IPv6 Global Status
IPv6 Essentials

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Walk the Talk

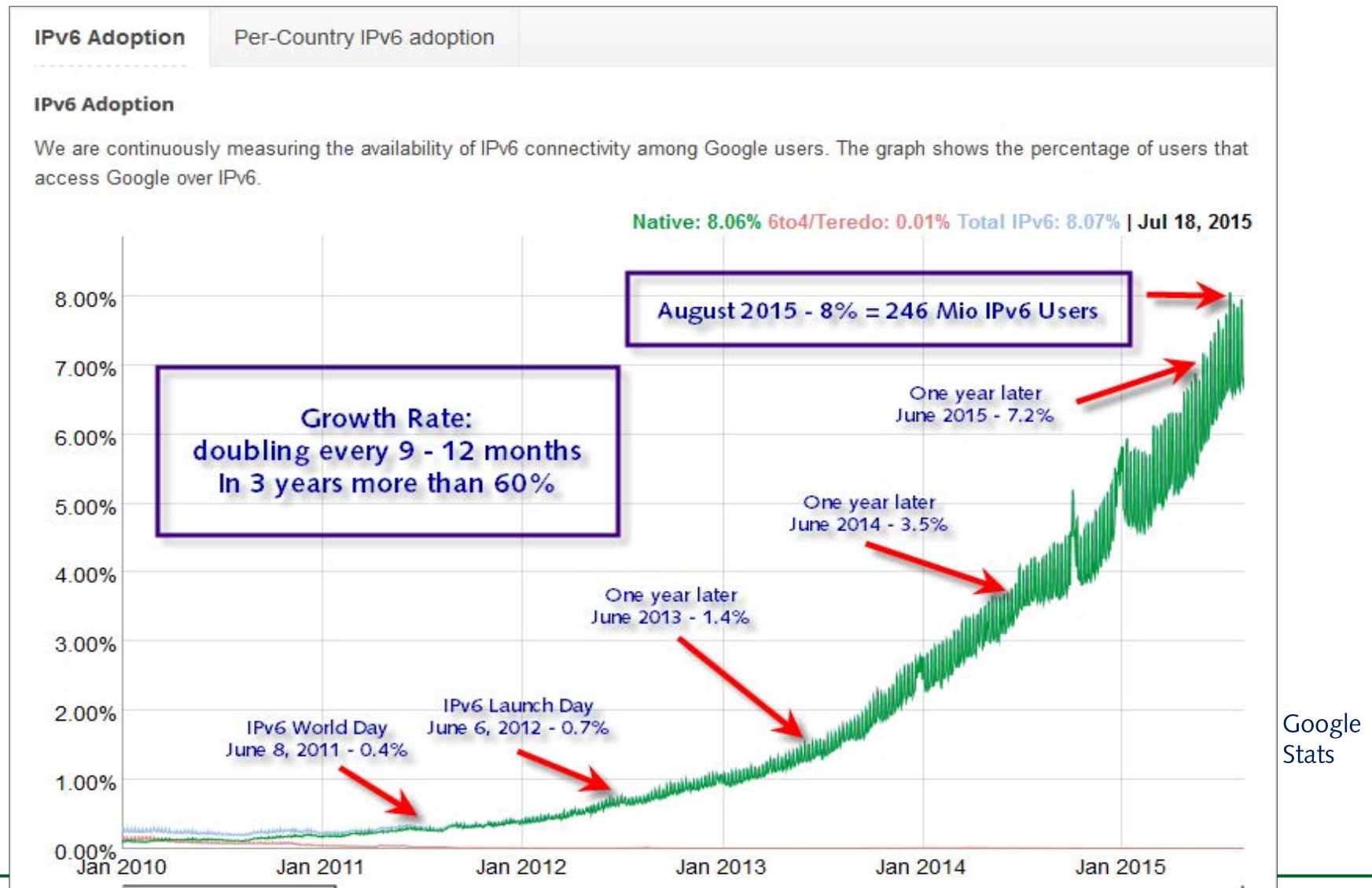You're connecting with IPv6 from [2a02:120b:c3ea:36c0:9503:5afa:52f3:7fb9]

