

The Mayan Perspective on the Business Case of IPv6

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Topics

- Context
- Technical Thoughts
- Facts – Figures – Business Case
- Notable Things



Infrastructure, Upgrades and Evolution



This upgrade solved the horse dung issue



Horse dung issues threatened society.



Why IPv6? – The big context

- IPv6 is about the continuation of the Internet.
- The Internet is a global collaborative creation.
- Each of us has to contribute his part in the evolution of the Internet, because we all benefit from it. It takes a collective effort for the best of all.
- This is the main reason to drive the integration of IPv6.



Business Case and Cost Issue

- IPv6 is an upgrade of the infrastructure („it's the plumbing“ as Jim Bound used to say).
- There is no direct business case for infrastructure upgrades.
- If you want to save cost, turn it off (yes, I mean the network).

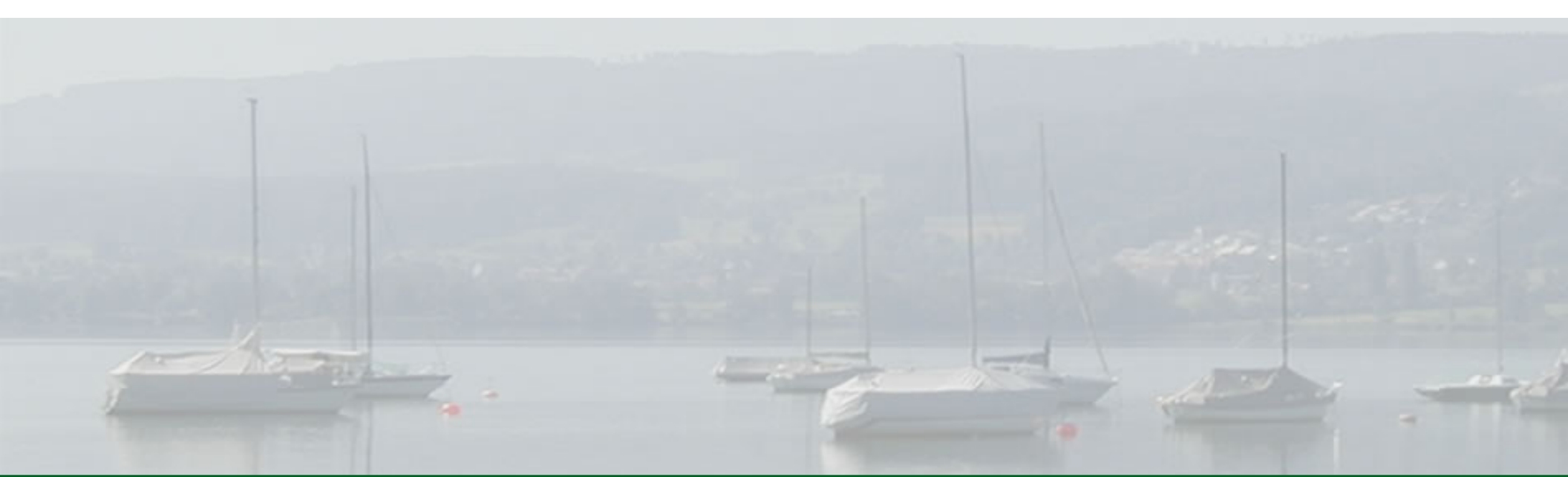
- The Business Case is in the applications and services.
To run state-of-the-art services you need a state-of-the-art infrastructure.
- Customers will never ask for IPv6. Customers ask for services.



The Mayas?

- So why the Maya's?
- The calendar of the Maya's is a calendar describing the large and smaller cycles of the evolution of human consciousness.
- They had a calendar, which starts some 15 Bio years ago and ends in 2012.
- If we look at the IPv4 addresses probably running out in 2012, we may wonder if the Mayan calendar that ends in 2012 may has been an IPv4 address calendar.....





