

## Light Path To India

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KEIO University

IIT Japan Conference  
Nov. 15, 2007



WIDE

## Lambda Network for 2010 and beyond

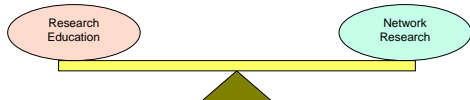
Space Science, Astronomy  
Environment, Energy  
Medical Study • Health Management  
ITER • High Energy Physics  
Digital Cinema • New Digital Media  
Sports (F1, Olympics)



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## Science Research and R&E Network

- Research and Educational Network
- Infrastructure for Top-level Research and Education
- 'Research Network' for Networking Research



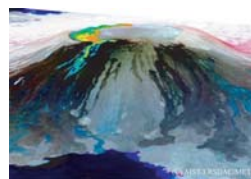
- Science Research requires the best network
- EOS, ALOS, ITER, LHC, eVLBI, Education and Digital Cinema
- The best network has to be developed and operated
- Light path based network



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## EOS (Earth Observation System)

- Earth Observation System
- Many observation satellite launches
- Received data would be shared
- Analyzed by researchers world-wide.



Lava of the ocean

<http://www.gsfc/>  
<http://terra.nasa.gov/>

EOS TERRA



Shared Data from EOS

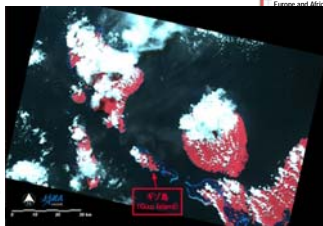


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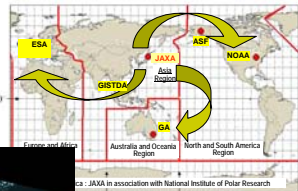
## ALOS (Advanced Land Observing Satellite)

- JAXA project
- Earth Observation
- Data analysis globally
- Shared by researchers around the world
- Requires huge amount of data

<http://www.eorc.jaxa.jp/>



ソロモン群島沖地震の解析



地球観測衛星 ちしち

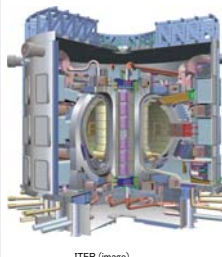


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## ITER

- Global project for the next generation of energy
- EU, China, Korea, Russia, US, India and Japan
- Core System would be in France
- JAEA

Research resource would be shared with network



ITER (image)

<http://www.naka.jaea.go.jp/ITER/>  
<http://www.iter.org/>  
<http://www.itered.org/>



CEAカダラッシュ研究所



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## LHC (Large Hadron Collider)

- 大規模な陽子加速器の実験場
- 国際的な素粒子研究が行われる
- ジュネーブ郊外、CERN研究所の地下100mに建設
- 日本担当機関: 高エネルギー加速器研究機構 (KEK)



Atlas実験装置の組み立て



CERN研究所

LHCトンネル内

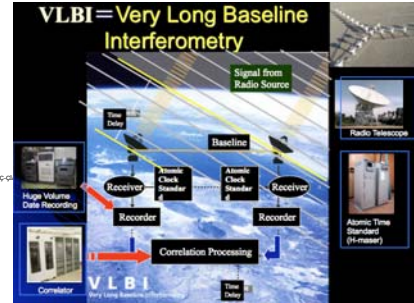
参加各国の研究者が遠隔から測定データを解析するためにネットワークが必要

出典  
http://www.kek.jp  
http://ho.web.cern.ch/ho/



## e-VLBI

- 衛星データを地上の離れた地点で計測する
- 複数の地上観測点のデータの差異から計測結果を得る
- 離れた観測点をネットワークで結ぶことにより多くの結果を得られる
- 応用分野
  - 天体観測
  - 測地
  - 宇宙船のナビ

