

# The Road to IPv6 Taiwan

Report: Prof. Yao-ming Yeh  
Kainan University

Taiwan Network Information Center  
Taiwan





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- The Roadmap of IPv6 Program in Taiwan
- Taiwan IPv6 Status
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# World IPv4 Depletion Schedule

Depletion starts when the RIR has less than 1 Class A block

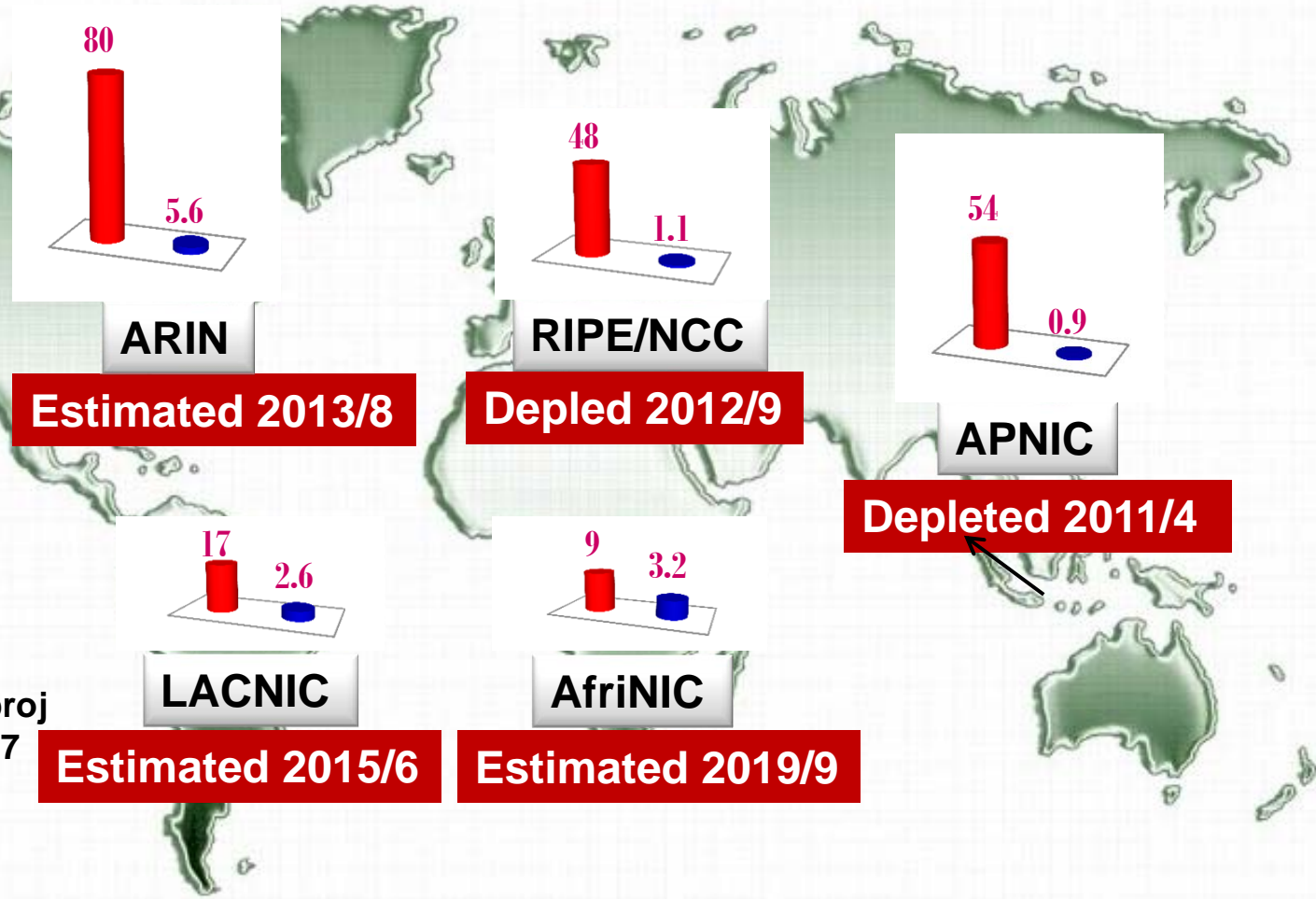
**IPv4枯竭計數器**

▼現狀 (區域)

最後期限及數目塊 (單位 /8)

AfriNIC	2019/09/23	3.27
APNIC	2011/04/15	0.91
ARIN	2013/08/27	5.67
LACNIC	2015/06/09	2.67
RIPE NCC	2012/09/14	1.03

NetCore via IPv6



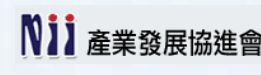
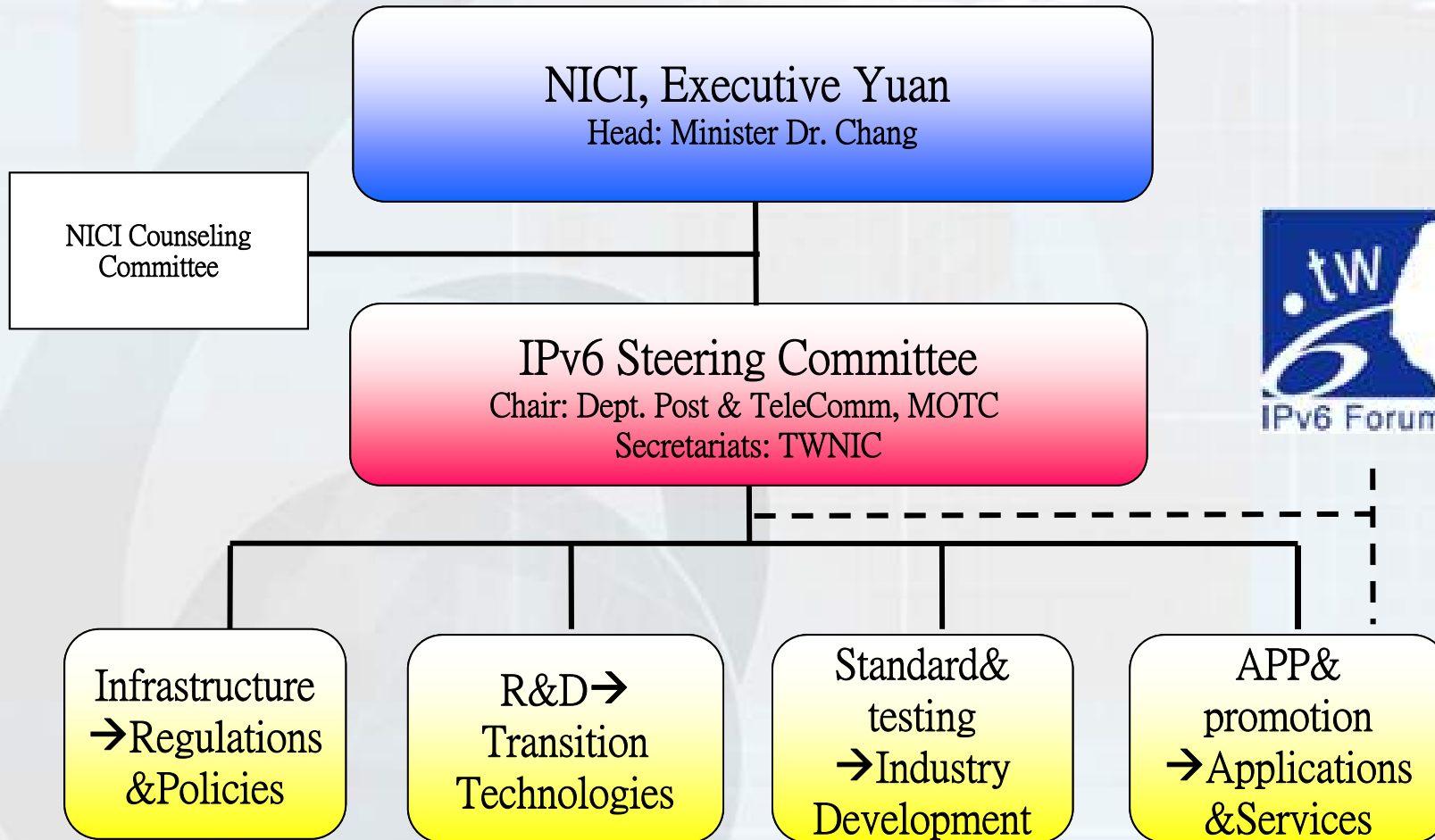
<http://inetcore.com/project/ipv4ec>, 2012/10/17

