



# Google Enterprise IPv6 deployment

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"96 more bits, no magic"

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- **The problem**  
Why the migration to IPv6 is necessary?
- **What methodology to use?**  
Planning and design steps
- **How we did it?**  
The approach used within Google Enterprise and what's next?
- **The bottom line**  
Words of wisdom from the field

# The Problem

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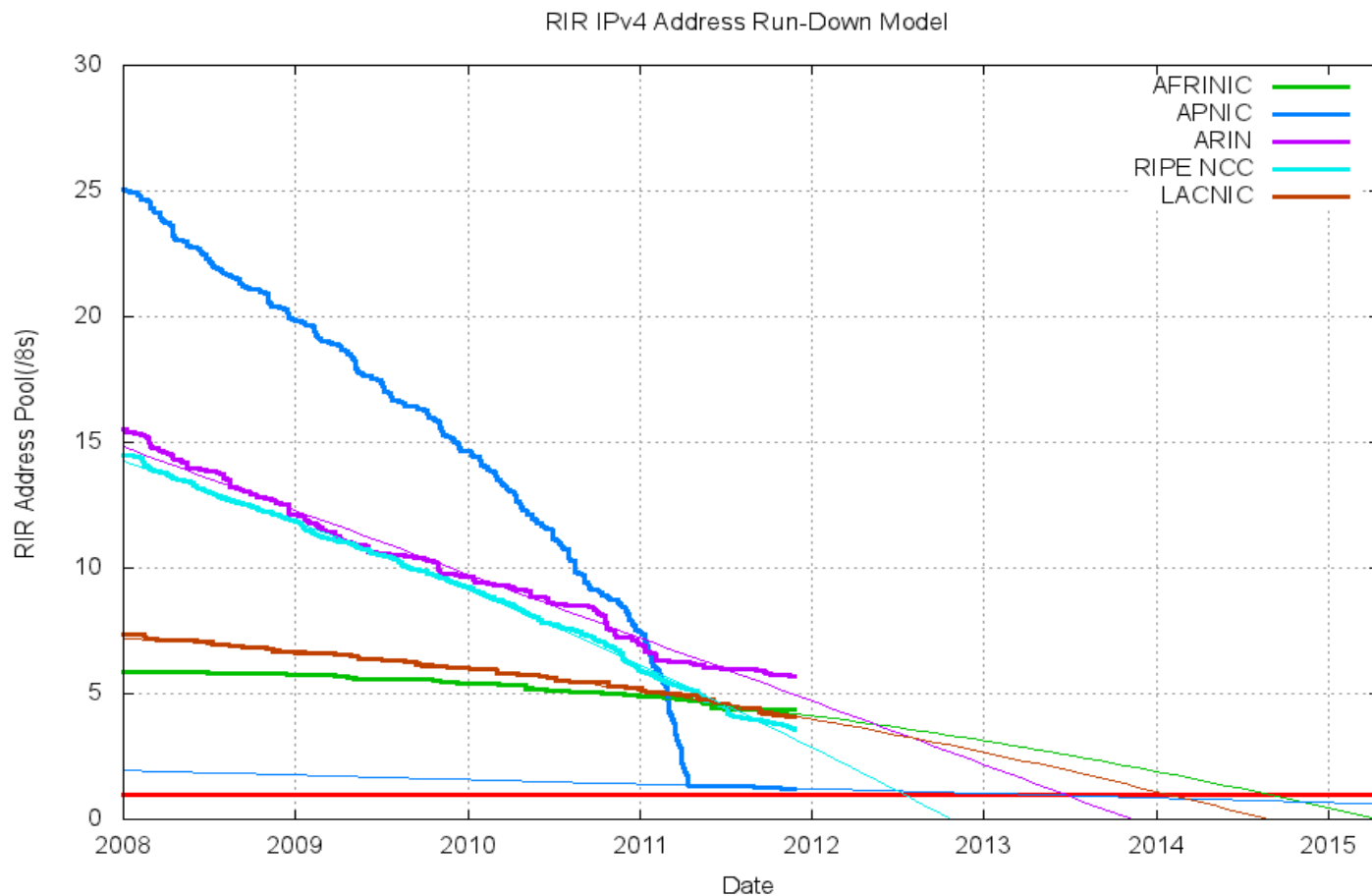
Why to migrate to IPv6?