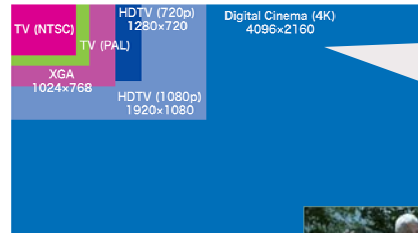


出典  
NTT 田中 氏



## Media for Collaboration

## DVTS, HD-DVTS, and 4Kcinema



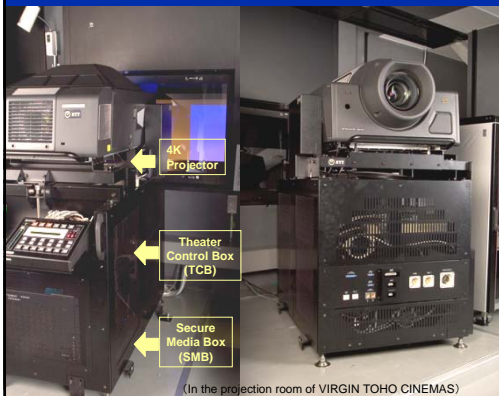
- ✓ Comparison of screen resolutions for TV, computer display (XGA), HDTV and digital cinema
- ✓ The higher the resolution, the clearer and more realistic the picture

✓ The 4K Digital Cinema format has been developed by members of DCCJ (Digital Cinema Consortium Japan) with contributions from DMC researchers

The format has been approved as an international standard by DCI (Digital Cinema Initiative)



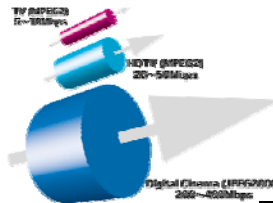
## "4K Pure Cinema" Prototype In-Theater System



Corpse Bride  
Harry Potter 4  
V for Vendetta  
DaVinci Code  
Poseiden  
Mission  
Impossible 3  
+  
Tokyo Film  
Festival  
Batman Begins  
Stealth

Source: WIDE

## TV, Cinema and the new Media



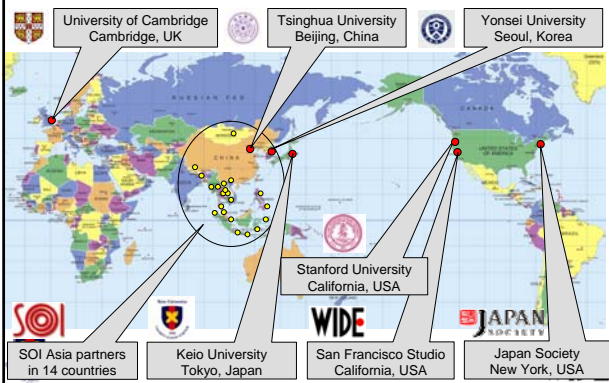
✓ DMC, in cooperation with NTT, UCSD and UIC, achieved the world's first successful transmission of a real-time 4K digital cinema stream across the Pacific Ocean in September 2005

✓ This proved that global giga-bit networks can be formed to transmit ultra-high resolution moving images for academic, educational, medical and cultural applications





