TECHNICAL CODE

INTERNET PROTOCOL VERSION 6 (IPv6) - DEPLOYMENT REQUIREMENTS TO COMPLETE TRANSITION TO IPv6

Developed by

Malaysian Technical Standards Forum Bhd

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MCMC MTSFB TC G034:2022

Development of technical codes

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Committee representation

This technical code was developed by Numbering and Electronic Addressing Working Group of the Malaysian Technical Standards Forum Bhd (MTSFB), which consists of representatives from the following organisations:

American Malaysian Chamber of Commerce

Celcom Axiata Berhad

Cisco Systems Malaysia

Digi Telecommunication Sdn Bhd

Maxis Broadband Sdn Bhd

My6 Initiative Berhad

SIRIM QAS International Sdn. Bhd.

Telekom Malaysia Berhad

Webe Digital Sdn Bhd

Foreword

This technical code for Internet Protocol version 6 (IPv6) - Deployment Requirements to Complete Transition to IPv6 ('this Technical Code') was developed pursuant to the section 185 of the Act 588 by the Malaysian Technical Standards Forum Bhd (MTSFB) via its Numbering and Electronic Addressing Working Group.

This Technical Code shall continue to be valid and effective from the date of its registration until it is replaced or revoked.

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**INTERNET PROTOCOL VERSION 6 (IPv6) -
DEPLOYMENT REQUIREMENTS TO COMPLETE TRANSITION TO IPv6**

1. Scope

This Technical Code specifies the deployment requirements for organisations to complete the transition to Internet Protocol version 6 (IPv6). The full transition to IPv6 is the only viable solution to sustain the development of Internet.

Despite the criticality of Internet Protocol version 4 (IPv4) address exhaustion, organisations in Malaysia have been rather slow to adopt IPv6 and the same trend is evident in developing nations all around the world.

This Technical Code will assist organisations:

a)   that have not or are considering to deploy IPv6 in their network and services;

b)   that have initiated transition but looking to enhance IPv6 in their network and services;

c)   in creating the push factor to move towards native IPv6; and

d)   with greenfield deployments that are looking for quick wins.

The requirement from this Technical Code is aligned with the national aspiration to accelerate the adoption of IPv6 services in Malaysia and to allow consumers access to application or services using IPv6.

2. Normative references

The following normative references are indispensable for the application of this Technical Code. For dated references, only the edition cited applies. For undated references, the latest edition of the normative reference (including any amendments) applies.

See Annex A.

3. Abbreviations

For the purposes of this Technical Code, the following abbreviations apply.

See Annex B.

4. Terms and definitions

For the purpose of this Technical Code, the following terms and definitions apply.

4.1   Applications Service Providers (ASP)

Who provide particular functions such as voice services, data services, content-based services, electronic commerce and other transmission services. Applications services are essentially the functions or capabilities, which are delivered to end-users.

4.2 Content Applications Service Providers (CASP)

Who are special subset of applications service providers including traditional broadcast services and the latest services such as online publishing and information services.

4.3 Internet Protocol version 4 (IPv4)

Uses 32-bit addresses and is the current version of the Internet Protocol (IP).

4.4 Internet Protocol version 6 (IPv6)

Uses 128-bit addresses and is designed to replace and enhance IPv4.

4.5 Mobile Virtual Network Operators (MVNO)

A wireless communication service operator that provides telecommunications services through the infrastructure and network of existing Mobile Network Operators (MNOs).

4.6 Network Element (NE)

The definition in MCMC MTSFB TC T013 shall apply.

4.7 Network Security Element (NSE)

The definition in MCMC MTSFB TC T013 shall apply.

4.8 Network Service Providers (NSP)

Who provide the basic connectivity and bandwidth to support a variety of applications. Network service enables connectivity or transport between different networks. A network service provider is typically also the owner of the network facilities. However, these services may also be provided by a person using network facilities owned by another.

4.9 Terminal/host

The definition in MCMC MTSFB TC T013 shall apply.

5. Overview

In accordance to Direction No. 2 of 2015, *Commission Direction on Adoption of Internet Protocol version 6 (IPv6) in Malaysia*, Internet Service Providers (ISP) or Network Service Providers (NSP) licensees have been subjected to IPv6 Compliance Audit by Malaysian Communications and Multimedia Commission (MCMC) for both fixed and cellular services to ensure the following:

a) readiness of service;

b) assignment of IPv6 (via dual-stack);

c) Domain Name System (DNS) and World Wide Web (WWW) reachability.

