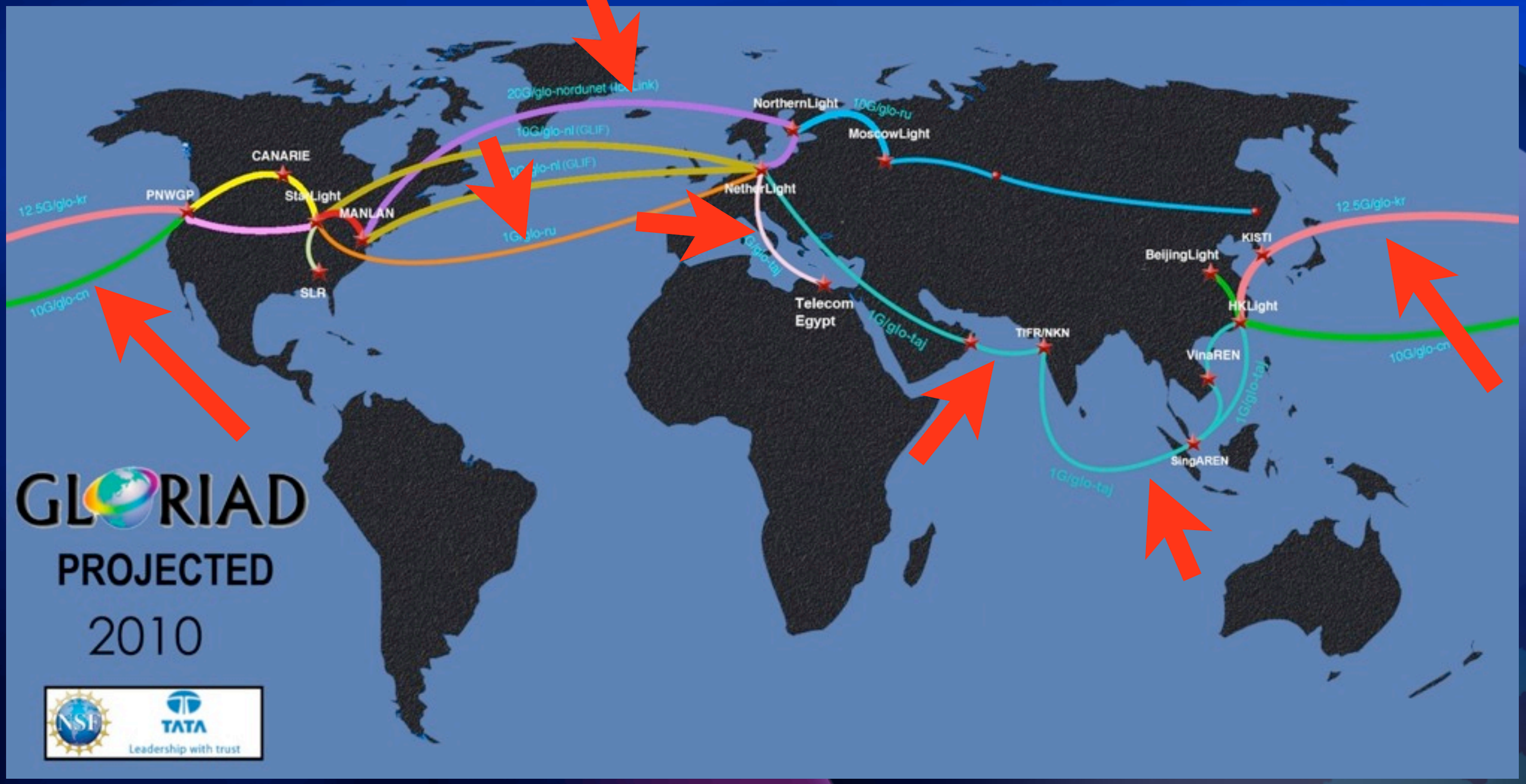
Taj: NSF Grant Deliverables

- Gratis 1-year contribution by Tata Communications (est. $6M) of a new 1 Gbps service with exchange points in Hong Kong, Singapore, Egypt, India and Europe, extending access to India, SE Asia and Egypt, including a likely connection to Vietnam, and broader North & East Africa.
- ~$3M commitment by the Chinese Academy of Sciences (w/$240K match from Taj proposal) to expand US-China connectivity by a factor of 4 (to 10 Gbps), offering greater capacity for US collaborations with China - but also India, Egypt and across SE Asia, and providing new equipment to enable better deployment of hybrid services for more advanced science applications.
- ~$600K annual commitment (+ equip. needed to hand capacity to R&E community) from NORDUnet (w/ $300K NSF match) to deploy a new high-capacity circuit connecting the US with Greenland & the 5 Nordic countries, serving polar, climate change, cyberinfrastructure and other research.
- This will also expand US-Russia capacity through Nordic infrastructure to St. Petersburg. Contingent on the network capacity, the Nordic Research Council is planning green- powered supercomputing facilities in Iceland, supporting a variety of key global research initiatives.
- Implementing across Taj a new model of distributed, decentralized network measurement, security and management tools for newly-connected India, SE Asia & Egypt, and communities in US, Asia, Europe. This enables sharing of global network management tasks and focuses on user-level performance.
- Deploying a new program of targeted information dissemination, education, outreach and training to help cyberinfrastructure providers and users better understand available infrastructure and improve global collaborations.

Infrastructure Update

- Korea-China-US Circuit upgraded to 12.5G
- China-US circuit upgraded to 10G
- US-Russia circuit upgraded to 1G
- New US-Nordic (IceLink) circuits operational at 12.5G (and Nordic-Russia dark fiber operational now)
- First Egypt/Africa-US R&E trial link operational in March (new 1G circuit operational by November)
- New circuit from Mumbai-Singapore-Hong Kong-Seattle ready to be provisioned
- New Canada-US (trans-North America) circuits operational

Transition from 2009 to 2010



Egypt

June 4, 2009: A New Beginning .. “We will create a new online network so that a young person in Kansas can communicate instantly with a young person in Cairo...”



Comments for March 10, 2010



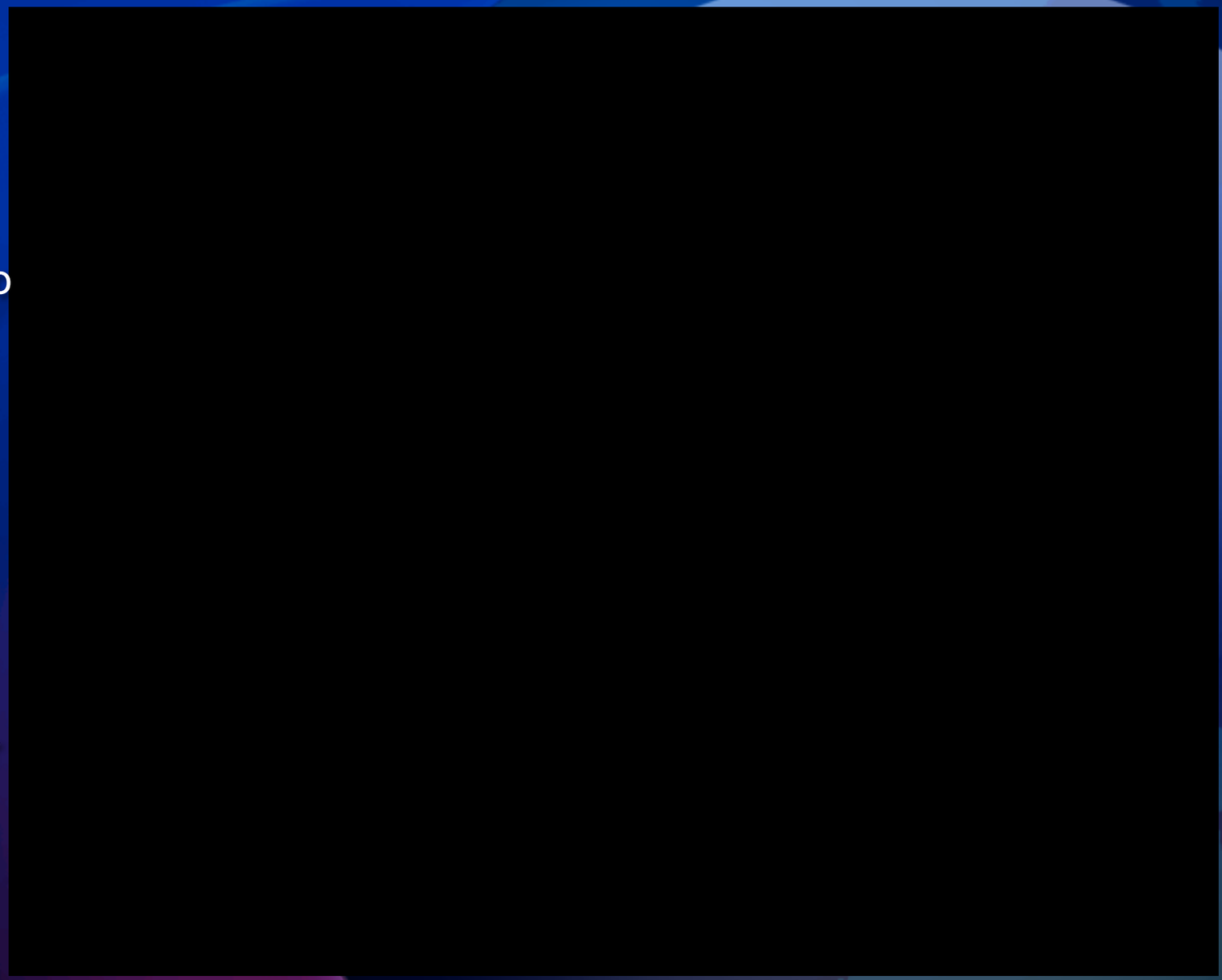
"It was 9 months ago that the US President spoke at Cairo University and in an address aimed at fostering an improved environment for active collaboration and exchange, promised to "invest in online learning for teachers and children around the world; and create a new online network, so a young person in Kansas can communicate instantly with a young person in Cairo." With our Egyptian friends, we share this vision of a world connected for science and education – and today marks a milestone achievement towards that vision and towards realizing President Obama's promise." – Arden Bement, Director, U.S. National Science Foundation

Dr. Arden L. Bement, Jr.
Director
U.S. National Science Foundation

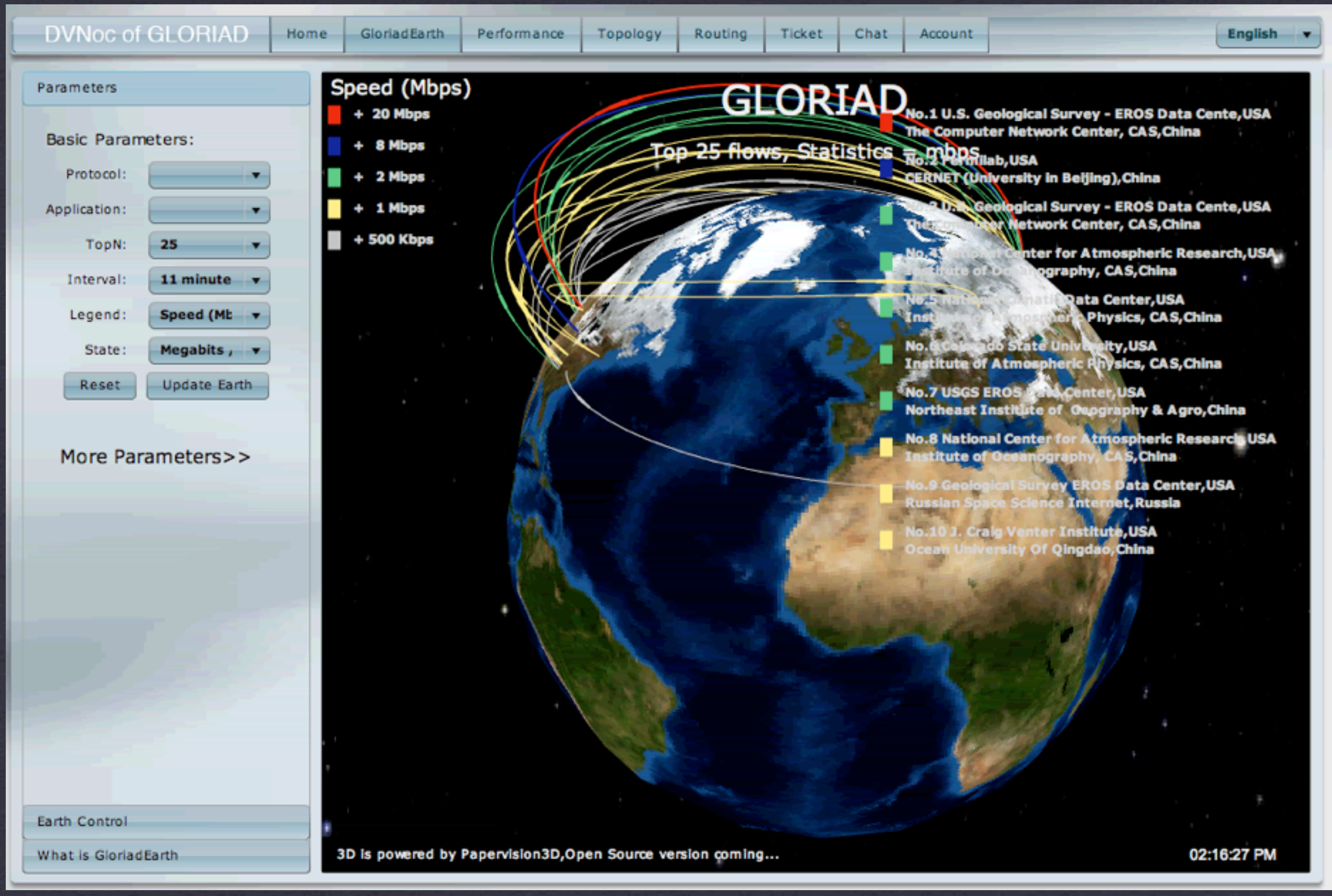


AMCOST4* Meeting in Cairo March 7-10, 2010

- GLORIAD and GLIF community brought up new network (Cairo-Chicago) in < 5 days (with Tata and Telecom Egypt)
- Commitment made at AMCOST to launch major R&E networking initiative in Africa (Egyptian GLORIAD partners chair AMCOST 2010-2012)
- Meeting being organized for GLORIAD/GLIF, US, Egypt, AMCOST/Africa for April, 2011 to launch major Africa networking initiative (Egypt Ministry of Higher Education and Science)
- GOLE development underway in Egypt



*Africa Union Ministerial Conference on Science & Technology



LIVE DVNOC DISPLAY

MARCH 24, 2010, 2:16 PM (STARBUCKS ON L STREET)

New 1GE GLORIAD - Egypt/Africa link

- Ola Laurence, Director of Egypt NREN ENSTInet signing the purchase order with Telecom Egypt for 1 Gbps GLORIAD-Egypt/Africa Link
- Signed October 4, 2010
- Circuit Operational by October 30, 2010
- Agreement with ENSTInet & TE to Establish GOLE in Cairo



India

US-India Joint Commission Meeting (JCM)

June 24, 2010



Dr. John P. Holdren, Director of the White House Office of Science and Technology Policy, delivers opening remarks at the U.S.-India Joint Commission Meeting on Science & Technology Cooperation on June 24, 2010. Shri Prithviraj Chavan, India's Minister of Science, Technology, and Earth Sciences, is seated to the right.

