



Future Of *Internet*

A G E N D A

IPv6:-How Big?

IPv6:-Business Drivers

Key Steps in Migration

IPv6 :-Case-Studies – TCL Adaptation

Concluding Thoughts!!

How Big is The Ipv6 Address Space

- ($2^{128} = 340,282,366,920,938,463,463,374,607,431,768,211,456$)
- = 67 billion billion addresses per cm^2 of the planet surface

80 Tonnes



- You would need 80,000 Kgs of Atoms to represent IPv6!!!

IPv6 Business Drivers

IPv4 Address Space Completion

- Public or Private Space
- Limiting network expansion and putting at risk business continuity
- Introducing Operational Challenges

National IPv6 Strategies

- Compliance: DOT Mandate, IPv6 task Force
- Next Generation Internet CNGI Project in China
- European Commission Recommendation

IPv6 in Client Software

- Ipv6 "ON" in Microsoft Vista
- Sensor Network
- Peer to Peer Networking
- V6 over v4 Tunnel Providers

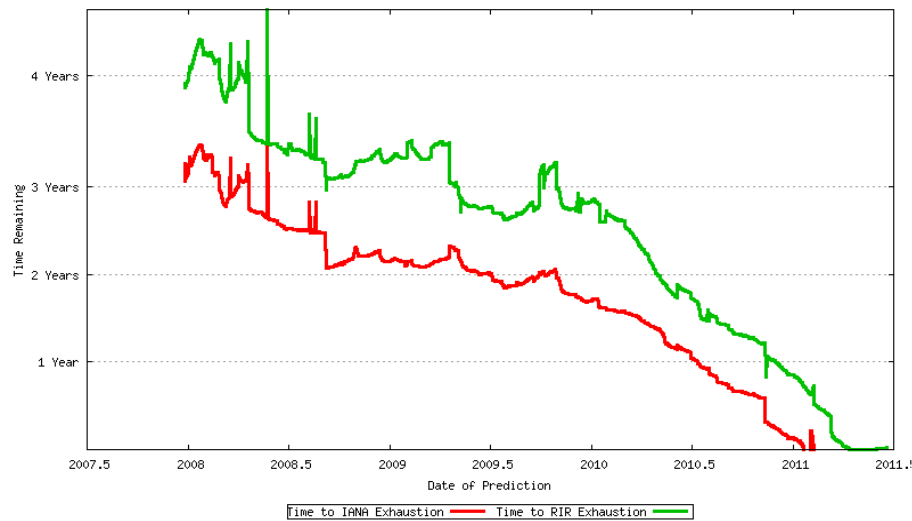
Infrastructure Evolution

- NGN architecture require IPv6
- Mobile/PDA/Tablets etc
- Network in Motion
- Networked Sensor i.e. AIRS



IPv6 Business Drivers

The Gap between supply and demand of IP addresses is widening



The pool of IPv4 address blocks is **dwindling rapidly**

While the number of new Internet devices is **exploding**

IPv6 Ready

Business Apps



Internet of Things



Operating systems



Mobile Internet



Internet Protocol – Version 6 –Integration Techniques:

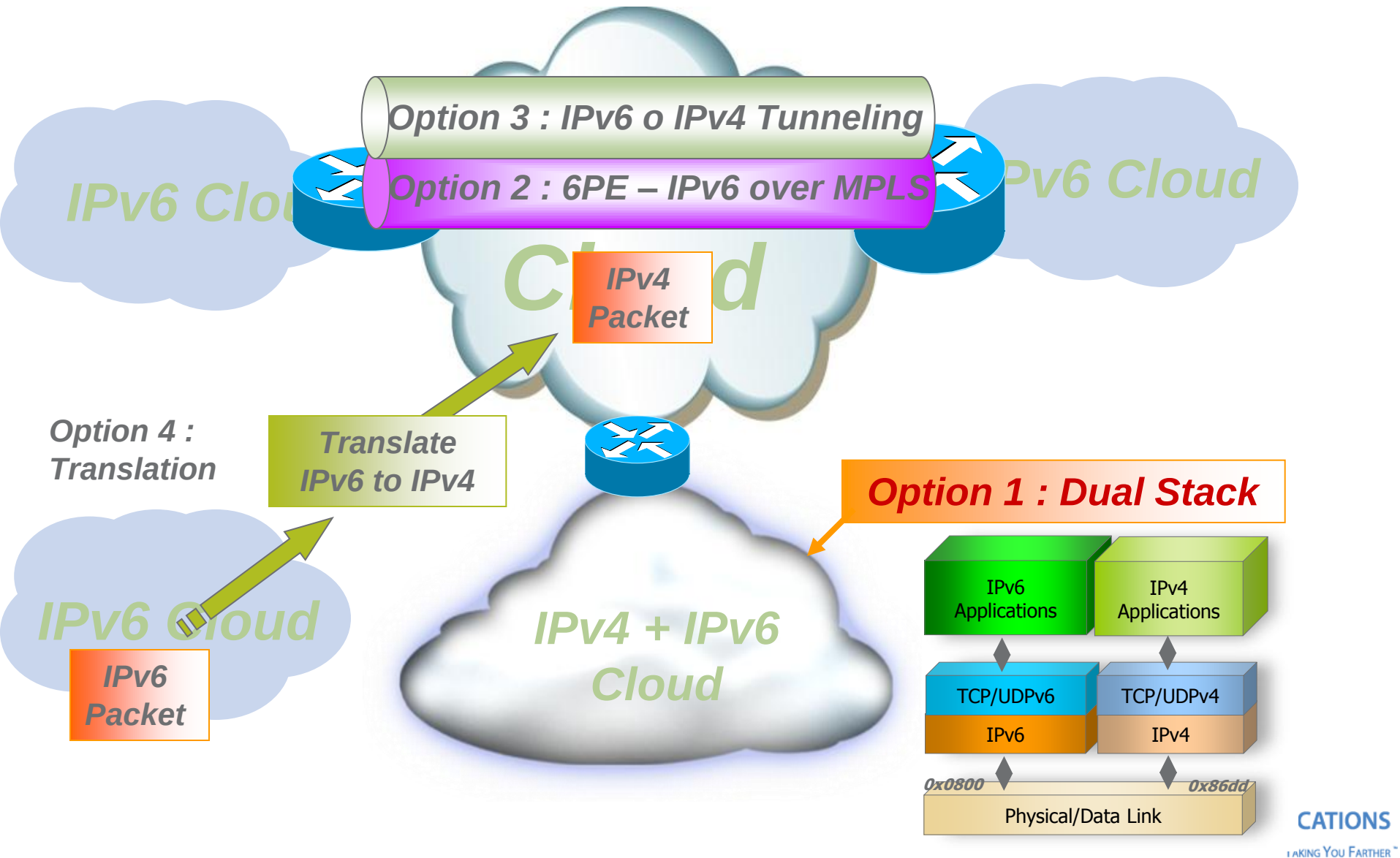
IPv6 Migration techniques can be broadly classified under the following 4 options:

*Most
Preferred*

- *Dual Stack*
- *IPv6 over MPLS – 6PE*
- *IPv6 over IPv4 Tunneling*
- *IPv6 Protocol Translation*

*Least
Preferred*

Internet Protocol – Version 6 – Integration Techniques:



All four options are non-disruptive and allow for a peaceful co-existence of IPv4 and IPv6.

IPv6 transition planning steps:

Step 1

Incubate
IPv6
resources



- Create a pool of IPv6 resources through IPv6 technical training:
- Class Room training
- Web based CBTs.
- IPv6 seminars etc.,

IPv6 transition planning steps:

Step 2

Lab Testing and Validation



- Create an IPv6 LAB Test Bed:
- Create an IPv6 test plan based on :
 - Production network scenarios.
 - Production application environments

IPv6 transition planning steps:

Step 3

Create an Inventory of various network hardware and the IPv6 feature set needed.

Work out the budgetary requirement for IPv6 network upgrade.

E10						
Font Alignment Number						
A	B	C	D	E	F	G
Asset	Network Equipment Model	Equipment Software	IPv4 Features	Corresponding IPv6 Features	Actionables	
Branch Router	Cisco 1841	12.0(32)S	OSPFv2	OSPFv3	No Hardware or Software upgrade needed	
Gateway Router	Cisco 7200	XXX	OSPFv2	OSPFv3	Software to be upgraded.	
Core Switch	XXX	YYY	OSPFv2	OSPFv3	Router to be upgraded	

• Identify the upgrade requirement for the various inventories

Based on this work out the budget needed for network upgrade.