Issued(/8)

Remained(/8)

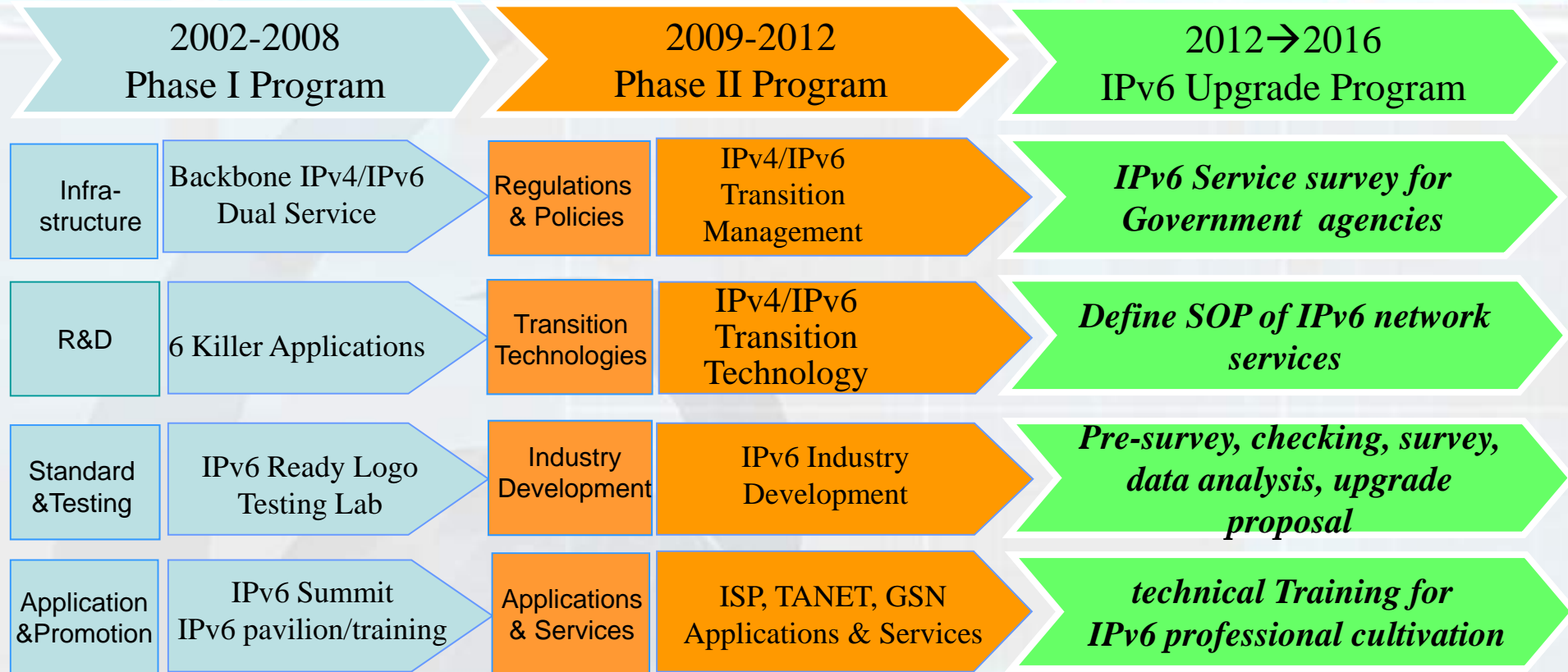


# National IPv6 Program (2003-)





# The Roadmap of IPv6 Program in Taiwan



- Analyze Global IPv4/IPv6 policy
- Analyze IPv4/IPv6 interoperability among ISPs
- Access network on TANet and GSN
- Collaboration with national research program
- IPv6 upgrade promotion for government agencies



# Taiwan IPv6 Status



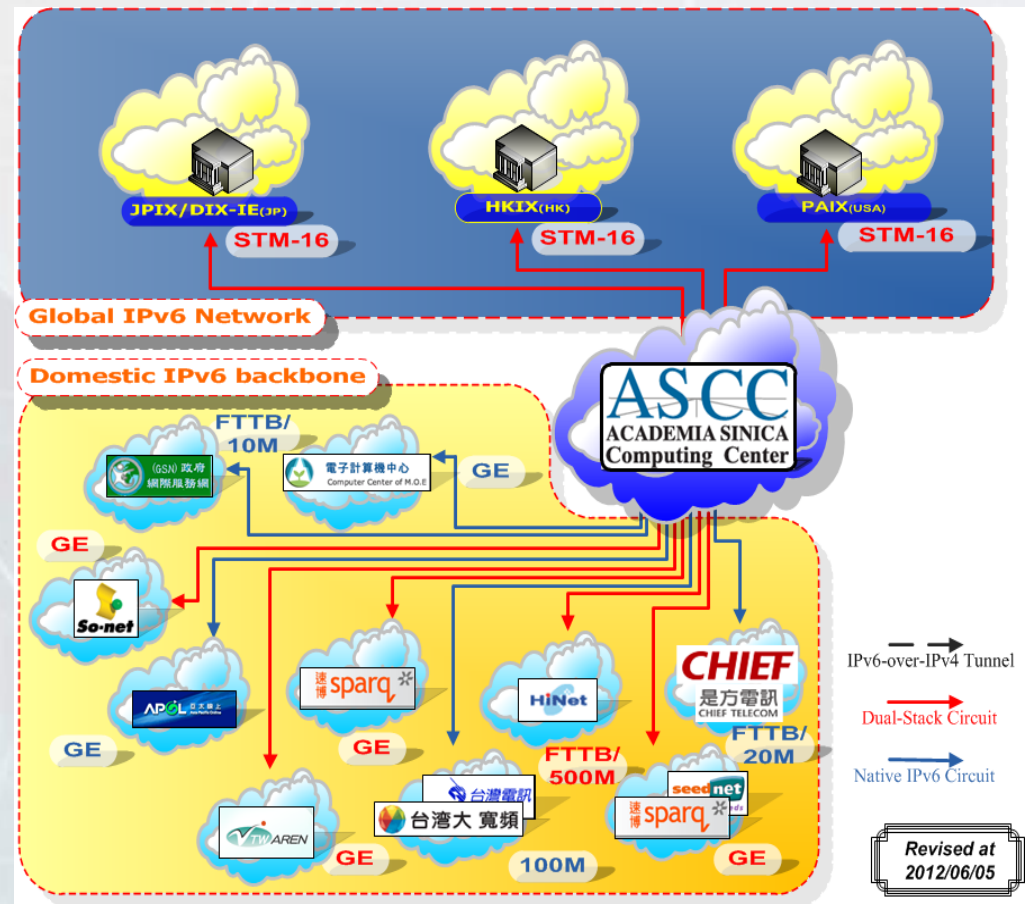
# Taiwan ISPs IPv6 Current Status

- Infrastructure

- 10 ISPs deployed IPv6 backbone
- IPv6 IX – **ASNet** Internet eXchange v6 (ASIX6)

