

Global Advanced R&D Networks

- Enabler for “globe is computer” -



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Who is the WIDE Project



- ✧ WIDE ; Widely Integrated Distributed Environment
- ✧ Since 1988
- ✧ Goal ;
 - Establish large-scale distributed computing environment
- ✧ Board members : 20
- ✧ WIDE Research Members;
 - 100+ companies, 40 universities
 - 300-400 active R&D researchers
- ✧ Active Working Groups; 20+
- ✧ IETF/ITU-T, ICANN/RIR, ISOC



Agenda/Conclusion

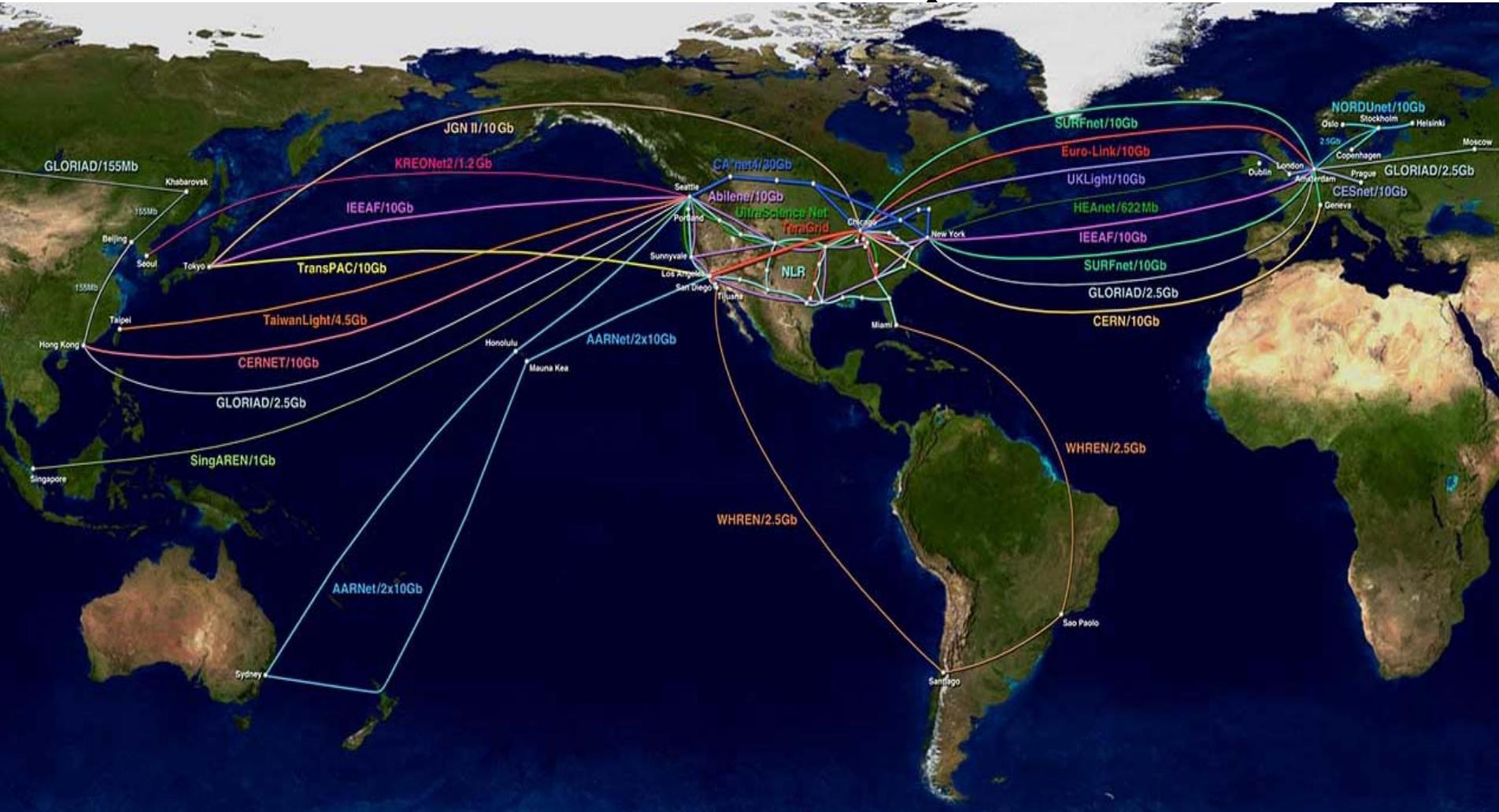
Global R&D network will enable ;

1. New architectural paradigm
 - Toward global scale distributed computing
2. Education and collaboration on the “globe”
 - Toward globally connected digital studio
3. Business deployment
 - Establishment of technologies for global operation

We realize that;

- Computing resources on the “globe” will be available with large bandwidth
- We should/can (?) start a new architectural paradigm, assuming that we will be able to use global computing resources

Global Lambda Integrated Facility GLIF World Map – 2005



IEEAF/GLIF in Asia

- Prof. Jun Murai of WIDE Project serves as Stewart of Asian area
- Integrating all the R&D and R&E Networks
- Key landing point candidates
 - China ; Beijing, Hong Kong, Shanghai
 - Korea ; Seoul, Pusang
 - Russia
 - Singapore
 - Thai ; Bangkok
 - India



