

4 Byte ASN Development and Deployment

SANOG 13
Lahore, Pakistan
22 January 2009

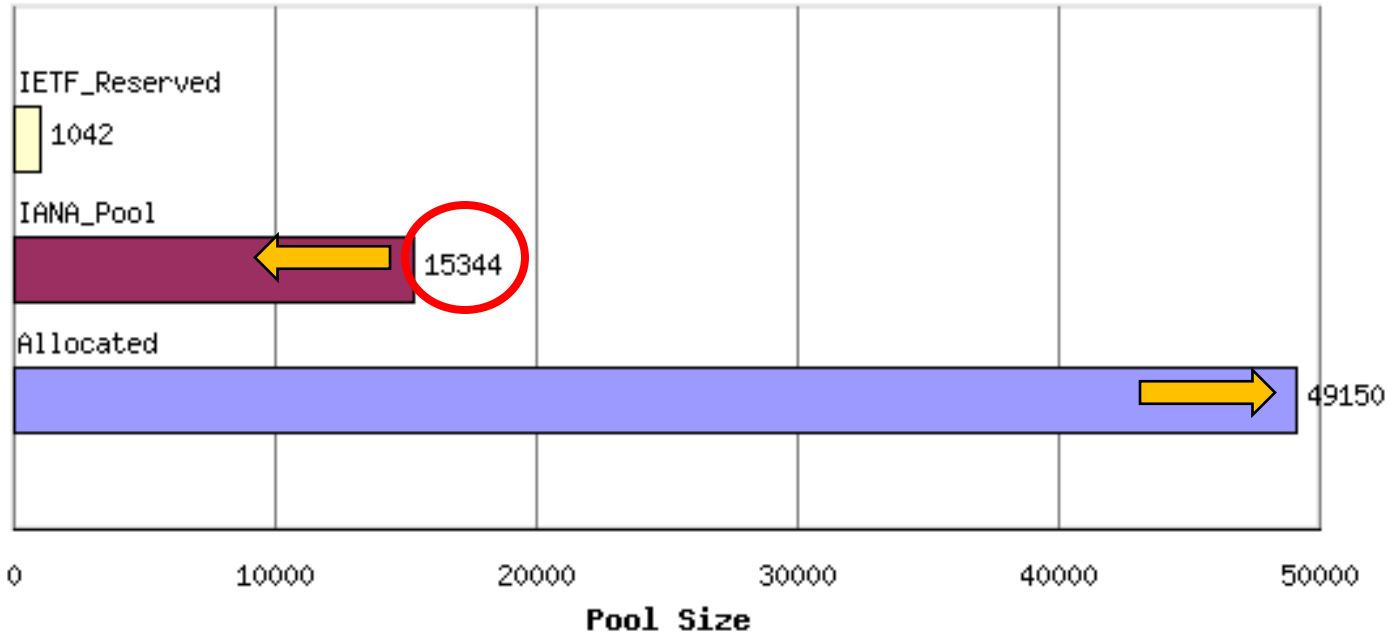
Srinivas (Sunny) Chendi
External Relations Manager

2-byte ASN and 4-byte ASN format

- Two-byte ASN (16-bit)
0 ~ 65535
- Four-byte ASN (32-bit)
0.0 ~ 65535.65535
- APNIC four-byte ASN range
2.0 ~ 2.1023

