25 years of WIDE Project

Jun Murai
Founder of WIDE Project
History of the Internet

- 1969
- 1982
- 1990
- 1993
- 1995
- 1997
- 2000
- 2001
- 2005
- 2011
- 2012
History of the Internet

• 1969 ARPAnet and UNIX were born
• 1982 4.2BSD (source code TCP/IP deployed)
• 1990 WWW started
• 1993 ISP commercial service launched
• 1995 Windows ’95, 1.17 (Hanshin Awaji Earthquake)
• 1997 Rakuten Ichiba launched
• 2000 Y2K
• 2001 9.11
• 2005 Internet Neutrality
• 2011 3.11
• 2012 Accessing right to the Internet is ‘Human Right’
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Trust People
133ms
Overcome difficulties
challenge
Platform
size science
respect individual, view the world

International vs
Global
With Nature
For Nature
Against Nature
PING200ms

Damn!
#include <stdio.h>

int main(void)
{
    char s[]="Hello World!¥n";
    printf ("%s",s);
    return 0;
}
#include <stdio.h>

int main(void)
{
  char s[]="Hello World!¥n";
  printf ("%s",s);
  return 0;
}

char ?
char ≠ 7 bits

# of characters > 26
Celebrating 25 Years

.JP

1986-2011

Presented in October 2011 to Japan Registry Services Co., Ltd. by

Rod Beckstrom
CEO and President
Internet Corporation for Assigned Names and Numbers

Steve Crocker
Chair, Board of Directors
Internet Corporation for Assigned Names and Numbers
Pre WIDE

- **JUNET**
  - UUCP Based
  - E-Mail
    - Domain Based Routing
    - jun@titcca.titech.junet
  - Kanji Characters
    - for X window system
    - Free Kanji Font: k14
    - Input Method
    - Tools

Most Popular UUCP Modem for JUNET
Telebit TrailBlazer T2500

k14 kanji font and
kterm (Terminal Emulator with Kanji Characters)
Researches in network development of JUNET

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Proceedings of the ACM workshop on Frontiers in computer communications technology ACM New York, NY, USA ©1988
Dr. Jun Murai  
University of Tokyo

In light of our discussion this afternoon, on behalf of NSF it is a pleasure to grant Internet access to the Japanese IP community.

Sincerely,

Stephen S. Wolff  
Division Director
2002/1/25: WIDE Workshop at Stanford University
The first overseas WIDE Workshop at Stanford University with the cooperation of Cisco Systems Inc.

July 14-19 2002: 54th IETF Meeting, Yokohama
Hosted IETF meeting in Asia for the first time.

September 25 2002: WIDE Project Sponsor Meeting held at the Nihon Kaiun Club
Conferences are held twice a year to report the results of joint research to sponsors of the WIDE Project.

December 18-19 2002: Global IPv6 Summit in Japan
We actively invite international summits.

WIDE: 25Years of History

September 18 2003: The 15th anniversary of the WIDE Project at Akasaka Prince Hotel
Had a party to express our appreciation to our sponsors for supporting 15 years, with approximately 350 attendees.

March 3-6 2003: WIDE Spring Camp 2003;
Nagahama Royal Hotel (Shiga Pref.)
We hold intensive 4-day camp twice a year.

June 30-July 02 2004: NETWORLD+INTEROP 2004 TOKYO
held at Makuhari Messe
Providing technical support since the 1st exhibition in 1994.

June 1992:
Hosted INET'92 (Kobe)

2005
Aichi World Expo.
History of the WIDE
Before the WIDE

1981 N1 Started

1982 Network installed at Keio University Yagami campus

1984
- JUNET started
- First connection between Tokyo Institute of Technology and Keio University (300 bps)
- Tokyo Institute of Technology, Keio University and University of Tokyo are connected (1200 bps)

1985 Research Group started (Predecessor of WIDE Project)

1986
- Email with Japanese characters at JUNET
- Connected to CSNet (US), the first international connection for JUNET