### Global Digital Studios –Media and Tele-Presence with Sound-

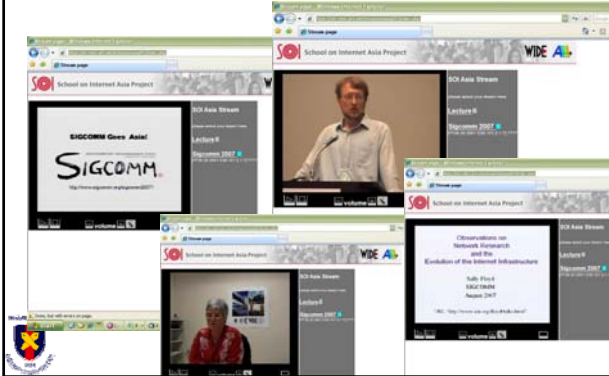


### Studio at Keio University

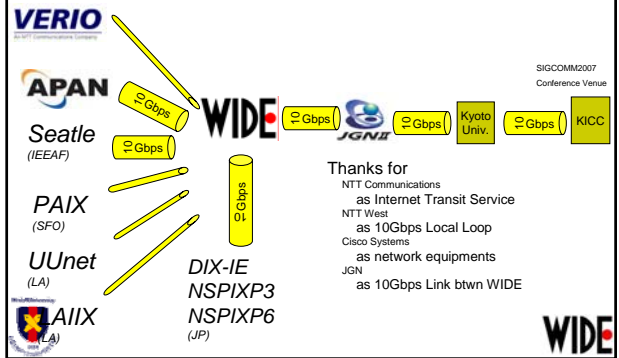
Location: Tokyo, Japan  
 Operated by: Keio University DMC Institute  
 DVTS and Polycom / Multipoint capable  
 IPv4/IPv6  
 Re-constructed in February 2006



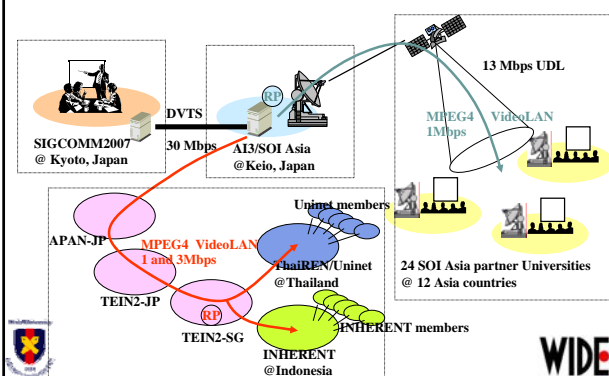
### SIGCOMM2007 ASIA IPv6 Multicast Live Streaming



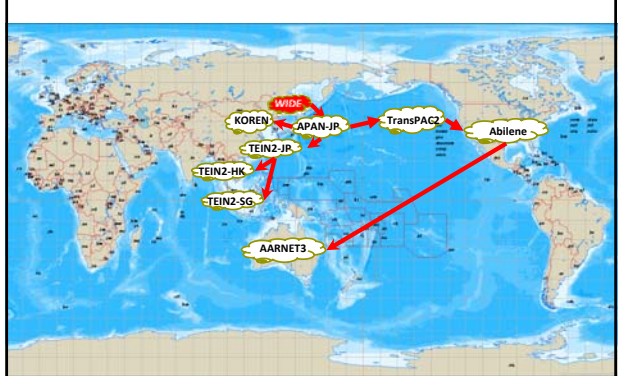
### Topology



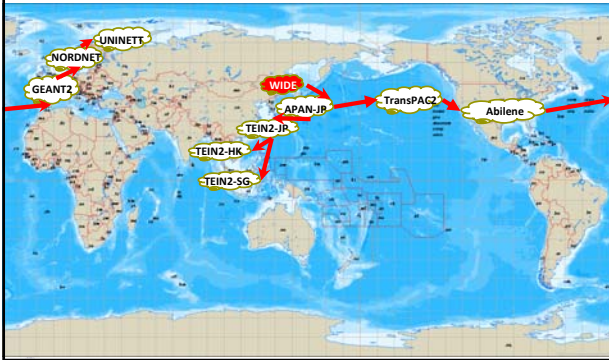
### ACM SIGCOMM2007 ASIA IPv6 Multicast Live Streaming



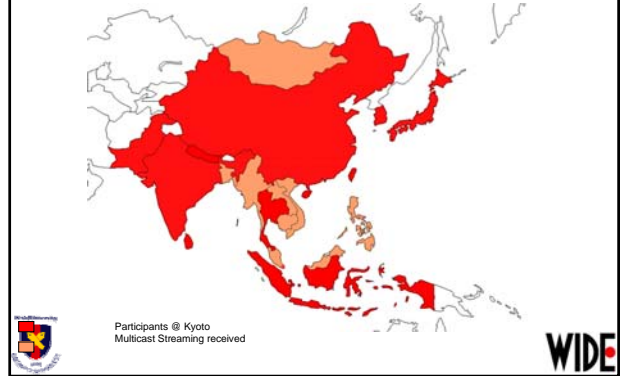
### IPv4 Listener AS ( Confirmed)



