



UNIVERSITY OF  
OXFORD

# Why Universities and Colleges Need to Implement IPv6

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## Core Message of This Session

# Failure [to Act] is Not an Option.

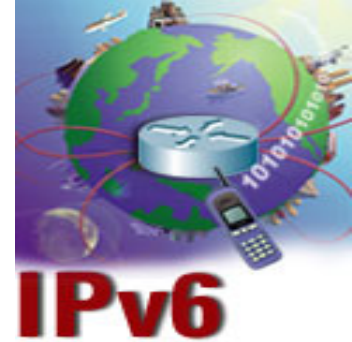


Gene Krantz, Flight Director, Apollo 13  
April, 1970

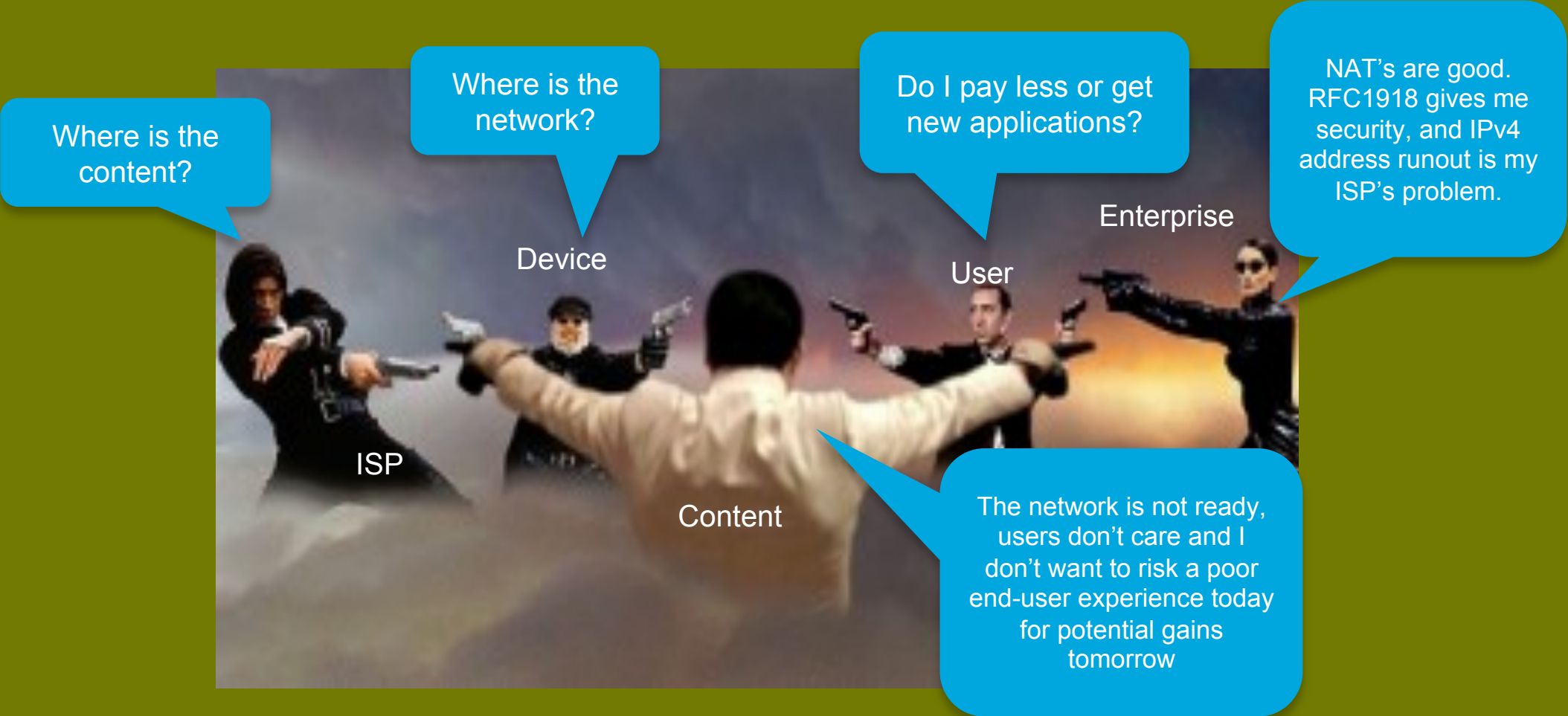
The whole of IT must collectively embrace this transition, it is not just about the networks team.

# First Up.....What is IPv6?

- It is the next generation Internet Protocol and the follow-up of the existing IPv4 technology
- **IPv6 will involve the whole of ICT – EVERYTHING**
- Developed in 1996 – largely by Cisco - and in IOS since 2000 (12.0S code). Cisco chair over half the dev committees.
- IPv6 provides auto-configuration, increased address space, improved mobility and enhanced operation as key benefits
- **IPv6 is “NOT COMPATIBLE” with IPv4**
- IPv6 address space has **79,228,162,514,264,337,593,543,950,336 times** the address space of IPv4!
- IPv6 deployment has historically been suffering a Mexican stand-off...



# IPv6 migration: A Mexican Standoff



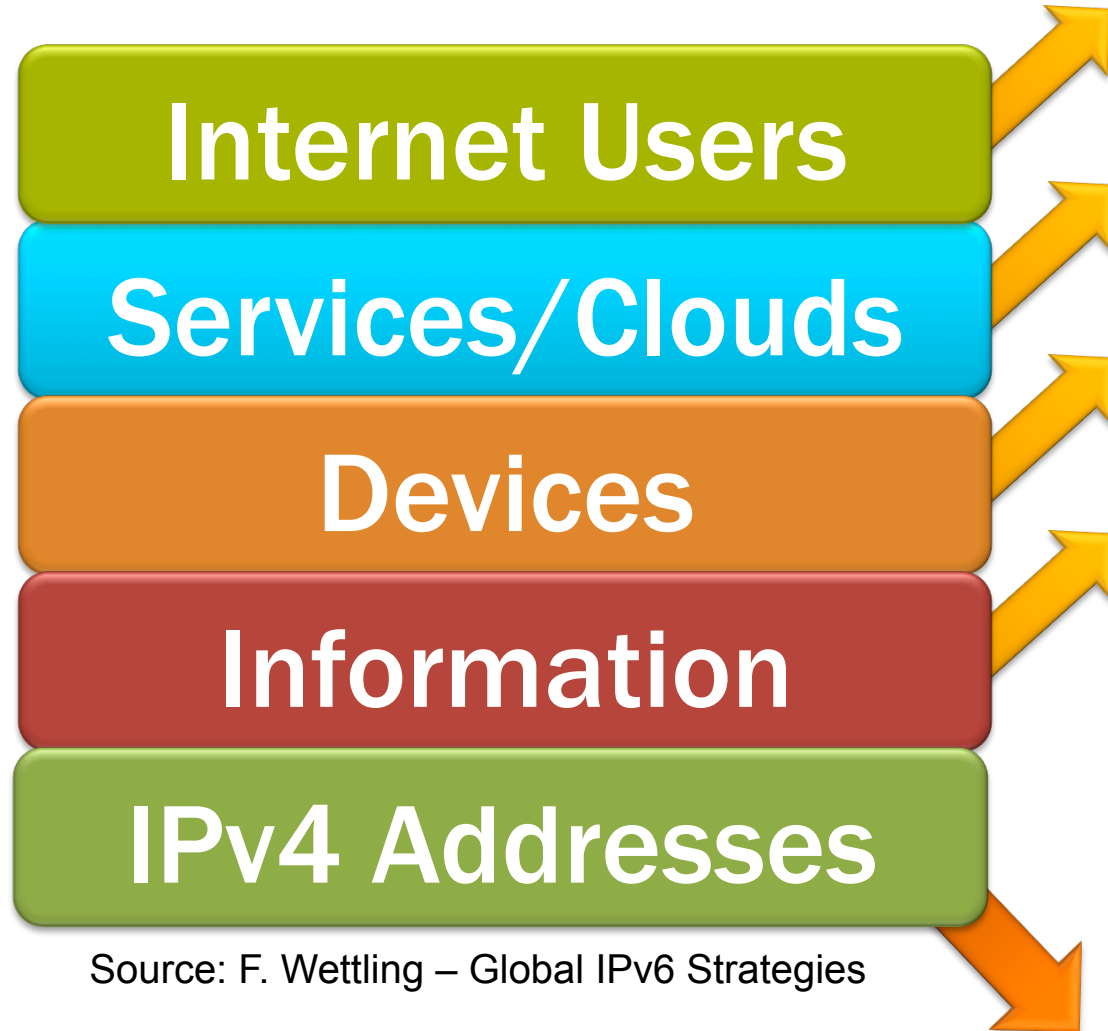
"A deadlock, stalemate, impasse; a roughly equal (and frequently unsatisfactory) outcome to a conflict in which there is no clear winner or loser,"





**IPv4  
IPv6**

# Why should I care? IPv6 Drivers



Source: F. Wetling – Global IPv6 Strategies

- Global connectivity
- IP convergence
- Ubiquitous Information
- Internet of Everything