1987 University of Tokyo and Tokyo Institute of Technology are connected
History of the WIDE Project (1)

1988 WIDE project started (August)
1989
- NSFnet and Univ.Tokyo connected by cooperation of NACSIS (9.6kbps)
- WIDE connected to US by dedicated line via Hawaii (64kbps)
- WNOC-Tokyo started (Iwanami-shoten, Publishers)
- WNOC-Kyoto started (ASTERM)
1990
- WNOC-Osaka started (Senri International Information Institute)
- WNOC-SFC started (Keio Shonan Fujisawa Campus)
- WNOC-Fukuoka started (System Soft Corporations)
1991
- WNOC-Sendai started (AIC)
- Increased bandwidth between SFC and Univ of Hawaii (192kbps)
- Network introduced to WIDE camp (64kbps)
1992
- INET92 at Kobe
- WNOC-Hiroshima started (Hiroshima University)
History of the WIDE Project (2)

1993
- Connected to IIJ
- WNOC-Nara started (NAIST)
- WNOC-Sapporo started (Sapporo Electronic Center)
- Change international connection from Univ of Hawaii to NASA (FIX-W)

1994
- WNOC-Hamamatsu started (Shizuoka University)
- WNOC-Hachioji started (Tokyo University of Technology)
- VSAT introduced to WIDE camp (2Mbps Satellite link)
- WNOC-SFO started (Hayward, San Francisco)
- Increased international bandwidth (1.5Mbps)
- NSPIXP-1 started

1995
- WNOC-Gifu started (Softopia Japan Corp.)
- WNOC-Komatsu started (JAIST)
- Ryuichi Sakamoto internet concert
1996
- Internet 1996 WORLD EXPOSITION
- The first Internet disaster drill (IAA)
- IPv6 operation started between Tokyo and Osaka
- Collaborate to operate Atlanta Olympic Website
- NSPIXP-2 started
- Mobile computing joint test with Stanford University started

1997
- The second Internet disaster drill
- M Root DNS Server operation started
- SOI (School on the Internet) project started
- NSPIXP-3 started

1998
- The third Internet disaster drill
- Collaborate to operate Nagano Olympic/Paralympic game
- KAME project and TAHI project started
- WIDE project 10th Anniversary symposium
History of the WIDE Project (4)

1999
- The fourth Internet disaster drill
- WNOC-SFO closed
- WNOC-LA started (Los Angels)
- NSPIXP-6 operation started
- First IPv6 address assignment by APNIC
- C-band parabola antenna (7.6 meter at SFC and NAIST)
- Technical support to “LIFE Ryuichi Sakamoto Opera 1999”
- Hosted IETF IPng WG Interim meeting
- Distant learning using DV over IPv6 started at Keio University, Univ of Wisconsin and NAIST

2000
- INET2000 (Yokohama)
WIDEmembers

現在866名
WIDEcamp

一般
学生
(うち外国人)
WIDE organizations

- Operation Support
- Universities
- Live-E!
- Unwired Consortium
- AI3/SOI Asia
- NSPIXP sponsors
- WIDE sponsors
DV/IP in the sakamoto opera LIFE

- A collaboration of music at Tokyo and dancers at NYC and FRA
- World’s first application of DV/IP in a commercial event

Frankfurt

Comet

BW: 45Mbps/FDX
RTT: 320ms
Jitter: 10ms
Packet drop: 0.08%
Frame error: 63%

Tokyo

Comet

Comet

Comet

New York

BW: 45Mbps/FDX
RTT: 172ms
Jitter: 4ms
Packet drop: 0.06%
Frame error: 5%
What JB Achieved Now (2)

- **NSPIXP6 (IX for IPv6 in Japan)**
  - Operation from Middle of September 1999
  - IIJ, NTT-C, DTI, WIDE

- **s-TLA Transition from p-TLA (on-going)**

- **Routing Protocol**
  - Multicast: PIM-SM & PIM-DM
  - Unicast: OPSF for IPv6

- **QoS/CoS Control**
  - Diff-Serv Integration with ALTQ(Sony-CSL)
  - BB(Bandwidth Broker) with COPS

