

# Internet Futures

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A personal glimpse into a future  
of the internet

Geoff Huston  
APNIC

A quick look back:  
20 years ago

# A quick look back: 20 years ago



The flagship of Digital's technology of the time, that turned out to be a commercial flop. Anyway, it's still a true mainframe, in that: the system takes up a whole room, it consumes electricity as if it was free, and generates heat like hell. All this is due the fact that it's built out of ECL components, which are very fast (CMOS wasn't even close to that at that time), but draws significant power (the whole system takes around 20 kW). It was designed to have water-cooling, but that didn't work, so they modified it to air-cooling, the name however remained: "Aquarius". There were different models, with performances varying from 40 to 157 VUPs (125 MFLOPS). The I/O-memory-CPU interconnect is switched (with a frequency of 1 GHz), which was a totally new concept at that time. There were only a few dozen 9000's ever made.

# A quick look back: 20 years ago



The end of the  
mainframe dinosaur

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# A quick look back: 10 years ago

Computing meets  
consumer electronics:  
the rise and rise of  
the personal computer

Ugly, aren't they!

Today!

# The new iPad



"We are now living in a post-PC world"



With desktop devices the Internet was a dedicated activity

reliable power lighting

privacy

large view screens

dedicated worktop

wired bandwidth

dedicated chair



PLACED UPON THE HORIZON (CASTING SHADOWS)

Grand View College and the Institute Without Borders  
**MASSIVE CHANGE**  
The Future of Global Design