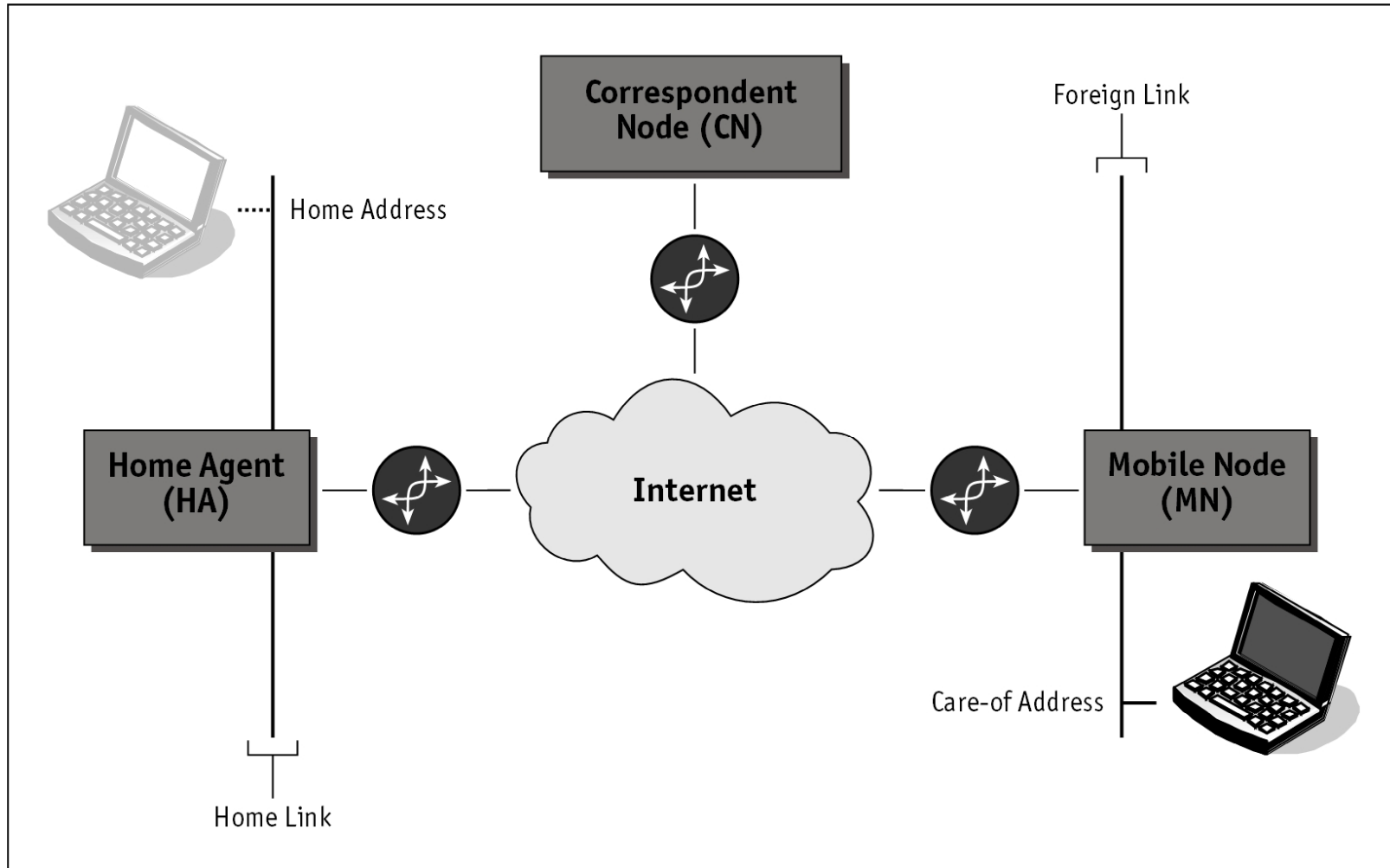
Technical Thoughts

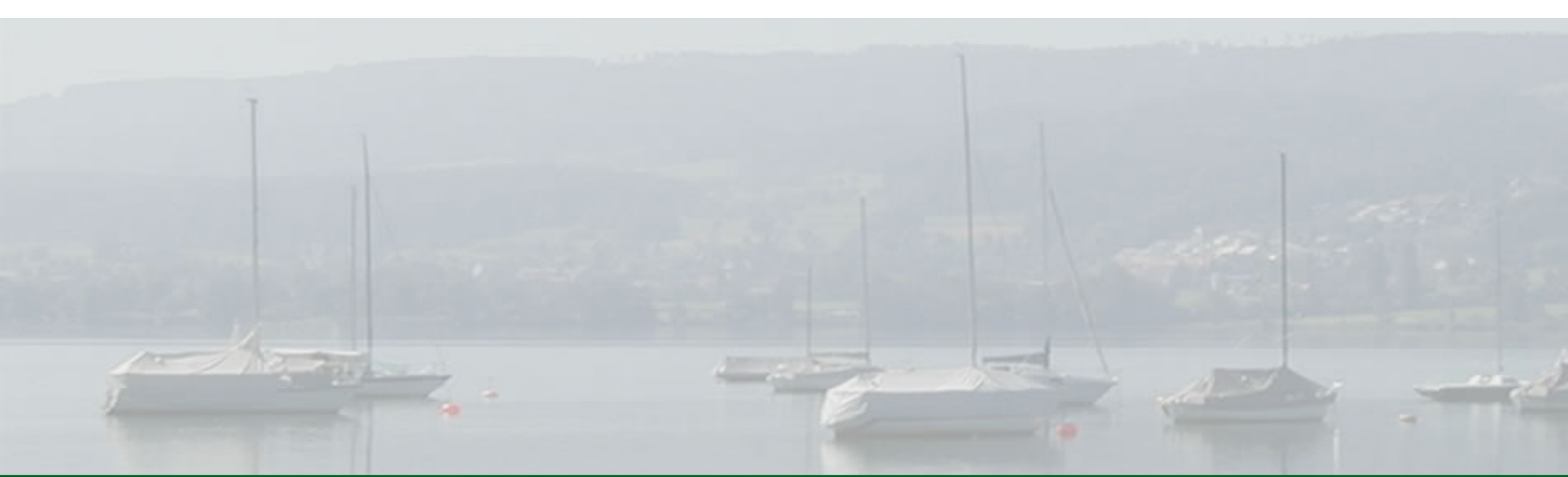
Main Changes from IPv4 to IPv6

- Expanded addressing capability (128 bits)
- Expanded autoconfiguration mechanisms
- Simplification of the header format (fixed length: 40 bytes)
- Improved support for extensions and options (Extension Headers)
- Extensions for authentication and privacy (security)
- Flow labelling capability (QOS – Quality of Service)



Mobile IPv6





Fact, Figures, Business Case

IPv4 Address Space

- Total IPv4 address space 4.3 Billion
- World population 2009 6.8 Billion
- Growth rate ~80 Mio / year

- Today approximately 28% of world population have Internet access.
- Internet growth rate since 2000: 444% average world
Highest rate in Middle East, Africa, Latin America
(over 1000%)



Population and Internet Users

Region	Online Users	Population	Online in %
World (world in 2001)	1'966 Mio. 360 Mio.)	6'845 Mio.	28.7%
USA/Canada	266 Mio.	344 Mio.	77.4%
