Academia Sinica Internet Exchange v6 Status Report

Ethern M.C. Lin

- NICI Introduction
- ASNet IPv6 Status
- ASIX6 Status Introduction
- TaipeiGigaPoP Status

NICI Introduction

NICI Introduction

- **About NICI**
  - **N**ational **I**nitiatives for **C**ommunication and **I**nformation
  - the highest government agency in charge of the information technology in Taiwan
  - URL: http://www.nici.nat.gov.tw/content/application/nici/eng/index.php
  - established the 「IPv6 Steering Committee」
- **IPv6 Steering Committee**
  - chaired by the DGT(Directorate General of Telecommunications)
  - four divisions
    - Research & Development, Standard & Testing, Infrastructure Development, Application & Promotion
  - The 5 years project started from 2003, and about USD 3.4 millions has been allocated till 2004.

ASCC Role in NICI….
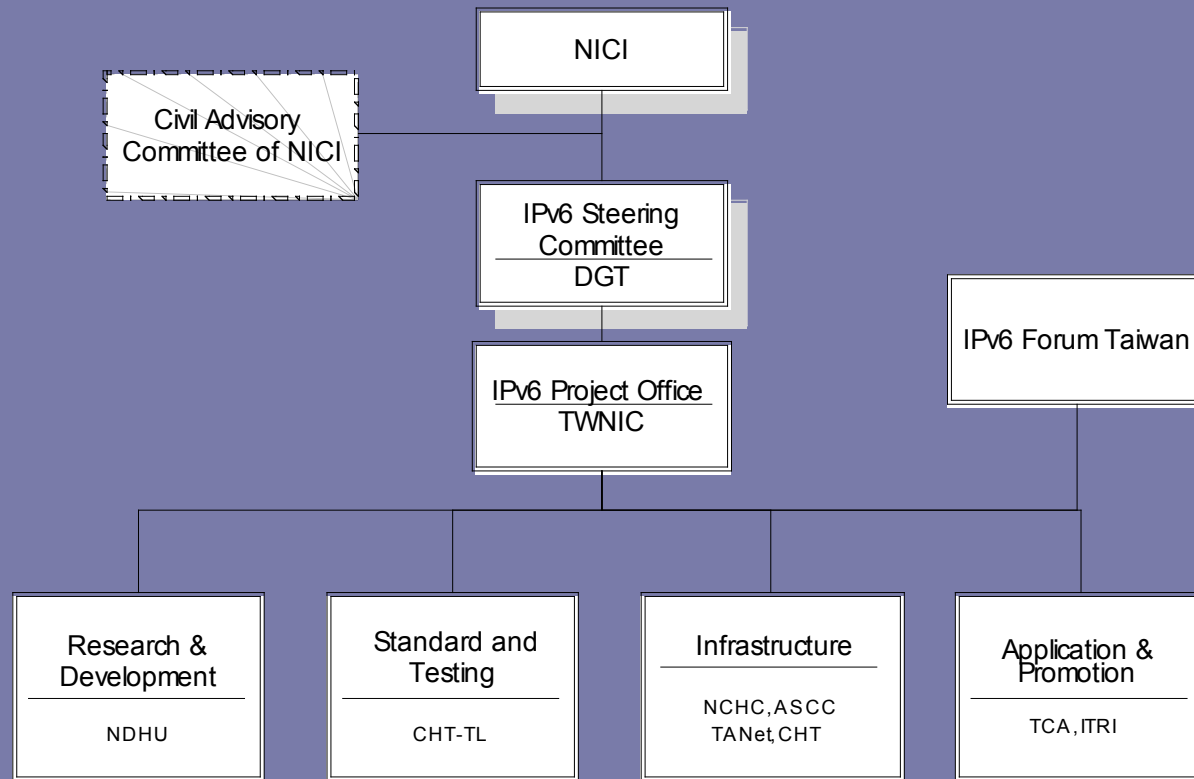
- <u>A</u>cademia <u>S</u>inica <u>C</u>omputing <u>C</u>entre
  - APAN-TW NOC
  - To provide global Internet access service for academic & research domain in Taiwan
  - Co-founder of NICI IPv6 Infrastructure Development Division
    - MOECC(TANet), NCHC(TWAREN), CHT(HiNet)
- 2003, 「IPv6 Migration and Promotion for Local Internet Service Providers」
- 2004, 「Construction of IPv6 Internet Exchange Project for ISP IPv6 Backbone Network」, Phase I
- 2005, the Phase II of 2004 project

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Projects focus on….

