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

Horse dung issues threatened society.

This upgrade solved the horse dung issue

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Evolution never stops

- Mankind has always embraced progress.
- And infrastructures need to be built and then continously 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.

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Technical Reasons

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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)

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Special addresses

Take enough time for that new address plan!

- All-zeros Address: 0:0:0:0:0:0:0:0 (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 (ff02:0:0:0:0:1:ffXX:XXXX)
- CGA Addresses (cryptographically generated addresses)
- …. And many more for 6to4, 6rd, Isatap, Teredo
- RFC 5156 is a compilation of IPv6 address types
- Addresses have scopes, interfaces have multiple addresses

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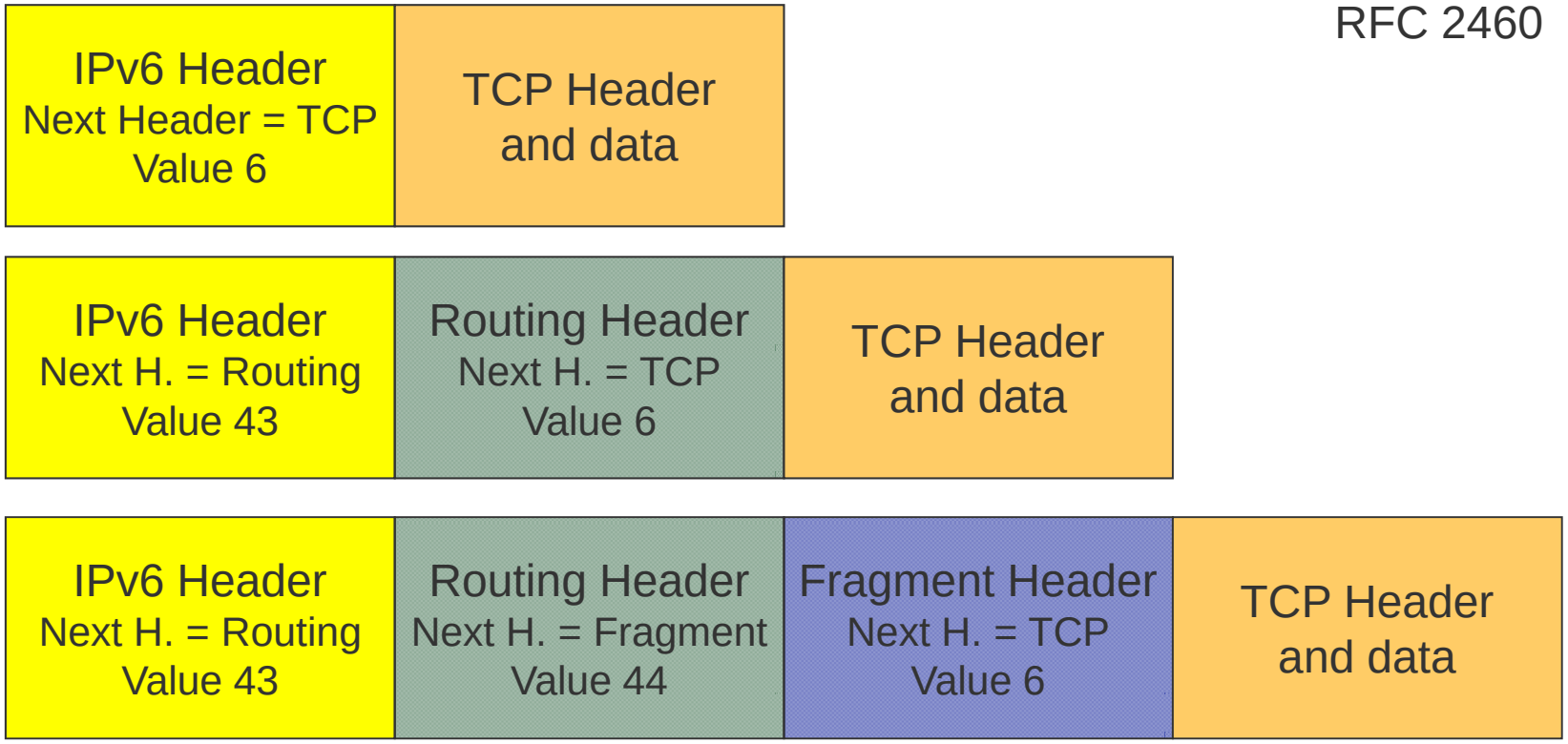
Extension Headers (cont)

