IPv6 Deployment Issues
A Tier 1 Perspective

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AGENDA

- Introduction
- Implementation issues
  - What they are
  - Ways to deal with them

Introduction

- Not many people seem to take IPv6 seriously within the Internet industry in Europe and (more so) in the US.
  - ARIN: 12 x /23 allocations from IANA
  - RIPE: 71 x /23 allocations from IANA
  - APNIC: 64 x /23 allocations from IANA
- NA might not be, but other places in the world ARE looking at it.
- Increase in customer requests for IPv6 in recent times.
- IPv6 will become a more regular request in EU and US public funded bids.

Problematic Steps

- 4 main issues hindering IPv6 deployment:
  - Decision Making
  - Network
  - People & Politics
  - Systems

MAKING THE DECISION

Making The Decision

- Lack of desire to move to IPv6 on a voluntary basis.
- Being pushed in the direction by customer requirements.
  - Public-funded projects in EU and US now making an issue of IPv6.
- Traffic volumes still not significant compared to IPv4.
  - Therefore not much associated revenue.

THE NETWORK

IPv6 Implementation Rules

- Two golden rules in implementation decision:
  - Do NOT break the IPv4 network by adding IPv6.
  - Do NOT spend much money to add IPv6 as associated revenue is expected to be low.

Don’t Break The IPv4 Network

- Need to have IPv6 functionality in the “toolbox”.
- Must not affect IPv4 functionality.
- Not all kit on networks out there support IPv6 well, or at all.
- Don’t necessarily need to have IPv6 functionality on every box.
- Need geographical support for IPv6 on an “as-needed” basis.

Don’t Spend Much Money

- Very difficult to justify a large CapEx spend on IPv6 right now.
- ROI doesn’t look too good in the short term.
- Increase in OpEx also needs to be considered.
- Not going to be able to IPv6 enable an entire global Tier-1 network!
- The more you look, the more costs there are.
- However, some tier-1s are doing this now.

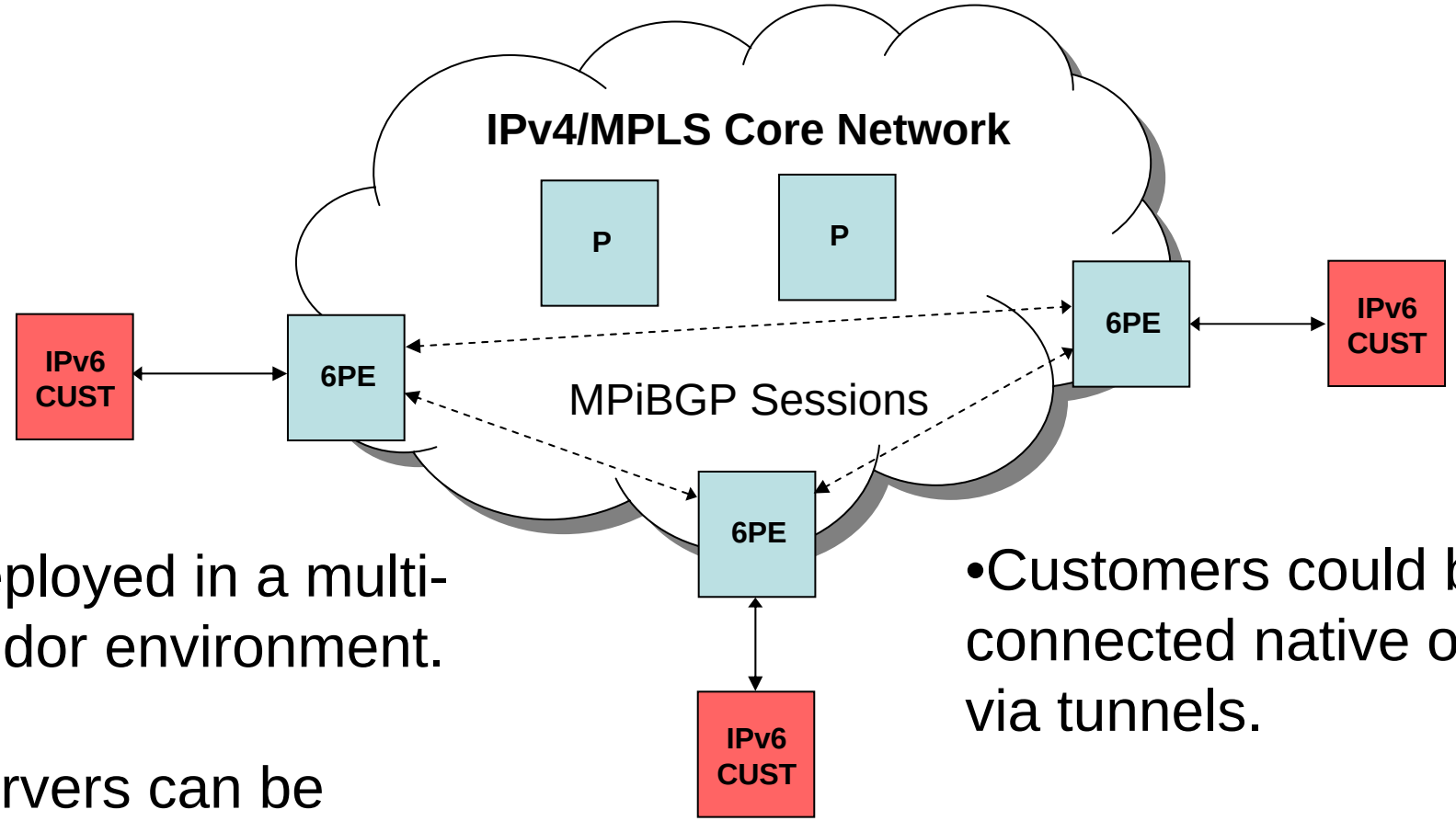
What Did Level3 Consider?