## IPv6 Listener AS(Confirmed)



## Participated Asian Countries



## AI3 and SOI-ASIA

IPv6 multicast in All Asia everyday



## What is SOI Asia ?

Multilateral partnership among Asian universities  
to operate a platform for educational collaboration among universities in Asia



## 27 universities/institutes in 13 countries

- Indonesia - 5
  - Brawijaya University
  - Sam Ratulangi University
  - Hasanuddin University
  - Institut Teknologi Bandung
  - Universitas Syiah Kuala
- Thailand - 4
  - Asia Institute of Technology
  - Chulalongkorn University
  - Chulachomkraj Royal Military Academy
  - Pricen of Songkla University
- Laos - 1
  - National University of Laos
- Myanmar - 2
  - University of Computer Studies, Yangon
  - University of Computer Studies, Mandalay
- Malaysia - 2
  - University Science Malaysia
  - Asian Institute of Medicine, Science & Technology
- Singapore - 1
  - Tamasek Polytechnic
- Vietnam - 3
  - Institute of Information Technology
  - Vietnam National University
  - Hanoi University of Technology
- Philippines - 2
  - Advanced Science and Technology Institute
  - University San Carlos
- Mongolia - 1
  - Mongolian University of Science and Technology
- Cambodia - 2
  - Institute of Technology of Cambodia
  - Asian Institute of Medicine, Science & Technology
- Bangladesh - 1
  - Bangladesh University of Engineering and Technology
- Nepal - 1
  - Tribhuvan University
- Japanese Partners - 2
  - Keio University
  - NARA Institute of Science and Technology



## platform?

- Sharing Knowledge
  - Sharing university lectures in real-time and archived.
  - Organizing seminars and symposiums
  - Helping remote participation to the international conference and seminars.
- Creating opportunity
  - for joint research
  - to study in Japan
- IT HRD
  - Workshops
  - Internships



## Educational programs

- The project provided more than 20 graduate level courses consisting of more than 170 lecturers were provided by 9 universities in Japan, received by more than 1000 students in region wide. Some were accredited in universities.
- Lectures were delivered from 15 sites from Japan, Indonesia, Malaysia, Thailand, Bangladesh and USA.
- Topics were selected based on the partners' requirement and **academic committee** are formed for each area.
  - Marine Science and Technology, Bio Technology, IT ...



- 65 real-time sessions (special seminars, tutorials, streaming from conferences) were shared.



## Collaboration with NREN

- Sharing contents with more universities through each country's NREN.
- Thailand
  - Uninet (150 universities)
  - Technical trial were successfully completed.
  - Joint workshop held in June 2007.
  - MoU between SOI Asia and Thailand government for Uninet collaboration is under preparation
- Indonesia
  - INHERENT (80 major universities, increasing)
  - Technical trial are undergoing.
  - A lot of demands from INHERENT universities
  - MoU between SOI Asia is under preparation
- Vietnam
  - VINAREN
  - Technical setup has been done
  - MOU signed up by 2 individual universities. More will come.
- Philippines
  - PREGINET
  - Technical setup has been done and some of the contents are shared.
- Malaysia
  - MYREN
  - IPv6 collaboration
- INDIA
  - A LOT OF OPPORTUNITY !!!!



## Various Types of Collaborations

- Contents partners
  - Providing more contents in wider area
  - JICA
  - UNESCO
    - 3 courses were delivered in 2007
    - ITB, AIT, BUET delivered lectures
    - More courses are planned in 2008
- Platform partners
  - Sharing each other's contents for both community
  - UNU/API through U of Hawaii
- Global Studio partners
  - Getting guest speakers around the world.