In the last decade in Malaysia, the transition to IPv6 was mainly focused on dual-stack, which is becoming increasingly complex to sustain and inevitably prolongs the life of IPv4. With the advent of disruptive technologies such as Internet of Things (IoT), autonomous vehicles and advancement in wireless communications, it is very clear that complete transition to an IPv6-only environment is the viable solution for internet services.

The deployment requirement for IPv6 goes through the standard development life cycle of the following phases:

a)   Phase 1 - Plan and design;

b)   Phase 2 - Testing;

c)   Phase 3 - Implementation; and

d)   Phase 4 - Monitoring.

Deployment process does not end at implementation phase, instead it is an on-going process that goes into learning and adapting as part of improvement to the initial plan and design.

The following content in this Technical Code will be structured according to this continuous IPv6 deployment life cycle. Organisations looking to fully adopt IPv6 may consider each of the checklist throughout the cycle as guidance tabulated in the Table 1.

Table 1. IPv6 deployment life cycle

Phase	Requirements

Phase 1:
Plan and design
	a) IPv6 readiness assessment
	b) Network assessment
	c) Security assessment
	d) IPv6 addressing plan
	    i) Subnet planning
	    ii) Prefix size
	    iii) Obtaining IPv6 address
	e) Services
	    i) Internet presence services
	    ii) DNS
	    iii) Email

Phase 2: Testing	a) Device compliance b) Network compliance

Phase 3:
Implementation
	a) Transition mechanism
	b) IPv6 connectivity by default to service provider/peering
	c) Internet presence services
	    i) DNS
	    ii) Web Services
	    iii) Email
	d) Security

Phase 4: Monitoring	a) Monitoring and control b) IPv6 security vulnerability, risks, threats and impacts (post-deployment) c) Service experience

6.   Phase 1 - Plan and design

6.1   Internet Protocol version 6 (IPv6) readiness assessment

IPv6 readiness evaluation establishes a baseline for current architecture and identifies gaps for successful IPv6 migration. Detailed information on Information Technology (IT) infrastructure assets is required to determine which component will be impacted by the transition to IPv6 for network and system applications, for example:

a)   Devices - Host, Network Element (NE) and Network Security Elements (NSE) as specified in MCMC MTSFB TC T013.

b)   Operating Systems (OS).

c)   Backend systems.

d)   Application and service components - Such as web services, mobile and desktop applications.

The readiness assessment can be further broken down into 4 sub-phases as follows:

a)   assessment planning (refer to 6.1.1);

b)   assessment execution (refer to 6.1.2);

c)   analysis and findings (refer to 6.1.3); and

d)   reporting and recommendations (refer to 6.1.4).

6.1.1   Assessment planning

The objectives of this stage are as follows:

a)   Establish project team members of the stakeholder within the organisation.

b)   Finalise the scope of work and project timeline.

6.1.2   Assessment execution

A holistic approach needs to be done using a combination of assessment tools as well as conducting a face-to-face interview to achieve desired outcome as tabulated in the Table 2.

Table 2. Assessment tools

Assessment tools	Description
Interview or questionnaire	Engaging discussion with the Information and Communications Technology (ICT) team and its provider or supplier to understand its current network and system infrastructure environment by answering a series of questions.
Network diagram	Reviewing current physical and logical network diagram.
Network discovery	Running network discovery tools to establish a list of network devices, servers, and hosts on the client network.
Network scanning	Running scanning tools to establish inventory lists of IP assets.
Validation	Verify OS or software features information retrieved with actual information by requesting confirmation from the organisation's ICT personnel or the provider or supplier.

6.1.3 Analysis and findings

Once the list of asset inventory and other important information regarding IPv6 requirements have been gathered, the next step organisations need to take is to confirm capabilities and readiness of the identified devices to more effectively determine the appropriate IPv6 design.