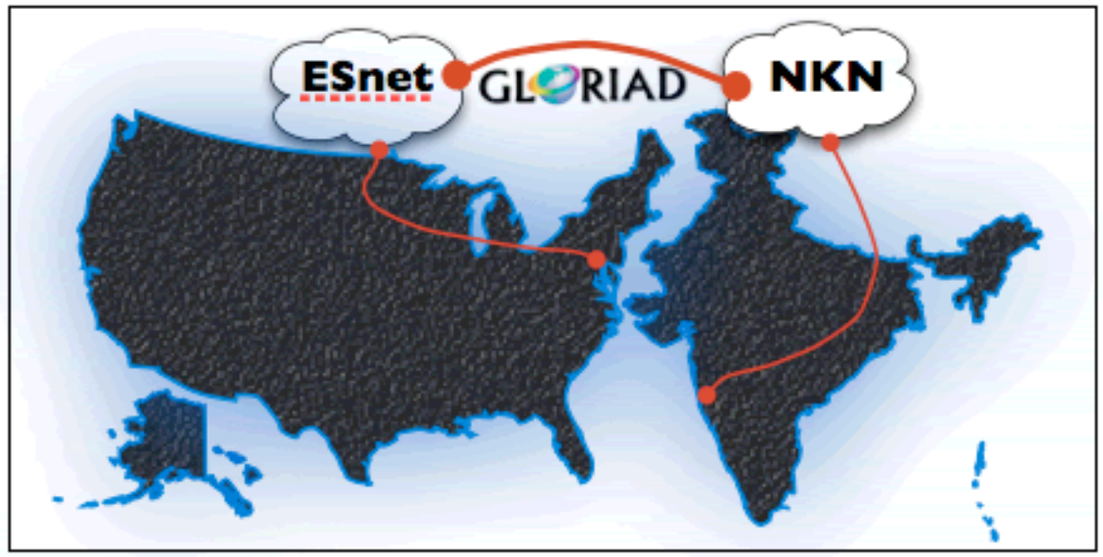
Substantive Discussion about GLORIAD and GLIF

and integration with India’s new National Knowledge Network

US-India Active, Funded Science

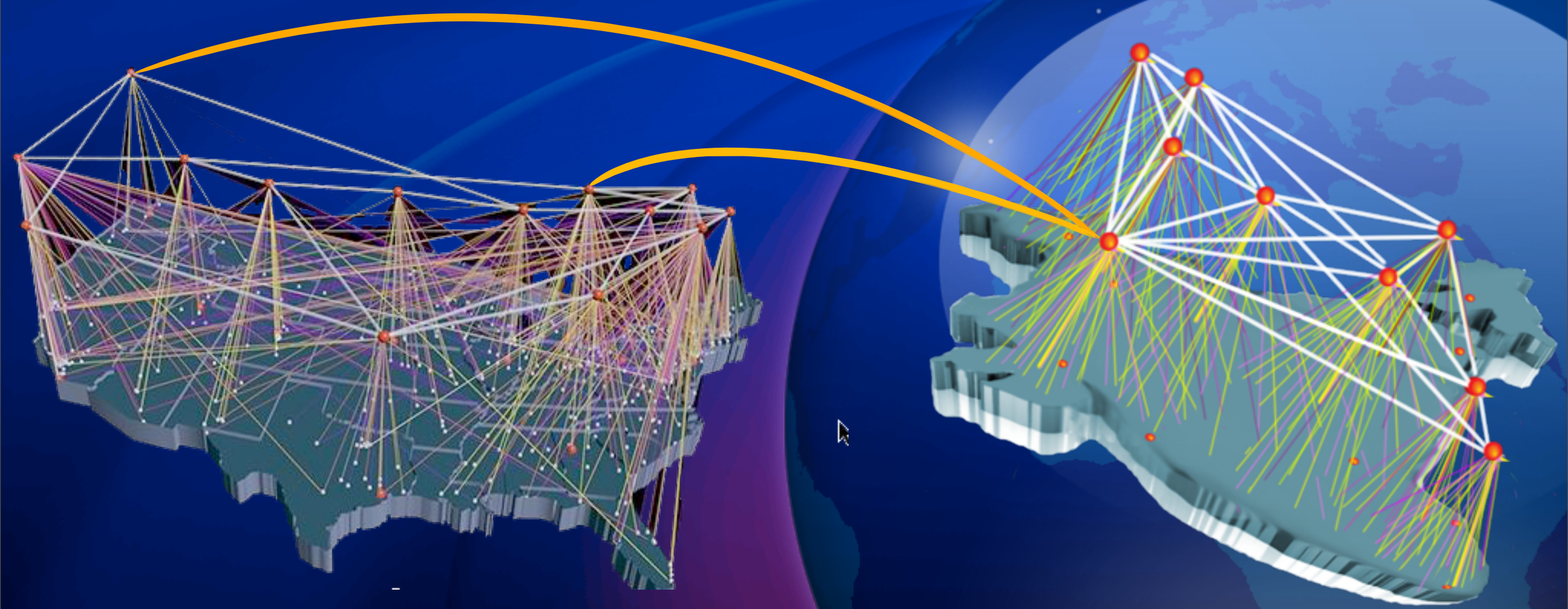
APP Technical Assistance - US-India Cities Partnership on Energy and Environment

Bhatt, Vatsal
Brookhaven National Laboratory (BNL), Upton, NY (BNL)
melucci@bnl.gov
Physical Sciences



This work effort may support at a minimum level or concurrently, as appropriate the Technology Transfer and Science Education missions of the Department of Energy (DOE). Brookhaven National Laboratory (BNL) provides Asian Pacific Partnership Buildings (APP) Technical Assistance to the DOE for United States (US)-India Cities Partnership on Energy and Environment. The objective is to use cooperative mechanisms to promote best practices and demonstrate technologies to Indian urban stakeholders. Leverage these instruments to identify and respond to the range of barriers that limit implementation and management of sustainable urban development plans and practices on energy and environment in India. The project will: 1.Initiate cooperation with Indian cities on clean development, energy and environment; 2. Establish US-India Mayors cooperation and arrange for signing of an accord (e.g., a Memorandum of Understanding) for sharing best practices on topical issues (e.g., energy, climate change, water/sanitation,

Taj: working to connect US-India Science and Education



Commitment made by Indian Minister of Science (Chavan) to create 10G connections from India to Chicago and Seattle (via Amsterdam and Singapore/Hong Kong)

India GLORIAD Agreement

MEMORANDUM OF UN

between

The Global Ring Network for Advanced App
and
The National Knowledge
and
Tata Institute of Fundament

This agreement is made and entered into by and
Advanced Applications Development (GLORIA
(NKN) and the Tata Institute of Fundamental
international Hub of NKN at TIFR will be sh
Mumbai) for the broad purpose of developing a
improved collaboration between the U.S. and In
communities in other GLORIAD partner countrie

PARTIES TO THE MEMORANDUM:

GLORIAD is a fiber-optic ring of networks arou
providing scientists, educators and students with
communications and data exchange, enabling
problems. With GLORIAD, the scientific comm
of valuable data effortlessly, stream video and c
video-conferencing. GLORIAD exists today due
Russia, China, Korea, Canada, the Netherlands
including Greenland, Finland, Iceland, Norway a
to promote increased engagement and cooperat
with their scientists, educators and young people
under the auspices of The University of Tenness
U.S. National Science Foundation (NSF).

The NKN is a Government of India approved
Informatics Centre (NIC) with the aim to set
infrastructure in India for research and educatio
reasonably good international connectivity with
collaborative projects in Scientific and Education

The Tata Institute of Fundamental Research (TIF
umbrella of the Department of Atomic Energy of
basic research in physics, chemistry, biology, m
campuses in Mumbai, Pune and Bangalore, and
in India. TIFR offers masters and doctoral progra
hosts international hub of NKN.

These organizations jointl
following clauses:

WHEREAS:

GLORIAD and NKN, rec
cooperation to the achiev
goals, share common inter
improved infrastructure su
and

The parties have furtherm
second (Gbps) GLORIAD
(NKN) via NKN PoP at T
funding is to be jointly s
operational during 2011,

NOW THEREFORE THE

CLAUSE ONE: PURPOS

The purpose of the prese
which the parties shall p
exchange technical inform

CLAUSE TWO: INTERP

The present Agreement
principles of international
Agreement is intended to s

CLAUSE THREE:
COOPERATION

The objective of the techn
promote cyber-infrastructu
will enhance joint scientif
other participating countri
the following statements:

The parties herein join
for advancing S&E c
several countries and
collaborative research
S&E network and Gr
network and program

multiple disciplines and provide for sharing suc
databases, instrumentation, computational services, s
supporting active scientific exchange with network
provide a test bed for advancing the state-of-the-art in
technologies – including Grid-based applications,
IPv6 networking, network traffic engineering and ne
the increasing growth in global S&E cooperation and
GLORIAD will cooperate with the Global Lambda Int
other national S&E networks and scientific resour
GLORIAD will ensure appropriate IP service peering
(including Internet2, NLR, ESnet, NASA networks, a
networks); the NKN will ensure peering with instit
Indian NKN.

Among the science issues to be supported are based
in Science, Research and Education including, but
change, joint responses to natural and man-made dis
of the human genome, high energy physics collabora
other environmental studies and simulations.

The two national teams will coordinate closely to en
network and will track utilization carefully to ensure
capacity is adequate to demand; efforts will be und
capacity of international links as traffic patterns dictat

CLAUSE FOUR: OTHER PROGRAM AREAS OF COO

Other programs of cooperation will be undertaken wi
involved parties.

CLAUSE FIVE: FINANCIAL ARRANGEMENTS

The financial arrangements for joint activities, inclu
contractual agreements for telecommunications service fo
be agreed to on a project-by-project basis. GLORIAD will
for the first one year for the 1G links at TIFR. From the I
expenses as agreed mutually for 1G/2.5G/10 Gbit circuits

CLAUSE SIX: LAWS AND REGULATIONS

All joint activities are subject to the national laws and
member countries.

CLAUSE SEVEN: EXECUTIVE AGENTS AND IMPLEMENTATION

CLAUSE NINE: ANNUAL GLORIAD CONFERENCE

The GLORIAD team intends to identify funding for an annual conference of all GLORIAD members in various countries, which is rotated among the partner countries and held, when possible, in connection with another major networking or scientific event. The purpose will include a program year review and planning for new program year involving reports from the executive board and all working groups but will also facilitate sharing papers, presentations and experiences among the GLORIAD user community.

CLAUSE ELEVEN: MODIFICATION OF THIS AGREEMENT

This agreement will remain valid till international Hub of NKN at TIFR is not shifted to NIC office at Belapur, Navi Mumbai. Amendments to this agreement – including the addition of new international members of the consortium and corresponding additions to the executive board – will be adopted by mutual agreement of the parties.

Agreed upon and signed by the executive board, this 30th day of September, 2010.

M. Barma

Tata Institute for Fundamental Research

M. BARMA
DIRECTOR
TATA INSTITUTE OF FUNDAMENTAL RESEARCH
HOMI BHABHA ROAD,
MUMBAI - 400 005

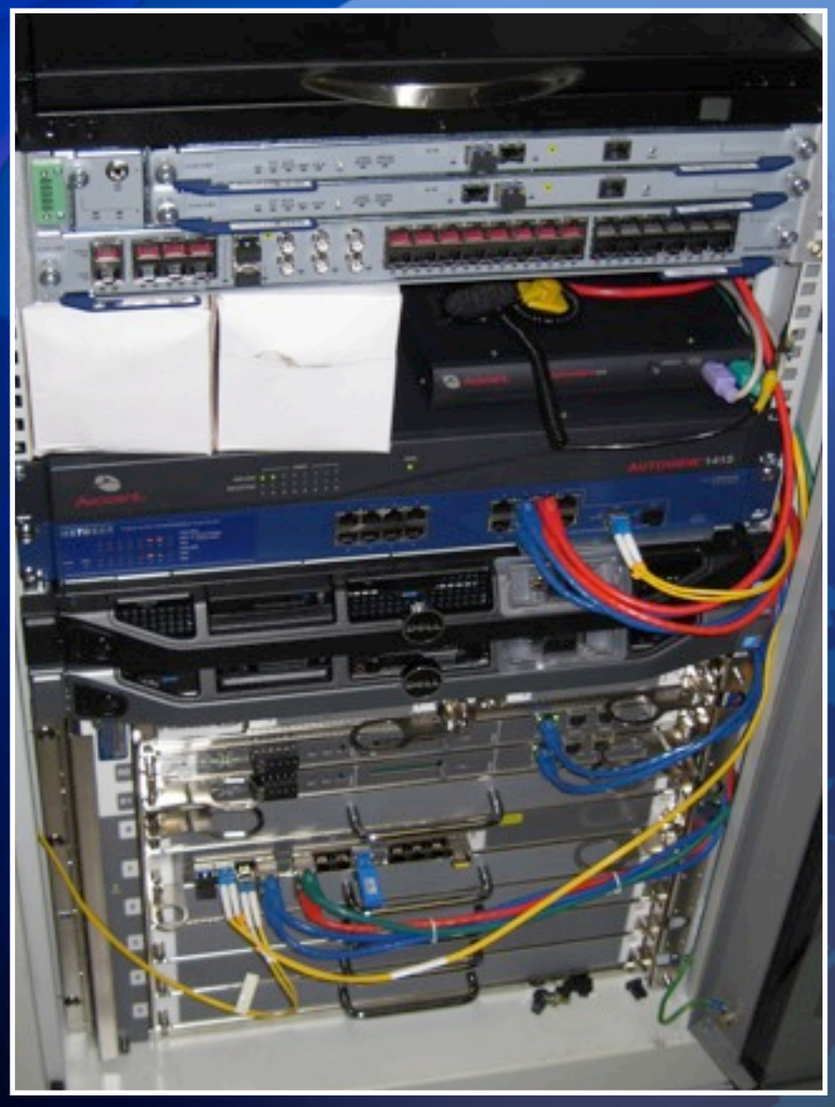
B. K. Gairola
Director General
National Informatics Centre

Greg Cole
Principal Investigator
U.S. NSF-Sponsored GLORIAD Program

Singapore and (SingLight)

GLORIAD Partnership with SingaREN (Singapore)

- Force10 E300 router (on the bottom) that will connect to our nodes in Mumbai and Hong Kong,
- 2 Dell servers for running ‘Nprobe netflow emitter’ and ‘perfsonar’
- A small netgear switch, Avocent KVM (keyboard-mouse-monitor) switch and Avocent IP remote access device.
- Force TE100 for connection to Vietnam
- Rackmount keyboard/monitor on the top.