- To minimize the preliminary construction cost and promote the IPv6 construction for commercial domain
- To provide domestic IPv6 interconnection for academic and commercial domain
- To obtain and share the IPv6 operation experience
- To build the IPv6 architecture which has excellent performance and scalability
- To construct the access service between domestic and global IPv6 internet
- To construct the IPv6 platform for IPv6 applications implementing and testing

NICI IPv6 Steering Committee

THE ARCHITECTURE OF THE NICI IPV6 STEERING COMMITEE

NICI

Civil Advisory Committee of NICI

IPv6 Steering Committee DGT

IPv6 Project Office TWNIC

IPv6 Forum Taiwan

Research & Development
NDHU

Standard and Testing
CHT-TL

Infrastructure
NCHC,ASCC TANet,CHT

Application & Promotion
TCA,ITRI

ASNet IPv6 Status

ASNet IPv6 Status Report

- **ASNet**
  - <u>A</u>cademic <u>S</u>ervice <u>Net</u>work(ASN: 9264)
  - Maintained by ASCC
- **IPv6 Address allocated**
  - Pseudo-TLA: <u>3FFE:4001::/32</u>, 2002/3, will be phase-out at 2006/6/6
  - Sub-TLA: <u>2001:C08::/32</u>, 2002/7
- **Campus networks**
  - IPv6 Ready
  - Cisco 6509 w/ Sup720, Cisco 7609 w/ Sup720, Juniper
- **TaipeiGigaPoP**
  - IPv6 Ready
  - Cisco GSR 12416, Cisco 7609 w/ Sup720

ASNet IPv6 Status Report (contd.)

- Architecture
    - Layout: Layer 2 and Layer 3 peering
    - Protocol: BGP4+ 、 RIPng、OSPFv3
- IPv6 services
    - Multi-Router Looking Glass, http://mrlg.ipv6.ascc.net/
    - Tunnel Broker, http://tb.ipv6.ascc.net/
    - ASpath-tree, http://bgp.ipv6.ascc.net/
    - 6to4 relay service
    - DNS v6
- M6Bone
    - IPv6 Multicast Routers:
        - FreeBSD w/ KAME and Juniper,
        - Cisco 7513 w/ IOS 12.3(7)T1
    - IPv6 Multicast client
        - Desktop PC w/ camera
    - Protocol
        - MBGP4+、PIMv6-SM、MLDv1/v2

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ASIX6 Status Introduction

ASNet Internet eXchange v6(ASIX6)

- **Purpose and Benefits**
  - To provide the global IPv6 connection for participants of IX
  - To provide the mature of IPv6 infrastructure for IPv6 development and implementation in Taiwan
  - To share the IPv6 experience with IX participants
  - To minimize the cost for IX participants in initial IPv6 construction
  - To improve the IPv6 traffic performance and network quality

ASIX6 Status (contd.)

- **Schema**
  - The IPv6 links between Academia Sinica and participants are focus on the native and dual-stack
  - Academia Sinica will provide needed gears and interfaces which we have for the participants
    - T1, E1, T3, STM-1, FE, GE and even 10Gbps
  - We will provide the rack spaces, power, UPS, and air conditioner for participants
  - There are several carriers for participants to choice to minimize the cost of IPv6 link construction
  - We provide the 6Bone pTLA IPv6 address space for preliminary usage of participants, and assistance in the early develpoment
  - We can provide IPv6-over-IPv4 tunneling connections in the first trial

ASIX6 Status - Domestic

- **IPv6 Peerings**
  - Commercial： HiNet(AS 17419), TTN(AS 4747), TFN(AS 9924), GigaMedia(AS 9416), SeedNet(AS 4780), APOL(AS 17709)
  - Academic & Research：TANet(AS 17717), TWAREN、TANet2(AS 7539), NHRI(AS 18181).
  - ASNet provides the connection to 6Bone and global IPv6 internet service for the academic and commercial IPv6 networks in Taiwan
  - All circuits are Native IPv6

- **Domestic bandwidth**
  - 4.26 Gbps in 2004, about 9 times than 2003

ASIX6 Status - Domestic (contd.)

- TANet: <u>2001:288::/32</u>
  - TaipeiGigaPoP Dark Fiber, GiE. We provide IPv4/IPv6 transit.
- TANet2: <u>2001:C58::/32</u>
  - ATM PVC 50 Mb/s, transit to APAN-JP.
- TWAREN: <u>2001:E10::/32</u>
  - GiE., transit to APAN-JP.
- NHRI: <u>2001:D48::/32</u>
  - FaE.
- ASNet provides global IPv6 Transit service for above networks.

ASIX6 Status - Domestic (contd.)

- Internet Service Providers
  - HiNet: <u>2001:238::/32</u>
    - ATM PVC 5Mb/s
  - TTN: <u>2001:C50::/32</u>
    - E1 Native-Link => FTTB in the future
  - TFN: <u>2001:D20::/32</u>
    - T1 Native-Link => FTTB in the future
  - SeedNet: <u>2001:CD8::/32</u>
    - FaE
  - GigaMedia: <u>2001:D58::/32</u>
    - GiE
  - APOL: <u>2001:F10::/32</u>
    - GiE
  - NCIC, will connect in the near future
- ASNet provides 6Bone IPv6 Transit service for the above networks.