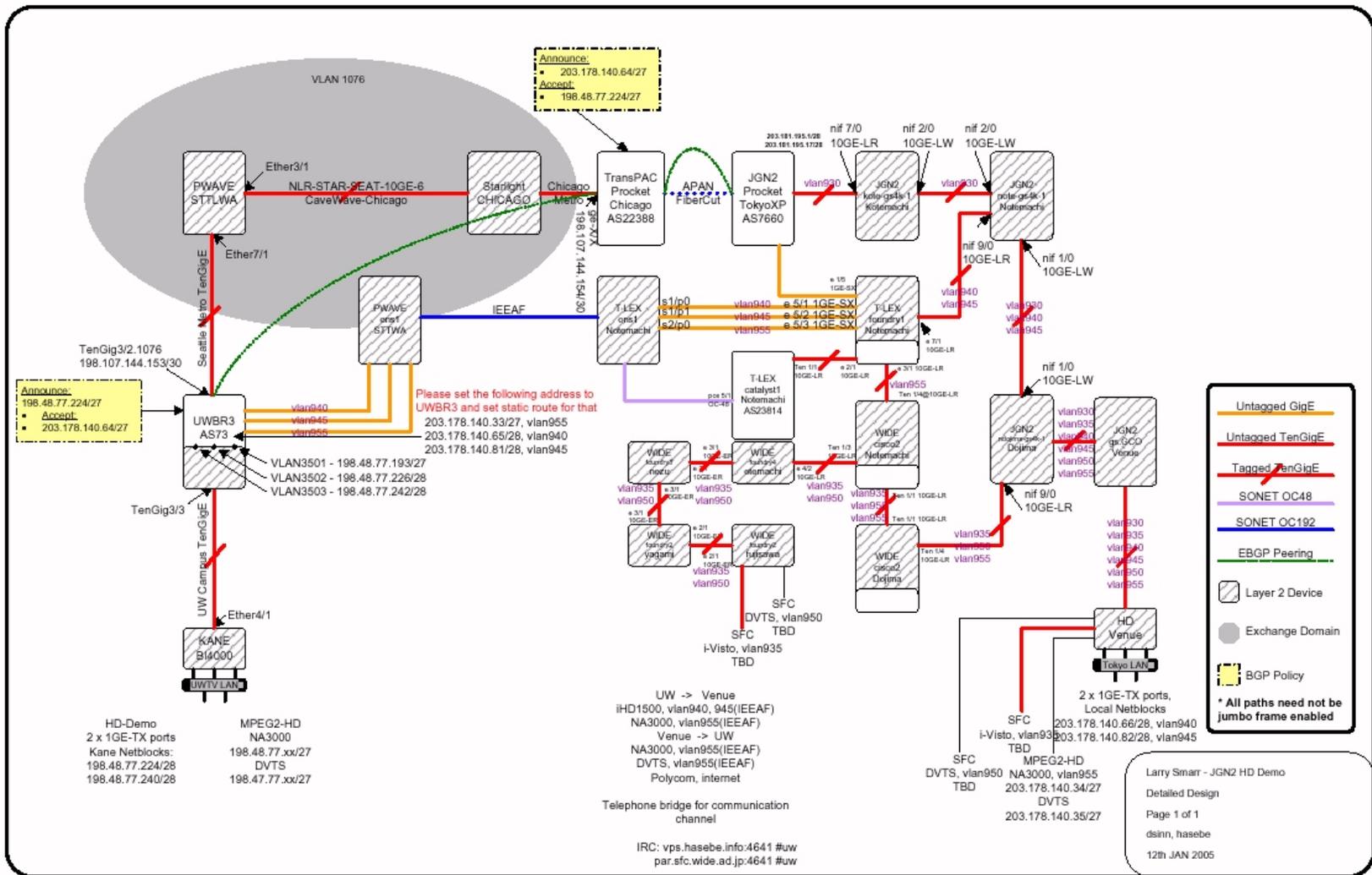
Recent Activities over Global Network

- Remote lectures with uncompressed HD (Jan.15, 2005)
- TSUNAMI Symposium (Feb.23, 2005)
- “Deep Impact” real-time multicasting (September 5, 2005)
- Remote lecture from SUBARU in Hawaii (Aug.04, 2005)
- Music collaboration between Amsterdam and Aichi at World Expo (Sept.21, 2005)
- 4K uncompressed HD real-time collaboration in 2006

JGN2 Symposium (Jan.17,18, 2005)

- Two of uncompressed HDTV
 - University of Washington (Seattle) = Osaka ; clear VLAN
 - Keio University (Tokyo) = Osaka ; Shared bandwidth
- Small latency is essential for Interactive Session
- Global collaboration and cooperation
 - JGN2, WIDE, GLIF, STARLIGHT, PacificWave, IEEAF, NLR, etc





- 10 GbE VLAN across Pacific Ocean
- Two redundant paths
 - Seattle = Chicago = Tokyo = Osaka
 - Seattle = Tokyo = Osaka

Understanding and Solving Real-world Problems at SOI Asia -Tsunami Disaster Recovery Project

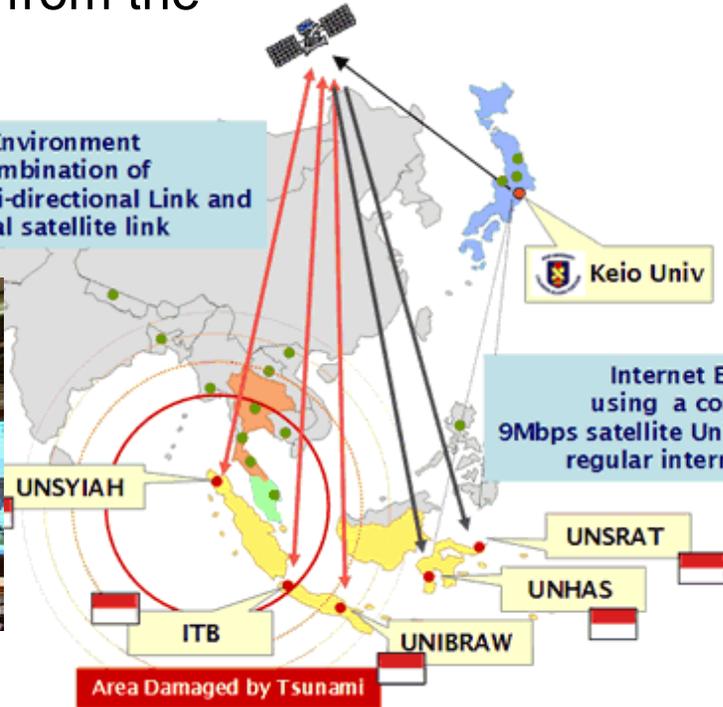
Keio University and SOI Asia assisted Universitas Syiah Kuala, the largest national university in Indonesia, by providing distance learning during its recovery from the tsunami.



Photos by Chermg Talay Subdistrict Administration Office



Internet Environment using a combination of 9Mbps satellite Uni-directional Link and bi-directional satellite link



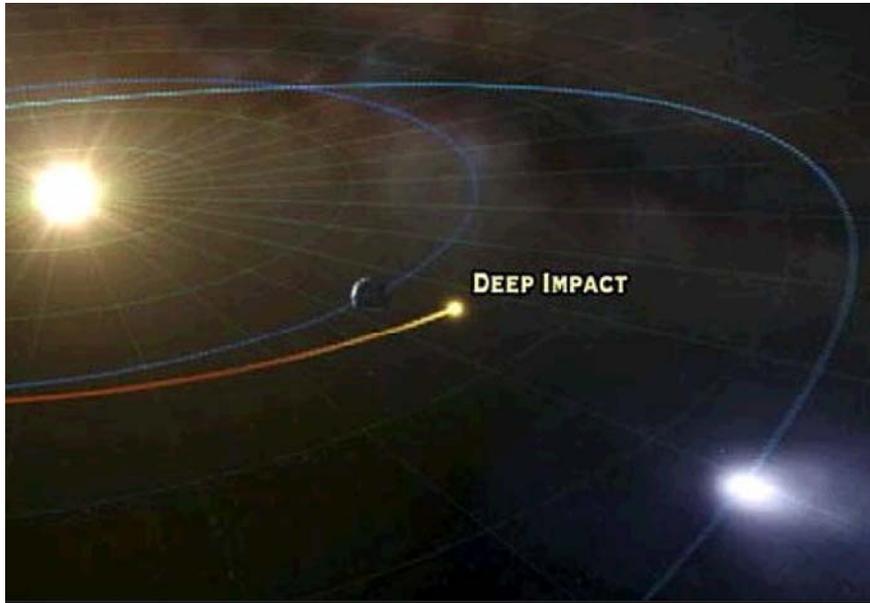
Internet Environment using a combination of 9Mbps satellite Uni-directional Link and regular internet connectivity



