Why, When & How ?

Asela Galappattige
Sri Lanka Telecom PLC

LkNOG

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Precursor

- World has run out of IPv4 addresses
- IPv6 is the new Network Address Scheme for the Internet
- IPV6 address is 128bits long compared to 32bits of IPv4
- IPv6 provides the solution for address scarcity

Why do you need IPv6 ?

1. **IPv6 is no more a Minority**
   - IPv6 traffic is growing rapidly throughout the world
   - IPv6 only Users and ISPs are immerging
   - IPv6 enabled APPs growing

Notes:

- *Starting June 1, 2016, all apps submitted to the Apple App Store must support IPv6-only networking*
- *Microsoft moves to IPv6 only internally*
- *T-mobile (US) launches IPv6 only network*

Global IPv6 Status

APNIC Labs – Global IPv6 Capability Analysis

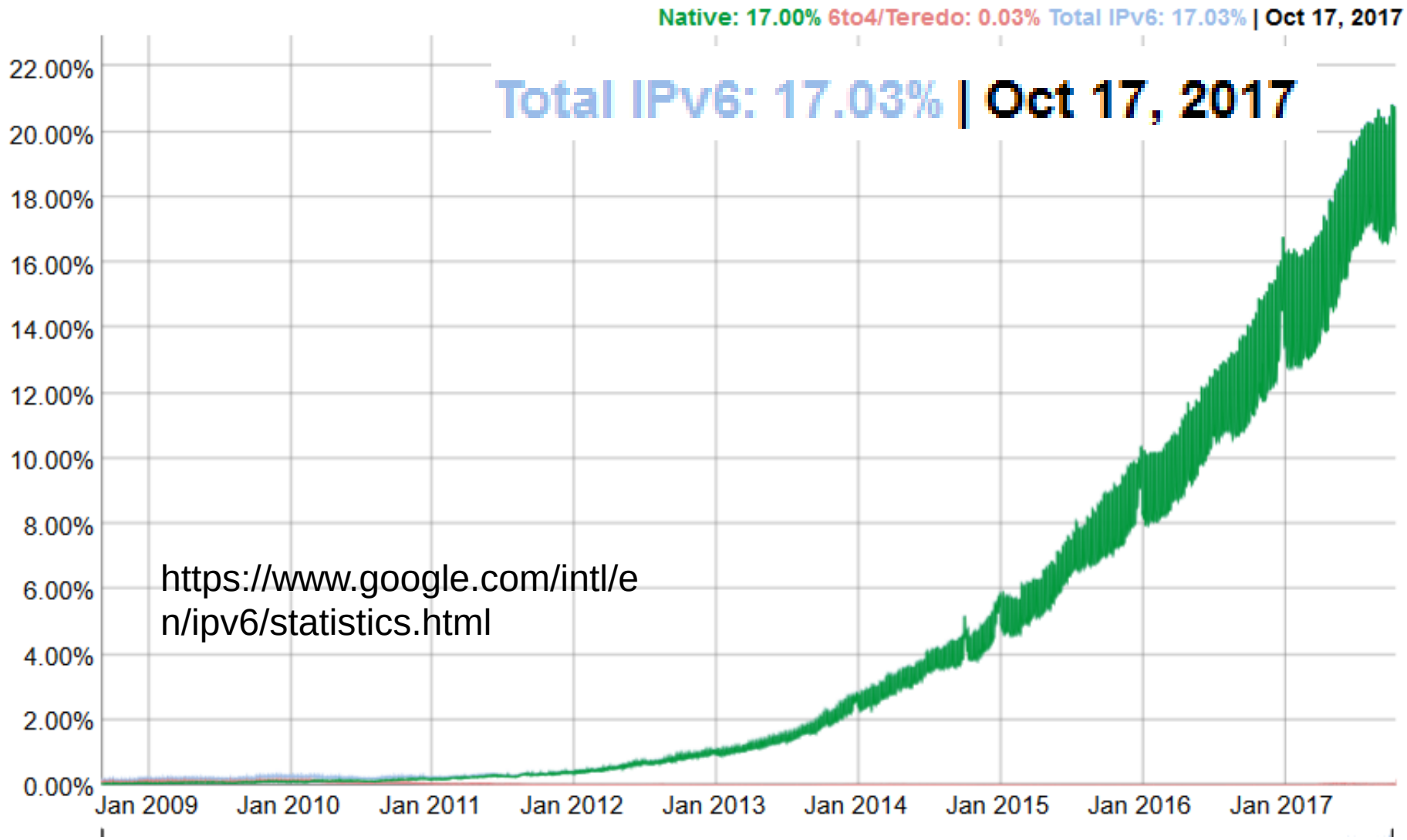
Region	IPv6 Capable	IPv6 Preferred
World	15.47%	14.88%
Unclassified	86.22%	85.81%
Americas	24.30%	23.28%
Europe	15.24%	14.78%
Asia	14.70%	14.13%
Oceania	13.42%	12.72%
Africa	0.50%	0.48%