Based on the hardware and firmware information, organisations can crosscheck with the manufacturer or principal on the IPv6 support (and features) for each of those devices. The following approaches may vary depending on manufacturer or principal:

a) using web feature navigator tools to list down IPv6 features supported;

b) refer to product-specific datasheets and IP feature matrix; and

c) contact directly with the manufacturer or principal (if the information could not be found using previous methods).

6.1.4 Reporting and recommendations

The final phase of the IPv6 readiness assessment is to develop the internal IPv6 readiness and recommendations report, which shall include but not limited to the following items:

a) critical assessment findings and gap analysis;

b) data and statistics regarding individual systems and vulnerabilities; and

c) recommendations for improvement.

This report can be presented to all stakeholders. A Transfer of Knowledge session may also be conducted to the organisation's ICT team to brief on the assessment results and to share the IPv6 implementation design.

6.2   Network assessment

6.2.1   Internet Protocol version 6 (IPv6) architecture and design

Design development is a hands-on approach whereby the technical requirements and design goals are integrated into IPv6 architectural design based on leading practices and case studies. It involves transition design for the network, applications, and services. This phase includes the development of the following:

a)   A business case justification, including requirements and risk analysis.

b)   A solution concept with the proposed network architecture.

c)   Recommended protocols and features to implement the required IPv6 solution.

d)   A high-level design for a resilient, scalable, secured, modular network infrastructure with the targeted availability defined by the organisation, including a high-level IPv6 address plan.

e)   Design definition specific to business or technical requirements and primary metrics.

f)   A solution gap analysis and implementation design (refer to Figure 1), including high-level integration considerations.
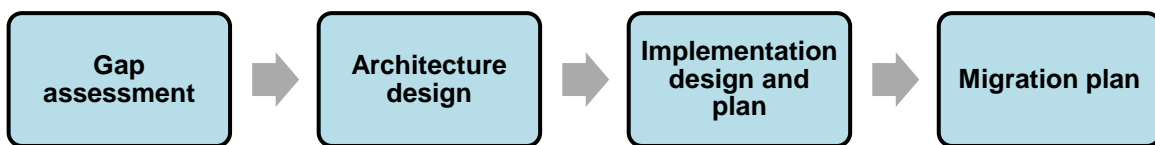

Figure 1. Gap analysis and implementation process flow

Based on Figure 1, IPv6 architecture and design are formulated based on the comprehensive IPv6 readiness assessment findings. IPv6 architecture and design provide an outlook of IPv6 implementation design and plan. It gives details of incremental migration from IPv4 to IPv6. During this phase, the scope of work enablement is defined, and a design blueprint is created.

A design blueprint and a migration strategy will facilitate organisations to introduce IPv6 without disrupting the IPv4 network. It shall include the following but not limited to:

a)   IPv4 or IPv6 interconnectivity - Individual IPv4 and IPv6 networks are connected via various tunnelling mechanisms, dual stacks, etc.

b)   IPv6 routing - Reachability across IPv4 and/or IPv6 through the appropriate deployment of IPv6 routing protocol.

c)   IPv6 security, Quality of Service (QoS), multicast services, and monitoring.

d)   Monitoring of IPv6 traffic sessions across the network.

e)   Ensure Network Management System (NMS) applications or solutions are seamlessly able to support and monitor IPv4 and IPv6 networks.

f) Ensure seamless integration to Operations Support System (OSS) and Business Support System (BSS) applications and services (e.g., Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), etc.).

The migration plan shall not only be limited to the network but also the services and applications.

6.3 Security assessment

Preliminary security assessment is essential during the planning stage to determine if there is any vulnerability in the capability of network and devices in providing IPv6 security control.

Organisations may use vulnerability security assessment tools to conduct the security assessment such as the following, but not limited to:

a) open ports;

b) rouge devices; and

c) OS vulnerability.

Organisations shall incorporate the findings in their overall IPv6 readiness assessment report with a declaration and sign-off by their security team.

6.4 Internet Protocol (IP) addressing plan

RFC 4291, *IP Version 6 Addressing Architecture* describes the different types of IPv6 addresses, its notation and provides the basis of the following recommendation. Organisations are advised to understand the IPv6 addressing architecture before going into process of subnet planning and requesting for IPv6 address.

6.4.1 Subnet planning

Considerations for subnet planning shall include the following:

a) network size;

b) number of users;

c) number of nodes deployed;

d) number of connected devices; and

e) multihoming requirements.