IPv6 transition planning steps:

Step 4

Pilot
Network
Deployment

Network
Transition
planning

- Identify a small part of the network for IPv6 Pilot deployment.
- Identify some clients and services for pilot deployment
- Based on the learning's from the pilot deployment, plan the network transition.

The first step is to get access to IPv6 internet and start testing access to IPv6 Websites/front end and hosting content on the IPv6 internet

For Internet content migration application proxy solutions can be a good starting point

What can you expect during the process?

Routers and Switches

- Most of the hardware procured in the last 1 - 2 years should be IPv6 ready.
- Might need software upgrade in some cases.
- Older hardware might not switch IPv6 in hardware.
- Some IPv4 features such as DHCP Snooping might not have equivalents in IPv6.

Firewalls

- Only some of the recent firewalls support IPv6, so there is a good possibility that you might need a H/W or software upgrade.
- Not all filters might be supported for IPv6, you might need to do a careful feature wise due diligence to understand feature gaps.

Software

- Windows Vista , linux , MAC desktops should have IPv6 support.
- Older versions of windows , MAC might not have all of IPv6 functionality.
- Open Source software for web hosting, DNS, Mail etc., should support IPv6 but might need upgrades.
- Commercial software and custom apps should be carefully looked at for IPv6 dependency.

World IPv6 Day Experiment :

On the world IPv6 day the Content providers opened the flood gates

Key Objectives were to understand the issues that will degrade or enhance the delivery of Internet Service Experience :

Network related aspects

Non-Network related aspects (App / OS etc.,)

Other preparations for the World IPv6



Day Experiment :



AS 4755

Specialized Ipv6 helpdesk
for the v6 day

AS 4755

AS 6453

REPORT FROM AS6453

S.no	Date (GMT)	Time (GMT)	URL	IPv6 Address						
1	7-06-2011	01:16:25	tatacommunications.com	2001:5a0:5000:2::149						
2	7-06-2011	01:16:25	www.google.co.in	2404:6800:8000::68						
3	7-06-2011	01:16:25	in.yahoo.com	2a00:1288:100e:ffe::3001						
4	7-06-2011	01:16:25	www.youtube.com	2404:6800:8000::5b						
5	7-06-2011	01:16:25	www.facebook.com	2620:0:1c18:0:faceb00c:0:2						
6	7-06-2011	01:16:25	www.bing.com	2600:140e:5::3f96:8359						
7	7-06-2011	01:16:25	www.xbox.com	2402:6800:720:11:230:48ffe8d						
8	7-06-2011	01:16:25	www.aol.com	2001:4b0:1668:2202::1						
9	7-06-2011	01:16:25	www.mapquest.com	2001:4b0:1668:2202::3	64.12.99.162	267	Not Reachable	↑	↑	Traceroute Result
10	7-06-2011	01:16:25	www.t-online.de	2003:22:4062:153:159:92	62.153.159.92	Not Reachable	299		↓	Traceroute Result
11	7-06-2011	01:16:25	www.cisco.com	2001:420:80:1c::15c:b0a06700d	60.254.168.170	272	278	↑	↑	Traceroute Result



IPv6 Address	IPv4 Address	IPv6 RTT Avg	IPv4 RTT Avg	IPv4 Status	IPv6 Status	Traceroute Results
2001:5a0:5000:2::149	121.243.66.50	13	201	↑	↑	Traceroute Result
2404:6800:8000::33	74.125.235.51	247	234	↑	↑	Traceroute Result
2001:4998:000e:ffe::3000	67.195.160.76	33	Not Reachable	↑	↑	Traceroute Result
2404:6800:8000::5b	74.125.235.38	241	240	↑	↑	Traceroute Result
2620:0:1c18:0:faceb00c:0:2	69.171.224.41	71	90	↑	↑	Traceroute Result
2001:418:2007:1:a88f169	204.245.162.35	Not Reachable	Not Reachable	↑	↑	Traceroute Result
2001:418:2007:1:a88f128	204.245.162.41	Not Reachable	Not Reachable	↑	↑	Traceroute Result
2001:4b0:1668:2202::1	64.12.245.203	Not Reachable	Not Reachable	↑	↑	Traceroute Result
2001:4b0:1668:2202::3	64.12.99.162	Not Reachable	Not Reachable	↑	↑	Traceroute Result
2003:22:4062:153:159:92	62.153.159.92	Not Reachable	99	↑	↓	Traceroute Result
2001:420:80:1c::15c:b0a06700d	72.246.112.170	78	Not Reachable	↑	↑	Traceroute Result