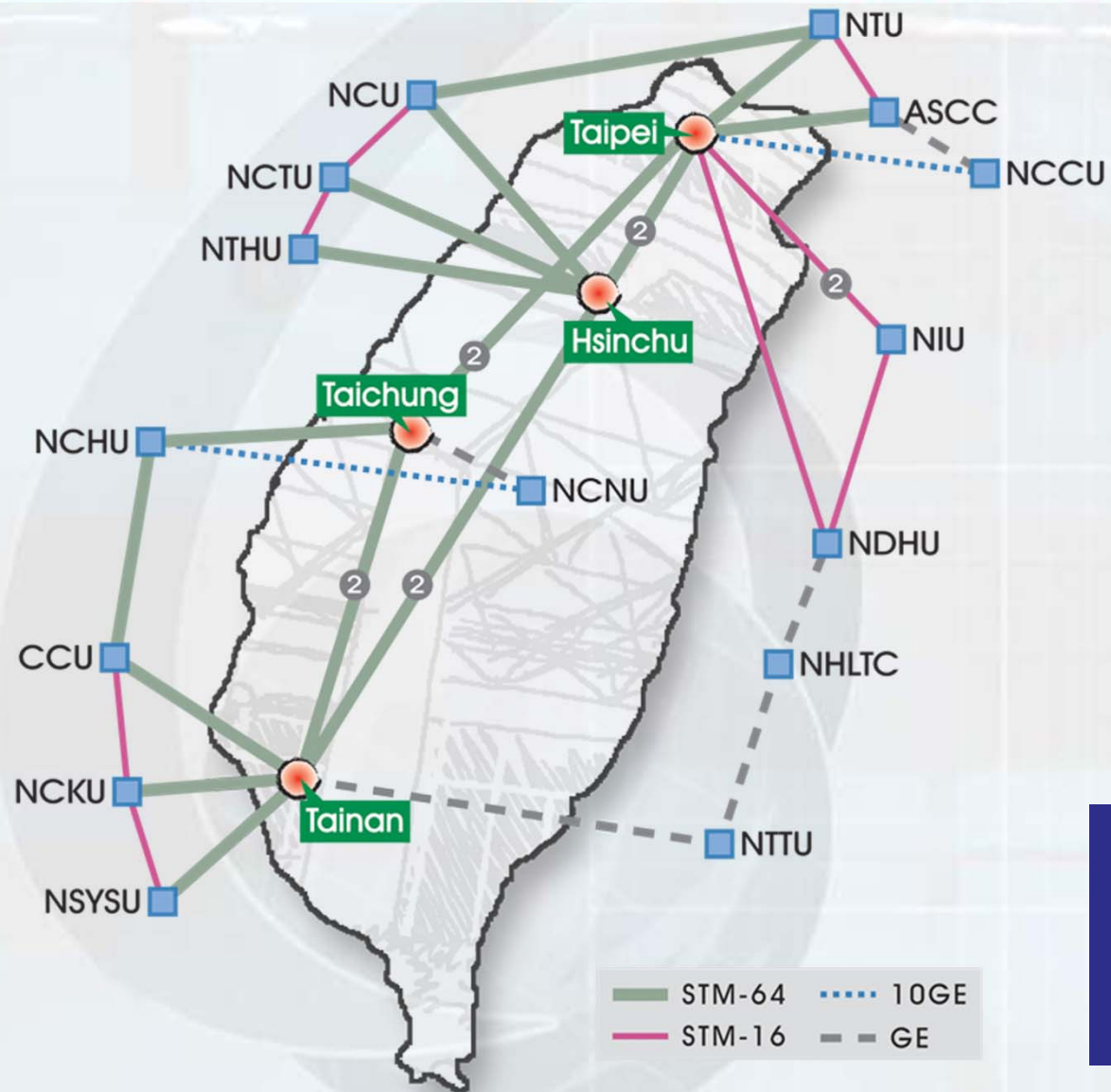
- Access

- IPv6 Tunnel Services are provided in major ISPs (HiNet, Sparq, SONET, APOL, TFN) since 2007.
- Chung-Hwa Telecom(HiNet) NGN (FTTX) provides IPv4 and IPv6 dual stack services since 2011.
- Dual stack is the major technology to transition to IPv6





# TWAREN Architecture



## Taiwan Advanced Research & Education Network (TWAREN)

- **4 core nodes**
- **20 G backbone**
- **12 Giga Pops**
- **Connect HPC resources**
- **5 Gbps to USA**
- **622 Mbps to Amsterdam**

IPv4/IPv6 dual stack upgrade since 2003. Provide IPv6 backbone service for TAnet.





# TANet (Taiwan Academic Network) IPv6 Network Deployment

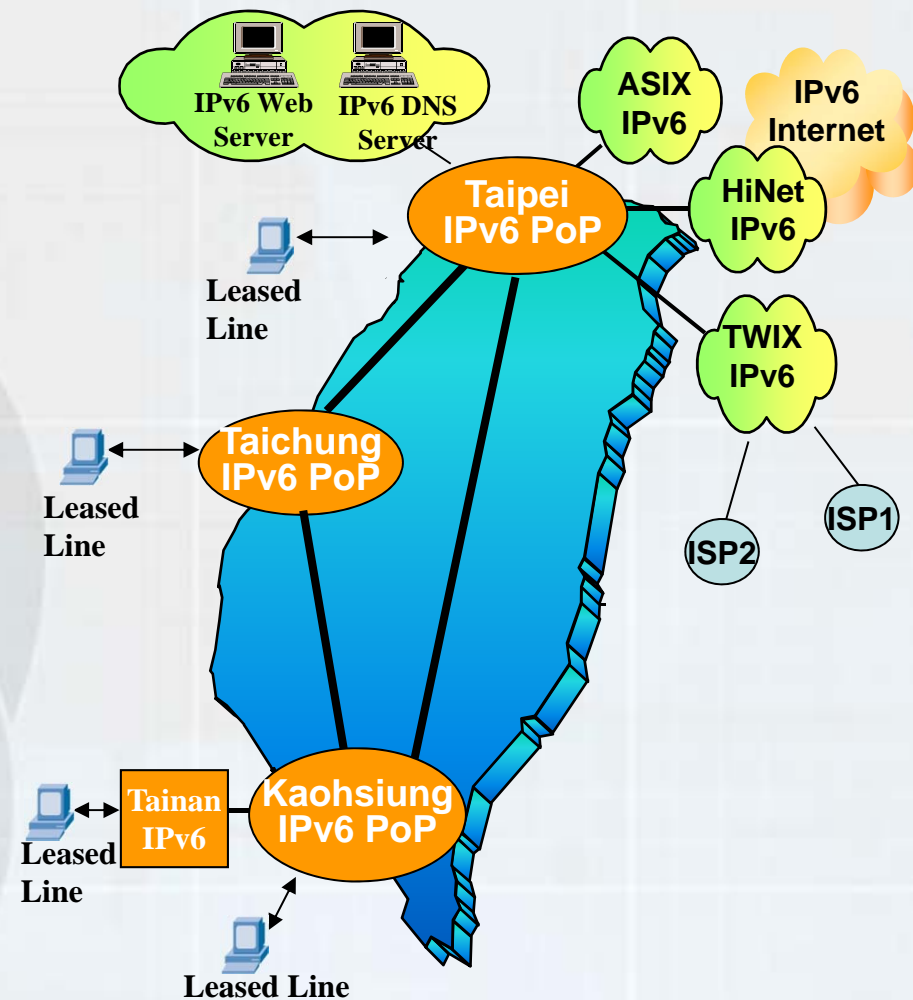
- 5 Counties demo sites deployment at 2009
  - I-Lan County, Taipei County, Tao-Yang County, Nan-Tou County, Tai-Nan City Campus Deployment
  - IPv6 accessibility of WWW, DNS, SMTP
- Fully scaled deployment of primary and high schools at 2010
  - 95% of schools provide IPv4/IPv6 dual stack access
  - 68% of classes provide IPv4/IPv6 dual stack VoIP service (50,000 pones)





# IPv6 Transition of Government Service Network, GSN

- Government Service Network, GSN
  - 2012/6/30, provide island-wide dual stack backbone
  - 2012/7/1, provide dual stack IDC services in every PoPs
  - 2012/7/1, provide dual stack access network service in 4 major cities
  - 2013/1/1, provide island-wide dual stack access network service