RFC 2460



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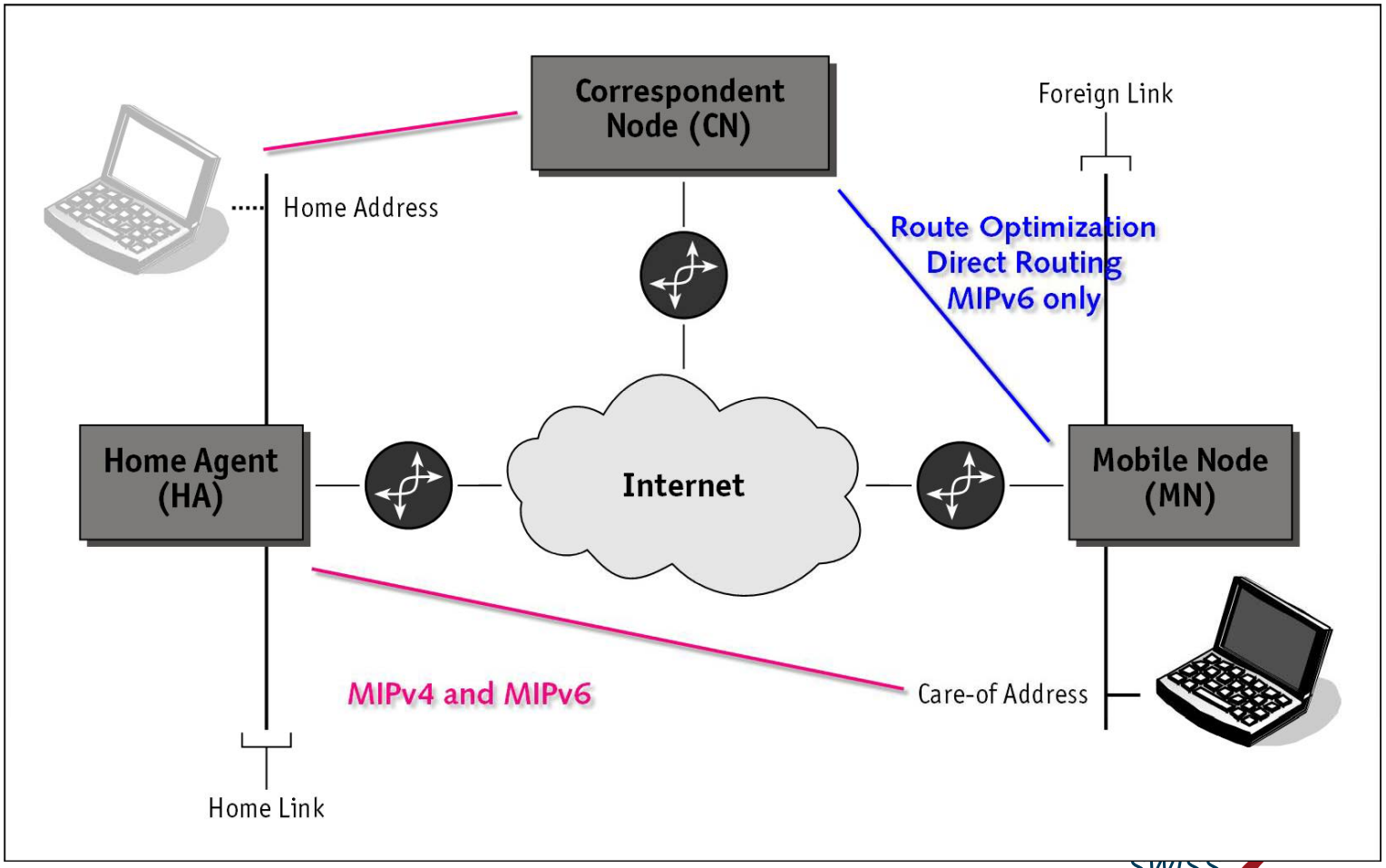
Mobile IPv6