## SOI Asia activities

- Sharing university lectures of global issues, global & local interests from Japan and other area, in real-time and archived.
- Helping remote participation to the international conference and seminar.
- Creating opportunity for joint research and studying in Japan.
- Training technical staffs at partner universities
- Developing the environment by ourselves



## AI<sup>3</sup> & SOI-Asia: IPv6 Operation Started from Nov 16, 2005

- 2004 July—Equipments readiness
- 2005 August—IPv6 Training at the WS
- 2005 Nov 16—IPv6 Operation started
- 2007 January—Full SOI-ASIA applications are on IPv6
- 2007: IPv6 only network



## Human resource development for network administrations

- 1<sup>st</sup> Workshop: First beginner's workshop for operators in 2002
- 2<sup>nd</sup> Workshop: First advanced operator's workshop in 2003
- 3<sup>rd</sup> Workshop: First workshop for training workshop lecturers in 2004
- 4<sup>th</sup> Workshop: First local workshop in 2005
- 5<sup>th</sup> Workshop: Combination of beginners/advanced contents workshop in 2005
- 6<sup>th</sup> Workshop: First Global-e-Workshop in 2006
- 7<sup>th</sup> Workshop: First Workshop focusing on IPv6 in 2007



## AI<sup>3</sup> & SOI Asia : Internship for Operators

### 14 interns from 8 countries

- 1<sup>st</sup> batch :Jan – Apr 2006
  - Myanmar (USCY)
  - Indonesia (UNSRAT)
- 2<sup>nd</sup> batch :March – June
  - Laos (NUOL)
  - Nepal (TU)
- 3<sup>rd</sup> batch :May - Aug
  - Indonesia (UNIBRAW)
  - Bangladesh (BUET)
- 4<sup>th</sup> batch :July - Oct
  - Indonesia (ITB)
  - Cambodia (ITC)
- 5<sup>th</sup> batch :Sept - Dec
  - Indonesia (UNHAS)
  - Mongolia (MUST)
- 6<sup>th</sup> batch :Jan – Apr 2007
  - Indonesia (UNSYIAH)
  - Malaysia (USM)
- 7<sup>th</sup> batch :Aug – Nov 2007
  - Indonesia (UNIBRAW)
  - Nepal (TU)

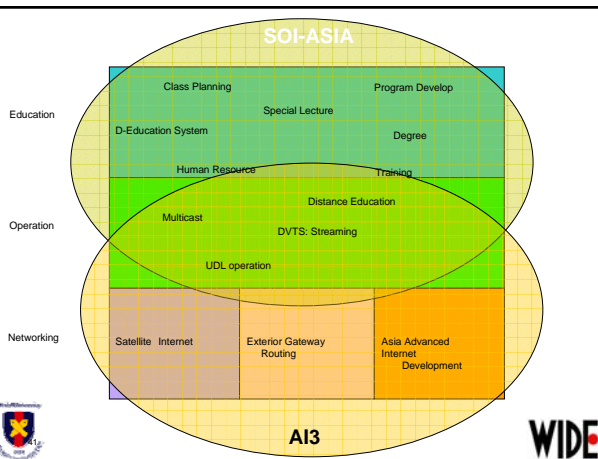
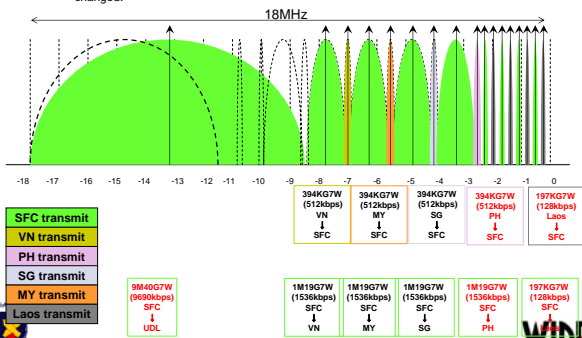


