IPv6 to the EDGE

Managing the Transition from IPv4 to IPv6: Interoperability is the Keyword

Malaysian IPv6 Scene: Background

The main driver for IPv6 implementation in TM is to support the Malaysian Government MyICMS 886 (Malaysian Information, Communications and Multimedia Services 886) strategy, which highlights IPv6 as one of the essential infrastructure:

Services	Infrastructure	Growth
1. High Speed Broadband 2. 3G & Beyond 3. Mobile TV 4. Digital Multimedia Broadcasting 5. Digital Home 6. Short Range Communications (e.g. RFID-based) 7. VoIP/Internet Telephony 8. Universal Service Provision	Hard 1. Multiservice Convergence Networks 2. 3G Cellular Networks 3. Satellite Networks Soft **4. Next Generation Internet Protocol (IPv6)** 5. Home Internet Adoption 6. Information & Network Security 7. Competence Development 8. Product Design & Manufacturing	1. Content Development (e.g. education, entertainment, games) 2. ICT Education Hub 3. Digital Multimedia Receivers (set top box) 4. Communication Devices (e.g. VoIP phones) 5. Embedded Components, Devices (e.g. RFID) 6. Foreign Ventures

NEW CHALLENGES • NEW OPPORTUNITIES

National IPv6 Implementation Plan

Starting 2006	2007-2008	2008-2010
• MyREN connected to other NRENs using IPv6. • IPv6 addresses issued to all MYREN members. • **ISPs conducted self-audits with respect to IPv6.** • IPv6 Awareness Programmes were started by MEWC and NAv6. • Plans to create an IPv6 Roadmap (this document) for Malaysia were initiated. *Source: National Strategic IPv6 Roadmap, 10 June 2008*	Milestones: • MEWC started migrating their core networks to IPv6. • Initial drafts and intermediate drafts of this roadmap were completed. • MCMC completed the Phase 1 compliance audit of Malaysian ISPs. **Targets for ISPs:** • **IPv6 network backbone should run on dual-stack.** • Offer IPv6 for mobile and 3G services in selected areas of the nation. • MyREN to be working on native IPv6 links with other NRENs.	**Targets for ISPs:** • **Commercial roll-out of IPv6 service by 2008.** • **Broadband services to be IPv6 and IPv4 dual-stack for all broadband users.** Targets for Govt. Agencies: • Core networks to support IPv6 features. • E-government infrastructure is IPv6-enabled by 2008 – 2010. • Start converting all existing Internet applications and services to run on IPv6 and on dual-stack. • Planning and starting IPv6 dual-stack migration; completion by 2010.

NEW CHALLENGES • NEW OPPORTUNITIES

National IPv6 Compliance Audit Roadmap

	Phase 1	Phase 2	Phase 3
Scope	i. Basic connectivity ii. IPv6 application functionality iii. Transition mechanism	i. Inter-ISP connectivity	i. Commercial network services ii. Advanced network services iii. Broadband services (Wi-Fi, 3G etc.) iv. Full connectivity
Remark	TM had successfully underwent the phase 1 audit on the 27 March 2007	Phase 2 self-audit December 2009	Phase 3 audit March 2010

IPv6 Compliance Audit Phase 1 Status

IPv6 Compliance Audit conducted by National Advanced IPv6 (Nav6) on 27th March 2007 had shown TM to have successfully complied with all IPv6 test cases.

Test Criteria	Result	Compliance
- IPv6 address assignment - Neighbour Discovery Protocol (NDP) - Path MTU Discovery (PMTUD)	All tests were completed successfully	YES
Establish BGP (Border Gateway Protocol) peering and exchange of prefixes	All tests were completed successfully	YES
DNS extension to support IPv6	All DNS queries were resolved except for reverse DNS lookup for local hosts. In addition, native IPv6 DNS queries were also resolved.	YES

IPv6 Compliance Audit Phase 2 Status

Test Criteria	Result	Compliance
Each ISP must secure the IPv6 Forum ISP logo (mandatory) from http://www.ipv6forum.com/ipv6	All tests were completed successfully	YES
Each ISPs will demonstrate at least 1 peering for global connectivity and is strongly recommended to establish local peerings over IPv6. Test items include ping, traceroute and IPv6-enabled website.	All tests were completed successfully	YES

NEW CHALLENGES • NEW OPPORTUNITIES

2nd Phase IPv6 Compliance Audit Results

- 24th February 2004 – obtained IPv6 block from APNIC [2001:OE68:: /32]
- TM secured the IPv6 Forum ISP logo
- An IPv6-enabled website is up and running:
  - www6.tm.net.my [2001:e68:2001:1:202:188:100:225]

NEW CHALLENGES • NEW OPPORTUNITIES

2nd Phase IPv6 Compliance Audit Results: Demonstrate Global Peering Using IPv6

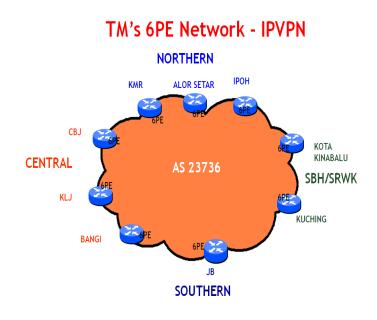Traceroute test using NTT Communications Looking Glass

NTT America - Customer Support - Looking Glass - Mozilla Firefox

File   Edit   View   History   Bookmarks   Tools   Help

https://www.us.ntt.net/support/looking-glass/

Loading... | Most Visited | Getting Started | Peti Masuk (60) | Friends | Topics for Pregnancy,... | Latest Headlines | View Course | http://219.93.176.21...