www.tatacommunications.com is also hosted on IPv6 since the world IPv6 day

IPv6 :-Case-Studies – TCL Adaptation

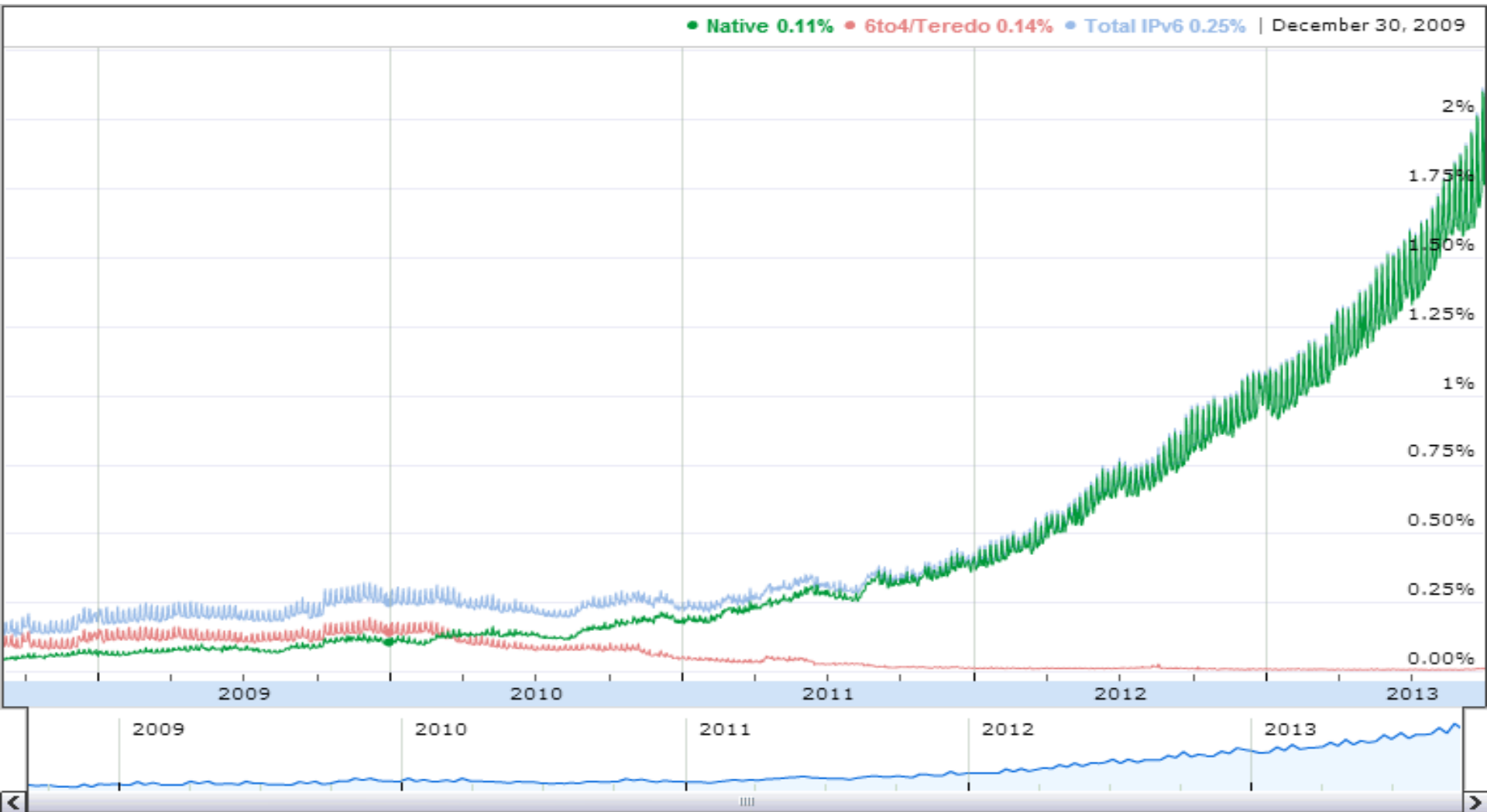
TCL was a lead service provider participant in the World IPv6 day experiment :