INTERCONNECTING  
SMART OBJECTS  
WITH IP



Jean-Philippe Vasseur  
Adam Dunkels

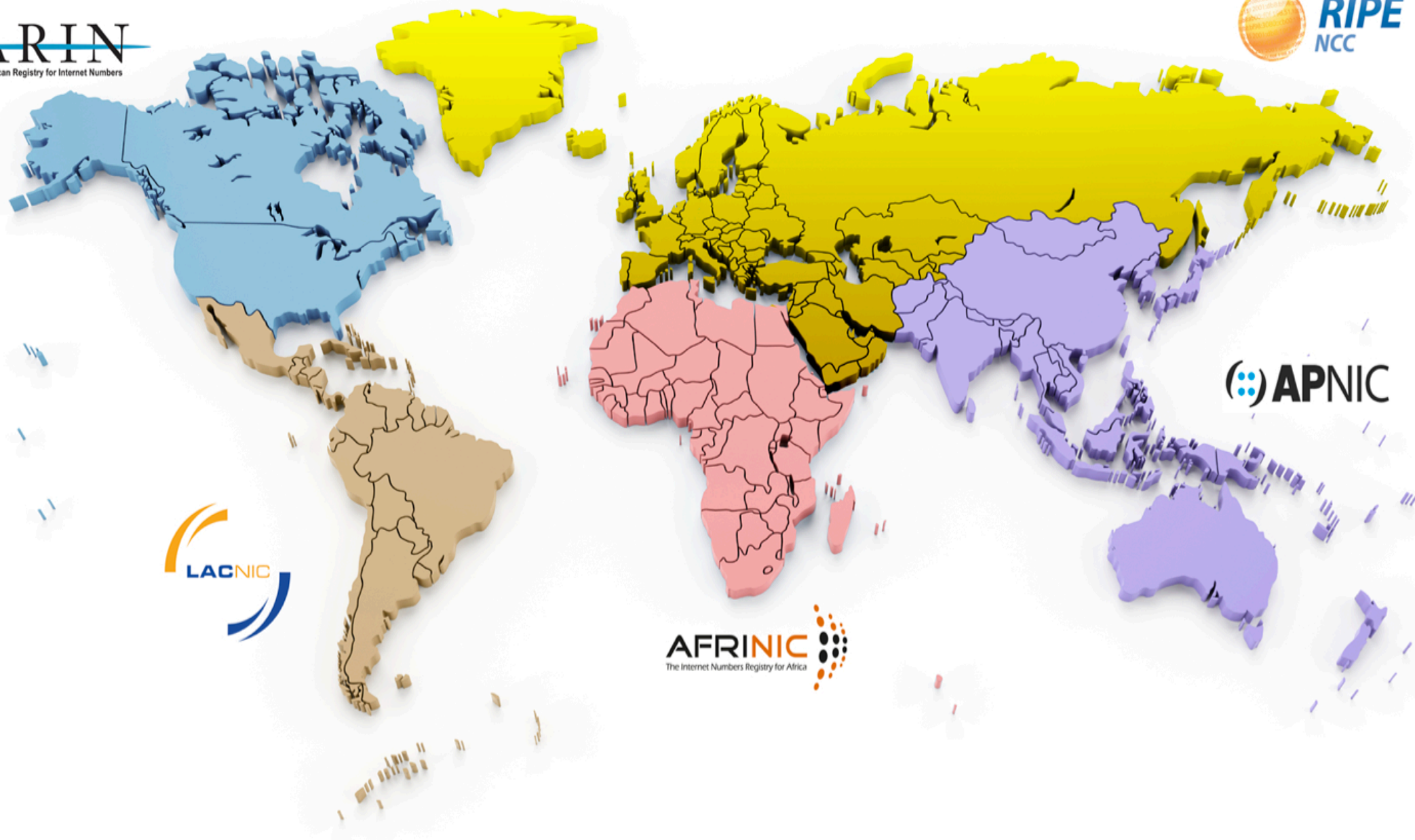


# The IANA Pool Finally Ran Out for IPv4



**ARIN**  
American Registry for Internet Numbers

**RIPE**  
NCC



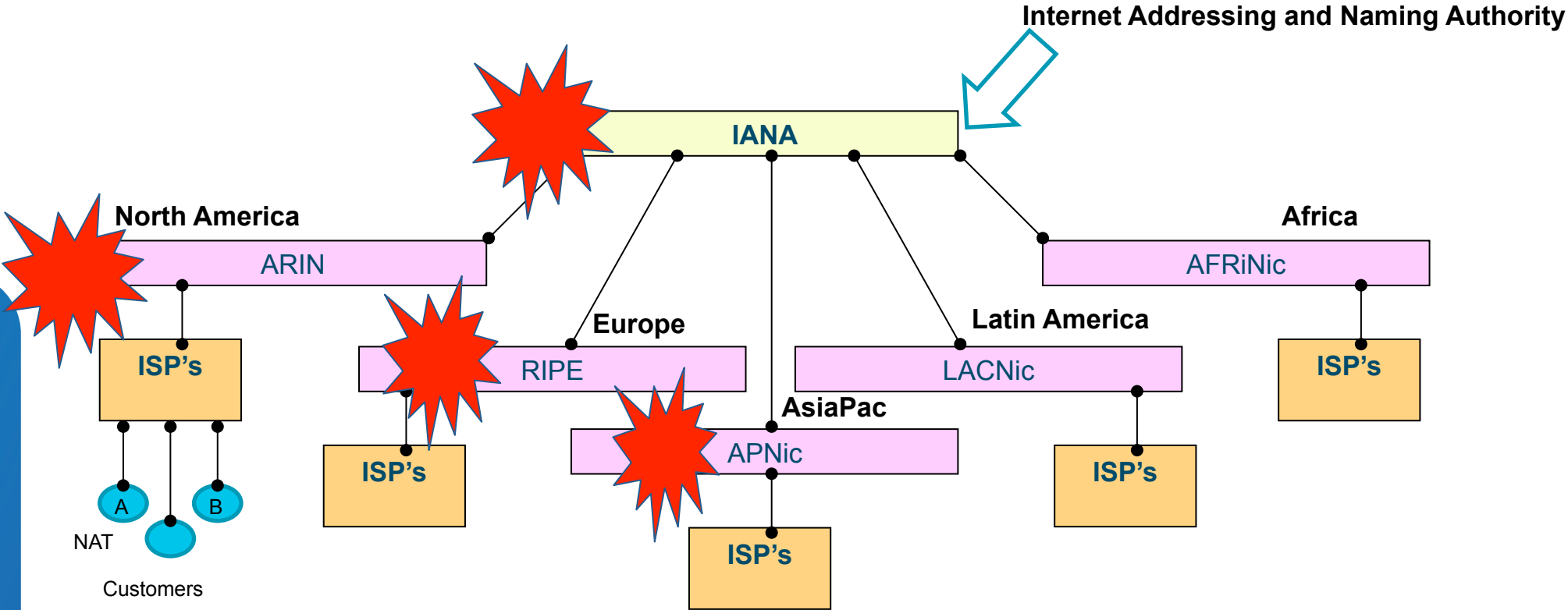
**LACNIC**

**AFRINIC**  
The Internet Numbers Registry for Africa

**APNIC**



# So What Happened to the IPv4 Pool ?

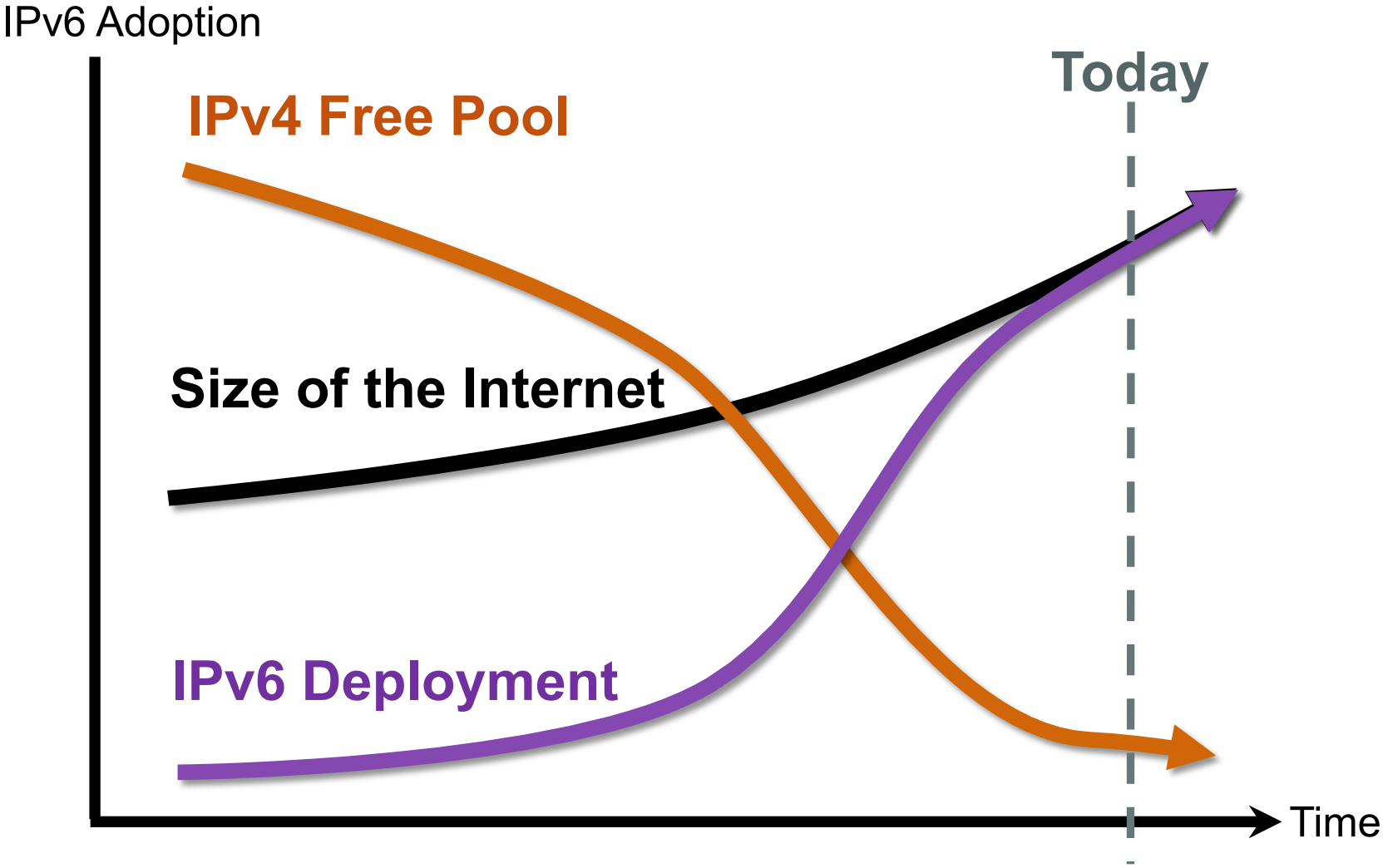