@ Global Switch Singapore,

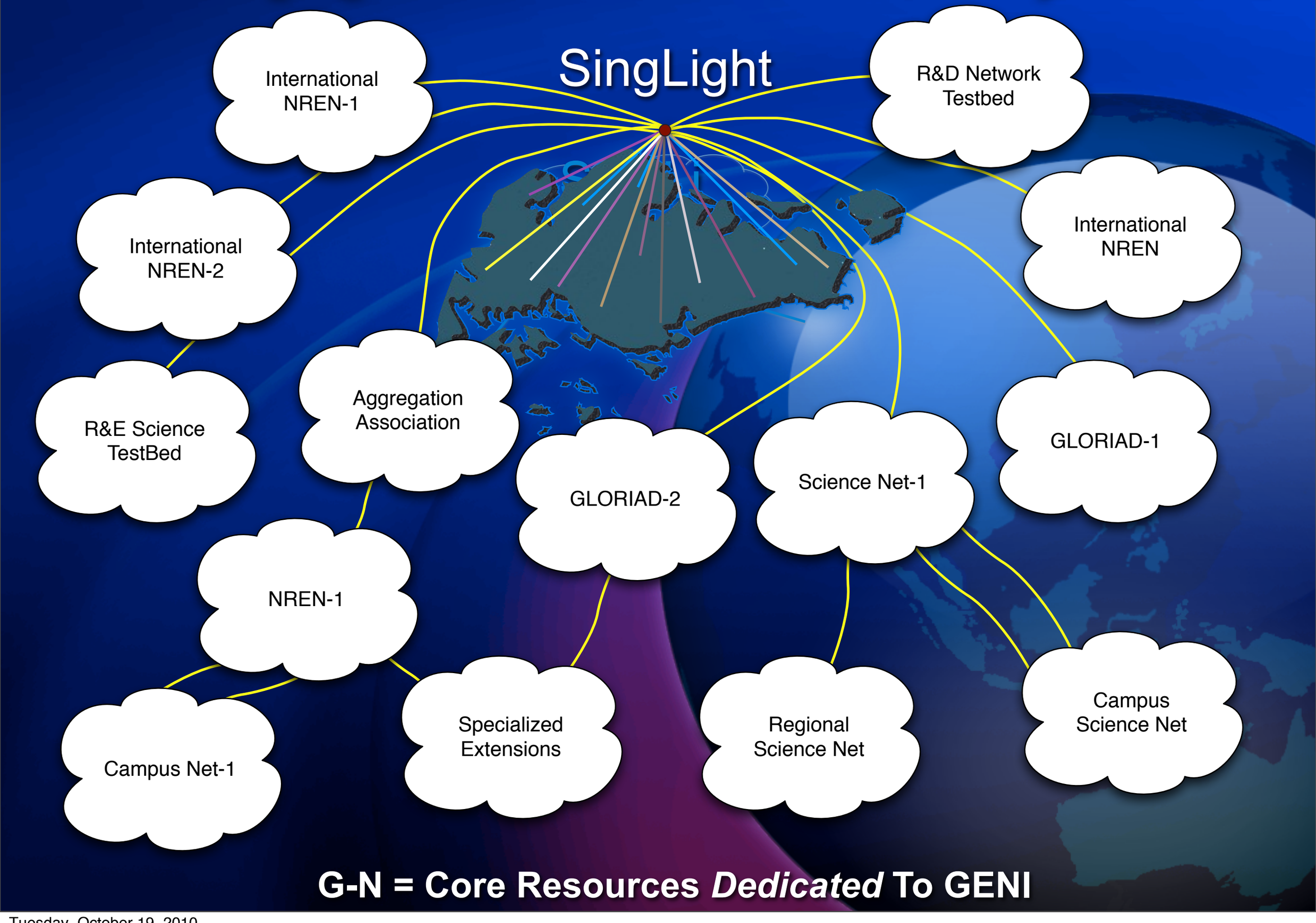
Provided to us by our partner SINGAREN.

SingLight*: Motivation

- Enable New Applications and Services
- Accelerate Transition from Limited Peering Facilities To Unlimited Service Communication Exchanges
- Enable Customization At All Service Layers
- Enable Enhanced Capabilities For Many Types of Peerings, Regionally and Globally
- Enable Migration Paths To New Architecture and Technology

*Being developed with SingaREN and Joe Mambretti

SingLight Will Enable Peers at All Layers



G-N = Core Resources *Dedicated* To GENI

Other Infrastructure Developments

- Improved GLORIAD network infrastructure in Chicago
- New GLORIAD network infrastructure in Seattle (terminating new US-CN link and providing for new cross-connect and backup with US-Korea and direct peerings in Seattle)
- New GLORIAD equipment in Singapore for “SingLight”, working with partners at SingaREN
- New GLORIAD equipment deployed to Cairo and Mumbai

Chicago Rack



Equipment installed:

- Force10 E300 router (10G and 1 GE cards)
- Bro, PerfSONAR, Nprobe and 2 other monitoring/management servers
- Packeteer 10000 (for packet loss stats)
- 3 misc. switches
- Ciena CN4200 optical gear (for use by Univ. of TN)

Features:

- Full Layer2/3 capability
- Out-of-band management
- Local and Remote KVM access
- IP power management

Seattle Rack

Equipment installed:

- Force10 E300 router (10G and 1 GE cards)
- PerfSONAR, Nprobe and backup network management server
- Ciena CN3600 optical gear to terminate 10 G (STM-64) to HKG

Features:

- Full Layer2/3 capability
- Out-of-band management
- Local and Remote KVM access
- IP power management



What GLORIAD community has done since last GLIF Meeting

- New PerfSonar boxes deployed / shipped to Chicago, Seattle, Singapore, Mumbai, Cairo
- New nprobe boxes deployed / shipped to all locations
- New dvNOC software project deployed; team developing dvNOC expanded (now: China, Korea, NORDUnet, US)
- New passive->active network performance measurement system deployed
- New Zeeba “social media network” deployed (soon to launch)
- New Partnership with CRDF providing access to all scientific journals in various national communities (integrated with Zeeba)

Nprobe Monitoring box



GOALS

- Network utilization and performance measurement box - running at 10G line speed
- Improve and extend open source nprobe netflow emitter software
- Emit extended netflow records including retransmissions, application classification

HARDWARE

- Dell PowerEdge R410 Server - 8 core intel processor
- 10GE Intel Fiber Card

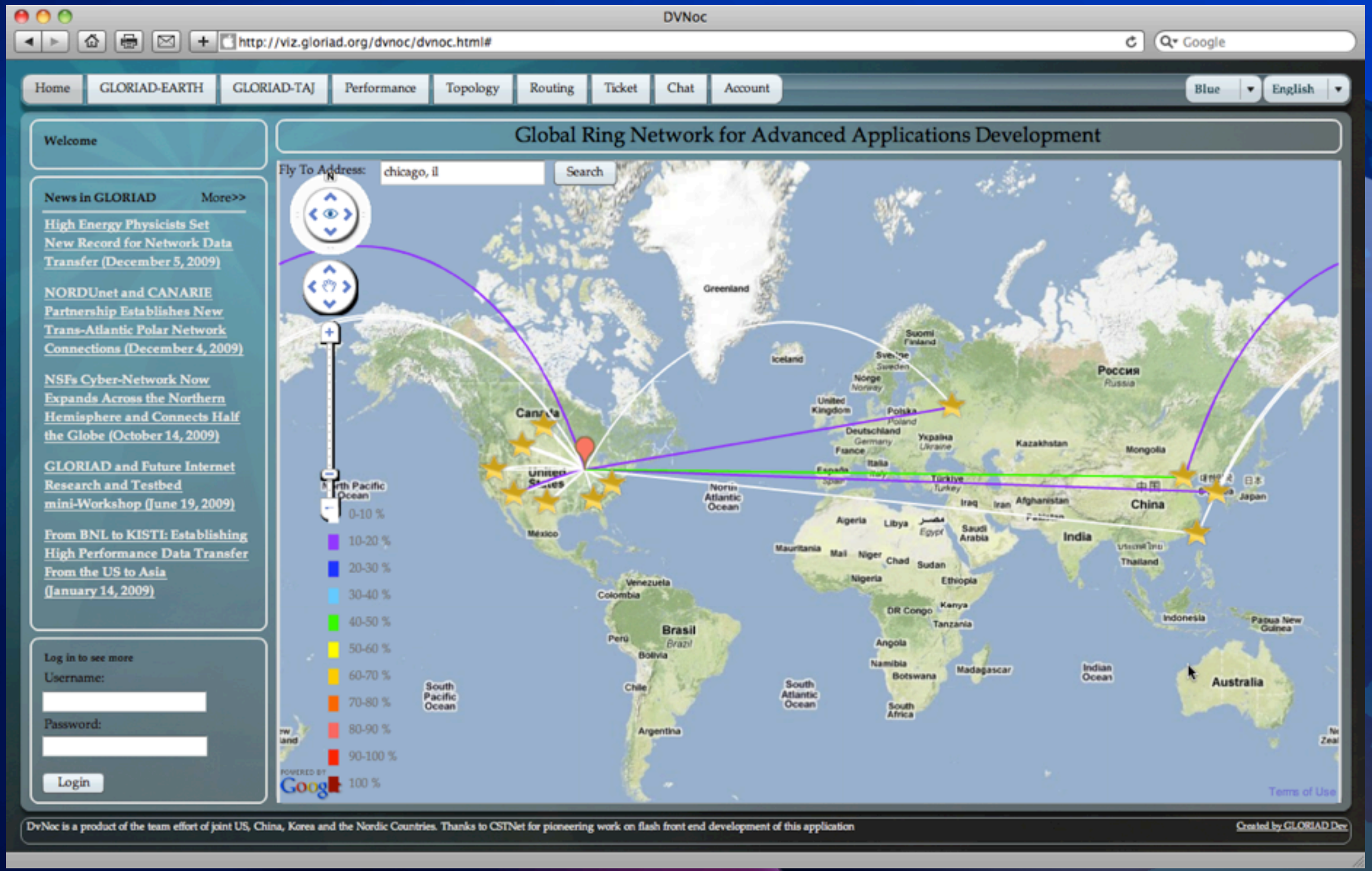
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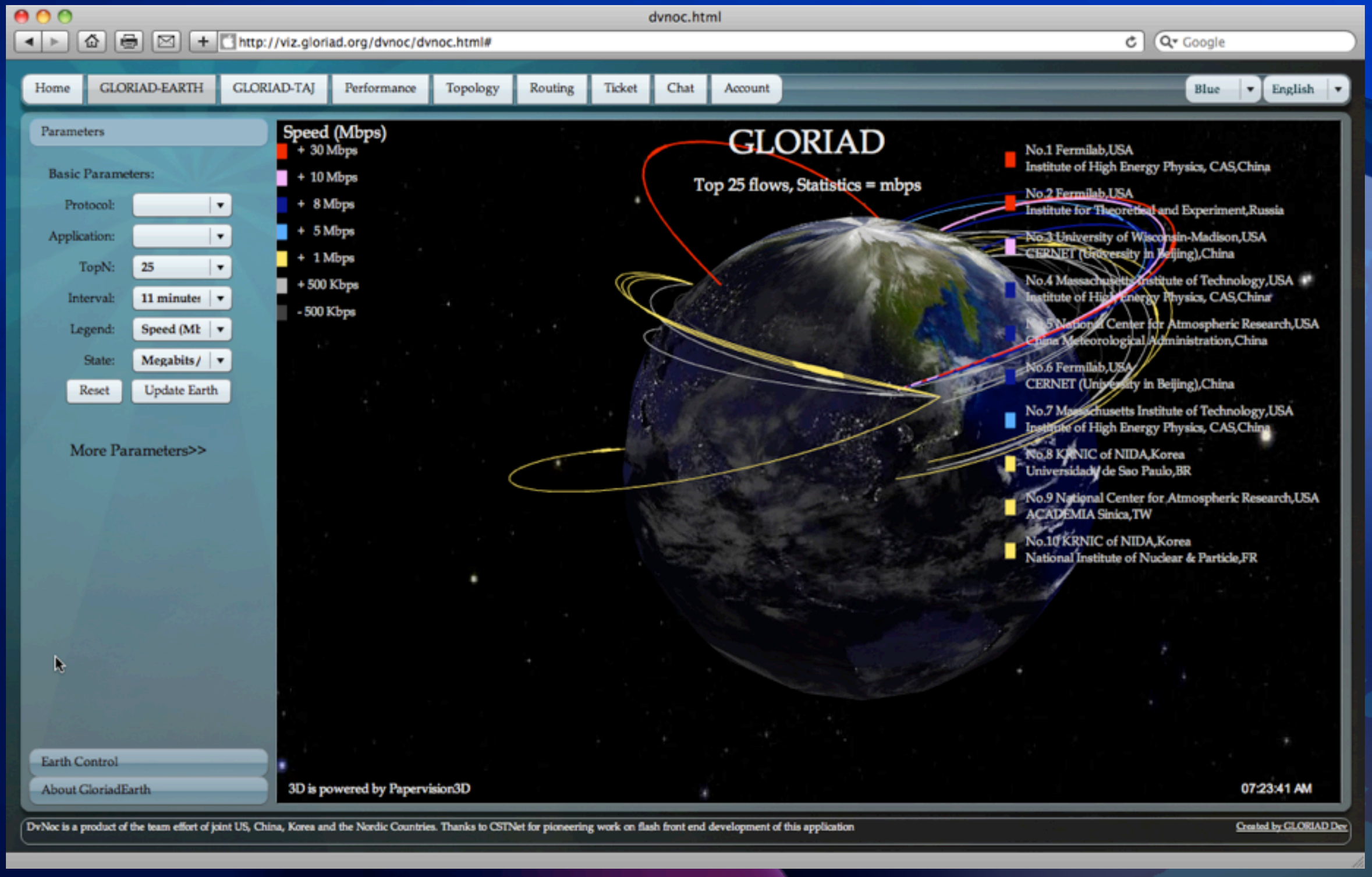
dvNOC

- Addresses need for all levels of cyberinfrastructure operators (and users) to collaborate on decentralized, distributed and reliable operations of links and services
- Consensus-driven approach to common standards, tools and software
- Focus on customer-based performance
- Large development effort on part of Chinese, Dutch, Korean, Nordic and US (and we hope, soon, other national) GLORIAD teams

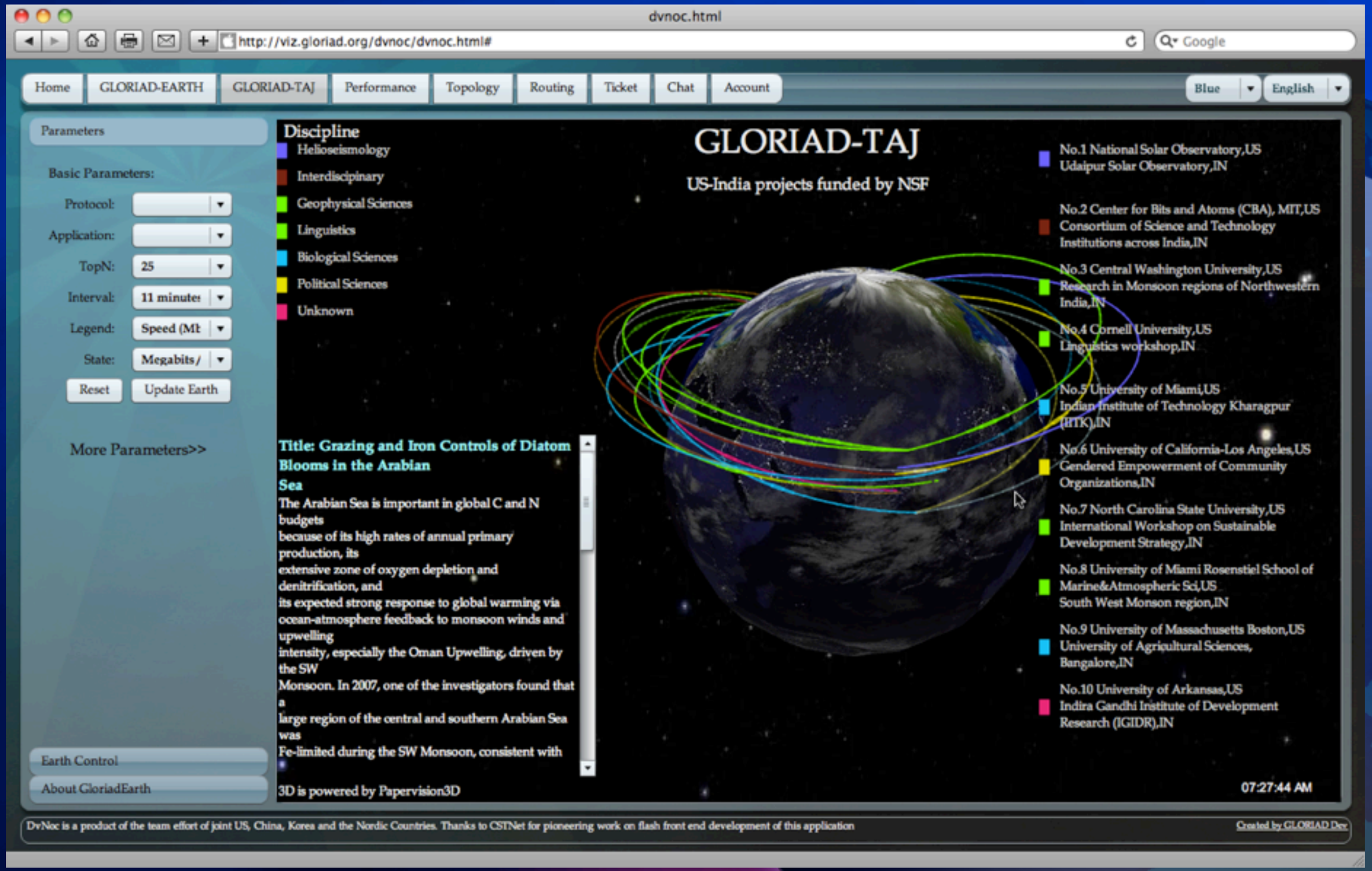
dvNOC


DVNoc
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More>>
High Energy Physicists Set New Record for Network Data Transfer (December 5, 2009)
NORDUnet and CANARIE Partnership Establishes New Trans-Atlantic Polar Network Connections (December 4, 2009)
NSFs Cyber-Network Now Expands Across the Northern Hemisphere and Connects Half the Globe (October 14, 2009)
GLORIAD and Future Internet Research and Testbed mini-Workshop (June 19, 2009)
From BNL to KISTI: Establishing High Performance Data Transfer From the US to Asia (January 14, 2009)
Log in to see more
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South Pacific Ocean
North Atlantic Ocean
North Pacific Ocean
México
Venezuela
Colombia
Perú
Brasil Brazil
Bolivia
Chile
Argentina
Terms of Use
DvNoc is a product of the team effort of joint US, China, Korea and the Nordic Countries. Thanks to CSTNet for pioneering work on flash front end development of this application
Created by GLORIAD Dev

