

How D-NET Jakarta implemented IPv6

Implementing IPv6 in a small to medium ISP

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Overview

- About D-NET
- Making decision to adopt IPv6 at D-NET
- IPv6 implementation strategies at D-NET
- Plan for transition phases
- Challenges
- Post deployment stage
- Management system
- Conclusion
- Reflection

About D-NET

- One of the first ISPs in Indonesia
- Focused on corporate customers
 - Major services are providing connectivity via wireless networks and fiber optic networks
- Services includes:
 - Dedicated Internet Connection
 - DNS, mail and web hosting
 - Data Center and some Managed Services.
- D-NET is allocated with:
 - /17 + /19 + /20 IPv4 allocation and
 - /32 IPv6 allocation.

Making decision to adopt IPv6 at D-NET

- The decision was made by our Board of Directors (BoD):
 - IPv4 address exhaustion (of course)
 - IPv6 is the future, and we must be ready for the future
 - Stay ahead of the game from other competitors
 - While others are just thinking about IPv6, we should actual implement it
- D-NET implemented IPv6 in 2006
 - It was hard to find any implementation examples back then
 - We groped our way toward adopting IPv6

IPv6 implementation strategies at D-NET

1. Requested for IPv6 allocation

- We got our first /32 IPv6 allocation on Oct 11, 2006

2. Inventory on current device assests

- Routers, Switches → mostly 7200 series.
 - <http://www.cisco.com/en/US/docs/ios/ipv6/configuration/guide/ip6-roadmap.html>
- Servers
 - OS and applications

IPv6 implementation strategies at D-NET

3. Choosing Transition Method – we chose dual stack. Why?
 - Maintain current IPv4 compatibility
 - Not much change in hardware and topology is required
 - Smoother IPv4 to IPv6 transition
 - IPv6 only network is certainly not possible!
 - Most of networks still run on IPv4
 - Can't live without IPv4!
 - IPv6 Tunneling is not scalable for production purpose.
 - Requires more complex configuration
 - More security concerns : encapsulated ipv6 traffic is uninspected by most IPv4 Firewalls.

IPv6 implementation strategies at D-NET

4. Engineer staff training

- Ask our upstream provider for an introduction of IPv6,
- Attend IPv6 Trainings held by APNIC, APRICOT, APJII
- Involve in our National IPv6 Task Force

