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Department of Communications and the Arts
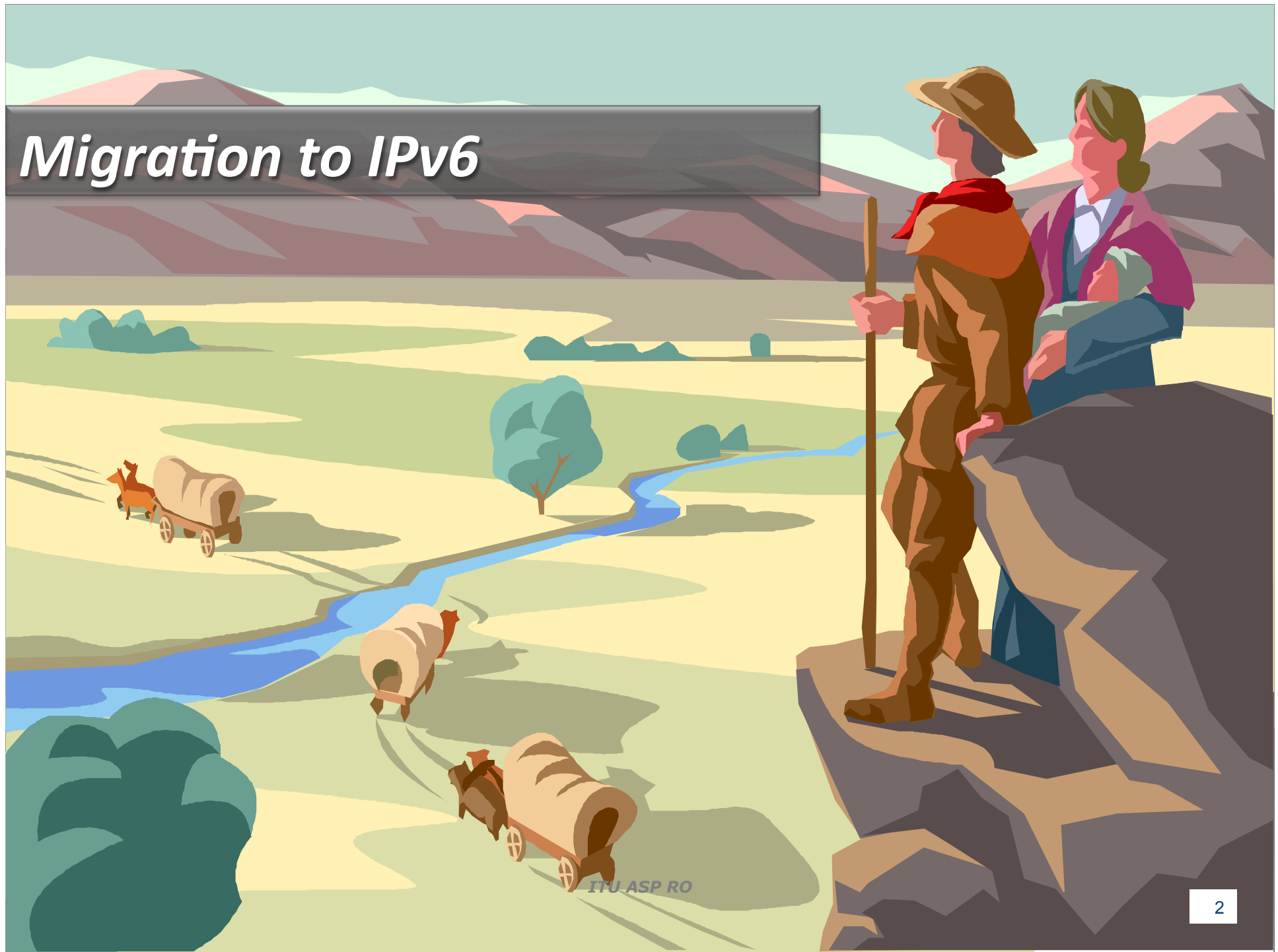