Global Ranking : #7				
Customer Base				
4	☆ Sprint	1239	IPv6	
5	☆ Tinet SpA	3257	IPv6	
6	☆ TeliaNet Global Network	1299	IPv6	
7	★ Tata Communications	6433	IPv6	
	☆ MCI Communications Services, Inc. d/b/a Verizon Business	701	IPv6	
8	☆ Savvis	3561	IPv6	
9	☆ AT&T Services, Inc.	7018	IPv6	
10				



The TCL Global Backbone is a dual stack enabled network. (1500+ Gbps of backbone capacity)

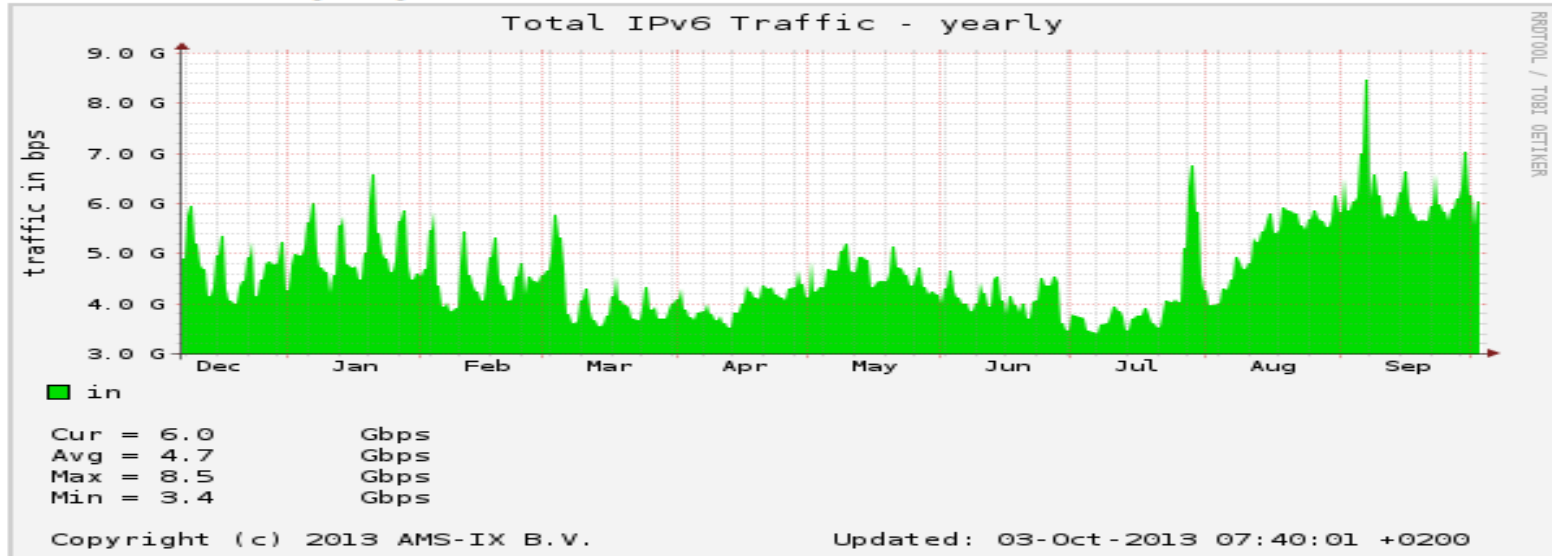
Worldwide IPv6 Statistics



Source:- www.google.com/ipv6/statistics.htm

Worldwide IPv6 Traffic Statistics

Total IPv6 Traffic - yearly



<https://www.ams-ix.net/technical/statistics/sflow-stats/ipv6-traffic>

[Home](#) [BGP Reports](#) [CIDR Reports](#) [IPv4 Reports](#) [IPv6 Reports](#) [IETF Docs](#)