5. Add IPv6 enabled featured as future procurement criteria

6. Zero down time in configuring IPv6

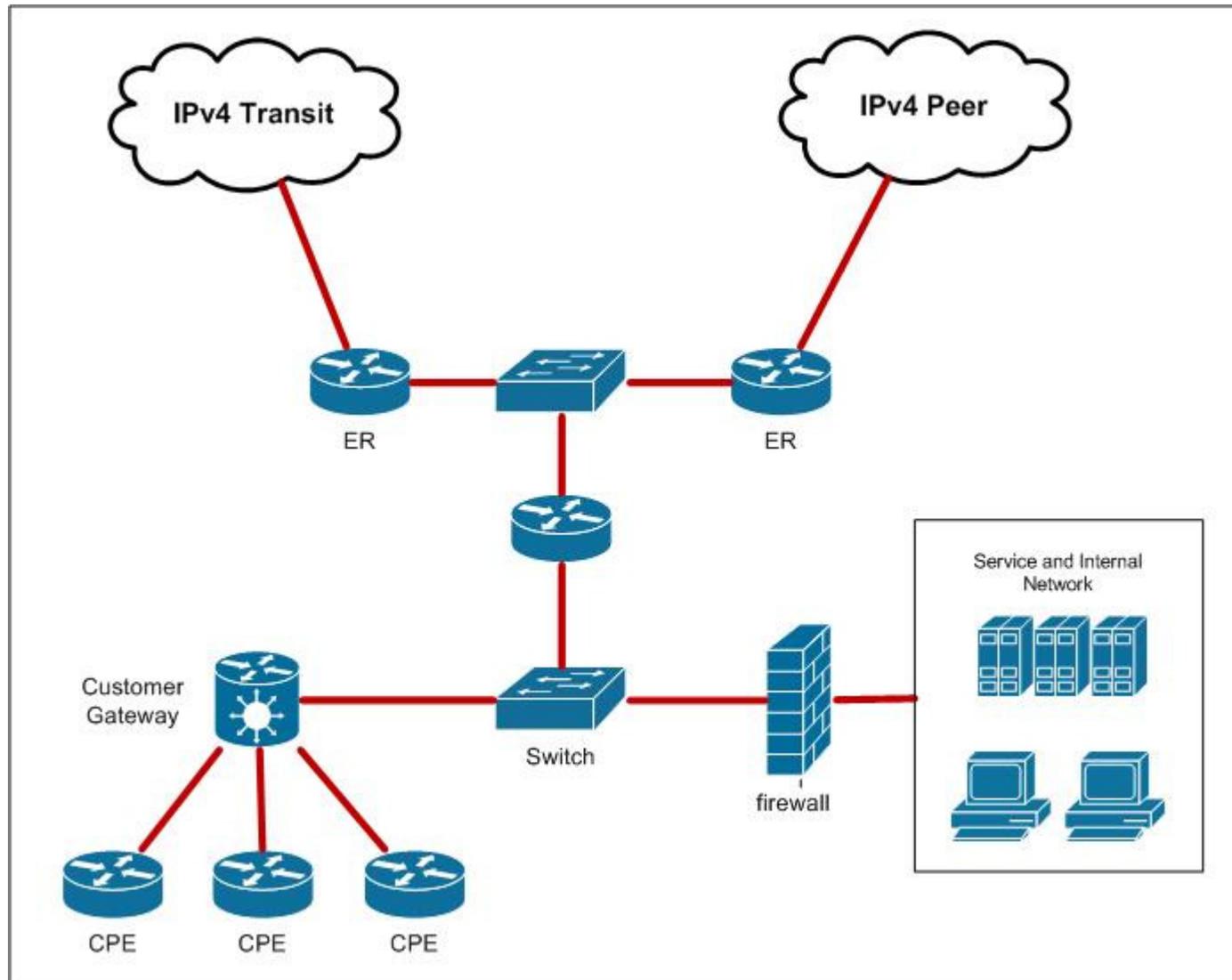
- Implement dual stack on critical devices
 - Upgrade them with correct version of OSes to enable IPv6
 - Then if IPv6 is correctly implemented no negative impact on IPv4 networks