dvNOC


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About GloriadEarth
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+ 1 Mbps
+ 500 Kbps
- 500 Kbps
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Top 25 flows, Statistics = mbps
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Institute of High Energy Physics, CAS,China
No.2 Fermilab,USA
Institute for Theoretical and Experiment,Russia
No.3 University of Wisconsin-Madison,USA
CERNET (University in Beijing),China
No.4 Massachusetts Institute of Technology,USA
Institute of High Energy Physics, CAS,China
No.5 National Center for Atmospheric Research,USA
China Meteorological Administration,China
No.6 Fermilab,USA
CERNET (University in Beijing),China
No.7 Massachusetts Institute of Technology,USA
Institute of High Energy Physics, CAS,China
No.8 KRNIC of NIDA,Korea
Universidade de Sao Paulo,BR
No.9 National Center for Atmospheric Research,USA
ACADEMIA Sinica,TW
No.10 KRNIC of NIDA,Korea
National Institute of Nuclear & Particle,FR
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DvNoc is a product of the team effort of joint US, China, Korea and the Nordic Countries. Thanks to CSTNet for pioneering work on flash front end development of this application
Created by GLORIAD Dev

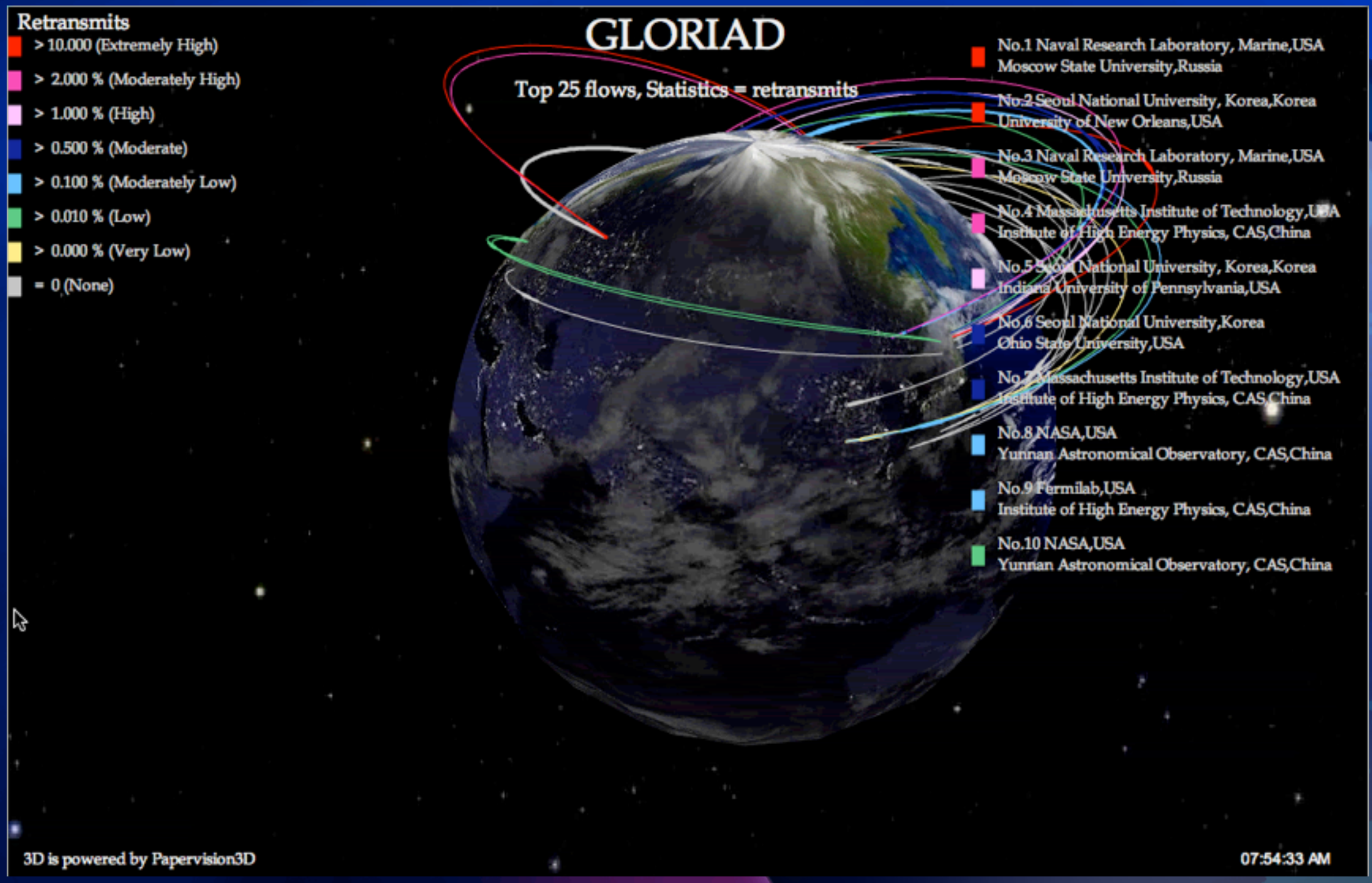
dvNOC


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Linguistics
Biological Sciences
Political Sciences
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US-India projects funded by NSF
No.1 National Solar Observatory,US
Udaipur Solar Observatory,IN
No.2 Center for Bits and Atoms (CBA), MIT,US
Consortium of Science and Technology
Institutions across India,IN
No.3 Central Washington University,US
Research in Monsoon regions of Northwestern
India,IN
No.4 Cornell University,US
Linguistics workshop,IN
No.5 University of Miami,US
Indian Institute of Technology Kharagpur
(IITK),IN
No.6 University of California-Los Angeles,US
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Organizations,IN
No.7 North Carolina State University,US
International Workshop on Sustainable
Development Strategy,IN
No.8 University of Miami Rosenstiel School of
Marine&Atmospheric Sci,US
South West Monson region,IN
No.9 University of Massachusetts Boston,US
University of Agricultural Sciences,
Bangalore,IN
No.10 University of Arkansas,US
Indira Gandhi Institute of Development
Research (IGIDR),IN
Title: Grazing and Iron Controls of Diatom
Blooms in the Arabian
Sea
The Arabian Sea is important in global C and N
budgets
because of its high rates of annual primary
production, its
extensive zone of oxygen depletion and
denitrification, and
its expected strong response to global warming via
ocean-atmosphere feedback to monsoon winds and
upwelling
intensity, especially the Oman Upwelling, driven by
the SW
Monsoon. In 2007, one of the investigators found that
a
large region of the central and southern Arabian Sea
was
Fe-limited during the SW Monsoon, consistent with
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DvNoc is a product of the team effort of joint US, China, Korea and the Nordic Countries. Thanks to CSTNet for pioneering work on flash front end development of this application
Created by GLORIAD Dev

What GLORIAD community has done since last GLIF Meeting

- New PerfSonar boxes deployed / shipped to Chicago, Seattle, Singapore, Mumbai, Cairo
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Performance Measurement



We're trying to shift towards "customer-based performance" in all areas of cyberinfrastructure deployment

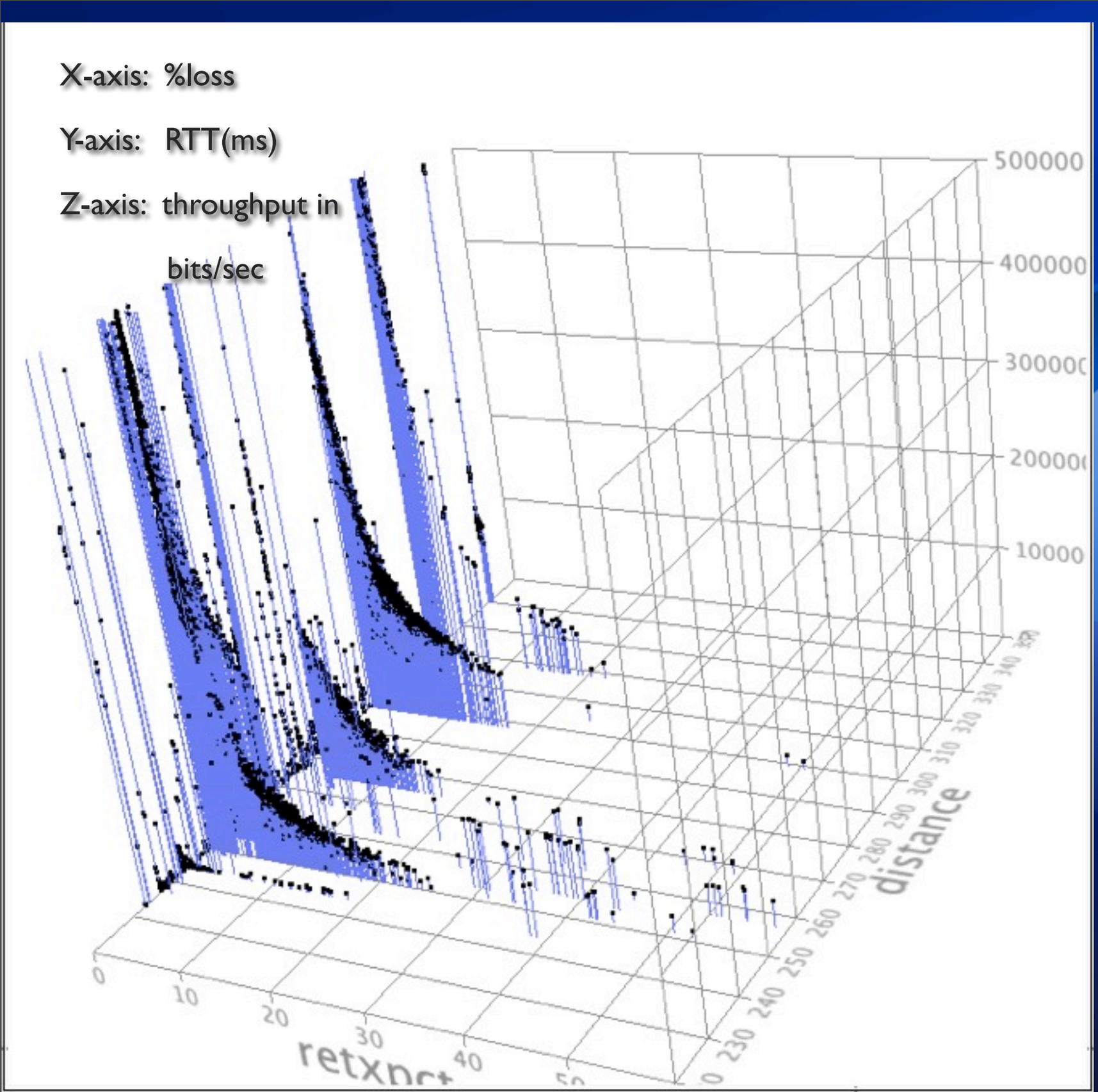
Emphasis on Customer Performance

- We wish to know of individual customer-based performance problems before customer can call
- We're developing statistically important base of information about where there are weaknesses in our global/regional/ regional/local networks
- Based primarily (at moment) on measurements of packet retransmits

X-axis: %loss

Y-axis: RTT(ms)

Z-axis: throughput in bits/sec



“Needle" chart i.e., a blue needle (topped by a black marker) illustrates one flow

3-D plot of throughput , loss & RTT using flow data from US to CSTNET over a 24hr period on GLORIAD network

Identifying Problem Areas in Global, National, Regional, Local, Campus Networks

- Problem: network operators have insufficient knowledge of nor relationship with each other (local/campus, regional, national, global operators) (and R&E customers less so)
- Solution: encourage common view towards customer-based performance, lead effort towards community-developed shared performance measurement instrumentation and tools for joint engineering management (dvNOC)
- (we will realize many other benefits from this community-building exercise)

Automated system to debug under-performing flows in wide area networks

by

Harika Tandra

(htandra@gloriad.org)

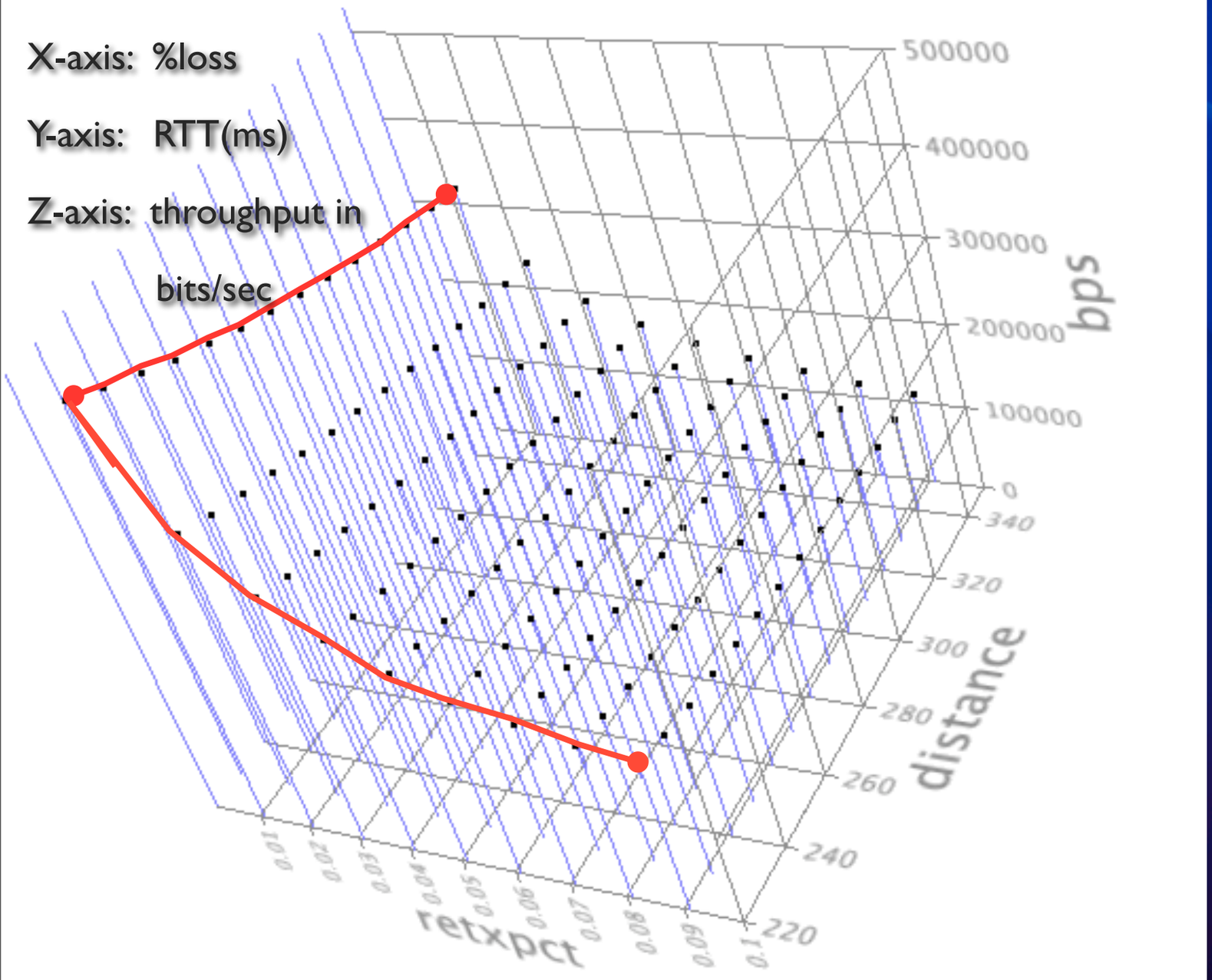


Harika Tandra
Software Engineer

AICIP RESEARCH

GLORIAD

Throughput vs Loss (contd..)



