

Deployment of 32 bit AS Numbers at the RIPE NCC

Henk Uijterwaal
RIPE NCC

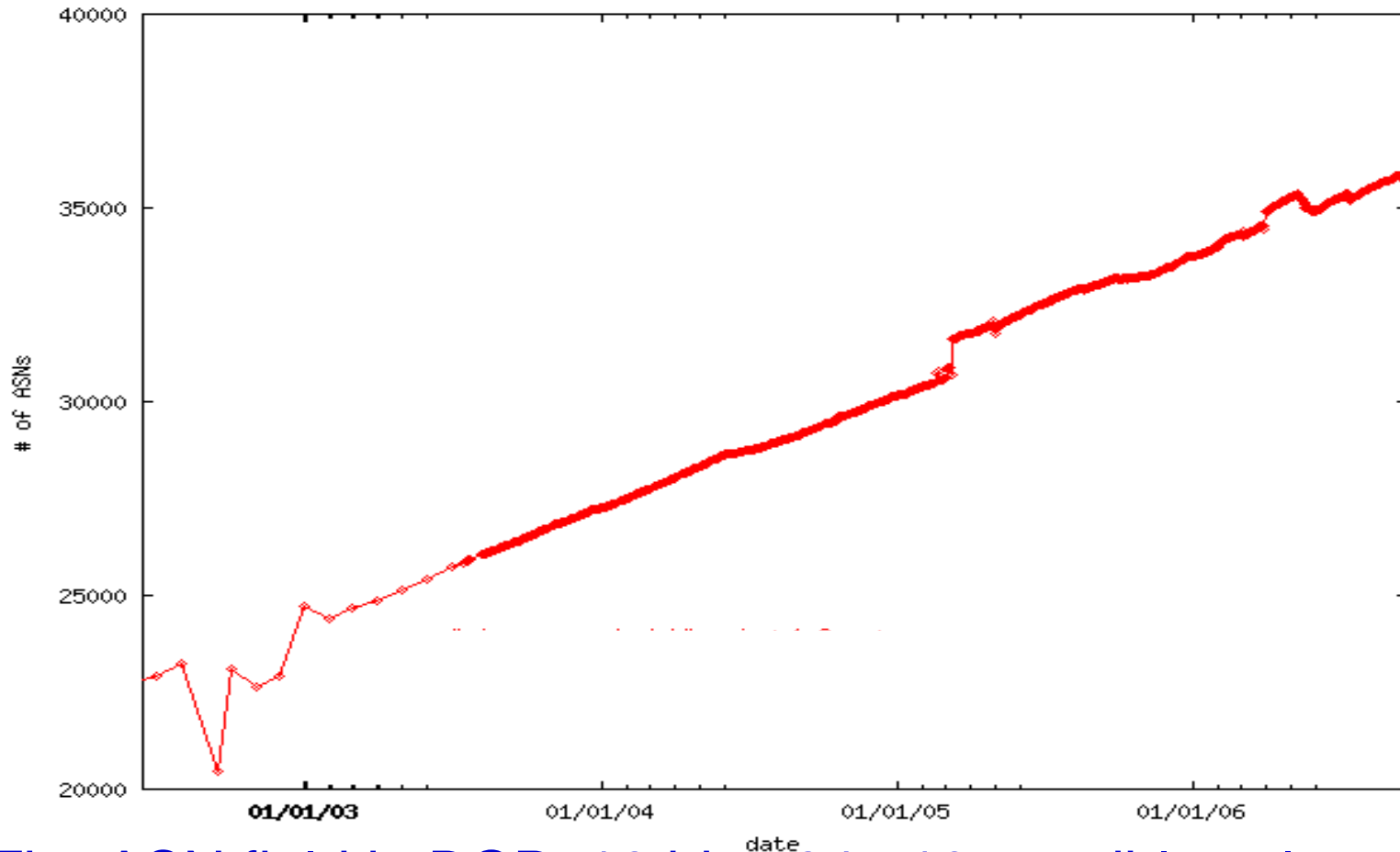
NANOG
February 2007



Overview

- Background
- Deployment
- Implementation at the RIPE NCC
- Lessons to be learned

