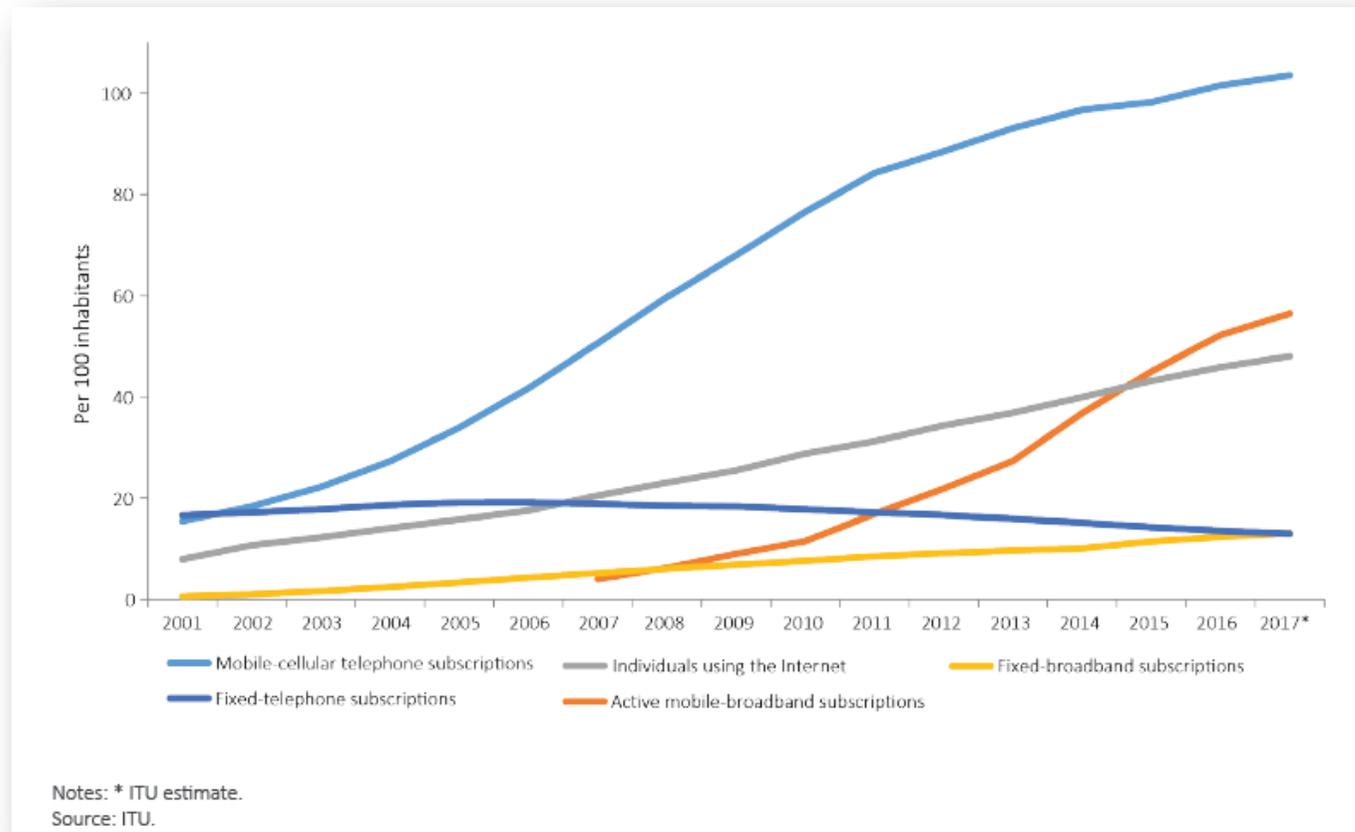# Migrating to IPv6 : Experiences from Asia-Pacific

Goals for a Sustainable Future : The SDGs

17 Sustainable Development Goals and

169 Targets

Per 100 inhabitants

- Mobile-cellular telephone subscriptions
- Individuals using the Internet
- Fixed-broadband subscriptions
- Fixed-telephone subscriptions
- Active mobile-broadband subscriptions

Notes: * ITU estimate.
Source: ITU.

Available for download at http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017.aspx