3-D plot of throughput derived from loss & RTT using Mathis formula

- We can see that the decrease in rate is steeper with the increase in loss than the increase in RTT

- Half the loss rate gives throughput increase of ~41%

Passive monitoring system - Input flow filter

- Filter the netflow records to identify under-performing flows

ip_src	ip_dst	MB	%rtpct	starttime	endtime
xx.xx.77.70	xx.xx.138.244	0.2137	0	2009-10-18 20:53:43	2009-10-18 20:58:50
xx.xx.16.49	xx.xx.4.71	0.2101	0	2009-10-18 20:53:42	2009-10-18 20:58:51
xx.xx.189.65	xx.xx.224.75	213.3897	0	2009-10-18 20:15:22	2009-10-18 20:58:51
xx.xx.3.226	**xx.xx.244.210**	**7.3098**	**0.9866**	**2009-10-18 20:56:50**	**2009-10-18 20:58:51**

MB - MBytes transfered, %rtpct - Percentage retransmissions per byte

Active monitoring system - My TraceRoute(MTR)

xx.xx.3.226 xx.xx.244.210 7.3098 0.9866 2009-10-18 20:56:50 2009-10-18 20:58:51



Data collected

ip_s	ip_d	MBytes	rtpct	starttime	endtime	keyid
xx.3.226	xx.244.210	7.31	0.987	2009-10-18 20:56:50	2009-10-18 20:58:51	28995

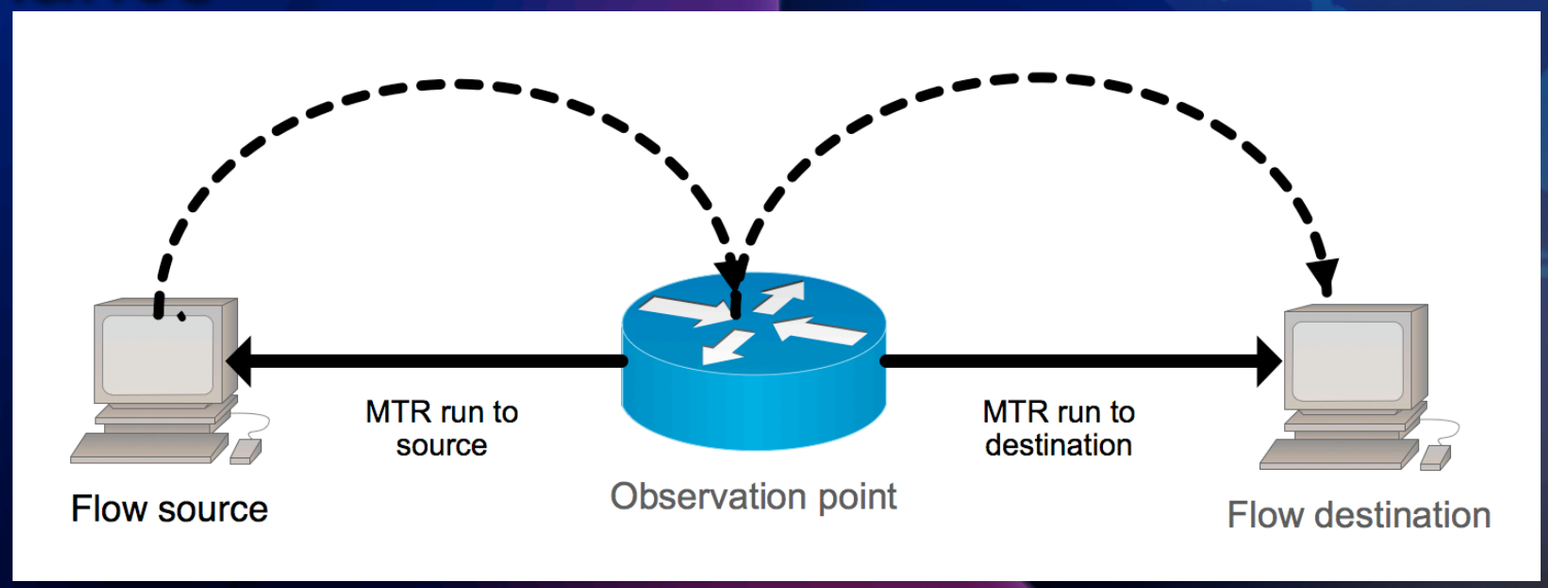
serial_n	node_ip	loss_pct	packets_s	avg_rtt	best_rtt	wrst_rtt	target_ip	masterkeyid	target_lbl
1	192.31.99.97	0	50	4.7	0.4	12.8	xx.244.210	28995	Destination
2	192.31.99.146	0	50	2.3	1.3	17.7	xx.244.210	28995	Destination
3	216.24.186.5	0	50	28.8	27.2	49.3	xx.244.210	28995	Destination
4	192.43.217.137	0	50	28.6	26.3	62.8	xx.244.210	28995	Destination
5	192.43.217.114	0	50	27.2	27.1	27.7	xx.244.210	28995	Destination
6	128.117.243.75	0	50	27.8	27.2	41.7	xx.244.210	28995	Destination
7	???	100	50	0	0	0	xx.244.210	28995	Destination
1	192.31.99.97	0	50	5.3	0.4	13.5	xx.3.226	28995	Source
2	192.31.99.166	0	50	189.9	189.8	196.3	xx.3.226	28995	Source
3	159.226.254.165	0	50	190.2	189.9	203.6	xx.3.226	28995	Source
4	159.226.254.253	0	50	228.8	228.8	229.1	xx.3.226	28995	Source
5	159.226.254.29	0	50	230.8	228.9	317.8	xx.3.226	28995	Source
6	159.226.254.190	2	50	229.6	229	254.1	xx.3.226	28995	Source
7	159.226.254.170	4	50	229.4	229.2	229.8	xx.3.226	28995	Source
8	159.226.46.230	2	50	229.6	229.4	230.3	xx.3.226	28995	Source
9	???	100	50	0	0	0	xx.3.226	28995	Source

Resultset

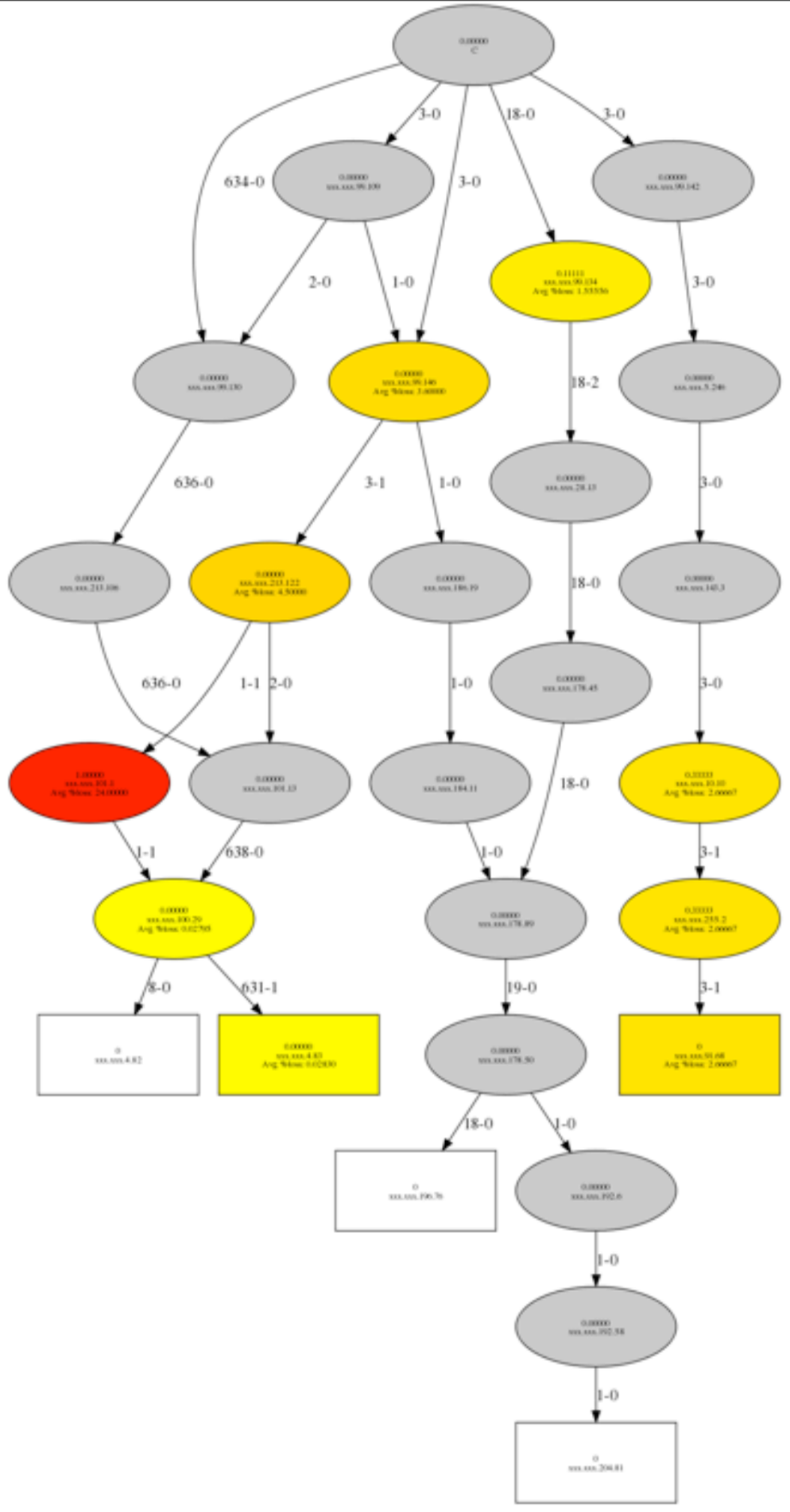
Result of MTR runs to source and destination of an under-performing flow

Active monitoring system

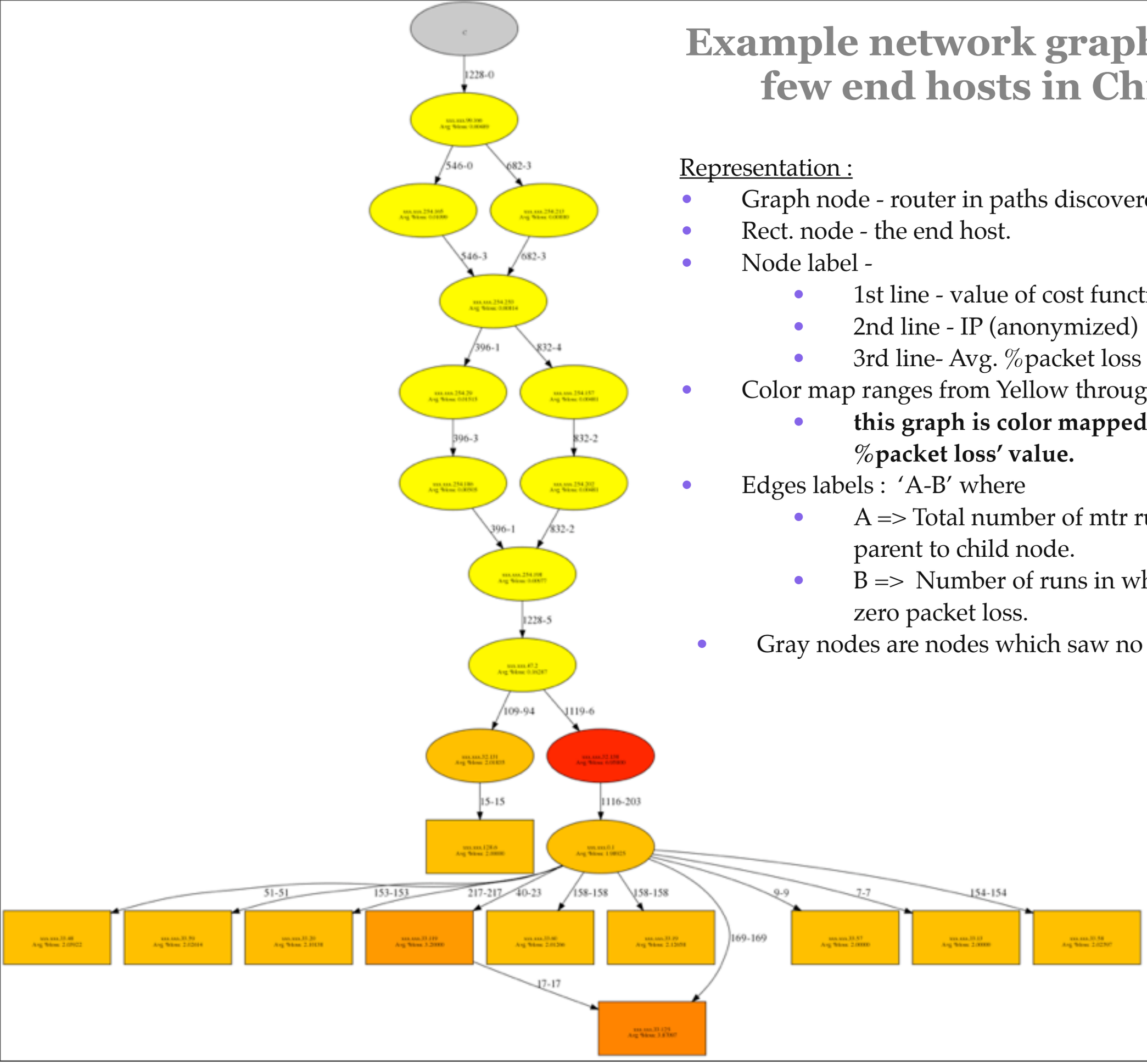
- For each under-performing flow identified, MTR runs are triggered to source and destination IPs
- Triggered in **near-real-time** to the flow detected. Thus, test packets are triggered in network conditions similar to those seen by the real traffic
- Combining the two gives approximate end-to-end performance



Example network graphs for a few end hosts in U.S.



Example network graphs for a few end hosts in China



Representation :

- Graph node - router in paths discovered by MTR.
- Rect. node - the end host.
- Node label -
  - 1st line - value of cost function
  - 2nd line - IP (anonymized)
  - 3rd line- Avg. %packet loss at the node.
- Color map ranges from Yellow through orange to red.
  - **this graph is color mapped based on the 'Avg. %packet loss' value.**
- Edges labels : 'A-B' where
  - A => Total number of mtr runs through the parent to child node.
  - B => Number of runs in which there was non-zero packet loss.
- Gray nodes are nodes which saw no packet loss.