# Business Case for Change (1)



- (Obviously) IANA IPv4 exhaustion in Feb 2011 (G Houston stats)
- IPv4 Space is rarely or never reclaimed



- Mergers & acquisitions, new partners will demand IPv6 migration
- Provide services to all customers (even IPv6 enabled ones)
- Smart phones, IPTV, virtualization and cloud computing, P2P applications, network aware devices and many more
- Assure the continuous growth and openness of the Internet
- IPv4 addresses will become scarce and expensive

- Allow for development of IPv6-ready products internally - "Eat your own dogfood"
- New in-house developed applications require a multitude of new IP addresses
- We are running tight on private RFC1918 addresses
- Overlap NAT creates network complexity and operation / support cost / security considerations
- Strong culture of innovation – build for the future

# What methodology to use?

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Planing and design steps





- Distributed offices in multiple countries
- Different connectivity options – MPLS, ISP, etc.
- Diverse networking vendors equipment
- Heterogenous in-house developed applications and setups



- Think globally and try to enable IPv6 everywhere
- Tap enthusiasm (20% work and small team of volunteers)
- Start **early**, launch and iterate often
- Test-driven development – build labs and **test!**
- Iterate with vendors until it works
- Incremental, **production-quality** deployment
- Monitor and provide the same **SLA** as for the IPv4 network
- Fold in IPv6 support as normal operating procedure
- Plan for **IPv6-only**

# Key Planning Steps

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Build IPv6 support into the networking tools

Test and certify code for various platforms

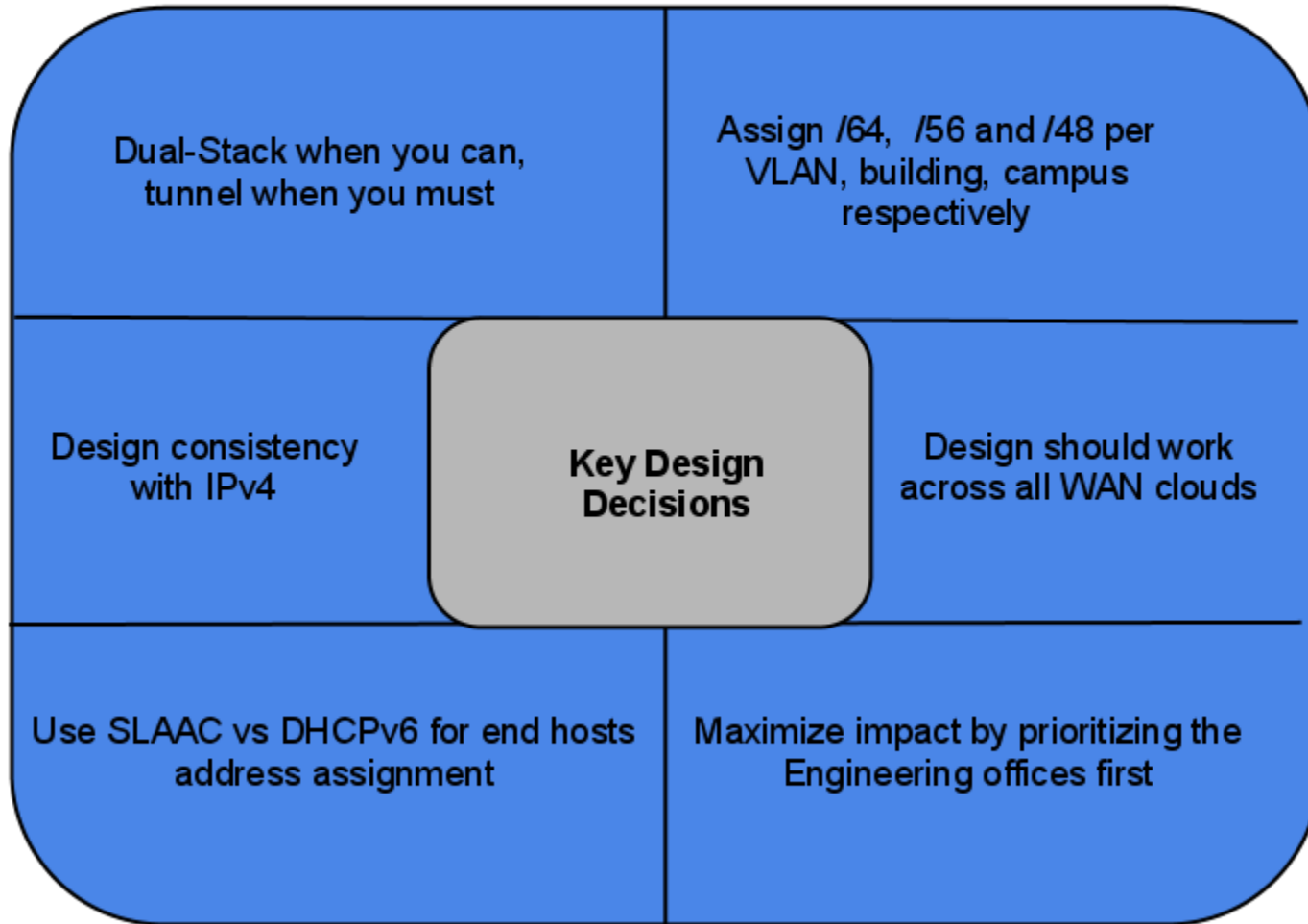
Decide on exact routing protocols and policies

