

The IPv6 Testbed and Projects in Taiwan

Han-Chieh Chao

Professor, Department of Electrical Engineering
National Dong Hwa University

Deputy Director, R&D Division
IPv6 Steering Committee

National Information & Communications Initiation

hcc@mail.ndhu.edu.tw

WHY IPv6

- ◆ Predicted that the IPv4 addresses will totally be exhausted around 2005-2015
- ◆ Support of mobility, security, and multimedia QoS



Differences between IPv4 and IPv6

Feature	IPv4	IPv6
Source and destination address	32 bits	128 bits
IPSec	Optional	required
Payload identification for QoS in the header	No identification	Using Flow label field
Fragmentation	Both router and the sending hosts	Only supported at the sending hosts
Checksum of header	included	Not included
Resolve address to a link layer address	broadcast ARP request	Multicast Neighbor Solicitation message



Differences between IPv4 and IPv6

Feature	IPv4	IPv6
Determine the address of the best default gateway	ICMP Router Discovery(optional)	ICMPv6 Router Solicitation and Router Advertisement(required)
Send traffic to all nodes on a subnet	Broadcast	Link-local scope all-nodes multicast address
Payload identification for QoS in the header	No identification	Using Flow label field
Configure address	Manually or DHCP	autoconfiguration
Map hosts name to addresses	A	AAAA
Manage local subnet group membership	(IGMP)	Multicast Listener Discovery (MLD)



The background is a light blue grid. There are decorative blue lines: a vertical line on the left, a horizontal line near the top, and another horizontal line near the bottom. There are also blue corner ornaments: a quarter-circle at the top-left, and a semi-circle at the bottom-right.

IPv6 Steering Committee in Taiwan

IPv6 Steering Committee

◆ NICI's policy:

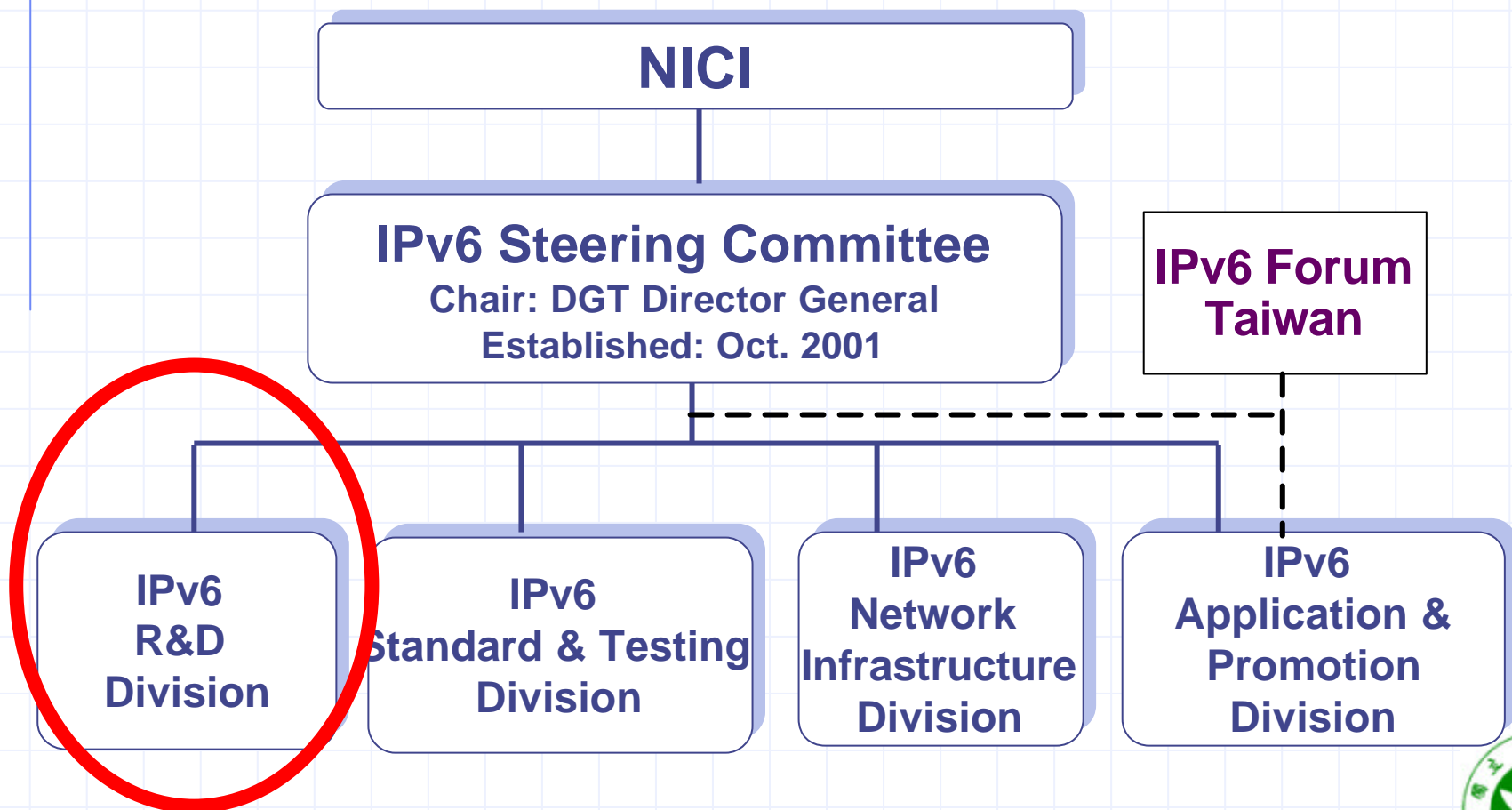
- Including IPv6 in the eTaiwan Deployment Plan
- Establishing IPv6 Steering Committee to integrate Taiwan's IPv6 resources and efforts

◆ Established in October 2001



IPv6 Steering Committee (Cont.)