What GLORIAD community has done since last GLIF Meeting

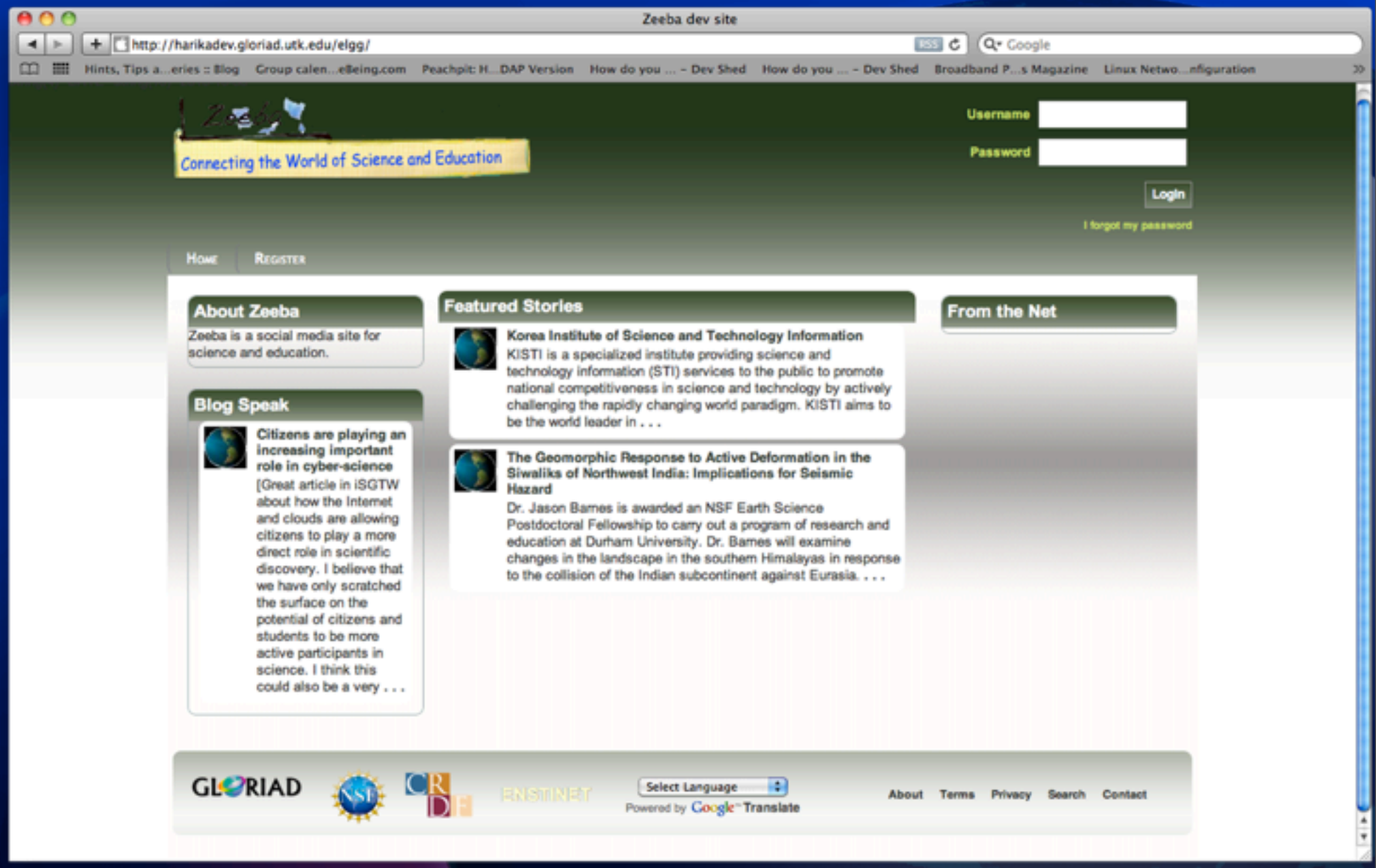
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Zeeba.net

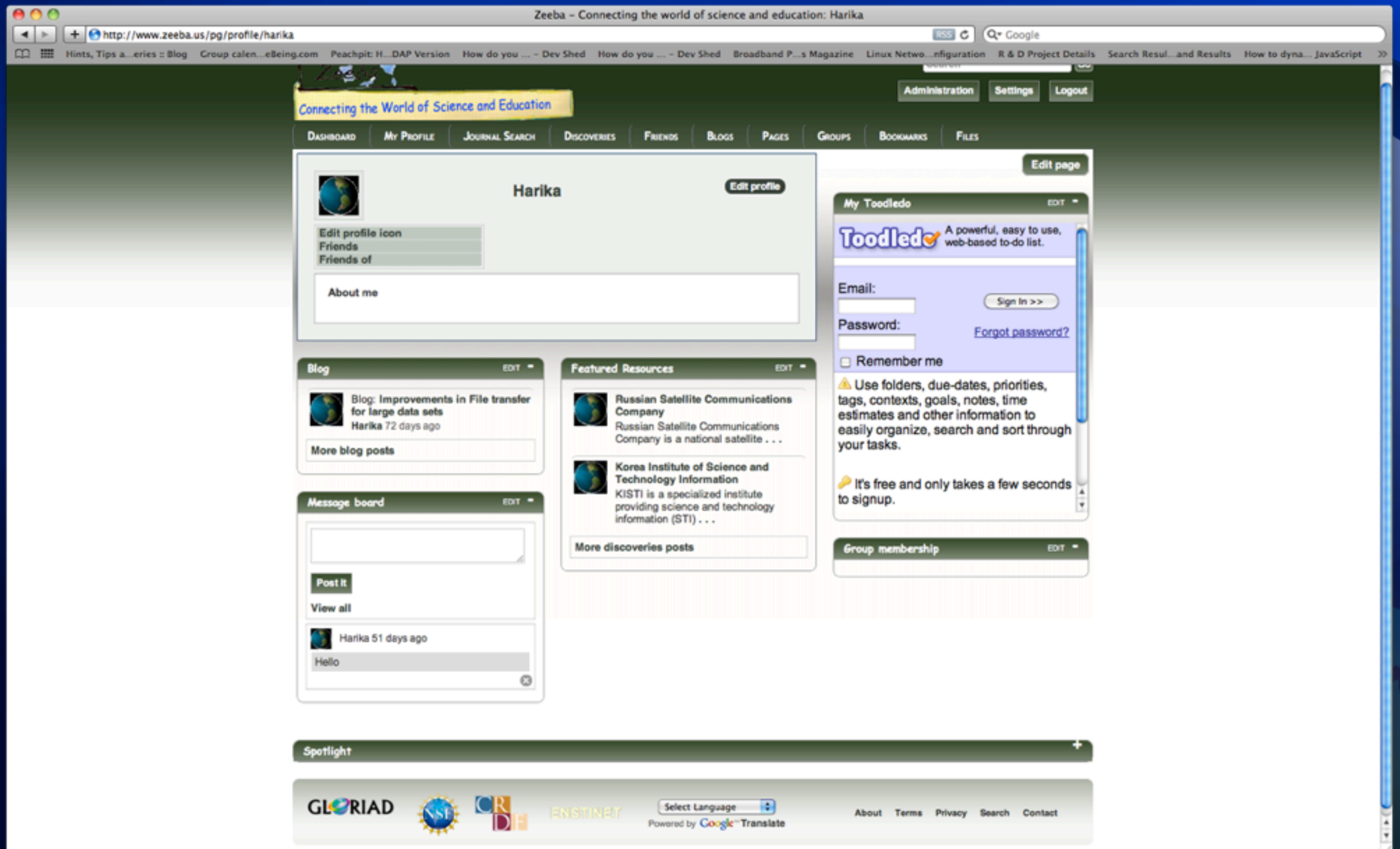
- Addresses lack of awareness of global cyberinfrastructure, of opportunities for global collaboration and resources and of “how to use” cyberinfrastructure effectively
- a “social networking” platform designed to enable the science + cyber community to educate/inform/ support itself (i.e., broader community)
- via partnership with U.S. Civilian Research and Development Foundation (CRDF), will integrate access to scientific literature (including full-text articles) for countries in Africa, Middle East and Southeast Asia and build social dialog around quality information services

Zeeba Front Page

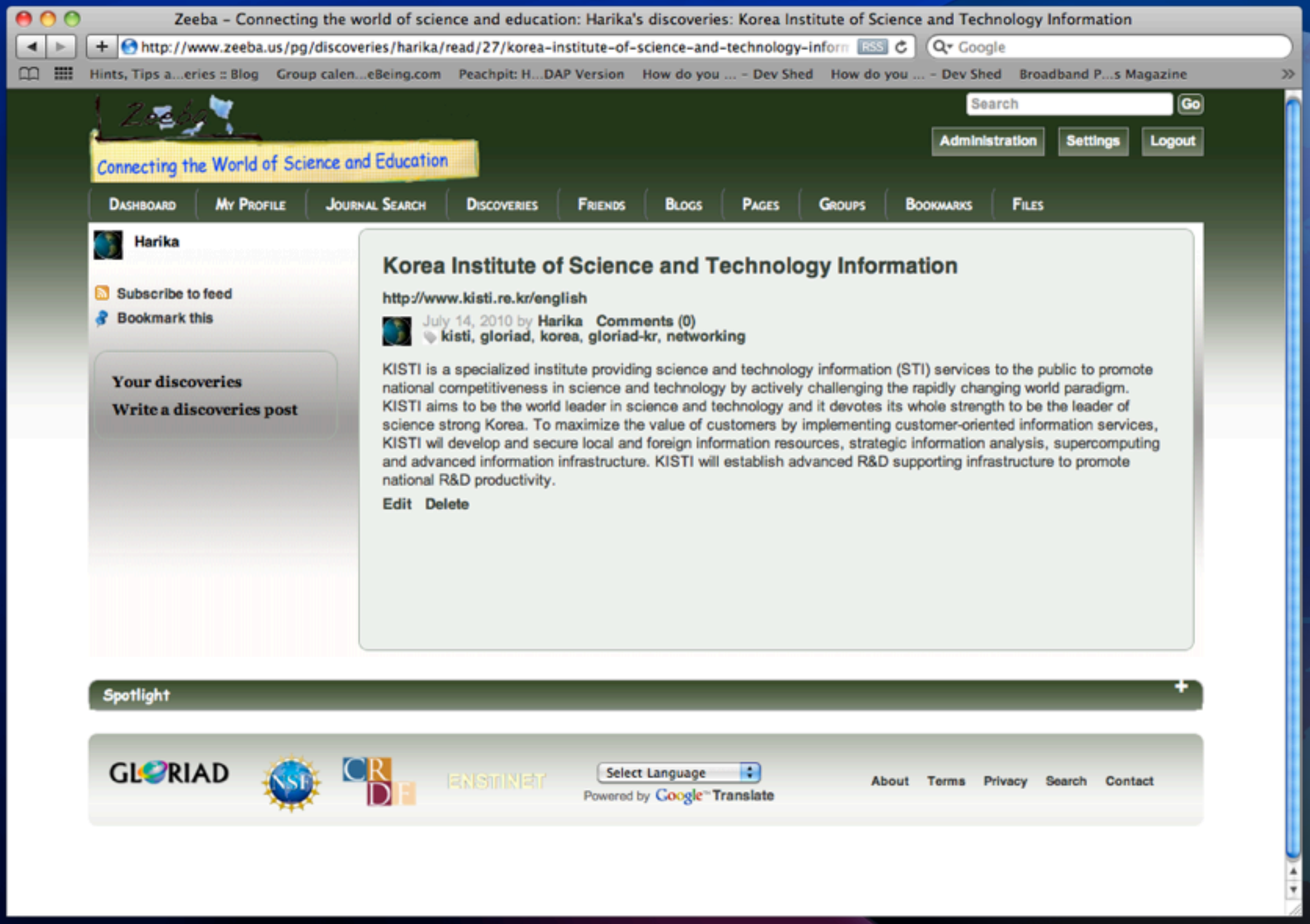
- Will feature showcase Blogs, web-based resources and Featured stories from Zeeba pages.
- Will contain an archive of Front -pages by date