MPT-ITU-APNIC IPv6 Workshop
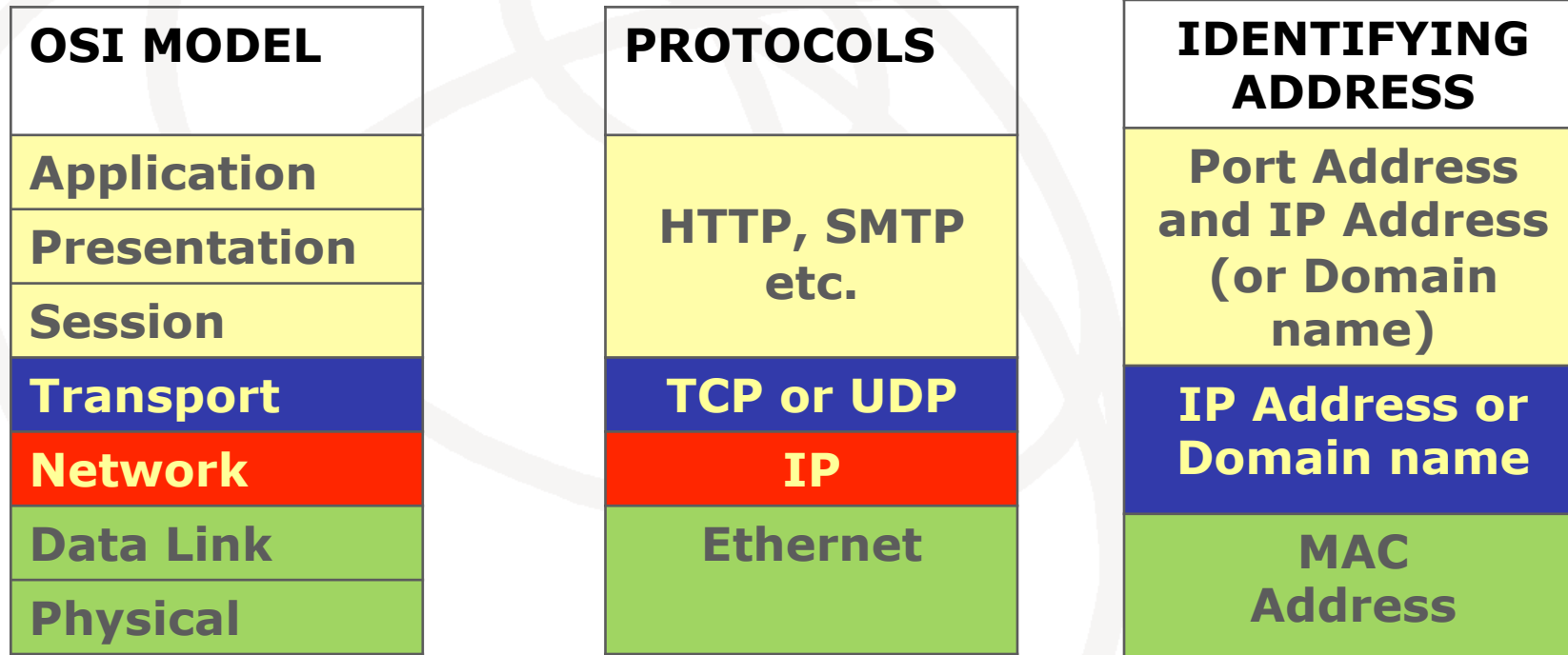
20-24 June 2016
Phnom Penh
Cambodia