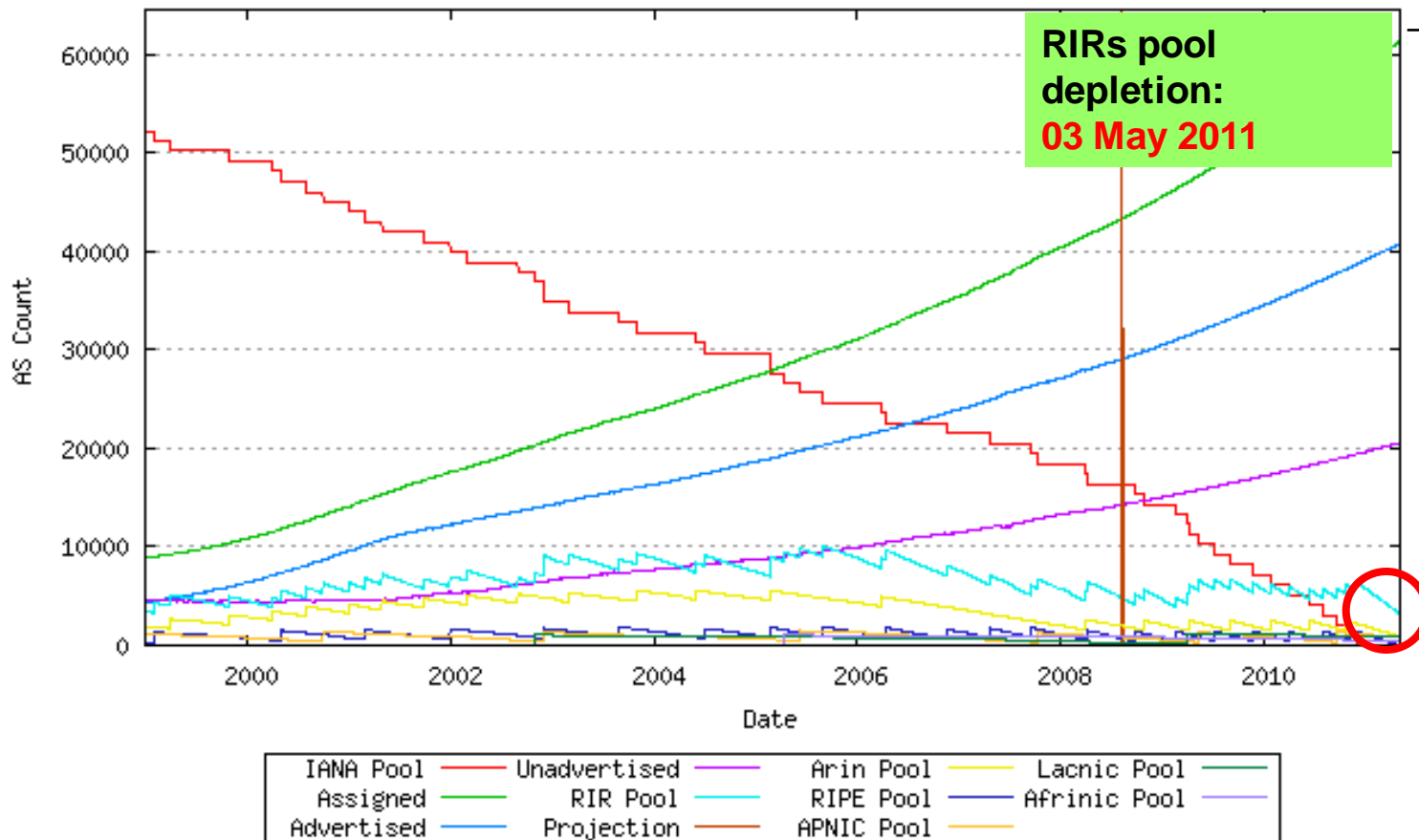
Current distribution of two-byte ASNs

AS Number Pool Status



Source: <http://www.potaroo.net> (As of this date)

Projected lifetime of remaining two-byte ASNs



Source: <http://www.potaroo.net> (As of this date)

RIRs and 32-bit AS Numbers

- From **1 January 2007** the RIRs are allocating 32-bit AS numbers (upon specific request)
- From **1 January 2009** the RIRs will be allocating 32-bit AS numbers by default (leaving some 16-bit AS numbers available upon specific request)

What does this imply?

If you are using 16-bit AS
as most (all) of you are today

and you don't want to upgrade all your
instances of BGP today
something you probably want to avoid (or at least defer!)

then you don't have to do anything at all!

NOTHING changes!