Running out of AS Numbers



- The ASN field in BGP: 16 bits, 64,510 possible values
- Late 2006: $\approx 38,000$ in stats files, $\approx 6,000$ in RIR pools, $\approx 20,000$ left

Running out of AS numbers (2)

- Several studies of consumption rates
 - Rene Wilhelm and Henk Uijterwaal: ASN Missing in Action
 - RIPE 50, NANOG 35
 - Geoff Huston: AS Numbers
 - RIPE 51, NANOG 35
- Allocation rate is 10-12/day
- We will run out sometime of ASN sometime between late 2010 and early 2013

Let's be pessimistic and assume 2010

We need more ASN !

- Recovery of unused ASN
 - Hard
 - Will only postpone the problem for a few years, not solve it
- Use more bytes for the ASN
 - 32 bit AS or ASN32
 - 32 bits will increase the pool to 4,294,967,296
 - Will be sufficient for a million years

More bits: ASN32

- Proposal: draft-ietf-idr-as4bytes-11.txt
- Main features:
 - Extend ASN space to 32 bits
 - Backward compatible with existing BGP implementations
 - AS path length metrics can still be used
 - Loop detection still possible
 - No need for a flag date, ASN16 and ASN32 can operate in a mixed world forever

Transition mechanism

- Mixed world:
 - ASN16: 16 bit numbers, ASN32: 32 bit numbers
- When moving from ASN32 space to ASN16 space:
 - Translate ASN32 path information into a 2 byte number
 - 32 bit AS becomes AS23456 in ASN16 world
 - “There was an ASN32 in the path” Preserve path information in a community attribute “NEW_AS_PATH”
- Reverse procedure when moving from ASN16 to ASN32
 - Extract ASN32 from community attribute
 - Pad ASN16 with 0's

Transition mechanism (2)

- ASN32 world
 - Must run new code
- ASN16 world
 - Must support NEW_AS_PATH as a transitive community attribute
 - Can continue to run old code
 - AS23456 appearing twice in a path can have 2 different reasons:
 - AS padding by a single AS
 - 2 ASN32 AS's in the path

More bits:

- Details in draft-ietf-idr-as4bytes-11.txt
 - Proposed standard, in IESG queue
 - Minor details to be fixed but no show stoppers
 - Implementations exist (more about that later)

Bottom line: let's deploy this



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Deploying the solution

- Get an ASN32
 - Policy for handing them out
 - LIRs have to request them
 - RIRs have to handle the request

- Use your ASN32
 - Upgrade hardware and tools
 - Test
 - Routine operations

Policy for handing out ASN32

- **1/1/2007 – 31/12/2008**
 - LIR can ask for an ASN16 or ASN32
 - RIR will give an ASN16 by default, ASN32 on request
- **1/1/2009 – 31/12/2009**
 - LIR can ask for an ASN16 or ASN32
 - RIR will give an ASN32 by default, ASN16 on request
- **After 1/1/2010**
 - RIR will always give an ASN32
- **No other changes in policies or procedures**

Policy for handing out ASN32

- Introducing the policy
 - Similar proposals were made in all 5 regions
 - Consensus reached everywhere late 2006
 - Introduced in all 5 regions as of 1/1/2007
- The RIRs have to start handling requests for ASN32 as of 1/1/2007
- LIRs have to be ready to use ASN32 by 1/1/2009
 - ... but I have an ASN, why should I care?
 - No new customers?