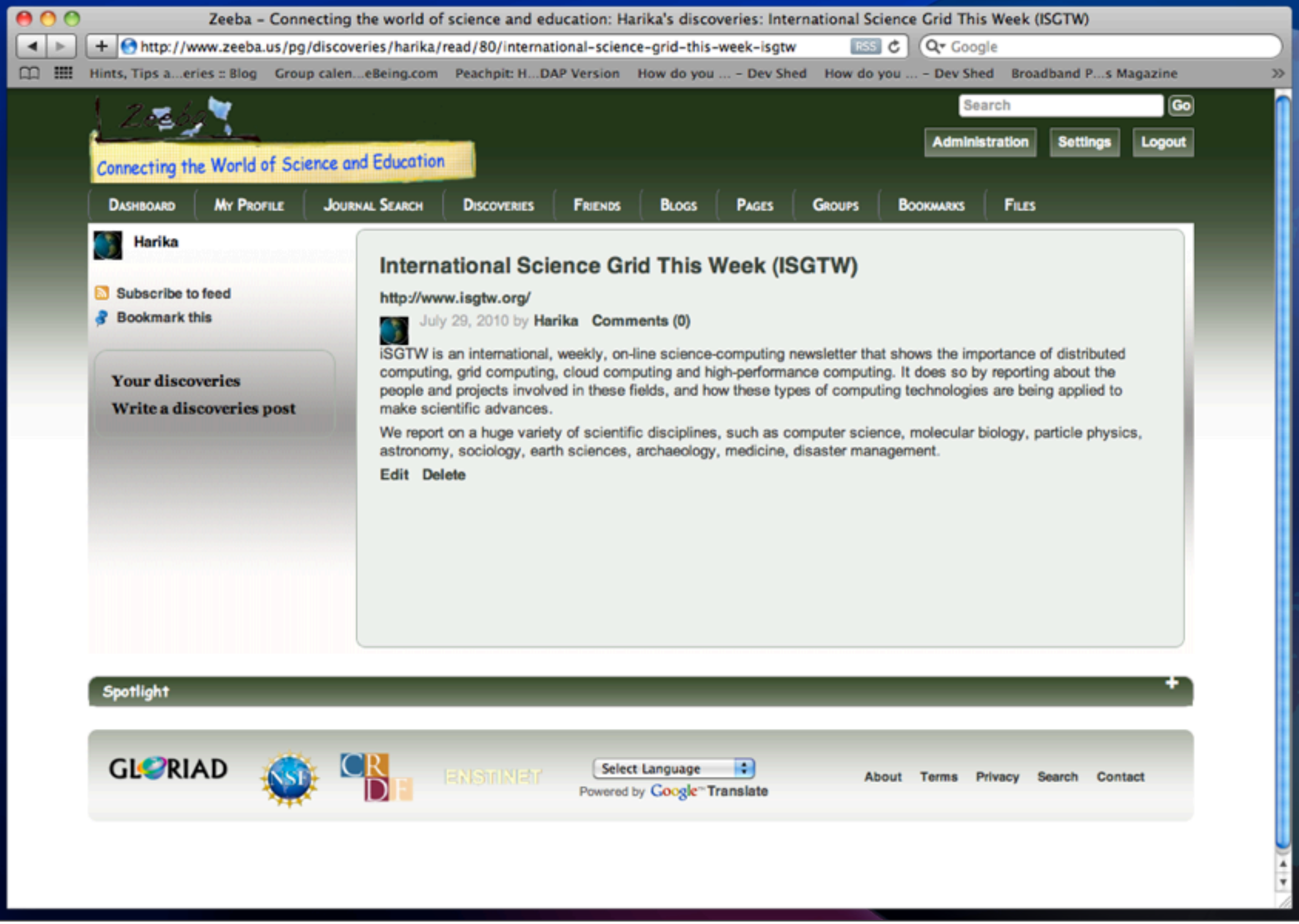
User Profile page



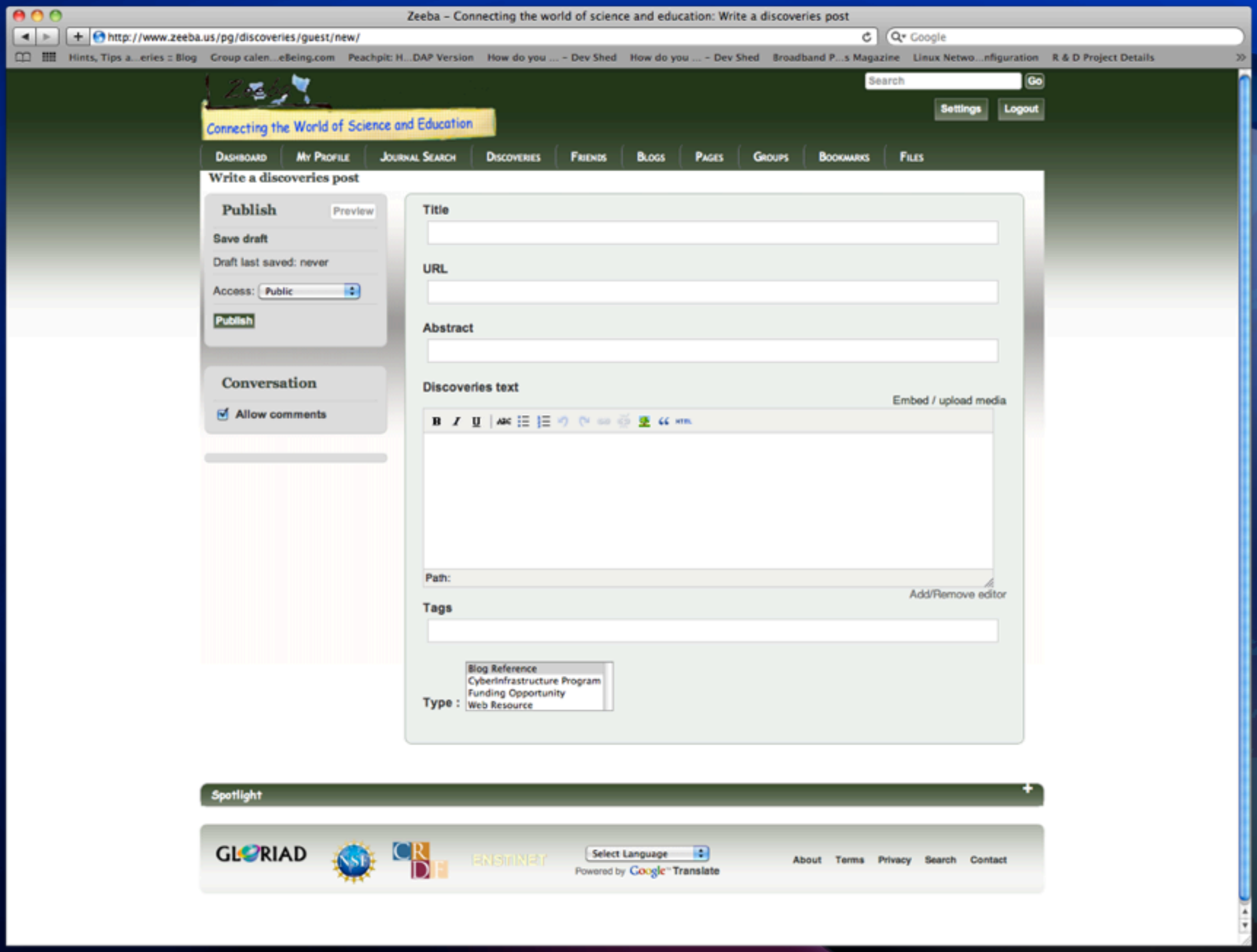
Articles shared across the site



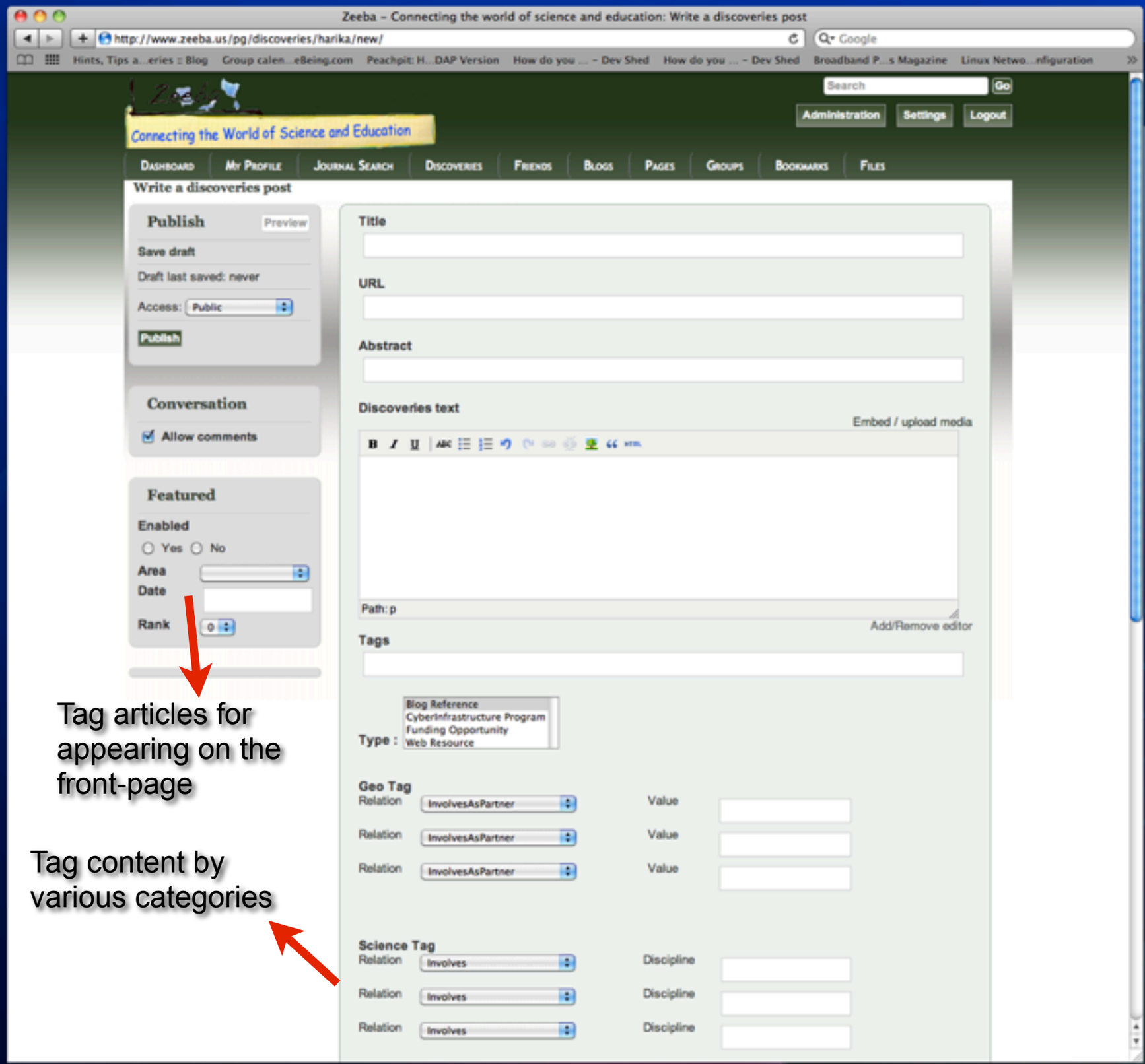
Articles shared across the site - II



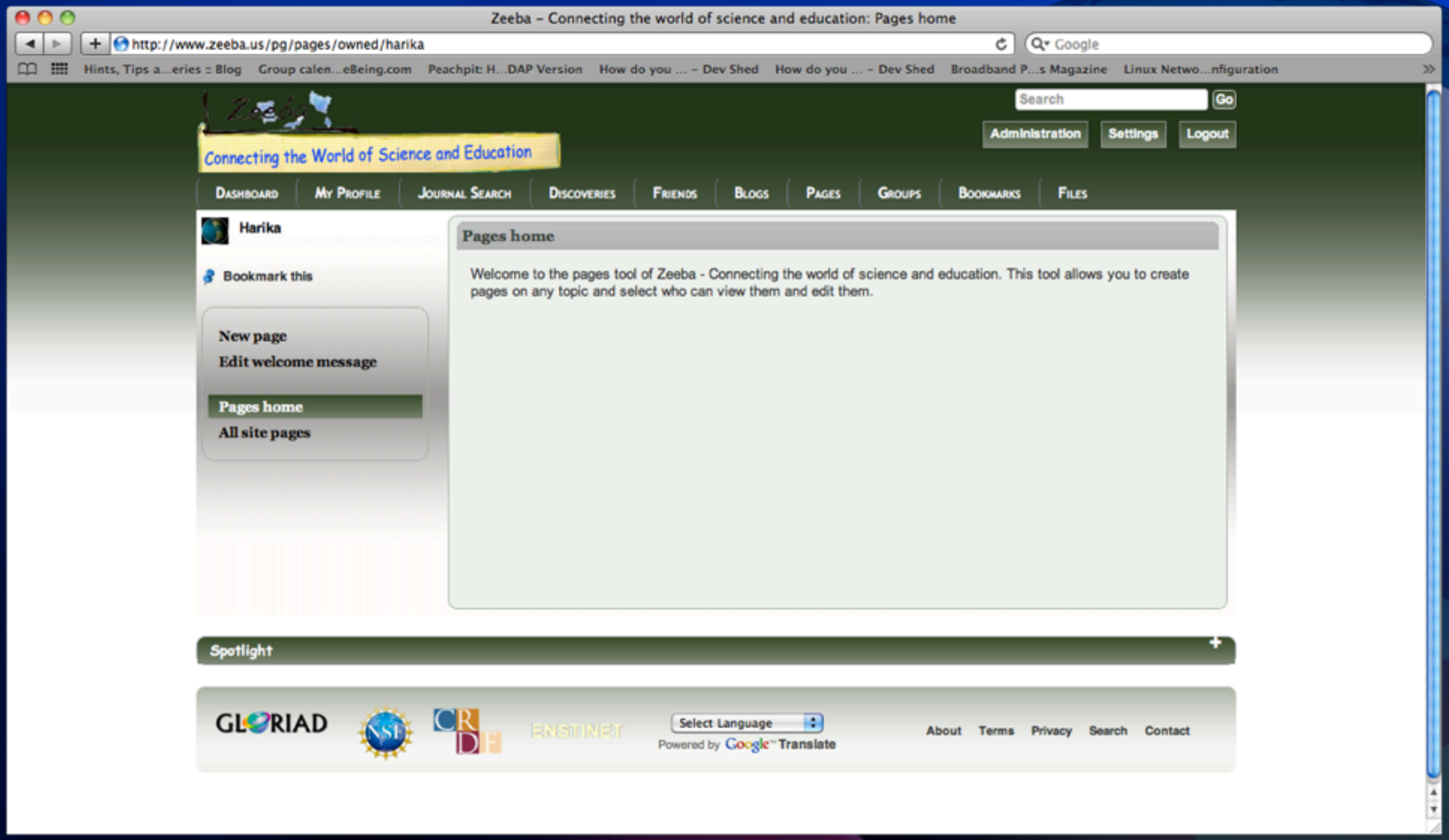
User contributions



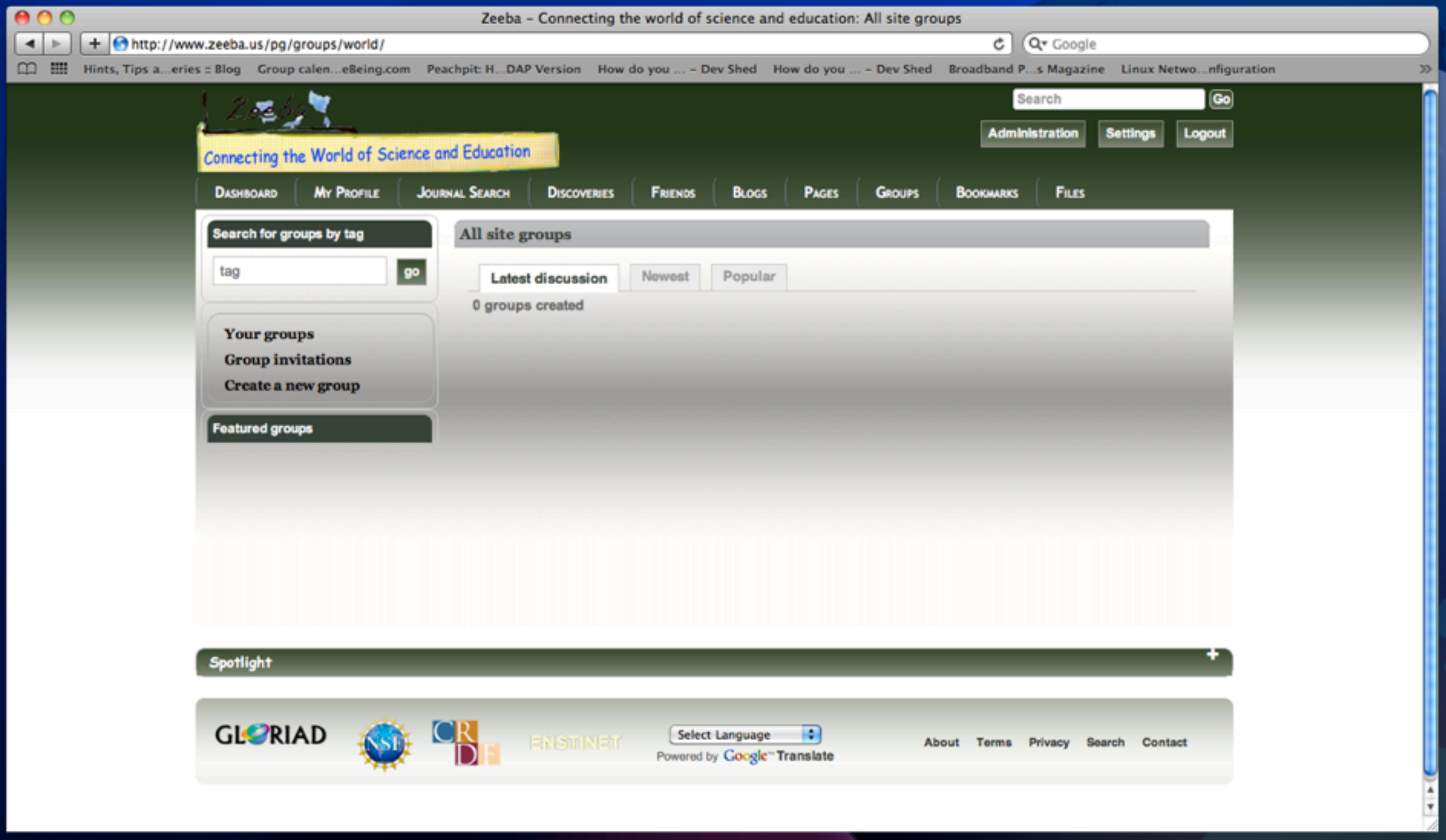
Curator's view



Pages


Zeeba – Connecting the world of science and education: Pages home
http://www.zeeba.us/pg/pages/owned/harika
Google
Hints, Tips a...eries :: Blog
Group calen...eBeing.com
Peachpit: H...DAP Version
How do you ... - Dev Shed
How do you ... - Dev Shed
Broadband P...s Magazine
Linux Netwo...nfiguration
Zeeba
Connecting the World of Science and Education
Search
Go
Administration
Settings
Logout
Dashboard
My Profile
Journal Search
Discoveries
Friends
Blogs
Pages
Groups
Bookmarks
Files
Harika
Bookmark this
New page
Edit welcome message
Pages home
All site pages
Pages home
Welcome to the pages tool of Zeeba - Connecting the world of science and education. This tool allows you to create pages on any topic and select who can view them and edit them.
Spotlight
GLORIAD
NSF
CRDF
ENSTINET
Select Language
Powered by Google Translate
About
Terms
Privacy
Search
Contact