- Organization Chart



R&D Division

- ◆ Chair: Dr. N. F. Huang (nfhuang@cs.nthu.edu.tw)
- ◆ Co-Chairs: Dr. Y. C. Chen (ycchen@csie.nctu.edu.tw) & Dr. H. C. Chao (hcc@mail.ndhu.edu.tw)
- ◆ Executive Secretary: Mr. R. C. Wang (rcwang@mail.ndhu.edu.tw)
- ◆ Objectives
 - Interoperability Technologies Development between IPv4 & IPv6
 - OSPFv6, Mobile IPv6, IPv6 Multicast, IPv6 state configuration
 - IPv6 Security
 - IPv6 QoS
 - IPv6 Multicast
 - Information Appliances and Home Networks
 - Video & Voice over IPv6 (VVoIP)
 - Killer applications?



R&D Division

◆ Projects

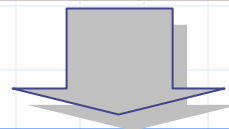
- **6TANET – IPv6 TrAnsition Network Environment of Taiwan**
- **6TIME – IPv6 TransItion for Mobile Environment**
- **6GIANT – IPv6 Gallop Internet AppliaNce of Taiwan**
- **6NDHU – IPv6 National Dong Hwa University**
- **6REAL – IPv6 REady Application Lab** (proposed to IST IPv6 Cluster)



Milestones

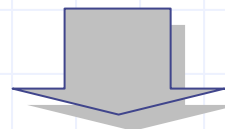
Phase I
(- 2002)

IPv6 Steering Committee
IPv6 Forum Taiwan



Phase II
(2002 - 2006)

IPv6 transition technology development
Native IPv6 network environment deployment



Phase III
(2007 -)

Nationwide pure IPv6 network completed
IPv6 to replace IPv4



IPv6 Forum Taiwan

- ◆ A membership organization
- ◆ To improve market and user awareness of IPv6
- ◆ Organized by two nonprofit organizations
 - **ITRI** (Industrial Technology Research Inst.)
 - **TWNIC** (Taiwan Network Information Center)
- ◆ A counterpart of global IPv6 Forum
- ◆ The window of Taiwan IPv6 activities



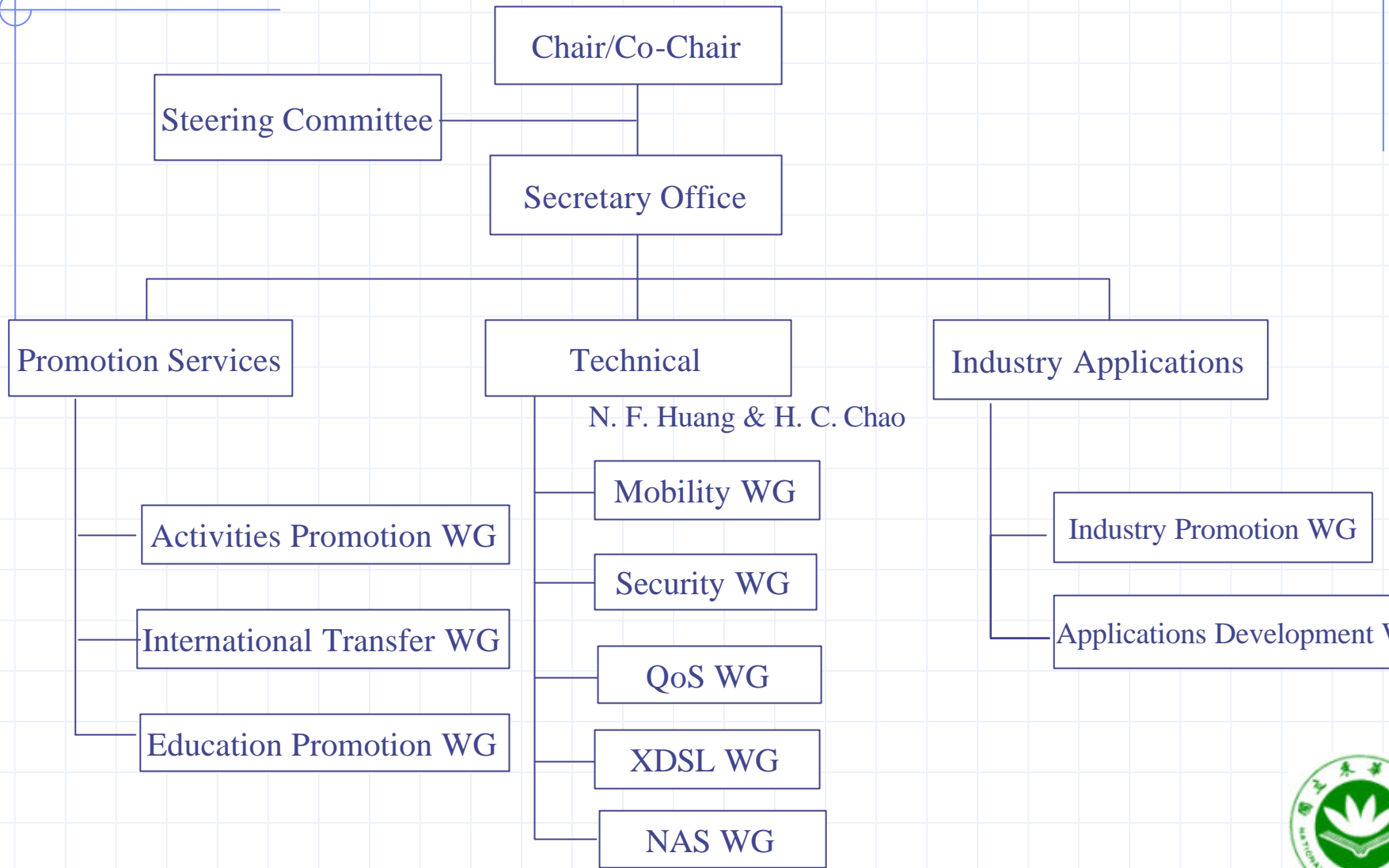
IPv6 Forum Taiwan (Cont.)