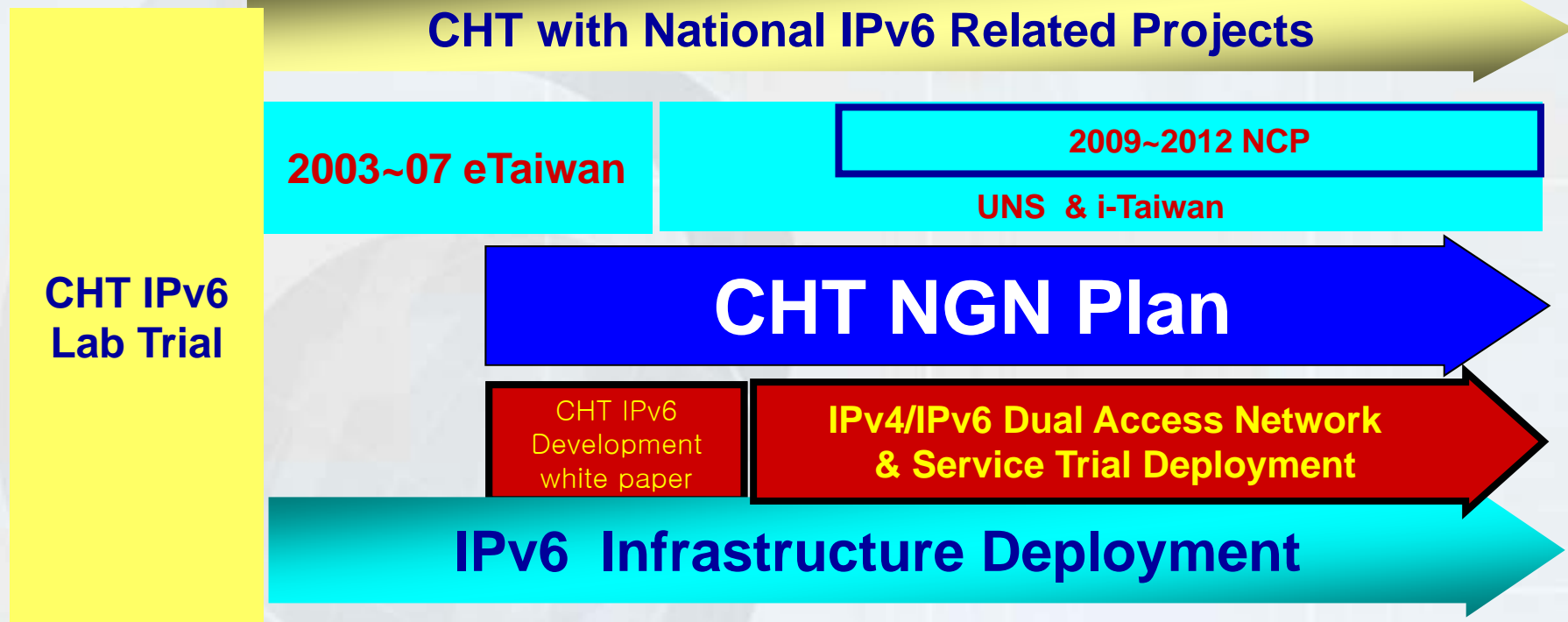
# IPv6 Roadmap of Chunghwa Telecom

## The biggest commercial ISP of Taiwan



Exhaustion of APNIC IPv4 Pool at Apr. 14, 2011

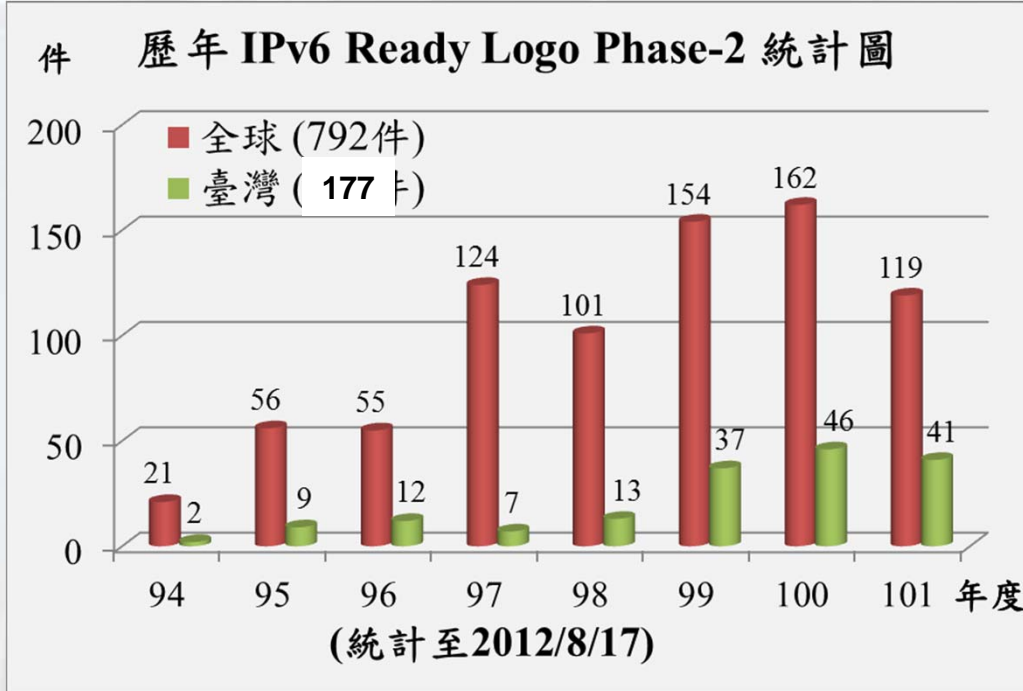
Dual Stack FTTx Trial Service Started from Jan. 1, 2011



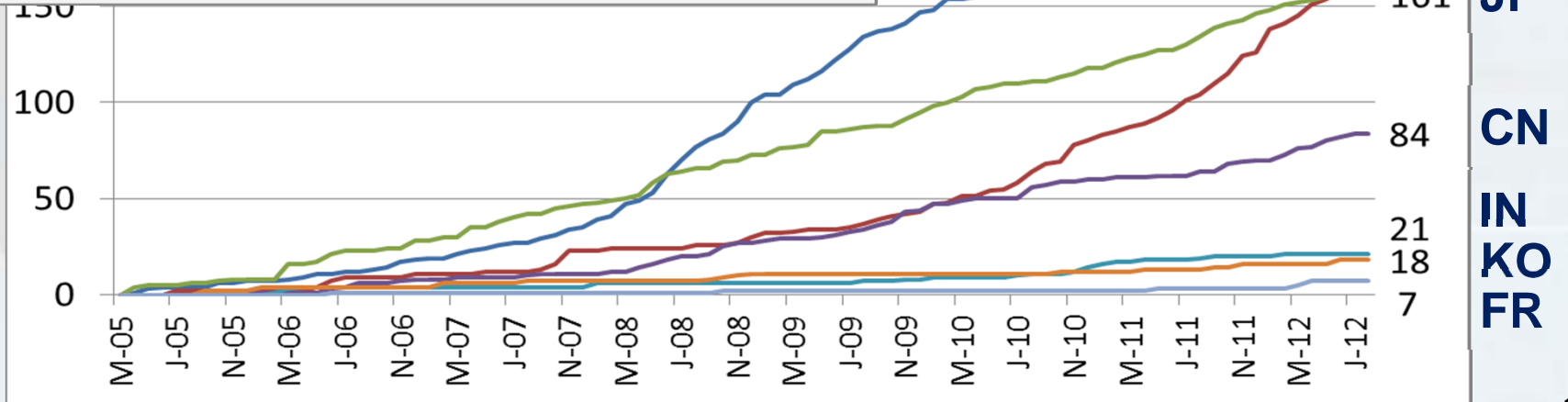
Island-wide Trial Operation of IPv6 Service Since 2011