IPv6: IPv6 / IPv4 Comparative Statistics

Report Date: 03-10-2013 0545

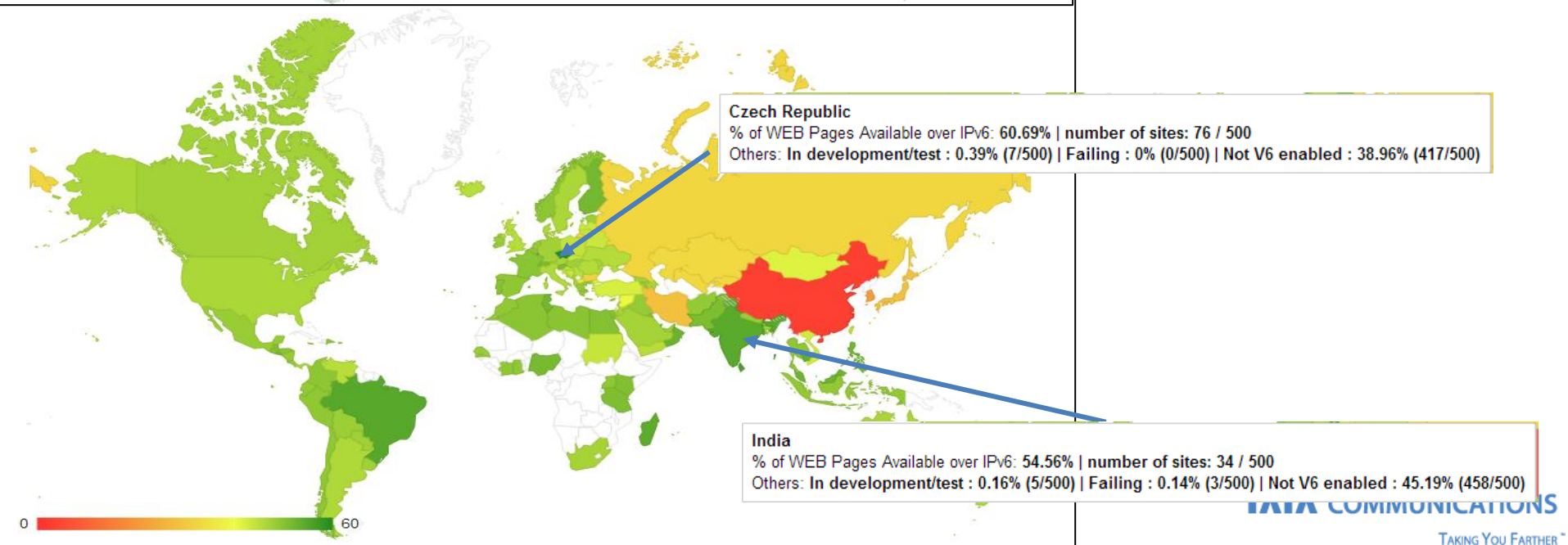
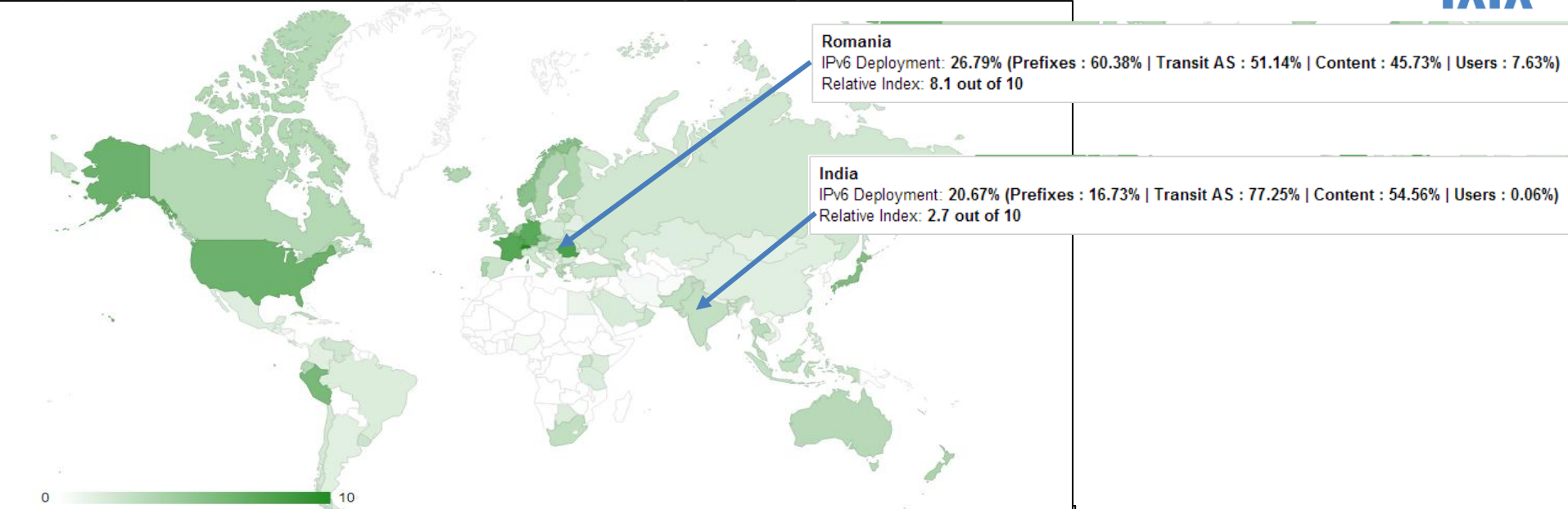
Prefixes