South Asia	39.01%	38.18%
Sri Lanka	**6.27%**	**5.96%**

Data as of 11 Oct 2017 *https://stats.labs.apnic.net/ipv6/*

Global IPv6 Status

Google IPv6 Traffic Measurement



Sri Lanka n IPv6 Status

***AS worldwide report* -> Sri Lanka**

15 ASNs are active
06 ASNs have IPv6 prefixes announced to the Internet.

In total there are 16 IPv6 prefixes configured by following networks;

1. ***Sri Lanka Telecom***
2. ***Dialog Axiata***
3. ***LEARN***
4. ***LankaCom***
5. ***Mobitel***
6. ***Etisalat***

https://www.tcpiputils.com/browse/as/lk

End User IPv6 Status

- **PC / Smart Phone OSs prefer IPv6 by default**
  - *Windows, Linux, Android, iOS*
- **Close to 90% user traffic will be on IPv6 when enabled**
  - *YouTube. Facebook, Google, Akamai etc. are on IPv6*
- **IPv6 only service providers and networks will soon immerge**
- **IOT and Smart Applications will prefer IPv6**

IPv6 has now passed the "INNOVATORS" and "EARLY ADOPTION" stages, & is moving into the "EARLY MAJORITY" stage.

Why do you need IPv6 ? *continued*

2. **Less Effort & Cost if Started Early**
   - **Train and educate People**
     - *Bring people to the Comfort Zone*
     - *Build LEADERS / CHAMPIANS*
   - **Adopt Gradually**
   - **Enforce compliance for new assets**

3. **Avoiding IPv6 is Costly**
   - **Invest on work-arounds** (for IPv4 address deficiency)
   - **Lose Confidence of Customers**
   - **Bad Reputation –** *" Technically Lagging "*

     ~~*" Cutting Edge Technology "*~~

When do you need IPv6 ? *continued*

Be ready NOW !

IPv6 adoption is a JOURNEY!
If you have not started the journey yet
you may be already late;

- Be with the **Cutting Edge Technology**
- Protect your **Reputation**
- **No more IPv4** new address allocations
- **Costs more when** started **Late**
- Takes **time to learn** & come to the comfort-zone

HOW should you deploy IPv6 ?

1. **Acquire Numbers & Connectivity**
   - *Get IPv6 Allocation (from ISP, APNIC)*
   - *Get connectivity from ISP (ILL, VPN, Broadband)*
2. **Adopt Early and Lead**
   - *Train People, Develop Skills*
   - *Come to the **comfort zone***
3. **Identify Gaps**
   - *Audit your systems / network capabilities*
4. **Identify Strategy**
   - *Dual Stack, IPv6 only, Tunnel*
   - *Identify priorities*

HOW should I deploy IPv6 ? *continued*

5. **Implement Gradually**
   - *Enforce Compliance for New Investments*
   - *Upgrade with minimum cost*
   - *Implement step by step*
     - *Security*
     - *Web Presence*
     - *Internal Networks*
     - *Back-End Systems*

IPv6 Adoption
Service Provider Experiences

The Dilemma of Business Justification:

- **IPv6 does not generate Direct Revenue $$$**
- **No Regulatory Pressure (in SL)**
- **No urgent IP address pressure**
  - ***IPv4 address Work-arounds in place (NAT, CGN)***
  - ***Comparatively smaller networks***
- **No serious Demand Pull ??**

Chicken & Egg syndrome !

Not True any more

IPv6 Adoption
Service Provider Experiences

It is a Long and Difficult Journey for an ISP

- Success depends on dedication and enthusiasm of Leaders
- Lead from the top
- Learn and Educate / Aware others
- Form a Task-Force / Steering Committee
- Get the Blessings from Management
- Operationalize in Stages

Service Provider Experiences

Most ISPs select DUAL-STACK operation in order to support the NEW and the OLD in one network

Start with the Easier Stuff;

A. Enable Dual Stack on ISP Network & Services

- Upgrade / Configure Routers
- Upgrade DNS Servers / Resolvers
- Upgrade / Configure Web Servers
- Upgrade / Configure Security Infrastructure
  - Firewalls / IPSs / DDOS / etc.
- Upgrade / Configure NMS / Monitoring Systems
- Configure OSS to support IPv6 fields for relevant products

B. Enable Dual Stack on Internet Up Links

- Dual stack is native with most global providers now
  - *Not so 5-10 years back*
- Make sure routing is efficient as for IPv4
  - *Sometimes routes could be advertised non-optimally*

