

# Deployment of 32 bit AS Numbers at the RIPE NCC

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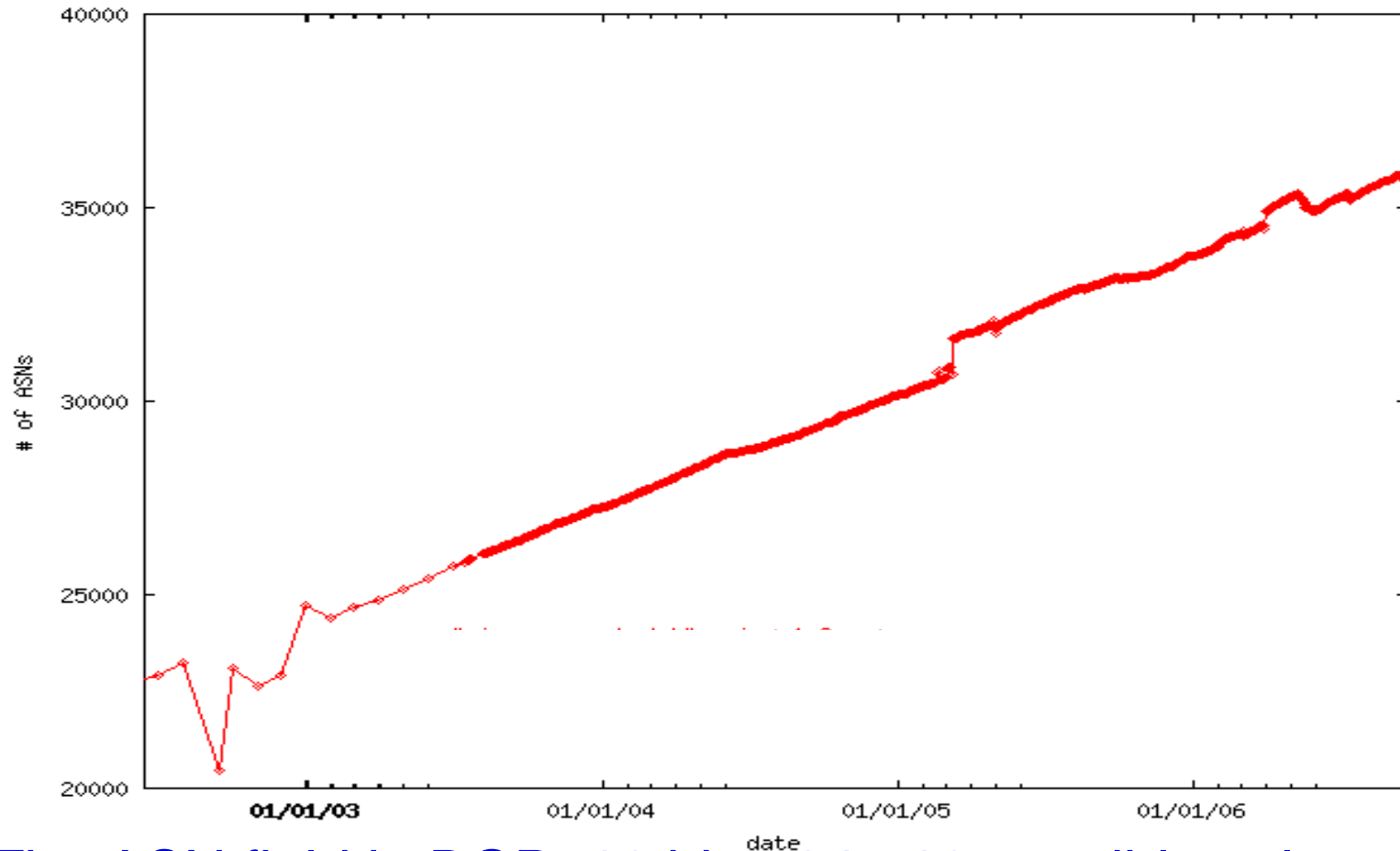
APRICOT  
February 2007



# 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?

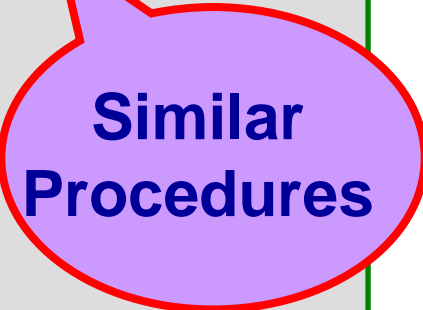
# Let's request an ASN32! (RIPE NCC)

## 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](mailto: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    | <a href="#">203.10.63.0/24</a> | 2007-01-07 05:08:01Z | 194.68.123.66 | <a href="#">194.68.123.66</a> | 1000 | IGP    | <a href="#">8434</a><br><a href="#">2119</a><br><a href="#">8210</a><br><a href="#">4637</a><br><a href="#">1221</a><br><a href="#">85001</a><br><a href="#">23456</a><br><a href="#">23456</a> | 2119:401<br>8210:209<br>8434:2001 | Netnod |
| A    | <a href="#">203.10.63.0/24</a> | 2007-01-07 05:08:09Z | 194.68.123.66 | <a href="#">194.68.123.66</a> | 1000 | IGP    | <a href="#">8434</a><br><a href="#">2119</a><br><a href="#">8210</a><br><a href="#">4637</a><br><a href="#">1221</a><br><a href="#">85001</a><br><a href="#">23456</a><br><a href="#">23456</a> | 2119:401<br>8210:209              | Netnod |
| A    | <a href="#">203.10.63.0/24</a> | 2007-01-07 05:08:10Z | 194.68.123.76 | <a href="#">194.68.123.76</a> | 0    | IGP    | <a href="#">8209</a><br><a href="#">3320</a><br><a href="#">4637</a><br><a href="#">1221</a><br><a href="#">23456</a><br><a href="#">23456</a>  | 8289:4004<br>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



## Status of other systems:

- Pending:
  - RIS and everything based on that
  - Our routers but peering through the transition mechanism done
- 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?