Asia-Pacific has the greatest variation

## Chart 3.7: IDI values, Asia and the Pacific, IDI 2017
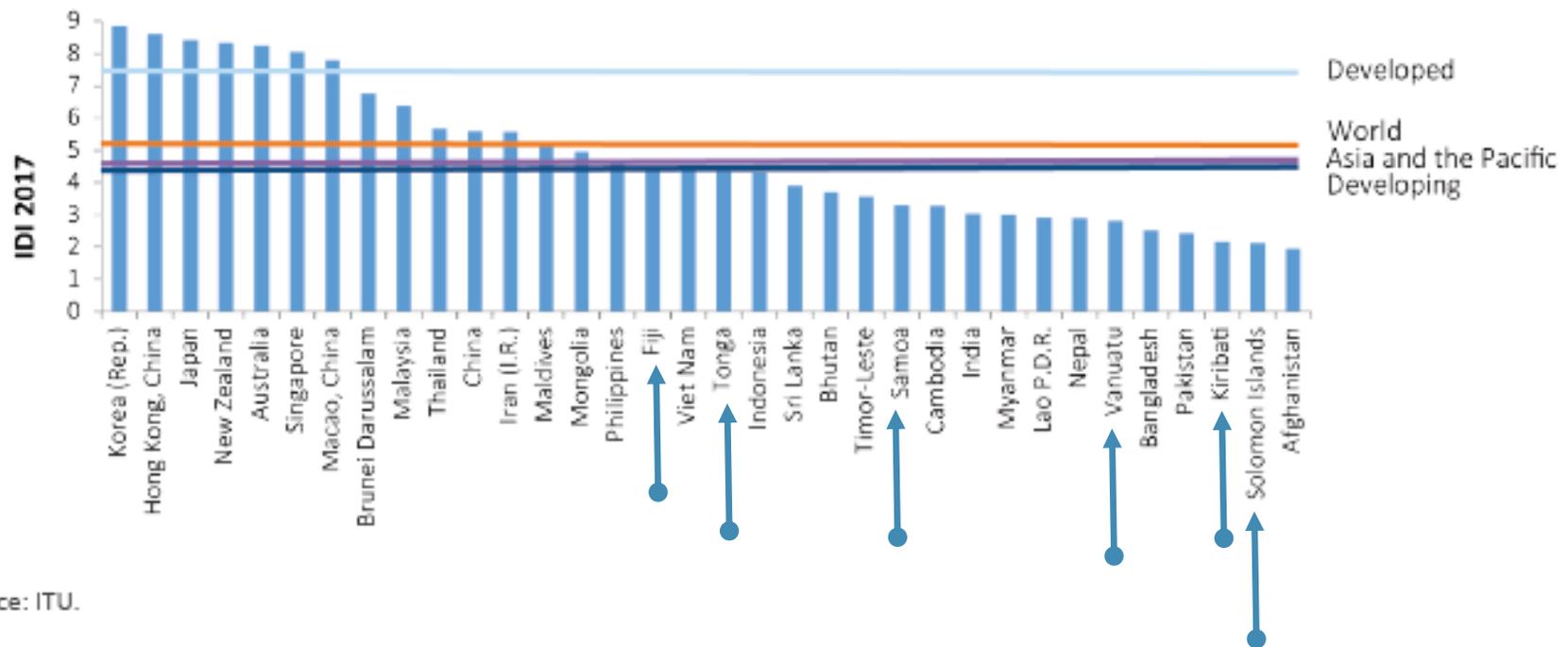
Source: ITU.

The most substantial average rate of improvement for any indicator in Asia and the Pacific was for mobile-broadband subscriptions. This indicator rose by an average 36.2 per cent between IDI 2016 and IDI 2017, with increases over 100 per cent, from very low baselines, in four countries (Samoa, Kiribati, the Lao P.D.R. and Afghanistan).

The second most substantial average rate of improvement (12.4 per cent) was for the proportion of households with Internet access, the highest improvements for which came from three LDCs (Bangladesh, the Lao P.D.R. and the Solomon Islands). All but one country in the region (Mongolia) recorded an improvement in this indicator.

Coverage of mobile-cellular networks in relation to world population and the number of Internet users (2007-2016)
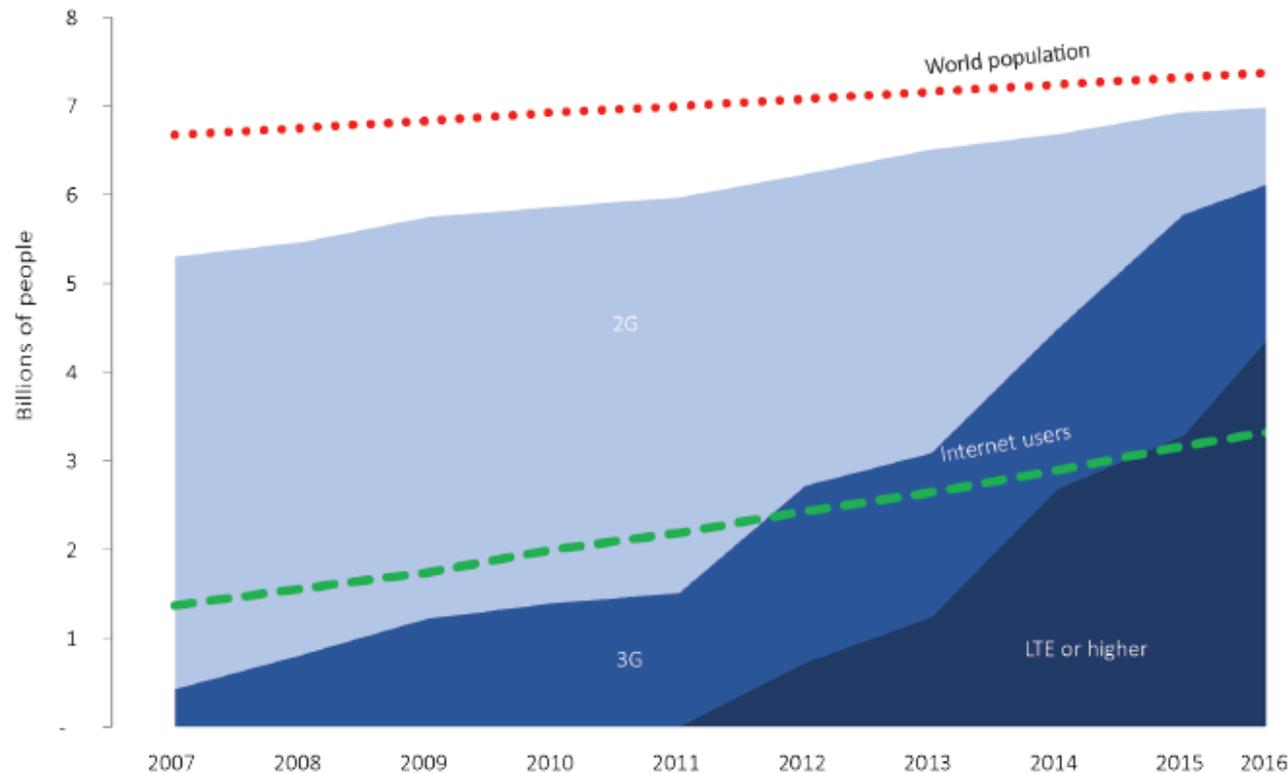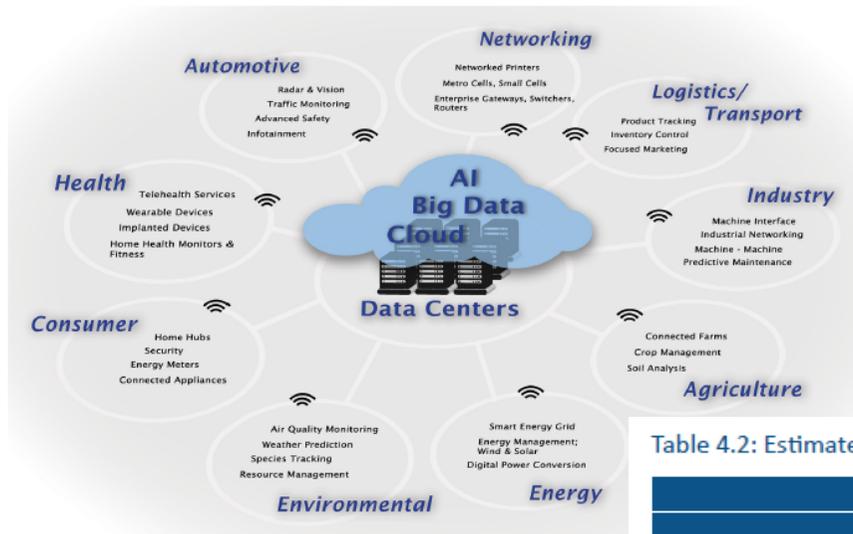