6.4.2 Prefix size

According to Asia Pacific Network Information Centre (APNIC), existing members of APNIC automatically qualify for an IPv6 block, where:

a) a member that has an IPv4 allocation will be eligible for a /32 of IPv6; and

b) a member that has an IPv4 assignment will be eligible for a /48 of IPv6.

The members may request multiple /32 prefixes from APNIC with proper justification of usage as per guideline published by APNIC.

Organisations may also request for smaller subnet from service provider depending on their requirement. APNIC-114, *APNIC guidelines for IPv6 allocation and assignment requests* depicted as follows:

a) A minimum of a /48 to organisations, with the following criteria:

    i) that are multihoming, serving as critical communication infrastructure or requires provider-independent IPv6 assignment;

    ii) that have multiple smaller networks or multiple Local Area Network (LAN); and

    iii) for larger sites, or if an end site is expected to grow into a large network.

b) /56 for smaller sites with only a few subnets required in the next two years. Subscribers can receive a /56 when connecting through on-demand or always-on connections such as small office and home office enterprises.

c) /64 if only one subnet is required (similar to single IPv4 address).

6.4.3 Obtaining Internet Protocol version 6 (IPv6) address

Organisations shall obtain IPv6 address from either of the following:

a) APNIC as the Regional Internet Registry (RIR) if the organisation plans to do multihoming to more than one service provider; or

b) service provider.

7. Phase 2 - Testing

7.1 Device compliance

All IPv6 capable equipment, directly connected to the service provider shall be certified starting 10 July 2020 and onwards. This is in accordance to the Technical Codes for the purpose of certifying communications equipment under the Communications and Multimedia (Technical Standards) Regulations 2000.

This encompasses the following equipment categories:

a) Hosts (e.g., 4G or 5G access points);

b) NE (e.g., switching or gateway equipment); and

c) NSE (e.g., firewalls).

All tested equipment shall comply to the following requirements:

a) general requirements on power supply, power supply cords and plugs, electromagnetic compatibility, markings, language and electrical safety; and

b) IPv6 compliance i.e., 5-core Request for Comments (RFCs) are as follows:

    i) RFC 8200;

    ii) RFC 4861;

iii) RFC 4862;

iv) RFC 8201; and

v) RFC 4443.

Once certified, the equipment will carry mandatory certification mark to indicate they have been certified in accordance with the Communications and Multimedia (Technical Standards) Regulations 2000. The compliance requirement shall fulfil the MCMC MTSFB TC T013.

7.2 Network compliance

IPv6 Ready Logo Program by IPv6 Forum is a conformance and interoperability testing program designed to verify protocol implementation and interoperability between products. It offers access to testing tools and global laboratories.

8. Phase 3 - Implementation

8.1 Transition mechanism

Completing the transition to IPv6 requires many different environments to be capable of operating completely on IPv6 without being dependent on IPv4. As IPv4 is fully exhausted thus IPv6 should be fully adopted by new technologies and deployment.

Dual-stack connectivity or other transition technology is deemed as temporary because the end goal is an IPv6-only state. However, the selection of transition technology depends on the organisation's objective, capability and service requirement.

8.1.1 Dual-stack (RFC 4213)

Dual-stack is the most common method of IPv6 transition in existing networks. In dual-stack environment (refer to Figure 2), all networking elements shall support both IPv4 and IPv6 versions but may incur additional resources (e.g; processing power, device memory and licenses) to handle both simultaneously.
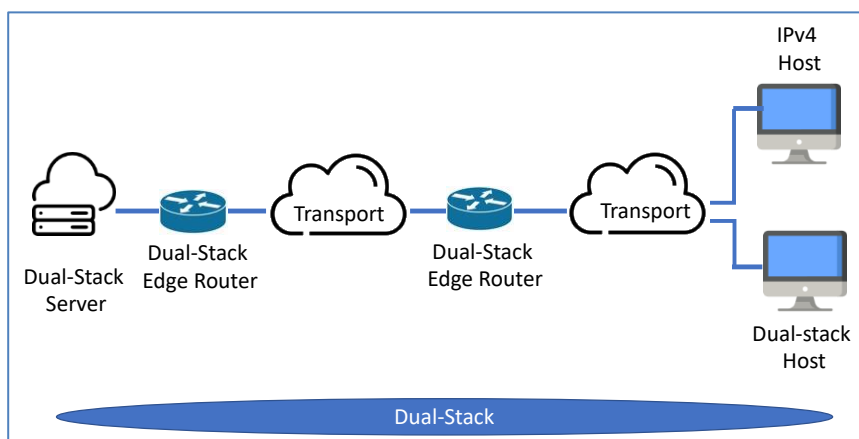