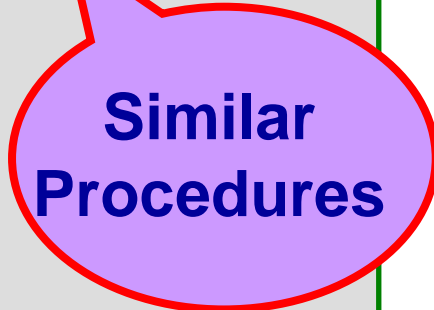
Let's request an ASN32! (RIPE NCC)

AS Number Request Form

```
#[GENERAL INFORMATION]#  
#[AS NUMBER USER]#  
#[ADDRESS SPACE TO BE ANNOUNCED]#  
#[PEERING CONTACTS]#  
#[DATABASE TEMPLATE(S)]#  
    aut-num: ASNEW  
  
#[INSERT SUPPLEMENTAL COMMENTS]#  
    I like an ASN32, please!  
  
#[END of REQUEST]#
```

A purple thought bubble with a red outline, containing the text "What about the other RIRs?".

What about
the other
RIRs?

A purple thought bubble with a red outline, containing the text "Similar Procedures".

Similar
Procedures

RIPE NCC has to process requests

- Our registration systems were designed for ASN16
 - RS forms, tools, database(s)
 - LIR Portal
 - ...
- And we use ASN in many more places
 - Peering/routers
 - RIS
 - RRCC
 - RIR statistics
 - ...
- We have work to do



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Implementation

- Study (spring'06)
 - Go through all our systems, documents and procedures
 - Define what has to be upgraded
 - Work items for 7 departments
 - About 1.5 to 2 man years of work
- Set up team to do the work
 - Start August '06
 - Ready early '07



The team

- **Software:** Denis Walker, Vlad Patenko, Oleg Muravsky, Katie Petrusha, Erik Romijn
- **Registration services:** Alex Le Heux, Laura Cobley
- **Training:** Ferenc Csorba, Arno Meulenkamp
- **Finance:** Martijn Schuuring
- **Communications:** Adrian Bedford
- **Operations:** James Aldridge, Mark Guz, Gerard Leurs, Cagri Coltekin
- **New Projects:** Lorenzo Colitti, Rene Wilhelm

- Henk Uijterwaal, *Project Manager*

First problem: Notation

- Not specified in draft-ietf-idr-as4bytes-11.txt
 - “x:y” has been used, e.g. “1234:5678”
 - Easy to confuse with community strings
 - Need something else
- Proposal in draft-michaelson-4byte-as-representation-01
- Proposal:
 - **ASx for ASN16**
 - AS0...AS65535
 - **ASz.y for ASN32**
 - AS1.0 ... AS65535.65535

Notation

- Discussion
 - Different from all other BGP attributes
 - Accepted by at least 1 vendor and the RIRs
- Open question: is **AS0.3333** a valid notation?
 - Current answer: yes
- Work item for the IETF-IDR WG
 - Comments on the mailing list (and elsewhere)
 - No consensus declared
 - Put on hold
 - *We assumed that this format will be used*



RPSL

- RPSL has to support ASN32
- RPSL has an extension mechanism, use this?
 - 30 new attributes
 - All ASN32 equivalent of existing attributes
- Impractical

RPSL

- Alternative: draft-uijterwaal-rpsl-4byteas-ext-01.txt
 - Use the **asx/asy.z** notation as in the Michaelson draft
 - Added:
 - On output a “0.” MUST be dropped,
 - “0.” MAY be accepted on input
- This requires tools to be upgraded
 - One time exercise
 - List of affected attributes is in the draft
- Comments on the RPSLng list
 - rpslng@ripe.net

Update software, main issues

- The new format
 - Parsing of ASN on input
 - Formatting on output
 - **Danger:** Some languages will treat “x.y” as a floating point number without warning
- Sufficient bits
 - ASN have been 16 bits “forever”
 - Code using unsigned short int’s will break immediately...
 - ... but what about regular int’s?
 - Will break in the future



Routers

- Vendors:
 - Juniper and Redback have officially announced an implementation
 - Unfortunately only for high end routers
 - Lower end routers “early 2007”
 - Cisco has an implementation but it is not official
 - Again for high end routers, not for the vanilla ones
 - ETA for lower end ones unclear