# IPv6 Ready Logo P2 Products



**IPv6 Ready Logo Phase-2  
Taiwan has 51 certified in  
2012, totally 177, rank #2**





# IPv6 Ready Logo Certification Testing Lab





# Applications & Services Development

- **Phase I Program**
  - **VoIPv6**, EcoGridv6, Carv6, Personv6, Campusv6, Healthcarev6, IPTV, Energy Saving
- **Phase II Program**
  - IPv6 video streaming platform
  - Flooding and mudslide forecasting
  - IPv6 RFID sensor and navigation (IoT over IPv6)
  - IPv6 healthcare and physiological signal monitoring system
  - Live E! IPv6 guesthouse weather sensor



# IPv6 P2P IPTV Services

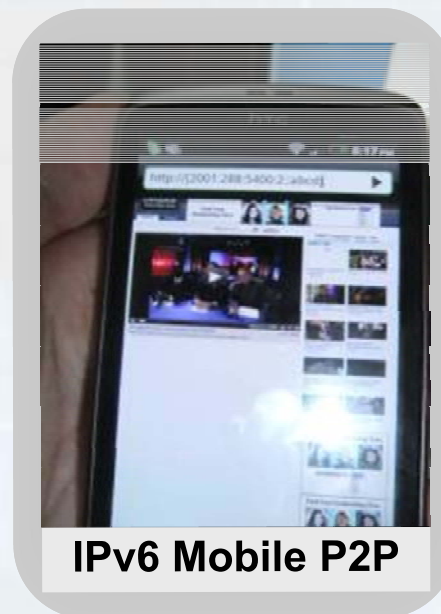
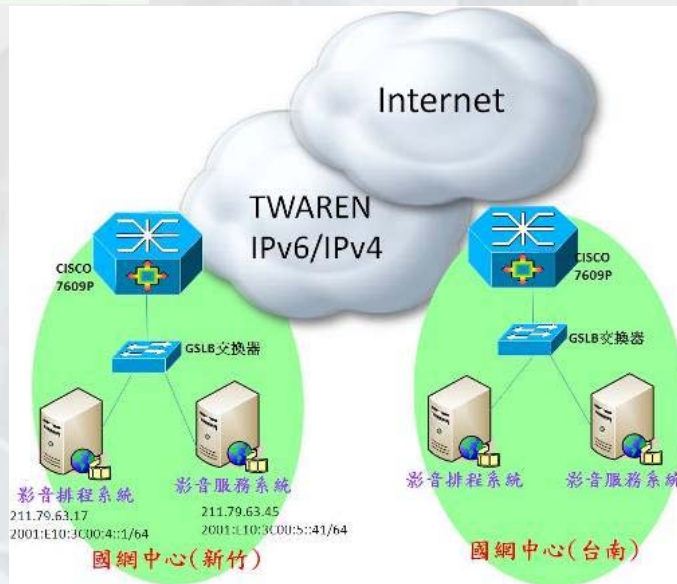


Live broadcasting of ophthalmic surgery video from Czech hospitals to Taiwan **over IPv6**



MLB Live broadcasting **over IPv6**

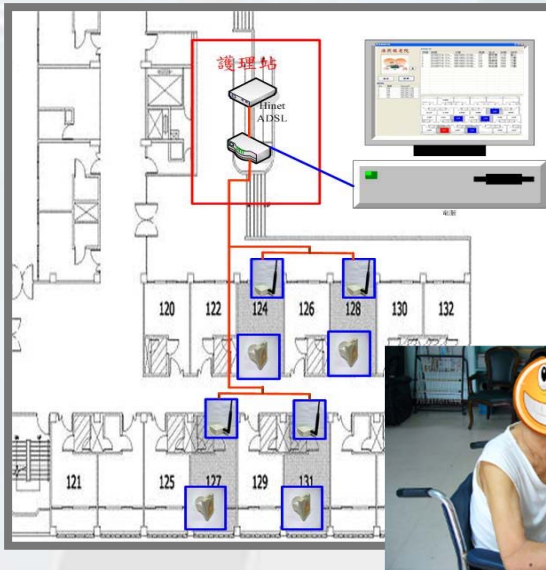
Global Server Load Balance and Redundancy System



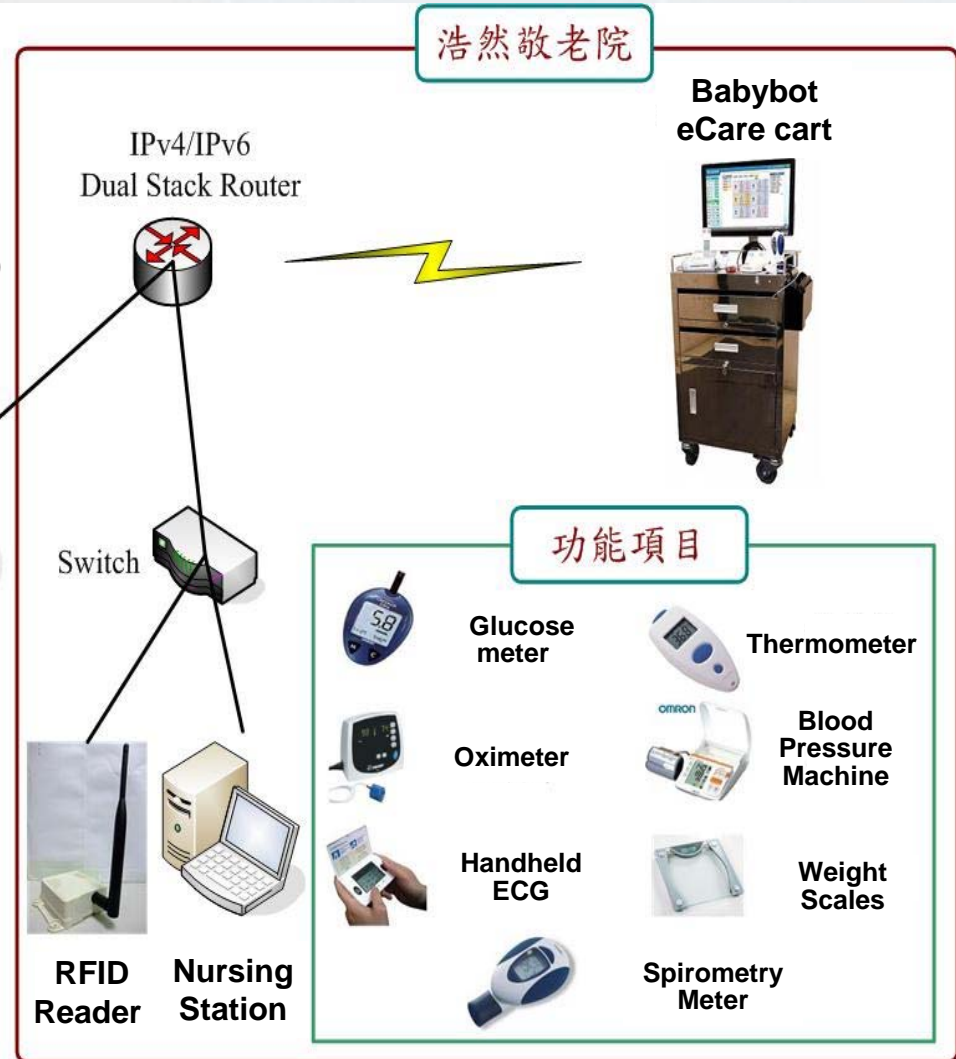
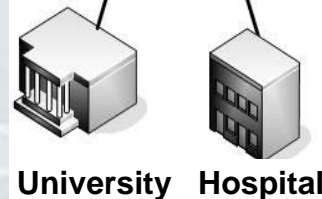
IPv6 Mobile P2P



# eHealthCare RFID over IPv6



RFID Radios with active fall sensor (G-sensor)