Europe	475 Mio.	813 Mio.	58.4%
Middle East	63 Mio.	212 Mio.	29.8%
Latin America	204 Mio.	592 Mio.	34.5%
Africa	110 Mio.	1'013 Mio.	10.9%
Asia	825 Mio.	3'834 Mio.	21.5%
Oceania/Australia	21 Mio.	34 Mio.	61.3%

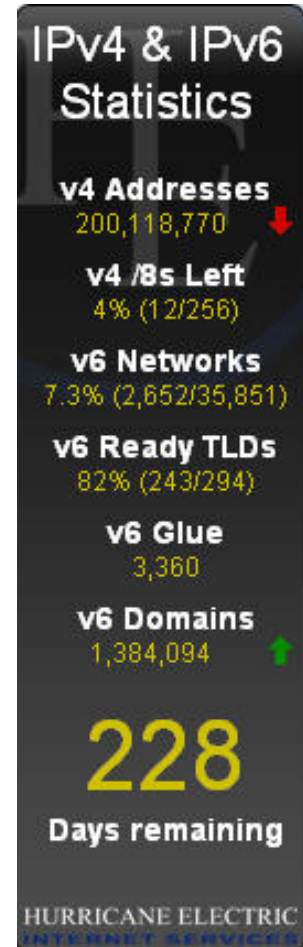
www.internetworldstats.com/stats.htm



Address Allocation IPv4 - Worldview

- IANA Pool (unallocated addresses)
 - October 2005 64 /8 (Class A)
 - May 2007 47 /8
 - January 2008 42 /8
 - January 2009 34 /8
 - January 2010 24 /8
 - June 2010 16 /8
 - October 2010 12 /8
- Projected end of IPv4 pools:
 - IANA Pool June 2011
 - RIR Pools January 2012
- Source: <http://www.potaroo.net/tools/ipv4>

<http://ipv6.he.net>



Address Allocation IPv6 - Global

		Jan 2010	
Registry		No of /32	%
AfriNic		60	0.04%
APNIC		24'494	17.6%
ARIN		15'113	10.8%
LACNIC		65'901	47.3%
RipeNCC		33'843	24.3%
Total		139'411	100%

One single /32 block has more IPv6 networks than the whole IPv4 address space contains addresses!!

