

Title:

Removing the IPv6 deployment speed-bumps

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RIPE-554/501 or “how to talk to your vendor”

- and –

**IPv6 Troubleshooting for Helpdesks using
isp.test-ipv6.com document**

About Me – A Quick History

- Name: Jan Žorž <zorz@isoc.org>
- Founder of Slovenian Go6 Institute
- Worked in Internet operations for 20+ years
- 16 years of IPv6 experience
- Active and contributing member of RIPE and IETF communities
- Primary co-author of RIPE-501/RIPE-554 IPv6 procurement BCP document
- Co-author of RFC 6346 (A+P approach to IPv4 depletion)
- Joined Internet Society DO team in December 2012

Walls-of-text warning

Despite long contemplations on how to make this slide-pack without walls-of-text – we could not find any better way how to tell our story.

We apologize for any inconvenience. 😊

Please, bear with us anyway...

RIPE554/501- what is it

A document that you can use during equipment evaluation and in the RFP creation process to request IPv6 support in equipment and software

It's a list of IPv6 requirements that vendors must meet in order to sell you equipment.

Let me first tell you what it is and later on how it was made and adopted

RIPE-501

- Predecessor of RIPE-554
- Included 4 groups of hardware
 - Host
 - Switch
 - Router
 - Firewall
- Each section divided in Mandatory and Optional sections
- Software IPv6 support specification
- Requirements for system integrators

RIPE-554 Table of content

- Introduction
 - General information on how to use this document
 - How to specify requirements
- Proposed generic text for the tender initiator
- Lists of mandatory and optional RFC/3GPP standards support for various hardware and software
 - IPsec: mandatory or optional
 - Definitions and descriptions of different types of devices
- Lists of required RFC/3GPP standards for different types of hardware
 - Requirements for "host" equipment
 - Requirements for consumer grade "Layer 2 switch" equipment
 - Requirements for enterprise/ISP grade "Layer 2 switch" equipment
 - Requirements for "router or Layer 3 switch" equipment
 - Requirements for "network security equipment"
 - Requirements for CPE equipment
 - Requirements for mobile devices
 - Requirements for load balancers:
- Requirements for IPv6 support in software
- Skill requirements of the systems integrator
 - Declaration of IPv6 competence
- Acknowledgments

Requirements for "host" equipment

Mandatory support:

- IPv6 Basic specification [RFC2460] *
- IPv6 Addressing Architecture [RFC4291] *
- Default Address Selection [RFC3484]
- Unique Local IPv6 Unicast Addresses (ULA) [RFC4193]
- ICMPv6 [RFC4443] *
- DHCPv6 client [RFC3315] *
- SLAAC [RFC4862] *
- Path MTU Discovery [RFC1981] *
- Neighbor Discovery [RFC4861] *
- If support for tunneling and dual stack is required, the device must support Basic Transition Mechanisms for IPv6 Hosts and Routers [RFC4213]
- If support for mobile IPv6 is required, the device must support “MIPv6” [RFC6275, RFC5555] and “Mobile IPv6 Operation With IKEv2 and the Revised IPsec Architecture” [RFC4877]
- DNS protocol extensions for incorporating IPv6 DNS resource records [RFC3596]
- DNS message extension mechanism [RFC2671]
- DNS message size requirements [RFC3226]
- Deprecation of Type 0 Routing Headers in IPv6 [RFC5095] *

RIPE-554 – example of “Optional” section

Optional support:

- IPv6 Router Advertisement Options for DNS Configuration [RFC6106]
- Extended ICMP for multi-part messages [RFC4884]
- SeND [RFC3971]
- SLAAC Privacy Extensions [RFC4941]
- Stateless DHCPv6 [RFC3736] *
- DS (Traffic class) [RFC2474, RFC3140]
- Cryptographically Generated Addresses [RFC3972]
- IPsec/IKEv2 [RFC4301, RFC4303, RFC4302, RFC5996] *
- SNMP protocol [RFC3411]
- SNMP capabilities [RFC3412, RFC3413, RFC3414]
- SNMP MIBs for IP [RFC4293] Forwarding [RFC4292] and DiffServ [RFC3289]
- Multicast Listener Discovery version 2 [RFC3810] *
- Packetisation Layer Path MTU Discovery [RFC4821]
- IPv6 Host-to-Router Load Sharing [RFC4311]
- Default Router Preferences and More-Specific Routes [RFC4191]

RIPE-554 – What to include every time

Proposed generic text for the tender initiator

In every tender, following text shall be included:

All ICT hardware as subject of this tender must support both the IPv4 and IPv6 protocols. Similar performance must be provided for both protocols in input, output and/or throughput data-flow performance, transmission and processing of packets.