Figure 2. Dual-stack connectivity

8.1.2   Tunnelling (RFC 7059)

There is various mechanism for tunnelling available for providing IPv6 connectivity over IPv4 network (refer to Figure 3). This option may be required for situations where it is not possible to get native IPv6 connectivity. However, encapsulating IPv6 packets in IPv4 packets may have some effect on performance and security that must be considered when deciding the best transition mechanism.
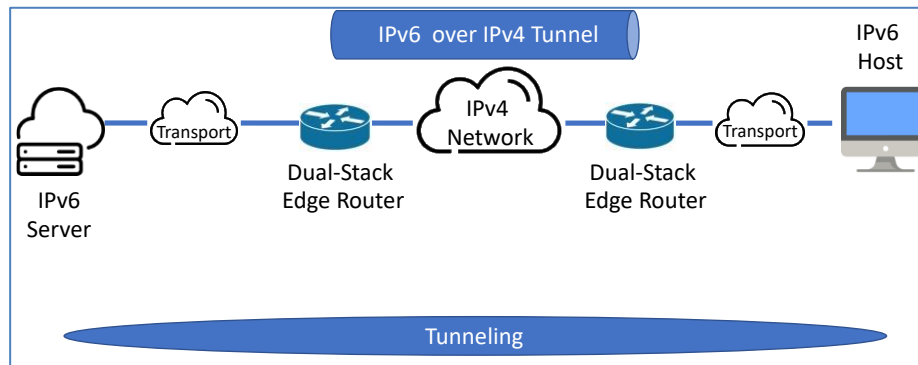

Figure 3. Tunnelling connectivity

8.1.3   464XLAT (RFC 6877)

The 464XLAT is deployed on IPv6 transport and supports end-to-end IPv6 connectivity (refer to Figure 4). However, this connectivity also allows for IPv4 service extension using a combination of stateful, Provider-Side Translator (PLAT) and stateless translation, Customer-Side Translator (CLAT). CLAT needs to be supported on the client-side (i.e. mobile device or Customer Premises Equipment (CPE)) and NAT64 (RFC 6146 to be supported on the PLAT gateway).
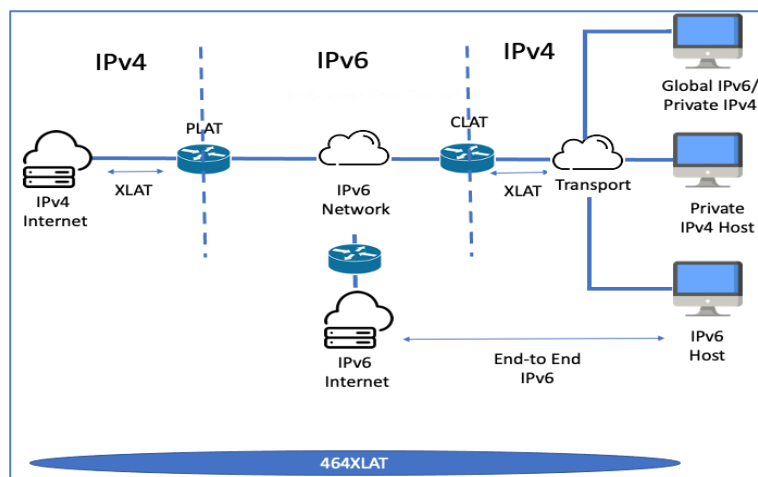

Figure 4. 464XLAT connectivity

Table 3 indicates that for IPv6 host to IPv4 server communication, single translation will happen while IPv4 host to IPv4 server communication will incur double translation. The 464XLAT architecture works for IPv4 in client-server model, but not in peer-to-peer communication.