7. Planning transition phases

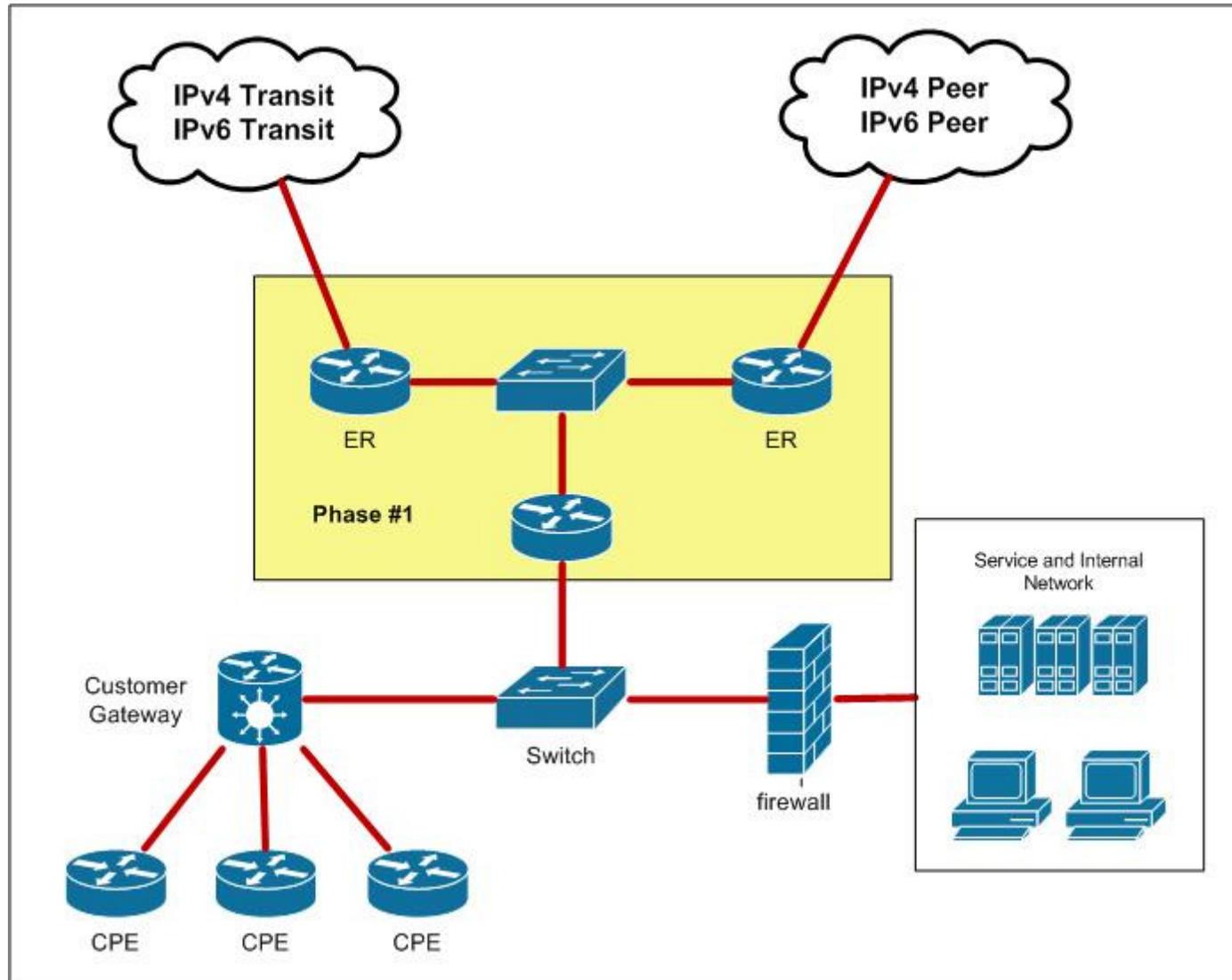
Planning transition phase

- Phase 1
 - Adopting IPv6 in our core networks
 - Estimated working time – 3 days
 - Actual working time – one day
- Phase 2
 - Adopting IPv6 in our internal network and some services
 - Estimated working time – 5 days
 - Actual working time – one day
- Phase 3
 - Adopting IPv6 at our customers end
 - This phase is still under progress