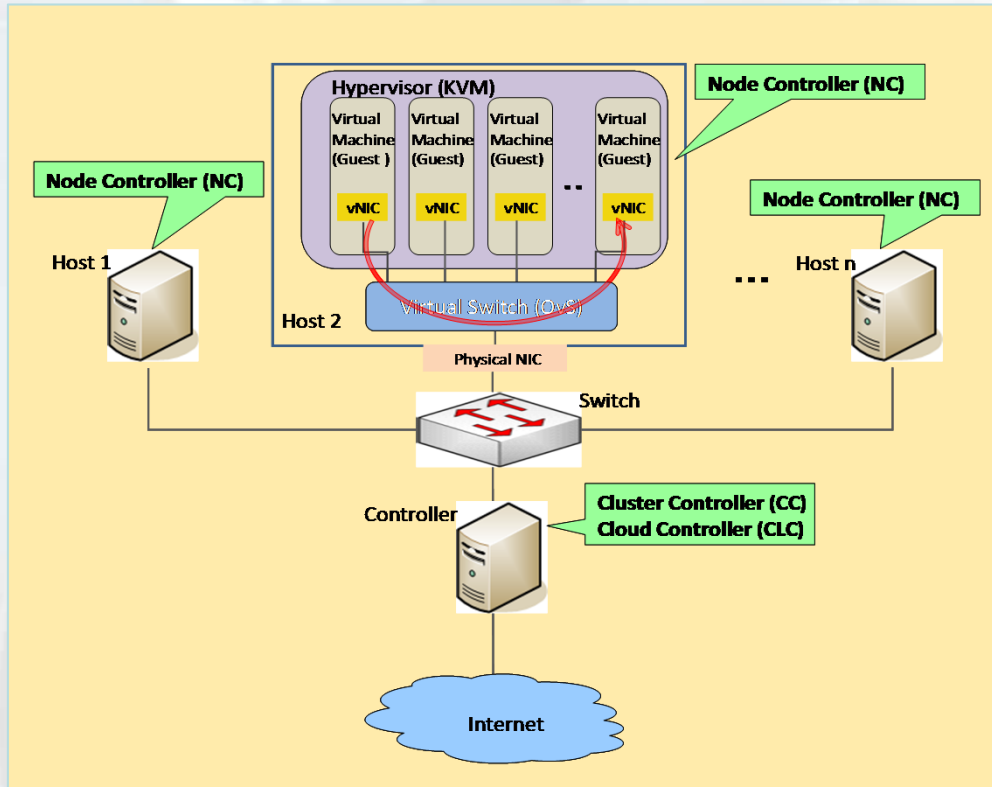


- **U-Healthcare Service Platform**
- **RFID Notification System for Getting Out of Room**
- **Active RFID Voice Notification System for Elder Falls**





# IPv6 Cloud and Virtual Machine Services

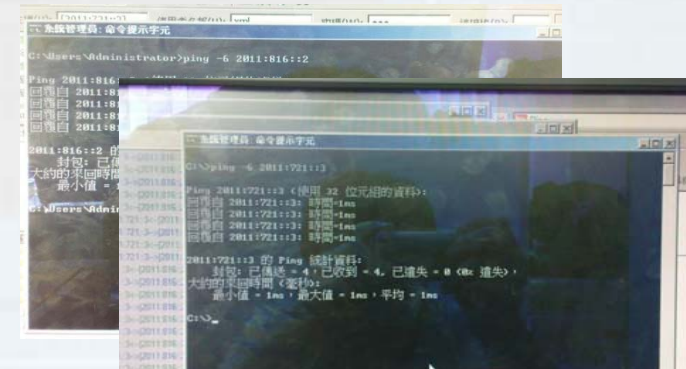


## IPv6 Cloud and Virtual Machine Services

- A demo site for IPv6 advanced application.
- Provide a testbed for ICPs to adopt IPv6.



IPv6 service with Android CPE



Mcloud service for education

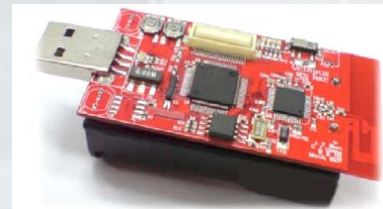
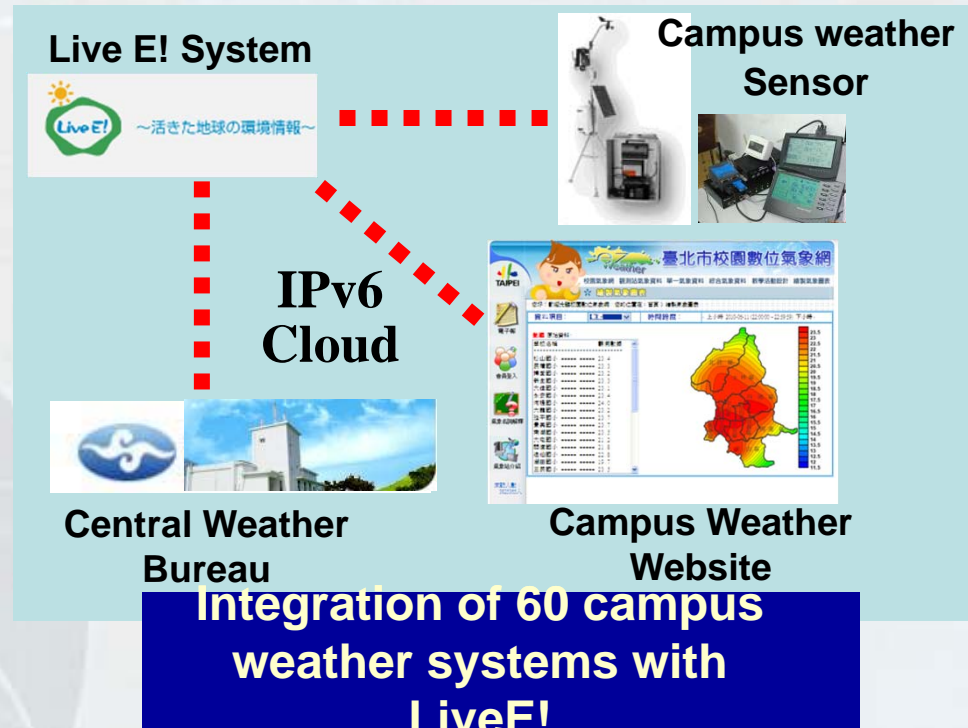


# IPv6 Smart Objects and Sensors Network

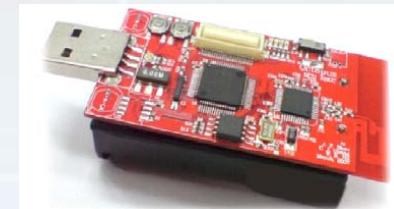
- IPv6 Protocol for Smart Object
- 6LoWPAN over Octopus II platform
- Joint project with LiveE!