Status: *IPv6 Enabled*
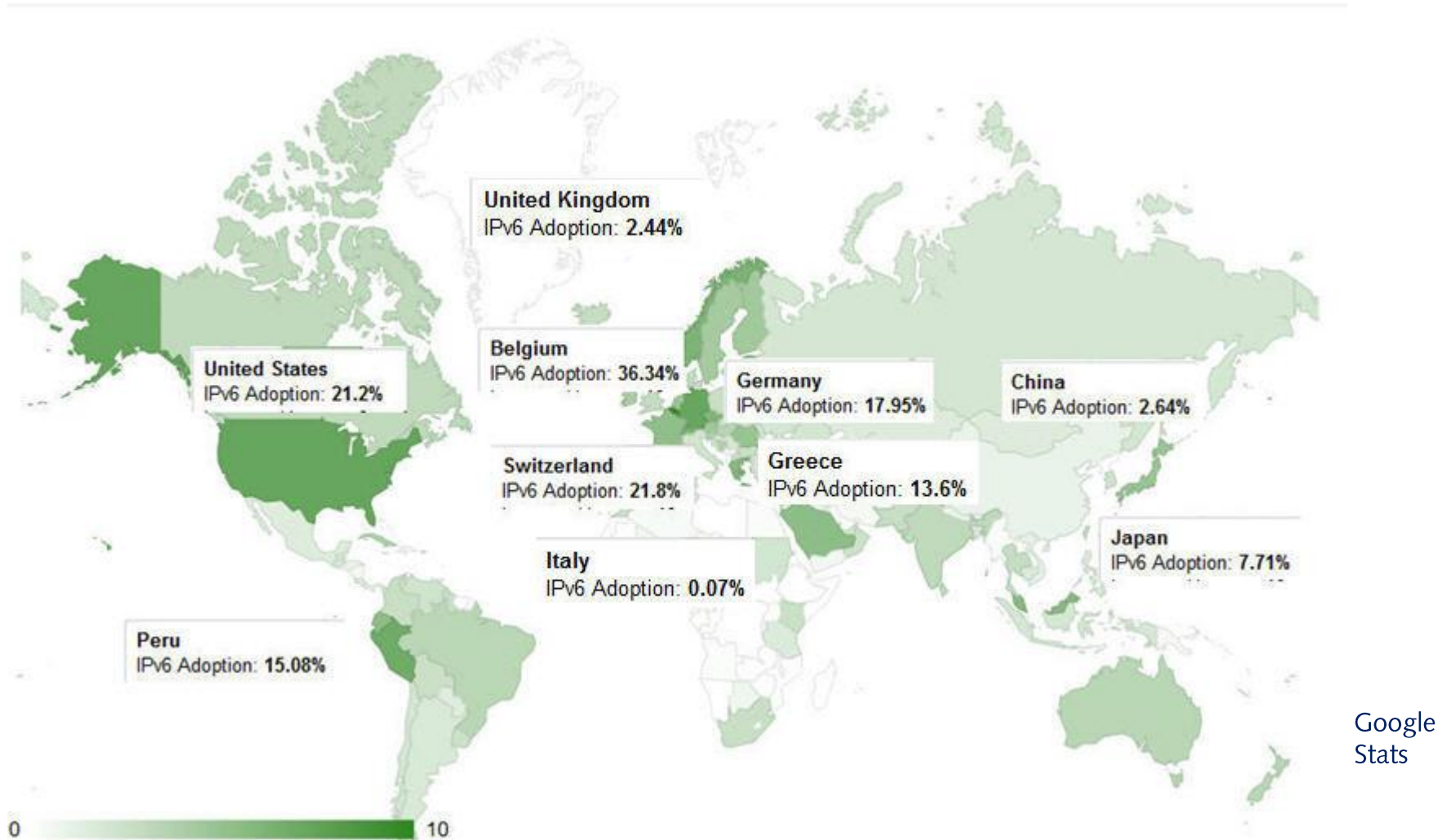Last: *2015-05-30*

Sunny Connection — Networks, Education & Consulting — info at sunny dot ch

Some stats to start with…… 8%!

IPv6 Adoption | Per-Country IPv6 adoption

IPv6 Adoption

We are continuously measuring the availability of IPv6 connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.