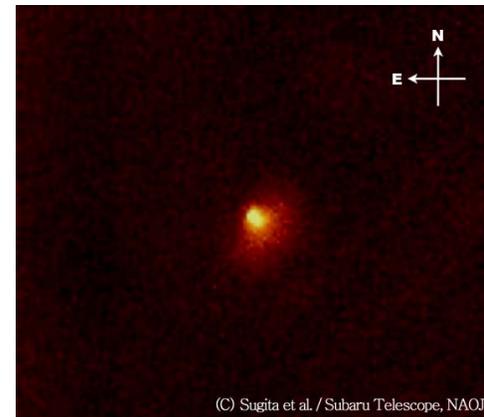
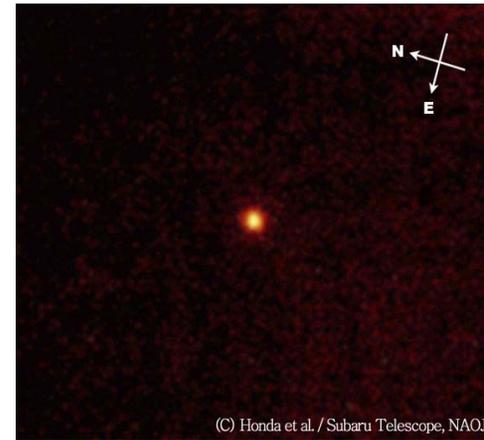
Tsunami Symposium on SOI Asia network

Deep Impact Project by NASA

- Live Image from Maunakea@Hawaii



Providing the contents for
commercial use (NHK)

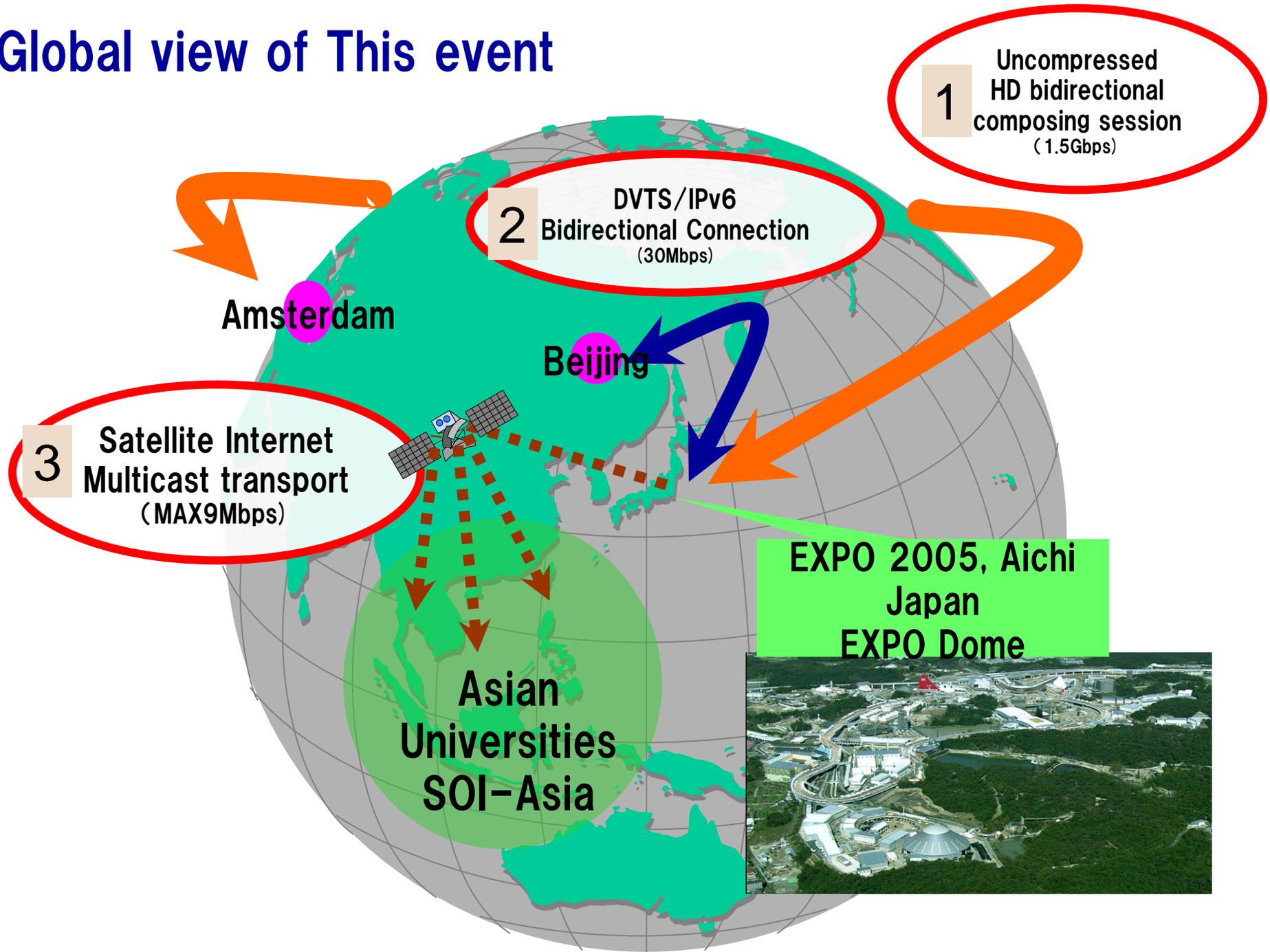


Live images from SUBARU
in Hawaii

**EXPO 2005 Aichi, Japan Message Event,
Closing Forum,
"Towards the Creation of a Sustainable Society"**

Event: Sept 21st, 2005

Global view of This event



Remote Live Music Session at 2005 World Exposition, Aichi, Japan

“Delayed Live Music Session between Aichi and Amsterdam”

Dual Direction Collaboration with Ultra Long Distance Internet HDTV

Aichi



Closing forum “EXPO 2005 International Forums”