Table 3. Translation in 464XLAT

Server	Application and host	Traffic treatment	Location of translation
IPv6	IPv6	End-to end IPv6	N/A
IPv4	IPv6	Stateful translation	PLAT
IPv4	IPv4	464XLAT	CLAT/PLAT

8.2   Internet Protocol version 6 (IPv6) only

The goal is to achieve an IPv6-only state where IPv6 connectivity is made possible without any tunnelling or translation and networks can finally remove any dependency on IPv4. This connectivity is illustrated in Figure 5.
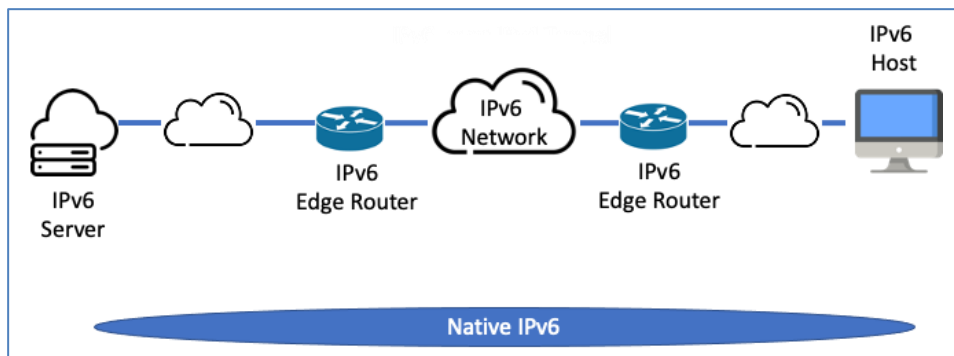

Figure 5. Native IPv6 connectivity

9.   Phase 4 - Monitoring

9.1   Monitoring and control

Once an organisation has started its IPv6 adoption, continuous monitoring and review is required to ensure successful and smooth IPv6 transition. The following are some recommendations of measurement that can be performed:

a)   monitoring of dual-stack, IPv4 and IPv6 in a single environment to ensure that any configuration changes are synchronised (e.g. firewall rule changes applied in dual stack or mixed IPv6 and IPv4 environment);

b)   self-declaration audit checklist to validate readiness of public-facing IPv6 services (refer to Annex C);

c)   encourage collaboration and knowledge sharing within the industry to further improve the deployment of IPv6 in Malaysia; and

d)   boost local adoption by establishing native IPv6 peering at Malaysia Internet Exchange (MyIX) and enabling IPv6 domains for large enterprises, Applications Service Providers (ASP) and Content Applications Service Providers (CASP).

9.2   Communication and awareness

Organisations have to plan for adequate communication and awareness to both internal and external customers or users to facilitate for smooth transition to IPv6. The communication can describe the benefits of adoption and the changes expected in terms of services or infrastructure (where applicable).

9.3   Service experience

The exhaustion of IPv4 address is one of the biggest driver for NSP, ASP and CASP to shift to IPv6 especially when introducing new services and applications, in particular those made available on the Internet. However, the adoption of IPv6 services must not compromise customer accessibility & experience. The following consideration should be weighed in during the service planning stage:

a)   Adoption of IPv6 is transparent to most end-user and should be introduced by default without causing disruption to the service

b)   The stigma surrounding IPv6 assignment is that IPv6 brings performance degradation in certain internet applications. The Quality of Experience (QoE) over IPv4 versus IPv6 may vary for applications that are sensitive to network performance (i.e. packet loss, jitter, latency) such as gaming, video streaming and Voice over Internet Protocol (VoIP). Thus, the performance for applications on IPv6 should be equal to or more superior than IPv4.

c)   Impact of application behaviour over dual-stack if IPv4 traffic passes through Carrier Grade Network Address Translation (CGNAT).

d)   End-user device could have different experience when preferring IPv6 address over IPv4. Further details as in RFC 6724 and RFC 8305.

e)   QoE measurement as part of compliance checklist by organisations to gather information (crowdsourcing) on differing experiences of users using IPv6 in bid to enrich information and contribute towards the development of IPv6 in this region.