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ASIX6 Architecture
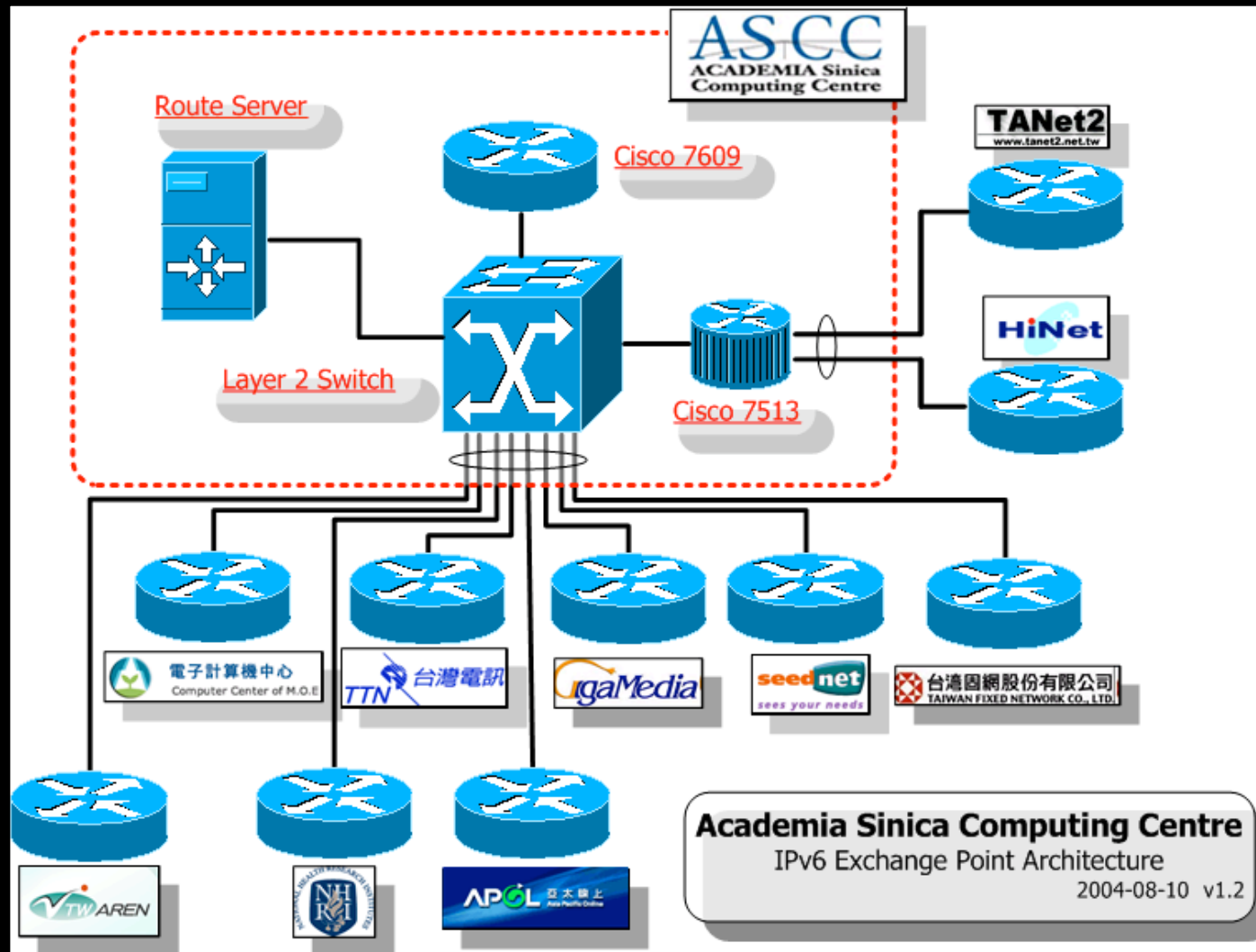
ASIX6 Status - International

- **JAPAN/APAN-JP**
  - STM-4, Dual-Stack Link
  - Fully Transit for ASNet.
- **JAPAN/NSPIXP-6**
  - FaE, Native Link
  - The World Largest Native IPv6 IX.
  - 23 peerings(IIJ-AS2947, ODN-AS4725, WIDE-AS2500, NTT-VERIO-AS2914, IMNet-AS2513……)
- **Singapore/SOX**
  - STM-1, Dual-stack Link
  - Peer with SingAren (AS7610) just a few days ago
- **Netherlands/AMS-IX**
  - STM-16, Dual-Stack Link
  - 28 peerings with ASNet.

ASIX6 Status - International (contd.)