Plan for IPv6 Transit (WAN) connectivity

Create a comprehensive addressing plan

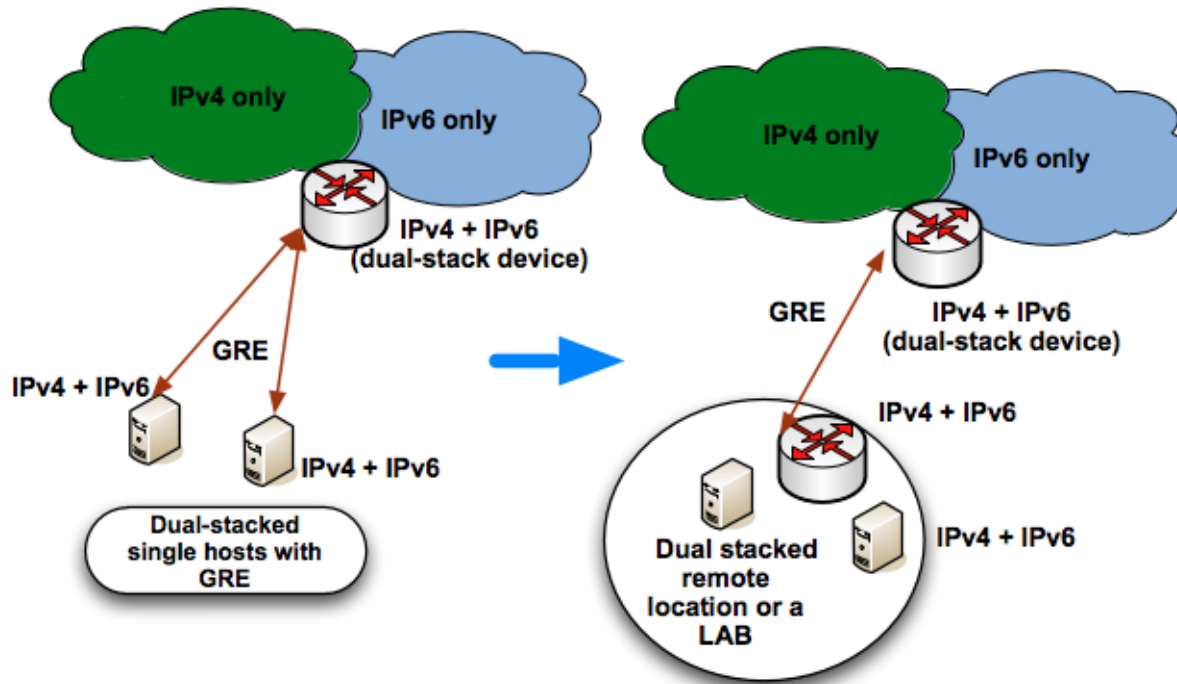
Request IPv6 address space from RIR or ISP