# You need to develop an IPv6 Strategy to run your organisation if.....

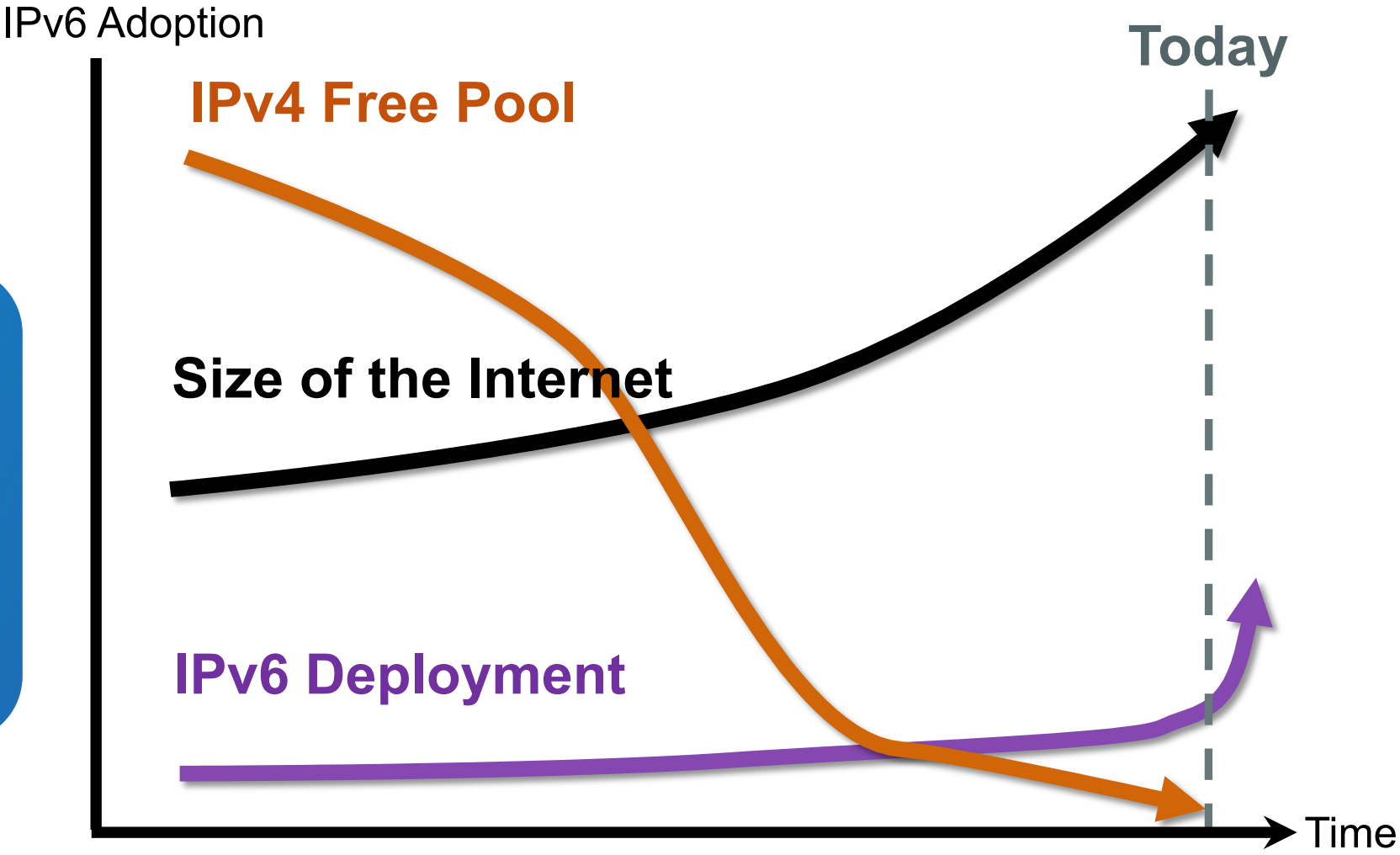
- You serve **content** to the students and the internet
- You use **cloud based services**
- You **take orders and reservations** from internet customers/students
- Your customers **pay their bills** on line
- **VPN access** for my home working/green initiatives for my employees
- Your **backup strategy** uses the internet
- You want to **open an office** where there are **limited IPv4 addresses** – AsiaPac etc