**WORLD PREMIERE**  
October 2, 2004 to January 3, 2005



The Internet is now anywhere and everywhere



radio connectivity

Thumb operated

hand sized

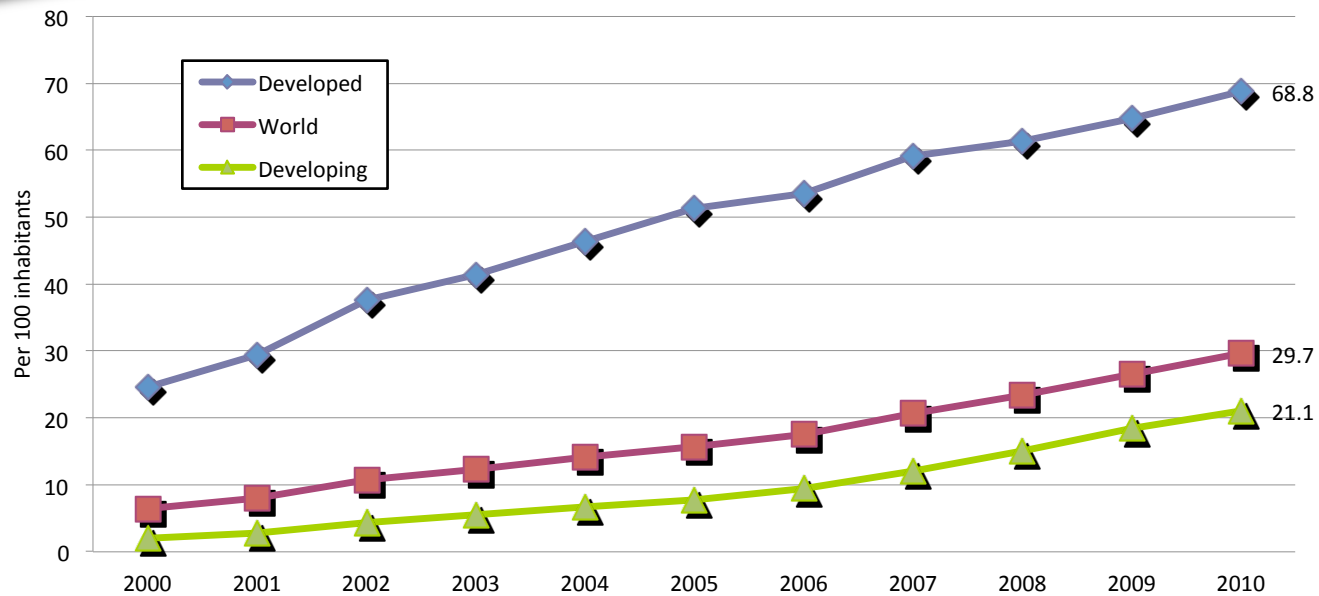
battery power

Its trivial, commonplace and blends into all our activities

# Counting Users...

There are 2.5 billion internet users today

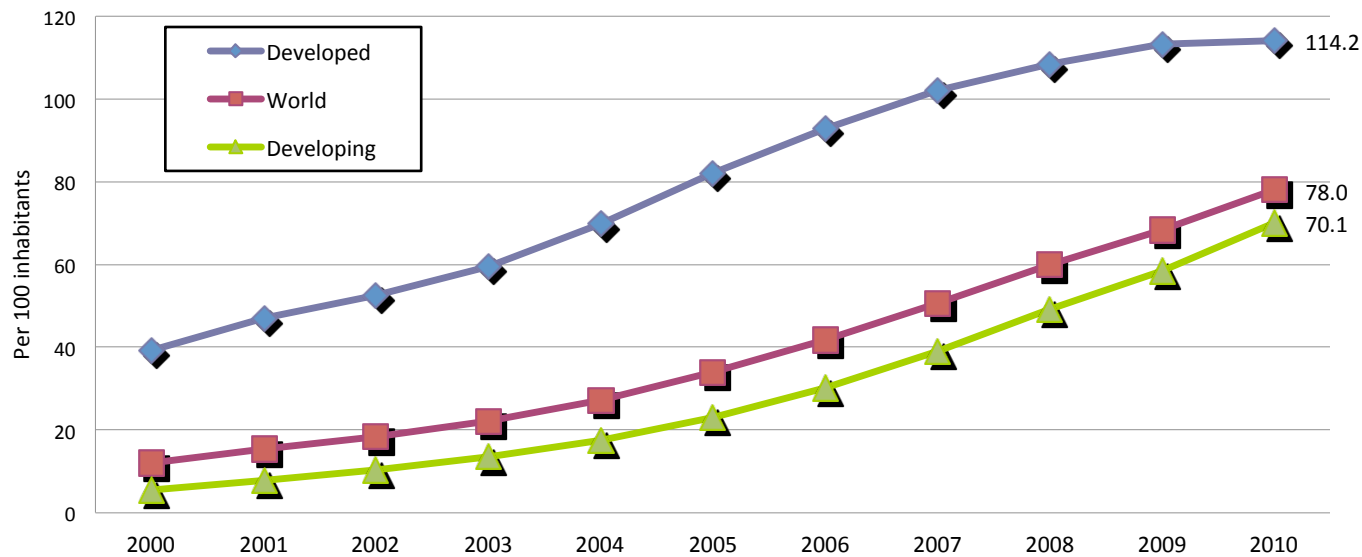
Internet users per 100 inhabitants, 2000-2010



# Counting Users...

There are internet users  
And 5 billion mobile phone users!

Mobile cellular subscriptions per 100 inhabitants, 2000-2010



The developed/developing country classifications are based on the UN M49, see:  
<http://www.itu.int/ITU-D/ict/definitions/regions/index.html>  
Source: ITU World Telecommunication /ICT Indicators database

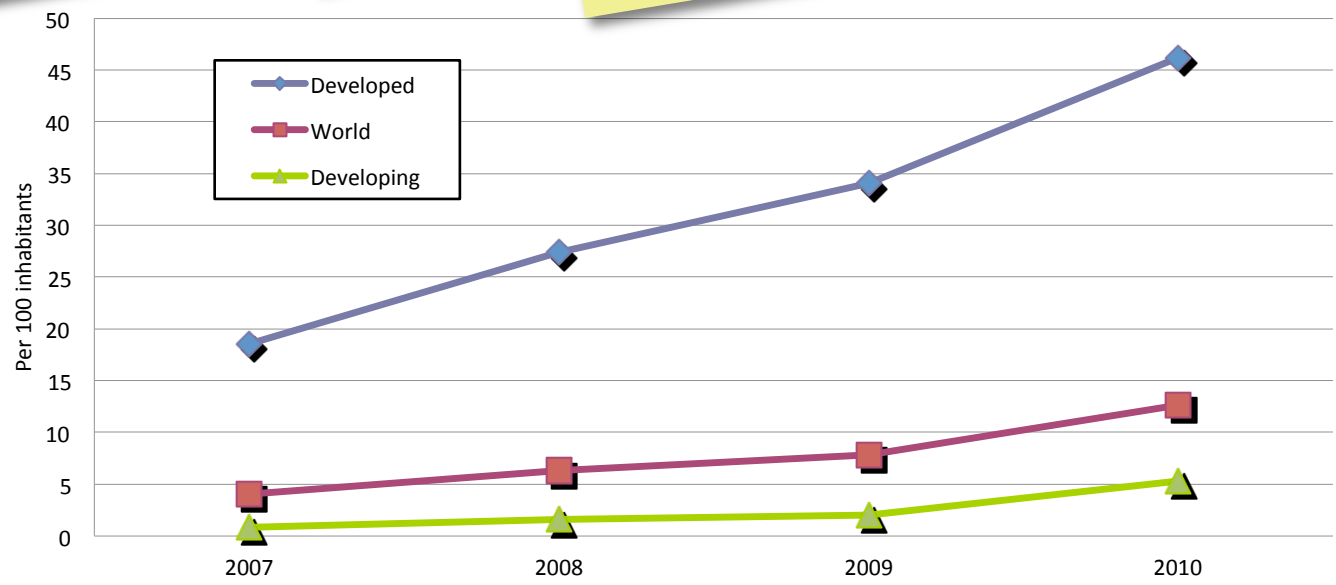
<http://www.itu.int/ITU-D/ict/statistics/>

# Counting Users.....

There are internet users

And 5

And 750 million mobile internet users!