Service Provider Experiences *continued*

Enable the Business Segments

C. Enable the Transport / Core Network Edges

- Dual-stack the PE (MPLS) routers – 6PE / 6VPE -
- No need to upgrade the P-Routers
  - *Can remain IPv4 since MPLS takes care of Packet Transport*

D. Enable Dual Stack for Internet Leased Circuits

- Provide DS Internet leased lines
- Encourage and Assist Customers

E. Enable Dual Stack for VPNs

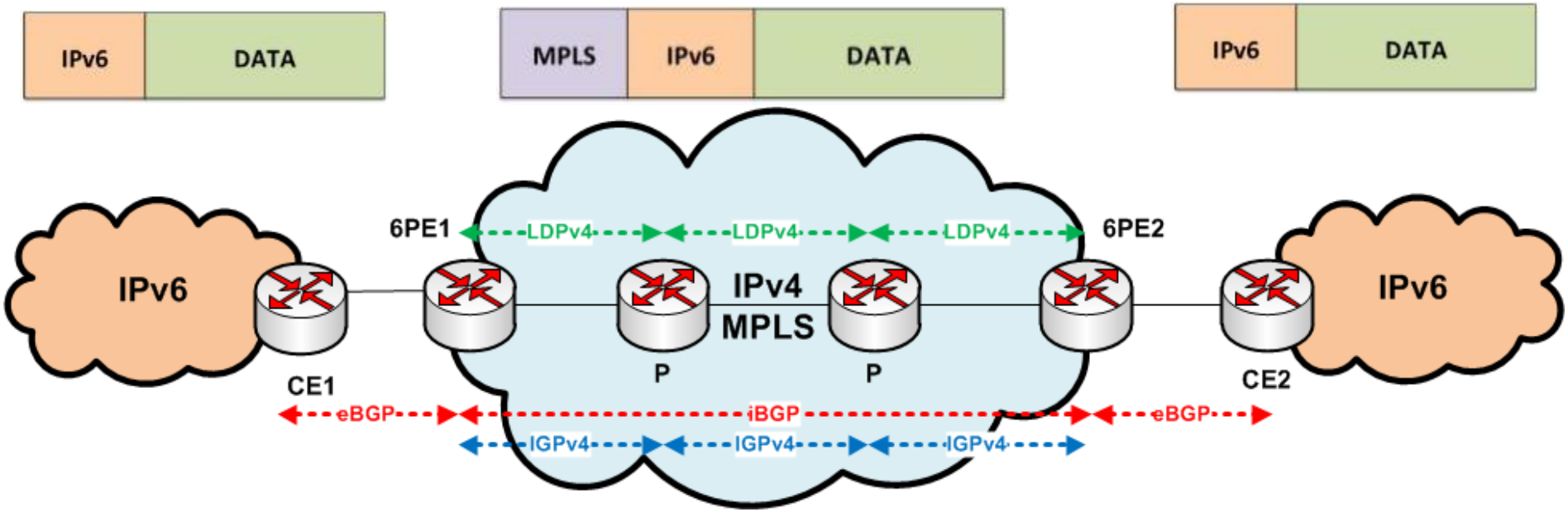
- Use 6VPE
- Encourage and Assist Customers

6PE

RFC 4798
Configuring IPv6 Islands over IPv4 MPLS Using Provider Edge Routers

Features

- Core remains IPv4
- Edge devices (6PE) must support dual-stack
- IPv6 packets transported over LSP
- IPv4 Control plane (IGPv4, LDPv4, MP-BGP)

