Internet Futures

A personal glimpse into a future of the Internet
A quick look back: 1992

The flagship of Digital's technology of the time, that turned out to be a commercial flop. Anyhow, it's still a true mainframe, remarkable in any aspect: the system takes up a whole room, it consumes electricity as if it was free, and dissipates heat like hell. All this is due to 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 it 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.

The mainframe era ended around this time.
A quick look back: 2002

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

The new iPad
"We are now living in a post-PC world"
Where to from here?
5 Years Out

2017
It's turning into 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:
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• Q3 2011: Apple shipped 9.2M iPads
  – “every iPad we could make has been sold”

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- **Q4 2011:**
  - iPhones: shipped 37M iPhones
  - iPads: shipped 15M iPads

**Q4 2011 profit:** $13.1B profit!
Coping with Demand

Global IPv4 supply shortfall is predicted to reach 800m addresses by 2014
Coping with IPv4 Address Exhaustion
Coping with IPv4 Address Exhaustion

Hopefully, we’ve figured out this transition to IPv6 by 2017!!

RIR Address Pool (/8s)

Date


AFRINIC  APNIC  ARIN  RIPE NCC  LACNIC
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...
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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.

If the price is too low then there is little incentive for incumbents to move away from IPv4 and commence investments in IPv6, leading to stasis and entrenched incumbents.
in the next five years...

we have a choice
in the next five years...

Everything gets squashed into HTTP, IPv4 and CGNs

IPv6
And it's not yet clear which path the Internet will take!
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market forces
Can we look further out?
10 Years Out?
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,...)
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
My personal view...by 2022

Cloud / Data Centre services may well be at their peak by 2022

Innovative competitive pressure at this time may well come from highly distributed systems that do not rely on intense concentrations of computation and information storage
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?

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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!
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