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Fact, Figures, Business Case

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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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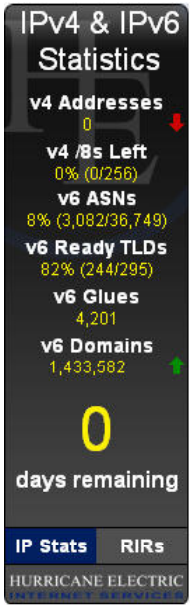
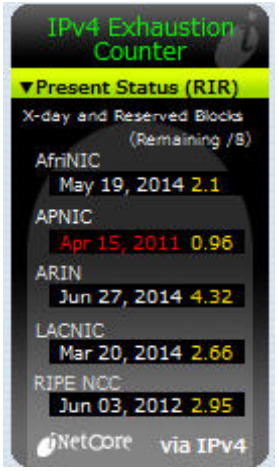
Address Allocation IPv4 - Worldview

- 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





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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.

HTTP 405 - End of Internet reached

Or else introduce IPv6!

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The Future

```
C:\Users\shagen>ping www.devoteam.com

Pinging www.devoteam.com [2001:41d0:1:1b00:213:186:33:18] with 32 bytes of data:

Reply from 2001:41d0:1:1b00:213:186:33:18: time=31ms
Reply from 2001:41d0:1:1b00:213:186:33:18: time=29ms
Reply from 2001:41d0:1:1b00:213:186:33:18: time=30ms
Reply from 2001:41d0:1:1b00:213:186:33:18: time=30ms

Ping statistics for 2001:41d0:1:1b00:213:186:33:18:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 29ms, Maximum = 31ms, Average = 30ms

C:\Users\shagen>ping www.search.ch

Pinging www.search.ch [2001:1702:3::3:90] with 32 bytes of data:
Reply from 2001:1702:3::3:90: time=20ms
Reply from 2001:1702:3::3:90: time=21ms
Reply from 2001:1702:3::3:90: time=23ms
Reply from 2001:1702:3::3:90: time=23ms

Ping statistics for 2001:1702:3::3:90:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 20ms, Maximum = 23ms, Average = 21ms

C:\Users\shagen>
```

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

			Jan 2011	
Registry			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

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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

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Dashboard

Wo bleibt Ihr denn?

Table 1: Domains of Swiss IPv6 Council Members (Companies, Commercial sites, ISP's and more):