AMSTERDAM INTERNET INFRASTRUCTURE WITH i-Visto

202.0.73.5 VT

File Edit Setup Control Window Help

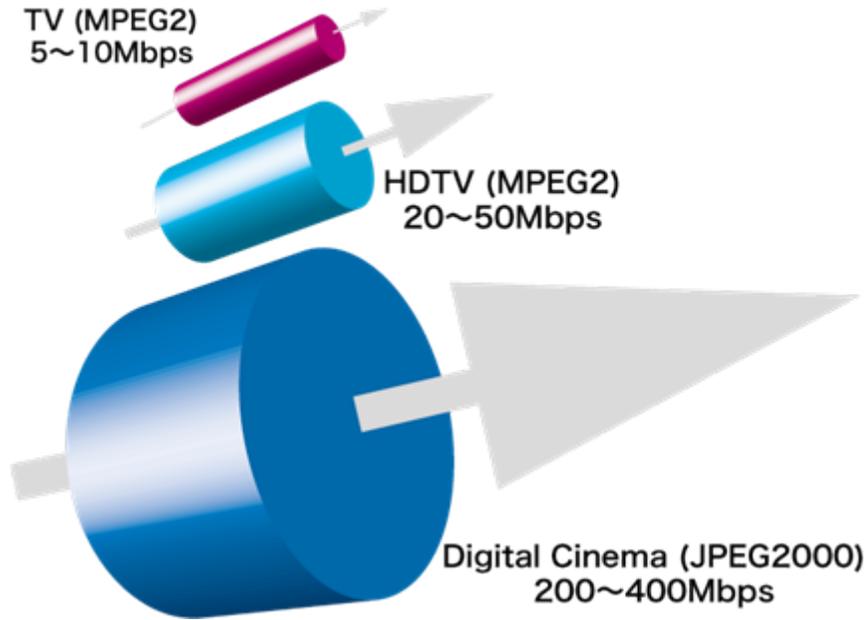
Load Average		/0	/1	/2	/3	/4	/5	/6	/7	/8	/9	/10
Interface	Traffic		Peak		Total							
	in	out	KB/s	KB/s	KB	KB						
lo0	in	out	0.000	0.000	0.711	0.711						
			KB/s	KB/s	KB	KB						
em3	in	out	0.062	3.954	10.688	10.037						
			KB/s	KB/s	MB	MB						
em2	in	out	95.503	95.534	3.338	1.858						
			MB/s	MB/s	GB	GB						
em0	in	out	95.434	96.365	1.945	3.173						
			MB/s	MB/s	GB	GB						

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File Edit Setup Control Window Help

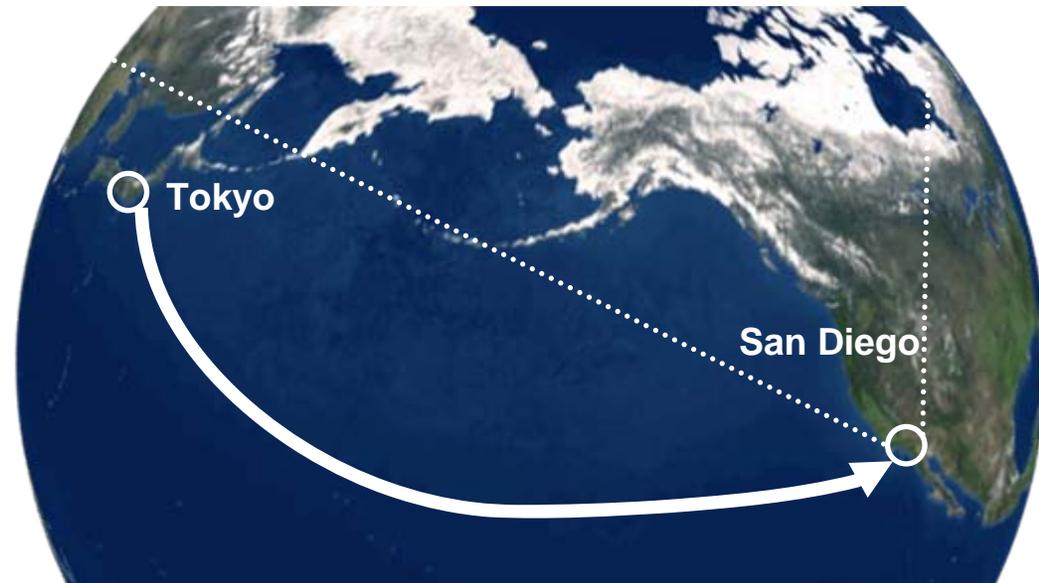
Load Average		/0	/1	/2	/3	/4	/5	/6	/7	/8	/9	/10
Interface	Traffic		Peak		Total							
	in	out	KB/s	KB/s	KB	KB						
lo0	in	out	0.000	0.000	0.711	0.711						
			KB/s	KB/s	KB	KB						
em3	in	out	0.138	1.140	11.019	10.021						
			KB/s	KB/s	MB	MB						
em2	in	out	95.481	95.550	3.407	2.263						
			MB/s	MB/s	GB	GB						
em0	in	out	95.486	95.540	3.772	3.242						
			MB/s	MB/s	GB	GB						

Real-time, Peer-to-Peer Communication Across Pacific Ocean



✓ 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

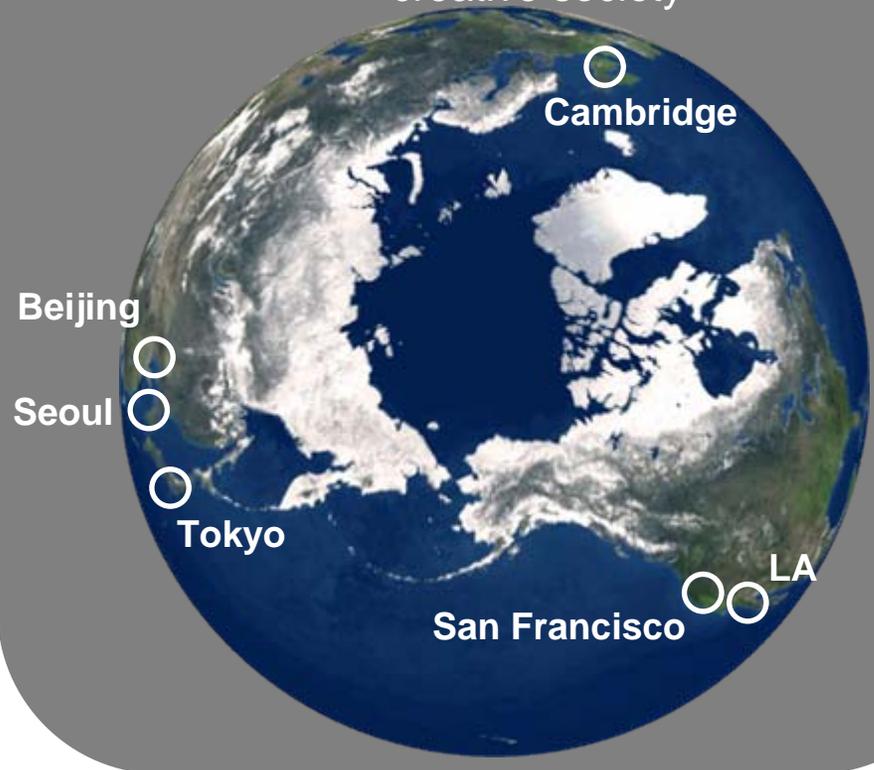


DMC Institute International Symposium: Convergence: Towards A New Paradigm for Creative Society