- 139'411 /32 blocks represent **0.026%** of the currently available global IPv6 Unicast space (2000::/3).
- With 139'411 /32 blocks 9.1 Bio. Customers can receive a /48.

Source: <http://www.bgpexpert.com/addrspace-ipv6.php>



Internet Growth

- Online World population in
 - 2001 360 Mio
 - 2005 938 Mio 14% global penetration rate
 - 2009 1'400 Mio 21% "
 - 2010 1'966 Mio 28% ", **99.9% IPv4 users**

 - 2012 ~3.0 Bio End of IPv4 - go figure
 - **2015** **4.5 Bio or more?** **Percentage of IPv6-only users?**













Okay, I agree, there will be many travelling with NAT464646464646, but they will have limited access, bad performance and you won't get your IP statistics and analytics the way you want them.



IPv6 Allocations

DFP visibility per RIR

- * 6bone (144) (phased out 6/2006)
- * RIPE (2561)
- * APNIC (1287)
- * ARIN (1605)
- * LACNIC (381)
- * AfrinIC (115)

Pos	Flag	Country	V	A	VP
1		United States	551	1501	9.09%
2		Germany	231	393	3.81%
3		United Kingdom (Great Britain)	133	277	2.19%
4		Australia	64	228	1.06%
5		Netherlands, The	149	224	2.46%
6		Japan	115	221	1.90%
7		Brazil	52	202	0.86%
8		Russia	80	177	1.32%
9		France	76	147	1.25%
10		China	28	130	0.46%
11		Canada	48	127	0.79%
12		Switzerland	69	119	1.14%

Find a list of IPv6 allocations and visibility per country at www.sixxs.net/tools/grh/dfp



Do you still want a Business Case now?

- ❖ The cost of not doing IPv6 is great. (Jim Bound)
- ❖ If you don't integrate you will have
 - Extra cost and risk due to an overaged infrastructure.
 - Not be able to integrate new applications and services.
 - Loose markets and customers due to outdated services
 - Limited global connectivity



New applications?

IPv6 Strategy in a nutshell

All Microsoft Enterprise applications are IP agnostic

- Nearly complete
- Engineering success

Modify specific applications to leverage IPv6

- This is the Value Prop of IPv6
- DirectAccess, Home Group (will be discussed next)
- These are IPv6-only applications

Clear, consistent messaging about IPv6

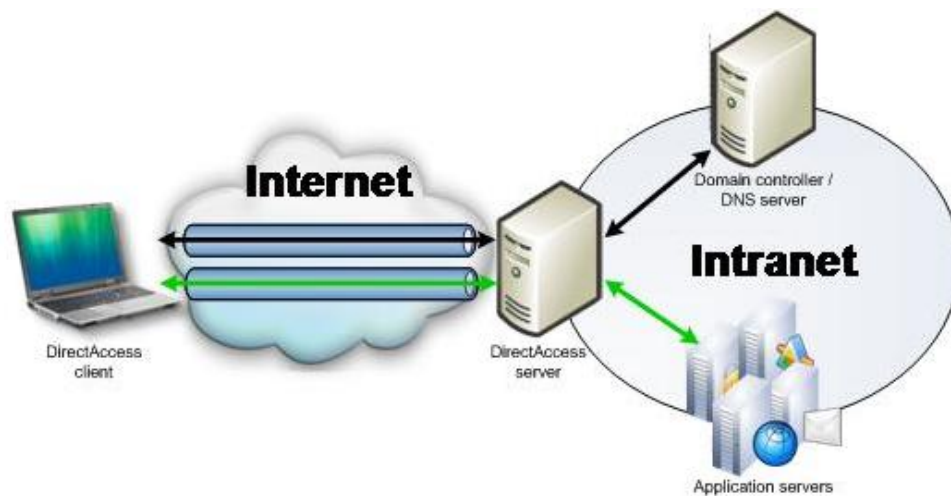
- We need to do better here
- Requires retraining everywhere

From a presentation by Sean Siler, Senior. IPv6 Product Manager at Microsoft (2009)



What is Direct Access?