Native: 8.06% 6to4/Teredo: 0.01% Total IPv6: 8.07% | **Jul 18, 2015**

August 2015 - 8% = 246 Mio IPv6 Users

Growth Rate:
doubling every 9 - 12 months
In 3 years more than 60%

One year later
June 2015 - 7.2%

One year later
June 2014 - 3.5%

One year later
June 2013 - 1.4%

IPv6 Launch Day
June 6, 2012 - 0.7%

IPv6 World Day
June 8, 2011 - 0.4%

Google
Stats

World Picture with some countries

United Kingdom
IPv6 Adoption: **2.44%**

Belgium
IPv6 Adoption: **36.34%**

Germany
IPv6 Adoption: **17.95%**

China
IPv6 Adoption: **2.64%**

United States
IPv6 Adoption: **21.2%**

Switzerland
IPv6 Adoption: **21.8%**

Greece
IPv6 Adoption: **13.6%**

Italy
IPv6 Adoption: **0.07%**

Japan
IPv6 Adoption: **7.71%**

Peru
IPv6 Adoption: **15.08%**

Google
Stats
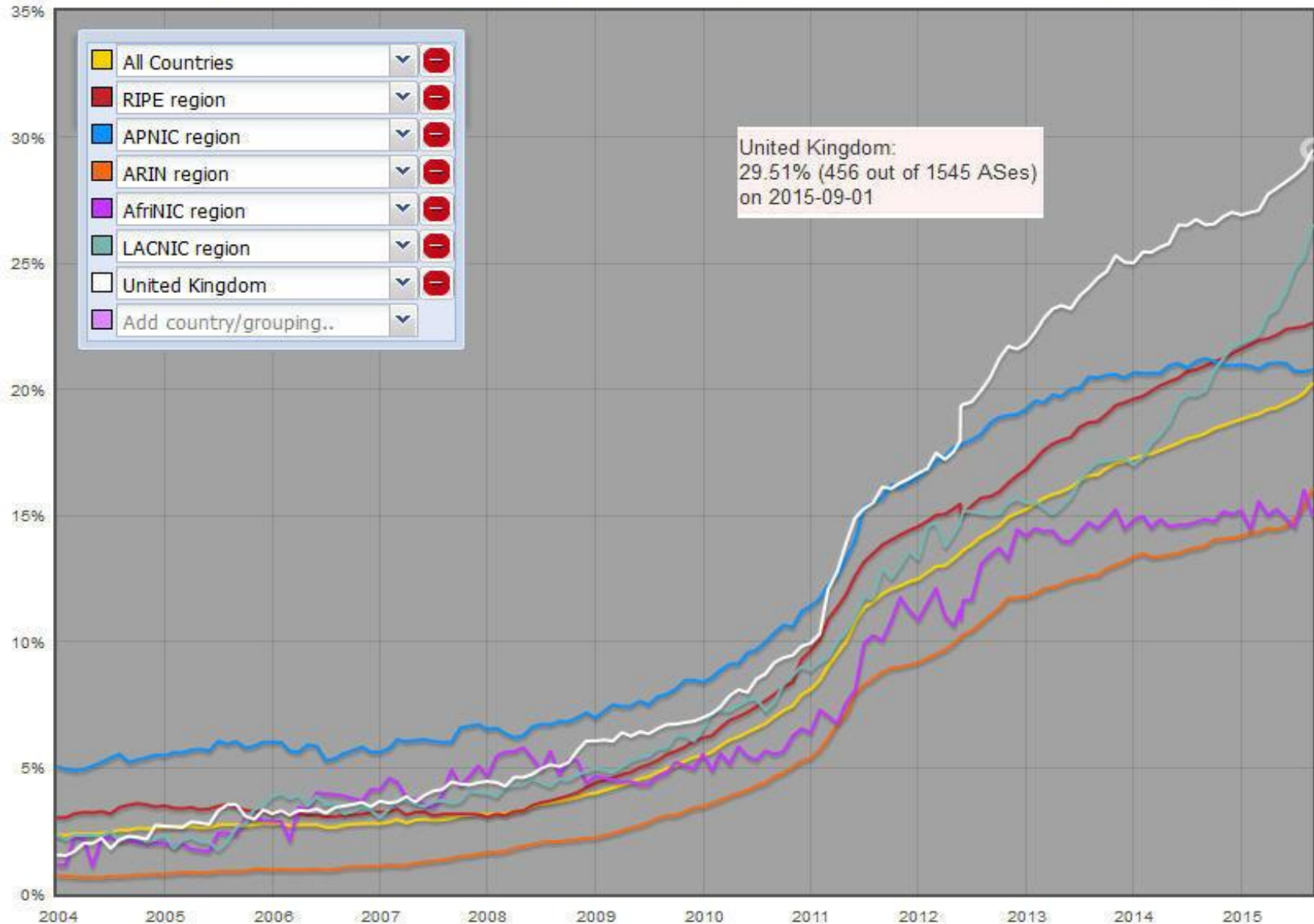
0   10

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Top Transit AS - Global
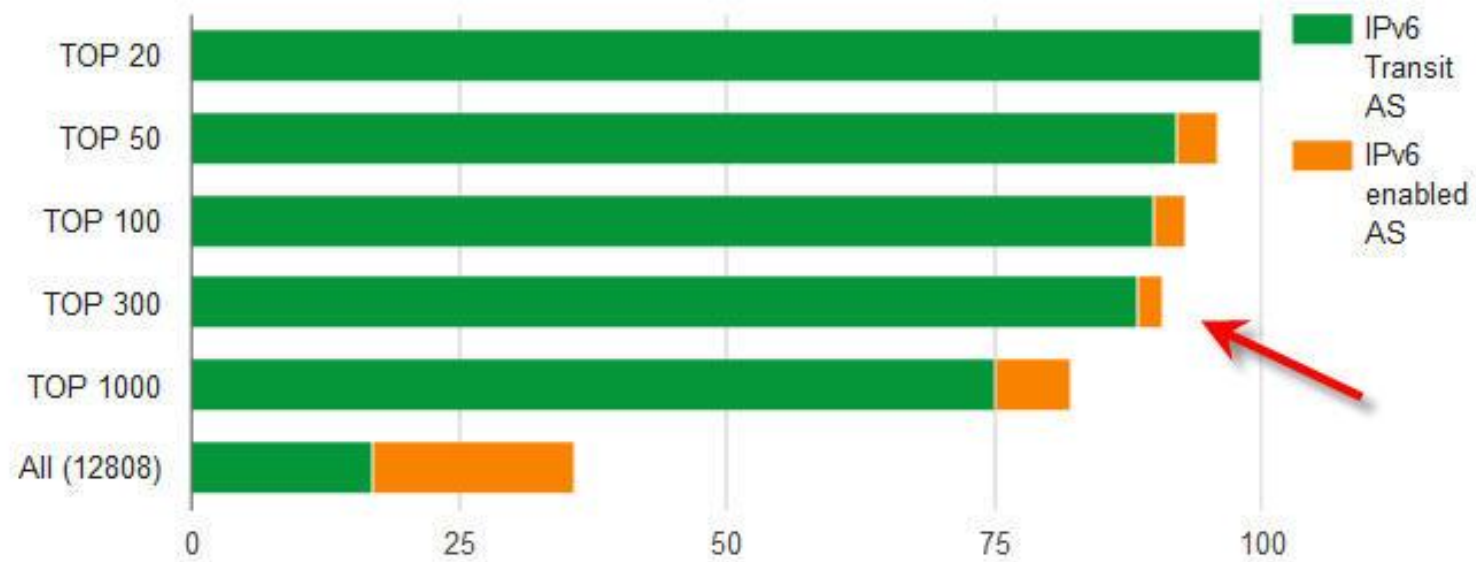
6lab.cisco.com – 09-2015