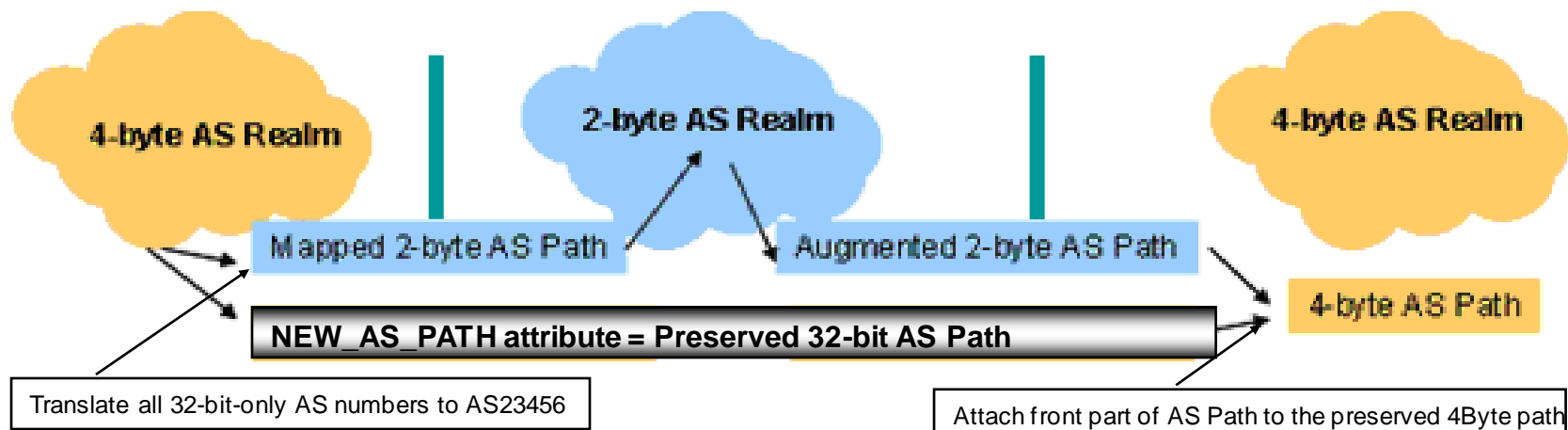
Well, almost nothing!

What's changed?

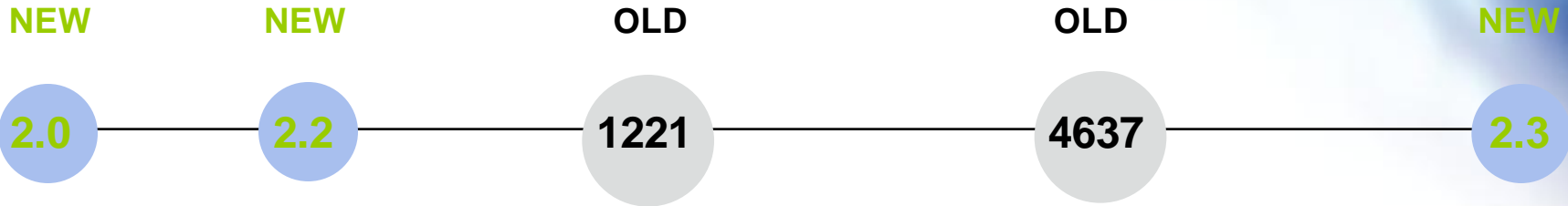
- BGP Update messages in the 16-bit world
 - May contain “lies” in parts of the AS Path
 - May be larger in size due to tunneled additional information
- But prefix reachability information is still communicated between 16-bit and 32-bit BGP “realms”

32-bit AS Transition

- Think about this space as a set of NEW / OLD boundaries
- Define the NEW / OLD and the OLD / NEW transitions
- Preserve all BGP information at the transition interfaces
 - **Translate** 32-bit AS Path information into a 16-bit representation
 - **Tunnel** 32-bit AS Path information through 16-bit AS domain as an update attribute



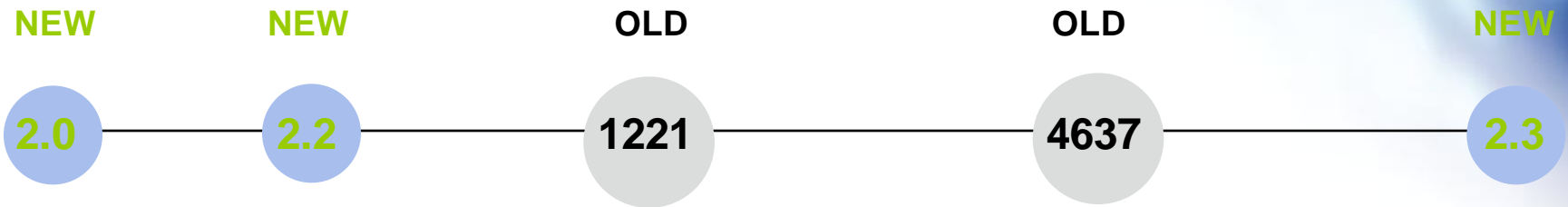
32-bit / 16-bit BGP Example...



