The Second Internet

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Presented by

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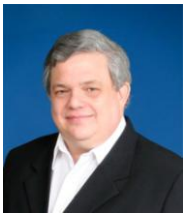
Your Speaker



- 35+ years in IT field, including:
  - 2 years with VeriSign (PKI, crypto)
  - Co-founder, CTO at CipherTrust (e-mail security)
  - Founder InfoWeapons (IPv6 Infrastructure)
- I've personally invested heavily in IPv6
- Built team with large number of IPv6 and security experts (development, testing, Q/A, etc.)
- Author of the book: "The Second Internet: Re-inventing Computer Networks with IPv6", downloadable free at *www.secondinternet.org*.
- My company (InfoWeapons) has been running production dual stack in-house networks for 4 years, and has already created 3 dual-stack products (DNS/DHCP, VoIP and Firewall), with two more products underway.
- Many future IPv6 products planned, including ISP home/SOHO gateway (CPE)

The First Internet

- The First Internet was based entirely on IPv4. It was born (went live) on Jan 1, 1983. Current predictions are that the IANA pool of IPv4 addresses will run out in early 2011. As of the end of September 2010, there are 14 “/8” blocks of IPv4 left in the IANA pool. Current allocation rate is about 2 per month. Assuming this rate remains constant (it could accelerate as we get closer):
  - Oct 31, 2010: 12 left
  - Nov 30, 2010: 10 left
  - Dec 31, 2010: 8 left
  - Jan 31, 2011: 6 left
- By Valentines day 2011, we will be down to the final 5 “/8” blocks, which will then be given to the five RIRs (AfriNIC, APNIC, ARIN, LACNIC & RIPE).
- Although the RIRs and ISPs will have IPv4 addresses in stock for 6-9 months after that, in one sense, this is the end of the First Internet, as we know it.

If IP Addresses were Cars...

- If IP addresses were cars, this would be equivalent to all of the companies that make cars announcing that the last car would be manufactured on February 14, 2011.
- At that time, there would still be some cars in the distribution pipeline, on ships, on car carriers, etc. There would be some in stock at dealers. BUT, once those are sold (in 9 months?), dealers will not be able to get any more.
- The cars already on the road will, of course, continue to run. However, once that last car is bought, no more *new* cars will be available ever again. I sure hope someone would already have come up with something to replace them (say, Jetson style flying cars). In the case of IP addresses, that would be IPv6. It would take some time for us all to get used to the new fangled flying cars, but soon people will wonder how they ever got along with those old clunkers that were limited to running on the ground, and would barely go over 100 mph!

Actually the First Internet is Already on Life Support...

- We actually have tried to keep the First Internet alive WAY past its natural lifespan, and it's starting to show. Badly. It had a major heart attack in the mid 1990's when it first looked like we were going to run out of addresses. There were many "End of the Internet As We Know It!" articles in the press.
- Good old Doc IETF patched the First Internet up with quadruple bypass surgery, by introducing NAT and RFC 1918 private addresses. Unfortunately the price for keeping the First Internet alive was giving up one of its coolest features: universal end-to-end connectivity. Before NAT, any node could in theory connect directly to any other node. Ah, those were the days!
- At the same time, the IETF ran back to the labs and started creating the Second Internet, based on IPv6. That was in 1995. Good news, everyone! They've been VERY busy these last 15 years, and the Second Internet is alive and well, and already growing exponentially, just like the First Internet did.
- Bloody good thing, because they are about to stop making IPv4 addresses.

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Life in the Final Days of the First Internet...

- Alice and Bob want to chat. Both of them are behind NAT gateways. They both must connect *out* to some intermediary site (say LOL Instant Messenger), which will shuttle messages back and forth between them.
- Anyone at LOL Instant Messenger could be snooping on their conversation. Maybe Big Brother has installed a sniffer there, and is listening in...
- No matter how big LOL Instant Messenger's computers are, there is *some* upper limit of how many Alices and Bobs can be chatting at any given time.
- LOL Instant Messenger in not in business for their health. They have to either charge you, sell your contact info to someone, or send ads to you themselves. *Somehow* they are selling *you* to someone else in return for providing you with a "free" service (the Television business model).
- Without NAT in the way, Alice and Bob could simply connect directly to each other, securely, while a billion or so OTHER such connections were going on at the same time. Disintermediation is a wonderful thing.

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Life in the Final Days of the First Internet...

- And then there is the free VoIP provider "Skrap" who came up with a way to automatically tunnel right through everyone's firewalls with "NAT Traversal", so users can call each other. You might be amazed at what can come right into your network and computer along with Skrap's service, or just where your voice happens to go. Many network security guys consider Skrap to be one of the leading security vulnerabilities. Without NAT in the way, providing the same VoIP service could easily be done, quite securely by *just about anyone*, using completely standards-based software (which Skrap is definitely NOT).
- I'm currently paying US$160 per "real" IPv4 address per year (compared to the same bandwidth with only *one* real IPv4 address instead of *five*). This is for using five NUMBERS, which my ISP is paying only a few dollars a year to get from APNIC. On the other hand, I have 2^{80} IPv6 addresses in my house (a "/48"), every one of which is "real" (globally routable). At the same price per address, this would cost 1.93×10^{26} US$ every year, and there is only about 1.25×10^{14} US$ of wealth in the entire world. Fortunately, those are FREE.