RIPE ASN Stats

This graph shows the percentage of networks (ASes) that announce an IPv6 prefix for a specified list of countries or groups of countries
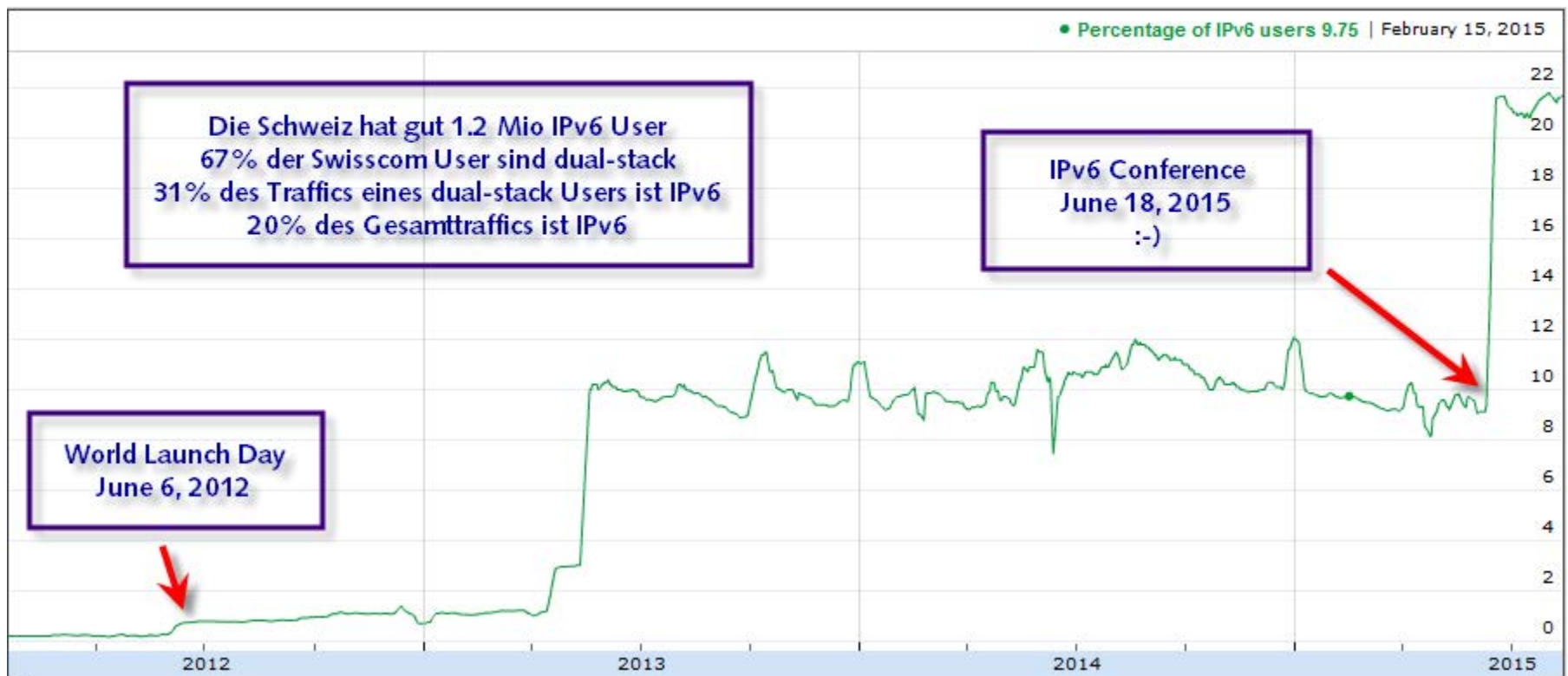
Switzerland Users

Content

Switzerland

Display Content Data ⓘ

● IPv6 websites 73 ● in construction / test 6 ● failing websites with IPv6 1 ● not IPv6 enabled 420 | June 07, 2015

These are from Swiss
Top Alexa 500
Websites

Today 73, up from 53
a year ago

Globally 16% of Top Alexa 1000 sites are v6-enabled

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Dashboard Swiss Sites

- Public –
  http://dashboard.swissipv6council.ch

- Alexa –
  http://dashboard.swissipv6council.ch/#alexa

- Government -
  http://dashboard.swissipv6council.ch/ipv6dashboard/government

- Universities –
  http://dashboard.swissipv6council.ch/ipv6dashboard/university

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This is what it looks like

Table 2: Alexa Top Sites in Switzerland:

Ranking	Name	Website Test	Mail Exchange Test	Nameserver Test
1	**Google Schweiz** (google.ch)	OK	OK	FAIL
2	**Facebook** (facebook.com)	OK	FAIL	OK
3	**Google** (google.com)	OK	OK	FAIL
4	**YouTube – Broadcast yourself** (youtube.com)	OK	OK	FAIL
5	**Wikipedia** (wikipedia.org)	OK	OK	FAIL
6	**Yahoo!** (yahoo.com)	OK	FAIL	OK
7	**Amazon.com** (www.amazon.com)	FAIL	FAIL	OK
8	**Blick** (blick.ch)	FAIL	OK	FAIL
9	**Ricardo.ch**	FAIL	FAIL	OK
10	**Windows Live** (live.com)	FAIL	FAIL	OK
11	**20 Minuten** (20min.ch)	FAIL	FAIL	FAIL
12	**Amazon DE** (www.amazon.de)	FAIL	FAIL	OK
13	**Bluewin** (bluewin.ch)	FAIL	FAIL	FAIL
14	**Linkedin** (www.linkedin.com)	OK	OK	OK
15	**Twitter** (twitter.com)	FAIL	OK	OK
16	**Search.ch**	OK	FAIL	OK
18	**Schweizer Radio und Fernsehen** (www.srf.ch)	FAIL	FAIL	OK
19	**Google Deutschland** (google.de)	OK	OK	FAIL
20	**Portal der Schweizer Regierung** (www.admin.ch)	FAIL	FAIL	FAIL
27	**Tagesanzeiger** (tagesanzeiger.ch)	FAIL	FAIL	OK
33	**Blogspot** (www.blogspot.ch)	OK	UNKNOWN	FAIL
39	**Apple** (www.apple.com)	OK	FAIL	FAIL
43	**Swisscom** (www.swisscom.ch)	OK	FAIL	OK
46	**Blogger.com**	OK	OK	FAIL
51	**Microsoft** (www.microsoft.com)	OK	FAIL	OK
61	**Post CH AG** (post.ch)	OK	OK	OK
78	**Comparis** (comparis.ch)	OK	OK	OK
115	**Swisslos** (swisslos.ch)	OK	FAIL	OK
130	**Infomaniak** (infomaniak.ch)	OK	OK	OK
139	**TIO – Portale del Ticino** (tio.ch)	OK	OK	OK

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back to top
Tests generated at 2015–09–18 12:04:13

Redefining UTC - Users – Transit - Content
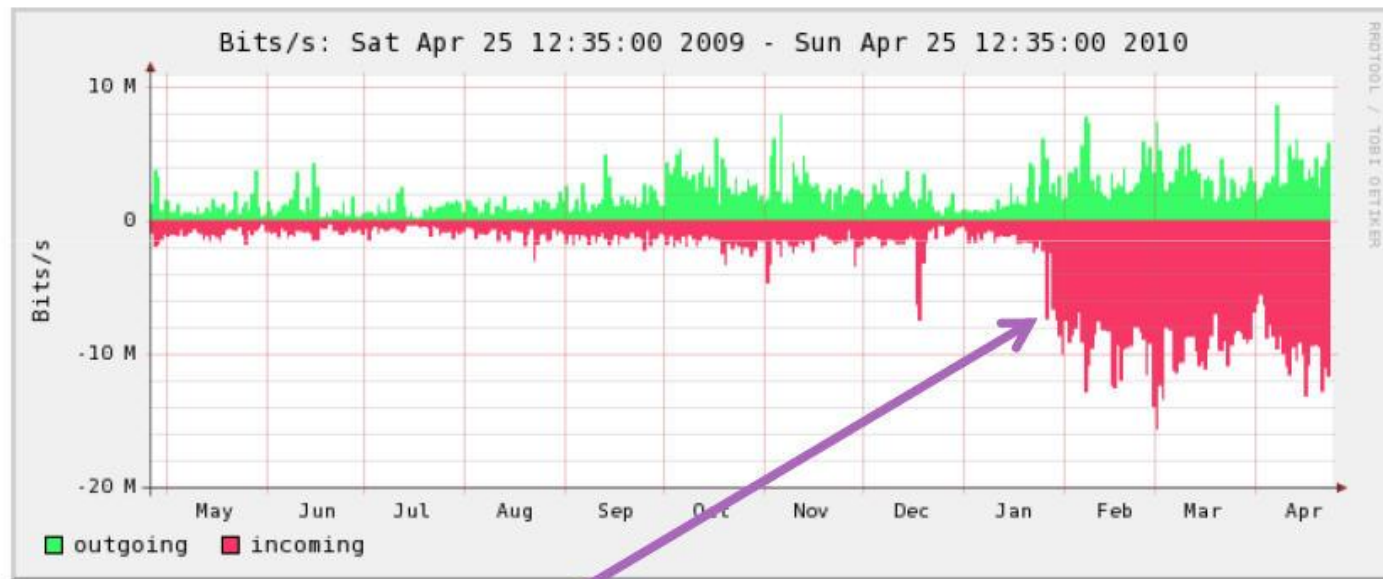
Google added AAAA records for YouTube

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New Internet Users

- Will have:
    - NATed IPv4 Internet Access (possibly multiple NATs with CGN) – to extend IPv4 address space and running native IPv6 in parallel
    - IPv6-only Internet Access with translation for IPv4 Internet (NAT64/DNS64) – to make IPv4 work over an IPv6-only network

- 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
    - Business Analytics! Geolocation don't work with NAT (why is Google interested in the deployment of IPv6? ;-)

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Why should you dual-stack your Website?