- With DirectAccess, users are able to access corporate resources (such as e-mail servers, shared folders, or intranet Web sites) securely without connecting to a virtual private network (VPN).



Direct Access uses standard technologies such as IPv6 and IPsec for Tunneling, Authentication and Encryption



Ways to go....

- **Core to Edge** (preferred, only possible if enough IPv4 addresses available)
- **Edge to Core** (starts where complexity is highest)
- **IPv6 Islands** (can look attractive at first sight, heterogeneous environments can increase administrative cost substantially, evaluate carefully)

- For an IPv6 high level concept many basic decision have to be made
- **Take your time and care for these decisions, you will live with the results for many years.**



Take a deep breath



**And go ...
You will
get there –
but only if
you start
moving**



Methodology

GET EDUCATED – all teams!

1. Create a high-level implementation plan
2. Identify network elements to be effected
3. Create detailed IPv6 Requirements Specification
4. Conduct a detailed assessment of software and operating systems
 - a. Identify systems that currently comply with IPv6 requirements
 - b. Identify systems that must be upgraded to meet IPv6 requirements
 - c. Identify systems that must be replaced to meet IPv6 requirements
5. Create detailed test plans
6. Issue vendor RFIs
7. Perform compliance and interoperability testing as required
8. Perform regression testing as required
9. Make vendor or software selections
10. Create low-level implementation plan and risk analysis
11. Execute implementation
12. Acceptance testing and verification
13. Post-implementation analysis

**If you think
education is expensive,
try ignorance.**



If you integrate IPv6 ...

- You can create a new IP address concept for the coming years, building on all the experience you have with managing IPv4 networks

BUT

- Adding all the space, possibilities and flexibility the IPv6 address space offers

- It will take some time to get rid of the conservative thinking we have programmed in our cells to create address plans.

Think Big. Then Realize That's
Not Big Enough



IPv6 Address Concept

- An IPv6 address concept should take the following into consideration:
 - Prefix aggregation
 - Subnet consistency
 - Use of address types (ULA's)
 - Use of address mechanisms (DHCPv6, SLAAC, IPAM)
 - Security aspects
 - Operational aspects such as optimization of filtering rules (performance!)
 - Network growth



When you integrate IPv6

- You can create the following:
 - A new address concept
 - A new network and routing concept
 - A new security concept
 - A new service management concept
 - A new (you name it)
- And in all these concepts you can integrate your experience from running IP networks since many years **AND ADD the new possibilities IPv6 offers**



Do you want to save money?

- If you plan early, you can save a lot of money and human resources
- Use the natural lifecycles of your products and align the IPv6 integration with other projects such as:
 - Move datacenter
 - Redesign DMZ
 - Implement VoIP
 - Evaluate and replace core routers
 - Replace mainframes
 - Migrate XP to Windows7
 - Migrate Windows Server 2003 to Server 2008



This only works

- If you plan ahead while there is time
- If you educate all your teams before creating any new concepts
- If you don't try to do it the quick and dirty way



Why should you run out of time?

- **If you don't have enough IPv4 addresses**
 - To support future growth of your network (users, devices or applications)
 - To support an integration using dual-stack mechanism
- **If your CEO or your customers want a new application** which is business critical and leverages new features of IPv6 (it won't run in your IPv4 network!)
- **Because of the fast increasing number of IPv6-only devices in the Internet your IPv4-reachability becomes limited** (consider the current Internet growth rate and the day of IPv4 exhaustion)



IPv6 Myths – no time for excuses

- All devices need to be upgraded to IPv6
- The core of the network is too difficult and expensive to upgrade to IPv6
- My ISP doesn't support it, so why care?
- We have enough IPv4 addresses, so why care?
- It would be too hard to change all applications to IPv6
- We don't want to put our current infrastructure at risk.

These are all very good reasons to start rather sooner than later!



The Golden Rule Set

- Never touch a running system.
- Before investing in extending or fixing your IPv4 infrastructure, evaluate IPv6.
- **Don't wait for a flag day or killer application.**
- Go for step by step integration and learn as you go.
- Use the natural life cycles of your devices, operating systems and applications.
- Align the integration of IPv6 with other projects
- Be careful when dealing with Asia!
- Watch your public services.



The ultimate killer application

- Microsoft announces a Powerpoint Version that only runs on an IPv6 network.

This will bring IPv6 as a top priority into every board room immediately.

Anybody from Microsoft here?