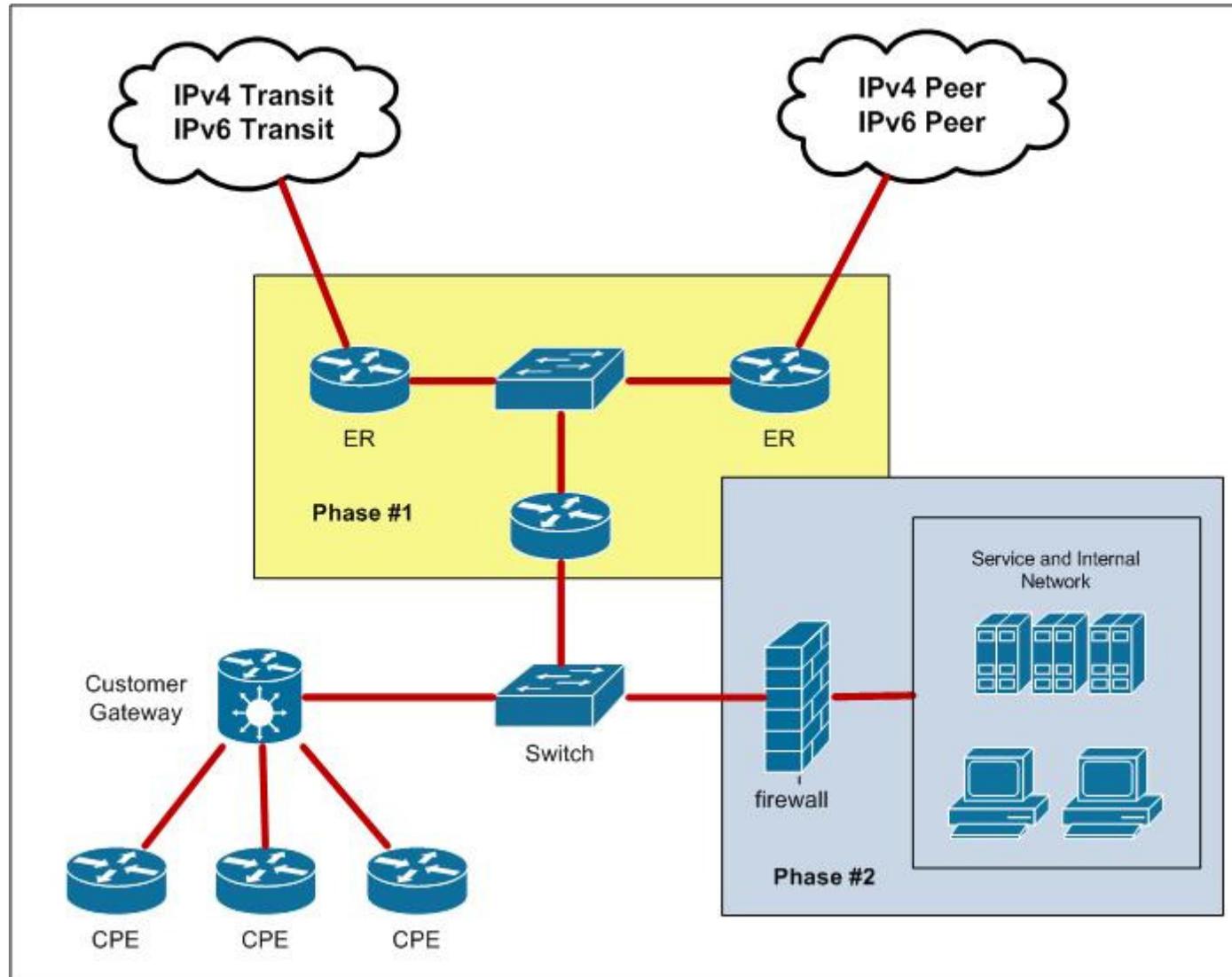
D-NET's global topology



Phase 1: Core networks



Phase 2: Internal networks



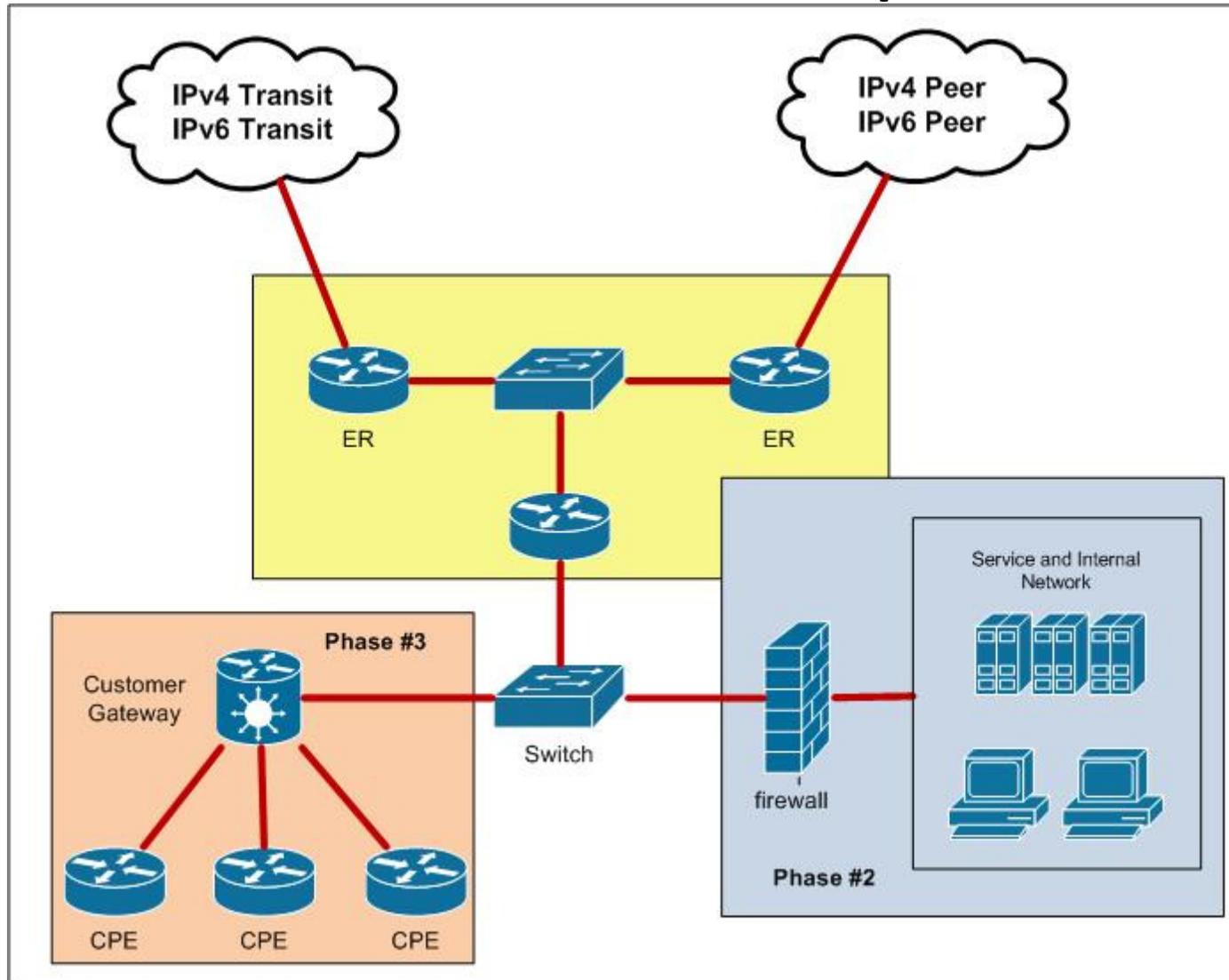
Phase 2: Internet networks

- Firewall
 - Firewall (Mikrotik ver 3.0) only partially supported IPv6 in 2006
 - Caution was required during experimenting IPv6
 - Ver 3.8 is has more IPv6 features, including firewall.
 - We configure basic ACL's in our routers, and ip6tables in our servers
- Setting up DNS:
 - Dual stack on the DNS Server
 - Configure bind to listen to IPv6 (in named.conf)
 - `listen-on-v6 {any;};`
 - Make AAAA records for your domain
 - It's that easy!

Phase 2: continued

- Setting up Apache
 - Dual stack on the servers
 - Configure httpd.conf to listen to IPv6
 - Configure the Virtual Hosts of an IPv6 Website.
 - NameVirtualHost [2001:db8::a00:20ff:fea7:ccea]:8080

Phase 3: future plan



Challenges

- Security
 - With dual stack, we applied every security rules twice to provide same security level as our IPv4 Network,
 - But our Firewall only partially support IPv6 → wait for an upgrade from the developers.
 - Depended on ip6tables.

Challenges

- Managing IPv6
 - Not many examples were available in 2006
 - Contacted other ISPs to gain some insight
 - IPv6 is abundant, can't treat them the same way as IPv4
 - RFC3177 → /48 is suggested for most customers
 - Point to point : /126
 - /40's to each area (geographically)/POP → 256 POPs.
 - First /48 in each /40 for Router loopbacks.
 - Second /48 in each /40 for Infrastructure (Servers).
 - Third /48 in each /40 reserved for ptp links
 - Forth /48 and so on are for end customers

Challenges

- Our current CRM does not support IPv6
- Our Bandwidth Management does not support IPv6
 - Our customers are mostly point to point connection, so we can limit the links.