- Business Continuity (number one reason for enterprises)

- To be reachable for all Internet users with good performance

- To show you are using current standards (IPv4 is a legacy protocol from the last century)

- To support the Internet community in building an IPv6 Internet as soon as possible (ISP incentive)

- ISP incentive:
  for an ISP in the long term (5 years) the deployment of native IPv6 in parallel to supporting IPv4 can reduce the cost by as much as 40%*
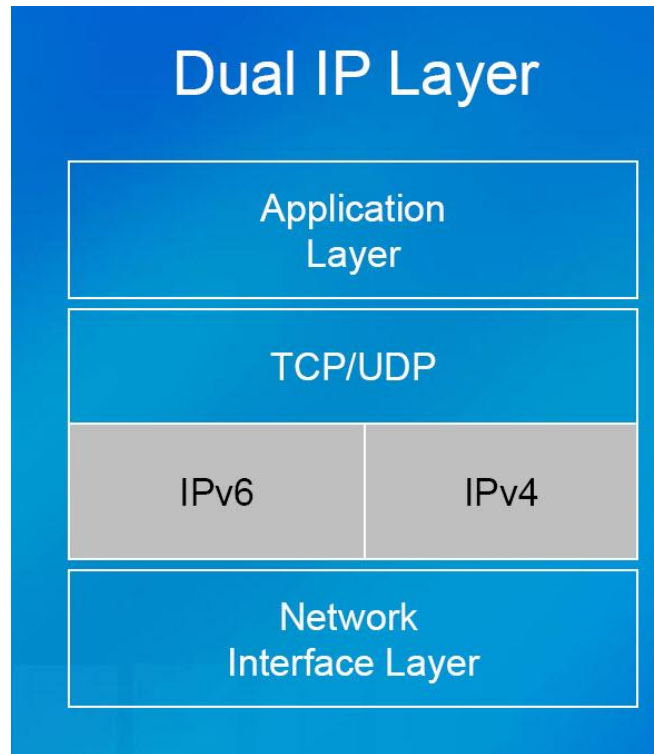
  *Cisco study,
  http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns1017/idc_ipv6_economics.pdf).

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IPv6 101

If you think education is expensive, try ignorance.

Main Changes from IPv4 to IPv6

- Expanded addressing capability (128 bits)
- Expanded address architecture
- 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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Dual IP Layer

Dual IP Layer

Application Layer	
TCP/UDP	
IPv6	IPv4
Network Interface Layer	

- Many applications that follow the OSI model have no issues in IPv6 networks.

- If you develop your own applications for yourself or for your customers, make sure your developers understand the implications.

- State of the Art applications have to perform in an IPv4-only network, in a dual-stack network and also in an IPv6-only network.

- Apple requires all iOS9 apps submitted to its App Store to support IPv6.

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Executive Summary - Enterprise

IPv6 is on its way. It will take you 3 to 5 years for 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 and align the integration with other IT initiatives, costs will be excessive

- **Why now?**
  - Business Continuity
  - Reachability
  - Life Cycle Management
  - Investment protection
  - Time for education and to build experience

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Facing the challenges

✖ **Don't think** IPv6 is almost like IPv4 and your guys can handle it without a lot of education and consulting, they have been doing IPv4 for many years after all

✖ **Don't think** IPv6 is way to complex, new and immature. it will kill your company to introduce it.

■ **Do** try to find the balance and use the opportunity to clean out and improve your network, your address, and security designs

■ **Profit:**
you will save many headaches and operational cost in the future!

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Plan early

Common Excuses

✖ We don't need IPv6, we have enough IPv4 addresses

✖ We have outsourced our network / our services, we don't care – oh really?

✖ Our applications won't support IPv6 for many years, so why care?

✖ We have many other projects on the table, no priority for IPv6.

✖ We are currently busy planning our next generation datacenter.

▪ So why should you plan early?