Source: ITU.

The number of subscriptions per 100 population has grown from 33.9 in 2005 to 76.6 in 2010, 98.2 in 2015 and an estimated 103.5 in 2017.

The number of subscriptions worldwide now exceeds the global population, with subscriptions also exceeding population in 112 of the 176 countries included in IDI 2017

IOT, Big Data and Artificial Intelligence – The new drivers of ICT ecosystem

Figure 4.1: IoT, cloud computing, big data and artificial intelligence – the new drivers of the ICT ecosystem

Source: ITU.

Table 4.2: Estimated global market sizes for selected advanced ICTs (USD millions)

	Estimated global revenues		
	2015	2020ᵃ	2025ᵃ
IoTᵇ	193 500	267 000	640 000ᶜ
Big dataᵈ	27 300	57 300	88 500
Public cloudᵉ	75 300	278 200	489 800
Artificial Intelligenceᶠ	644ᵍ	6 076	36 818

ᵃForecast. ᵇStatista (2017b); Hunke et al. (2017). ᶜEstimate based on expected compound annual growth rate. ᵈStatista (2016, p. 22). ᵉStatista (2017a, p. 13). ᶠKaul and Wheelcock (2016). ᵍInformation for 2016.
Sources: Statista (2016, 2017a, 2017b), Hunke et al. (2017), Kaul and Wheelcock (2016).

WTDC-17 : ITU-D OBJECTIVES AND ASIA-PACIFIC REGIONAL INITIATIVES

ITU-D OBJECTIVES 2018-2021

Foster international cooperation and agreement on telecommunication/ICT development issues

Modern and secure telecommunication/ ICT Infrastructure: Foster the development of infrastructure and services, including building confidence and security in the use of telecommunications/ICTs

Enabling environment: Foster an enabling policy, and regulatory environment conducive to sustainable telecommunication/ICT development

Inclusive digital society: Foster the development and use of telecommunications/ICTs and applications to empower people and societies for sustainable development

ASIA-PACIFIC REGIONAL INITIATIVES 2018-2021

Addressing special needs of LDCs, SIDs including Pacific island countries and LLDCs

Harnessing ICTs to support the digital economy and an inclusive digital society

Fostering development of infrastructure to enhance digital connectivity

Enabling policy and regulatory environments

Contributing to secure and resilient environment

WTDC-17 RESOLUTION 63 (REV. BUENOS AIRES,2017)

IP address allocation and facilitating the transition to IPv6 deployment in the developing countries

……….. instructs the Director of the Telecommunication Development Bureau

1 to continue the close cooperation and coordination with the Director of the Telecommunication Standardization Bureau in this regard, and to continue ongoing activities to facilitate the process of raising awareness on IPv6 deployment among all members, and to provide the necessary information on training and education activities;

2 to continue cooperating with relevant international and regional organizations, including the Regional Internet Registries (RIRs), on capacity building and the enhancement of technical skills for IPv6 in order to respond to the needs of developing countries;

3 to submit an annual report to the ITU Council on the progress made in this regard, and report to the next WTDC;

4 to develop guidelines, to enable, if necessary, adjustment of the organizational frameworks and policies necessary for migration to and deployment of IPv6,

………………………………………

ITU PLENIPOTENTIARY CONFERENCE 2014:
RESOLUTION 180 (REV. BUSAN, 2014 PP 2014): Facilitating the transition from IPv4 to IPv6
RESOLUTION 102

ITU-D STUDY GROUP 1

## ASP RI 3: Fostering development of infrastructure to enhance digital connectivity

Objective: To assist Member States in the development of telecommunication/ICT infrastructure in order to facilitate provision of services and applications on that infrastructure.