IPv6 support can be verified and certified by the IPv6 Ready Logo certificate.

Any software that communicates via the IP protocol must support both protocol versions (IPv4 and IPv6). The difference must not be noticeable to users.

Equipment that has not been put through the IPv6 Ready testing procedures must comply with the RFCs listed below:

[appropriate list of selected mandatory and optional RFCs from below lists]

RIPE-501/554 – how it all started

- Go6 Institute asked Slovenian government why they didn't require IPv6 when buying equipment
- Slovenian government asked what exactly they should require...
- The result was a great document about buying IPv6 capable equipment
 - Usable for more than just the Slovenian government
 - But who can read Slovenian?!?
- The Slovenian document was translated to English and adopted as a work item by the RIPE IPv6 WG on 1st of October 2010

RIPE-501/554 – how it all started

- And on the 24th of November 2010 RIPE-501 was published
- There were immediately some questions and comments
- On the 3rd of January 2011 discussion on RIPE-501bis started
 - Now that improvements and changes were being made everybody started sending in suggestions and contributions
 - This took a while...
- **And finally in June 2012 the result was published as RIPE-554**

RIPE-554 – “Acknowledgements”

Sterle, Urban Kunc, Matjaz Straus, Simeon Lisec, Davor Sostaric and Matjaz Lenassi from Go6 Expert Council for their enthusiastic governance of this document. We recognise the work done in the Slovenian IPv6 working group for their review and useful input. Special recognition goes to Ivan Pepelnjak, Andrej Kobal and Ragnar Us for their efforts and work done on the document. Thanks also to the co-Chairs of RIPE IPv6 Working Group, David Kessens, Shane Kerr and Marco Hogewoning for their support and encouragement. We would also like to thank Patrik Fältström, Torbjörn Eklöv, Randy Bush, Matsuzaki Yoshinobu, Ides Vanneuville, Olaf Maennel, Ole Trøan, Teemu Savolainen and people from RIPE IPv6 Working Group (Joao Damas, S.P. Zeidler, Gert Doering among others) for their input, comments and review of the document. Last but not least, we would like to thank Chris Buckridge and the Communications Team from the RIPE NCC for correcting our grammar and wording in this document. And everyone else who contributed to this work.

The authors of this document would like to thank the RIPE IPv6 Working Group and its chairs for all of the support and encouragement to develop a follow-up version of the document. Special thanks goes to Ole Trøan, editor of RFC6204 for his help in the CPE section and for suggesting other changes across the document. Thanks to Marco Hogewoning, Ivan Pepelnjak and S.P. Zeidler for great input in ideas how to make the document structure and content better, Timothy Winters and Erica Johnson (both IPv6 Ready Logo committee, UNH) for help in marking RFCs they test and constructive suggestions. Thanks also to Yannis Nikolopoulos and Frits Nolet. Special thanks goes to Jouni Korhonen, Jari Arkko, Eric Vyncke, David Freedman, Tero Kivinen and Michael Richardson for

RIPE-554 – example of “discussion” - IPsec

- RFC 6434 changes IPsec MUST to SHOULD
 - This was a much-debated topic in the RIPE IPv6 WG
 - In the end IPsec was moved to the “optional” sections
 - So, IPsec is not mandatory and not optional ☹
 - ...with the added advice in the document:

Organisations that use IPsec or expect to use it in the future should include the following in the mandatory section when initiating the tender:

- IPsec/IKEv2 [RFC4301, RFC4303, RFC4302, RFC5996] *

RIPE-554 – Adoption

After careful analysis of RIPE-501, C** is expressing its support for the following reasons:**

- **The set of features listed is deployment oriented and takes into account architectures that have been validated by experience.**
- **The profile does not restrict itself to a small set of core IPv6 features.**
- **The document lists a coherent set of IPv6 features that are likely to help the industry deploy IPv6 at a faster pace.**

http://www.cisco.com/en/US/prod/collateral/iosswrel/ps6537/ps6553/brief_c80-674464.html