WHINING

THIS IS A
NO WHINING
ZONE

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Early planning

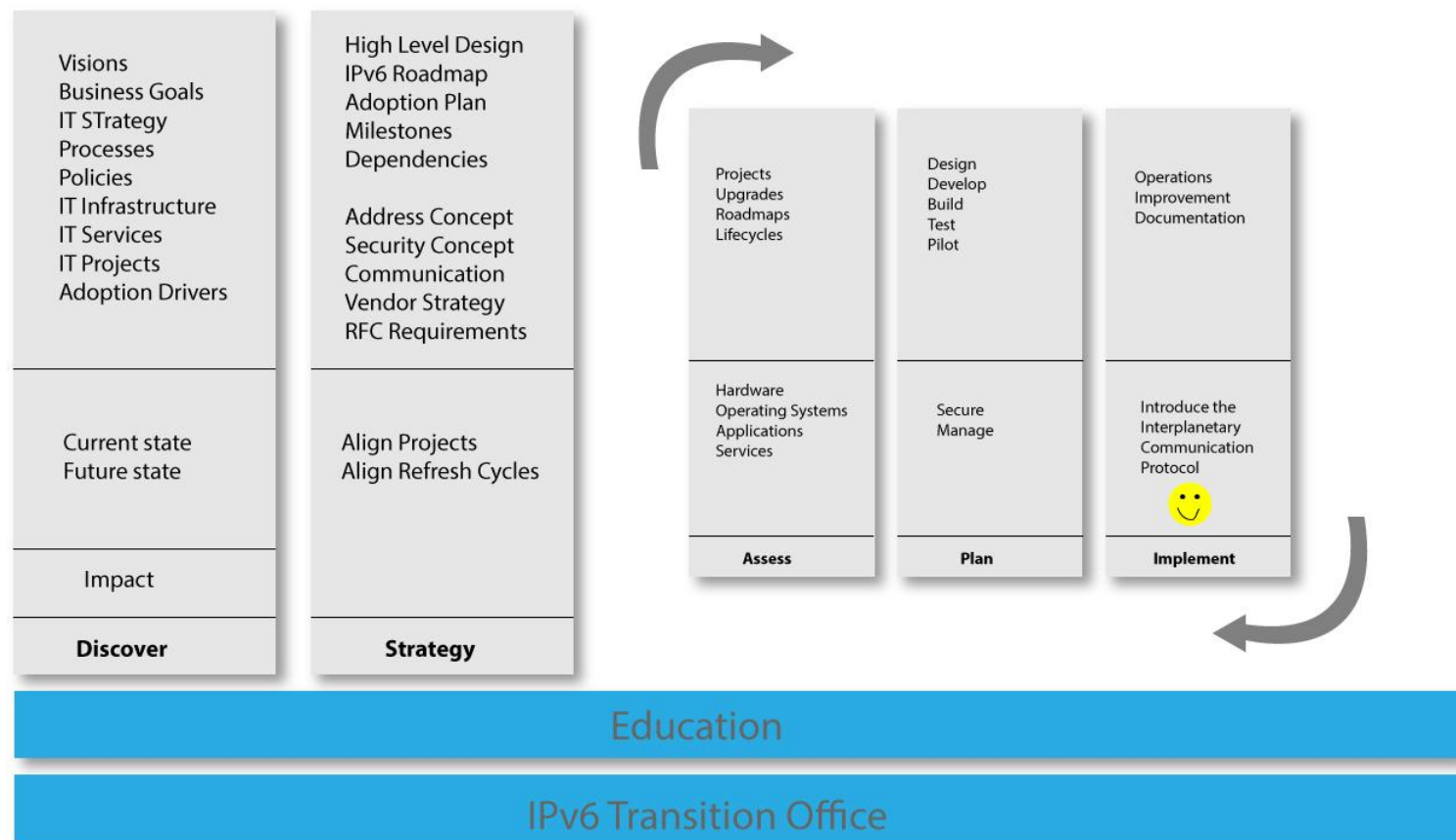- **Early planning allows for:**

  - Make use of product life cycles, refresh cycles, other IT projects
  - Investment protection by having clear IPv6 requirements for purchasing, outsourcing contracts and SLA's (!!!)
  - Integrating IPv6 will take up to 3 or even more years. If you don't plan early, you won't be ready when you need it.
  - You need time to educate all IPv6 team members and IT personel
  - You want to use all the opportunities IPv6 offers!
  - You need sufficient time for labs, testing and pilots
  - You need time for bugfixing with vendors

Is a unique opportunity to clean out and redesign your IT and to implement standardization

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Methodology

If you think education is expensive, try ignorance.

Discover
- Visions
- Business Goals
- IT STrategy
- Processes
- Policies
- IT Infrastructure
- IT Services
- IT Projects
- Adoption Drivers

- Current state
- Future state

- Impact

Strategy
- High Level Design
- IPv6 Roadmap
- Adoption Plan
- Milestones
- Dependencies

- Address Concept
- Security Concept
- Communication
- Vendor Strategy
- RFC Requirements

- Align Projects
- Align Refresh Cycles

Assess
- Projects
- Upgrades
- Roadmaps
- Lifecycles

- Hardware
- Operating Systems
- Applications
- Services

Plan
- Design
- Develop
- Build
- Test
- Pilot

- Secure
- Manage

Implement
- Operations
- Improvement
- Documentation

- Introduce the Interplanetary Communication Protocol ☺

Education

IPv6 Transition Office

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General Design Rules

- Native IPv6 where ever possible, dual-stack as long as necessary
- New services IPv6-only whenever possible (internally!)
- Tunneling only if necessary and only as a temporary solution
- No NAT, no translation (only with a gun to your head)
- Future networks are end-to-end
- The expanded address architecture allows for new security concepts
(embed service information in address, adapt security concept)
- Consider new services (monitoring, sensors, health care, Car2Car … depending on industry) – many new services have a much higher demand for addresses and mobility requirements

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Manage your vendors

- Assess your vendor strategy

- Your vendors face the same challenges you do, only they should be ahead of the game. But don't assume they are. Check!

- If they had the greatest services or products for IPv4, don't assume they also have the best for IPv6.

- Don't expect your vendors know what you need!

- In the early stage write letters of intent

- Don't forget SLA's, Outsourcing contracts, ISPs….

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Do they walk the talk?

Example: June 2014, Ron Broersma, DoD:
"US DoD's DREN Will Only Buy Products With An IPv6 Website"

Quoted: Our #1 rule:

If we can't get to the company or product website via IPv6, we won't consider such products.

- we learned the hard way that without strong corporate commitment to IPv6 support, it will take forever to get IPv6 bugs fixed or features added.