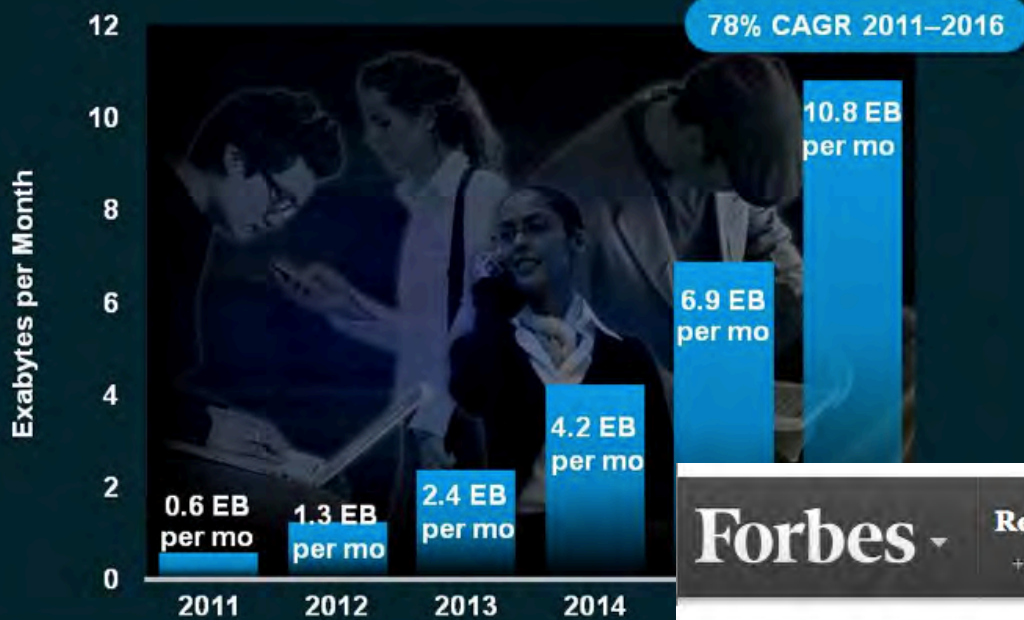


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# Tomorrow's Users and Usage

**Gartner Says Worldwide Media Tablets Sales to Reach 119 Million Units in 2012**

**Global Mobile Data Traffic Growth / Top-Line**  
Global Mobile Data Traffic will Increase 18X from 2011 to 2016



Source: Cisco Visual Networking Index (VNI) Global Mobile Data Traf

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or Approximately 35 Percent of Sales

worldwide media tablet sales to end 2012, a 98 percent increase from Apple, Inc.

tablet operating system (OS), as it is expected to drive media tablet sales to end users in the software-based devices to this market, and therefore, Apple will continue to be the

Forbes

Real Time

+18 posts this hour

Popular

89 Cliches For MBAs

Lists

The World's Billionaires

Videos

Sell Yo

TECH | 4/24/2012 @ 4:40PM | 32,913 views

## Apple Results Top Estimates as iPhone Sales Soar

Where to from here?





# 5 Years Out



# it's a mobile world!

## **2011: 270 million mobile units shipped**

### **Factors:**

- **Production volumes are bringing down component unit cost**
- **Android is bringing down software unit cost**
- **No need for new content - leverage off the the existing web universe of content**
- **Shift away from the desktop and the laptop by the production industry seeking new markets for their production capability**

# Apple's Numbers

## iPhones:

- Q3 2010 : Apple shipped 8.4M iPhones
- Q3 2011 : Apple shipped 20.3M iPhones
  - Added 42 carriers and 15 countries in the quarter!

## iPads:

- Q3 2010 : Apple shipped 3.3M iPads
- Q3 2011 : Apple shipped 9.2M iPads
  - “every iPad we could make has been sold”

Q3 2011 profit: \$US 7.3B

# Apple's Numbers



Apple's earnings for the last three months of 2011 surpassed all expectations. It racked up a record \$46.3 billion in sales for the quarter and more than doubled its net profit, to \$13.1 billion. Apple's share price jumped on the news, vaulting it once again over Exxon Mobil to become (briefly) the world's most valuable listed company.