## SOI Asia Operators Workshop



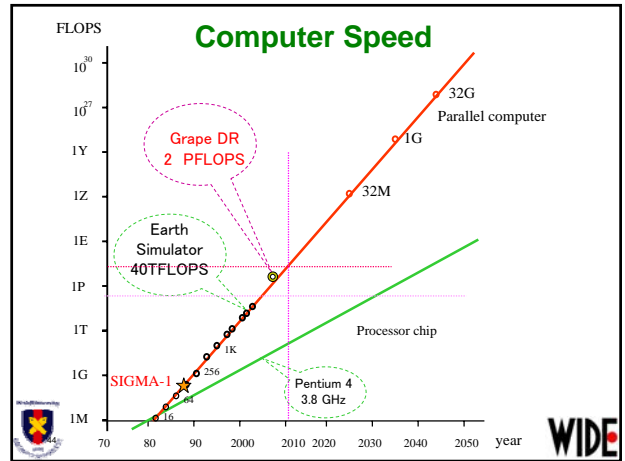
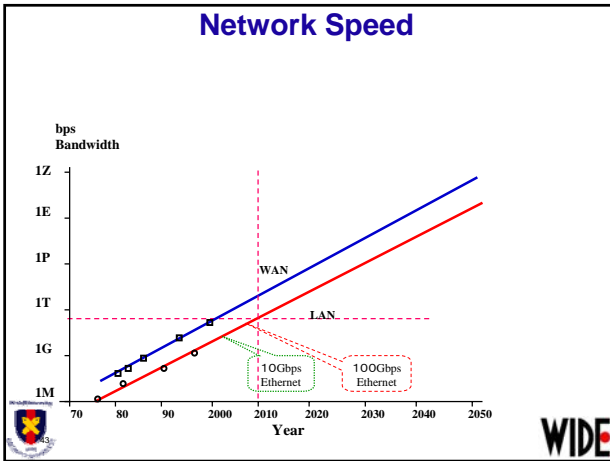
## New AI<sup>3</sup> C-Band Frequency Allocation

- When more than 3 197KG7W carriers are transmitted from SFC, the SFC license need to be changed.