- we learned that the corporate website being IPv6Y-enabled was a good indicator of corporate commitment to IPv6.

- this has been tested many times, and it works.

- in the process, we encourage industry to IPv6-enable their public facing services

Read full article: http://www.internetsociety.org/deploy360/blog/2014/09/us-dods-dren-will-only-buy-products-with-an-ipv6-website/

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Allocating time

- Education across all teams
- Building experience in labs

You don't know what you don't know

- Strategy – Addressplan – Security Concept
Plan for multiple iterations, take time for thorough reviews and discussions, get 2nd and even 3rd opinions from people with an external view (challenge your plan)

- This is going to be the foundation for your network for the next 20 years

- Don't do it quick and dirty!

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Addressplan

- Take the learnings from operating an IPv4 network into designing an IPv6 address plan

- Use all the rules you know:
    - Aggregation
    - Subnet Consistency
    - …..

Think Big. Then Realize That's Not Big Enough

- Get rid of all conservation rules (host counts)

- Value ease of administration over conserving address space. This results in saving operational cost!

- Align it with security concept

- Reserve enough space for Growth-Growth-Growth and new technologies

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General recommendations

- Minimize the number of prefix lengths categories (/48, /56)
- Reserve space for infrastructure (separate prefix range)
- Structure at nibble boundaries if possible
- Make ease of operation a main criteria
- Aggregate as much as possible
- Don't use easy to discover and sequential IIDs
- Define addressing rules for all scopes
- Evaluate address management tools based on the demands of the addressing schema developed (make your vendors become creative with clear requirements!)

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The 7 most important steps (+1)

1. Get management on board, appoint an IPv6 program manager
2. Education for all team members (focused and specific to groups)
3. Define Strategy, High Level Plan and Roadmap
4. Perform assessments (everything, HW, SW, OS, Services, Apps)
5. Refine strategy and roadmap, define detail projects, create budget for investments and work
6. Define addressplan and network design
7. Define security- and management concept

8. Test, test, test and deploy – (cycles)

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The most common stumbling blocks

- Lack of management support
- Heads in the sand politics
- Processes (get in your own way)
- Shortterm thinking
- Lack of authority (across departments)
- Too many projects, not enough people, no time for carefulness
- Too much pressure, doing it quick and dirty
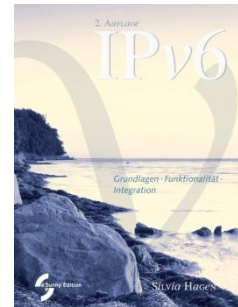- Treat IPv6 as a network and infrastructure project (mind the apps)

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Thank You For Your Attention!

IPv6 Grundlagen, Funktionalität,

Integration

von Silvia Hagen, Deutsch

2. Auflage, Sunny Edition, 2009
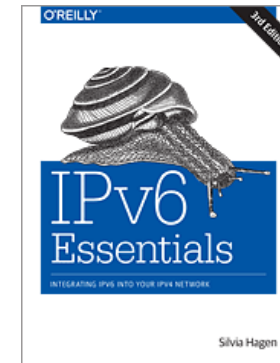
ISBN 978-3-9522942-2-2

IPv6 Essentials

by Silvia Hagen, English

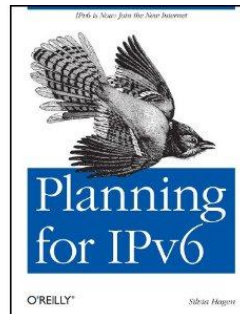3rd Edition, O'Reilly, June 2014

ISBN 978-1-4493-1921-2

Planning for IPv6

by Silvia Hagen, English

O'Reilly, July 2011

ISBN 978-1-4493-0539-0

eBook 978-1-4493-0538-3

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Appendix Summary of all recommendations

- Aligning with other IT initiatives saves a lot of money
- No identifyers and decimal identifications in addresses
- We lost a lot of time waiting for different upgrades, patches and fixes
- Make design and fallback scenario for downgrade
- Mind the apps and create application development guidelines and requirements
- The biggest challenge is to get enough internal ressources
- Take your time to rethink current concepts
- Test if hardware can cope with extra load in dual-stack mode
- Invest enough time for concept and deployment plan (address, routing, security, DNS....)
- test test test test test test test test test
- One thing at a time, make isolated steps
- Expect the unexpected
- Don't think you can dual-stack in two weeks
- Don't overdefine your concepts, it will restrict you later
- Don't believe manufacturers are IPv6 ready. They will write anything on the box, just to sell it. Most products have limitations.

- Don't buy new hardware just because of IPv6. Use regular product life cycles
- Don't forget monitoring, logging, security: one for IPv4, one for IPv6
- It's no rocket science
- DHCPv6 is definitely not DHCPv4Invest in education and labs early (first)
- It takes time. Plan and think ahead of time.
- Take time for software planning and integration
- The network is the easy part
- Don't rush, make staged deployment, start with early adopters.
- Go IPv6-only whereever you can
- Problems may not show up at 1%, 5% or 10%, but theydo at 100%
- Iterate Iterate Iterate
- Don't make IPv6 an all or nothing proposition. You will fail
- Java developers write code that disables IPv6
- We are removing IPv4 from the datacenter
- We deploy an IPv6-only backbone and will remove IPv4 from our network around 2024

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