10. Security

Internet Engineering Task Force (IETF) standards on operational security consideration for IPv6 are still in ongoing discussion tracks due to new challenges and developments in security controls. For organisations that are planning to start IPv6 deployment or have already started transition to IPv6 via dual-stack, it is important to acknowledge that IPv6 is not more or less secure than IPv4. An oversight on its differences could be a dangerous blind spot for organisations that have adopted or planning towards adoption of IPv6.

10.1   Internet Protocol version 6 (IPv6) security concerns

IPv6 security assessment should be conducted periodically as part of the overall network security audit in any organisation. Table 4 shows security consideration specifics to IPv6 that can be included in the assessment and should be reflective of any changes in the RFC standards.

Table 4. Security assessment

Category		Standard	Title
IP addressing	N/A	RFC 7721	*Security and Privacy Considerations for IPv6 Address Generation Mechanisms*
IPv6 Protocols	NDP	RFC 3756	*IPv6 Neighbor Discovery (ND) Trust Models and Threats*
		RFC 6980	*Security Implications of IPv6 Fragmentation with IPv6 Neighbor Discovery*
	RA	RFC 7713	*Implementation Advice for IPv6 Router Advertisement Guard (RA-Guard)*
Transition	N/A	RFC 4942	*IPv6 Transition/Coexistence Security Considerations*
	N/A	RFC 7123	*Security Implications of IPv6 on IPv4 Networks*
	NA	RFC9099	*Operational Security Considerations for IPv6 Networks*
	Dual-Stack	RFC7359	*Layer 3 Virtual Private Network (VPN) Tunnel Traffic Leakages in Dual-Stack Hosts/Networks*
Firewall	CE	RFC6092	*Recommended Simple Security Capabilities in Customer Premises Equipment (CPE) for Providing Residential IPv6 Internet Service*
	ICMP	RFC4890	*Recommendations for Filtering ICMPv6 Messages in Firewalls*
	CE	RFC6204	*Basic Requirements for IPv6 Customer Edge Routers*
Network Reconnaissance		RFC7707	*Network Reconnaissance in IPv6 Networks*

Annex A
(normative)

Normative references

MCMC MTSFB TC T013, *Internet Protocol version 6 (IPv6) - Equipment Compliance*

Communication and Multimedia Act 1998, Direction No. 2 of 2015, *Commission Direction on Adoption of Internet Protocol version 6 (IPv6) in Malaysia*

RFC 3596, *DNS Extensions to Support IP Version 6*

RFC 3810, *Multicast Listener Discovery (MLD) for IPv6*

RFC 4291, *IP Version 6 Addressing Architecture*

RFC 4443, *Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification*

RFC 4861, *Neighbor Discovery for IP version 6 (IPv6)*

RFC 4862, *IPv6 Stateless Address Autoconfiguration*

RFC 4942, *IPv6 Transition/Coexistence Security Considerations*

RFC 6146, *Stateful NAT64: Network Address and Protocol Translation from IPv6 Clients to IPv4 Servers*

RFC 6724, *Default address selection for Internet Protocol Version 6 (IPv6)*

RFC 6877, *464XLAT: Combination of Stateful and Stateless Translation*

RFC 6980, *Security Implications of IPv6 Fragmentation with IPv6 Neighbor Discovery*

RFC 7123, *Security Implications of IPv6 on IPv4 Networks*

RFC 7217, *A Method for Generating Semantically Opaque Interface Identifiers with IPv6 Stateless Address Autoconfiguration (SLAAC)*

RFC 7824, *Privacy Considerations for DHCPv6*

RFC 8200, *Internet Protocol, Version 6 (IPv6) Specification*

RFC 8201, *Path MTU Discovery for IP version 6*

RFC 8305, *Happy Eyeballs Version 2: Better Connectivity Using Concurrency*

RFC 8415, *Dynamic Host Configuration Protocol for IPv6 (DHCPv6)*

Annex B
(informative)