IPv6 Forum Taiwan Opening Plenary & Seminars

- ◆ April. 11, 2002
- ◆ Over 300 attendees in 3 days
- ◆ Research Partnership agreement signed in front of the audience by a dozen vendors in support of IPv6

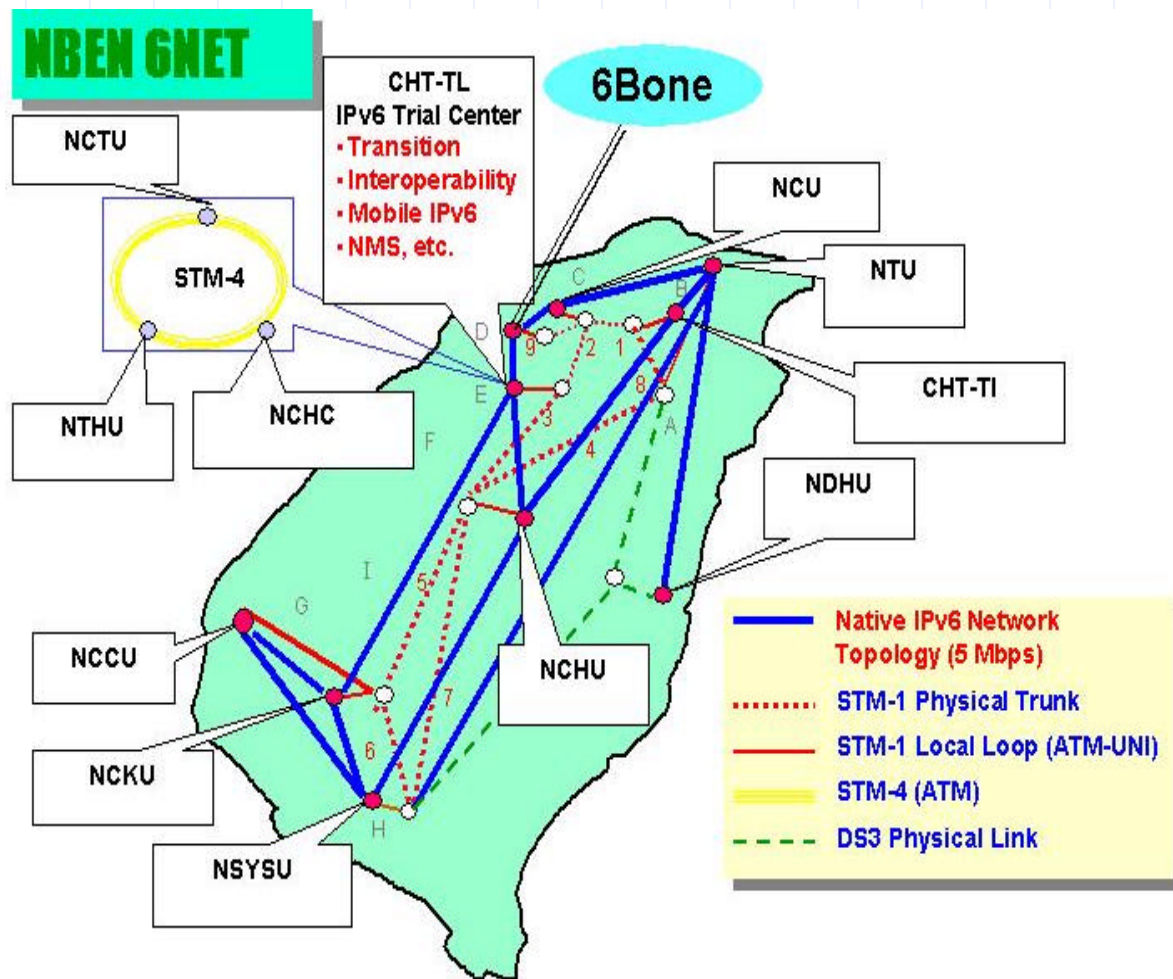


IPv6 Forum Taiwan Organization



IPv6 Testbed in Taiwan

The NBEN Topology



Eleven academic research institutes

- ◆ National Taiwan University (NTU)
- ◆ National Central University (NCU)
- ◆ Chunghwa Telecommunication Laboratories (CHTTL)
- ◆ National Center for High-performance Computing (NCHC)
- ◆ National Tsing Hua University (NTHU)
- ◆ National Chiao Tung University (NCTU)
- ◆ National Chung Hsing University (NCHU)
- ◆ National Chung Cheng University (CCU)
- ◆ National Dong Hwa University (NDHU)
- ◆ National Cheng Kung University (NCKU)
- ◆ National Sun Yat-Sen University (NSYSU).