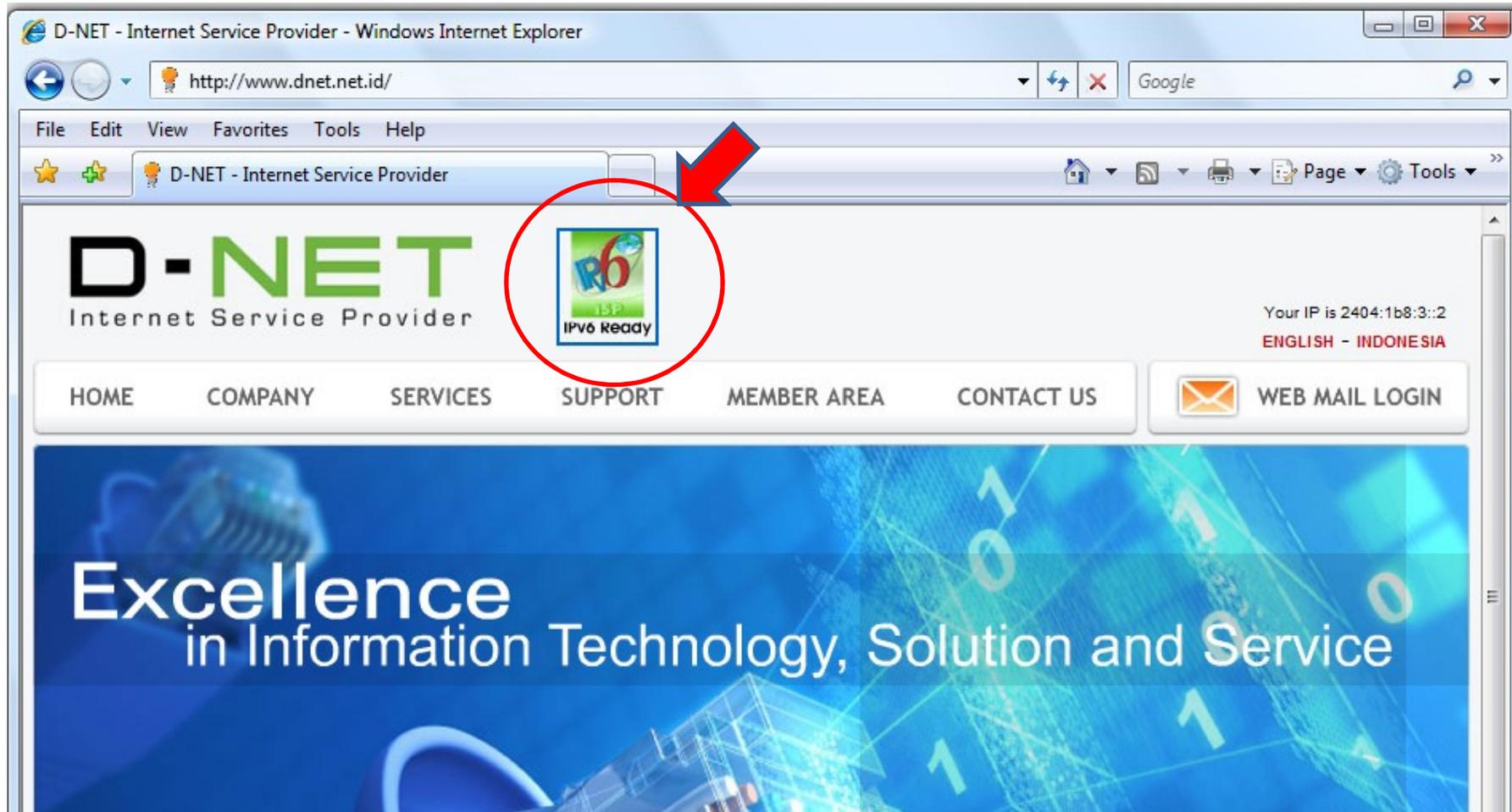
Post deploying stage 1

- Marketing
 - Obtain IPv6 Enabled ISP Logo from www.ipv6forum.com
 - You will be instructed to insert a script in your web site to check IPv6 reachability from global IPv6 network
 - If you pass the test, then you will receive a Logo ID with a unique serial number
 - Benefit of obtaining this logo
 - Exhibit growth of IPv6 enabled ISPs to the world
 - Increase awareness of IPv6 to site visitors
 - Increase awareness among D-NET staff about D-NET's forward-thinking vision
 - Increase staff confidence toward D-NET's future growth