Migration to IPv6

ITU ASP RO

2

OSI MODEL	PROTOCOLS	IDENTIFYING ADDRESS
Application	HTTP, SMTP etc.	Port Address and IP Address (or Domain name)
Presentation		
Session		
Transport	TCP or UDP	IP Address or Domain name
Network	IP	
Data Link	Ethernet	MAC Address
Physical		

Understanding Naming and Addressing

	Name (Source – Destination independent)	Address (Source independent – Destination dependent)
Fixed Telephone	E.164 Number	Q.708 ISPC
Mobile Telephone	E.164 Number	E.212 IMSI
Internet	Domain Name	IP Address

Promoting Efficiency in Allocation of IP Addresses

32 bit address space allocated
- 256 Networks, 16 Million Hosts each

Network Class Based Architecture
- Class A (128 Networks, 16 Million Hosts each)
- Class B (16384 Networks, 65,535 Hosts each)
- Class C (4 Million Networks, 255 Hosts each)

Classless Inter-Domain Routing
- Variable length network portion in the address

Use of Restrictive Policy by RIR for allocation

Taking into account: -
- Scarcity of IPv4 Addresses
- Need to Maximize Aggregation
- Limit Routing Table Growth

Migration from IPv4 to IPv6
- 128 Bits,
- 3.4 X 10 ^38 Addresses

ITU and IPv6...........

ITU and IPv6

RESOLUTION 101 (REV. BUSAN, 2014)
Internet Protocol-based networks

RESOLUTION 180 (REV. BUSAN, 2014)
Facilitating the transition from IPv4 to IPv6

RESOLUTION 63 (Rev. Dubai, 2014)
IP address allocation and facilitating the transition to IPv6 in the developing countries
ASIA-PACIFIC REGIONAL INITIATIVE 3
Harnessing the benefits of new technologies
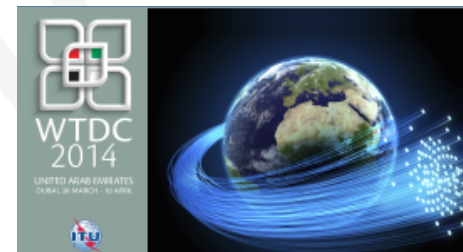
RESOLUTION 64 (REV. DUBAI, 2012)
IP address allocation and facilitating the transition to and deployment of IPv6

CAPACITY BUILDING AND MEMBER ASSISTANCES

ITU COUNCIL

ITU-T and ITU-D STUDY GROUPS

Name of Organization	Type of Organization	IPv6 Role and Activities
Standards Bodies		
European Telecommunications Standards Institute (ETSI)	Standardization Body	Interoperability Testing IPv6 Ready Logo Programme
The Internet Engineering Task Force (IETF)	Standards, Engineering	Sole IP designer of IPv6
Internet Governance & Advocacy Groups		
International Chamber of Commerce (ICC)	Advocacy Group	Repeated and consistent support for IPv6 transition Identified measurements of IPv6 deployment.
Internet Corporation for Assigned Names and Numbers (ICANN)/ Internet Assigned Numbers Authority (IANA)	Internet Governance	Added IPv6 addresses for six of the world's 13 root server networks.
Internet Governance Forum (IGF)	Advocacy, Policy Discussion	Has held workshops to address IPv6 transition issues
Internet Society (ISOC)	Advocacy, Policy Discussion	World IPv6 Day, 2011 World IPv6 Launch Day, 2012
RIPE NCC	RIR[28] for Europe	Portal IPv6 ActNow High IPv6 allocation count
ARIN	RIR for North America	Began aggressive rollout plan in 2007
APNIC	RIR for Asia	Monitors and supports IPv6 deployment in the Asia-Pacific region
AFRINIC	RIR for Africa	Offers IPv6 transition support, featuring training materials and test beds
LACNIC	RIR for Latin America and the Caribbean	Maintains a portal in 3 languages (Spanish, Portuguese, English) as a one-stop IPv6 resource
European Network and Information Security Agency (ENISA)	Advocacy, Policy Discussion	Center of Excellence for European States on network and information security