# The Plan – What we hoped would happen with IPv6

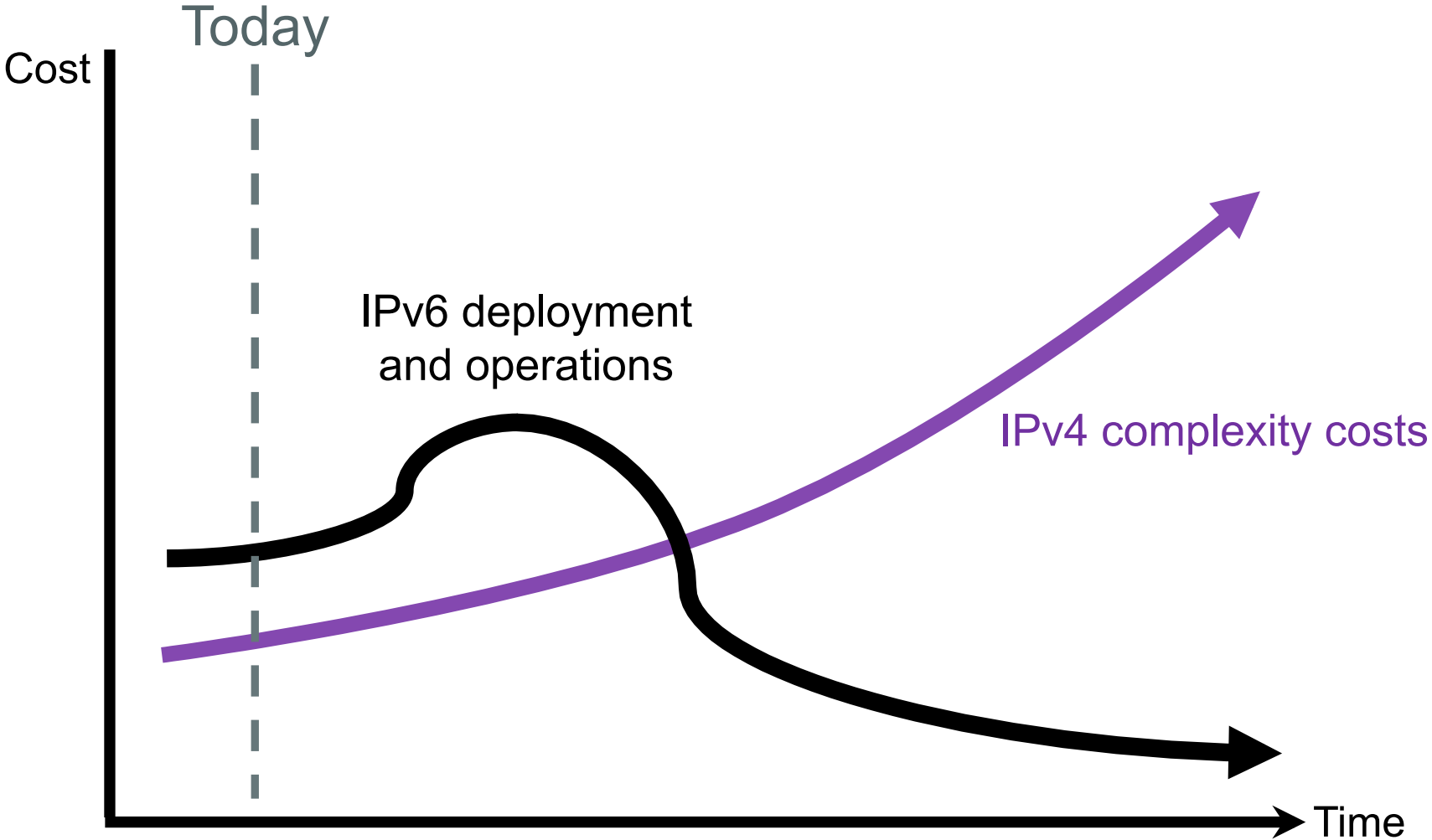


# The Reality – What Actually Has Happened

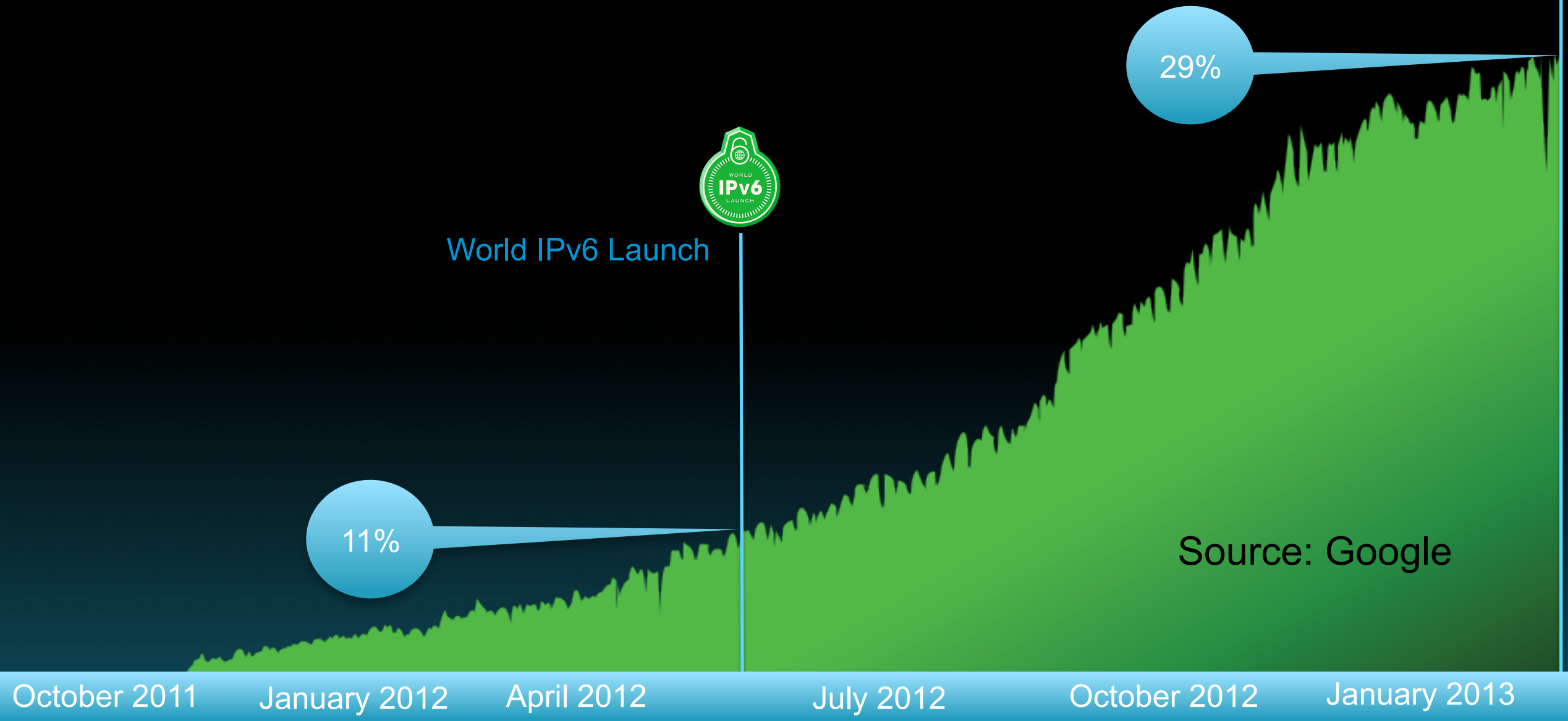




# IPv6 vs. IPv4 costs over time ----- The reason for the delay? A lot to Plan!



# IPv6 at Verizon Wireless



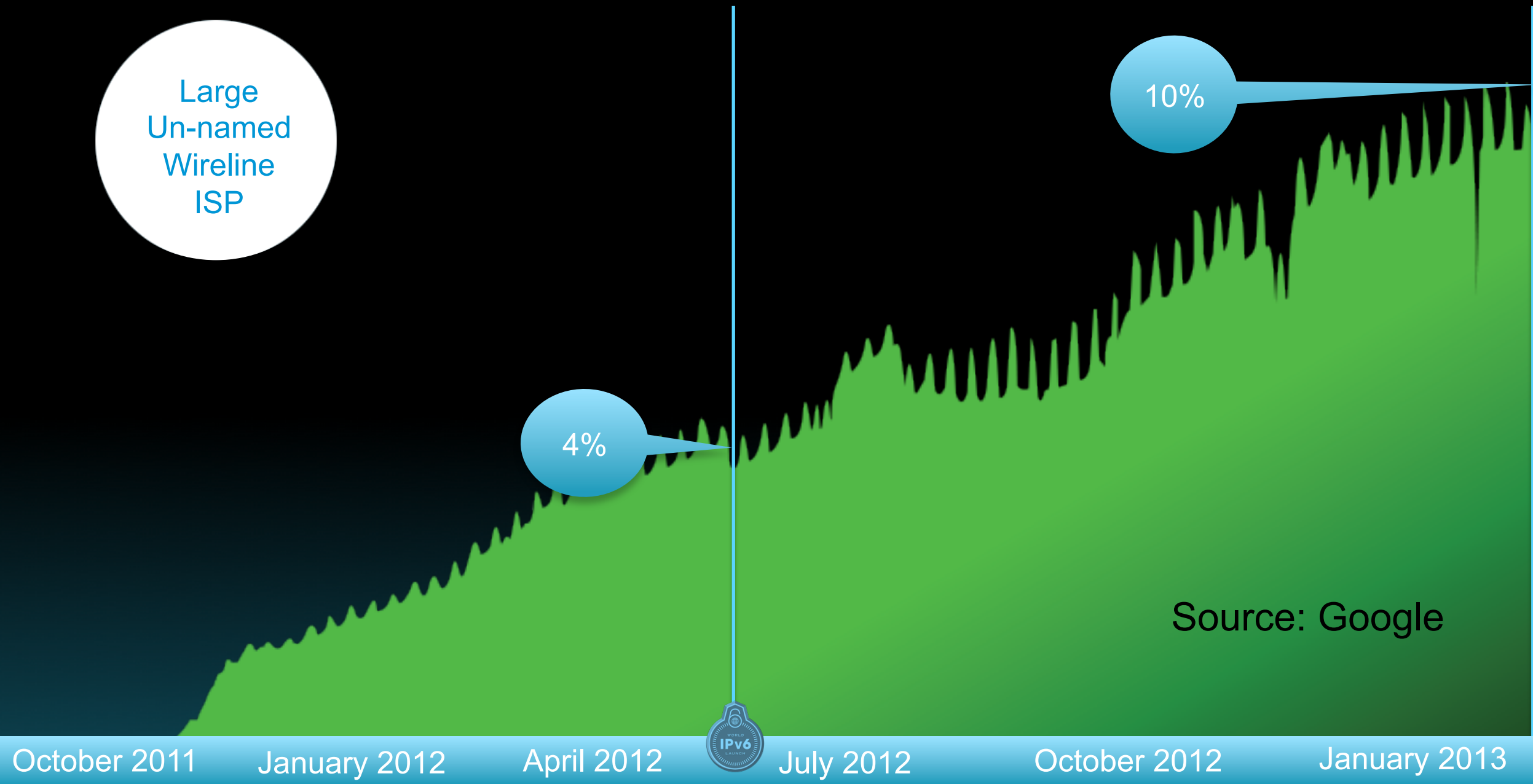
World IPv6 Launch

11%

29%

Source: Google

Large  
Un-named  
Wireline  
ISP



Source: Google



October 2011

January 2012

April 2012

July 2012

October 2012

January 2013

# 6lab.cisco.com

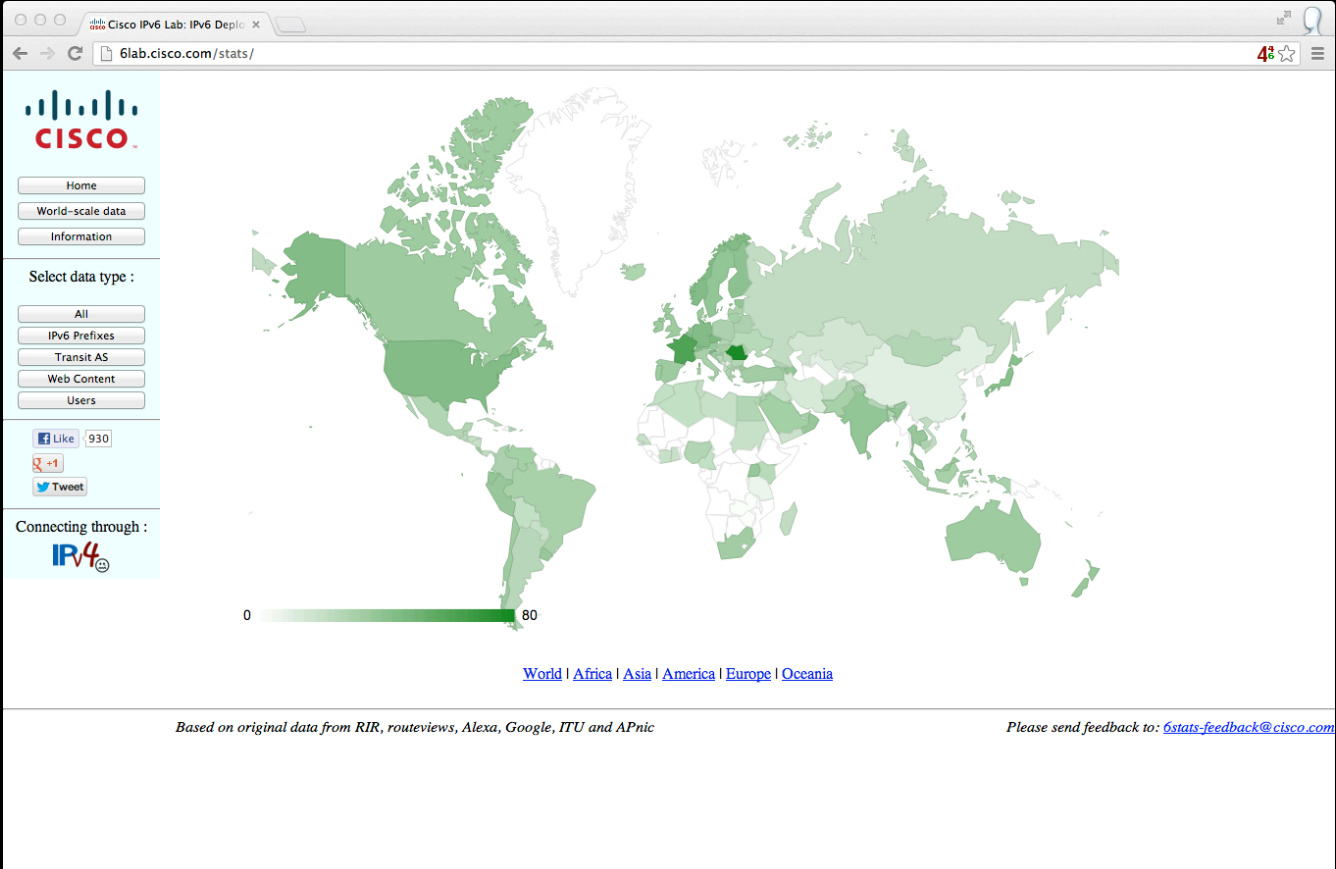
## Global IPv6 Adoption

USA	43%
Japan	40%
France	59%
India	37%
China	10%

Internet core	59.16%
Global content	35.86%
Users	2.27%

Discover how your country compares >



The screenshot shows the Cisco IPv6 Lab website interface. The main feature is a world map where different regions are shaded in various shades of green, representing IPv6 adoption rates. A legend at the bottom of the map shows a color gradient from 0 to 80. The website includes a navigation menu with 'Home', 'World-scale data', and 'Information'. Below the map, there are social media sharing options for Facebook (930 