Expected results:

1) Migration/transition of analogue networks to digital networks, application of affordable wired and wireless technologies (including interoperability of ICT infrastructure), and optimized use of the digital dividend;

2) Maximized use of new and emerging technologies for the development of telecommunication/ICT networks, including 5G and smart grid infrastructure and services

3) Strengthening of capacity to develop and implement national broadband plans in order to provide broadband access to unserved and underserved areas (including support for study of the status of national broadband networks and international connectivity), to promote affordable access, especially for youth, women, indigenous peoples and children, to select appropriate technologies, to develop and use universal service funds effectively, and to develop financially and operationally sustainable business models

4) Promotion of Internet exchange points (IXPs) as a long-term solution to advance connectivity, **deployment of IPv6-based networks and applications, and progress in the transition from IPv4 to IPv6**

5) Strengthening of the capacity to implement conformance and interoperability (C&I) procedures and testing and to plan resources for C&I programmes, and facilitation of the establishment of common regional and subregional C&I regimes (including the adoption and implementation of mutual recognition arrangements)

6) Attention to spectrum-management issues, including radio-frequency planning, new spectrum-sharing approaches, harmonized spectrum allocation and spectrum monitoring systems, and support for preparations for world radiocommunication conferences (WRCs) and implementation of their outcomes

7) Building of skills for the development and use of satellite telecommunications

8) Strengthening of cooperation with international/regional organizations to enhance regional ICT connectivity, such as the Asia-Pacific Information Superhighway (AP-IS).

2018   Universal Access to Broadband and International High Capacity Backbone, IPv6   **2022**
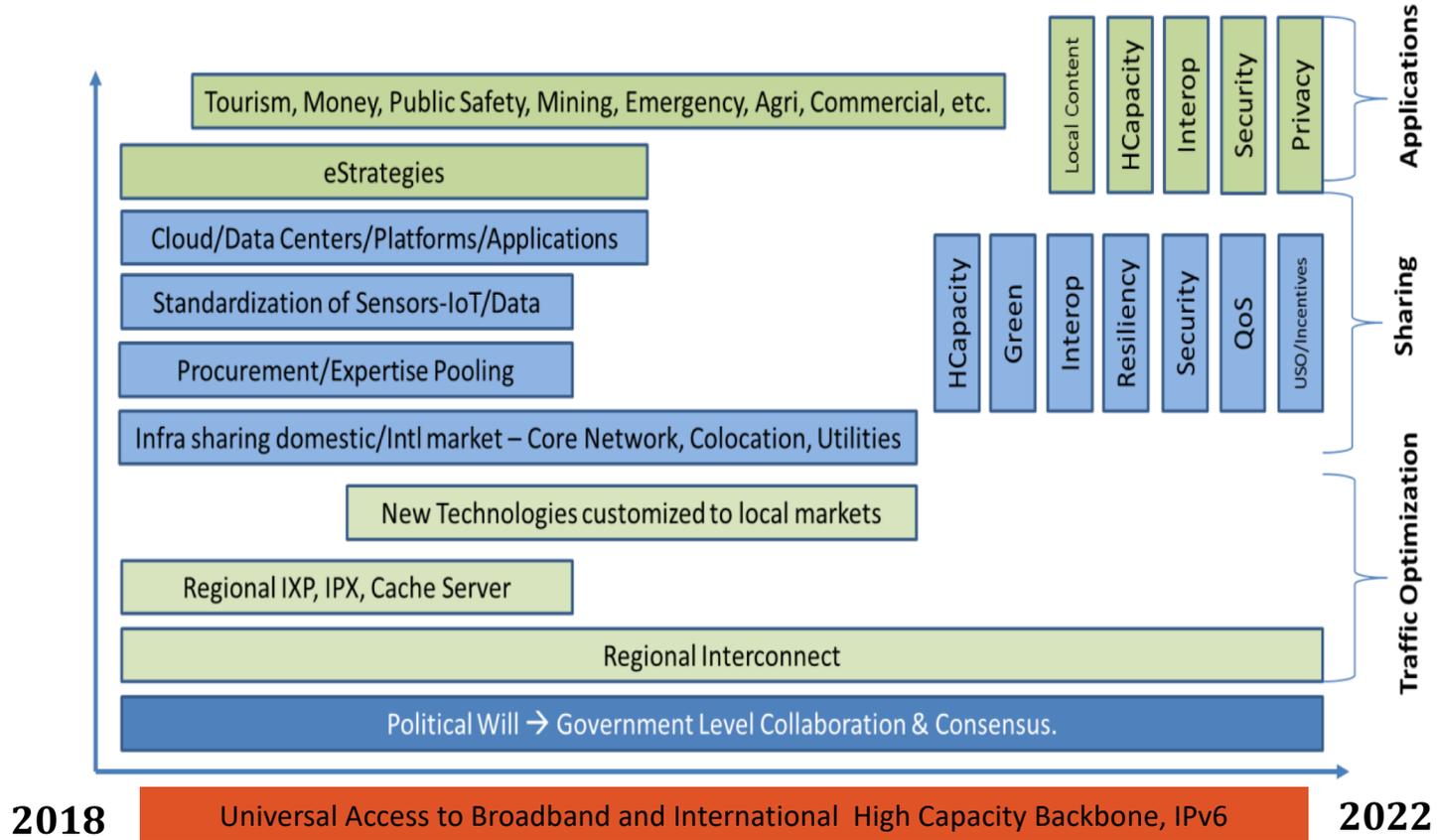
Supported by

Source: ITU-PITA ASP CoE Workshop, 21-23 Nov 2017, Nadi, Fiji

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IPv6 migration : *The Why? questions of stakeholders*
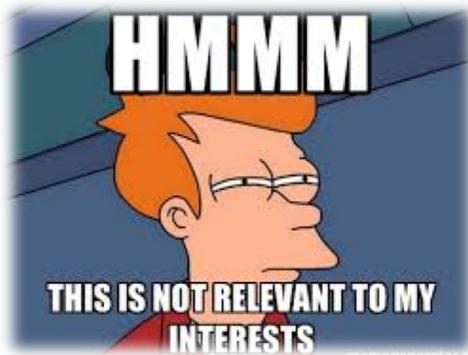
Business continuity (esp. 4G, IoT)

IPv6 in IPv4 only network (Security risks)

Economic decision – Invest in IPv6 Vs Prolong IPv4

IPv6 is growing rapidly

Resources and best practices available

Policy and regulatory support

Convincing decision makers in stakeholders – A major challenge

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Who are these stakeholders?