	IPv6	IPv4	IPv6 / IPv4
Prefix Count	14683	480530	$14683 / 480530 = 0.0306$

Addresses

	IPv6	IPv4	IPv6 / IPv4
Announced Address Span	9.6717	0.69775186	$9.6717 / 0.69775186 = 13.8612$
Announced % of Total Address span	0.122612	61.653220	$0.122612 / 61.653220 = 0.0020$
Average Address Span per Announcement	23.5135	19.5722	$23.5135 / 19.5722 = 1.2014$
Average Announcement Length	40.1607	22.4331	$40.1607 / 22.4331 = 1.7902$

Worldwide IPv6 Deployment



Tata Communications : Tier-1 Dual Stack Enabled Internet Backbone:



IPv6 deployment council regularly reviews and realigns TCL IPv6 strategy.
Following IPv6 prefixes have been allocated to TCL in various regions.

- Americas - 2003:2001:5A0::/32
- Asia - 2405:2000::/32
- India Domestic - 2403::/32
- Africa - 2001:42c8::/32

India IPv6 6 PE Architecture - ILL



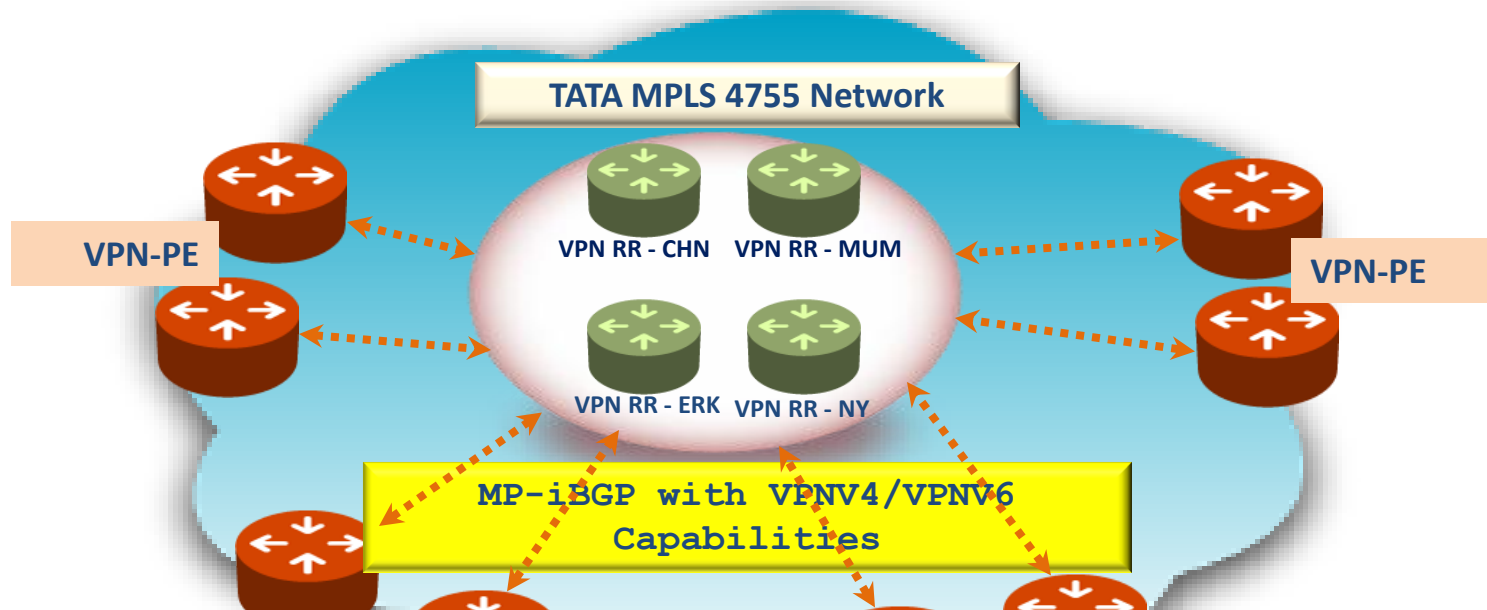
At a high level it seems that all vendors follow the RFC standard