- Considered various options:
  - Overlay network
    - Very expensive
    - High resource use
  - IP tunnels
    - Could be very manual
    - Didn’t scale over network
    - Just plain ugly
  - Complete IPv6 network deployment
    - Not all kit supports IPv6 in hardware, or at all
    - Risks to existing IPv4 network
    - IPv6 Regression testing needed for lots of code

What Did Level3 Do?

- Used existing global MPLS network.
- Deployed IPv6 boxes using 6PE.
  - Dedicated to IPv6 connectivity only.
- Used existing edge technology.
  - Reduces risk. Box could be reused for IPv4.
- Cookie-cutter approach.
  - Install a box wherever IPv6 is needed.
- Leaves IPv4 network untouched.
- Much faster packet processing than tunnels.

6PE Technology Recap



- Deployed in a multi-vendor environment.
- Servers can be connected to 6PE devices.
- Customers could be connected native or via tunnels.
- Peers also connected to 6PE devices.

6PE Technology Recap

- Easy to configure:
  - Enable MPLS and LDP from P to 6PE devices
  - Give the 6PE devices full IPv4 routing (BGP & IGP to get to/from loopback interfaces)
  - Set-up BGP in address-family format on Cisco:

```
router bgp 1234
 neighbor 111.222.111.222 update-source Loopback0
 neighbor 111.222.111.222 remote-as 1234
address-family ipv6
 neighbor 111.222.111.222 activate
 neighbor 111.222.111.222 send-label
```

6PE Advantages

- Need IPv6 in a location? Drop in a 6PE box!
- Easy configuration.
- Quick deployment.
- Large geographical coverage without deploying large amounts of kit.
- Traffic usually hardware processed.

6PE Disadvantages

- Some people consider it a hack.
- You still don’t get an IPv6 native core.
- Some devices aren’t 6PE capable.
- Potentially need to install a new device (per location) for IPv6 service.
- Need to understand 6PE, as well as IPv6.

Timescales

- Decision was made to deploy and IPv6 network at the start of 2005.
- Training (for engineering) and testing took place in Q1 and Q2
- Physical implementation took place at the end of Q2.
- Network deployment completed at the start of Q3.
- Network running as expected.
  - Low maintenance overhead and very few issues.

Looking Back?

- 6PE has been a great success for Level3.
- No impact whatsoever on IPv4 network.
- Limited expenditure.
- BUT, what works best for one network doesn’t always best for another.

What Next For Level3?

- Medium term
  - More 6PE devices
  - More native peering connections
  - More education on IPv6 for staff
  - Billable dual-stack connectivity to customers
- Long term
  - Native IPv6 core… at some point… maybe
  - IPv6 support for back-end system

PEOPLE & POLITICS

People Problems

- IPv6 views generally fall into 1 of the following categories:
  - "We should do IPv6 in some way."
  - "We should not do IPv6 at all."
  - "I don't care what we do, as long as we make money."
  - "What the hell is IPv6?"
- Winning people over is possibly the single most difficult task.

People Problems

- Need to train all the staff in IPv6:
  - Sales & marketing.
  - Installs.
  - Support (all tiers, including NOC)
  - Engineering.
- VERY time consuming and expensive.
  - Staff recruitment and turnover can be problematic.
- Usually ends up being a small specialist team.
  - “Bob the IPv6 bloke”

Political Problems

- What SLA should be provided to IPv6 customers?
  - Often not possible to provide normal SLA.
  - Service provided on “best-effort” basis.
- How to bill IPv6?
- Who is responsible for installs & support?
  - Again “Bob the IPv6 bloke”.
- Some people are very anti-IPv6.
  - Due to IPv6 still being a philosophical debate rather than a mature technology.

SYSTEMS

Systems Issues

- How many systems are there running your business?
- Do they support IPv6?
- How many are bespoke?
- Who wrote them?
  - "Steve the scripter"
  - "Oh he left four years ago!"
- Can be a massive and potentially impossible task to make all business critical systems support IPv6 without large investment.

What Systems?

- DNS.
- IP allocations.
- Network Monitoring.
- Sales.
- Billing.
- Support & trouble tickets.
- Network inventories.
- All those little scripts kicking around.
- All other systems and servers.

Conclusion

- Moving to IPv6 is **not** easy.
- The bigger you are, the harder it can be.
- Difficult to justify the financial, network and human resources required.
- Ongoing support can be tricky.
- We all have other "*more important*" things to be doing.
- BUT, we'll probably have to go there soon.
- The later you do it, the more difficult it will be.
- Start thinking about it NOW.

Thoughts For You To Take Away

- Start thinking about:
  - Where do you *really* see IPv6 going?
  - Do you think you will have to deliver IPv6?
  - What kit you have supports IPv6 (well)?
  - Who in your organisation knows about IPv6?
  - What back-office systems (need to) support IPv6?

Q & A