-Ministry, Regulatory authority, e-Government agencies, Telecom service providers, Content developers and providers, Standardization agencies, IP address allocation agencies, Development agencies, Academia and Training Providers, Telecom research organizations, Data centre providers, Internet exchange providers, Equipment importers, Type approval agencies, Enterprises with own networks, End Users ....

Country experiences

Lao PDR

Cambodia

Mongolia

Bhutan

Annual (regional / sub-regional) training on IPv6 deployment and IPv6 Infrastructure Security 2011 onwards

Specialized technical advice and training to countries and interested telecom operators

Recommendations on IPv6 deployment

IPv6 Roadmap Development

Policy Goals → Priorities → Challenges → Solutions and Recommendations

Key challenges

1. Policy, legislation, regulation and standardization issues

2. Institution, stakeholder engagement and coordination issues

3. Technology (hardware and software), infrastructure, and interoperability aspects

4. Security issues

5. Knowledge, awareness and skills issues

6. Procurement and financial issues

IPv6 migration - Experiences

Stakeholder engagement and stocktake
- *Current status and plans of government agencies and enterprises, telecom operators), content developers and device manufacturers on the status of IPv6 deployment and future plan*
- *Engaging stakeholders in a common dialogue*
- *Survey*

Policy, Task Force, Regulation and Roadmap
- *Include IPv6 adoption as part of the national telecommunication/ICT policy*
- *IPv6 task force*
- *IPv4 to IPv6 national roadmap*
- *Standards and interoperability*
- *IXPs for IPv6 peering*

Government leadership
- *Set deadlines for deployment of IPv6 within all Government Agencies and procurement processes*
- *Monitoring mechanism*

Telecom Industry and Business
- *Enterprise public facing content needs to support IPv6*
- *Start migration to IPv6 within their internal networks*
- *Recommendations /guidelines for IPv6 address plans*
- *Equipment which is type approved needs to be IPv6 capable as far as possible*
- *Prepare an implementation plan for IPv6 in their own networks*
- *Transition technologies*

IPv6 Security
- *Develop an IPv6 Security Guideline in consultation with the IPv6 task force*

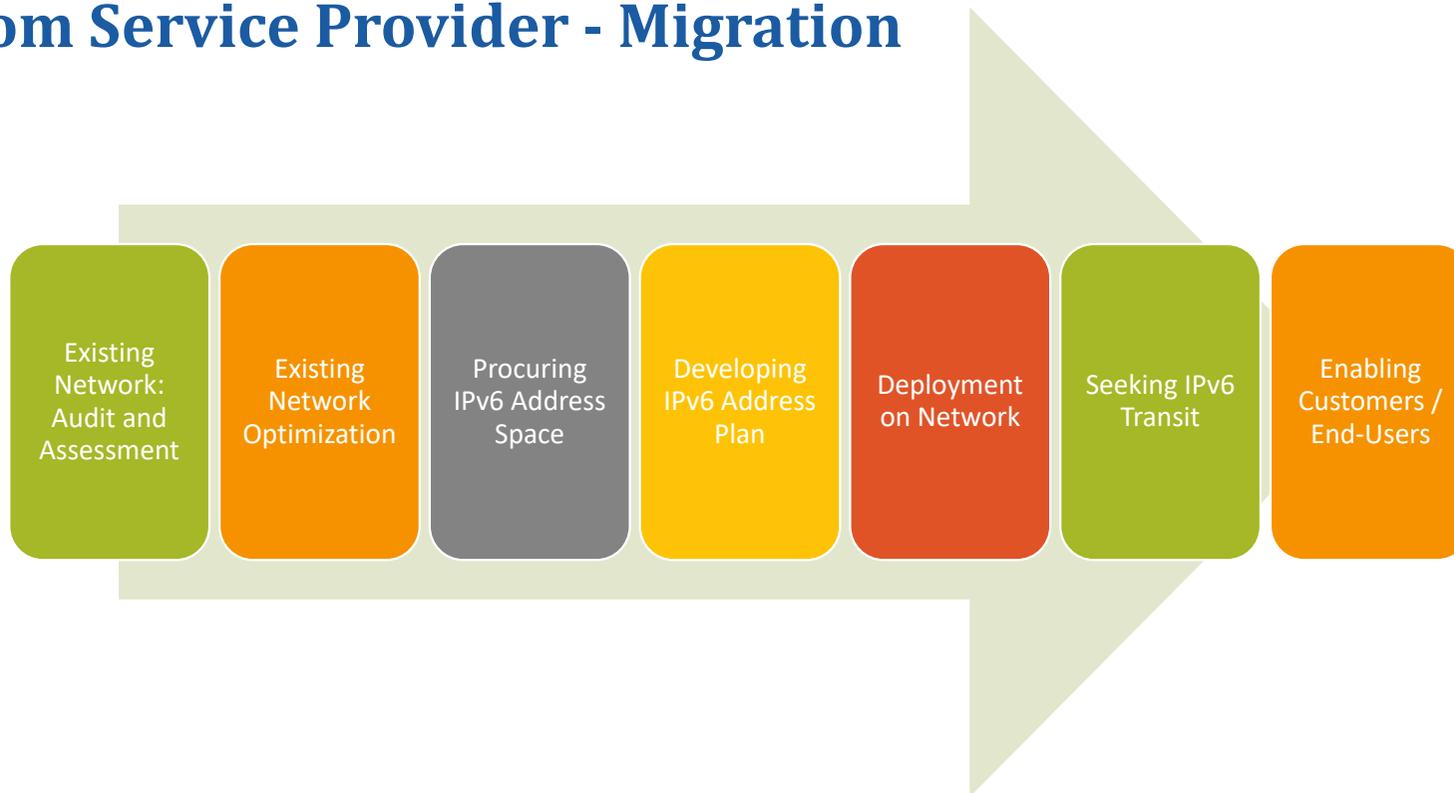**Human Capacity Building**
- *Build human capacity on IPv6 transition mechanism including security*