Source: Author

- *Collaboration between ITU and relevant Organisations*

- *Raising awareness and human capacity building*

- *e.g. ITU , APNIC, MICT Thailand, Others*

- *Assist Member States with existing IPv6 management and allocation policies*

-*e.g. ITU APNIC assistance in Asia-Pacific*

- *Undertake detailed studies of IP address allocation…, both for IPv4 and IPv6*

- *Technical Standards*

ITU-T Study Groups and IPv6

Study Group 2 — *Operational aspects of service provision and telecommunications management*

Study Group 3 — *Tariff and accounting principles including related telecommunication economic and policy issues*
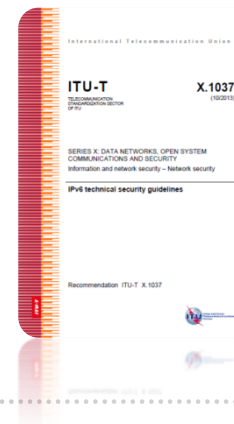
Study Group 13 — *Future networks including mobile and NGN*

Study Group 16 — *Multimedia coding, systems and applications*

Study Group 17 — *IPv6 Security*

IPv6 Related ITU-T Recommendations

Rec. ITU-T Y.2051 - General overview of IPv6-based NGN
Rec. ITU-T Y.2052 - Framework of multi-homing in IPv6-based NGN
Rec. ITU-T Y.2053 - Functional requirements for IPv6 migration in NGN
Rec. ITU-T Y.2054 - Framework to support signaling for IPv6-based NGN
Rec. ITU-T X.1037 - IPv6 technical security guidelines

ITU-T related work on IPv6 Security (ongoing)

Work item	Question	Subject/title	Timing	Study group	Study period
X.gsiiso	Q2/17	Guidelines on security of the individual information service for operators	2016-03	SG17	2013-2016
X.sdnsec-2	Q2/17	Security requirements and reference architecture for Software-Defined Networking	2017-09	SG17	2013-2016
X.sgmvno	Q2/17	Supplement to ITU-T X.805 Security guideline for mobile virtual network operator (MVNO)	2016-09	SG17	2013-2016
X.tigsc	Q2/17	Technical implementation guidelines for ITU-T X.805	2017-03	SG17	2013-2016

Source: http://www.itu.int/net/ITU-T/ipv6/itudocs.aspx

Migration to IPv6: Building Roadmaps, Action Plans

ITU ASP RO

General Approach

- *Policy Announcements*

- *Creation of IPv6 Task Force*

- *Encouraging IPv6 deployment in government*

- *Standards, Pilot tests, Interoperability etc.*

- *Awareness and Capacity Building*

- *Measuring Deployments and Tracking Progress*

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.
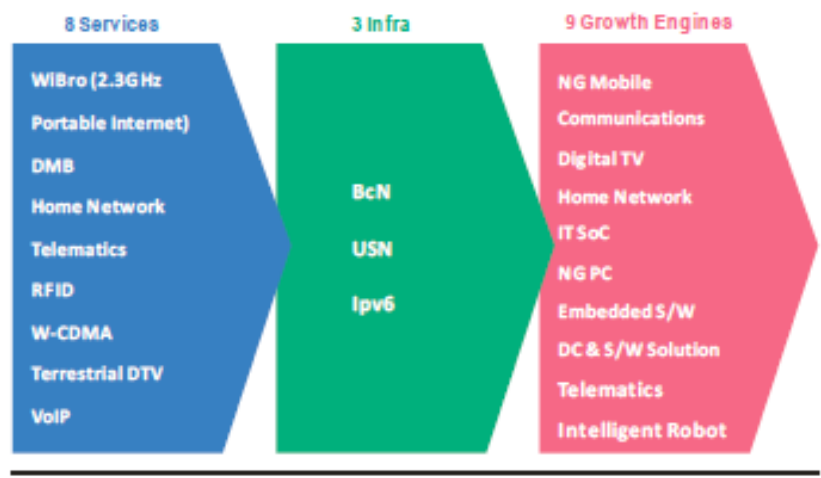
India: NTP 2012 and IPv6

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.

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**.'