IPv6 tunnels

IPv6 tunnels between

◆ NDHU

◆ NTHU

◆ CCU

◆ CHTTL

◆ NCHC



IPv6 projects in Taiwan

Network-processor

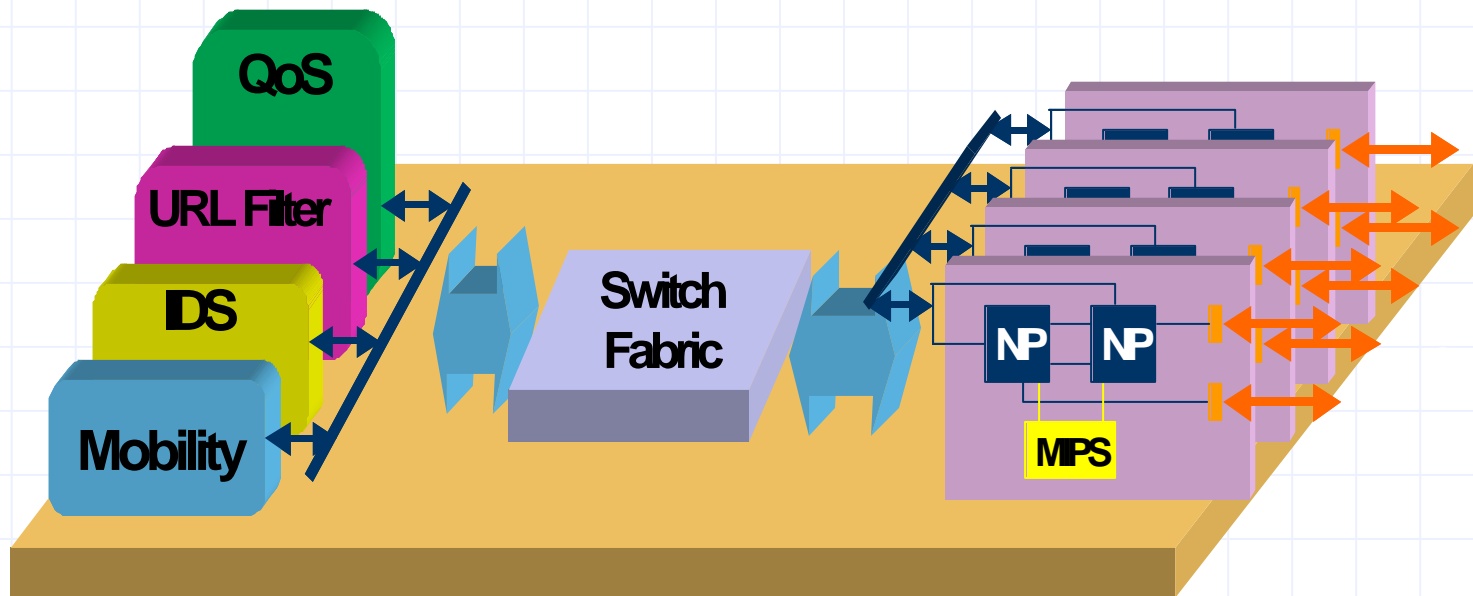
- ◆ IPv6 based gigabit switches

- ◆ a chassis-based system will be constructed to support ipv6 applications on multi-gigabit network environments



Chassis-based system

- ◆ one switching fabric module
- ◆ eight hardware modules



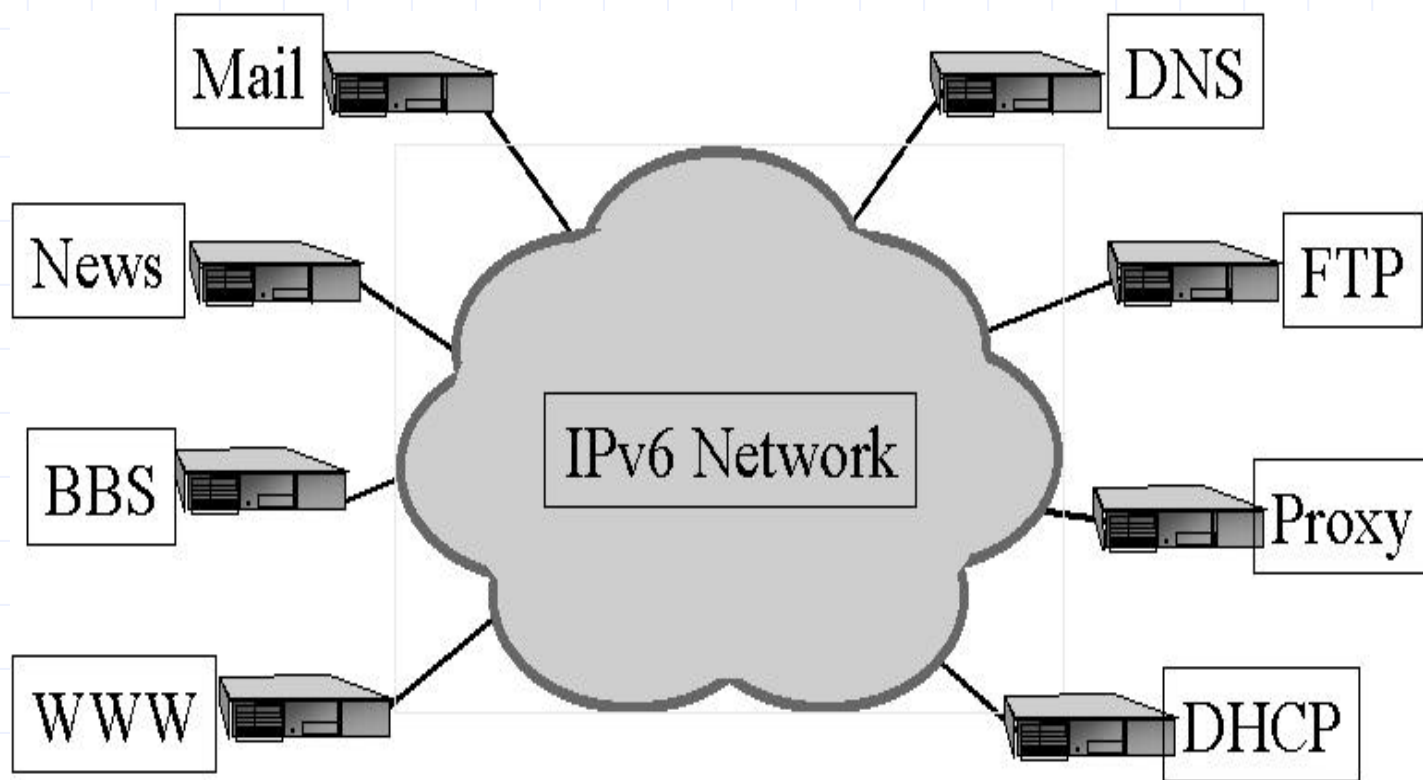
Architecture of Multiple Gigabit IPv6 Service Switch



Prototype of IPv6 Gigabit Service Switch.