AS Path in the RIB (Routing Information Base)

i

32-bit / 16-bit BGP Example...



AS Path in the RIB

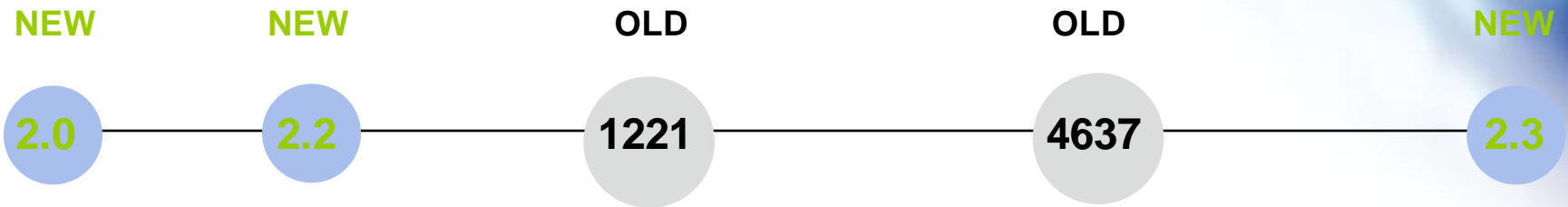
i



AS Path Attribute in the UPDATE Message

2.0

32-bit / 16-bit BGP Example...



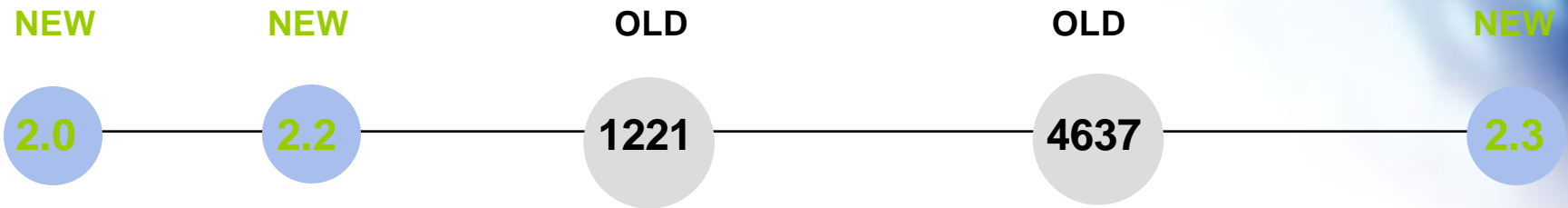
AS Path in the RIB



AS Path Attribute in the UPDATE Message



32-bit / 16-bit BGP Example...