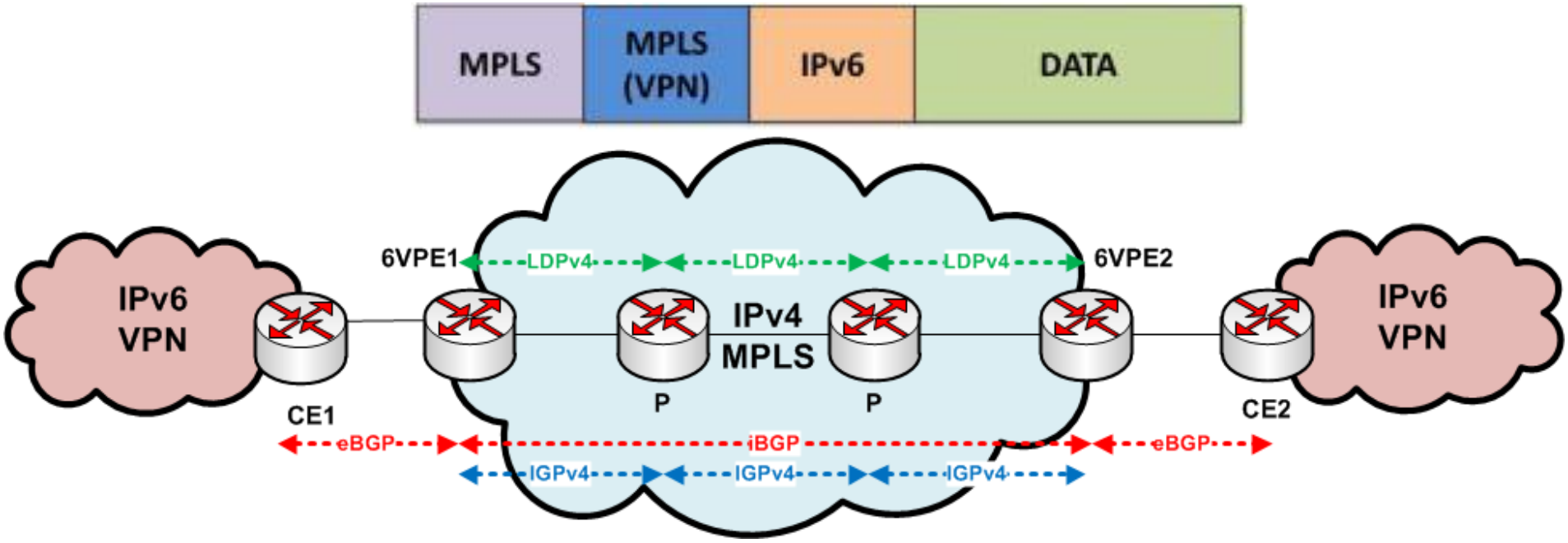


6VPE

RFC 4659
BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN

Features

- IPv6 VPN provisioning over IPv4/MPLS
- Edge devices (6VPE) must support dual-stack
- Same MPLS VPN features as for IPv4



Service Provider Experiences *continued*

Mass Market (Fiber, DSL, Wireless – LTE)

F. Control Systems

- Upgrade & Configure Authentication Systems (AAA)
- Upgrade Policy Enforcement Points
  - DPIs / BRASs / PGWs / etc.
- Enable and Verify Usage Measurements on Dual Stack
- Scale DNS infrastructure
- Modify Billing / Mediation Systems
- Modify OSS as necessary

G. Access Networks

- Manage Migration Gradually
  - Minimize Disruption
  - Verify proper customer experience
    - Optimize routing
    - Scale DNS

Service Provider Experiences *continued*

Mass Market (Fiber, DSL, Wireless – LTE)

H. Customer Equipment

- Existing CPEs
  - *Dual Stack ready (most)*
  - *Configured for IPv4 only*
  - *Re-configuration required for Dual Stack*
- Ship NEW CPEs with DS Enabled by Default
- Verify Experience on both Protocols

I. Customer Care

- Aware Field & Support staff of changes
- Train staff for new Concepts and Troubleshooting
- Modify supporting tools
  - *NMS / EMS / ACS / System Interfaces*

Service Provider Experiences *continued*

Minimal IPv6 Specific investment

COSTS

- **IPv6 specific infrastructure** investments
  - *Most network and system upgraded with software / firmware upgrades* → ***No Cost***
  - *IPv6 is made mandatary for new investments* → ***No added cost***
- **IPv6 Transition Capabilities** (NAT64, DNS64, Tunnel Servers etc.)
  - *Delivered bundled with CGNAT / Load Balancers / Firewalls etc.* → ***No added cost***

- **Training and Development**
- **Cost to sustain IPv4 growth** – CGNAT → **IPv4 Cost**

Message

- IPv6 allows the growth to continue
- IPv6 is not an expensive affair
- Learn from others' experiences
- Identify your unique strategy
- Adopt early and migrate gradually

Be a Leader &

Do not get left behind!

How Can LkNOG Help

LKNOG can assist you in the learning process based on demand

- ***Awareness***
- ***Workshops***
- ***Knowledge Sharing platform***

Thank You!

LkNOG Wi-Fi is IPv6 Enabled
sponsored by **SLT**

Check your IPv6

```
C:\Users\#####> nslookup
Default Server:  ##
Address:  ##

> www.slt.lk
Server:  ##
Address:  ##

Non-authoritative answer:
Name:    www.slt.lk
Addresses:  2402:d000:100:2::2
          220.247.222.74
```

← Quad-A (AAAA) DNS Record

Utilities:Windows: Command line / Netsh
Android: Network Utilities App

Check your IPv6

```
C:\Users\#####> tracert www.slt.lk
Tracing route to www.slt.lk [2402:d000:100:2::2]
over a maximum of 30 hops:
```

IPv6 address is Preferred

Check your IPv6

```
C:\Users\#####> ipconfig
```

Check your IPv6