Constructed IPv6 Servers



DNS DEMO

```
國立東華大學
Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\Documents and Settings\Administrator>nslookup
Default Server:  dns.ipv6.ndhu.edu.tw
Address: 211.73.86.201

> set querytype=any
> www.ipv6.ndhu.edu.tw
Server:  dns.ipv6.ndhu.edu.tw
Address: 211.73.86.201

www.ipv6.ndhu.edu.tw      AAAA IPv6 address = 3ffe:3600:1:0:220:edff:fe10:95cf
www.ipv6.ndhu.edu.tw      ??? unknown type 38 ???
ipv6.ndhu.edu.tw          nameserver = dns.ipv6.ndhu.edu.tw
dns.ipv6.ndhu.edu.tw      internet address = 203.64.88.93
dns.ipv6.ndhu.edu.tw      internet address = 211.73.86.201
dns.ipv6.ndhu.edu.tw      ??? unknown type 38 ???
dns.ipv6.ndhu.edu.tw      AAAA IPv6 address = 3ffe:3600:1:0:220:edff:fe11:2898
> 8.9.8.2.1.1.e.f.f.f.d.e.0.2.2.0.0.0.0.0.1.0.0.0.0.6.3.e.f.f.3.ip6.int
Server:  dns.ipv6.ndhu.edu.tw
Address: 211.73.86.201

8.9.8.2.1.1.e.f.f.f.d.e.0.2.2.0.0.0.0.0.1.0.0.0.0.6.3.e.f.f.3.ip6.int name = d
ns.ipv6.ndhu.edu.tw
1.0.0.0.0.6.3.e.f.f.3.ip6.int nameserver = dns.ipv6.ndhu.edu.tw.1.0.0.0.0.6.
3.e.f.f.3.ip6.int
>
```



WWW DEMO


下一代IPv6網路之建置 - Microsoft Internet Explorer

檔案(F) 編輯(E) 檢視(V) 我的最愛(A) 工具(T) 說明(H)

← 上一頁 → 搜尋 我的最愛 媒體

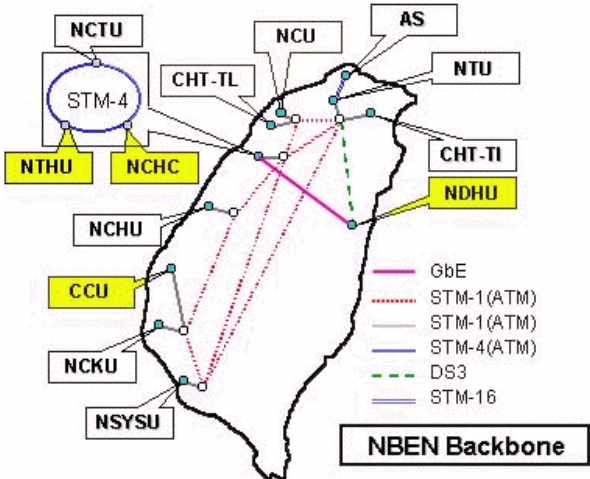
網址(D) <http://2001:288:381:1001:2d0:b7ff:fe4e:797f> 移至 連結 >>

回首
IPv6 簡介
IPv6環境設定
計劃簡介
研究成果
伺服器架設
環境架設
現有伺服器列表
先進技術研究
檔案資料
IPv6 RFC
相關連結
研究團隊
工具下載
Q&A
留言版
聯絡方式