RIPE-554 – Adoption

- Intended to use as an initial template for the European Commission to develop a “Generic EU IPv6 profile”
- And RIPE-554 is in high demand all over the world!
 - Translated in many many languages
 - Influencing the vendors IPv6 roadmaps
- Important: It's very neutral, as it was agreed by wide technical community and consensus driven.
- Use it – it's free, it's yours

<http://www.ripe.net/ripe/docs/ripe-554>

RIPE-554 – Next steps

- We are in the process of updating RIPE-554
- We already got some suggestions and comments from the community
- Why ***you*** don't read it and suggest the improvements?

[mailto:<554-bis@go6.si>](mailto:554-bis@go6.si)

Removing next IPv6 speed-bumps

IPv6 Troubleshooting for Residential ISP
Helpdesks

(Using test-ipv6.com)

Misconceptions and reality ;)

- **Disclaimer: This document is *not* an ISOC document. This is a product of a group of a brilliant experts from the community (list with names comes later in the slide pack).**
- **I just happen to be the initiator and one of the editors of the document**
- **I would like to thanks ISOC for dedicating some of my working time to run this effort.**



Removing one of the next IPv6 speedbumps

- One of the first speed-bumps was addressed by RIPE-554
- Next speed-bump is lack of IPv6 knowledge at ISP helpdesks

IT helpdesk staff can be... difficult sometimes ☺



HELPDESK

HAVE U TRIED TURNING IT OFF
AND ON AGAIN?

Removing one of the next IPv6 speedbumps

Title: ***“IPv6 Troubleshooting for Residential ISP Helpdesks (Using test-ipv6.com)”***

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Chris Grundemann (ISOC),
Jen Linkova (Google),
Chris Tuska (Comcast),
Daniel Breuer (Comcast),
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Tools used?

- **Fact 1.: We need to build a short and simple set of detect/explain/action scenarios that would help people at help desks identify and fix the issue**
- **Fact 2.: We need a simple online tool to detect the state of connectivity on the users computer**
- **Fact 3.: Test-ipv6.com is a very useful tool that detects the state of connectivity on the users computer**
- **So the idea emerged to bring Jason Fesler in the group and talk him into creating a special version of the tool meant specially for ISP helpdesks 😊**

Tools used?

[Test IPv6](#)[FAQ](#)[Mirrors](#)[stats](#)

Test your IPv6 connectivity.

[For the Help Desk](#)[Summary](#)[Tests Run](#)[Share Results / Contact](#)[Other IPv6 Sites](#)

Your Internet help desk may ask you for the information below.

Help desk code: 46t

Dual Stack, Possible Tunnel

IPv4: Good, AS198644 - GO6 Zavod za IPv6 - go6,SI

IPv6: Good, AS2121 - RIPE-MEETING-AS Reseaux IP Europeens Network Coordination Centr

OtherSites: 50/50 good

IPv4 address: 91.239.97.101

IPv6 address: 2001:67c:64:42:fc13:17c1:7f76:7788

More information about this page, including how to bookmark it: [faq_helpdesk.html](#).

If your Internet help desk asks you to mail the 'results url', copy and paste the following URL. Note that this will share your current numeric Internet Protocol address(es). We do not recommend posting this link on public web sites such as forums.

<http://isp.testipv6.com?ip4=91.239.97.101&ip6=2001:67c:64:42:fc13:17c1:7f76:7788&a=ok,577&aaaa=ok,228&ds=ok,544&ipv4=ok,465&ipv6=ok,367&v6mtu=ok,237&v6ns=ok,1548&dsmtu=ok,386>

On most computers, you can right-click the above URL, and select 'Copy'.