Name	Website Test	Mail Exchange Test	Nameserver Test
Aarboard AG (aarboard.ch)	OK	OK	OK
Abacus Research AG (abacus.ch)	FAIL	FAIL	OK
Amanox Solutions AG (amanox.ch)	OK	OK	OK
Antares Kommunikation (antanet.ch)	OK	OK	OK
Beat Rubischon (0x1b.ch)	OK	OK	OK
Devoteam Genesis (devoteam.ch)	OK	FAIL	FAIL
Ecole d'Ingénieurs et d'Architectes de Fribourg (eia-fr.ch)	OK	FAIL	OK
FreeStone Systems (freestone.net)	OK	OK	OK
Hostpoint (hostpoint.ch)	OK	OK	OK
i-TEC (i-tec.ch) Innovative Technologies GmbH	OK	OK	OK
IBM Research Zurich (zurich.ibm.com)	OK	FAIL	OK
ImproWare AG (imp.ch)	FAIL	OK	OK
Init7 (init7.ch)	FAIL	OK	OK
iway AG (iway.ch)	OK	OK	OK
Leaseweb (leaseweb.com)	OK	OK	FAIL
meile.biz IT solutions (meile.biz)	OK	OK	OK
MiroNet GmbH (mironet.ch)	OK	FAIL	OK
Monzoon Networks AG (monzoon.net)	OK	FAIL	OK
Netrend Group (netrend.ch)	FAIL	FAIL	FAIL
Network Design GmbH (ndm.ch)	OK	FAIL	OK
Search.ch	OK	FAIL	OK
sunny.ch	OK	OK	OK
SwissIPv6Council (swissipv6council.ch)	OK	OK	OK
SwissIX (swissix.ch)	OK	OK	OK
Switch (switch.ch)	OK	OK	OK
Ticinocom SA (ticino.com)	FAIL	FAIL	FAIL
Ucom.ch	OK	FAIL	OK
Universität Bern (unibe.ch)	OK	FAIL	OK
Warinet Global Services SA (wari.net)	OK	OK	OK

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Alexa Top Sites CH

Table 2: Alexa Top Sites in Switzerland:

Ranking	Name	Website Test	Mail Exchange Test	Nameserver Test
1	**Google Schweiz** (google.ch)	FAIL	FAIL	FAIL
2	**Facebook** (facebook.com)	FAIL	FAIL	FAIL
3	**Google** (google.com)	FAIL	FAIL	FAIL
4	**YouTube - Broadcast yourself** (youtube.com)	FAIL	FAIL	FAIL
5	**Wikipedia** (wikipedia.org)	FAIL	OK	FAIL
6	**Yahoo!** (yahoo.com)	FAIL	FAIL	FAIL
7	**Windows Live** (live.com)	FAIL	FAIL	FAIL
8	**Blogger.com**	FAIL	FAIL	FAIL
9	**Ricardo.ch**	FAIL	FAIL	FAIL
10	**20 Minuten** (20min.ch)	FAIL	FAIL	FAIL
11	**Twitter** (twitter.com)	FAIL	FAIL	OK
12	**Blick** (blick.ch)	FAIL	FAIL	FAIL
13	**Bluewin** (bluewin.ch)	FAIL	FAIL	FAIL
14	**Google Deutschland** (google.de)	FAIL	FAIL	FAIL
15	**Tagesanzeiger** (tagesanzeiger.ch)	FAIL	FAIL	FAIL