Post deploying stage 1

- Get your IPv6 website listed
 - Let other people know you are ready with IPv6
 - Encourage other ISPs
 - Sample of ipv6 enabled website lists:
 - <http://www.ipv6.org/v6-www.html>
 - http://www.sixxs.net/wiki/IPv6_Enabled_Websites
 - <http://sixy.ch/>
 - http://www.ipv6forum.com/ipv6_enabled/isp/approval_list.php
- Educate our sales staff about IPv6
 - Help them to share IPv6 knowledge with our customers
 - Help them to increase their future vision about our business in the expanding Internet business model

IPv6 ready www logo



Get your IPv6 website listed

SixXS - IPv6 Deployment & Tunnel Broker :: Ghost Route Hunter : IPv6 DFP visibility : All - Windows Internet Explorer

http://www.sixxs.net/tools/grh/dfp/all/?country=id

Winamp Search

File Edit View Favorites Tools Help

SixXS IPv6 Deployment & Tunnel Broker :: Ghos...

www.sixxs.net

- Less than 80% of the GRH participants saw this route.
- Less than 50% of the GRH participants saw this route.
- Less than 30% of the GRH participants saw this route.

LG	Prefix	tld	NetName	Owner	AS	S	Allocated	First seen	Seen by	Last seen (*)
LG	2001:7fa:2::/48		APJII-IIX-IPv6	Asosiasi Penyelenggara Ja...		A	2003-03-04		0%	never
LG	2001:7fa:f::/48		nice-v6	National Inter Connection...		A	2005-09-29		0%	never
LG	2001:d10::/32		CBNNET-IPv6-APJII-ID	CBNNet	4787	A	2003-02-26	2005-04-21 22:02:17	100%	2009-08-09 13:17:30 2003-09-09 19:01:55
LG	2001:d68::/32		WINET-IPv6-APJII-ID	PT WIRELESS INDONESIA		A	2003-06-17	2009-06-16 21:02:30	100%	2009-08-09 13:17:30
LG	2001:dc6::/32		APJII-NIR	Asosiasi Penyelenggara Ja...	4622	A	2004-04-27	2004-05-18 09:50:35	100%	2009-08-09 13:17:30
LG	2001:de8:2::/48		apiti-vxp-idnic-id-2...	APITI - Indonesian Intern...		A	2008-04-22		0%	never
LG	2001:df0:48::/48		IPv6-DEPPERIN-ID-IDN...	Departemen Perindustrian ...		A	2009-04-09		0%	never
LG	2001:df9::/32		APRICOT2007-20070117	Asia Pacific Regional Int...	4795	A	2007-01-17	2007-01-29 05:47:23	0%	2009-03-31 22:47:28
LG	2001:e00::/32		INDOSAT-ID-20031118	INDOSATnet	4795	A	2003-11-18	2004-04-26 08:20:36	100%	2009-08-09 13:17:30
LG	2001:f20::/32		PESATID-APJII-ID-200...	PT. Pasifik Satelit Nusan...		A	2004-06-25	2004-06-27 15:40:37	0%	2008-12-09 10:02:37
LG	2001:4488::/32		TELKOMNET-20050901	PT Telekomunikasi Indones...		A	2005-09-01		0%	never
LG	2400:1400::/32		GRAMEDIA-ID-20090609	PT. GRAMEDIA		A	2009-06-09		0%	never
LG	2400:8000::/32		LINTASARTA-NET-IDNIC...	Indonesia Online Access		A	2008-11-14		0%	never
LG	2400:9800::/32		XLNET-IDNIC-ID-20090...	Excelcomindo Pratama, PT		A	2009-02-12		0%	never
LG	2400:dc00::/32		CEPATNET-ID	CepatNet		A	2009-08-06		0%	never
LG	2401:9000::/32		ASIAKOM-ID-20071217	Network Access Point and ...		A	2007-12-17		0%	never
LG	2402:9800::/32		CBNCyberNetworksIPv6...	Network Access Provider	38158	A	2008-07-17	2008-07-21 13:02:36	100%	2009-08-09 13:17:30
LG	2402:a000::/32		DETIK-IDNIC-ID-20070...	PT Detik Ini Juga	24211	A	2007-07-26	2007-09-18 11:17:26	99%	2009-08-09 13:17:30
LG	2403:8000::/32		BANDUNG-NET-20070302	Institut Teknologi Bandun...		A	2007-03-02	2007-05-21 06:17:23	50%	2009-08-09 13:17:30
LG	2404:c0::/32		TELKOMSEL-IDNIC-ID-2...	PT. Telekomunikasi Selula...		A	2006-04-10	2006-11-14 08:47:21	0%	2008-12-09 10:02:37
LG	2404:c8::/32		NTT-IDNIC-ID-200...	NTT Communications Groups		A	2006-04-13	2006-09-29 10:02:21	100%	2009-08-09 13:17:30
LG	2404:170::/32		INDONET-IDNIC-ID-20...	PT IndoInternet	9340	A	2006-08-17	2006-08-23 10:17:19	100%	2009-08-09 13:17:30
LG	2404:1b0::/32		DTPNET-IDNIC-ID-2006...	Dwi Tunggal Putra, PT.	18059	A	2006-10-10	2006-11-14 08:47:21	99%	2009-08-09 13:17:30
LG	2404:1b8::/32		DNET	PT. Dyviacon Intrabumi Tb...		A	2006-10-10	2007-12-27 09:32:24	100%	2009-08-09 13:17:30
LG	2404:8000::/32		BIZNET-AP-IDNIC-ID-2...	Biznet ISP		A	2008-11-14	2009-07-31 12:32:29	100%	2009-08-09 13:17:30
LG	2404:c000::/32		NAPNET-ID-20081201	PT. NAP Info Lintas Nusa ...		A	2008-12-01		0%	never
LG	2407::/32		ISAT-INP-IPv6-ID-200...	INDOSAT Internet Network ...		A	2006-12-15	2007-02-22 05:02:25	100%	2009-08-09 13:17:30