Deployments in Europe

- Most ISPs in Europe support IPv6, run pilots, don't announce it yet.
 - TeliaSonera has a /20 Allocation introduces IPv6 in 2006.
 - Deutsche Telekom got a /19 in 2004 and already had 2 /35, 1 /34, 1 /33. Pilots running, first commercial offerings in 2010.
 - France Telecom, BT, NTT Communications, Global Crossing, Swisscom offer commercial IPv6 services in Europe, among others.
 - Cable & Wireless is fully dual-stack, /21 Allocation.
 - Géant - European High Speed network, dual-stack.
- 80% of all European IEX Points support IPv6
www.euro-ix.net/ixp/serviceMatrix
- 8 of the 13 DNS Root servers are dual-stack and can be reached over IPv6. www.root-servers.org



EU, Germany and Switzerland

- The EU is working on concepts to support all members in the integration of IPv6.
- The German Government has obtained an IPv6 Prefix of /26 upgradable to /23 (reserved) in December 2009
- Some Bundesländer are active, such as Sachsen.
- Sachsen started project in 2006
- Created address plan, detailed implementation scenarios, ran labs and pilots
- Integrated IPv6 support in all their contracts with suppliers including VoIP, telephony and mobile communication
- Switzerland has a /32, created an integration strategy and a national address concept.



Who else, some examples

- Heise.de, Google.com, Youtube and Facebook are reachable over IPv6. Yahoo currently runs a pilot.
- Comcast (Broadband Access Provider), Verizon, Sprint Nextel (Service Provider), Tata Communications (Tier 1 Service Provider), Bouygues Telecom (Mobile Provider), Free.fr (6rd)
- Greek educational network, Factice World Bank, Cisco Systems, Microsoft, Bechtel Corporation (Construction Company), Arch Rock (Network Sensor Technology), Command Information (Professional IT Services).



When is it time for IPv6?



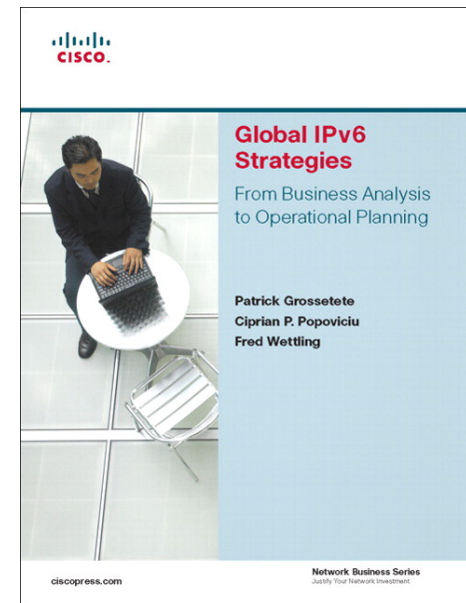
Business Strategies

"Global IPv6 Strategies – From Business Analysis to Operational Planning"

Patrick Grossetete, Fred Wettling, Ciprian Popoviciu, Cisco Press

Quote Fred Wettling:

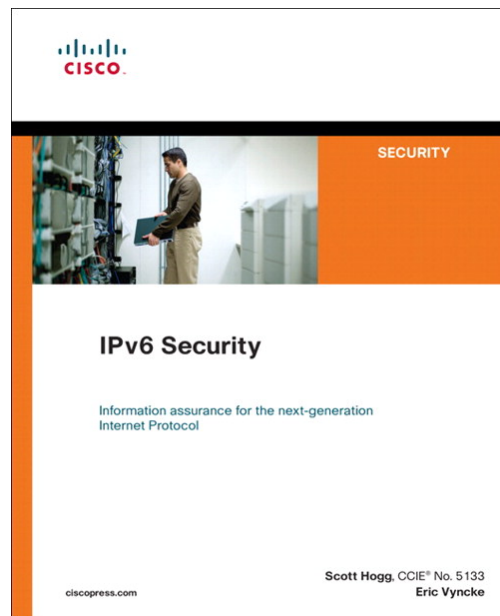
The cost for the introduction of IPv6 at Bechtel was less than 1% of our IT budget. Compared to the benefits we have, this is insignificant.



Security Concepts

"IPv6 Security"

Scott Hogg and Eric Vyncke, Cisco Press, 2009



Thank you for your attention!

IPv6 Essentials

by Silvia Hagen, English
2nd Edition, O'Reilly, May 2006
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