likes), Google+ (+1), and Twitter (Tweet). At the bottom, there is a footer with the text 'Based on original data from RIR, routeviews, Alexa, Google, ITU and APnic' and a feedback link 'Please send feedback to: [6stats-feedback@cisco.com](mailto:6stats-feedback@cisco.com)'.





# Common Objections – The Elephant in the Room

Reasons often cited for not planning for IPv6

- We have lots of IPv4 space. We're fine.
- What's wrong with NAT?
- We can buy more IPv4 from the open market
- We could use some of that multicast address space
- We could reengineer our IP addressing schema and reclaim some of the waste
- We've been talking about this for years. It'll blow over....



Wish I had a pound every time I heard these two!



# Some Address Exhaustion Solutions

## NAT



- Degrade user experience, on-line services and commerce.
- Inhibits innovation.
- Operational expense – getting worse

## Trade



- This has started
- Doesn't help high-growth / high-population regions

## Evolve



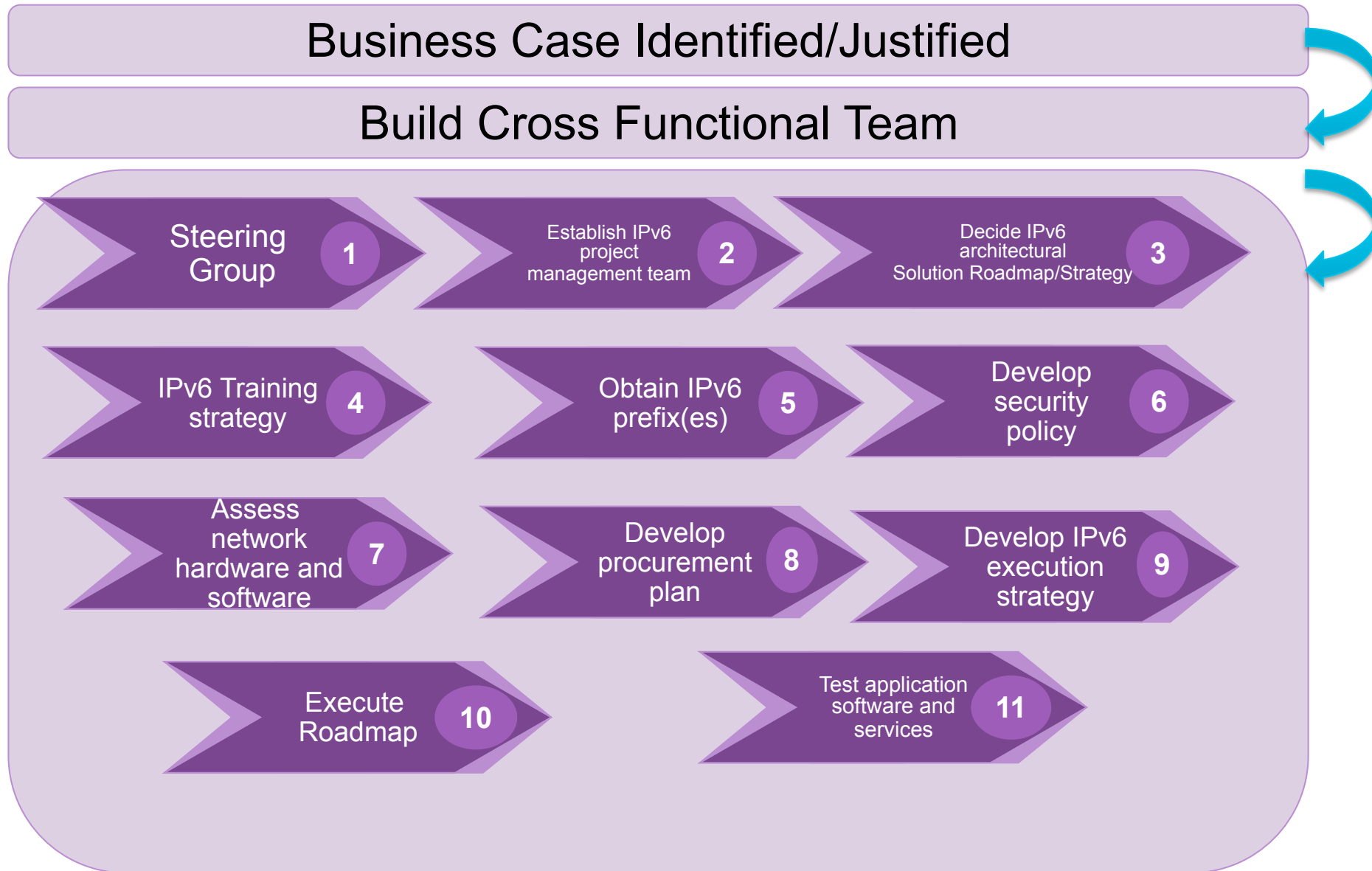
- Only long-term solution
- Unlimited growth for people, services & devices
- Will empower the “Internet of Everything”