The database currently holds 27 IPv6 DFP's.
Of which 0 (0.00%) are reclaimed, 0 (0.00%) are returned to the pool and 14 (51.85%) IPv6 DFP's didn't have a routing entry.

IPV6 DNET 2 Micr... 202.148.1... SixXS - IP... Untitled ... Untitled ... Untitled ... Microsof... SixXS - IP... IN < 6:28 PM

Post deploying stage 2

- Future Plans
 - Dual stack to our every upstream providers
 - Currently only a few Upstream Providers who provide IPv6 / Dual Stack connectivity
 - Dual stack on Mail Systems
 - Spam filters, Anti Virus, RBLs, it's a complex system so it will take more time
 - Dual stack as default service to end customers
 - Automatically assign IPv4 and IPv6 to end customer.

Management system

- Currently we do not measure IPv6 traffic separately from IPv4
 - Currently using the same router interface for IPv4 and IPv6
 - Our firewall does not support IPv6-snmp.
- IPv6 DFZ issues
 - Not exactly clear how to define IPv6 DFZ yet
- These are issues we are currently working on
 - Looking forward to hearing other people's input

Conclusion

- Deploying IPv6 in small-medium size ISP is easy
- Deploying IPv6 is not about customer demands
 - It is about readiness of your network to secure future growth of your business
- Dual Stack is currently the best option to start migrating to IPv6
- Don't have to upgrade everything at a time!
- And if your firewall or other tools are not IPv6 compatible, raise your voice to the developers.

Conclusion

- Don't forget about the security!
 - Applying ipv6 in your network without proper security could result in your entire already secured system vulnerable!
- Educate your staff in planned manner
 - IPv6 knowledge can not be gained overnight
- Network with other network engineers
 - Share your experience and learn from their experience
- Useful information
 - APNIC ICONS Wiki IPv6
 - <http://icons.apnic.net/display/IPv6/Home>

Reflection

- Future IPv6 BGP Routing table size
- Multihoming, in relation to prop no.76
 - Requiring aggregation for IPv6 subsequent allocations
- Peer with as much IPv6 peering available, widen your IPv6 network
- So D-NET is now IPv6 ready
 - Now what?
 - How can we approach our enterprise customers?
 - What can we do?
 - Any thoughts?

Thank you!