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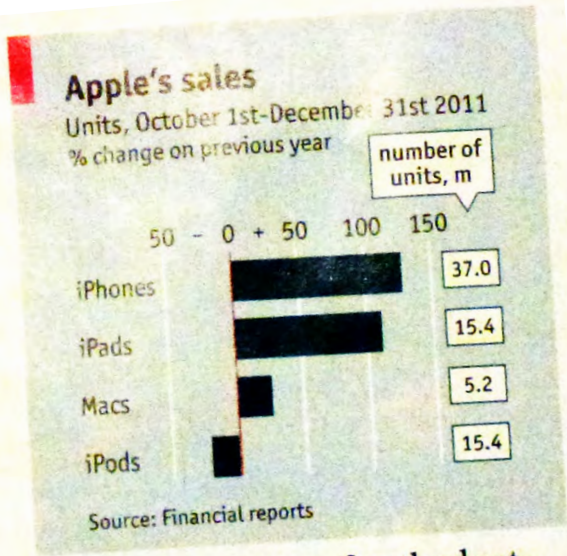
shipped 9.2M iPads

uld make has b

And Q4 2011 was  
even bigger!

NET PROFIT: \$US 7.3B

# Apple's Numbers



**37M iPhones**

~~shipped 8.4M iPhones~~

~~shipped 20.3M iPhones~~

shipped 37M iPhones and 15 countries in the quarter!

**15M iPads**

~~shipped 3.3M iPads~~

~~shipped 9.2M iPads~~

shipped 15M iPads

And Q4 2011 was even bigger!