Wouldn't It Be Nice If....

- What if you could have ISP service with as many REAL IP addresses as you could ever possibly eat, the ability to connect directly to ANY OTHER NODE IN THE WORLD without going through any intermediary node, with real multicast that would allow millions of people around the world to enjoy your remarkably clever audio and video creations (without having to spend millions of dollars building a broadcast network, or even having to upload them to EweTube)?
- You can. It's being rolled out today. It's the Second Internet, based on IPv6. Not available from your (physical) ISP today? If you are clever, you can get it for free over your clunky old First Internet connection, TODAY (see my book "The Second Internet" for complete instructions on how to do this). If you are not that clever (or don't have the time), soon there will be **VIRTUAL ISPs** that will ship you a magic router and tunnel IPv6 service to you for a reasonable fee every month. They will even provide dual stack e-mail, dual stack DNS, etc. We're setting one up in Malaysia NOW, called DualStak Networks.

What Lies Ahead for Folks who Stick With IPv4?

- Ever hear about Dual Stack Lite? Right now it's an Internet Draft. Shortly it will be an RFC. After the IPv4 addresses are gone, ISPs will be deploying it.
- With Dual Stack Lite, you get native IPv6 Service, with at least a "/64" block of REAL addresses ("YAY!"). But IPv4 will come only *tunneled* over the native IPv6. The fun part is there won't be even ONE real IPv4 address. All your IPv4 addresses will be *private*, behind NAT. Not just any old NAT, but CARRIER GRADE NAT (also called LARGE SCALE NAT). Your ISP will have literally a tiny handful of real IPv4 addresses, and share those among ALL of their customers. You will share your "external" address (ever happen to surf to "www.whatismyip.com"?) with potentially hundreds of other customers.
- What will you do if one of those customers does something naughty online, and your friendly neighborhood gendarme (or, the FBI or Interpol) thinks it came from YOU? After all, you are using the same IPv4 address! It may be very difficult to prove your innocence. What if someone blocks that address?

What will the Second Internet Be Like? (1)

- First, it's going to be *just* a bit bigger. Maybe 100 times as large within just a few years.
  - "The First Internet is only 1% of the size of the Second Internet?"
  - More than likely.
  - "But there are 1.3 Billion people on the First Internet – it CAN'T get more than 6 times as big!"
  - Wrong – every DEVICE you own will have its own address. Your phones, your car, your MP3 player, your TV, hundreds of environmental sensors around your "smart" house. Soon personal health monitoring sensors on your body (ever hear of 6loWPAN? That's IPv6 based Low Power PERSONAL Area Networks – yes, the computer really IS going to get Personal!). The Second Internet is the INTERNET OF DEVICES.

What will the Second Internet Be Like? (2)

- Second, some pretty major systems that are independent ones today are going to "collapse" into the Second Internet the same way that mail did in the First Internet. When did you last get a physical, snail-mail first class *letter*?
  - All Telephony is going to NGN / IP Multimedia Subsystem (wired and wireless). Also called 4G. This is all going to be on IPv6. It will be one of the larger subsystems of the Second Internet (billions of nodes), but still just ONE of the subsystems. These are built with VoIP, Presence and SIP. Chatting will be integrated with it, using SIMPLE (IM extensions for SIP).
  - Broadcast Entertainment (Television and Radio) will collapse into the Second Internet, with real multicast that scales to the entire world. Imagine Karaoke sessions with participants in 10 different countries! Instead of 300 channels, there will be 500,000. Want to watch Bollywood Music Videos from Cebu, Philippines? It's on channel *2001:db8:1:2::76*, available anywhere in the entire world (there might be 752 Bollywood channels!)

What will the Second Internet Be Like? (3)

- IPv4 address distribution was just a *tad* unfair. The U.S. has about 6 real IPv4 addresses per person. The rest of the world has about one address for every 5 people. China was effectively shut out from the economic miracle of the First Internet due to lack of IPv4 addresses. They are dead set on being a *full* participant this time around. There are already more Chinese speakers on the Internet than English speakers. The Second Internet will be truly GLOBAL.
- Are there enough addresses to go around this time? ITU is worried that some poor developing country won't get their fair share. The standard allocation block is a "/48" that's 65,536 subnets, each of which has 4 billion times as many addresses as the *entire First Internet*. Are there enough "/48"s to go around? There are some 5,000 of them *per person alive today*. I think ITU can stop worrying. I personally own (control?) a "/32" of IPv6. That's 18 quadrillion times as many addresses as in the entire First Internet. OK, maybe I'm just a bit greedy. But I got them free by getting a "/22" block of IPv4 from APNIC. All 7.9×10^{28} IPv6 address starting with 2402:2e00:: are *MINE, ALL MINE*.