下一代IPv6網路之建置

<http://www.ipv6.ndhu.edu.tw>



參與單位:
國立東華大學
國立清華大學
國立中正大學
國家高速電腦中心

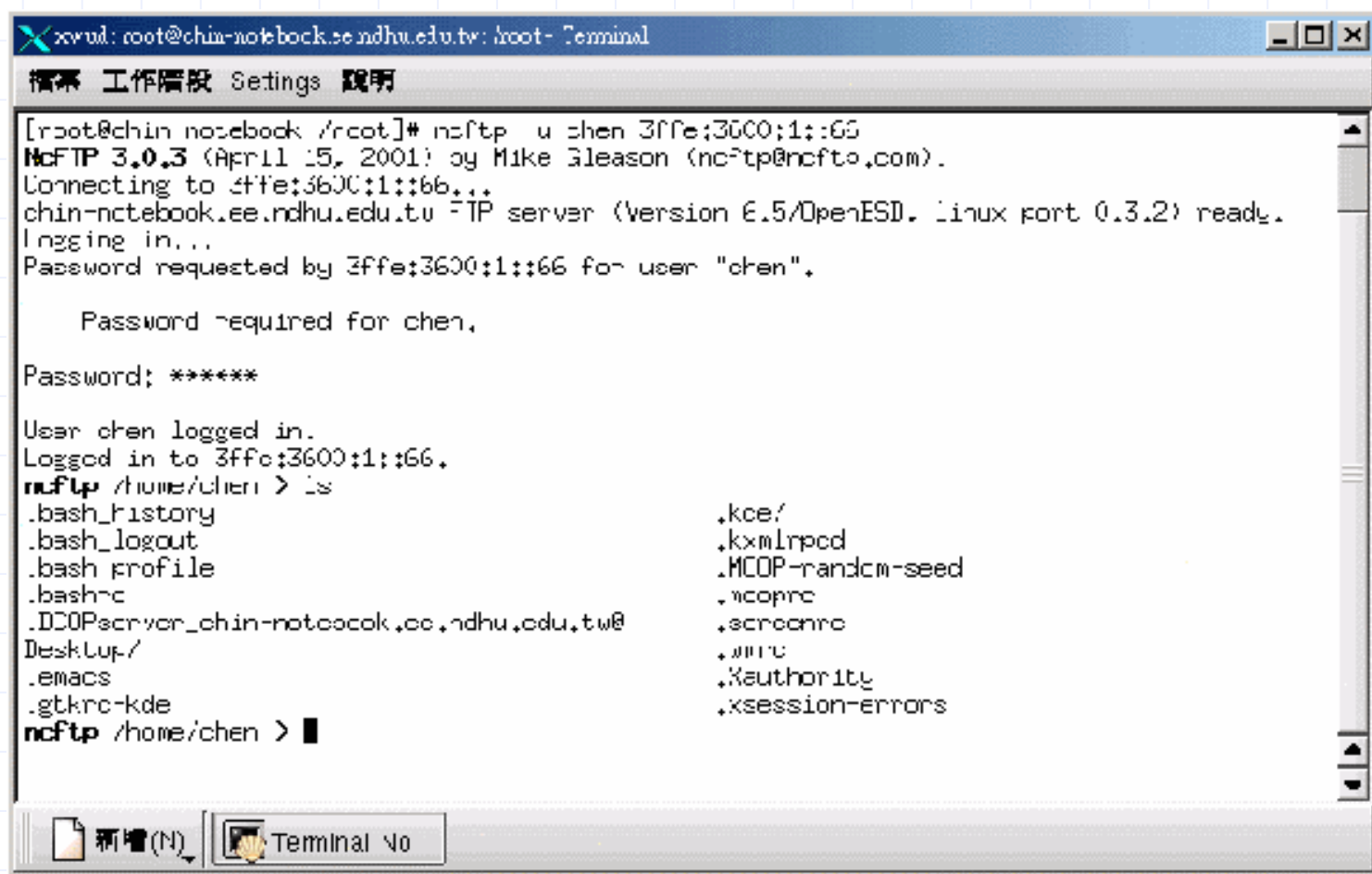
計劃主持人:
[趙涵捷教授](#)

聯絡人:
[王忍成](#)

網際網路



FTP Demo



```
xvwd: root@chin-notebook.ee.ndhu.edu.tw: root - Terminal
檔案 工作階段 Settings 說明

[root@chin-notebook /root]# ncftp -u chen 3ffe:3600:1::66
ncFTP 3.0.3 (April 15, 2001) by Mike Gleason (ncftp@ncftp.com).
Connecting to 3ffe:3600:1::66...
chin-notebook.ee.ndhu.edu.tw FTP server (version 6.5/OpenESD, Linux port 0.3.2) ready.
Logging in...
Password requested by 3ffe:3600:1::66 for user "chen".

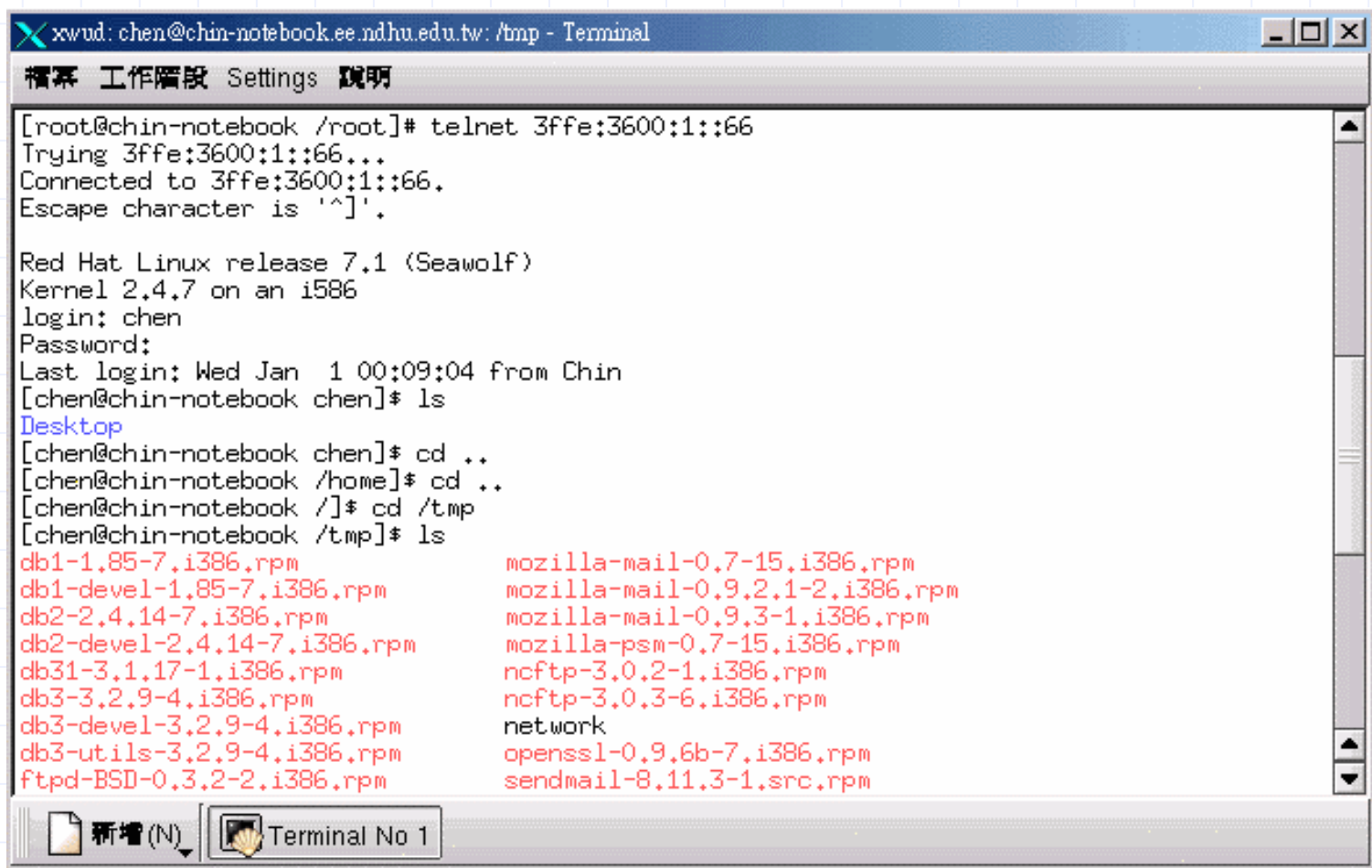
    Password required for chen.

Password: *****

User chen logged in.
Logged in to 3ffe:3600:1::66.
ncftp /home/chen > ls
.bash_history          .kde/
.bash_logout           .kxmlrpcd
.bash_profile          .MCOF-random-seed
.bashrc                .ncoprc
.DCOPserver_chin-notebook.ee.ndhu.edu.tw@ .screenrc
Desktop/               .vimrc
.emacs                 .Xauthority
.gtkrc-kde             .xsession-errors
ncftp /home/chen > █
```