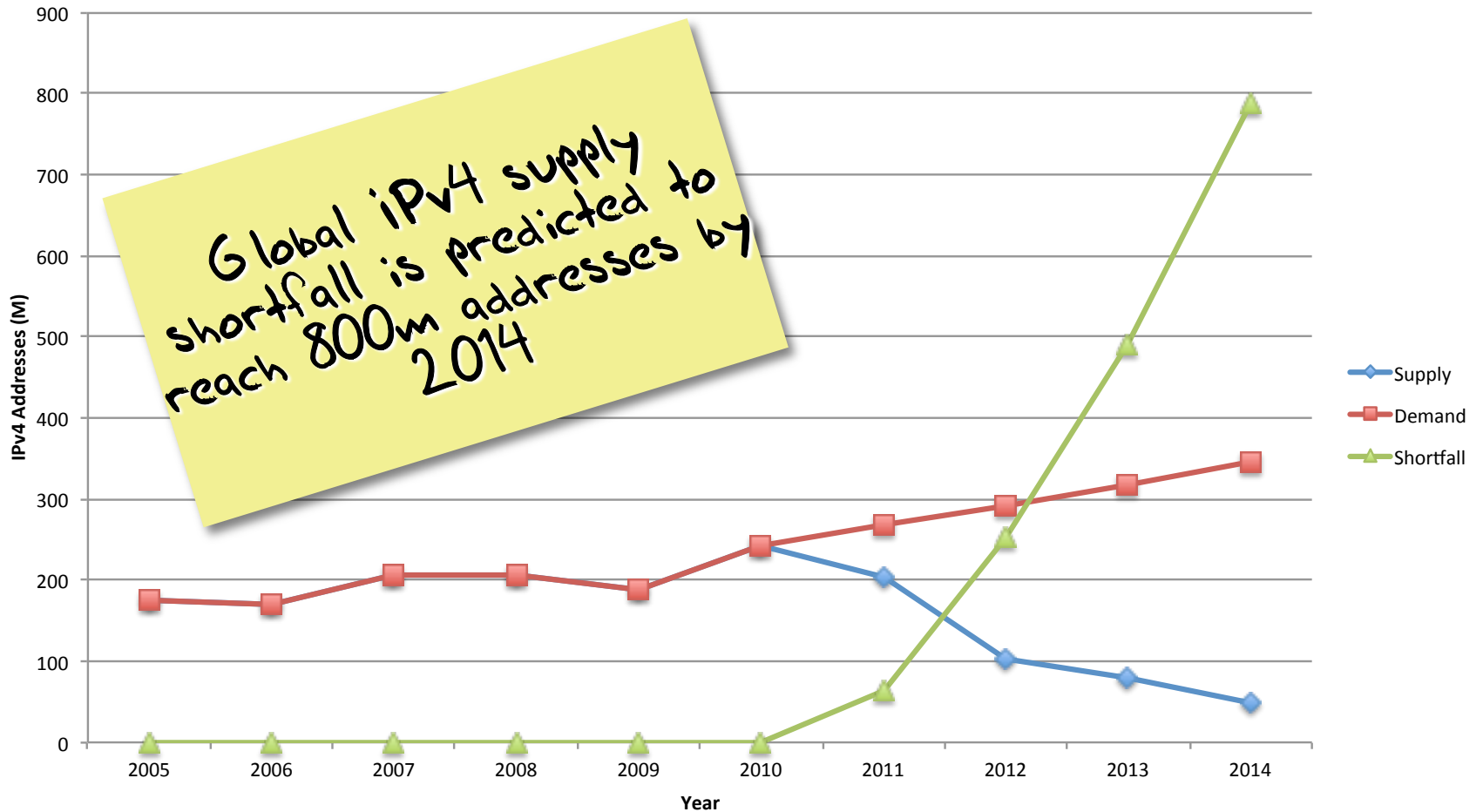
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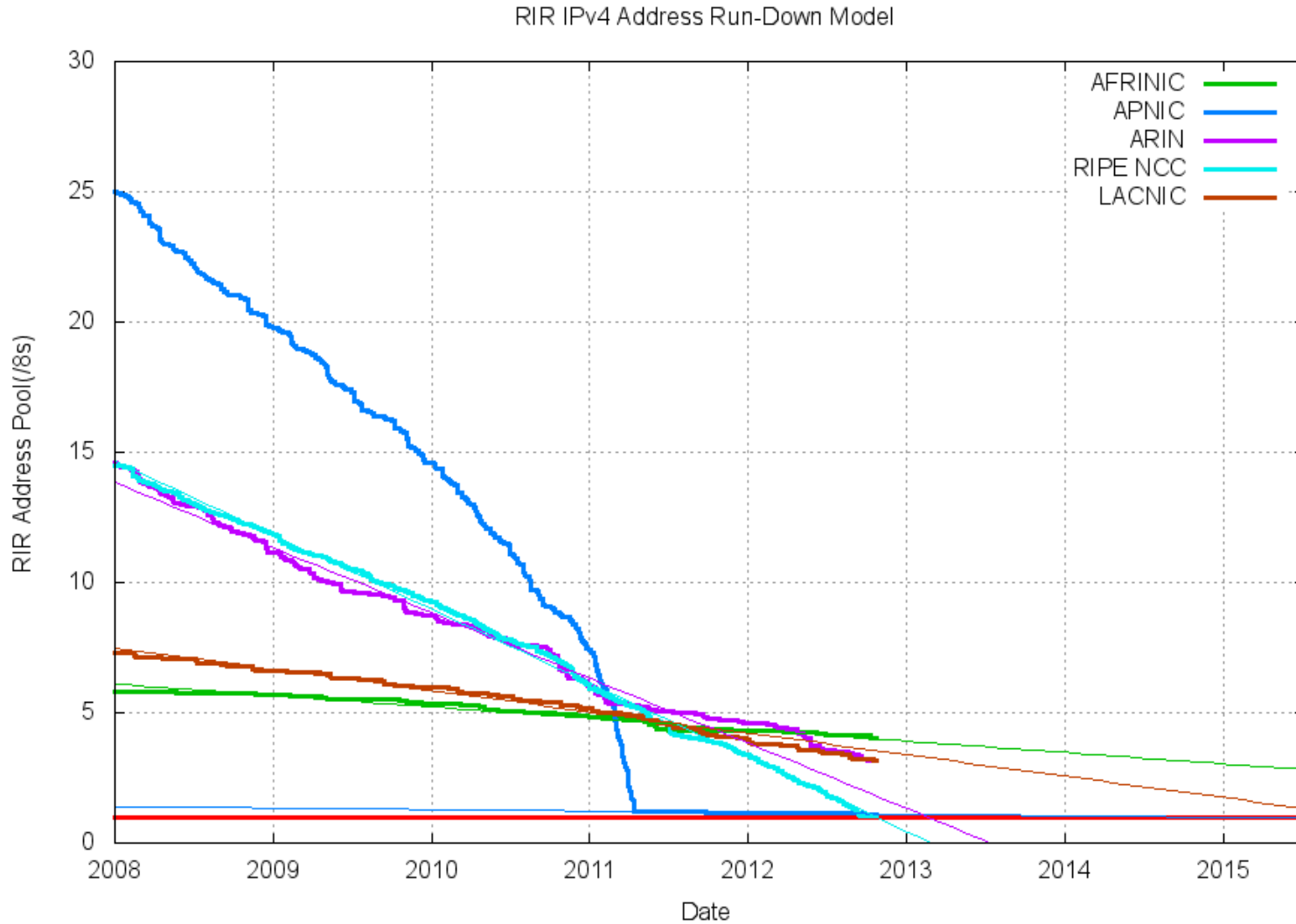
**\$13.1B profit!**