Intensive Discussion using the Global Studios

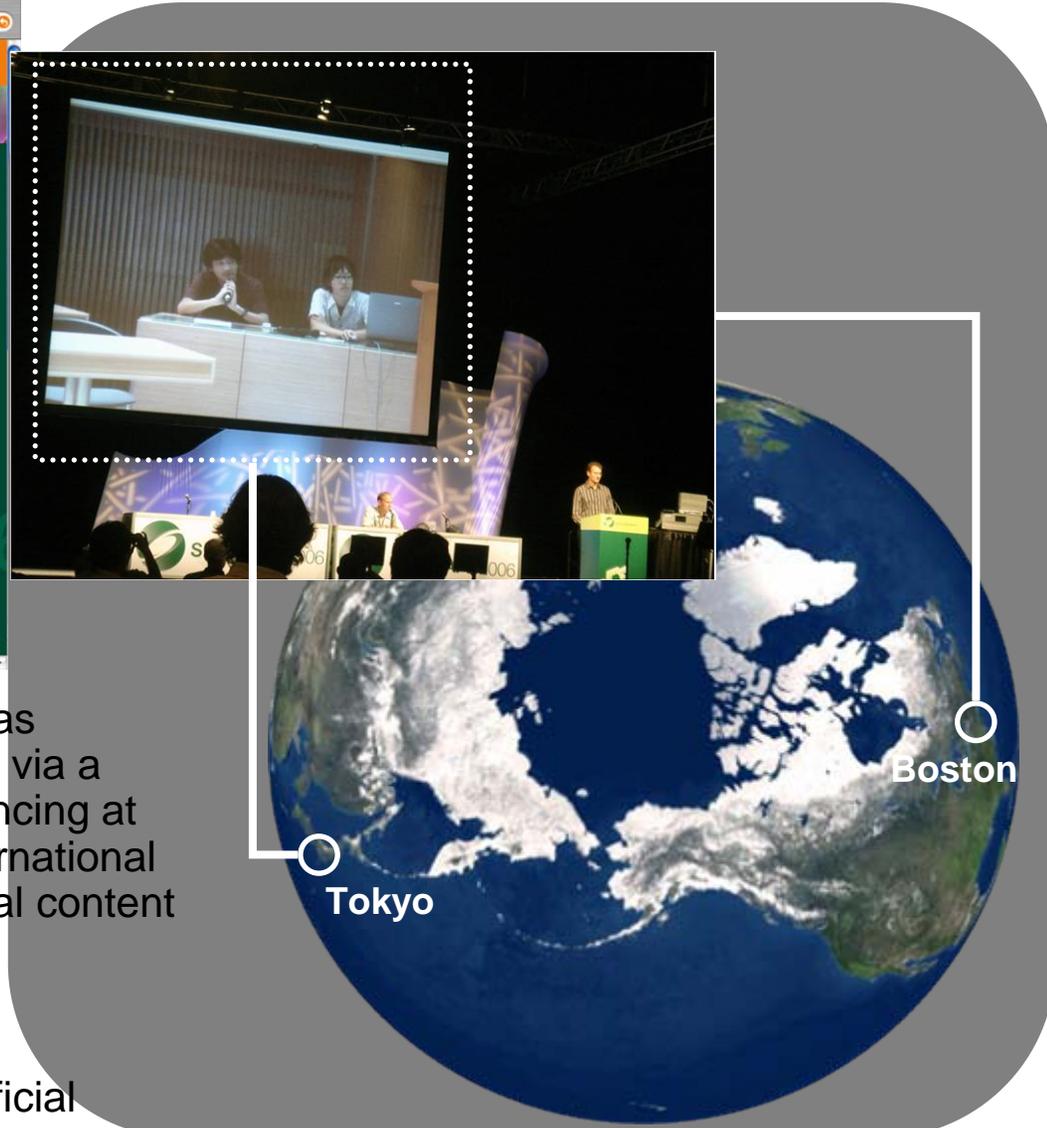
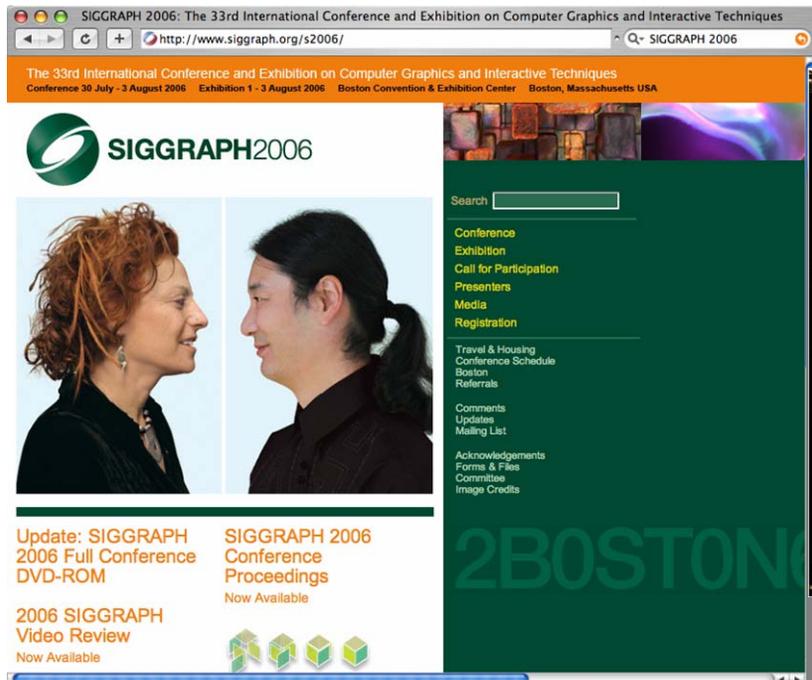
- Talking Circle 1: Content design
- Talking Circle 2: Media convergence in creative society
- Talking Circle 3: Distributed and autonomous creative society



✓ All operational Global Studio locations participated in our 5th international symposium

✓ The symposium concluded with all participants signing the DMC Manifesto towards the Creative Society (online)