Doing nothing is exposing your organization to risk

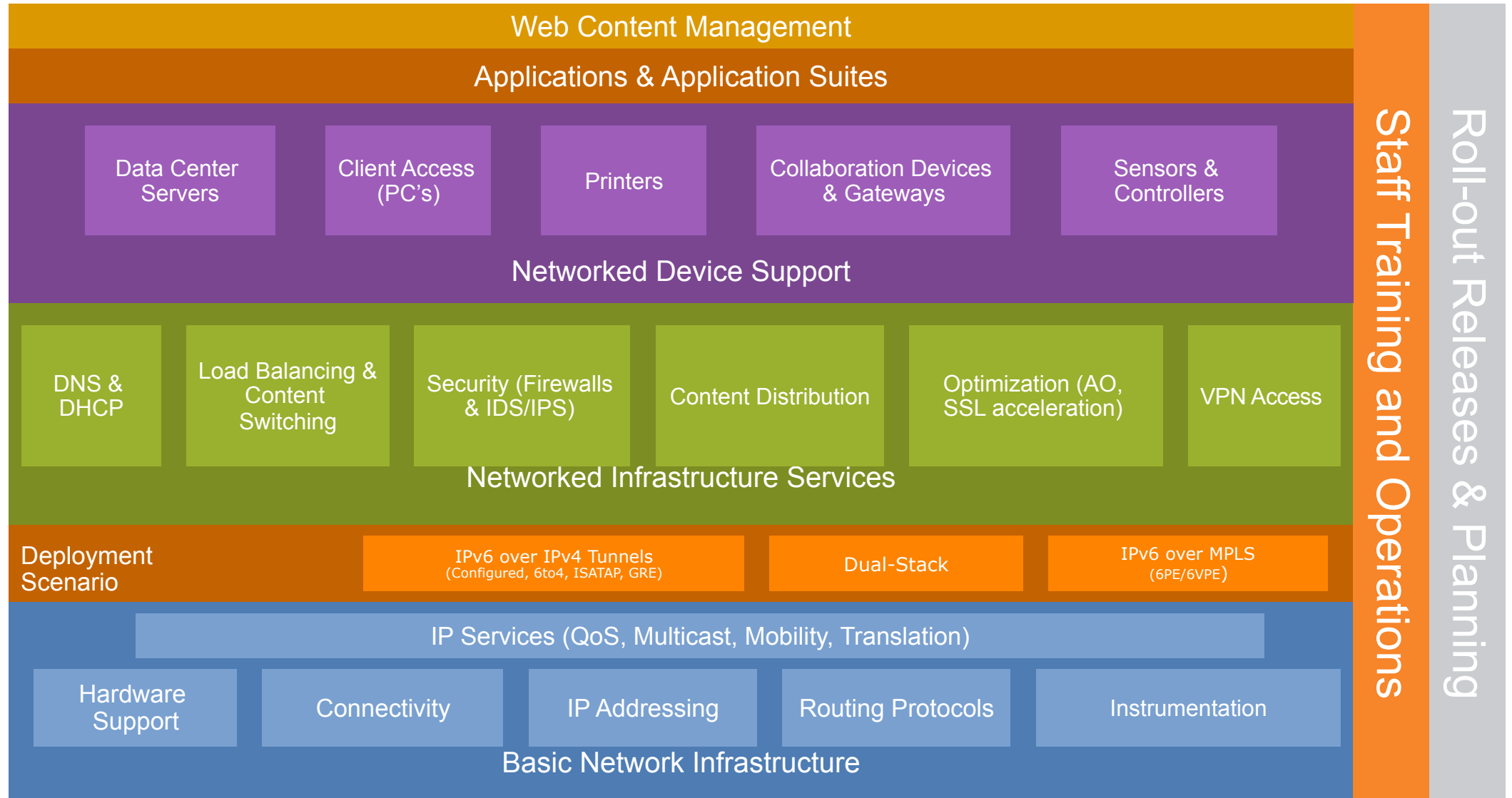
# Where Do I Start? PLAN, PLAN, PLAN !!!!!

**BUILD  
A  
LAB!**





# The Scope of IPv6 Deployment



# Modern Operating Systems Support IPv6

- Prefer IPv6 connectivity (RFC 5221)
- Use SLAAC/DHCPv6 and have Link Local Addresses (RFC 4862)
- Can run IPv6 over an IPv4 network under certain circumstances
  - Tunneled over an IPv4 core
  - And/or on L2 segment
- Will try to use IPv6 if they receive a AAAA record from DNS
- Don't always display IPv6 information (mobile devices)
- Can use privacy addresses (RFC 4961)
- Modern browsers implement RFC 6555 (Happy Eyeballs)
- Use IPv6 link-local capabilities for plug and play protocols



# Commonly Deployed IPv6-enabled OS/Apps



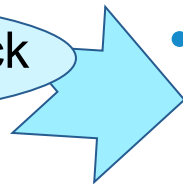
## Operating Systems

- Windows 7 /8/ Vista
- Windows Server
- SUSE
- Red Hat
- Ubuntu

## Virtualization & Applications

- VMware vSphere
- Microsoft Hyper-V
- Microsoft Exchange 2007 SP1/2010
- Apache/IIS Web Services
- Windows Media Services
- Multiple Line of Business apps - Oracle/SAP etc

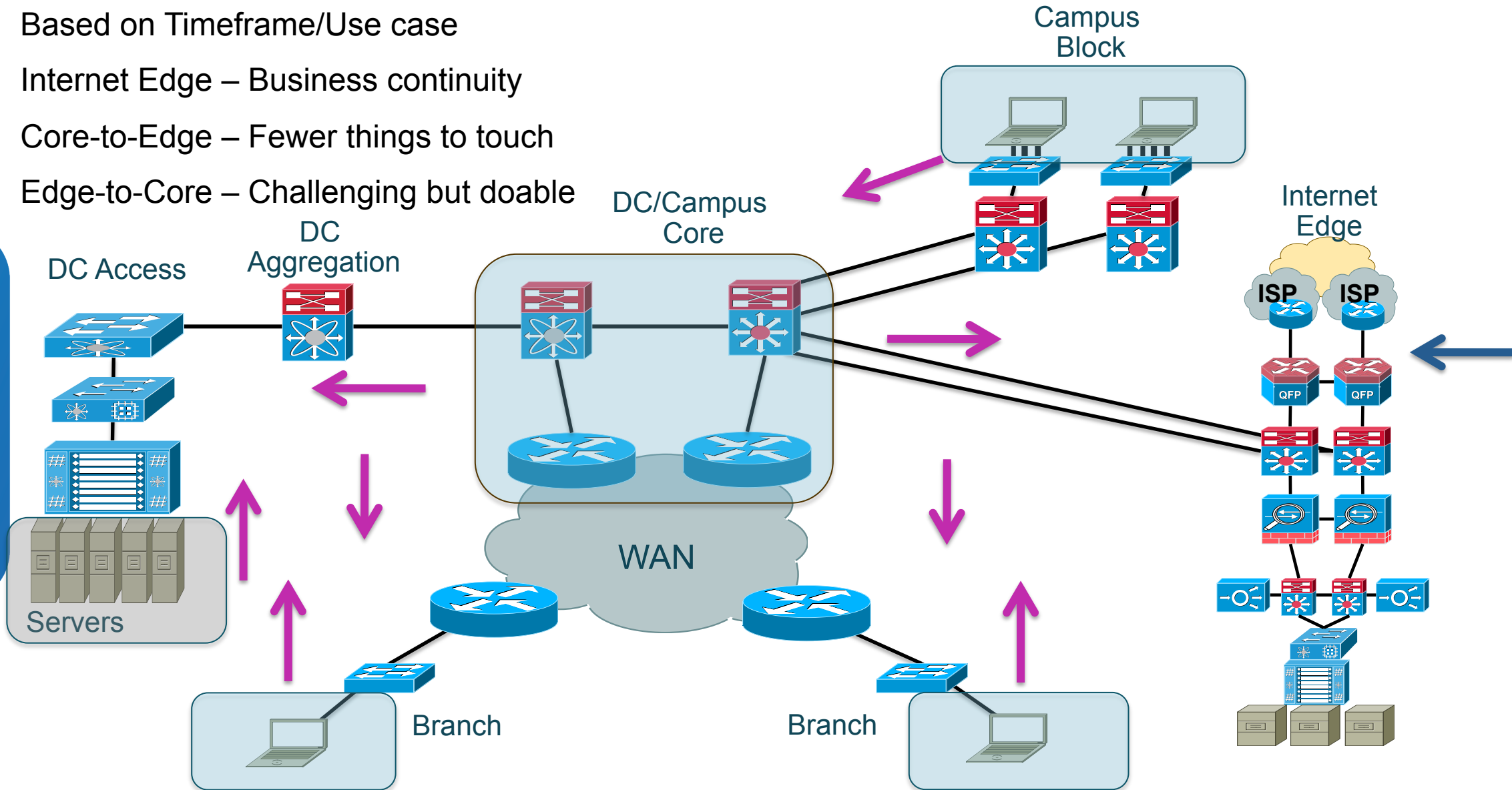
IPv6 Team Must check



**Most COTS - applications won't be your problem  
– it will be the custom/home-grown apps**

# Where do I start?

- Based on Timeframe/Use case
- Internet Edge – Business continuity
- Core-to-Edge – Fewer things to touch
- Edge-to-Core – Challenging but doable