**Faster**

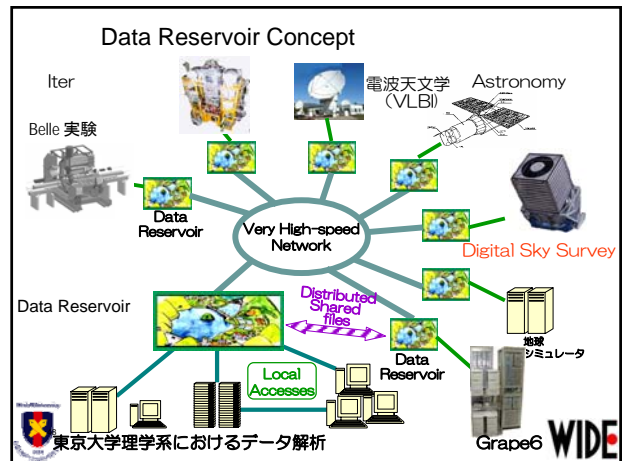


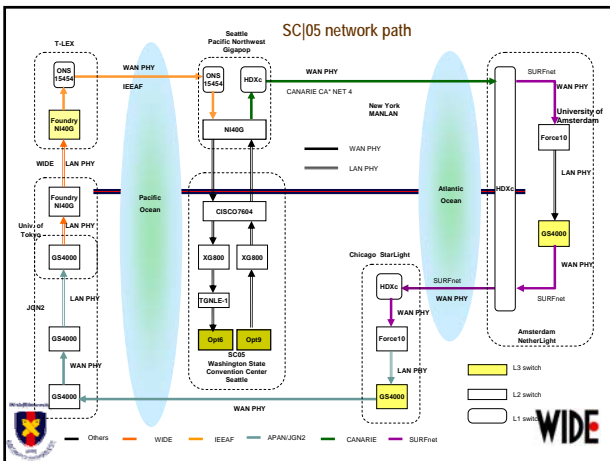


## Global Distributed System

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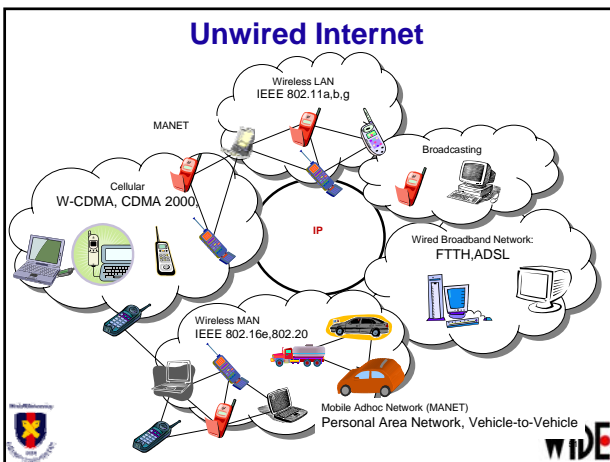
WIDE





### Collaboration for DATA Reservoir LSRs

Collaboration for DATA Reservoir LSRs. Logos include: WIDE, JGN2, ST\*RLIGHT, SURF.net, T-LEX, GRAPE-DR, NTT Communications, sara, IEEAF, PACIFIC GIGAPOP, STARLIGHT, TR\*NS LIGHT, CANARIE, Chelsio, FOUNDRY NETWORKS.



### Working for 'Infrastructure'

Working for 'Infrastructure' components:

- Application:** WWW, AAA, Mail, VoIP, IPTV
- Internet Technology:** IP Telephony: VoIP, SIP, ENUM; IP dynamic network: MANET; IP Mobility: MIP, NEMO
- Fiber, Wireless and Cables:** Cell Phone: W-CDMA, CDMA2000, 1x EVDO, HSDPA; Satellite; WLAN: 802.11a/b/g; WMAN: 802.16, 802.20; WPAN: 802.15.3, zigbee, bluetooth

Loong way to go! Legend: WIDE.

## Latency Sensitivity

Has come!

Legend: WIDE.



## 133ms to reach

Lambda Internet



WIDE

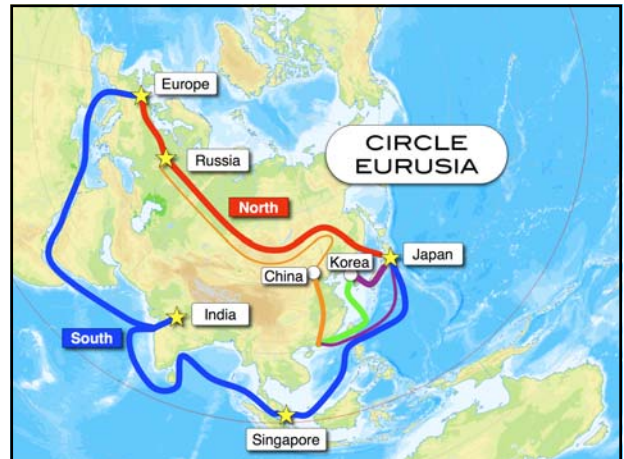
## Global Lambda Integrated Facility World Map – August 2005

International Research & Education Network bandwidth, to be made available for scheduled application and middleware research experiments by August 2005.



[www.glif.is](http://www.glif.is) Visualization courtesy of Bob Patterson, NCSA/University of Illinois at Urbana-Champaign. Data compilation by Maxine Brown, University of Illinois at Chicago. Earth texture from NASA.