- **US/StarLight**
  - STM-16, Dual Stack
  - Abilene(AS11537), CA*Net4(AS6509), 6TAP(AS3425), SURFNet(AS1103) and RBNet(AS5568) peering with ASNet.
- **US/PAIX**
  - STM-4, Dual Stack
  - AARnet(AS7575), ISC(AS 3557) peering with ASNet.
- **M6Bone: IPv6 Multicast Testbed**
  - Taiwan zone PoP site
  - Members
    - CHT-TL, TTN, TFN, SeedNet, GigaMedia, NCKU, MCU, NCU
- **International bandwidth**

  - **6.84 Gbps** in 2004, about **8** times than 2003

ASIX6 Global Infrastructure
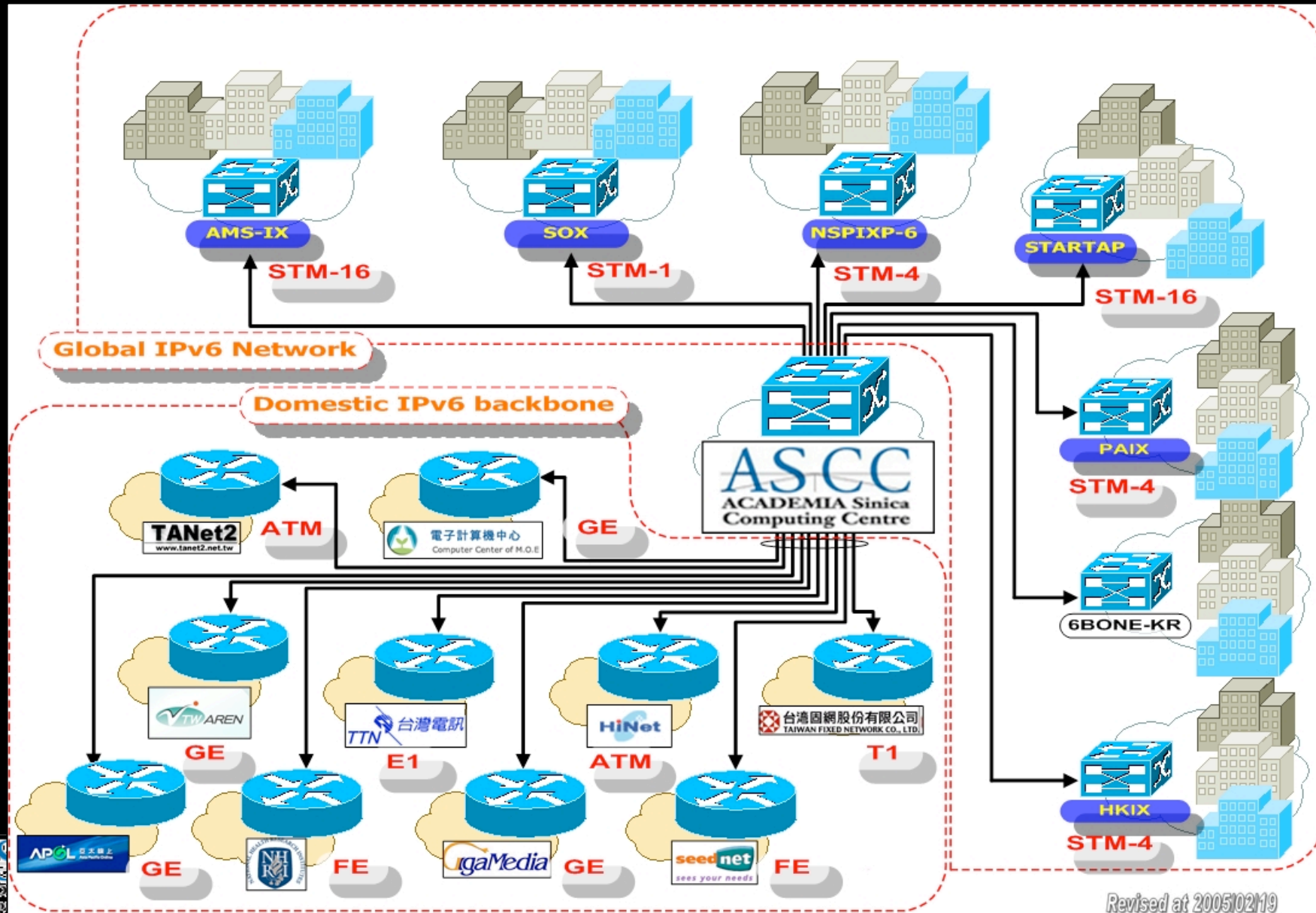
IPv6 Tunneling Peers

- **IPv6-over-IPv4 Tunneling**
- **Domestic**
  - 16 IPv6 networks
- **International**
  - 13 countries
  - 20 IPv6 networks
- **Total**
  - 36 networks

國家	連線網路名稱	國家	連線網路名稱
Taiwan	CHT-TL(AS 17715)		vBNS(AS 145)
	NCU		HE(AS 6939)
	NDHU(AS 17711)		EP.NET(AS 4555)
	SeedNet(AS 4747)		Cable & Wireless(AS 5594)
	GigaMedia(AS 9924)	Singapore	SingTel(AS 3758)
	TTN(AS 4747)	Korea	6BONE-KR(AS 3748)
	MCU	Thailand	INET-TH(AS 4618)
	NHRI(AS 18181)		ThiaSARN(AS 3836)
	NANYA	Canada	Viagenie(AS 10566)
	TAILYN	France	Renater(AS 1717)
	IMYDU		FASTNETXP(AS 25358)
	NTUST	U.K.	UK6X(AS 1752)
	NCKU	Italia	TILAB(AS 5609)
	YZU	Switzerland	CERN(AS 513)
	ISU	Netherlands	XS4ALL(AS 3265)
	Far Easton(AS 9674)	Hungary	T-NET(AS 2012)
U.S.A.	LavaNet(AS 6435)	Spain	EURO6IX(AS 65504)
	CISCO(AS 109)	Portugal	NFSI(AS 25137)