# Coping with Demand

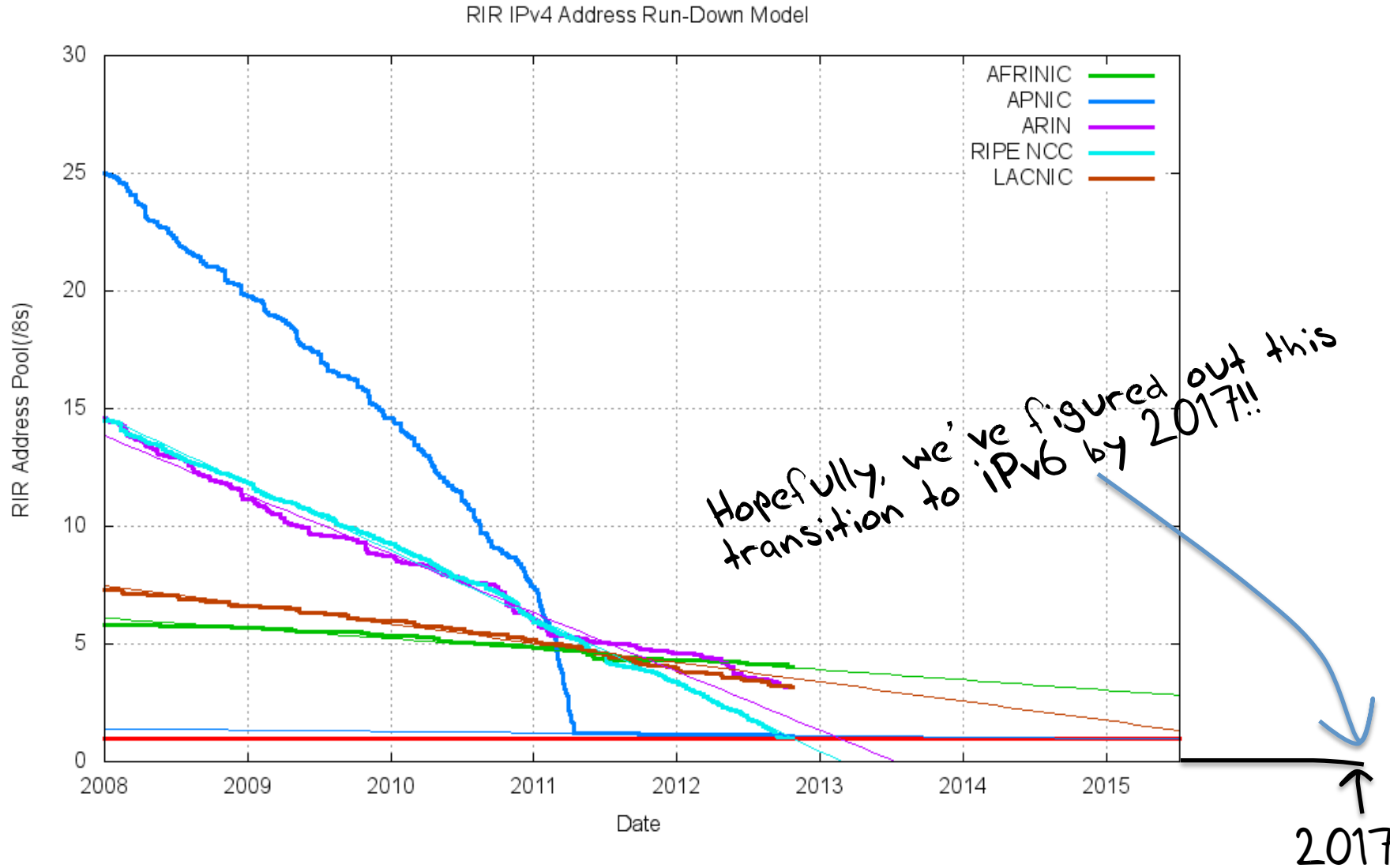
Global IPv4 Address Supply and Demand Estimates



# Coping with IPv4 Address Exhaustion



# Coping with IPv4 Address Exhaustion





But we're now High Risk!



