



IPv6 Opportunities

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Content

- Context
- Short Overview Technical Features
- Facts – Figures – Business Case
- Planning and Procedures



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Evolution has no Business Plan



This upgrade solved the horse dung issue



Horse dung issues threatened society.



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Evolution never stops

- Mankind has always embraced progress.
- And infrastructures need to be built and then continuously upgraded!

- Interplanetary Communication Protocol
 - Also called DTN (Delay Tolerant Networking)
 - RFC 4838 - Delay-Tolerant Networking Architecture
 - RFC 5050 - Bundle Protocol Specification
 - RFC 6255 to 6260 new specifications including IPsec for Bundle Protocol – published in May 2011



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Business Case

- 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, this also provides the best security protection).

- **The Business Case is in the applications and services.**
To run state-of-the-art services you need a state-of-the-art infrastructure.
- **The business case is in what you loose if you don't do it.**
- Customers will never ask for IPv6. Customers ask for services.

5

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Technical Reasons



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)

7

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Special addresses

Take enough time for that new address plan!

- All-zeros Address: 0:0:0:0:0:0:0 (short = ::)
- Loopback Address: 0:0:0:0:0:0:0:1 (short = ::1)
- Global Unicast range 2000::/3
- Unique Local Addresses (ULA): fd00::/8
- Subnet Router Anycast Address
- Solicited Node Multicast Address (ff02:0:0:0:1:ffXX:XXXX)
- CGA Addresses (cryptographically generated addresses)
- And many more for 6to4, 6rd, Isatap, Teredo
- RFC 5156 is a compilation of IPv6 address types

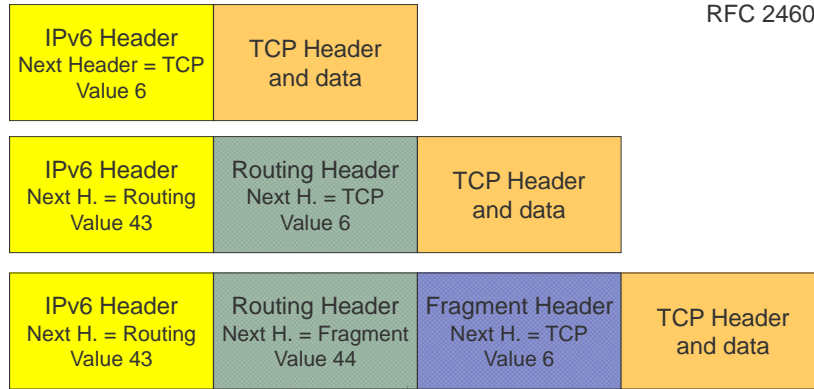
8

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Extension Headers (cont)

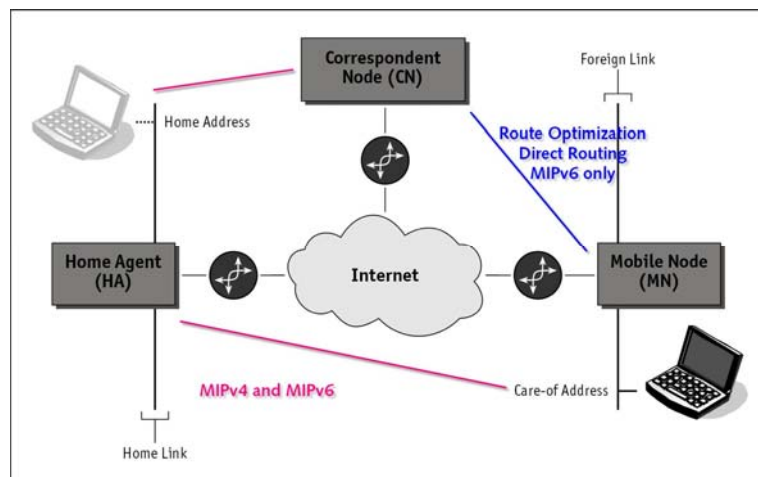
RFC 2460



9


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Mobile IPv6




10

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Fact, Figures, Business Case



IPv4 Address Space

- Total IPv4 address space 4.3 Billion
- World population 2011 6.9 Billion
- Internet Population 2011 2.1 Billion (30%)
- Internet Population 2001 360 Million

- Internet growth rate since 2000: 444% average world
- Highest rate in Middle East, Africa, Latin America (over 1000%)
- **In the future more and more devices are going to need IP addresses**



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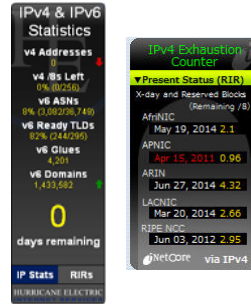
Address Allocation IPv4 - Worldview

- IANA Pool (unallocated addresses)
 - October 2005 64 /8 (Class A)
 - January 2008 42 /8
 - January 2009 34 /8
 - **January 2010 24 /8**
 - June 2010 16 /8
 - October 2010 12 /8
 - **Feb 3, 2011 zero**

- Projected end of IPv4 pools:
 - IANA Pool Feb 3, 2011
 - RIR Pools 2011/2012

- Source: <http://www.potaroo.net/tools/ipv4>

<http://ipv6.he.net>



13

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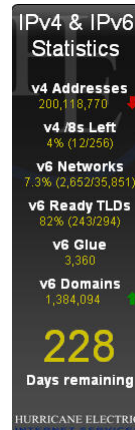
Address Allocation IPv4 - Worldview

- A year ago - Oct 2010**
- 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>



14

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Error 405 - You have reached the end of the...

http://www.blaha.at/

You have reached the end of the Internet.