  Osaka Univ., Keio Univ., Fujitsu/UCLA, Hitachi, Toshiba,

- **Label Switch (MPLS)**
  - Integrate IPv6, PIM, Diff-Serve and BB
WIDE Workshop on Nov.27, 1999 at KUSA
EQ: Information Delivery of Earthquake related Information

- File Check
- Naming
- Version Control

eq.wide.ad.jp

File Repository

a) cvs server
b) dropbox

eq.sakura.ne.jp

SAKURA CLOUD TEAM

eq.yahoo.co.jp

YAHOO

widerc.org

cvs server

dropbox

MINISTRY OF EDUCATION, CULTURE, SPORTS, SCIENCE AND TECHNOLOGY-JAPAN
Satellite Patch

SSID: The-Internet

WiFi Access Point (PoE)
What is Probe Vehicle Systems?

- **Probe Vehicle Systems**
  - Collects drivers’ behavior and electronics signals which is normally used for vehicle control.

- The characteristic of Probe Information Systems is the two-way communication between centers and vehicles.

- Vehicles not only gains the information from centers but also provides the information from their own sensors.
移動体からの情報収集
– 1台の自動車に120台程度のコンピュータが搭載されている

安全・安心プローブ
– ABSを使った低摩擦係数道路検知

プローブ情報システムの課題
– これまで、閉システムで運用されてきたため、車両によってデータ表現が異なる

環境・エネルギープローブ

環境負荷・大
加速度：小
エンジン負荷：大

環境負荷・小
加速度：大
エンジン負荷：小

安全・安心プローブ

環境負荷・大
加速度：小
エンジン負荷：大

環境負荷・小
加速度：大
エンジン負荷：小

エネルギー社会においてはデータ表現の標準化は必須。慶應義塾では世界標準として手法を提案中で、ISO/TC204/WG16で議論を重ねている。
Traffic Info.
Bargain Info.
Marketing Research
Accident Info.
Info. Exchange with other automobiles
Location of friends
Send a picture
Music
Private Info. exchange
Mobile Office

Internet Connectivity (ISP)

Cellular phone

Providing a software by software houses or Sunday programmer (ASP)

Sending information by contract or other incentive (Probe Information System)

Providing contents by contents provider or private persons (IP)

WIDE Project
InternetCAR
In-vehicle system:
A PC connecting to Internet collecting A/D/P information including GPS/positioning device
The TAXI tracking: Early morning to Midnight
Taxi:
Post processing of the archived data
Google Crisis Response 自動車・通行実績情報マップ

下記マップ中に青色で表示されている道路は、前日の0時～24時の間に通行実績のあった道路を、灰色は同期間に通行実績のなかった道路を表示しています。
(データ提供：日本技術工業株式会社)

Search by address

GoogleによるWebサイト
http://www.google.com/intl/ja/crisisresponse/japanquake2011_traffic.html
INTERNATIONALIZATION
ASIA SATELLITE
p2p(AIT) p2p(ITB) UDL

UDL Return

UDL

UDL from SFC

UDL p2p(5partners)
(from SFC)

UDL p2p

JCSAT-1B/Ku

JCSAT-3/C

Ku band
Receive Only Station

Internet

p2p

c band
Receive Only Station
A diagram showing a network setup involving RIM stations, HUB stations, and multicast traffic.

- RIM station-1 and RIM station-n.
- HUB station.
- Multicast hosts and Receivers.
- Unicast Router (R).
- Multicast Router (MR).
- IPv4 multicast traffic.
- UDLR tunnel.
- Point-to-Point Satellite Link.
- UDL satellite Link.