**The emergence of a market in IPv4 addresses is now a certainty.**

**But the outcomes of this market are by no means assured...**

# But we're now High Risk!

If the price goes too high then this will generate acute instability and potentially fragment the network



If the price is highly volatile this will deter new investors in networked services and entrench the incumbent services and incumbent providers

**The emergence of a market in IPv4 addresses is now a certainty.**

**But the outcomes of this market are by no means assured...**

in the next five years...



we have a choice

in the next five years...



Everything gets  
squashed into  
HTTP, IPv4 and  
CGNs

IPv6

And its not yet clear which path the internet will take!

And its not yet clear which  
path ~~the internet~~ will take!  
market forces

Can we look further out?

# 10 Years Out?





# My personal view...by 2022

The Internet will be all IPv6 by 2022!

The market in IPv4 trading is a short term phase  
CGNs also have near term limits under intense  
scaling pressure

There is no extended afterlife in store for CGNs +  
IPv4 if we make this transition to IPv6

(look at what happened to DECnet, SNA, Appletalk, X.25,...)

# My personal view...by 2022

Or there will be no more Internet by then

- because all the CGNs, ALGs, CDNs in the world will not hold the Internet for 10 years of intense growth pressure
- And because one common protocol platform, one common address space, one common name space is a brittle state, it will fracture and splinter under address pressure

# My personal view...by 2022

Radio spectrum will become even more of a scarce and highly valuable asset

well it is already, but the competition for spectrum in highly populous areas will continue

Fewer wide area services - more cellular / femtocell services backed by fibre backhaul to improve spectrum efficiency

# 20 Years Out?



# My personal view...by 2032

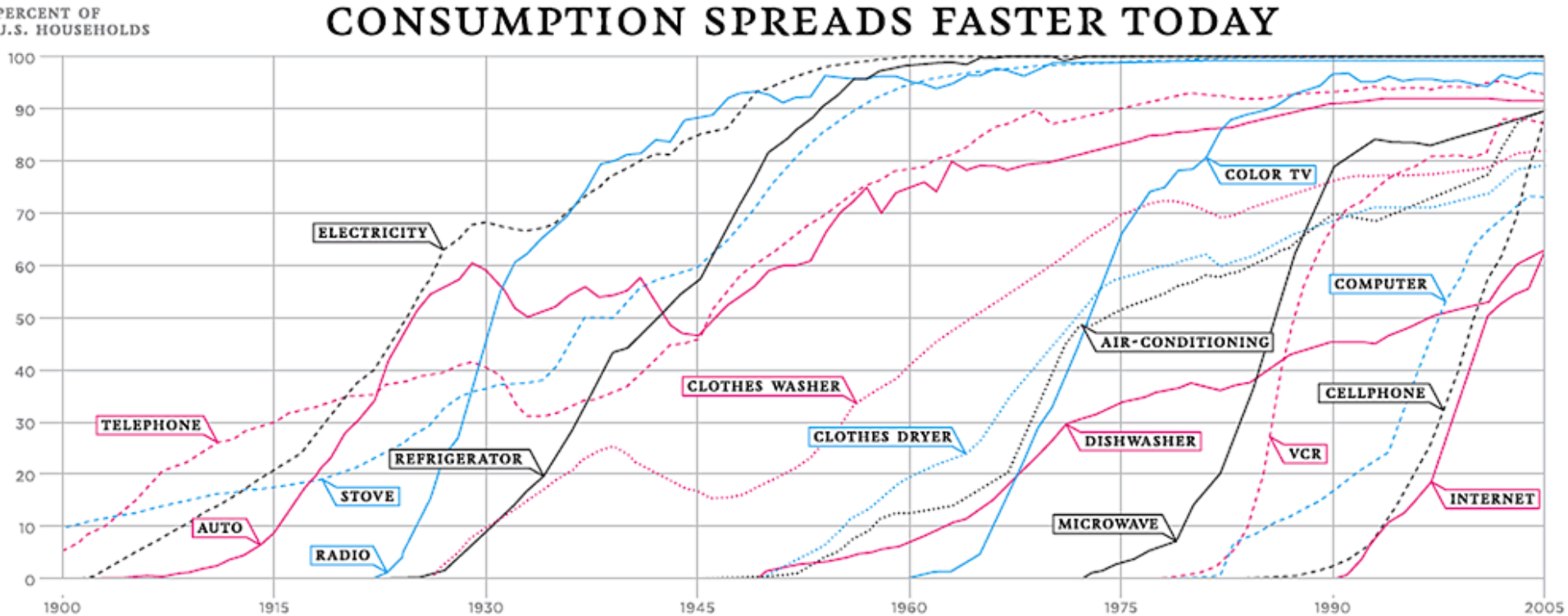
This is extremely tough!

very little from the world of 1992 is still with us today

very little of today's environment will be persistent for the next two decades

Why?