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- 1. What is a BCOP?**
- 2. Summary**
- 3. Background / History**
- 4. Using This Document - Note for Helpdesk Managers**
- 5. IPv6 Troubleshooting**
 - 5.1 Basic IPv6 Test**
 - 5.2 Test Connectivity**
 - 5.3 Test DNS**
 - 5.4 Check Home Router**
 - 5.5 Escalate**
- 6. Explanation of Help Desk Codes on <http://isp.test-ipv6.com>**
 - 112 - IPv4, plus Broken IPv6**
 - 4 - IPv4 only**
 - 4t - IPv4 plus Teredo**
 - 46 - IPv4 + IPv6**
 - 46t - Dual Stack, Possible Tunnel**
 - 624 - 6to4**
 - 64 - NAT64**

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64t - NAT64, possible tunnel

“slow”

“mtu” - “Possible MTU issues” Warning

“Site(s) with failed connectivity” Warning

7. IPv6 training for helpdesk

8. Conclusion

9. Operator’s specifics

Appendix A: Acknowledgements

Appendix B. Basic troubleshooting flowchart

Appendix C. Collecting Data for Escalation

Example: one of the possible generic situations

Help desk code: 624

6to4

IPv4: Good, AS65536, CableCo

IPv6: Good, 6to4, Preferred

IPv4 address: 192.0.2.1

IPv6 address: 2001:db8::1

Example (continued):

Interpretation: “6to4” was used to provide an IPv6 address; and the host was configured to actively take advantage of this service. Any web site that has an IPv6 presence, will be reached using 6to4 instead of native IPv4. Modern operating systems do not prefer these kinds of tunnels by default. Be aware that the user might have a very old operating system or a non-default configuration.

Action: 1. Have the user disable any automatic tunneling mechanisms that are active. 6to4 is a protocol that tries to get IPv6 traffic through a public relay, using IPv4 to reach the public relay. Public 6to4 relays offer no SLA; and published studies show approximately 15% failure rates. Windows: Disable tunnel interfaces using <http://support.microsoft.com/kb/929852> (for example, Microsoft Fix it 50412).

Example (Action continued):

2. If IPv6 is desired, configure IPv6 (verify the user has an IPv6 address, and a default route). and test again. If user is still experiencing access issues, follow the troubleshooting steps for the corresponding code returned by <http://isp.test-ipv6.com/>

Example (hardest and longest one):

112 - IPv4, plus Broken IPv6

Help desk code: 112

IPv4: Good, AS65536, CableCo

IPv6: broken

IPv4 address: 192.0.2.1

Example (hardest and longest one):

Interpretation: IPv6 network connectivity somewhere between the user and the website is broken. IPv6 connections are timing out instead of succeeding (or failing fast to IPv4). The user experience visiting major web sites may be suffering, and some applications completely failing.

Assumption: User has already power cycled home router, modem, and device, as part of your standard troubleshooting procedure.

Action: 1. Determine whether IPv6 is offered to this customer, based on company documentation. If yes, continue to the next step.

2. ...

Status and future work?

Document is in second final pre-draft stage and is currently submitted to

- RIPE BCOP TF and subsequently to RIPE IPv6 WG

Join the mailing lists and contribute to discussion:

RIPE BCOP TF: <https://www.ripe.net/mailman/listinfo/bcop>

RIPE IPv6 WG ML: <http://www.ripe.net/mailman/listinfo/ipv6-wg/>

Issues/comments/ideas tracker URL:

<https://git.steffann.nl/go6/ipv6-troubleshooting-for-helpdesks/issues>

After we go through first few community consensus building cycles and document edits we MAY choose to submit it for comments also to other BCOP efforts in other continents depending on interest from other regions.

Very quick reminder: What's a BCOP?

Best Current Operational Practice

- A living document describing the best operational practices currently agreed on by subject matter experts
- Vetted and periodically reviewed by the global network engineering community (GNEC)

Quick facts in case you are interested: BCOP activity around the world

<http://www.internetsociety.org/deploy360/about/bcop/>

- Africa region: A BCOP group was started under AfNOG, lead by Douglas Onyango
- Asia: BCOP Task Force started at JANOG, co-chaired by Seiichi Kawamura and Yoshinobu Matsuzaki, NZNOG BCOP starting up, lead by Dean Pemberton
 - No whole-region effort started yet
- Europe: RIPE BCOP Task Force created, co-chaired by Benno Overeider and Jan Zorž
- Latin America: A BCOP Task Force was started under LACNOG, lead by Luis Balbinot and Pedro R Torres Jr.
- North America: NANOG BCOP Committee established, lead by Aaron Hughes and Chris Grundemann

Where the document lives and resides?

<http://go6.si/v6helpdesks>

New versions of the document will be added
as they emerge, ;)

Please read the draft and comment! All ideas
for improvements are very welcome.

Thank you! Comments/Questions?

mailto:<v6troubleshooting@go6.si>