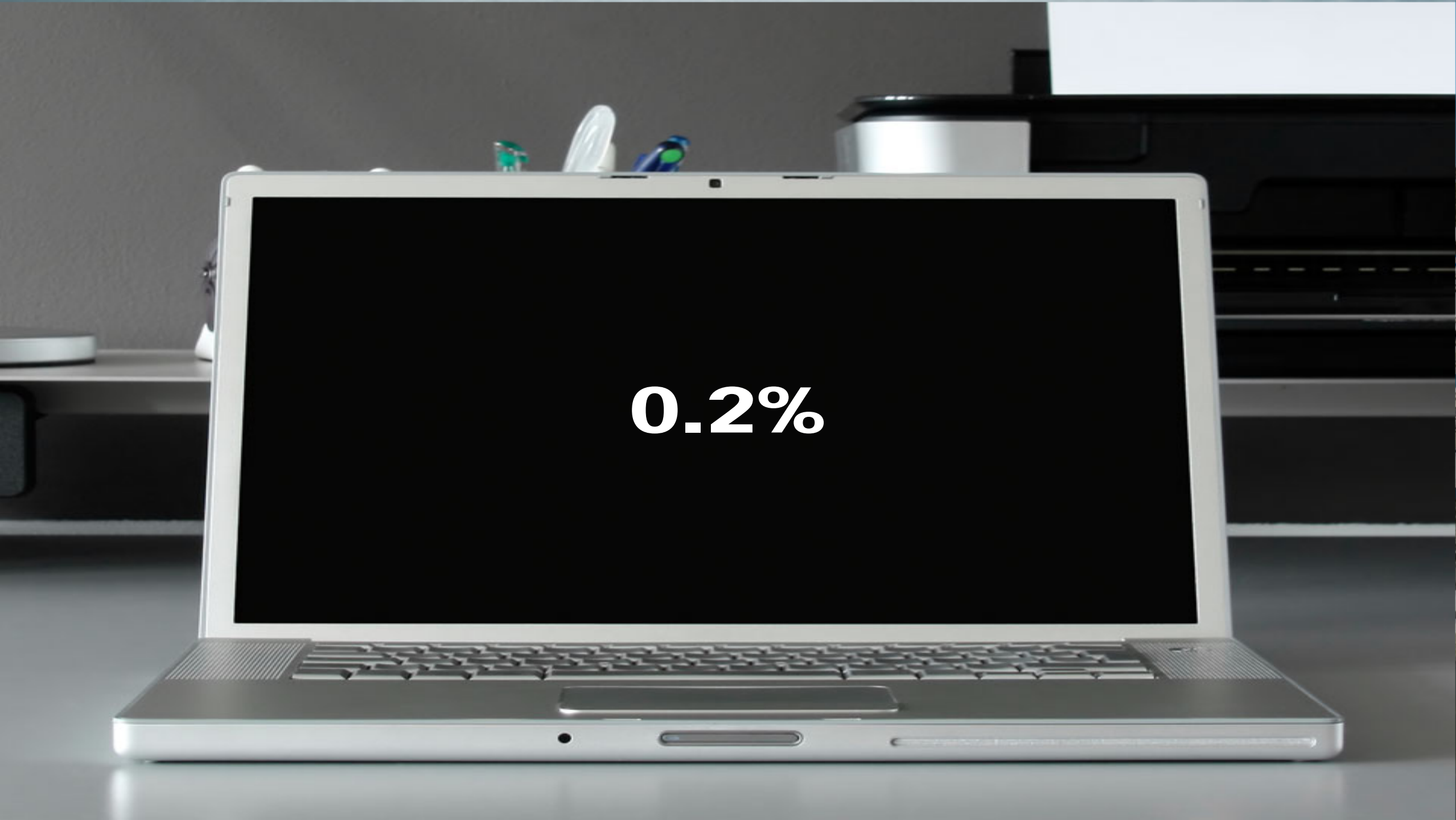




**Definition:** The Internet of Everything (IoE) is the connection of all machines, devices, sensors, automobiles, cameras and “things” to help customers improve operations and save valuable time, money and even lives.





A silver laptop is open on a desk. The screen is black with the text '0.2%' in white. In the background, there is a pen holder with pens and a silver coffee cup. The desk is light-colored, and the background wall is dark.

**0.2%**



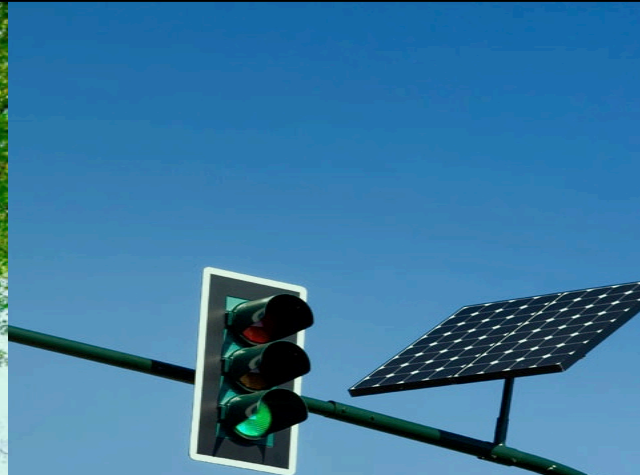


99.8%





**ADDRESS  
CLIMATE  
CHANGE**



**SMARTER  
INTERCONNECTED  
SYSTEMS**



**REMOTE  
MEDICAL  
SERVICIES**



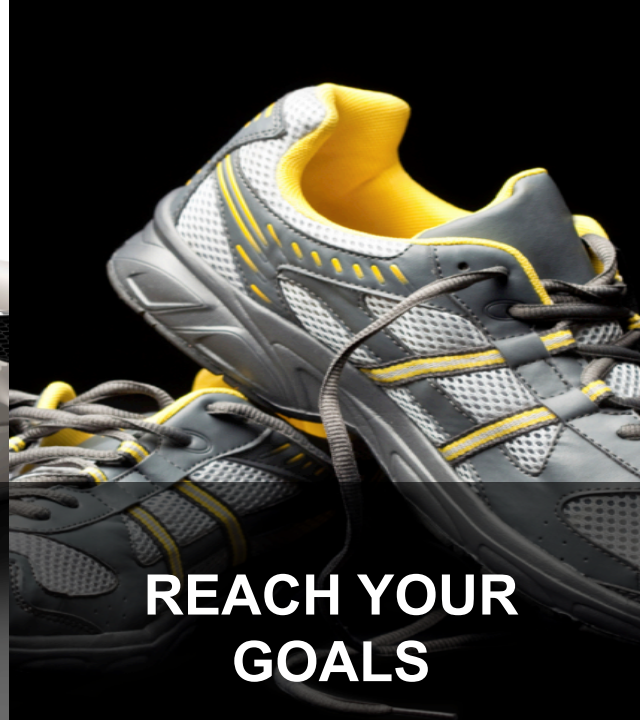
**LIVE  
HEALTHIER  
LIVES**



**LESS WASTE, SAVE  
MONEY**



**IMPROVE  
SAFETY**



**REACH YOUR  
GOALS**



**ENERGY  
EFFICIENCY**

# The Internet of Everything



## People

Connecting people in more relevant and valuable ways.



## Process

Delivering the right information to the right person (or machine) at the right time.



## Data

Leveraging data into more useful information for decision making.

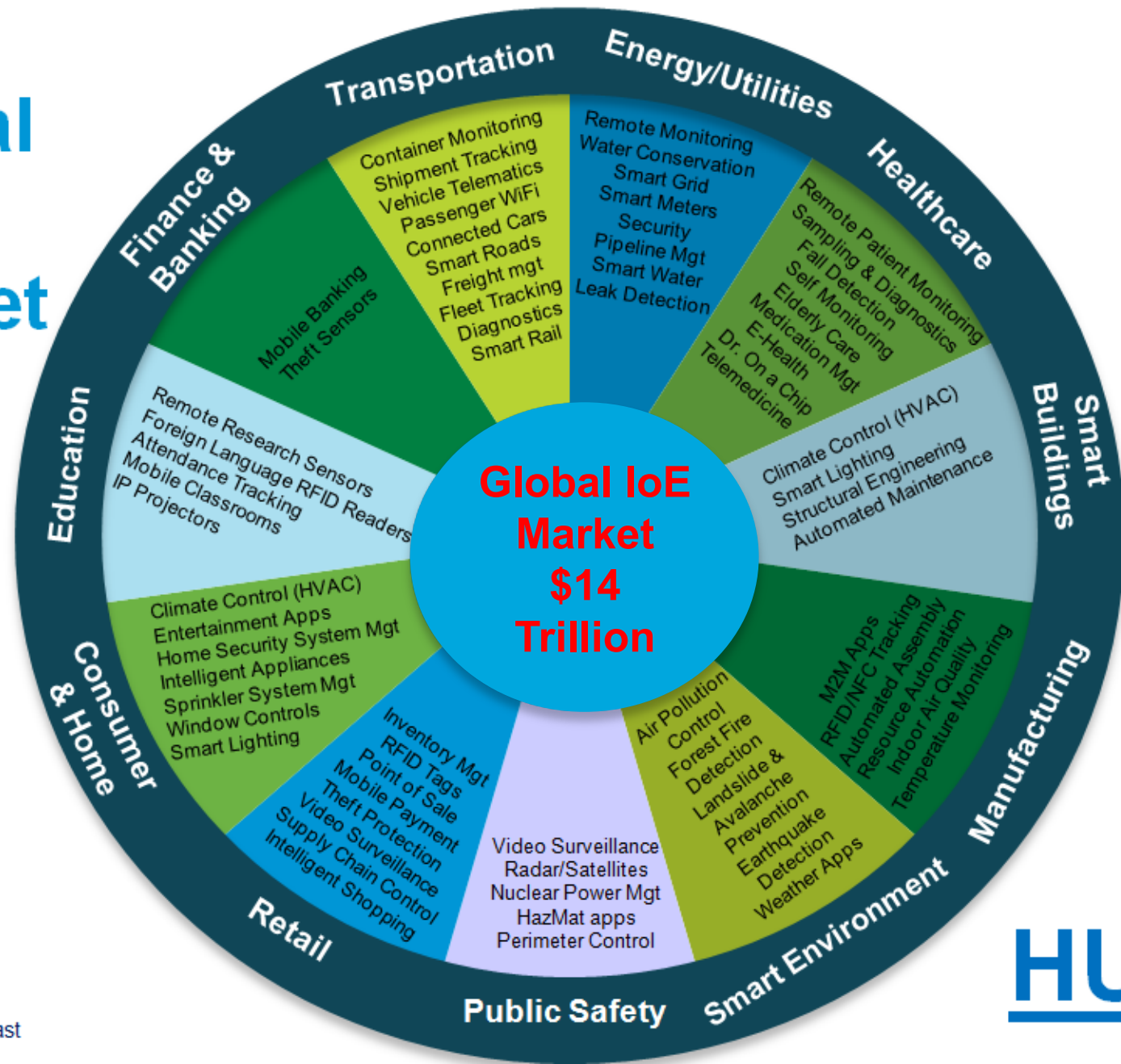


## Things

Physical devices and objects connected to the Internet and each other for intelligent decision making.