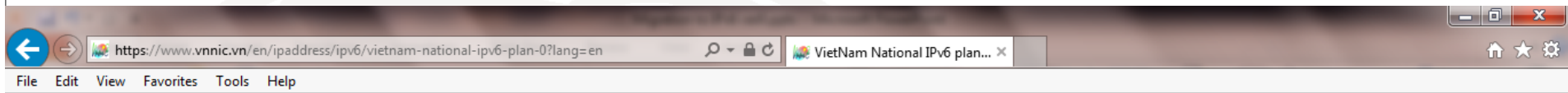# *Governments promoting IPv6 deployment (example India)*

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**.

Governments promoting IPv6 deployment (examples)

https://www.vnnic.vn/en/ipaddress/ipv6/vietnam-national-ipv6-plan-0?lang=en

VietNam National IPv6 plan... ×

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MINISTRY OF INFORMATION AND COMUNICATIONS
VIETNAM INTERNET NETWORK INFORMATION CENTER

Home page   Domain name   **IP/ASN**   Registrars   DNS & VNIX System

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   ▸ **ASN**
   ▸ **Statistics**

▸ **Registrars**

▸ **EPP Gateway**

▸ **DNS & VNIX System**

▸ **Internet statistics**

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.

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

Singapore: IPv6 Adoption Guide Report - I
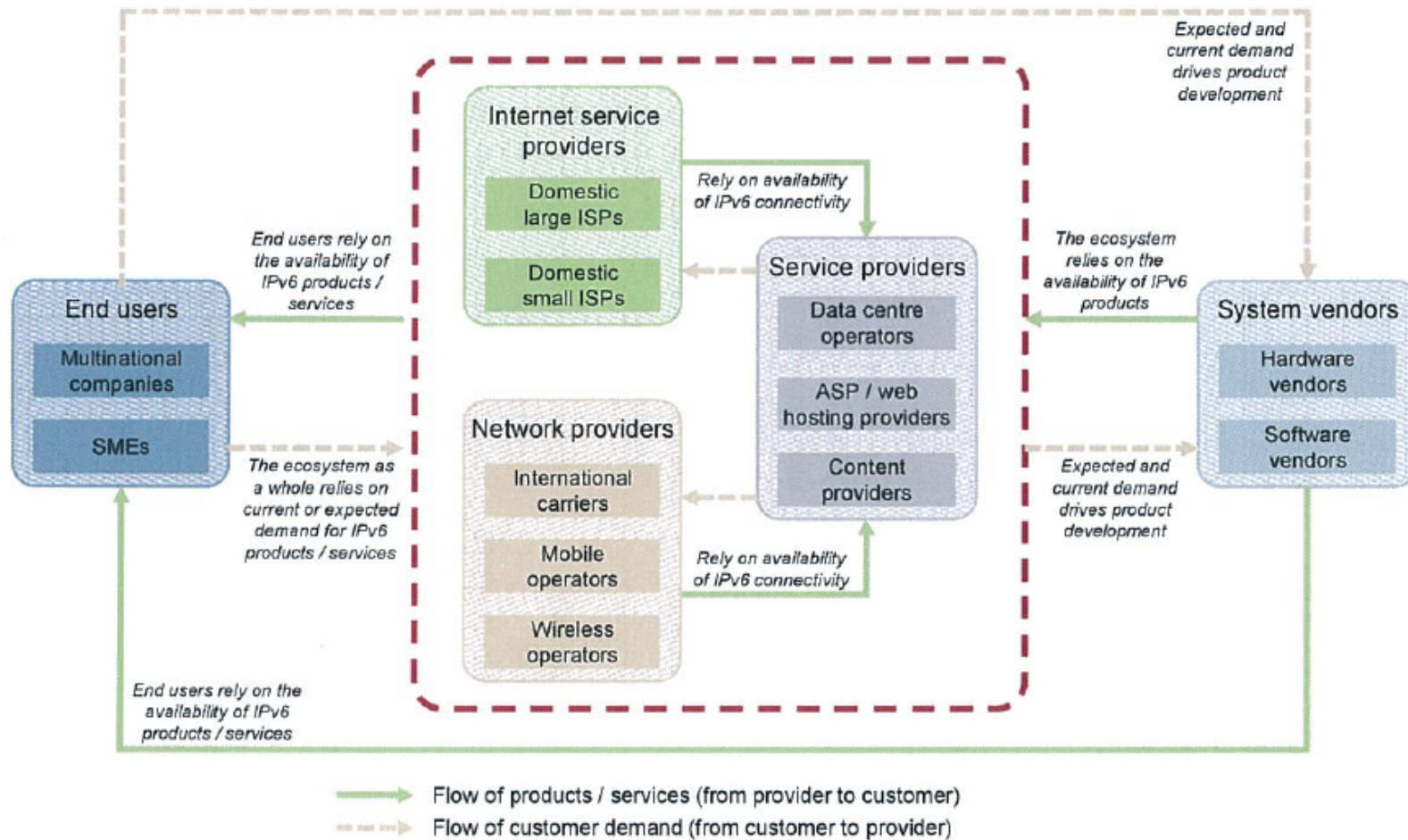
Figure 3.1:   Summary of IPv6 dependencies between stakeholder categories [Source: Analysys Mason]