IPv6 Native/Dual-Stack Peers

- Native/Dual-stack IPv6 peers
- Domestic
  - 10 networks
- International
  - 9 countries
  - 60 IPv6 networks
- Total
  - 70 networks

國家	連線網路名稱	國家	連線網路名稱
Taiwan	TTN(AS4747)	Netherlands	BIT(AS12859)
	TFN(AS9924)		We Dare(AS20495)
	GigaMedia(AS9416)		IntroWeb(AS20847)
	SeedNet(AS4780)		Luna.nl(AS12902)
	HiNet(AS17419)		TrueServer(AS15703)
	TANet(AS17717)		XS4ALL Internet(AS 3265)
	TANet2(AS7539)		WestBrabant Net(AS12871)
	NHRI(AS18181)		Solcon Internetdiensten (AS12414)
	APOL(AS17709)		Internet Online(AS24587)
	TWAREN(AS7539)		Rokscom Internet(AS25232)
Japan	APAN-JP(AS7660)		Computel(AS31383)
	ANC(AS18084)		Scarlet Telecom(AS12634)
	NTT-ECL(AS4697)		InterXS Networks(AS30913)
	NTT-Verio(AS2914)		InfoPact Netwerkdiensten(AS 21221)
	IIJ(AS2497)		ProServe Networks(AS21155)
	WIDE(AS2500)		ISP Services(AS24875)
	PTOP(AS4677)		InterConnect Services(AS9150)

IPv6 Native/Dual-Stack Peers (contd.)

- Domestic total
  - 26 IPv6 networks
- International total
  - 80 IPv6 networks
- Increase 48 networks more than 2003

國家	連線網路名稱	國家	連線網路名稱
	DTI(AS4691)		Amsterdam Internet Exchange (AS1200)
	ODN(AS4725)		RIPE(AS3333)
	Opentransit(AS5511)		SURFnet(AS1103)
	FDBC(AS10013)		CIPC(AS30727)
	APNIC(AS4777)	Australia	AARNet(AS7575)
	WIDE IPv6 DNS(AS7500)	U.S.A.	SURFNet(AS1103)
	CKP(AS4718)		NREN(AS24)
	BIGLOBAL(AS2518)		6TAP(AS3425)
	SONYTELCOM(AS9600)		RBNet(AS5568)
	JCN(AS4721)		CANet*4(AS6509)
	II-OKINAWA(AS9261)	Italia	Tiscali(AS3257)
	SRS SAKURA INTERNET(AS7684)	Finland	Song Networks(AS3246)
	BroadBand-Tower(AS9607)	Germany	Probe Networks(AS29686)
	V6TRANS(AS23789)		Schlund(AS8560)
	SINET(AS2907)	Belgium	Belgian Research Network(AS2611)
	V6PC(AS17935)	Austria	UPC Telekabel(AS6830)

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ASIX6 Services

- Layer 2 switching
  - Prefix:
    - 2001:288:3B0:5::/64
  - Commercial zone
    - TTN: 2001:288:3B0:5::4747:1 (ASN 4747)
    - SeedNet: 2001:288:3B0:5::4780:1 (ASN 4780)
    - GigaMedia: 2001:288:3B0:5::9416:1 (ASN 9416)
    - APOL: 2001:288:3B0:5:0:1:7709:1 (ASN 17709)
    - NCIC: 2001:288:3B0:5:0::9919:1(ASN 9919) in the near future
  - Academic & Research zone
    - TWAREN: 2001:288:3B0:5::7539:1 (ASN 7539)
    - TANet: 2001:288:3B0:5:0:1:7717:1 (ASN 17717)
    - NHRI: 2001:288:3B0:5:0:1:8181:1 (ASN 18181)
  - Protocol
    - BGP4+

ASIX6 Services (contd.)

- Layer 3 routing
  - TANet: 2001:288:1:1005::1 (ASN 17717)
  - TFN: 2001:288:3B0::5B (ASN 9924)
  - HiNet: 2001:238:E80::11 (ASN 17419)
  - Protocol
    - BGP4+, OSPFv3
  - ASN: 9264
- Route Server
  - FreeBSD w/ Zebra: 2001:288:3B0:5::5
  - Cisco: 2001:288:3B0:5::6
  - protocol
    - BGP4+, OSPFv3

ASIX6 Services (contd.)