# The Global IoT Market

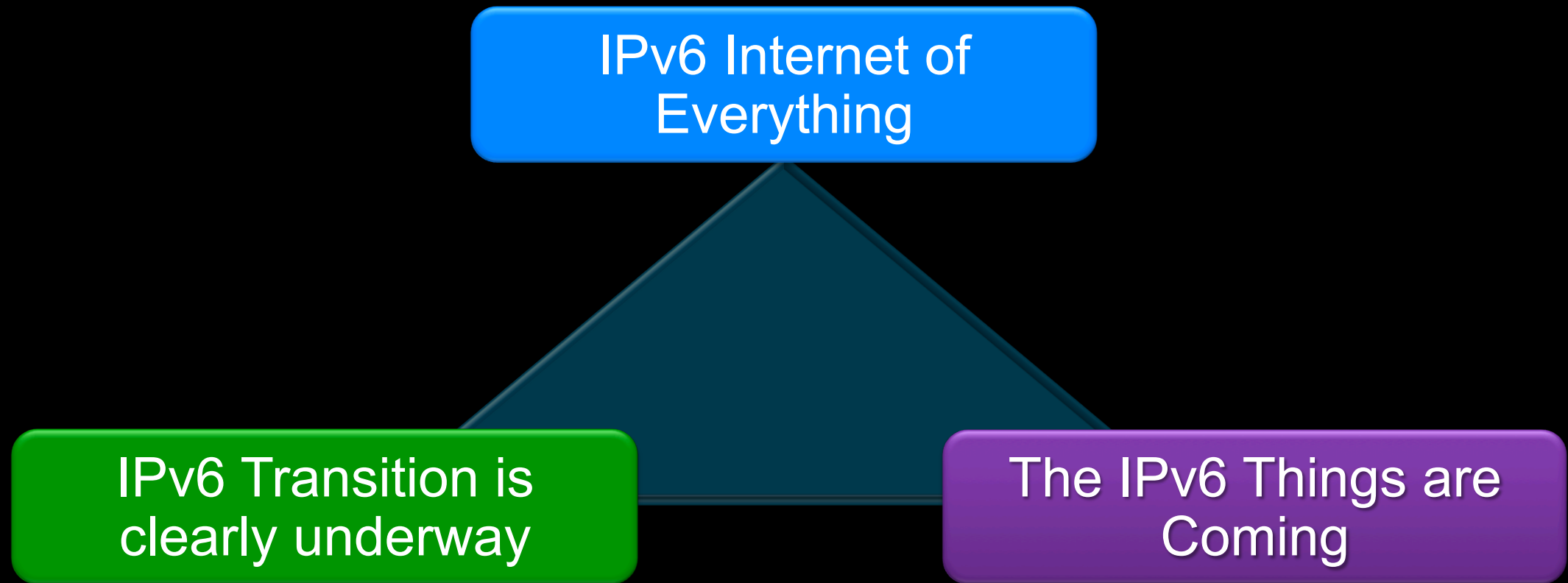


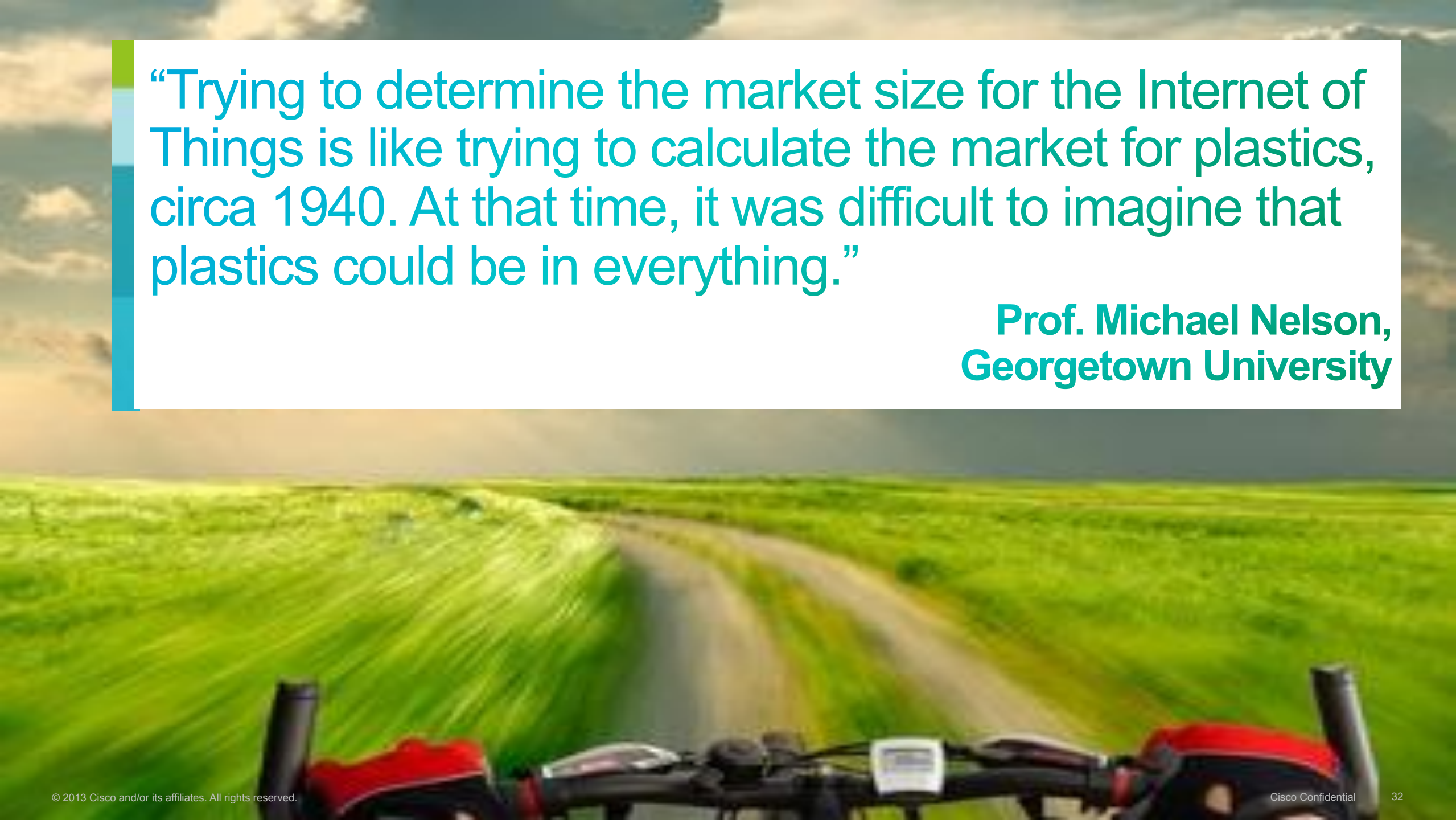
**Is  
HUGE!**

\* 2014 forecast



# IPv6 is Setting the Stage for the Internet of Everything

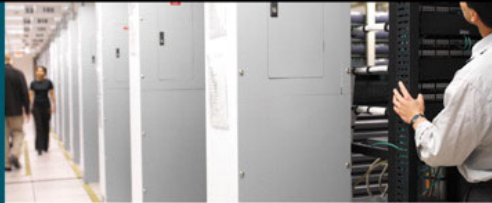




“Trying to determine the market size for the Internet of Things is like trying to calculate the market for plastics, circa 1940. At that time, it was difficult to imagine that plastics could be in everything.”

**Prof. Michael Nelson,  
Georgetown University**

# Good technical books



## Deploying IPv6 Networks

An essential, comprehensive, and practical guide to IPv6 concepts, service implementation, and interoperability in existing IPv4 environments

Ciprian Popoviciu, CCIE® No. 4499  
Eric Levy-Abegnoli  
Patrick Grossetete

ciscopress.com



SECURITY

## IPv6 Security

Information assurance for the next-generation Internet Protocol

Scott Hogg, CCIE® No. 5133  
Eric Vyncke

ciscopress.com



## IPv6 for Enterprise Networks

Shannon McFarland  
Munindor Sambi  
Nishi Sharma  
Sanjay Hooda

ciscopress.com

## Core Message of This Session

# Failure [to Act] is Not an Option.



Gene Krantz, Flight Director, Apollo 13  
April, 1970

The whole of IT must collectively embrace this transition, it is not just about the networks team



A dark, rounded rectangular box containing the text "Thank You" in a light blue, sans-serif font. The background of the slide is a vibrant, abstract digital scene with blue and green light trails and a glowing central point.

Thank You