Source: Roadmap assistances by APNIC and ITU

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Telecom Service Provider - Migration

| Existing Network: Audit and Assessment | Existing Network Optimization | Procuring IPv6 Address Space | Developing IPv6 Address Plan | Deployment on Network | Seeking IPv6 Transit | Enabling Customers / End-Users |

Source: Dr. Philip Smith, Roadmaps assistances by APNIC and ITU

Recommendation Categories

1. Recommendations applicable to all stakeholders
2. Recommendations relating to IPv6 deployment in government agencies
3. Recommendations relating to content and applications
4. Recommendations relating to Telecom service providers, CPE vendors, Data Centres and Enterprises
5. Recommendations relating to IPv6 security
6. Recommendations relating to customer awareness
7. Recommendations relating to institutional and individual capacity building

Singapore: IPv6 Adoption Guide Report - II

Focus areas identified in the report

- *Planning*

- *Network*

- *Applications*

- *Skills*

- *Services / products*

Governments promoting IPv6 deployment (examples)

VietNam National IPv6 plan

On 29th March, 2011, Minister of Information and Communications issued Vietnam National action plan on IPv6 which determined the objectives and specific roadmap for transition to IPv6 in Vietnam.

VietNam National IPv6 plan includes 3 following stages:

Stage 1: Preparation phase (2011 – 2012) with the main targets:
- Measuring the readiness status of local ISP networks with IPv6.
- Forming the national IPv6 testing network and implementation of IPv6 testing activities.
- Seting up the international native IPv6 connections.
- Performing extensive training of ICT human resources on IPv6.
- Local ISPs must setup their own IPv6 working group and issue their own IPv6 action plan that conform with the National plan.

Stage2: Implementation phase (2013 - 2015) with the main targets:
- Transition from IPv4 networks to simultaneously support IPv4 and IPv6.
- Forming national IPv6 network infrastructure.
- Provide testing IPv6 services to end users.

Stage 3: Accomplishment phase (2016 - 2019)
- Ensuring the stable operation of Internet in Vietnam with IPv6-based technology.
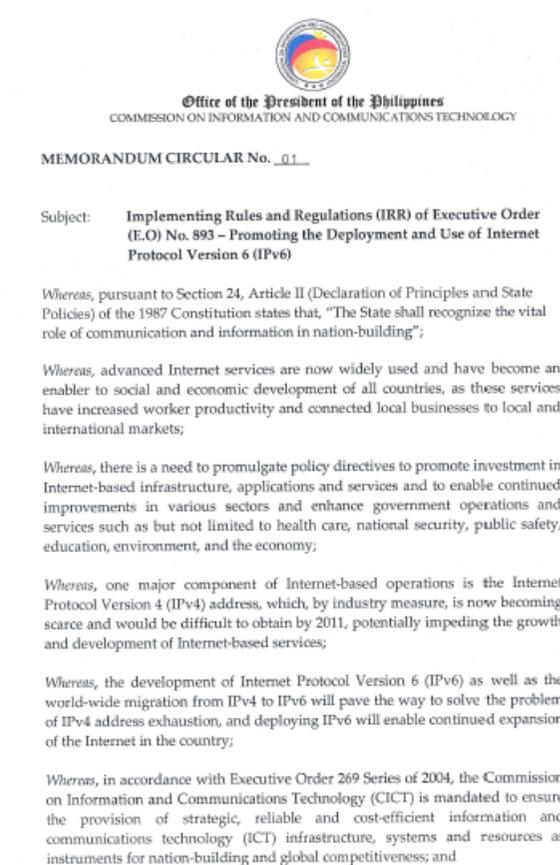
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Governments promoting IPv6 deployment (examples)

Governments promoting IPv6 deployment (examples)

Office of the President of the Philippines
COMMISSION ON INFORMATION AND COMMUNICATIONS TECHNOLOGY

MEMORANDUM CIRCULAR No. _01_

Subject: Implementing Rules and Regulations (IRR) of Executive Order
(E.O) No. 893 – Promoting the Deployment and Use of Internet
Protocol Version 6 (IPv6)

Whereas, pursuant to Section 24, Article II (Declaration of Principles and State
Policies) of the 1987 Constitution states that, "The State shall recognize the vital
role of communication and information in nation-building";

Whereas, advanced Internet services are now widely used and have become an
enabler to social and economic development of all countries, as these services
have increased worker productivity and connected local businesses to local and
international markets;

Whereas, there is a need to promulgate policy directives to promote investment in
Internet-based infrastructure, applications and services and to enable continued
improvements in various sectors and enhance government operations and
services such as but not limited to health care, national security, public safety,
education, environment, and the economy;

Whereas, one major component of Internet-based operations is the Internet
Protocol Version 4 (IPv4) address, which, by industry measure, is now becoming
scarce and would be difficult to obtain by 2011, potentially impeding the growth
and development of Internet-based services;

Whereas, the development of Internet Protocol Version 6 (IPv6) as well as the
world-wide migration from IPv4 to IPv6 will pave the way to solve the problem
of IPv4 address exhaustion, and deploying IPv6 will enable continued expansion
of the Internet in the country;

Whereas, in accordance with Executive Order 269 Series of 2004, the Commission
on Information and Communications Technology (CICT) is mandated to ensure
the provision of strategic, reliable and cost-efficient information and
communications technology (ICT) infrastructure, systems and resources as
instruments for nation-building and global competitiveness; and

Promotion of IPv6

IPv6 deployment and use

Interagency Task Force

Funding

Singapore: IPv6 Transition Programme

The IPv6 Transition Programme is a national effort spearheaded by IDA in its role as the national planner for Infocomm development, to address the issue of IPv4 (Internet Protocol version 4) exhaustion and to facilitate the smooth transition of the Singapore Infocomm ecosystem to IPv6 (Internet Protocol version 6).