AS Path in the RIB

i

2.0



AS Path Attribute in the UPDATE Message

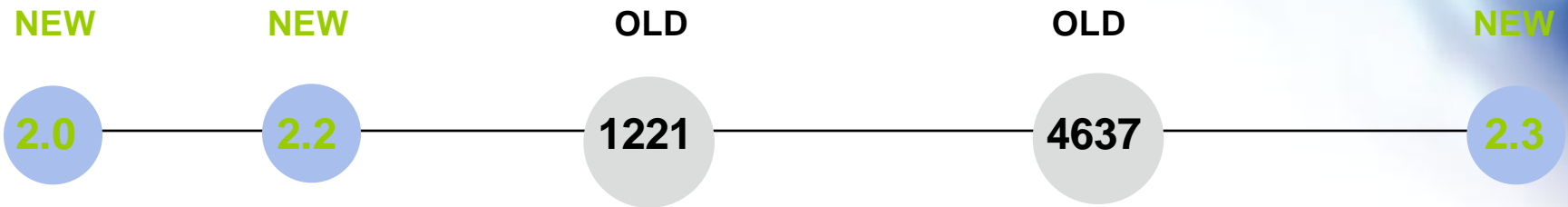
2.0

23456 23456

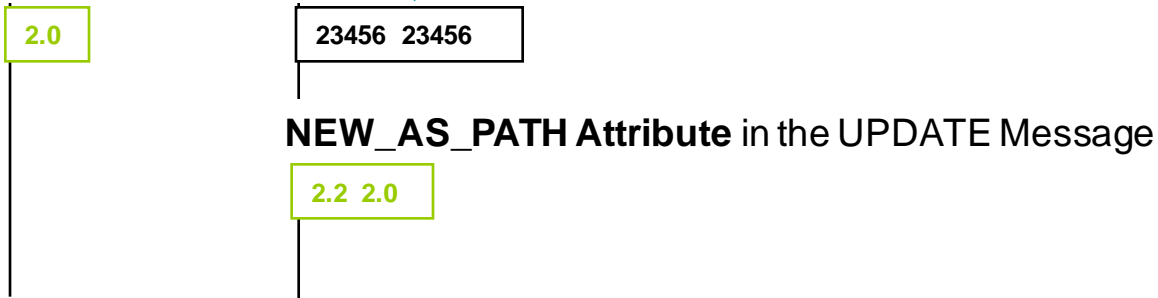
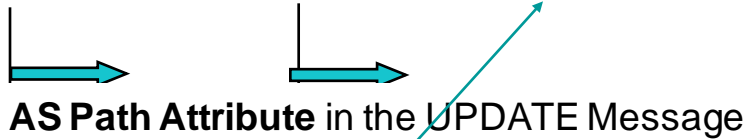
NEW_AS_PATH Attribute in the UPDATE Message

2.2 2.0

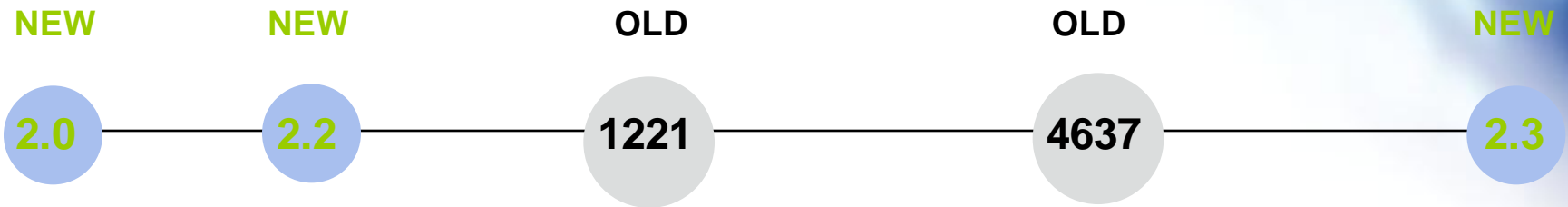
32-bit / 16-bit BGP Example...