- **MRLG**
- **BGP ASpath Tree**
  - Unicast
  - Multicast (in construction)
- **IPv6 Multicasting**
- **Tunnel Broker**
- **6to4 Relay**
- **IPv6 DNS**

M6bone Introduction

- **Multicast IPv6 Backbone**
  - Global coordinated by Renater, the G6 and the Aristote Association
  - http://www.m6bone.net/
- **International members**
  - 21 countries
  - 45 IPv6 networks
- **Taiwan PoP**
  - Maintained by ASCC

# M6bone Global Architecture

ASIX6 M6Bone service

- **To M6Bone**
  - IPv6-over-IPv4 Tunneling
  - By Cisco 7513
- **To members in Taiwan**
  - IPv6-over-IPv4 Tunneling
  - IPv6-over-IPv6 Tunneling
  - Native IPv6
- **Prefix**
  - 2001:C08:1FFF::/48
  - 3FFE:4001:1FFF::/48
- **Domestic members**
  - 8 networks
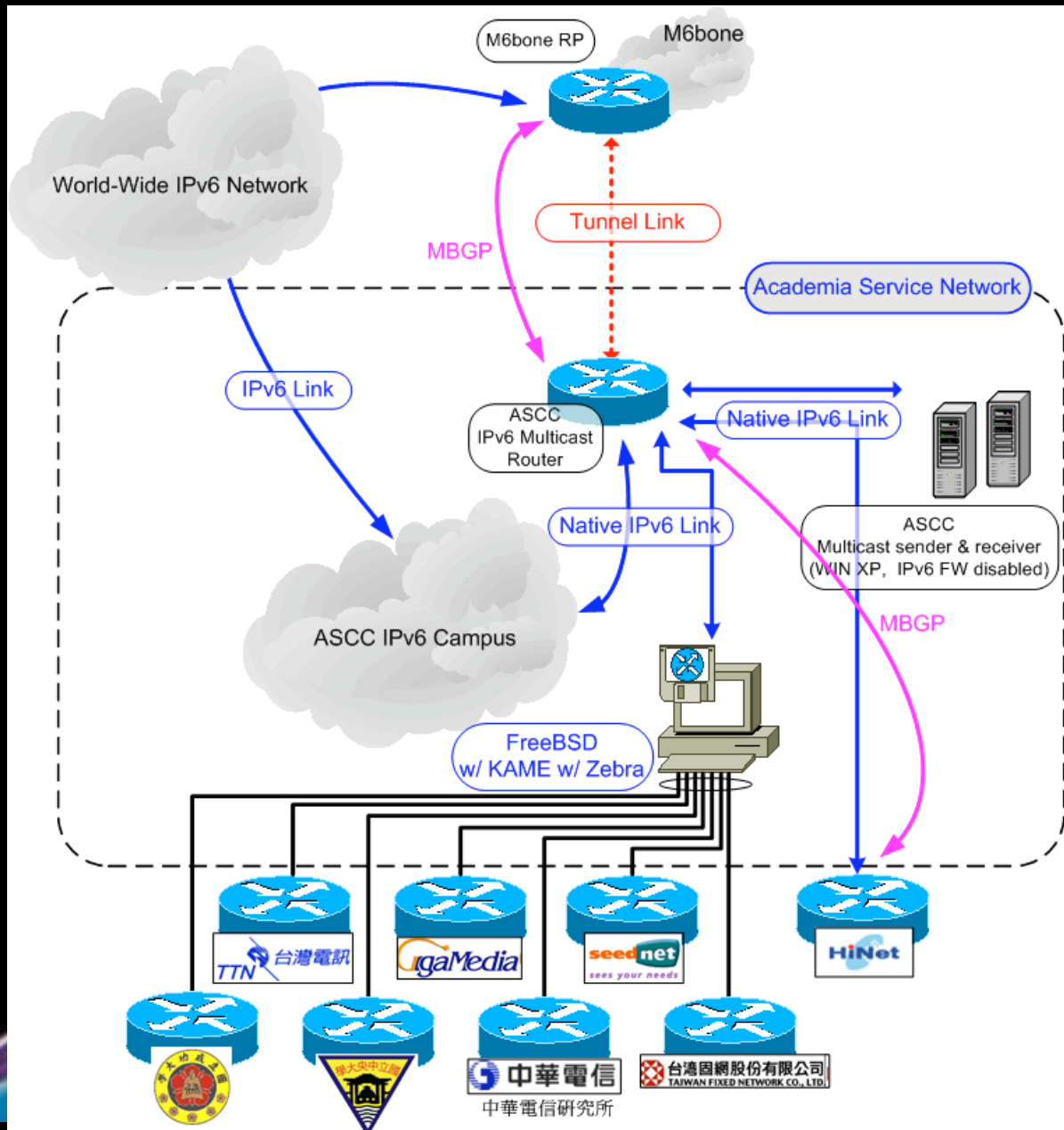
ASIX6 M6Bone service (contd.)