Will DNS Handle 100 Billion Nodes?

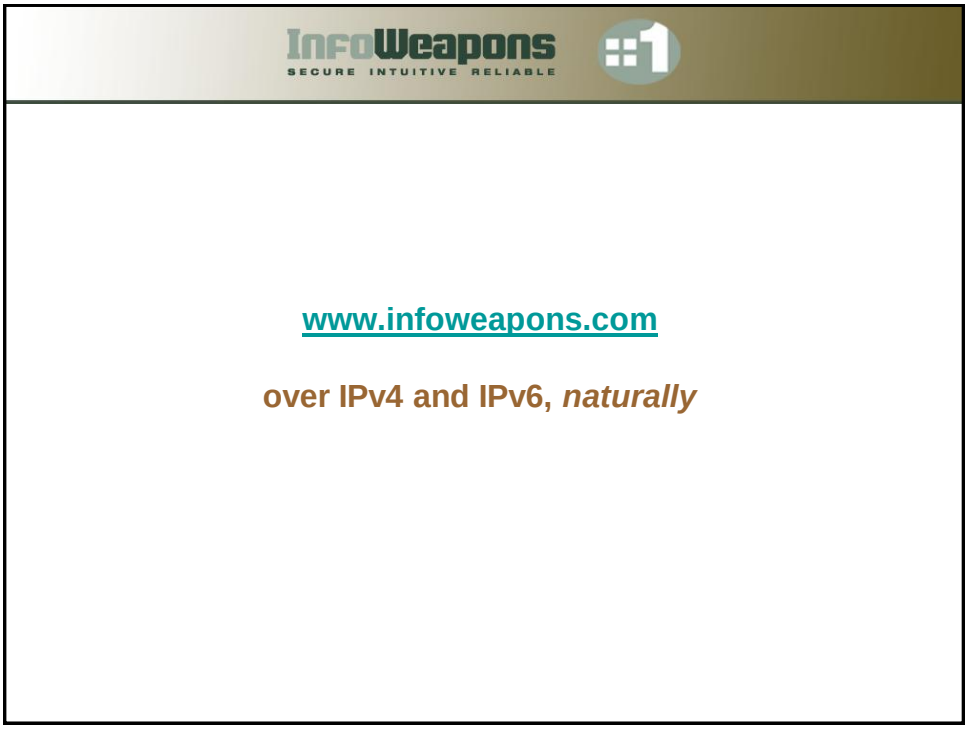
- DNS will easily handle the nodes that people want to share with the world (and that will probably be a LOT of them).
- But you won't use DNS to look up the address of the webcam in your home that you use to check on (or talk to) your new puppy from work. For things like that, there is a new scheme created by NTT called **M-2-MX** (Machine to Machine communication), based on SIP, with cryptographic authentication. Only you (and those you give permission to) will be able to resolve the nodename of your home webcam with M-2-MX.
- We're going to have to invent some interesting new things like that as the Second Internet becomes truly ubiquitous. It's going to be a brave new world.
- Many existing business models may no longer be needed (disintermediation *can* be a bitch, if you happen to be providing intermediary nodes today). Entirely *new* business models will let some bright dude (or dudette) create the next Google. It's going to be fun.

What Will to Happen to Those Who Don't Migrate?

- Not going metric along with the entire rest of the world seriously hurt U.S. competiveness and international trade. Imagine if they decided to stay with IPv4? No one would buy their network gear or software. It would be hard for them to connect to Second Internet websites. It will become difficult to even make calls to and from the U.S. Viewership of their antiquated TV networks will plummet worldwide (what? CNN is not available on my IPTV console?)
- OECD did a detailed study of the economic impact of the transition to IPv6 in 2008. You can download it today (only 44 pages) along with the 2010 update. Search for "OECD IPv6 Report". Fascinating reading. Not deploying IPv6 has *very* serious economic consequences for any country or company. Or in positive terms, those countries and companies that adopt it first, *will have an incredible economic advantage for the rest of the 21st century over the laggards*. Talk about a "digital divide"! That's a divide you *don't* want to be on the wrong side of.

So How Do We Build the Second Internet?

- Currently there is a DRASTIC shortage of expertise in IPv6. We've been working with the folks in charge of rolling it out in India. You can download their rollout plan from www.tec.gov.in. It's very well thought out. It had better be. They've got to provide IPv6 for about a billion people.
- The worldwide IPv6 Forum has helped create an infrastructure for testing IPv6 products for conformance and interoperation (see www.ipv6ready.org). They are now creating a standard curriculum, and certifying courseware and trainers to help train the army of engineers that need to understand the details to build the Second Internet. We are creating training today based on this curriculum, complete with hands-on labs. Watch our website for details.
- Today, you should download a copy of my book, "The Second Internet: Reinventing Computer Networks with IPv6". It is 300+ pages, and contains a ton of technical details, plus hands-on labs you can do with generic PCs and open source software. It's free, and you can share it (under Creative Commons license). You can find it at www.secondinternet.org.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