As the pace of technology adoption gets faster we cycle through successive generations of technologies at ever faster rates



What's shaping our future?

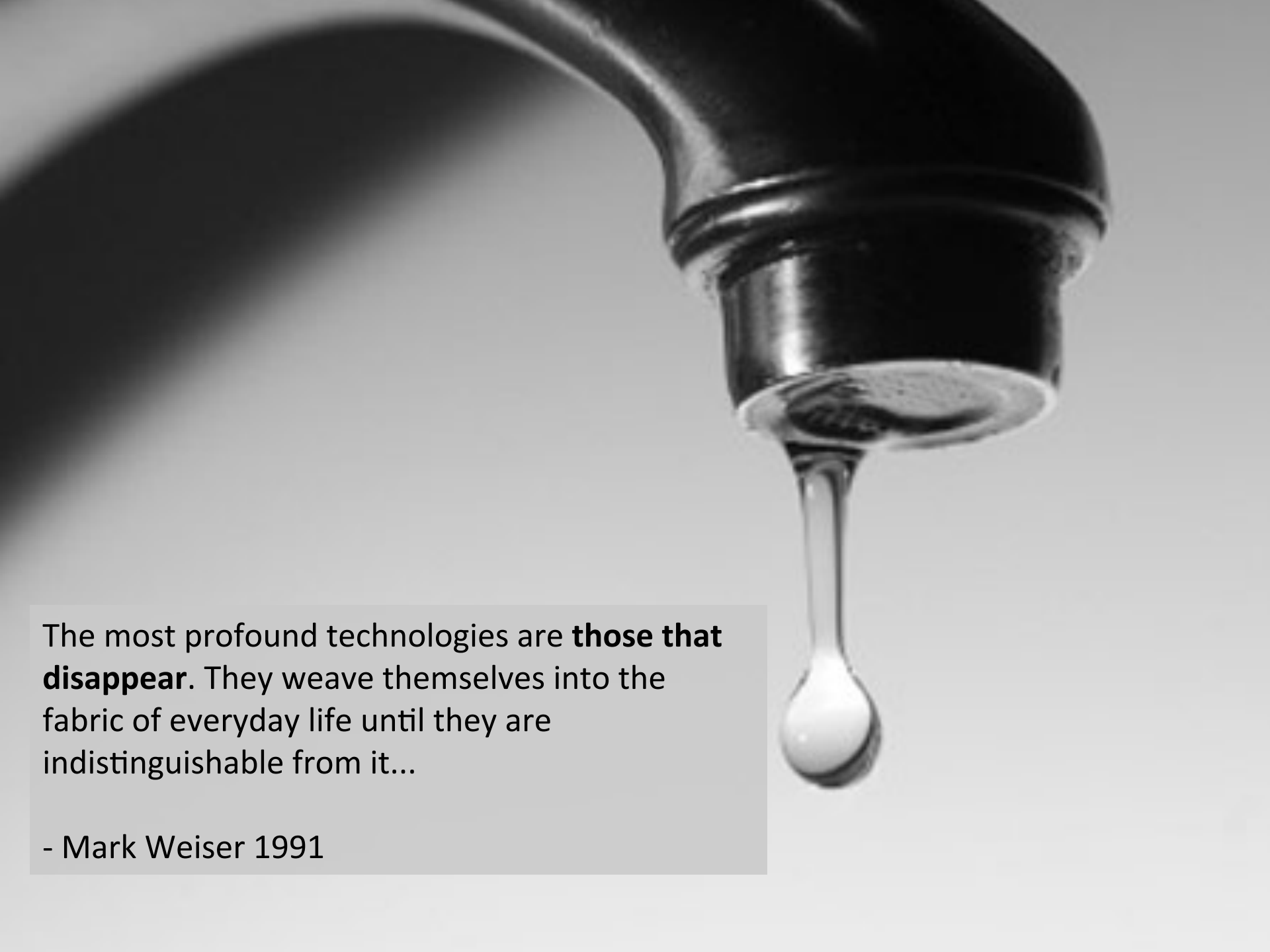
You and i!

# What's shaping our future?

You and i!

We need to think about a post-PC world where computation, storage and communications are abundant commodities. It's innovative mass-produced consumer devices and services that will shape much of the Internet's future. And the innovative force here is one of constant technology refinement and evolution!



A black and white photograph of a faucet with a single drop of water falling from it. The faucet is dark and metallic, and the water drop is clear and teardrop-shaped. The background is a light, neutral color.

The most profound technologies are **those that disappear**. They weave themselves into the fabric of everyday life until they are indistinguishable from it...

- Mark Weiser 1991