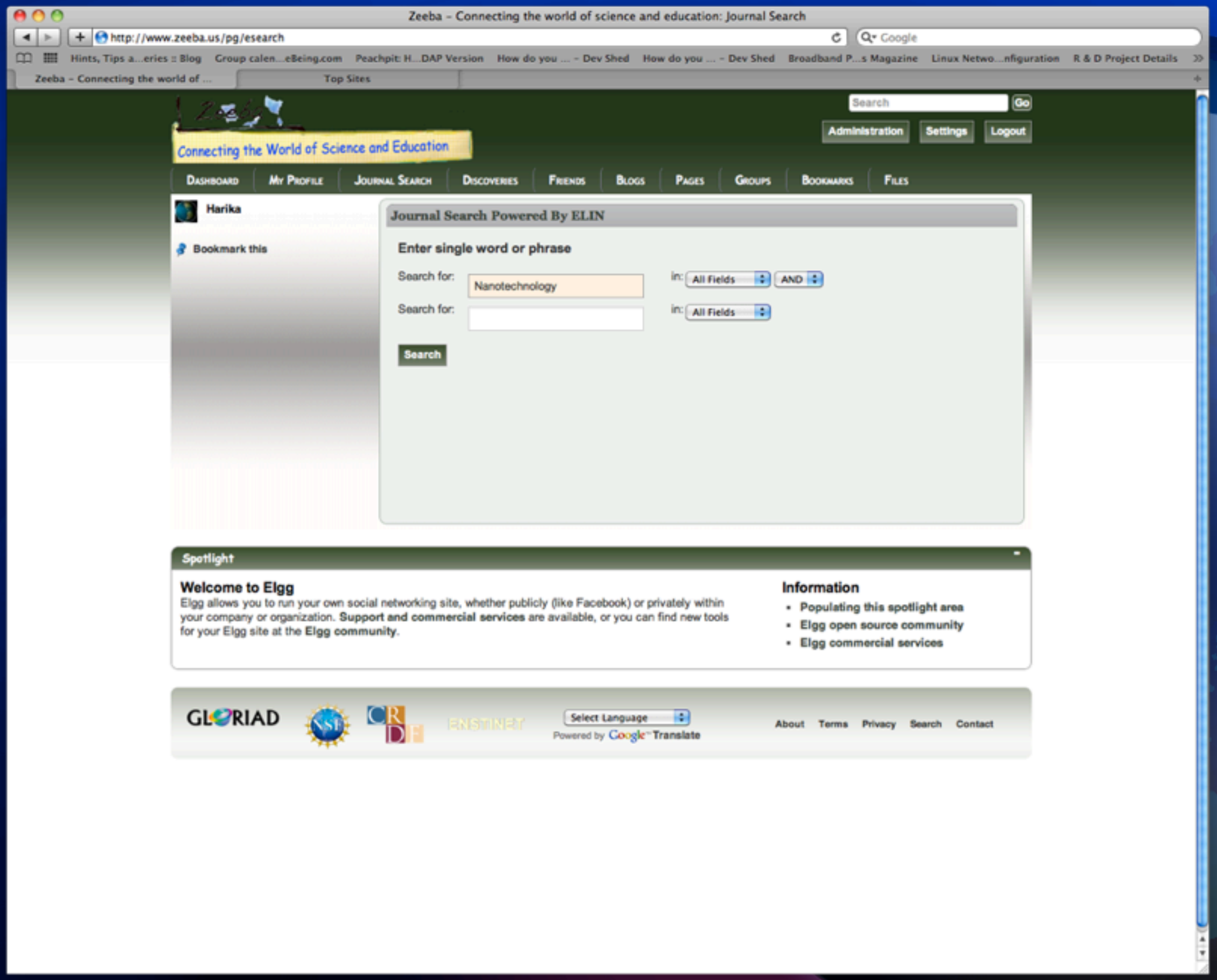
User created groups



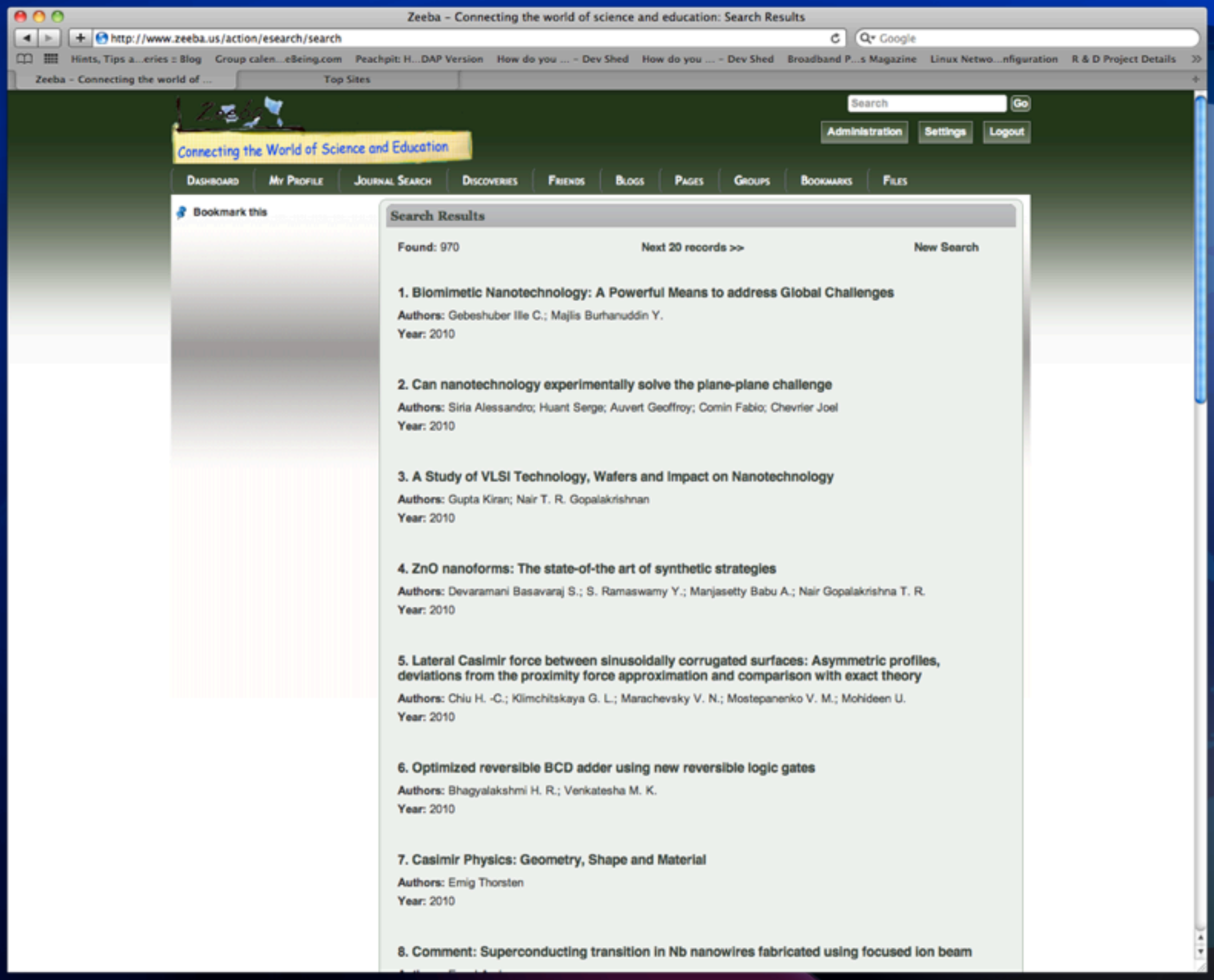
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Electronic journal search



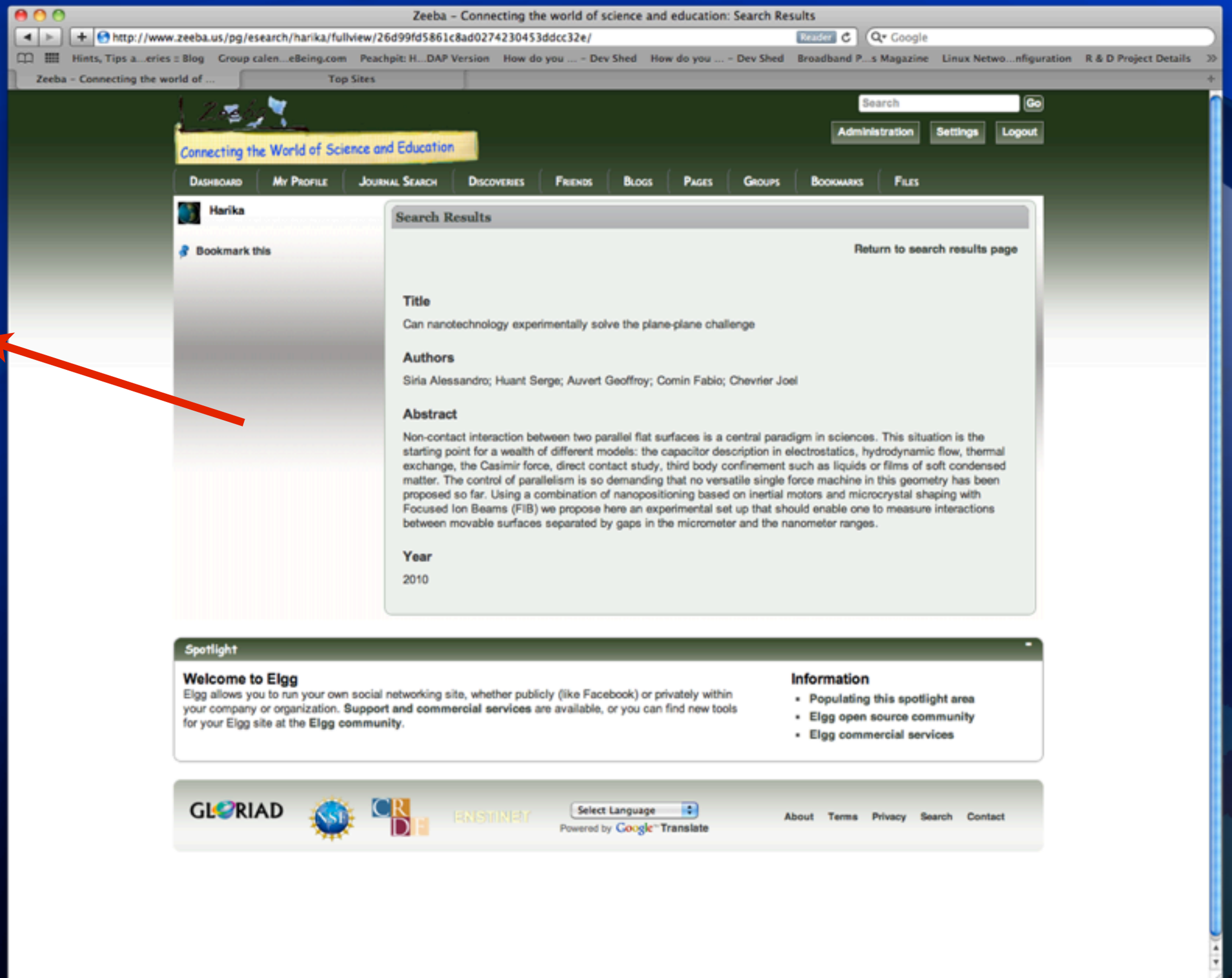
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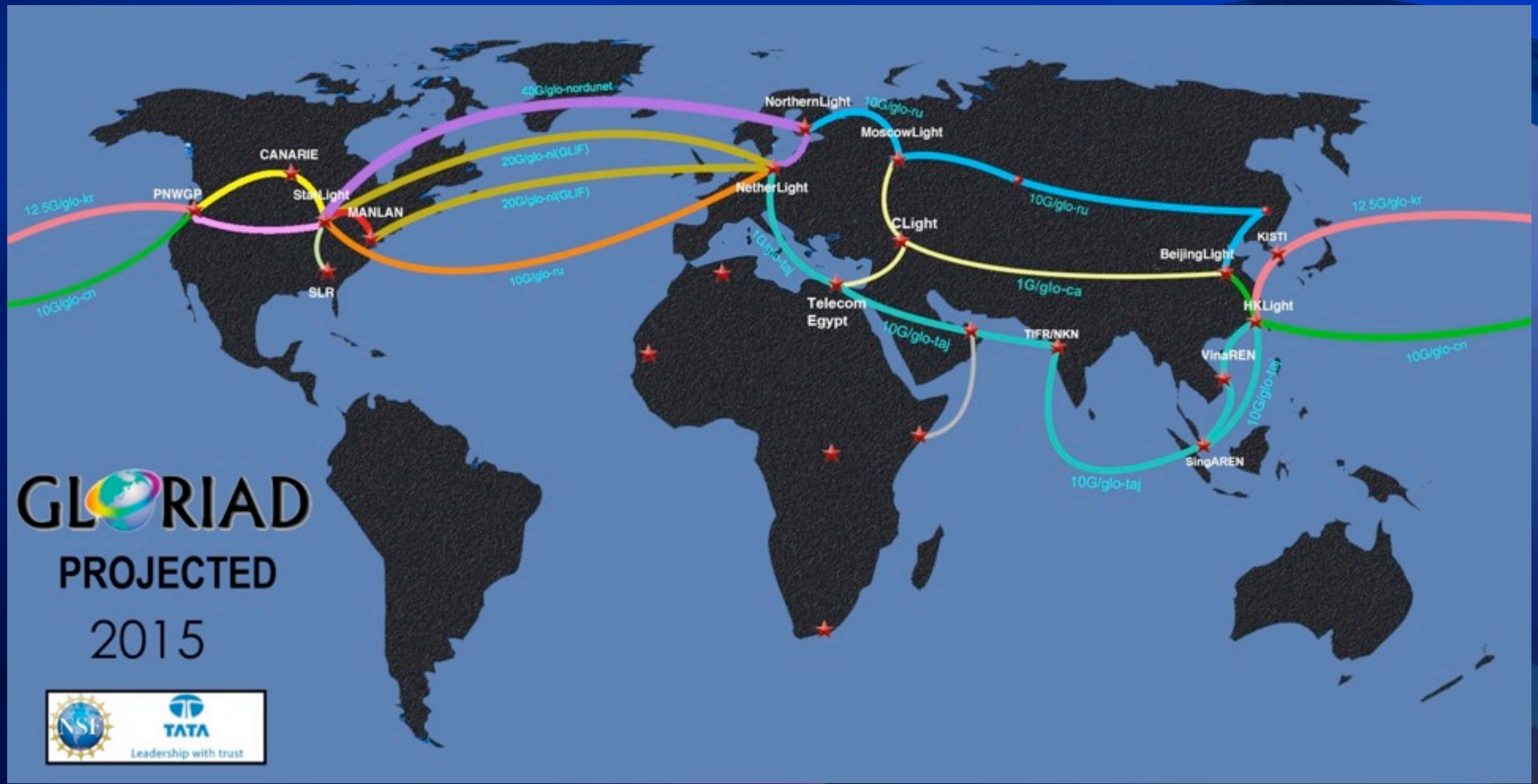
Electronic journal search

In Future:

- Section showing links to related articles in zeeba
- Section showing other researchers with similar interests



GLORIAD 2015



Other Activities

- Distributed Virtual Network Operations Center (dvNOC)
- Network Measurement and Monitoring Box (nprobe+)
- Community Outreach (Zeeba + K12)
- Green-powered IT
- IPv6 Activities
- Move to larger capacity circuits
- Dynamic provisioning
- Supporting next generation Internet research
- Renewed emphasis on connecting the unconnected (working with Egyptian partners on Middle East and African networking)
- Civic networking (community-owned fiber infrastructure)
- Engineering and student exchange
- Transoceanic fiber pair leasing
- Look at broader issues of “Collaboration Infrastructure” for science, education and global health

5-10 Years Out

- Innumerable science and education success stories
- New regional GOLEs, vastly increased set of lambdas
- Thriving network of science/cyber collaborators
- Distributed operations of global cyberinfrastructure
- Fiber-pair around the earth for science/education/ public purposes
- Community-owned fiber for science/education/public purposes
- “Green-powered” IT