- Multicasting platform
  - FreeBSD w/ KAME
  - Cisco
  - Juniper
- IPv6 Multicast protocol
  - RIPng, MBGP4+
  - PIM sparse mode
  - MLD v1, v2
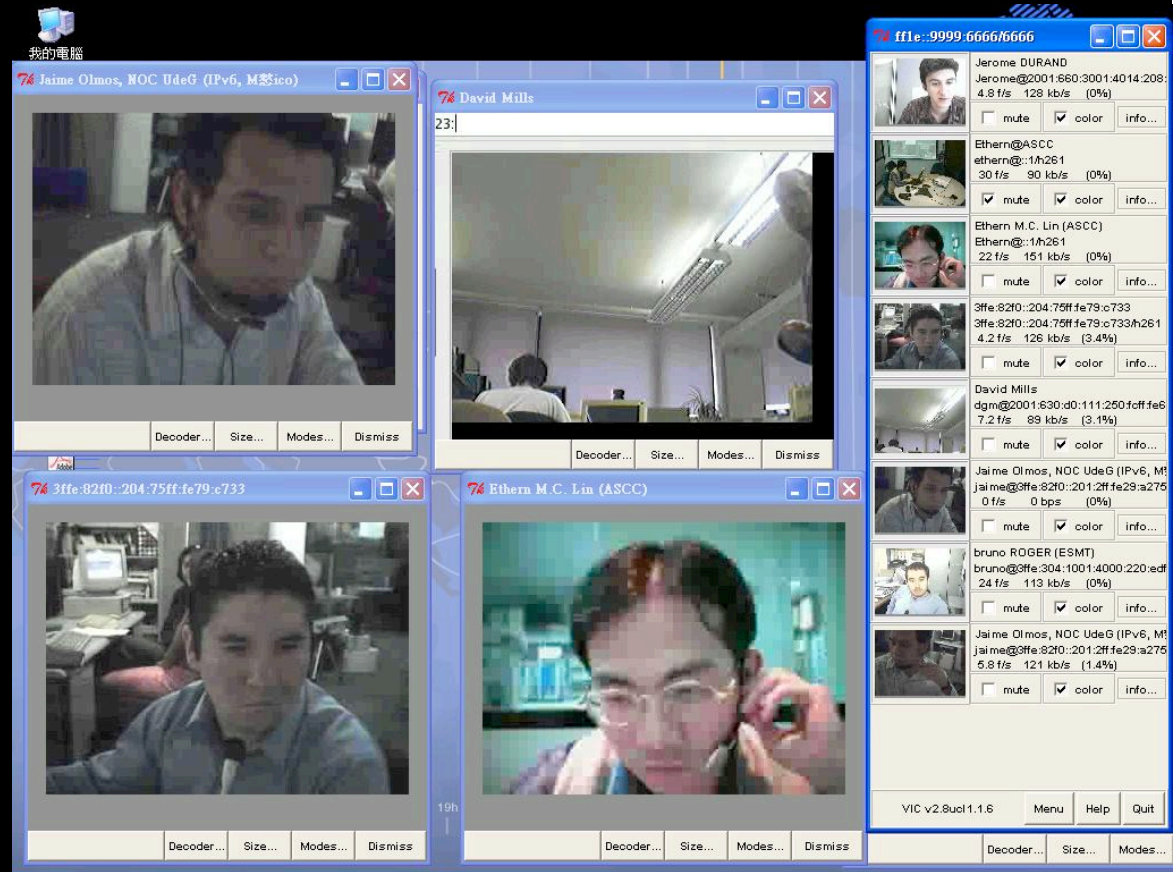
ASIX6 M6Bone service (contd.)