FTP Demo



A terminal window titled "xvud: chen@chin-notebook.ee.ndhu.edu.tw: /tmp - Terminal" with a menu bar containing "檔案", "工作階段", "Settings", and "說明". The terminal shows a telnet connection to 3ffe:3600:1::66. The user logs in as 'chen' on a Red Hat Linux 7.1 (Seawolf) system. The user navigates from /root to /home, then to /tmp, and lists the contents of /tmp, which shows a list of RPM packages.

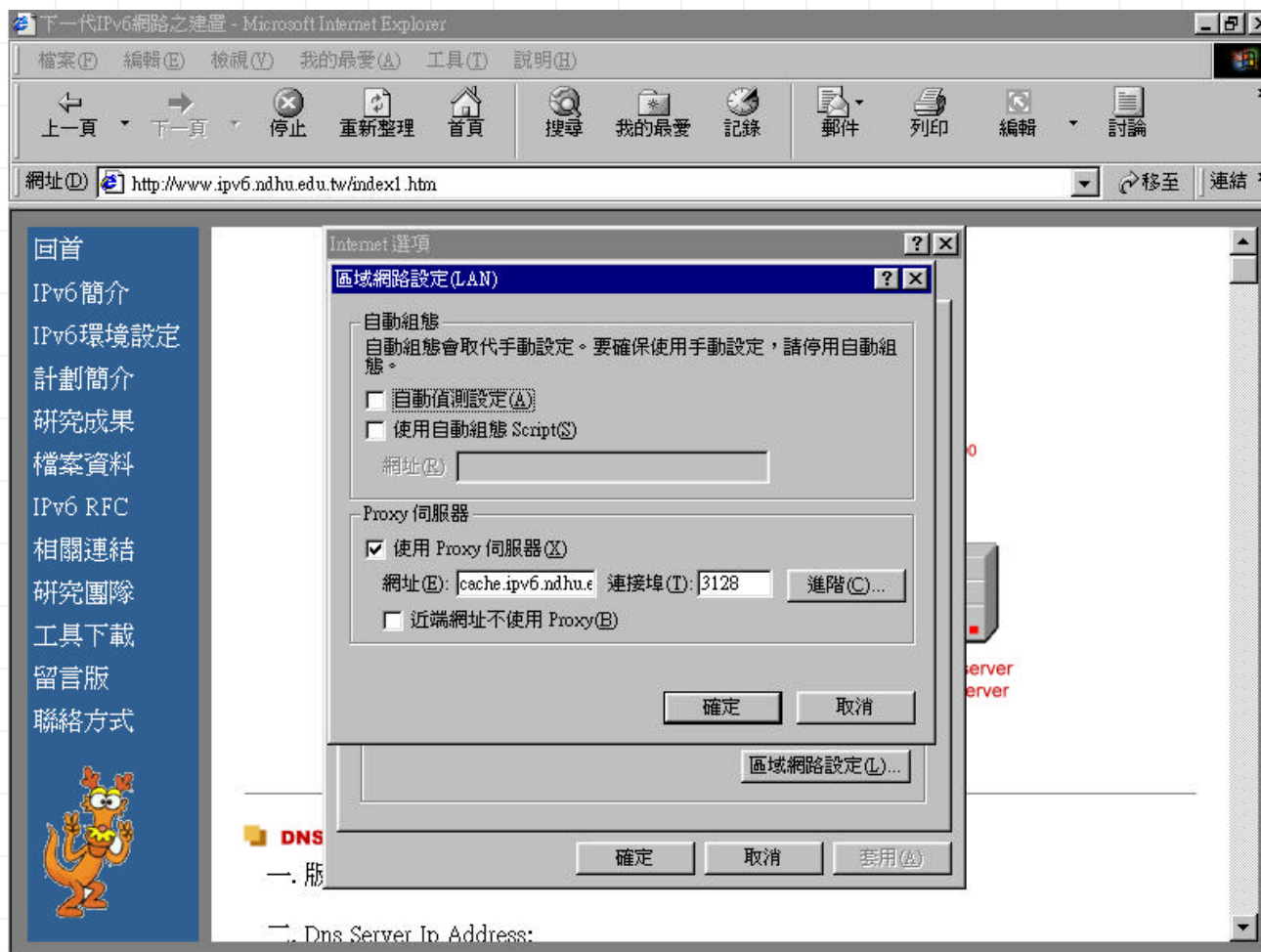
```
xvud: chen@chin-notebook.ee.ndhu.edu.tw: /tmp - Terminal
檔案 工作階段 Settings 說明

[root@chin-notebook /root]# telnet 3ffe:3600:1::66
Trying 3ffe:3600:1::66...
Connected to 3ffe:3600:1::66.
Escape character is '^'.

Red Hat Linux release 7.1 (Seawolf)
Kernel 2.4.7 on an i586
login: chen
Password:
Last login: Wed Jan  1 00:09:04 from Chin
[chen@chin-notebook chen]$ ls
Desktop
[chen@chin-notebook chen]$ cd ..
[chen@chin-notebook /home]$ cd ..
[chen@chin-notebook /]$ cd /tmp
[chen@chin-notebook /tmp]$ ls
db1-1.85-7.i386.rpm      mozilla-mail-0.7-15.i386.rpm
db1-devel-1.85-7.i386.rpm  mozilla-mail-0.9.2.1-2.i386.rpm
db2-2.4.14-7.i386.rpm   mozilla-mail-0.9.3-1.i386.rpm
db2-devel-2.4.14-7.i386.rpm  mozilla-psm-0.7-15.i386.rpm
db31-3.1.17-1.i386.rpm   ncftp-3.0.2-1.i386.rpm
db3-3.2.9-4.i386.rpm     ncftp-3.0.3-6.i386.rpm
db3-devel-3.2.9-4.i386.rpm  network
db3-utils-3.2.9-4.i386.rpm  openssl-0.9.6b-7.i386.rpm
ftpd-BSD-0.3.2-2.i386.rpm  sendmail-8.11.3-1.src.rpm
```