Tests generated at 2011-11-21 08:00:23

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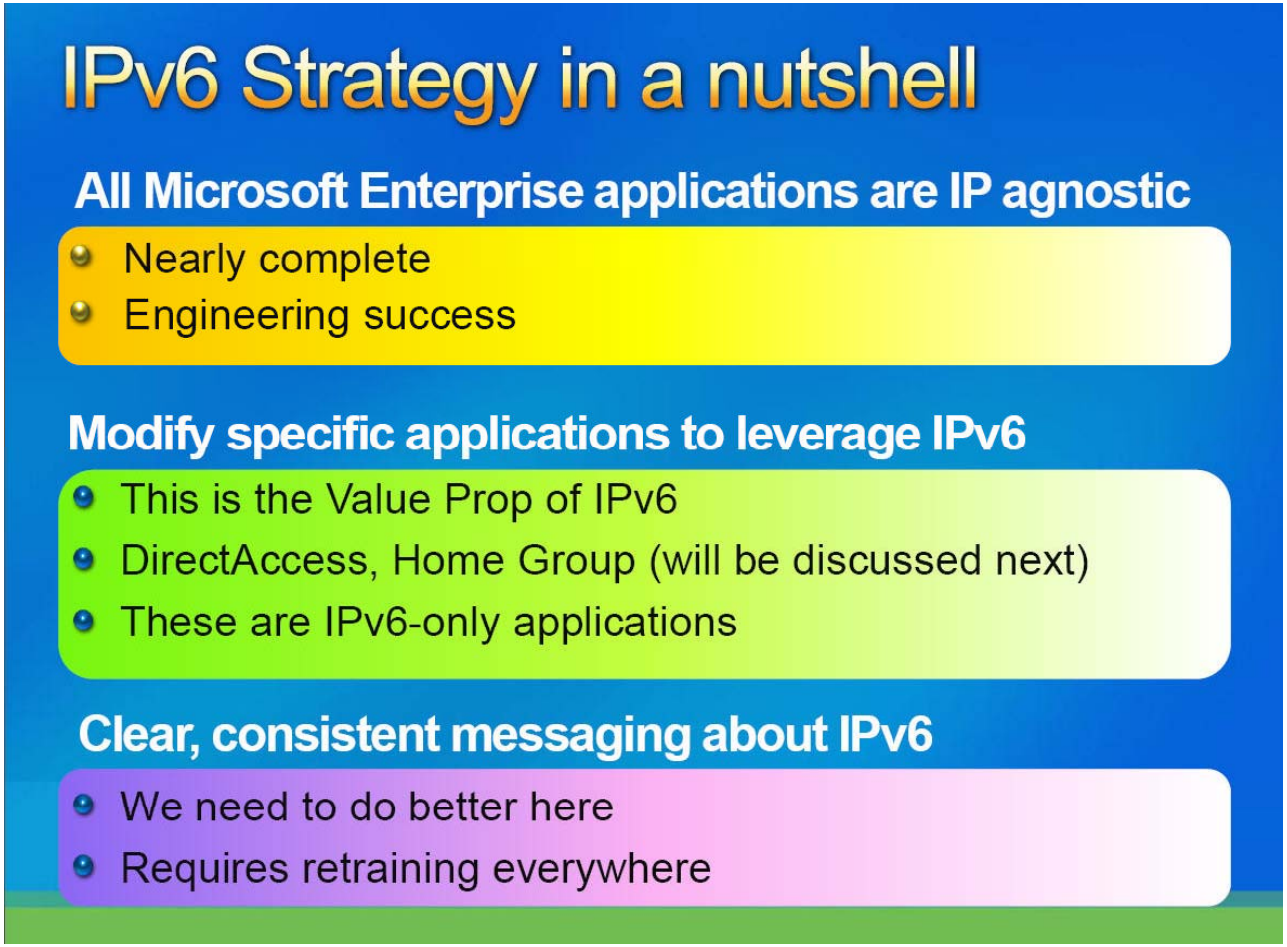
New Applications?



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

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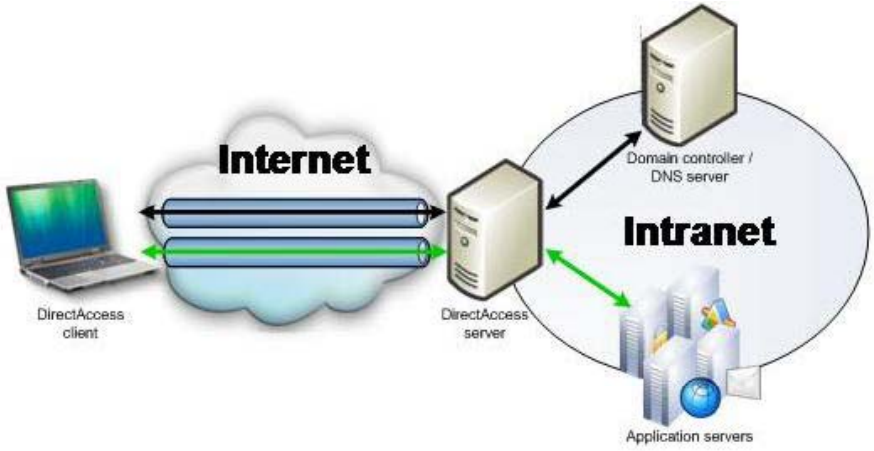
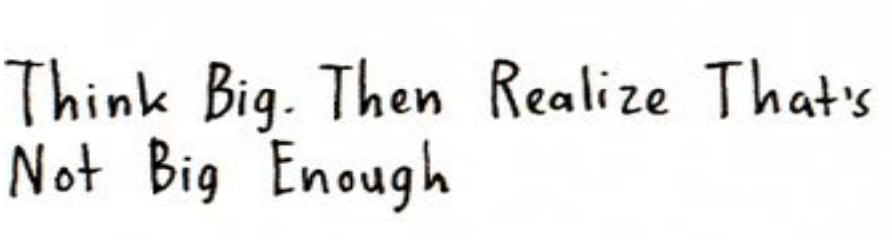
What is Direct Access?