- Members
  - NCKU: 3FFE:3600:1A::/48
  - CHT-TL: 3FFE:3600:E:1500::/64
  - TTN: 2001:C50:1FFF:FFFF::/64
  - TFN: 2001:D20:FFFF::/48
  - HiNet: 2001:238:F02::/48 (Native link)
  - GigaMedia: 2001:D58:574F:224::/64
  - SeedNet: 2001:CD8:9::/48
  - MCU: 2001:C08:2004::/48
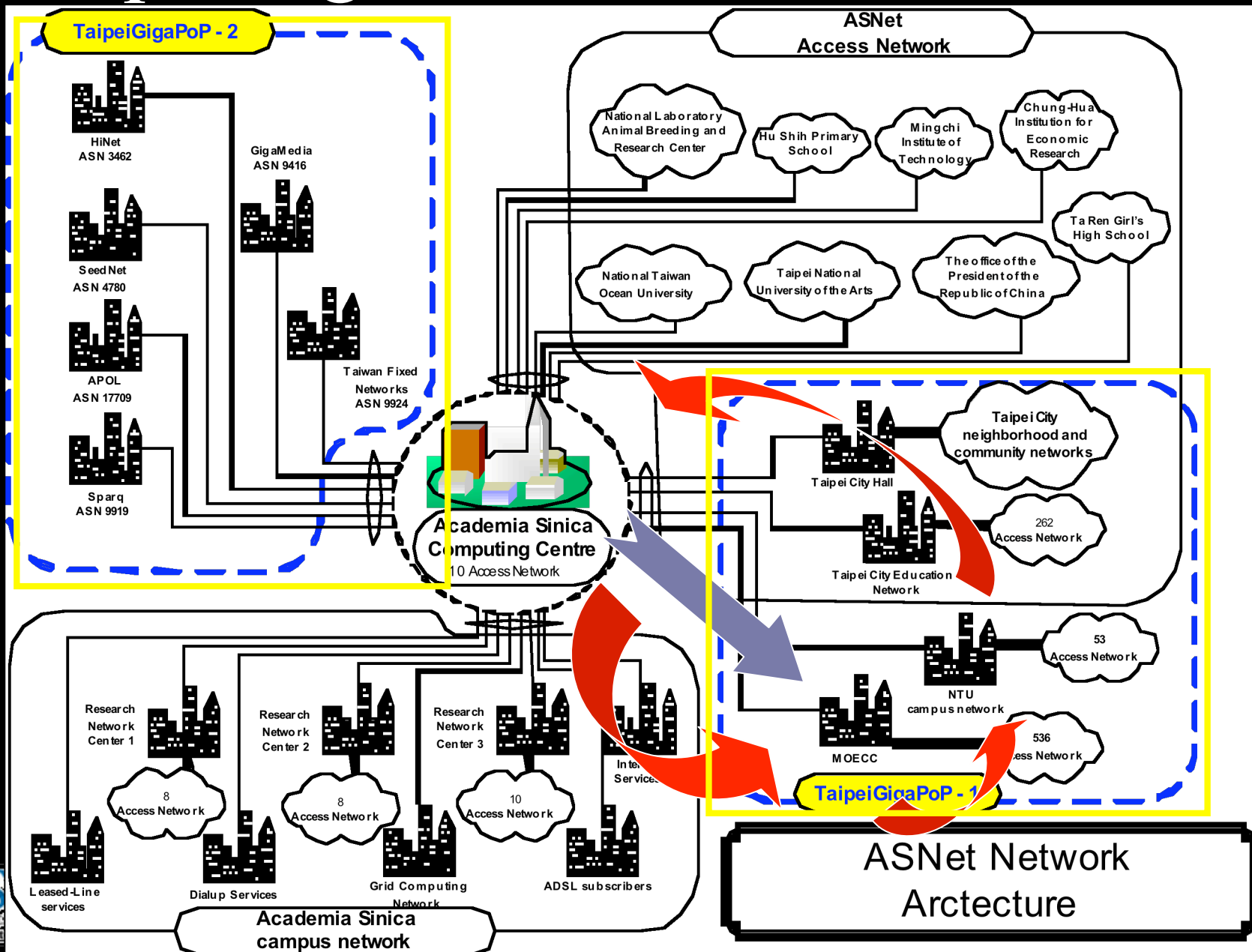 - NCU: 3FFE:3600:5:7968::/64

TaipeiGigaPoP Status

TaipeiGigaPoP

- First OC-192 in Taiwan
- 1550nm, 96 cords, dark fiber.
- The ASCC operates the TaipeiGigaPoP and provides interconnection service for the academic and commercial networks. The experience and operations of IPv6 will be the reference for the TaipeiGigaPoP
- TaipeiGigaPoP participants:
  - EBT(1G), TFN(1G), GigaMedia(4G), SeedNet(1G), Sparq(1G)
  - Taipei City Gov. Education(2.5G),Taipei City Gov.(1G), GSN(155M)
  - MOECC(10G+2.5G+2G), NTU(2.5G), NTOU(2.5G), CGU(2.5G), CCU(1G), CHIT(1G), SCU(1G), TKU(1G), NTUST(1G), NTUT(1G), NCREE(1G), NHRI(100M), CHIT(1G), SCU(1G), NTPU(1G), NTPTC(1G)

TaipeiGigaPoP

TaipeiGigaPoP - 2

HiNet
ASN 3462

GigaMedia
ASN 9416

Seed Net
ASN 4780

APOL
ASN 17709

Taiwan Fixed
Networks
ASN 9924

Sparq
ASN 9919

**ASNet
Access Network**

National Laboratory
Animal Breeding and
Research Center

Hu Shih Primary
School

Mingchi
Institute of
Technology

Chung-Hua
Institution for
Economic
Research

Ta Ren Girl's
High School

National Taiwan
Ocean University

Taipei National
University of the Arts

The office of the
President of the
Republic of China

Academia Sinica
Computing Centre
10 Access Network

Taipei City
neighborhood and
community networks

Taipei City Hall

262
Access Network

Taipei City Education
Network

53
Access Network

NTU
campus network

MOECC

536
Access Network

TaipeiGigaPoP - 1

Research
Network
Center 1

Research
Network
Center 2

Research
Network
Center 3

Internet
Services

8
Access Network

8
Access Network

10
Access Network

Leased-Line
services

Dialup Services

Grid Computing
Network

ADSL subscribers

**Academia Sinica
campus network**

**ASNet Network
Arctecture**

Internet

IPv6 affiliates in Academia Sinica

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