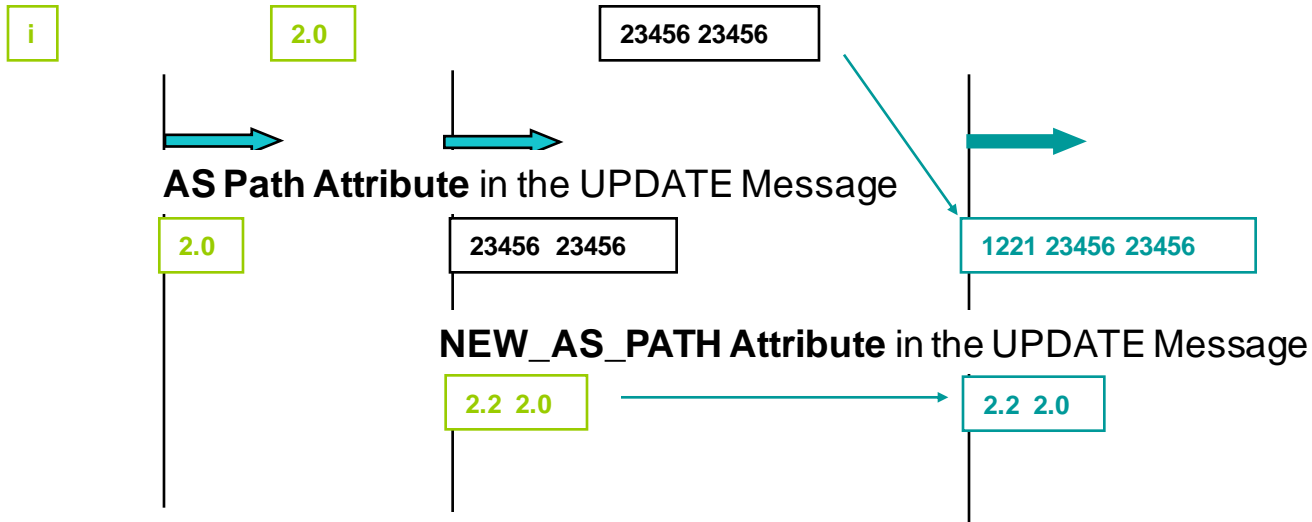
AS Path in the RIB



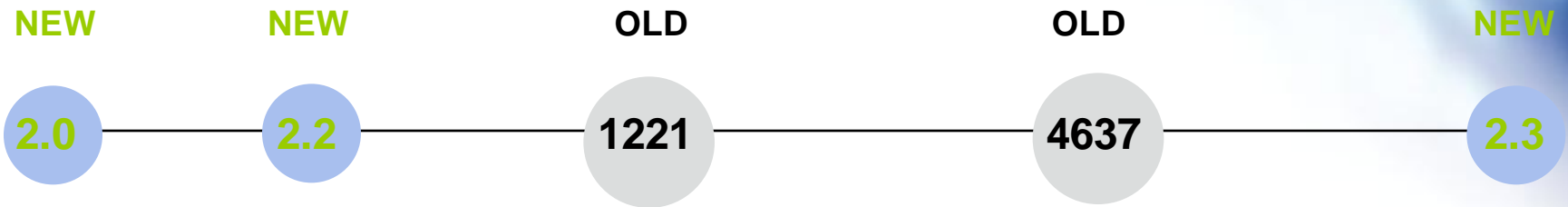
32-bit / 16-bit BGP Example...



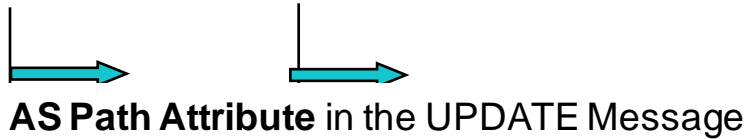
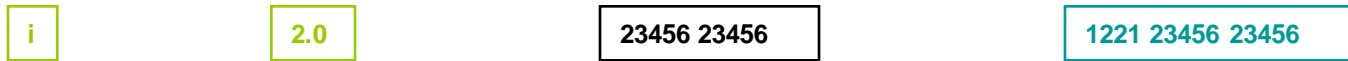
AS Path in the RIB



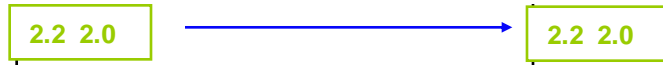
32-bit / 16-bit BGP Example...