You have reached the end of the Internet. Open a bottle of cold Lager and lean back.

Please try out the following options:

- Get outside in the fresh air.
- Start reading the books you never found time for.
- Gain further qualifications.
- Start living healthy.
- or, alternatively, try to [find me](#).

Or else introduce IPv6!

HTTP 405 - End of Internet reached

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Internet Growth

The IPv4 based Internet will not stop working, but it will stop growing, while the IPv6 based Internet is designed to grow for generations to come. (Tony Hain)

- Online World population in

■ 2001	360 Mio	
■ 2005	938 Mio	14% global penetration rate
■ 2009	1.4 Bio	21% "
■ 2011	2.1 Bio	30% " 99.9% IPv4 users
■ 2012	~3.0 Bio	End of IPv4 - go figure
■ 2015	5 Bio?	Percentage of IPv6-only users?

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Address Allocation IPv6 - Global

Registry	Jan 2011	
	No of /32	%
AfriNic	167	0.11%
APNIC	27'766	19.09%
ARIN	15'724	10.81%
LACNIC	65'945	45.35%
RipeNCC	35'781	24.61%
Total	145'383	100%

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

- 145'383 /32 blocks represent 0.027% of the currently available global IPv6 Unicast space (2000::/3).
- With 145'206 /32 blocks 9.5 Bio. Customers can receive a /48.

Source: <http://www.bgpexpert.com/addrspace-ipv6-2010.php>



The 2nd Generation Internet

- Will be very natural very soon:

```
C:\>ping www.ipv6.org.au
Pinging www.ipv6.org.au [2406:a000::31] with 32 bytes of data:
Reply from 2406:a000::31: time=334ms
Reply from 2406:a000::31: time=325ms
Reply from 2406:a000::31: time=324ms
Reply from 2406:a000::31: time=324ms
Ping statistics for 2406:a000::31:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 324ms, Maximum = 334ms, Average = 326ms
C:\>ping www.swissipv6council.ch
Pinging saga.interway.ch [2001:8e0:40:304::8] with 32 bytes of data:
Reply from 2001:8e0:40:304::8: time=14ms
Reply from 2001:8e0:40:304::8: time=13ms
Reply from 2001:8e0:40:304::8: time=13ms
Reply from 2001:8e0:40:304::8: time=11ms
Ping statistics for 2001:8e0:40:304::8:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 11ms, Maximum = 14ms, Average = 12ms
C:\>
```



Many New Internet Users

- Will have:
 - NAT-ed IPv4 Internet Access (possibly multiple NATs with Large Scale NAT)
 - IPv6-only Internet Access with translation for IPv4 Internet (NAT64/DNS64)
- Internet Access to IPv6 sites will soon outperform access to the IPv4 Internet
 - As a content provider you are interested in offering your content over IPv6 as soon as possible

19

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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)

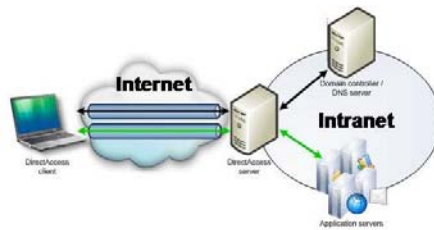
20

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What is Direct Access?

- Direct Access provides seamless access to corporate resources from anywhere without installing a third party VPN. Included in your Windows7 License.



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

Opportunities when you integrate IPv6

- You can create the following: *Think Big. Then Realize That's Not Big Enough*
 - 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



23

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The steps for an acceptable transition

If you think education is expensive, try ignorance.

- Get all teams well educated in IPv6
- Create a high level plan with a phased approach
- Align it with business strategy
- Identify the most critical areas for IPv6 in your network
- Perform assessment of these areas and determine scope
- Develop a design and a plan aligning it with other IT initiatives and product lifecycles
- Create a detailed IPv6 Requirements specification and reassess your vendor portfolio.
- Test and deploy, do it step by step
- Do all of this while there is time!

24

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Vendor and product assessment

- Use IPv6 Requirements specification
- Don't assume that a product or SP that provides high quality IPv4 services does equally well on IPv6 – evaluate and TEST
- Test features, functionality and performance
- A checkbox "supports IPv6" isn't sufficient
- Feature parity with IPv4 isn't sufficient

25

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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 and take your time for new concepts.
- 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.

26

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When is it time for IPv6?



27

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Thank You For Your Attention!

IPv6 Grundlagen, Funktionalität, Integration

von Silvia Hagen, Deutsch
2. Auflage, Sunny Edition, 2009
ISBN 978-3-9522942-2-2



IPv6 Essentials

by Silvia Hagen, English
2nd Edition, O'Reilly, May 2006
ISBN 978-0-596-10058-2



Planning for IPv6

by Silvia Hagen, English
O'Reilly, September 2011
ISBN 978-1-4493-0539-0
eBook 978-1-4493-0538-3



28

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