The diagram illustrates the flow of multicast traffic from the HUB station through the RIM stations, involving both unicast and multicast routing mechanisms.
Site Setup Status

Thailand

Myanmar

Laos
New AI3 C-Band Frequency Allocation

- When more than 3 197KG7W carriers are transmitted from SFC, the SFC license need to be changed.
• Indonesia
  – Brawijaya University
  – Sam Ratulangi University
  – Hsanuddin University
  – Institut Teknologi bandung
  – Univesitas Syiah Kuala(*)

• Thailand
  – Chulalongkorn University
  – Asia Institute of Technology
  – Chulachomklao Royal Military Academy
  – Pricen of Songkla University

• Laos
  – National University of Laos

• Myanmar
  – University of Computer Studies, Yangon

• Malaysia
  – Asian Youth Fellowship
  – University Science Malaysia

• Vietnam
  – Institute of Information Technology

• Philippines
  – Advanced Science and Technology Institute
  – University San Carlos

• Mongolia
  – Mongolian University of Science and Technology

• Cambodia
  – Institute of Technology of Cambodia

• Bangladesh
  – Bangladesh University of Engineering

• Nepal
  – Tribhuvan University

AIII Sol Partners
24 partners in 11 countries connected with IPv6
GLOBAL...
DNS Root Servers
Designation, Responsibility, and Locations

- E-NASA Moffet Field CA
- F-ISc Woodside CA
- M-WIDE Keio
- A-NSF-NSI Herndon VA
- C-PSI Herndon VA
- D-UMD College Pk MD
- G-DISA-Boeing Vienna VA
- H-USArmy Aberdeen MD
- L-DISA-USC Marina del Rey CA
- J-NSF-NSI Herndon VA

I-NORDU Stockholm
K-LINX/RIPE London
Root nameservers
- Status check map -

<table>
<thead>
<tr>
<th>Server</th>
<th>Operator</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Network Solutions, Inc</td>
<td>confirmed</td>
</tr>
<tr>
<td>B</td>
<td>USC/ISI</td>
<td>confirmed</td>
</tr>
<tr>
<td>C</td>
<td>PSInet</td>
<td>confirmed</td>
</tr>
<tr>
<td>D</td>
<td>UMD</td>
<td>confirmed</td>
</tr>
<tr>
<td>E</td>
<td>NASA</td>
<td>confirmed</td>
</tr>
<tr>
<td>F</td>
<td>ISC</td>
<td>confirmed</td>
</tr>
<tr>
<td>G</td>
<td>DISA</td>
<td>confirmed</td>
</tr>
<tr>
<td>H</td>
<td>ARL</td>
<td>confirmed</td>
</tr>
<tr>
<td>I</td>
<td>NORDUnet</td>
<td>confirmed</td>
</tr>
<tr>
<td>J</td>
<td>(TBD)</td>
<td>confirmed</td>
</tr>
<tr>
<td>K</td>
<td>RIPE</td>
<td>confirmed</td>
</tr>
<tr>
<td>L</td>
<td>ICANN/IANA</td>
<td>confirmed</td>
</tr>
<tr>
<td>M</td>
<td>WIDE</td>
<td>confirmed</td>
</tr>
</tbody>
</table>
Submarine cable after 3.11

- PC1, Japan-US, CHINA-US cable was broken at more than 10 point.
- But Internet was still working.
Locations of Earthquakes

世界の震源分布 (1977-2007)

http://outreach.eri.u-tokyo.ac.jp/education/material/
Lambda from Above
Internet is for Computers
Internet is for Everyone
Internet is for Everything
Internet 2013 (and beyond...)

• Evidence Based Society
  – With Bigdata and Cloud computing
  – Eternal preservation

• Video Traffic
  – Huge amount of data
  – Services, DRM and legal acts

• 20 billion to 70 billion users
  – Global, local, social, mobile
Dennis Ritchie

1941-2011

Father of C and UNIX

From dm Thu Apr 7 02:01 EDT 1981 resume from research:

Don't lose interest in the *very* terminal stuff, no matter what momentary problems you have with the device or the system. I think the approach and the progress so far are very exciting.

There's that line from Newton about standing on the shoulders of giants. We're all standing on Newton's shoulders.

-Kernighan
2011 Jonathan B. Postel Service Award

Jonathan B. Postel, 1943-1998
The Itojun Service Award 2011
The future of the Internet is...
The future of the Internet is yours to create!