IPv6 and smart grid project with Taipower



802.15.4  
IPv6 Protocol

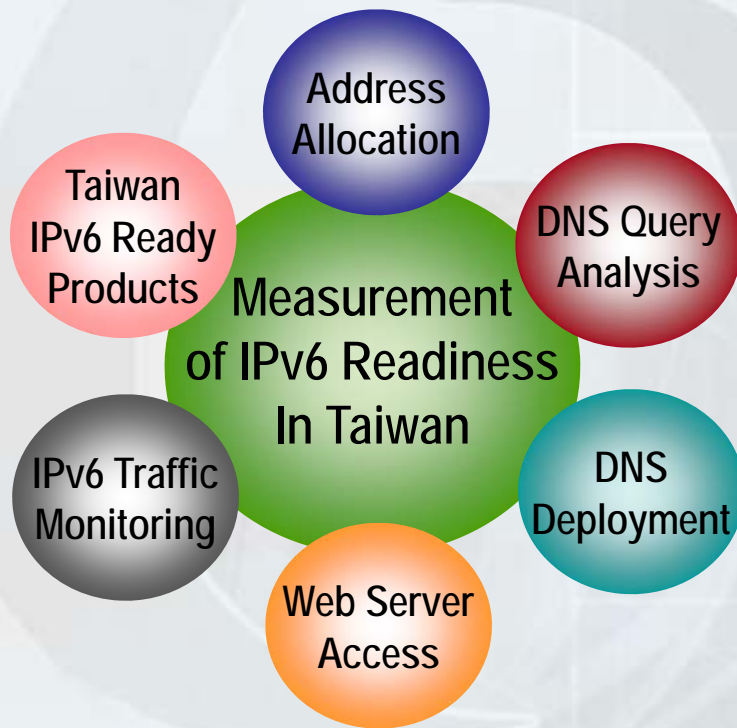


Data collection with Contiki O.S. in smart building

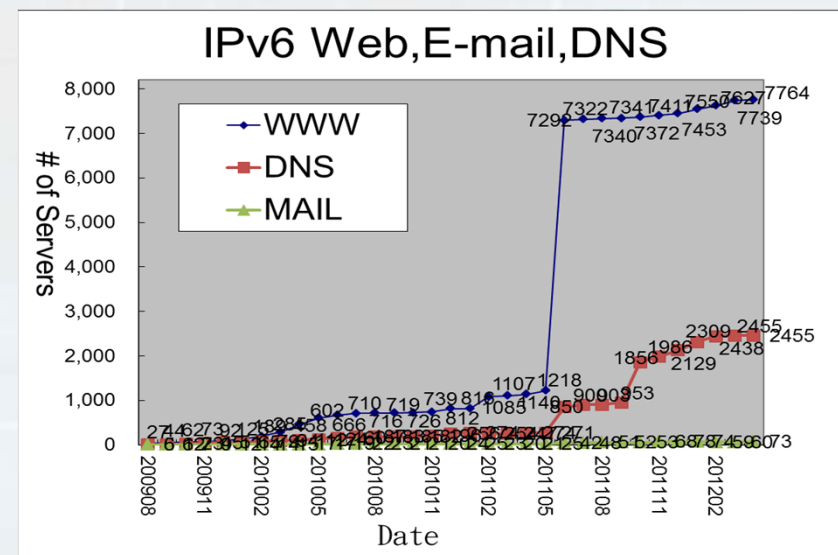


# Taiwan IPv6 Readiness Survey

- <http://v6readiness.ipv6.org.tw/>
- <http://v6metric.ndhu.edu.tw/>
  - IPv4: 134.208.9.115
  - IPv6: 2001:e10:c00:2:20c:29ff:fee2:2ba1



IPv6 Readiness Items	May-11	May-12	Growth
International IPv6 Traffic (Mbps)	109	167	153%
IPv6 Server	1,435	10,292	717%
IPv6 / IPv4 DNS Query Ratio	0.14%	0.78%	557%
IPv6 Ready Logo P2 Products Qty.	92	158	172%



Source: Taiwan Network Information Center (TWNIC)



# IPv6 Portal and Training Materials

- IPv6 Portal and E-learning ([www.ipv6.org.tw](http://www.ipv6.org.tw))



- IPv6 Training Material



## Training Course

Basic IPv6 Technology

Advanced IPv6 Technology

IPv6 Routing & Firewall Lab

Windows Server Lab

Linux Server Lab





# IPv6 Taiwan Directory

<http://v6directory.twnic.net.tw> 7,779 Websites since 2010/7/30

說明	IPv6網站名錄	新增IPv6網站	查詢IPv6網站	FAQ		
序號	類別	所屬單位	網站名稱[點選可查詢網站]	IPv6位址	登錄時間	IPv6連線狀態
1	個人	個人	<a href="http://www.xyz1943.idv.tw">http://www.xyz1943.idv.tw</a>	2001:5c0:1000:b::7e0b	2012-06-10	正常運作
2	教育	亞洲大學	<a href="http://v6web.asia.edu.tw">http://v6web.asia.edu.tw</a>	2001:288:5018:6031::222	2012-06-06	斷線狀態
3	教育	基隆市中正國小	<a href="http://www.ccps.kl.edu.tw">http://www.ccps.kl.edu.tw</a>	2001:288:2424::1	2012-06-06	正常運作
4	教育	萬能科技大學資訊工程系	<a href="http://www.csie.tw">http://www.csie.tw</a>	2001:470:19:4c4:215:5dff.fe36:3e00	2012-06-06	斷線狀態
5	公司	Dennis Lee	<a href="http://twipv6.com">http://twipv6.com</a>	2001:e10:6840:21:20c:29ff.fe5c:6195 2001:e10:6840:21:409::1	2012-06-03	正常運作
6	公司	中華電信股份有限公司	<a href="http://www.cht.com.tw">http://www.cht.com.tw</a>	2001:b000:180:3::136	2012-05-31	正常運作
7	教育	雲林縣莿松國民小學	<a href="http://joomla.nses.ylc.edu.tw">http://joomla.nses.ylc.edu.tw</a>	2001:288:6200:269::197	2012-05-30	正常運作
8	教育	基隆市隆聖國小	<a href="http://www.lspss.kl.edu.tw">http://www.lspss.kl.edu.tw</a>	2001:288:2400:2::27	2012-05-24	正常運作
9	教育	南投縣草屯鎮雙冬國小	<a href="http://www.stps.ntct.edu.tw">http://www.stps.ntct.edu.tw</a>	2001:288:c2bb::1	2012-05-17	斷線狀態
10	教育	基隆市仁愛區尚智國民小學	<a href="http://www.szps.kl.edu.tw">http://www.szps.kl.edu.tw</a>	2001:288:2428::1	2012-05-17	正常運作
11	教育	嘉義縣教育網路中心	<a href="http://教科書採購.台灣">http://教科書採購.台灣</a>	2001:288:6600:70::117	2012-05-10	正常運作
12	教育	東海大學	<a href="http://nms.thu.edu.tw">http://nms.thu.edu.tw</a>	2001:288:5009::118	2012-05-09	正常運作
13	政府	經濟部	<a href="http://www.moea.gov.tw">http://www.moea.gov.tw</a>	2001:4420:6003:12::13	2012-05-08	斷線狀態



# Taiwan IPv6 UP Program by Executive Yuan



# Motivation of Taiwan IPv6 Initiative

- **Why did we take the IPv6 initiative this Jan.?**
  - Face the fact of IPv4 address exhaustion.
  - Face the rapid growth of IPv6 services.
  - Let government be the driving wheel of IPv6 upgrade.
- We made a proposal of IP Network Development Strategies to government last Dec. And then the government launched “IPv6 UP Program” subsequently.
- Challenge : Based upon our past experience, how to find cost-effective Strategies to have a seamless transition



# The Goal of IPv6 UP Program

- Smoothly upgrade Government Service Network (GSN) to IPv6
  - Upgrade the first half of public network services (Web, DNS, Email) to be dual stack enabled **2012-2013**
  - Upgrade the second half of public network services to be dual stack **2014-2015**
- Encourage the research and development of IPv6 enabled appliances and services
- Encourage and stimulate the creation of intelligent IPv6 applications





# Strategies of IPv6 Initiative

- **Strategy 1**: **Make a survey** to find the problems and difficulties.
  - From small scale to large scale.
- **Strategy 2**: Define ***the standard operating procedure (SOP)*** of the IPv6 upgrade for major Internet services.
- **Strategy 3**: Encourage ISPs to provide ***dual-stack or tunneling for the IPv6 network connection.***
- **Strategy 4**: **Technical training courses** for IPv6 professional cultivation.



# The Public Network Services Survey

- **Principle** : Make a survey of public network service systems and their related hardware/software.
- **Stage 1**( Preparation) : Establish 5 standard operating procedures (SOP) of IPv6 upgrade for DNS, WEB, Email, FTP, Network services and survey data management system including the data acquisition authoring and on-line help tools.
  - technical trial to verify these SOPs.
- **Stage 2**( Launch) : Make a proposal of IPv6 deployment survey plan for government agencies.