NTT Communications Looking Glass

Router:
London

Query:
Traceroute

FQDN or IP Address

○ Your current IP Address: 58.27.115.117

● Specify an IP Address (IPv4 or IPv6) 2001:e68:2001:1:202:188:100:225

○ Specify FQDN

[Submit]   [Reset]

Query Results:
Router: London
Command: traceroute 2001:e68:2001:1:202:188:100:225

Disclaimer: Traceroute is a useful tool for determining the route a packet takes, but it should not be used as an accurate measure of network performance. For more information please view the Traceroute Disclaimer.

```
traceroute6 to 2001:e68:2001:1:202:188:100:225 (2001:e68:2001:1:202:188:100:225) from 2001:728:0:1000::1c, 64 hops max, 12
 1  po-2.r00.londen03.uk.bb.gin.ntt.net (2001:728:0:2000::5a)  1.420 ms  0.852 ms  0.876 ms
 2  fa-0-0.r00.londen03.uk.b6.gin.ntt.net (2001:728:0:7001::b600)  0.687 ms  0.570 ms  0.484 ms
 3  tu-0.kpn.londen03.uk.b6.gin.ntt.net (2001:728:0:5000::116)  15.554 ms  15.669 ms  15.714 ms
 4  e0-0-0.6b2.AMS7.Alter.net (2001:7f8:1::a501:2702:1)  10.986 ms  10.995 ms  11.082 ms
 5  gw6.dca6.alter.net (2001:600:8:2::2)  139.225 ms  123.626 ms  123.602 ms
 6  2600:809:10f::2 (2600:809:10f::2)  374.106 ms  380.320 ms  379.719 ms
 7  2600:809:10f::2 (2600:809:10f::2)  375.419 ms  375.436 ms  381.415 ms
 8  2001:e68::22 (2001:e68::22)  506.847 ms  376.905 ms  379.530 ms
 9  sputnik.tm.net.my (2001:e68:2001:1:202:188:100:225)  386.000 ms  380.665 ms  380.027 ms

(master)
```

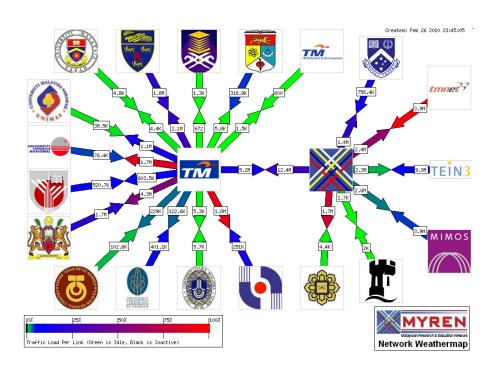# 2nd Phase IPv6 Compliance Audit Results: Demonstrate Global Peering Using IPv6

Ping test using NTT Communications Looking Glass

Current Status of IPv6 Implementation in TM

- Private network offering VPN services to corporate customers over MPLS backbone:
  - IPv6 is enabled at nine Provider Edge (6PE) routers nationwide (using dual-stack)
  - Assigned IPv6 address space 2001:4470:: /32
  - Currently, serving MyREN (Malaysian Research and Education Network)
- MyREN is high-capacity network connection between participating local and international universities, research organisations and scientific laboratories.
- Enabling researchers to run data-intensive applications, share computing power and run advanced applications within Malaysia as well as overseas.

TM's 6PE Network - IPVPN
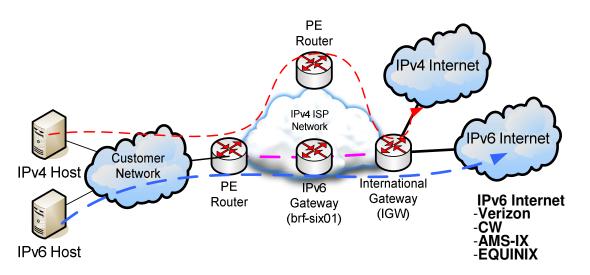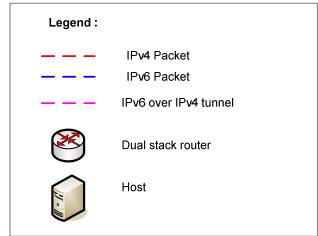
NEW CHALLENGES • NEW OPPORTUNITIES

Current Status of IPv6 Implementation in TM

Public internet network offering internet services to corporate customers via IPv6 tunnelling across IPv4 network.