## Lambda from Above



## Light Path to India

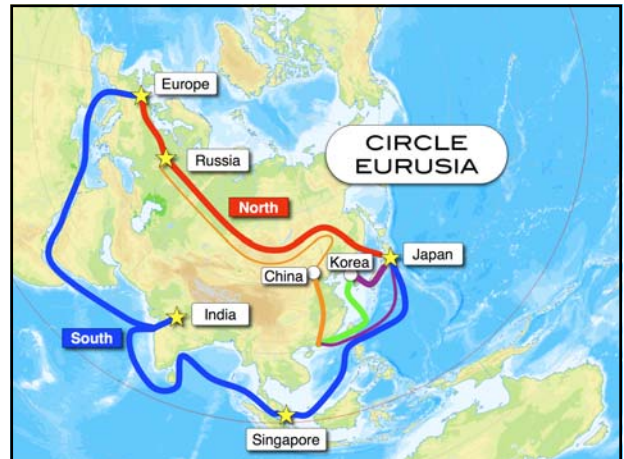
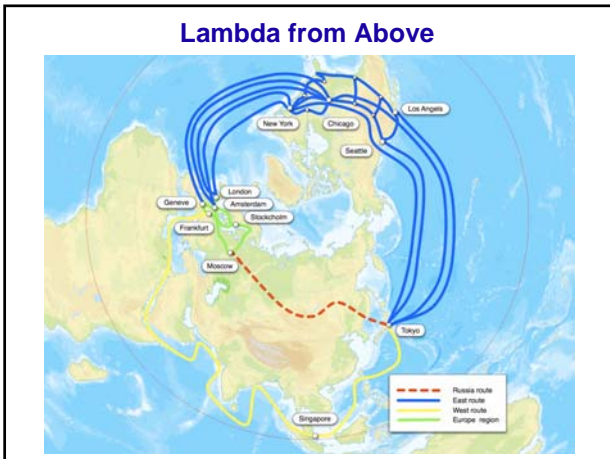
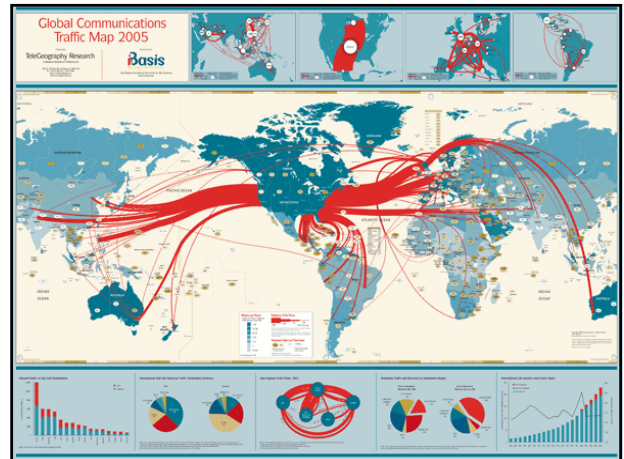
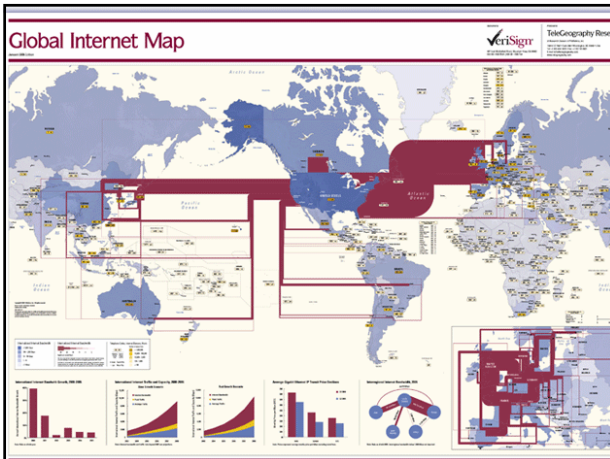
1. India-JP: 10Gbps
2. India-EU: 10Gbps
3. Glif model lambda exchange in a city in India
4. Some major institute to connect to the exchange by 10Gbps
5. National High-speed Research and Education network development and operation



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## 2001 InternetTraffic





### Graduate School of Media Design (to be established in 2008)

**Key Features**

- A well balanced program among "Design", "Technology", "Management" and "Policy" to foster "Media Innovators" capable of producing effort and value by combining and harmonizing four creative forces
- Two year consecutive curriculums
- Basics: Introductory and Intermediate course specialized to enhance knowledge required for Media designs
- Advanced courses for advancement in specialized and advanced knowledge
- "Real Projects", advanced research projects for practical society
- English language classes are available for internationalization

**Four Creative Forces of the School**

**Future of Graduates:**

**Media Innovators**, leaders with the global perspective that is required to lead the coming creative society

**WIDE**

### Lightpath to India

### Role of Universities.

**WIDE**