Abbreviation

APNIC	Asia Pacific Network Information Centre
ASP	Applications Service Provider
BSS	Business Support System
CASP	Content Applications Service Providers
CGNAT	Carrier Grade Network Address Translation
CLAT	Customer-Side Translator
CPE	Customer Premises Equipment
CRM	Customer Relationship Management
DHCPv6	Dynamic Host Configuration Protocol version 6
DNS	Domain Name System
ERP	Enterprise Resource Planning
ICMPv6	Internet Control Message Protocol for IPv6
ICT	Information and Communications Technology
IETF	Internet Engineering Task Force
IoT	Internet of Things
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IR 4.0	Fourth Industrial Revolution
ISP	Internet Service Provider
IT	Information Technology
LAN	Local Area Network
MCMC	Malaysian Communications and Multimedia Commission
MLD	Multicast Listener Discovery
MNO	Mobile Network Operator
MTU	Maximum Transmission Unit
MVNO	Mobile Virtual Network Operator
MyIX	Malaysia Internet Exchange
NDP	Neighbour Discovery Protocol
NE	Network Element
NMS	Network Management System
NSE	Network Security Elements
NSP	Network Service Provider

OS	Operating System
OSS	Operations Support System
PLAT	Provider-Side Translator
QoE	Quality of Experience
QoS	Quality of Service
RFC	Request for Comments
RIR	Regional Internet Registry
SLAAC	StateLess Address Auto Configuration
VoIP	Voice over Internet Protocol
WWW	World Wide Web

Annex C
(informative)

Self-declaration audit checklist

Table B.1. IPv6 service compliance

A	Licensee Information						
1	Service Provider						
2	Type of Service	**Fixed**			**Wireless**		
3	Product Name						
4	Date of Declaration	Dd		Mm		Yyyy	
5	Region	Central	Northern	Southern	Eastern	Sabah	Sarawak
		Others	Please specify:				

B	Connectivity			
1	Customer Segment	**Business**		**Consumer**
2	Method of IPv6 Prefix Assignment	**SLAAC**	**DHCPv6**	**Manual**
3	Request for IPv6 Assignment	**Default**		**Upon Request**
4	IPv6 Address Assignment	**Dual-stack**	**Native**	**Others :**
	a. IPv6 Prefix			
	b. IPv4 Prefix			
5	Device Info	**Computer**	**Mobile Phone**	**Others :**
	a. OS Version	*e.g.: macOS Catalina*		
	b. Application Version	*e.g.: Firefox 91.0*		

C	Application Testing	Evidence Required
	HTTP/S	
1	Perform dual-stack website access test to the following sites: 1. http://mtsfb.org.my 2. http://google.com 3. http://facebook.com 4. http://youtube.com 5. http://tonton.com.my	Demonstrate **successful accessibility** to **any** of the dual-stack websites
2	Perform web based IPv6 accessibility and connectivity tests by accessing the following sites: 1. http://test-ipv6.com 2. http://ipv6-test.com 3. http://ipv6.whatismyv6.com 4. http://ipv6test.google.com	Demonstrate **successful diagnostics** from **any** of the dual-stack websites

Table B.1. IPv6 service compliance *(continued)*

C	Application Testing	Evidence Required
	HTTP/S	

3	Perform dual-stack DNS resolving test to the following domains:
	   1. www.mtsfb.org.my
	   2. www.google.com
	   3. www.facebook.com
	   4. www.youtube.com
	   5. www.tonton.com.my
		Demonstrate **dual-stack DNS resolution** for **any** of the dual-stack websites

	Video Streaming	

1	Streaming of video content from the following sites:
	   1. Netflix
	   2. Youtube
	   3. Facebook Video
	   4. Disney HotStar
	   5. Tonton
		Demonstrate **successful streaming** from **any** of the dual-stack streaming video

D	Quality of Service Parameters	

1	Perform ping test to the following domains :
	   1. www.mtsfb.org.my
	   2. www.google.com
	   3. www.facebook.com
	   4. www.youtube.com
	   5. www.tonton.com.my
		Demonstrate **latency** to **any** of the dual-stack websites

2	Perform web-based dual-stack speed tests (upload/download) by accessing the following sites:
	   1. http://www.speedtest.net/
	   2. http://ipv6-test.com/speedtest/
	   3. http://ipv6-speedtest.net/
	   4. http://speedtest.comcast.net/
	   5. http://speedtest6.com/
		Demonstrate **speed test** from **any** of the dual-stack websites

3	Perform dual-stack website access test to the following sites:
	   1. http://mtsfb.org.my
	   2. http://google.com
	   3. http://facebook.com
	   4. http://youtube.com
	   5. http://tonton.com.my
		Demonstrate **page load time** to **any** of the dual-stack websites

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