Developed by the Singapore IPv6 Task Force, it involves a two-pronged approach to drive IPv6 adoption in the nation as well as encourage the efficient use of the remaining pool of IPv4 addresses to minimise the risks of depletion

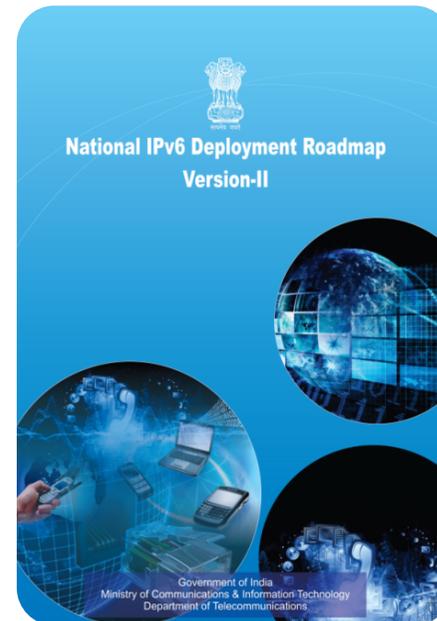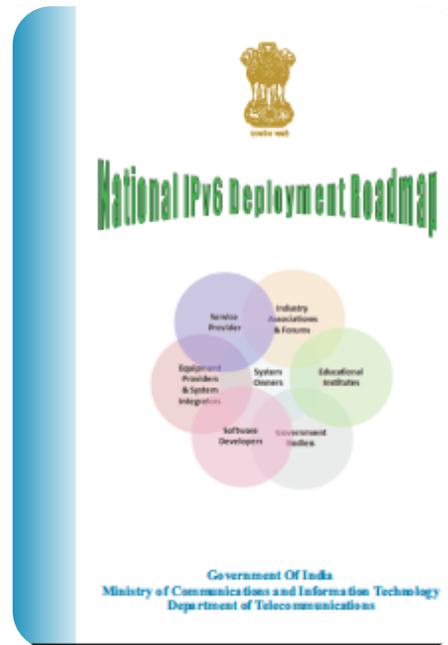| Developing reference specifications and transition guides	Engaging stakeholders	Developing IPv6 capabilities	Establishing an IPv6 Marketplace	Setting up IPv6 industry exemplars	Others

Source: http://www.ida.gov.sg/Technology/20110414104645.aspx

IPv6 Roadmap (example - India)

India: NTP 2012 and IPv6

Preamble
NTP-2012 recognises futuristic roles of Internet Protocol Version 6 (IPv6) and its applications in different sectors of Indian economy.

Objectives
Achieve substantial transition to new Internet Protocol (IPv6) in the country in a phased and time bound manner by 2020 and encourage an ecosystem for provision of a significantly large bouquet of services on IP platform.

Telecom Enterprise Data Services, IPv6 Compliant Networks and Future Technologies
To recognize the importance of the new Internet Protocol IPv6 to start offering new IP based services on the new protocol and to encourage new and innovative IPv6 based applications in different sectors of the economy by enabling participatory approach of all stake holders.

To establish a dedicated centre of innovation to engage in R & D, specialized training, development of various applications in the field of IPv6. This will also be responsible for support to various policies and standards development processes in close coordination with different international bodies.

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Structure of "India IPv6 Task Force"
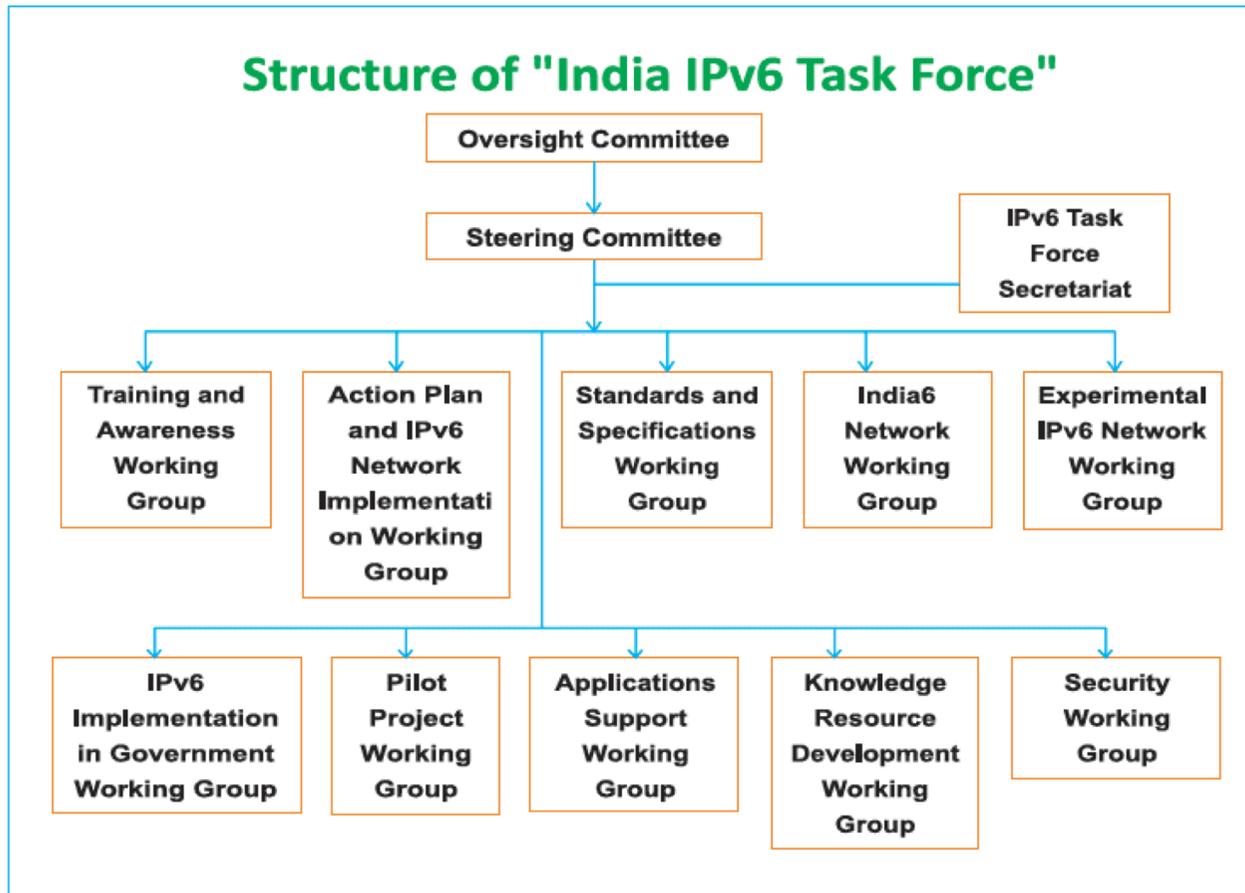
Governments promoting IPv6 deployment (example India)