But then we realized that they don't

Different vendors have different ways of following the same RFC ☺

But thank God! They all can be tuned to interop and coexist very well despite the differences !!

TCL IPv6 6-VPE Architecture – GVPN



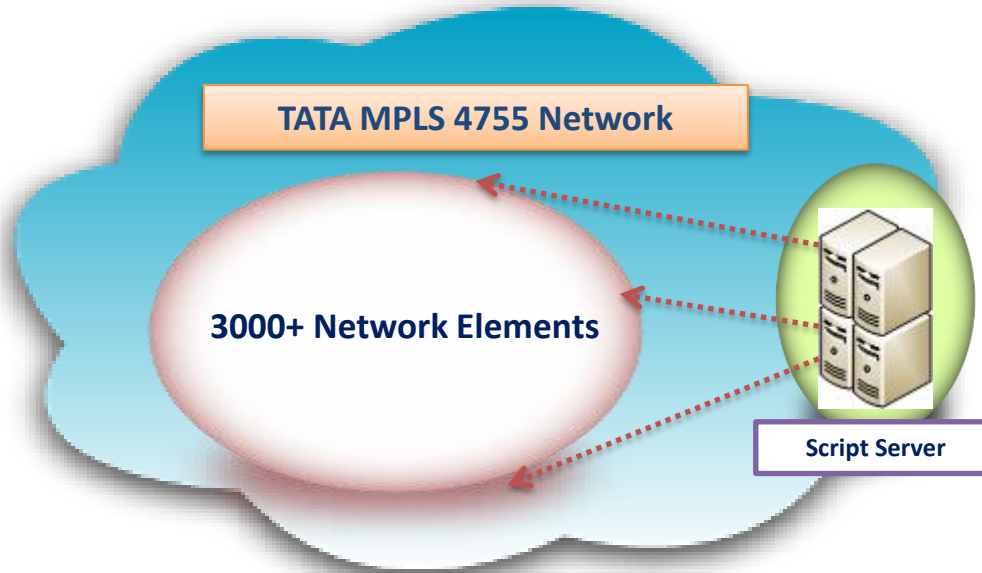
Identified the Provider Edge Routers on Dual Stack Support

IPv6 Enabled on Edge devices in Phased approach

Planned H/W + S/W upgrades for non-supporting Routers

Automated Script for IPv6 Readiness List Report

Automated Report– IPv6 Readiness



Location	Host Name	Image Version	IPv6 Status	Peer-1	Peer-1 Status	Peer-2	Peer-2 Status
HIGHBRIDGE	Router_Name	c7600s72033_rp	YES	A.B.C.D	26w4d	X.X.X.X	26w4d
HIGHBRIDGE	Router_Name	c7600rsp72043_r	YES	A.B.C.D	26w4d	X.X.X.X	26w4d
AHMEDABAD	Router_Name	C7200	YES	A.B.C.D	1w5d	X.X.X.X	1w5d
AHMEDABAD	Router_Name	c7600s72033_rp	YES	A.B.C.D	19w0d	X.X.X.X	19w2d

• IPv6 Readiness Status

Enough collaborative work has happened in this space



Thanks