# The Public Network Services Survey (cont.)

- **Stage 3** : Pre-survey trial (a small scale survey) for 6 voluntary government agencies
- **Stage 4**(Checking) :
  - Revise the plan according to the feedback
  - technical training
- **Stage 5** : Full scale survey
  - Data analysis.
- **Stage 6**: Make a summarized upgrade proposal.
- Till now, there are about 5,556 network services in the government agencies survey.



# IPv6 Upgrade Management System

1. Network survey data collection and checking

2. Analyze and define the upgrade plan

3. Monitor and verify the upgrade program

表一：對外服務系統-台網中心IP租

填寫清查資料		提交清查資料		依年度選取		服務系統統計		設備資料統計		提交採購清單		行動服務應用	
填寫清查資料 下載空白表單 上傳csv表格 下載已填寫表單 更改密碼		資料檢查 提交清查資料 重要說明		全部 2012年 2013年 2014年 2015年 2016年或以後 已經升級		升級清查統計 各服務類別統計 (下屬機關統計) 各機關填報進度 各機關升級年度 各機關服務類別 各機關主次服務		各服務設備類別 各服務設備升級 依升級方式統計 各類別交叉統計 軟硬體設備列表 (下屬機關統計) 依設備類別統計 依升級年度統計 依升級方式統計 各類別交叉統計		填寫採購清單 提交採購清單 列印採購清單 重寄驗證碼			
<input type="checkbox"/>	1	Email	Email				提供本館對外官網。	http://	依設備類別統計		N	Y	N
<input type="checkbox"/>	2	DNS	DNS				提供本館圖書資訊供民	http://	依升級年度統計		N	Y	N
<input type="checkbox"/>	3	Web	資訊部全球資訊網				提供本館對外官網。	http://	依升級方式統計	du.tw	Y	Y	N
<input type="checkbox"/>	4	Web	圖書自動化前台查詢				提供本館圖書資訊供民	http://	各類別交叉統計	nl.edu	Y	Y	N
<input type="checkbox"/>	5	Web	圖書自動化後台管理				提供本館圖書自動化系	http://hylib.ksml.edu.tw/			Y	Y	N



## Current status – participated org.

	<b># of organs</b>	<b># of units involved in survey</b>	<b># of units complete the survey</b>	<b>% of completion</b>
<b>Office of the President</b>	1	1	1	100%
<b>The Legislative Yuan</b>	1	1	1	100%
<b>The Examination Yuan</b>	1	7	7	100%
<b>The Control Yuan</b>	1	2	2	100%
<b>The Executive Yuan</b>	1	1	1	100%
<b>Ministries of the Executive Yuan</b>	9	186	182	98%
<b>Commissions of the Executive Yuan</b>	28	116	110	95%
<b>Local Governments</b>	22	490	452	92%
<b>Subtotal</b>	<b>64</b>	<b>804</b>	<b>756</b>	<b>94%</b>

Date : 2012/6/19

# Expected IPv6 ready for Service Systems

**Totally 5,355 service. Upgraded before 2013 is 62%, before 2015 is 92%**

Type of Service	Web	Email	DNS	FTP	Other	Total	Upgrade percentage by year					Total
							Web	Email	DNS	FTP	Other	
Already Ready	11	1	6		12	30	0.30%	0.20%	0.11%		2%	0.60%
Year 2012	276	49	55	1	29	410	8%	8%	11%	2%	7%	8%
Year 2013	1,783	436	363	20	273	2,875	58%	76%	79%	51%	53%	62%
Year 2014	309	59	53	3	51	475	67%	86%	89%	59%	62%	71%
Year 2015	884	50	33	15	160	1,142	92%	93%	95%	95%	89%	92%
Year 2016	238	38	18	2	62	358	99%	99%	98%	100%	100%	99%
TBD	52	4	9			65	100%	100%	100%	100%	100%	100%
小計	3,553	637	537	41	587	5,355						

Date:2012/6/19



# Expected IPv6 ready for Service Systems

	Total Servers	IPv6-enable	% of IPv6-enable	IPv6 Ready	# of Upgrade on 2012	# of Upgrade on 2013	# of Upgrade on 2014	# of Upgrade on 2015	# of Upgrade on 2016
Server System	5,560	4,155	75%	142	570	3,053	454	891	450
Server Software	5,640	3,628	64%	159	564	3,094	418	992	413
Firewall	1,690	1,045	62%	70	188	1121	93	143	75
Load Balance	452	210	46%	5	33	342	22	43	7
Network Device	2,874	1,347	47%	105	411	1750	190	271	147
Others	2,489	1,270	51%	27	163	1431	196	473	199
<b>Total</b>	<b>18,705</b>	<b>11,655</b>	<b>62%</b>	<b>508</b>	<b>1929</b>	<b>10791</b>	<b>1373</b>	<b>2813</b>	<b>1307</b>

Date:2012/6/17



# WWW Server systems distribution

	<b>Server System</b>	<b>Quantity</b>	<b>Percentage</b>
1	IIS6	1463	42%
2	Apache	820	23%
3	IIS7	587	17%
4	IIS5	223	6.3%
5	Tomcat	128	3.6%
6	Oracle Web Server	92	2.6%
7	WebSphere	61	1.7%
8	JBoss	29	0.8%
9	Sunweb	27	0.8%
10	TrendMicro	17	0.5%

Date : 2012/6/19





# Email Server systems distribution

	<b>Server System</b>	<b>Quantity</b>	<b>Percentage</b>
1	Exchange	139	27%
2	Sendmail	67	13%
3	Mail2000	64	12%
4	Postfix	48	9.2%
5	Omail	28	5.3%
6	RaidenMAILD	28	5.3%
7	Open WebMail	18	3.4%
8	SPAM SQR	15	2.9%
9	Share Tech	14	2.7%
10	HGIGA CCmai	13	2.5%

Date : 2012/6/19



# DNS Server systems distribution

	<b>Server System</b>	<b>Quantity</b>	<b>Percentage</b>
1	BIND	205	42%
2	Windows 2003	152	31%
3	Windows	58	12%
4	Windows 2008	44	8.9%
5	Windows 2000	29	5.9%
6	Smart DNS	1	0.2%
7	CITRIX Netscale	1	0.2%
8	NIOS	1	0.2%
9	Infoblox	1	0.2%
10	RaidenDNSD	1	0.2%

Date : 2012/6/19



# IPv6 Training Program in 2012

	Training Course	Training period	Organized	Implement	Trained people
<b>Introduction Program</b>	IPv6 Basic Technology	Mar. to Aug. 1 day training	11	7	553
	IPv6 Advanced Technology	May. to Sep. 1 day training	8	3	325
<b>hand on Program</b>	IPv6 Routing and Firewall Lab	Apr. to Nov. 1 day training	14	5	117
	Windows Server IPv6 Lab	Apr. to Nov. 1 day training	14	5	120
	Linux Server IPv6 Lab	Apr. to Nov. 1 day training	14	3	68
<b>Special Program</b>	By request	Jul. 2 day Training	2	0	0
<b>Total</b>			<b>63</b>	<b>23</b>	<b>1,183</b>



# Finding from Network Services Survey

- Most of government IT staffs are willing to have the IPv6 UP Program. The progress of network services survey is doing smooth.
- Most of IT staffs are lack of IPv6 skill. About 20% data of survey are defective.
- Start from IPv6 test bed is a good approach to culture IPv6 experience with addressing, routing and server configuration.
- Most concerned about issues are security and budgeting.



# Conclusion

- **Cost-effective strategies are successful.**
- Government's IPv6 transition give great motivation for the ICT industry to develop IPv6 service.
- We will continuously encourage the research and development of IPv6 enabled appliances and services.
- We will continuously encourage and stimulate the creation of intelligent IPv6 applications.

*Thank you!*