Government Organisations:

- The Government organisations should prepare a detailed transition plan for complete transition to IPv6 (dual stack) by December 2017 based on the network complexity & equipment/ technological life cycles. The plan should be prepared latest by December 2013 and accordingly the required budgetary provisions should be made in their demand for grant.
- For this purpose, it is recommended that a dedicated transition unit in each organisation should be formed immediately to facilitate entire transition.
- All new IP based services (like cloud computing, data centres etc.) to be provisioned for / by the Government organisations should be on dual stack supporting IPv6 traffic with immediate effect.
- The public interface of all Government projects for delivery of citizen centric services should be dual stack supporting IPv6 traffic latest by 01-01-2015. The readiness of Government projects in turn will act as a catalyst for private sector transition from IPv4 to IPv6.

Governments promoting IPv6 deployment (example India)

Government Organisations:
- The Government organisations should procure equipments which are also IPv6 Ready (Dual Stack) and go for deployment of IPv6 ready (Dual Stack) networks with end to end IPv6 supported applications. The equipment should be either TEC certified or IPv6 Ready Logo certified.
- The Government organisations should go for IPv6 based innovative applications in their respective areas like smart metering, smart grid, smart building, smart city etc.
- The Government organisations should develop adequate skilled IPv6 trained human resources within the organisation through periodic trainings over a period of one to three years to have a seamless transition with minimum disruption.
- The IPv6 should be included in the curriculum of technical courses being offered by various institutes / colleges across the country.

Governments promoting IPv6 deployment (example India)

Service Providers:

Enterprise Customers

- All new enterprise customer connections (both wireless and wireline) provided by Service Providers on or after 01-01-2014 shall be capable of carrying IPv6 traffic either on dual stack or on native IPv6.
- Regarding the existing enterprise customers which are not IPv6 ready, the Service Providers shall educate and encourage their customers to switch over to IPv6.

Retail Customers (Wireline)

- All new retail wireline customer connections provided by Service Providers on or after 01-01-2017 shall be capable of carrying IPv6 traffic either on dual stack or on native IPv6.
- The Service Providers shall endeavor to progressively replace/ upgrade the Service Providers owned CPEs which are not IPv6 ready as per the following timelines:
- Replacement/ upgradation of 25% of CPEs by December 2014.
- Replacement/ upgradation of 50% of CPEs by December 2015.
- Replacement/ upgradation of 75% of CPEs by December 2016.
- Replacement/ upgradation of 100% of CPEs by December 2017.

Regarding the customer owned CPEs which are not IPv6 ready, the Service Providers shall educate and encourage their customers to replace/ upgrade such CPEs to IPv6 ready ones.

Governments promoting IPv6 deployment (example India)

Retail Customers (Wireless)
- All new LTE customer connections provided by Service Providers with effect from 01-01-2017 shall be capable of carrying IPv6 traffic either on dual stack or on native IPv6.
- All new GSM/ CDMA customer connections provided by Service Providers on or after 01-01-2017 shall be capable of carrying IPv6 traffic either on dual stack or on native IPv6

Content & Application Providers:

- All contents (e.g. websites) and applications providers should endeavour to adopt IPv6 (dual stack) by 01-01-2017.'

- The complete financial ecosystem including payment gateways, financial institutions, banks, insurance companies etc. should endeavour to adopt IPv6 (dual stack) by 01-01-2017.'

- The entire '.in' domain should endeavour to adopt IPv6 (dual stack) by 01-01-2017.'

Governments promoting IPv6 deployment (example India)

Equipment Manufacturers:
- All mobile phone handsets/ data card dongles/ tablets and similar devices used for internet access supporting GSM/CDMA version 2.5G and above sold in India on or after 30-06-2014 shall be capable of carrying IPv6 traffic either on dual stack (IPv4v6) or on native IPv6.
- All wireline broadband CPEs sold in India on or after 01-01-2014 shall be capable of carrying IPv6 traffic either on dual stack or on native IPv6.

Cloud Computing / Data Centres:

- All public cloud computing service / data centres providers should endeavour to adopt IPv6 (dual stack) latest by 01-01-2017.

Key elements of government action

• Establishing or supporting national IPv6 transition task forces (often in conjunction with multistakeholder groups or RIRs);

• Establishing national "roadmaps" with benchmarks and timetables for IPv6 deployment;

• Mandating that government agencies adopt IPv6 technology for their networks, websites or services;

• Promoting the use of IPv6 in government-funded educational, science and research networks; and

• Promoting overall awareness of the transition through setting up websites, hosting workshops or forums, and setting up training programmes.

Thank You