- Assigned IP address space 2001:E68::/32
- Currently serving Multimedia University (MMU) , Malaysia University of Science & Technology (MUST), TM R&D Pte. Ltd. and Celcom as trial customers
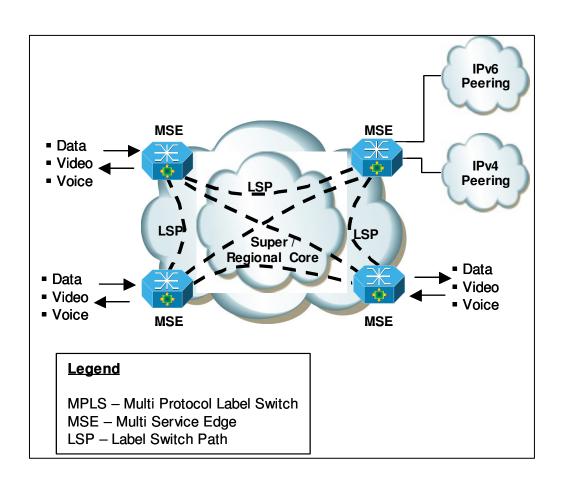
Current Status of IPv6 Implementation in TM

IPv6 peering sessions established globally with international service providers.

IPv6 peering through public switches (since 2007)	• LINX, London – 21 peering partners including Hurricane Electric, EuroNet, RETN • DE-CIX, Frankfurt – 14 peering partners including Init Seven AG, Colt, BIT BV, Hurricane Electric • AMS-IX, Amsterdam – 19 peering partners including Portugal Telecom, Hurricane Electric, NetCologne • Equinix, Ashburn, US • Equinix, San Jose
Direct connection through dual-stack	• KKDI (2007) – for testing purposes • TNZI (since 2008) • C&W (since 2008) • Googlev6 • Near future connection with Googlev6/YouTube • Future connection with all PPM (Pacific Partners Meeting) members • And the list is growing
IPv4 tunnelling	• NTT MSC (local peering) • Verizon US

NEW CHALLENGES • NEW OPPORTUNITIES

Future of IPv6 Implementation in TM

TM

Legend

MPLS – Multi Protocol Label Switch
MSE – Multi Service Edge
LSP – Label Switch Path

Key attributes in TM NGN IP Core Network:

- 2-layer architecture comprising of Multi Service Edge (MSE) and Super/Regional Core

- All MSE runs in dual stack mode supporting IPv4 and IPv6 (at 28 sites)

- MSE receives and terminates services such as Data, Video and Voice either in IPv4 or IPv6 format

- Super/Regional Core transports the IPv4 and IPv6 services via MPLS tunnel

The Current Status of IPv4 Address Pool in Malaysia

Start IP	Length	Date	Usage	Assignment status
58.26.0.0	/16	2005-03-03	32%	Expand graph - 32% used
58.27.0.0	/17	2005-03-03	27%	Expand graph - 27% used
218.208.0.0	/16	2003-03-14	84%	Expand graph - 84% used
219.95.0.0	/16	2003-03-14	100%	Expand graph - 100% used
219.94.0.0	/17	2002-11-11	80%	Expand graph - 80% used
219.92.0.0	/15	2002-04-26	96%	Expand graph - 96% used
210.187.128.0	/17	2001-08-20	100%	Expand graph - 100% used
210.195.0.0	/16	2001-08-20	100%	Expand graph - 100% used
210.186.128.0	/17	2001-05-29	100%	Expand graph - 100% used
210.187.0.0	/17	2001-05-29	83%	Expand graph - 83% used
210.186.0.0	/17	2001-01-24	100%	Expand graph - 100% used
203.106.144.0	/20	2000-05-29	100%	
203.106.160.0	/19	2000-05-29	100%	Expand graph - 100% used
203.106.192.0	/18	2000-05-29	93%	Expand graph - 93% used
203.106.128.0	/20	2000-05-09	100%	
203.106.64.0	/18	2000-01-31	97%	Expand graph - 97% used

2001:OE68:: /32 24th February 2004

The Challenges

- End-users only care about the services, not the manner in which the services are being delivered.

- Up to service providers to make sure the transition is as smooth as possible.

- There are different classes of end-users and each class requires different approaches:

Providers of new classes of services	General public
Introduction of devices that are eating up remaining IPv4 addresses: – Set-up boxes – IPTV – Smartphones – Telemetric devices (utilities) – Automated utilities reading – Future devices Easier to convince on the urgency of the situation.	Users of: – PC – Laptop – Netbook – Smartphone – SIP phone – Other existing devices A lot harder to convince on the urgency of the situation.

Both classes represent the same challenges:

Lack of **AWARENESS**

No sense of **URGENCY**

NEW CHALLENGES • NEW OPPORTUNITIES

Moving Forward

- The necessity to raise the awareness of the public
- While waiting for the level of awareness to achieve the necessary critical mass, we need to guarantee IPv4 and IPv6 interoperability:
  - IPv4 will continue to be used for the next 10-15 years.
  - During this long transition time, both protocols should continue to be supported.
- The need to introduce a **symbolic cut-off date** for the transition from IPv4 to IPv6 in order:
  - To ensure a shorter transition period to full IPv6 networks worldwide
  - To create awareness among the public

Thank You