# Key Design Decisions



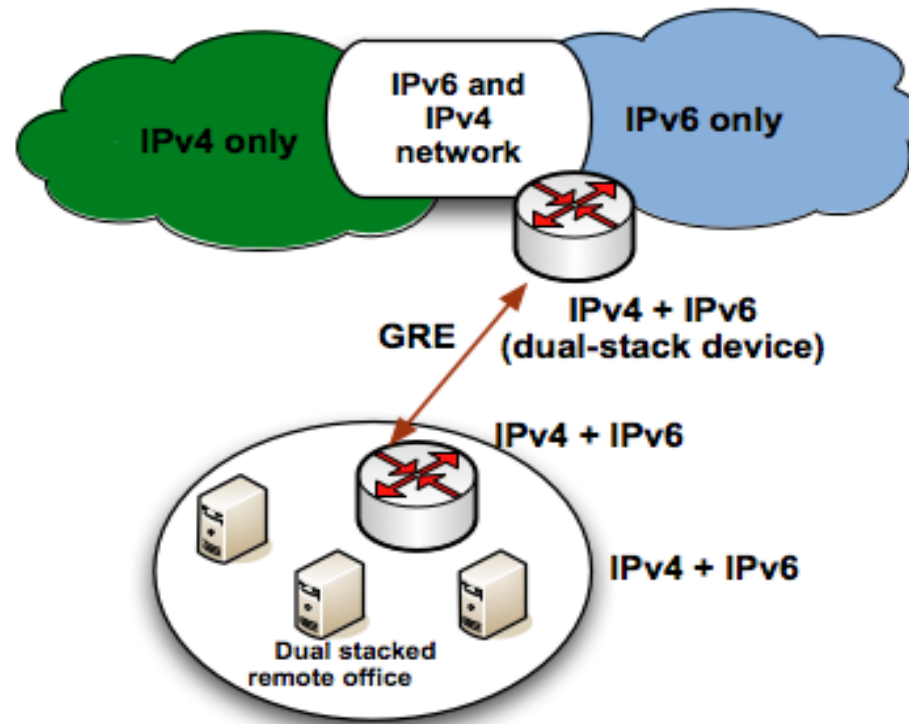


# Deployment Phases (1)



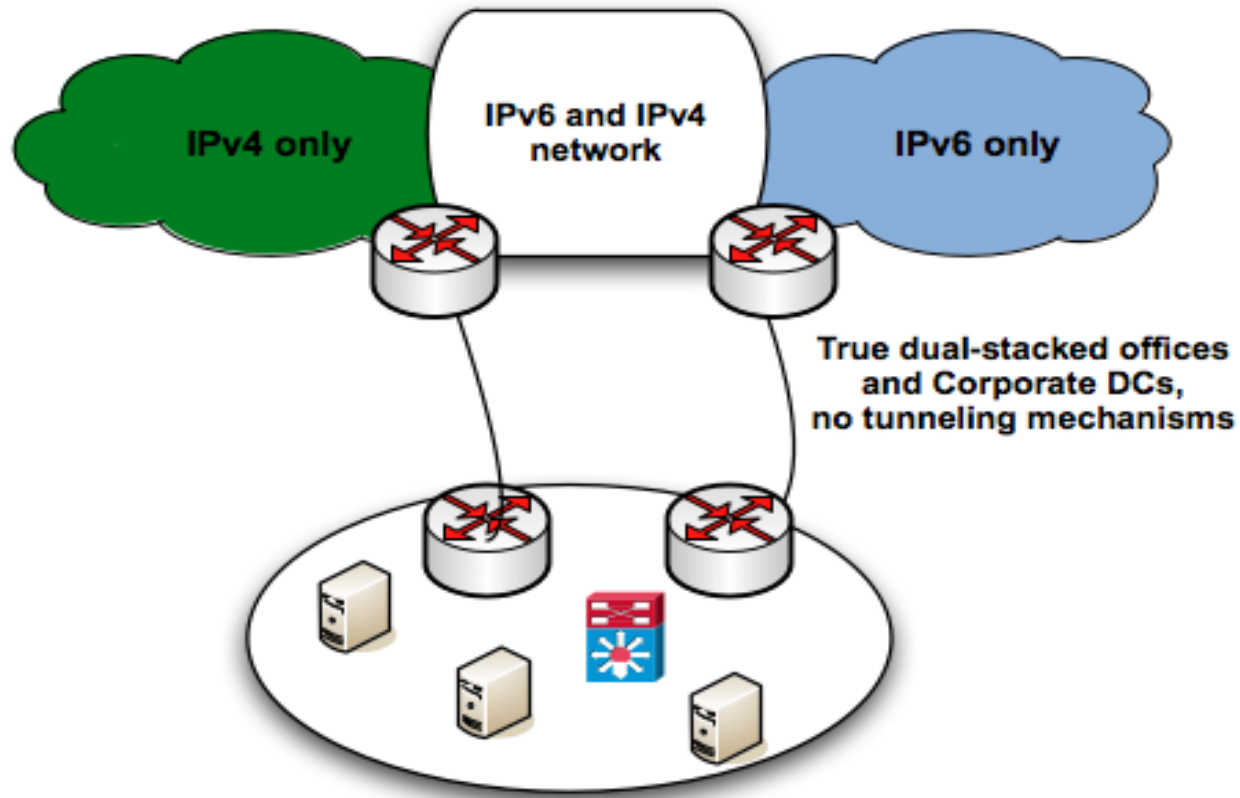
- Dual-stack single hosts and IPv6 in LABs