Teleconferencing across Pacific and American Continent: at SIGGRAPH2006



✓ Using Global Studio technology, DMC has successfully connected Tokyo and Boston via a high-speed network to enable teleconferencing at SIGGRAPH2006, the most renowned international conference in the world in the field of digital content technology, for the first time in its history

✓ A trial in 2006, teleconferencing via this technology will be incorporated into the official program from next year

Asia and Europe

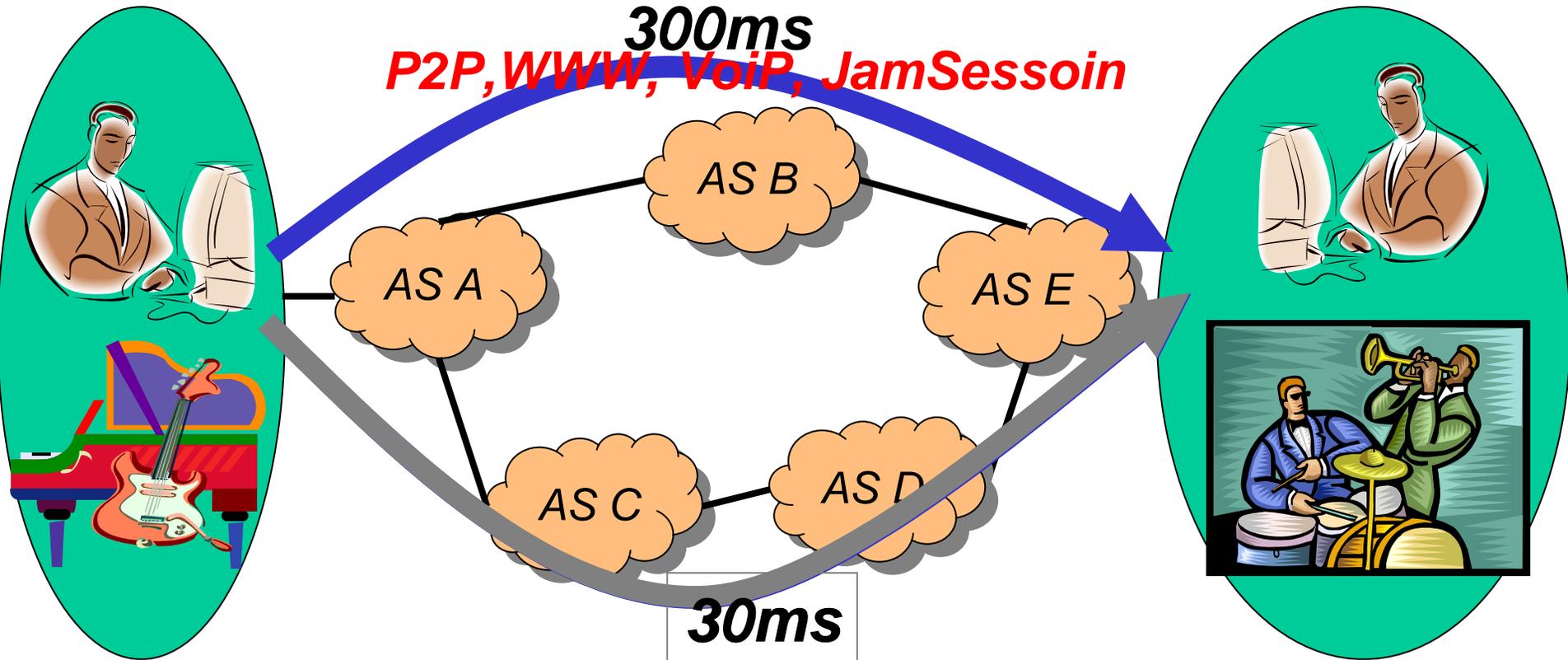
Difference between Straight route & Southern route



Current Routing System

- **Not-aware of Latency**
 - $A \rightarrow B \rightarrow E = 3 < A \rightarrow C \rightarrow D \rightarrow E = 4$
- We need some tunneling technologies, e.g., MPLS, IP-in-IP, with policy routing....

→ We need new(?) routing architecture or operational configuration ?

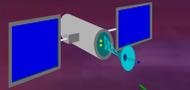


Lessons and challenges from VoIP/SIP activity

- Contribution and responsibility from R&D community to business deployment
 - Implementation
 - Operation
 - Governance (e.g., address)
- Essential technical challenge on Routing Architecture to come up with physical “globe”

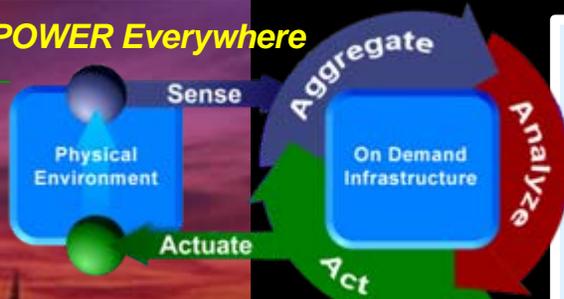
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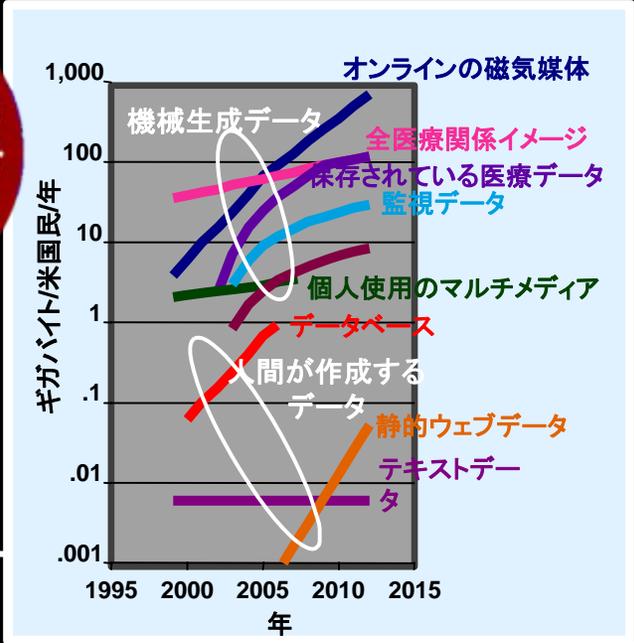
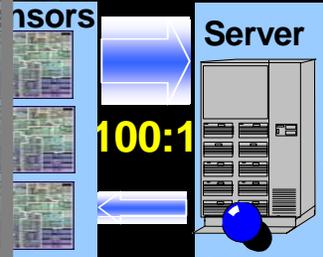
GPS