- Direct Access provides seamless access to corporate ressources 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 und Encryption

Opportunities 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
- This takes time!

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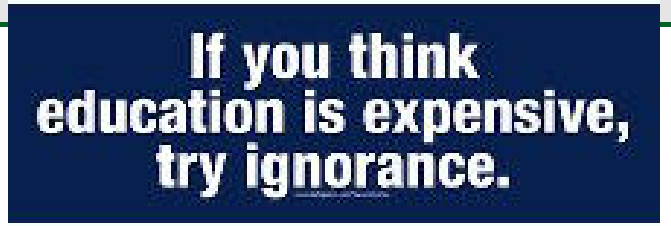
Do you want to save money?

- If you plan early, you can save a lot of money and human ressources
- 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

The steps for an acceptable transition



- 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!

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Recommendations

- Thorough education of the whole team, designers, managers and engineers is critical to the success of your project
- Get external experience or at least let your design be reviewed by people who have done it before
- Involve your internal team in the process
- Get second opinions
- Reserve enough time for reviews of concepts and strategies

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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
- Don't expect your vendor to know what you need
- Test features, functionality and performance (under load)
- A checkbox "supports IPv6" isn't sufficient
- Feature parity with IPv4 isn't sufficient

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The Golden Rule Set

- Never touch a running system.
- Before investing in extending or fixing your IPv4 infrastructure, evaluate IPv6. (IPv4 is an end-of-life technology)
- 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.

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Executive Summary

- IPv6 is on its way. It will take you 3 to 5 years to do a smooth and cost efficient migration. So you have to start today with the planning and testing.
- Every component in your network is affected. If you don't use the natural life cycles of your products, costs will be excessive.
- IPv6 is far more than just an address extension to IPv4. Rethinking concepts takes time and needs to be reviewed, otherwise you build expensive limitations into the design of your next generation network
($$$ yearly returning operational cost $$$).

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When is it time for IPv6?

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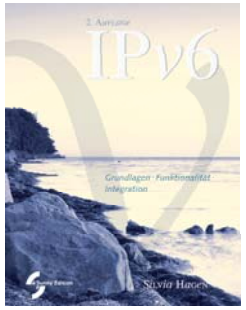
Swiss IPv6 Council

- Plattform zum Vernetzen von IPv6 Interessierten Organisationen in der Schweiz
- www.swissipv6council.ch
  werden Sie Mitglied und nehmen Sie an unseren regelmässigen Memberanlässen teil

Thank You For Your Attention!

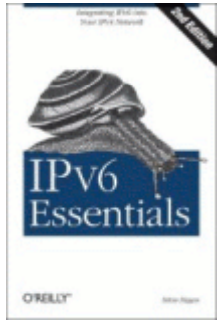
IPv6 Grundlagen, Funktionalität, Integration

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



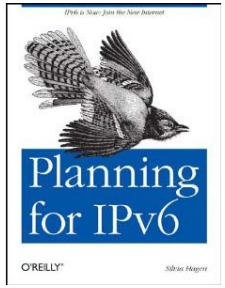
IPv6 Essentials

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



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