## Deployment Phases (2)



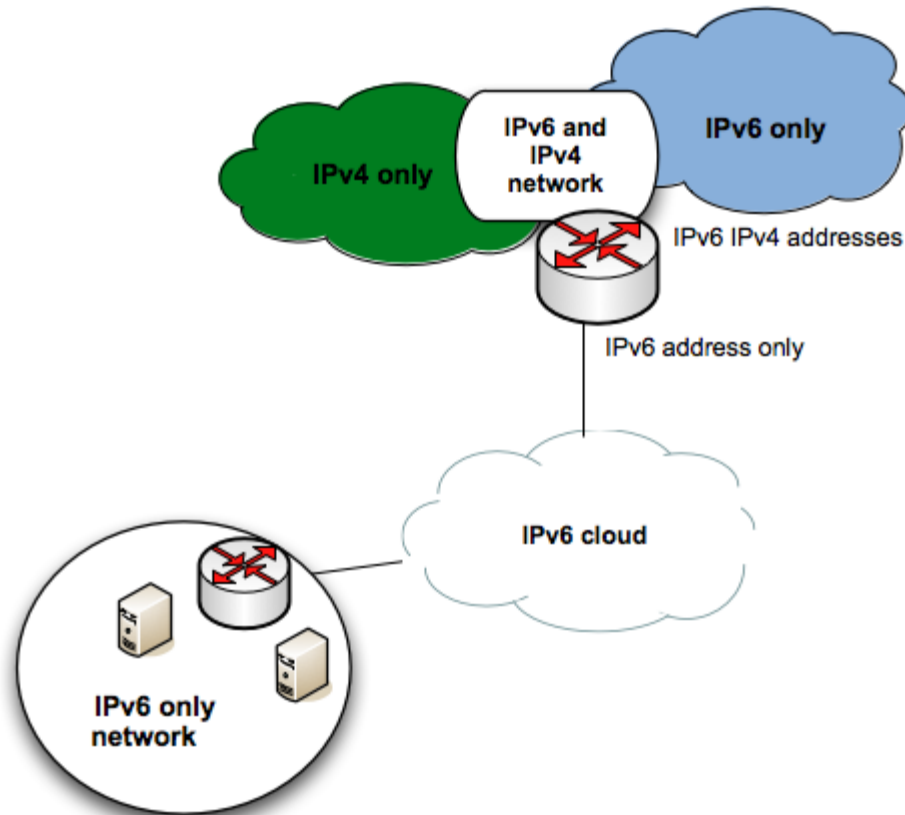
- Partial dual-stack networks with GRE tunnels
- Beginning of a dual-stack cloud

# Deployment Phases (3)



- True dual-stack offices ( no GRE!!)

# What's next?



- DS-Lite technology testing ongoing
- Combines IPv4 in IPv6 encapsulation and NAT



- Not all networking vendors supported IPv6
- IPv6 was still processed in software on many platforms
- Vendors didn't run IPv6 in their own networks
- Lack of DHCPv6 client support in many client OS
- In general - lack of ISPs which provided native IPv6 on an enterprise peering
- ISPs have very different SLA for IPv6

- Training and education – always the biggest challenge!
- Early information helps fight **F**ear, **U**ncertainty and **D**oubt :)
- Just in time (hands on) training before the rollout
- Resource allocation is still very IPv4 centric
- Internal chicken-or-egg problem (which team within the enterprise should start first with the deployment)

# What if I want to migrate to IPv6?

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The migration to IPv6 is **not a Layer 3 problem**;  
it's more of a **Layer 7-9** problem.



Start **early** and definitely don't wait!

## Bottom line

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Remember the previous slide?

Google

- It's not rocket science; IPv6 is simple to deploy, it just takes time
- Phased deployment gradually builds skills and confidence
- Design for the same quality standards as IPv4
- Resources, vendor relationship/management, and organizational buy-in are the biggest challenges
- Keep on testing!
- **Plan for IPv6-only network**

# Thank You!

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Q&A



# The six decisions we are glad we made