Proxy Demo



All-IPv6 network project

Such as

- ◆ Handoff scheme
- ◆ Mobility management
- ◆ Multicast service method
- ◆ Multimedia applications
- ◆ Security
- ◆ QoS guarantee



First-year

- ◆ In the first-year, the major focus is on the design of interworking system and high-quality data communications services for All-IPv4/IPv6 networks



Second-year

- ◆ In the second-year, the major focus will be on the development of the IPv6 network and highly efficient multimedia services for All-IPv6 network applications.



Third year

- ◆ In the third year, the major focus will be on the development of the mobile IPv6 network and multimedia services for All-IPv6 network applications and system integration



Mobile IPv6 project

- ◆ The goal is to construct and to popularize the Mobile IPv6 network architecture
- ◆ Constructed between NCKU and CCU over the NBEN backbone .
- ◆ The constructed environment tends to provide a platform for testing Mobile IPv6 technical issues, including intra-domain and inter-domain issues



NICI IPv6 Steering Committee

R&D Division Projects for 2003

6TIME(IPv6 Transition for Mobile Environment) &
6GIANT(IPv6 Gallop Internet AppliaNce of Taiwan)

Four sub-projects: US\$120K

1. Design and Implementation of an Multi-Hop Routing Protocol on Integrated IPv6-based Mobile Ad-Hoc Networks
2. The implementation of an IPv6 xDSL access support system
3. Design and Development of a Home Network Proxy using the IPv6 Multihoming Technique
4. The Development and Research of Attack, Defense and Cryptographic Module in IPv6



6TANET(IPv6 TrAnsition Network Environment of Taiwan)

Four sub-projects: US\$190K

1. Tunneling IPv6 through NATs
2. The Address-Concealed Network Detection and Management for IPv6
3. The Design and Implementation of Gigabit Ethernet IPv6/IPv4 Translator
4. Analysis of IPv6 Upper-Layer Protocols



Two Tentative Special Issue Call for Papers

IEEE Communication Magazine(Accepted to be announced)

- IPv6 - The basis for the next generation Internet

Schedule and Submissions

- Submission Deadline: May 1st, 2003
- Acceptance Notifications: August 1, 2003
- Final Manuscript Due: October 15, 2003
- Journal Publication: January 2004

Feature Topic Editors

Heinrich J. Stüttgen, Networking Laboratories, NEC Europe Ltd.

Email: stuttgen@ccrle.nec.de

Han-Chieh Chao, National Dong Hwa Univerisity

E-mail: hcc@mail.ndhu.edu.tw



Two Tentative Special Issue Call for Papers

IEEE JOURNAL ON SELECTED AREAS IN
COMMUNICATIONS (To be submitted) -
Wireless Overlay Networks Based on Mobile
IPv6

Feature Topic Editors

C. E. Perkins, Nokia USA

S. Y. Kuo, NTU

N. F. Huang, NTHU

H. C. Chao, NDHU



“The first Global IPv6 Summit in AP”
will be held during APRICOT2003 in
Taipei Taiwan, from Feb 24 to Feb26,
2003.

<http://www.ipv6.org.tw/summit/index.htm>

Welcome you all to attend!!!



References

- ◆ [1]. <http://www.bieringer.de/linux/IPv6>
- ◆ [2]. <http://www.research.microsoft.com/msripv6>
- ◆ [3]. <http://www.ipv6forum.com>
- ◆ [4]. <http://www.ietf.org>
- ◆ [5]. <http://netweb.cs.nthu.edu.tw/IPv6>
- ◆ [6]. <http://www.ipv6.ndhu.edu.tw/>
- ◆ [7]. <http://www.ipv6.org.tw> (English available)