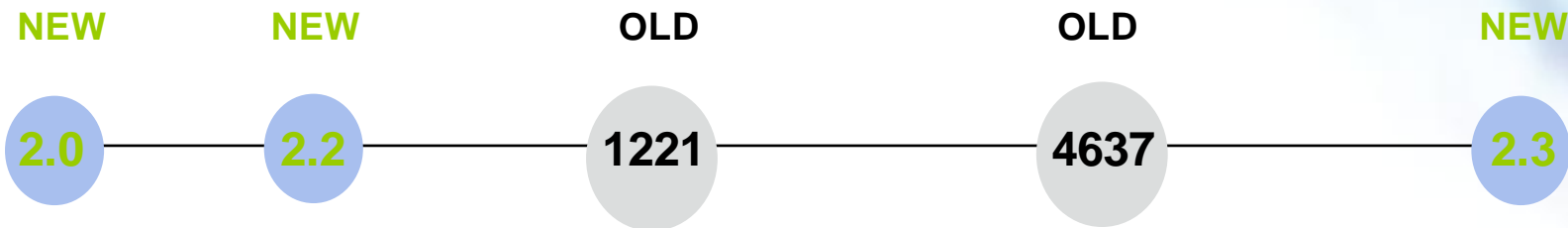
AS Path in the RIB



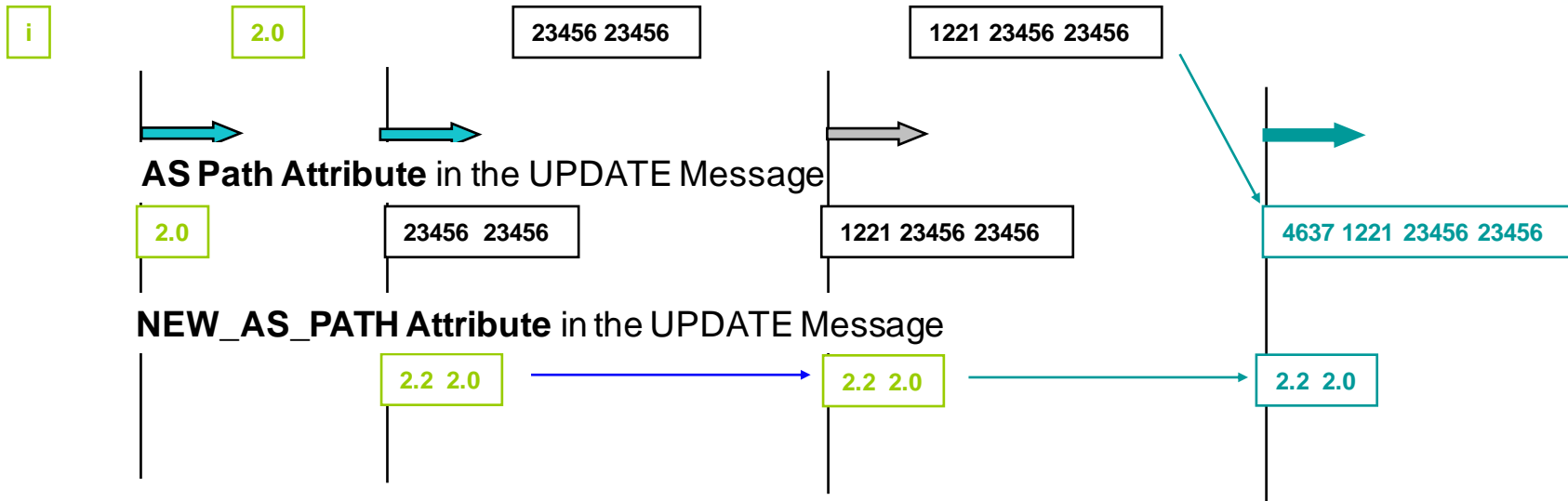
NEW_AS_PATH Attribute in the UPDATE Message



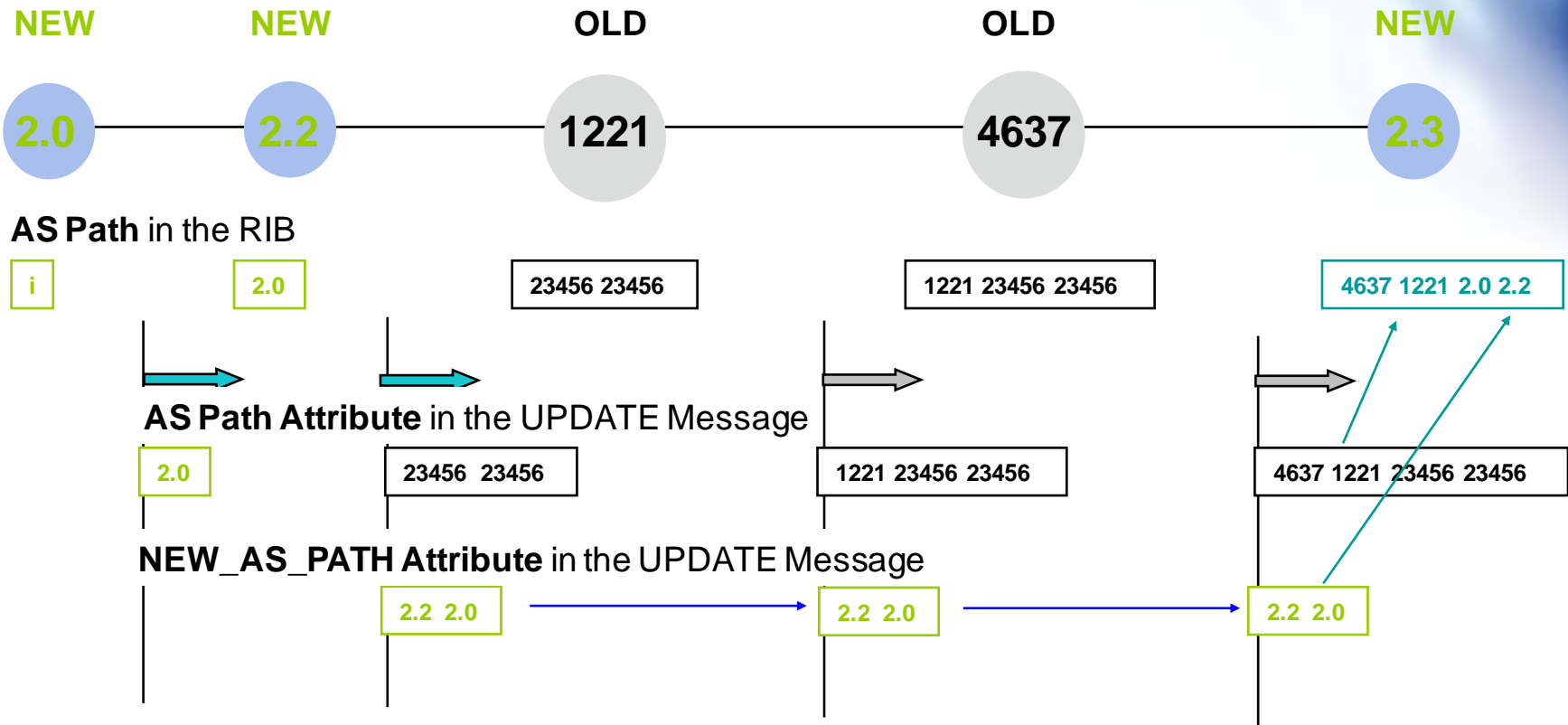
32-bit / 16-bit BGP Example...