Routers

- Lower end equipment:
 - Chicken and egg problem
 - Input to vendors should come from future customers
 - Speak up!
 - You will need this for your new customers

Software routers

- Quagga:
 - Patch exists
 - <http://quagga.ncc.eurodata.de>
 - Being tested, 1 known bug as of 12/1
 - Unfortunately, this means that the RIS cannot be upgraded
- OpenBGPD
 - Patch exists
 - <http://www.potaroo.net/tools/bgpd>
 - Successfully tested on public transit network



Supporting systems

- Monitoring:
 - Nagios:
 - BGP MIB needs to be updated
 - Draft expired, status unclear
 - Speak up in IDR WG
 - Same applies to other tools based on BGP MIB's
 - Pending
- RIS
 - Routing information service
 - Really useful if we can see ASN32's in the RIB

Other stuff that to has been updated

- Whois software
- Training material
- Documentation
- Scripts
 - RIR statistics report
 - Billing
 - RRCC
 - ...



NCC planning

- Essential systems
 - (Internal) trial requests for ASN32 possible 1/12/2006
 - LIR requests by 1/1/2007

- Other systems: early 2007
 - Strongly depends on vendors

Did this work out?

NCC reality

- Yes! First external request received on 2/1/2007
- Processed and allocated AS3.0 on 2/1/2007:

```
[x49:9] whois -h whois.ripe.net as3.0
aut-num:          AS3.0
as-name:         INTERNIC2
descr:           ...
org:             ORG-IG36-RIPE
import:          from AS8767 accept ANY
import:          from AS34306 accept ANY
import:          from AS15486 accept ANY
export:          to AS8767 announce AS3.0
export:          to AS34306 announce AS3.0
export:          to AS15486 announce AS3.0
admin-c:         ...
tech-c:          ...

organisation:    ORG-IG36-RIPE
org-name:        INTERNIC GmbH
org-type:        LIR
address:         ...
```

Can ASN32 be used on the net?

Routing Information Service - Mozilla Firefox

File Edit View Go Bookmarks Tools Help

No entries are found in RIB on 2007-01-07.

List of updates which are seen between 2007-01-07 05:07:00Z and 2007-01-07 06:10:00Z:

Type	Prefix	Last update time	Peer	Next HOP	MED	Origin	ASpath	Community	RRC
A	203.10.63.0/24	2007-01-07 05:08:01Z	194.68.123.66	194.68.123.66	1000	IGP	8434 2119 8210 4637 1221 85001 23456 23456	2119:401 8210:209 8434:2001	Netnod
A	203.10.63.0/24	2007-01-07 05:08:09Z	194.68.123.66	194.68.123.66	1000	IGP	8434 2119 8210 4637 1221 85001 23456 23456	2119:401 8210:209	Netnod
A	203.10.63.0/24	2007-01-07 05:08:10Z	194.68.123.76	194.68.123.76	0	IGP	8209 3320 4637 1221 23456 23456	8289:4004 8289:5000	Netnod

Can ASN32 be used on the net?

- Yes, we see at least 1 in the RIS!
- Unfortunately, we cannot tell which of the 3 ASN this really is (but we can guess)



Are people asking for ASN32?

- Yes:
 - RIPE NCC: 6 ASN32 allocated as of Feb 5
 - APNIC: 4 ASN32 allocated
 - ARIN: 3 ASN32 allocated

Status of other RIPE NCC systems:

- Pending:
 - RIS and everything based on that
 - Our routers but peering through the transition mechanism done
 - ETA: February 2007
- All other systems done



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Lessons to be learned

- Upgrading to ASN32 is not rocket science
- It is a lot of work though:
 - NCC
 - 1.5 to 2 man years, 7 departments
 - Supporting systems only:
 - Medium sided network
 - 0.5 to 0.75 man years

What should you do

- Start thinking about ASN32 in your organization
 - NOW!
- Ask your vendor for support
 - or be prepared for a nasty surprise in 2009
- Don't wait until you get assigned AS1.5432 in 2009 and don't know what to do with it

Questions?