Report prepared by analysys mason and Tech Mahindra for IDA Singapore available at http:// www.ida.gov.sg/images/content/Technology/Technology_Level1/ipv6/download/ IPv6AdoptionGuideforSingapore.pdf

Focus areas identified in the report

Planning

Network

Applications

Skills

Services / products

Zoom on network providers

Content providers — **Network providers** — **End users / customers**

- Content / Hosting providers (Web, audio, video)
- Transit ISP
- Mobile ISP
- IX
- ISP A
- ISP B
- Broadband ISP
- Enterprise X
- Mobile Services
- Devices, operating systems
- Customer premises

Domain name system
- Example.com DNS server
- TLD DNS server
- Root DNS server
- ISP DNS service
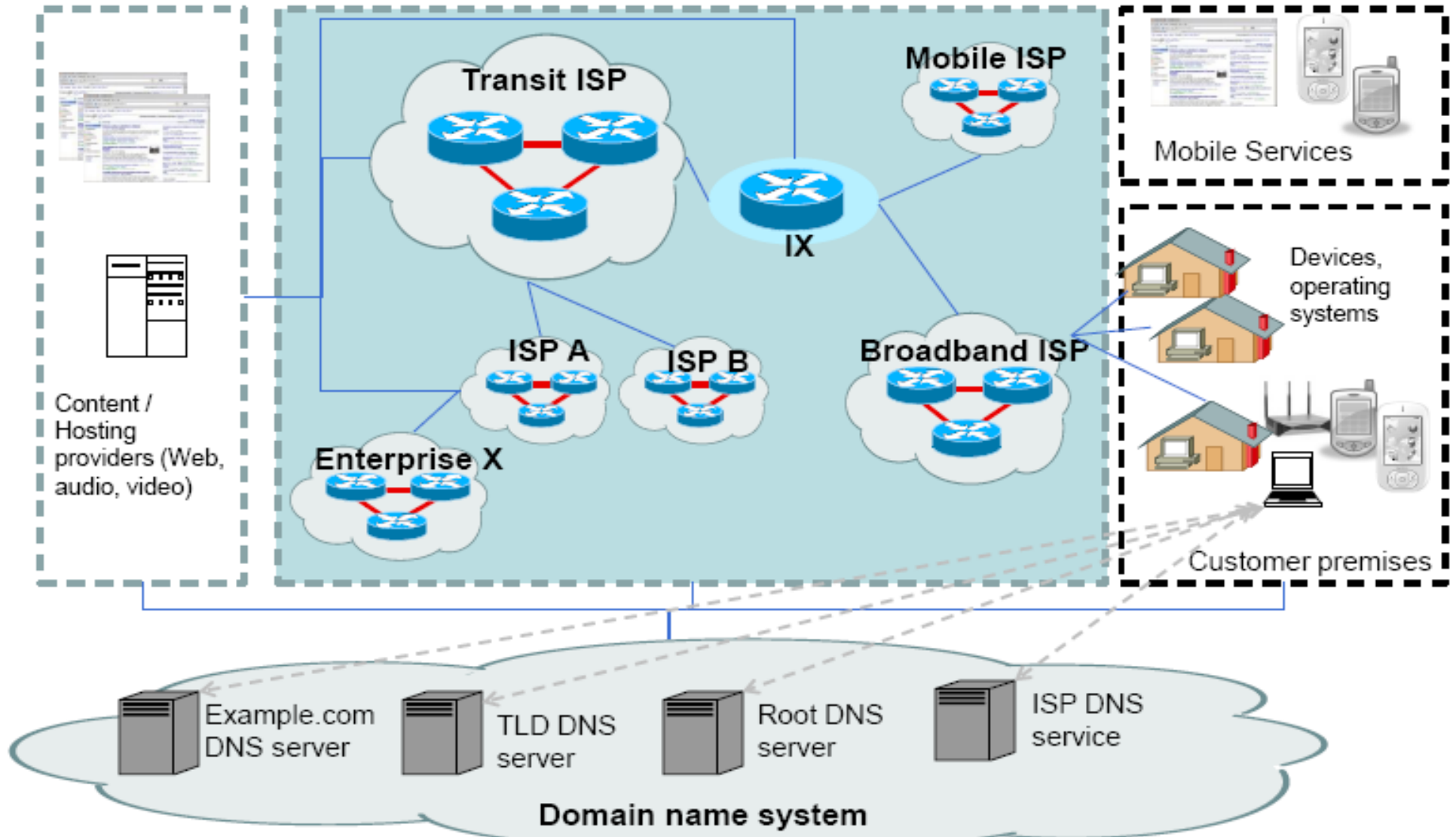
Source: OECD Presentation; Measuring Deployment of IPv6, Karine Perset
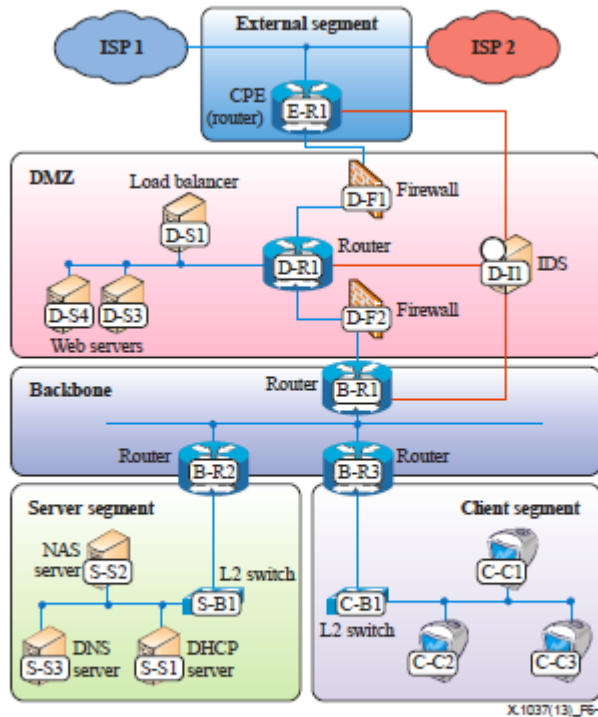
IPv6 Infrastructure Security (ITU-T X.1037)

Figure 6-1 – Example topology of an IPv6 enterprise network

Network Devices
(Router, Switch, NAT device)

Security devices such as firewalls and IDS Devices
(Intrusion Detection System, Firewall)

Clients, servers, and other end devices
(End Nodes, DHCP, DNS)

Thank You