POWER Everywhere

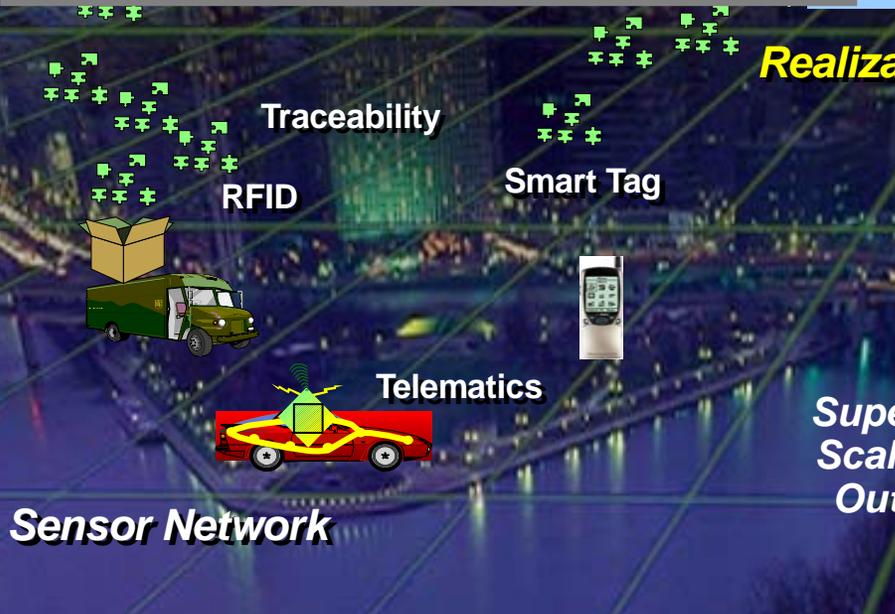


Change of Traffic Pattern
 10y ago : download
 2006 : symmetric
 10y : upload

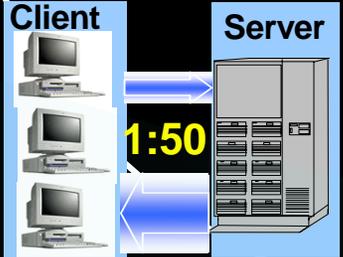
Sensor / Actuator Edge System



Realization



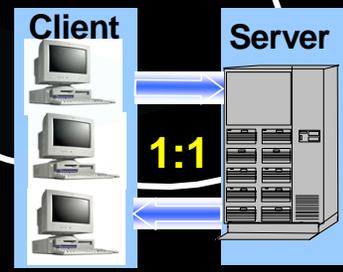
Web Server



Scale Out

Scale Up

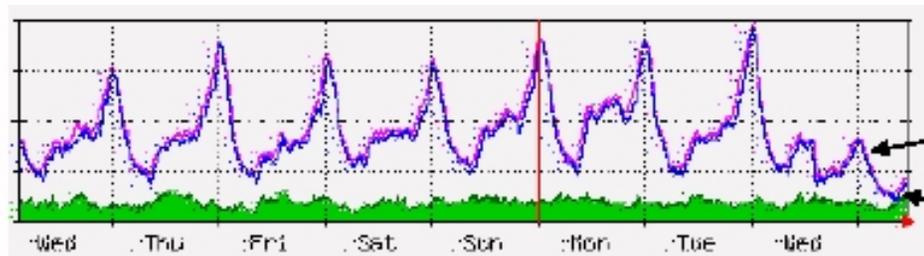
Traditional Transactions



Virtualization

あるISPにおけるトラフィック・パターンの変化

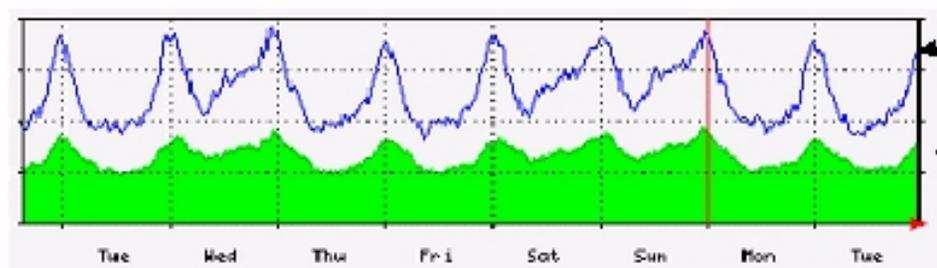
ダイヤルアップ
(2001年)



ISP網⇒エンドユーザ

エンドユーザ⇒ISP網

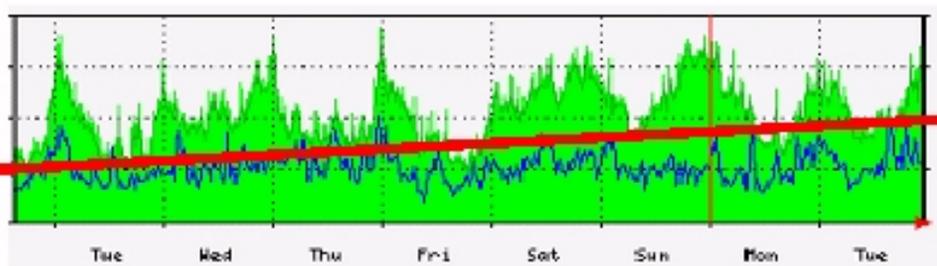
DSL
(2004年)



ISP網⇒エンドユーザ

エンドユーザ⇒ISP網

光ファイバ
(2004年)



エンドユーザ⇒ISP網

ISP網⇒エンドユーザ

上りトラフィックの底溜まり

Total IP Traffic in Japanese commercial ISPs

(1) A. 契約者(ユーザ)別のトラフィック

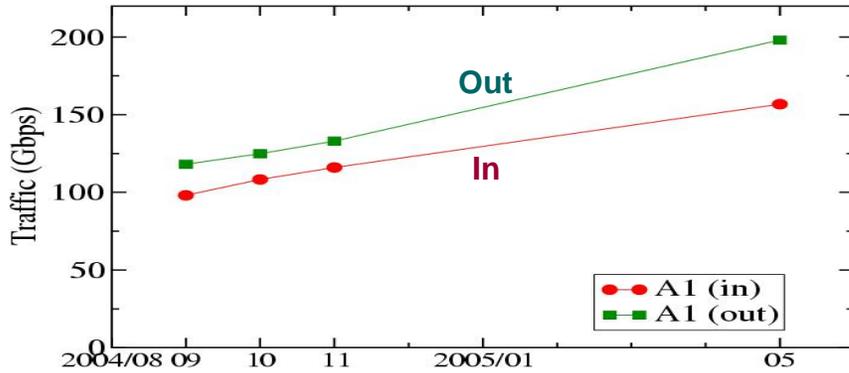


図1-1:[A1]ブロードバンド契約者(DSL, FTTH) <7社ベース>

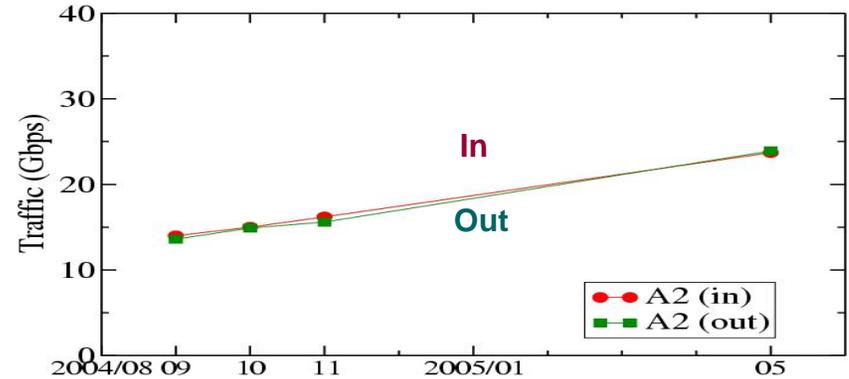


図1-2:[A2]その他の契約者(Dial up、専用線、Data Center) <4社ベース>

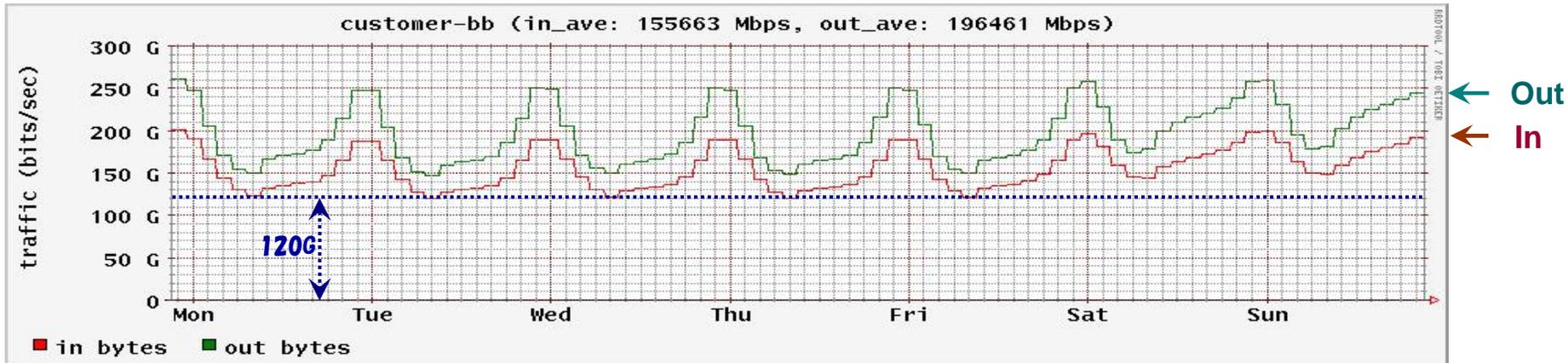


図1-3:[A1]ブロードバンド契約者 時間別(曜日) <平成17年5月>

Downloading vs. Uploading

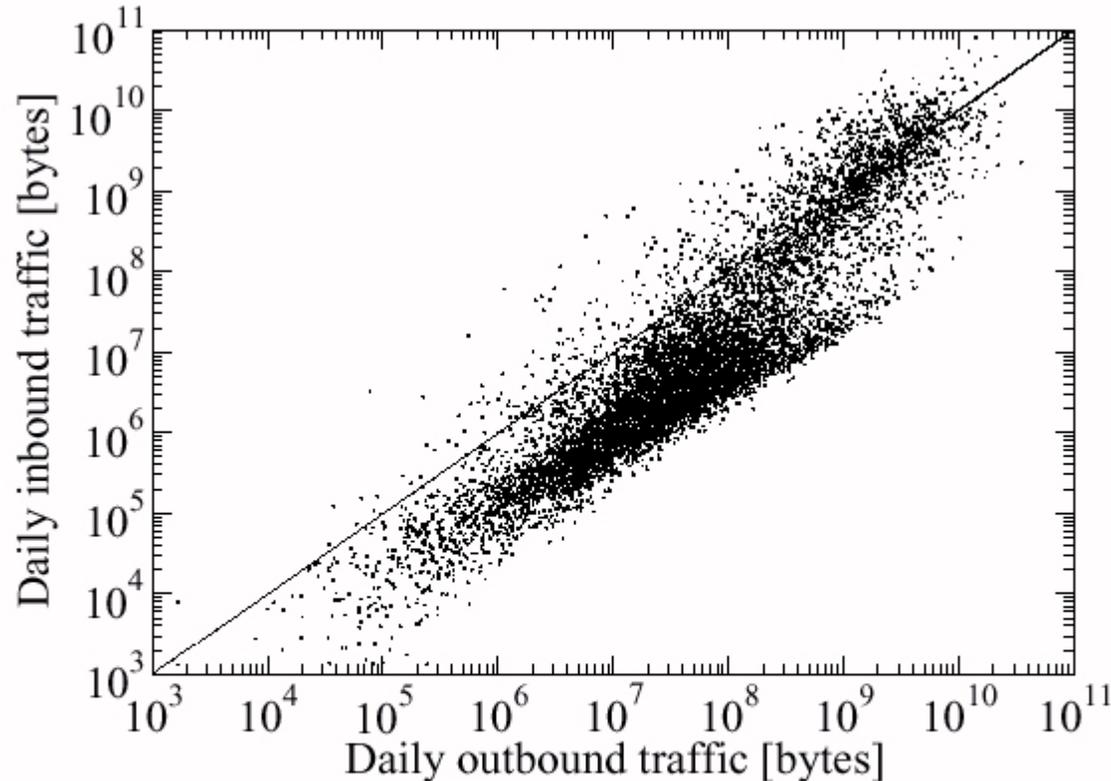


Figure 14: Correlation of inbound and outbound traffic volumes in one metropolitan prefecture

What we **shall** challenge ?

1. Real-space Internet
e.g., RFID, Live E!, Locky, InternetCAR
2. Unwired communication architecture
e.g., NEMO, MANET, WiMAX
3. Media Convergence
e.g., Multicasting, Peer-to-Peer, DVTS
4. Global computing architecture
e.g., middleware, SCTP/DDCP

→ Integration and sharing of technical components developed by each projects

Summary

- Responsibilities of “Global” R&D Network -

Global R&D network will enable ;

- New architectural paradigm (innovation)
 - Toward global scale distributed computing
- Education and collaboration on the “globe”
 - Toward globally connected digital studio
- Business deployment
 - Establishment of technologies for global operation