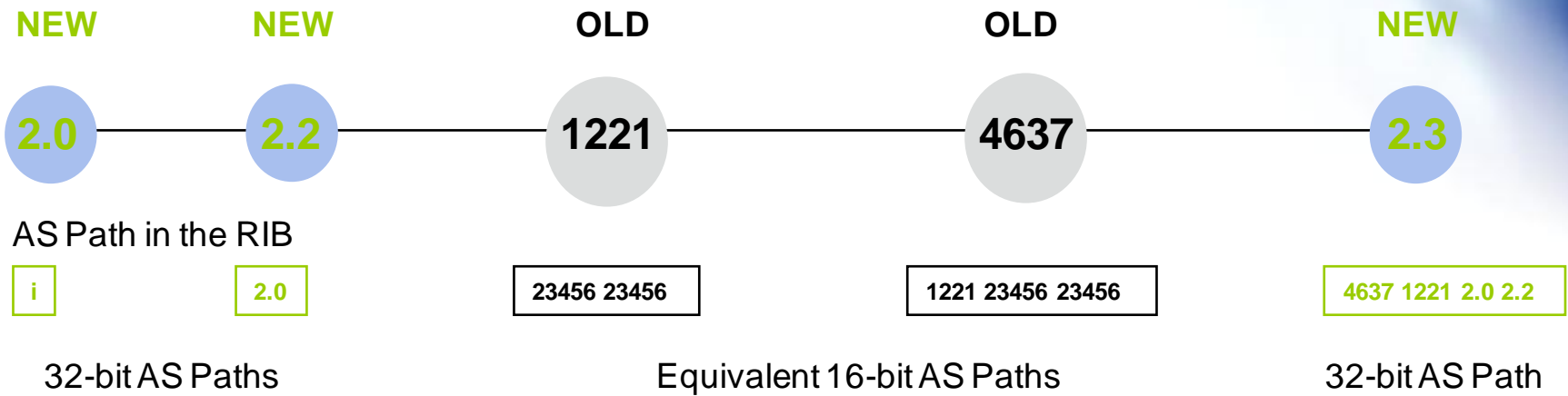
AS Path in the RIB



32-bit / 16-bit BGP Example...



32-bit / 16-bit BGP Example



AS 23456

- **AS 23456** is going to appear in many 16-bit AS paths – both origin and transit

This is not an error – it's a 16-bit token holder for a 32-bit AS number

The Route-Views View

```
route-views.oregon-ix.net>show ip bgp 203.10.62.0/24
BGP routing table entry for 203.10.62.0/24, version 177310093
Paths: (43 available, best #39, table Default-IP-Routing-Table)
Not advertised to any peer
3277 3216 3549 4637 1221 23456
    194.85.4.55 from 194.85.4.55 (194.85.4.16)
        Origin IGP, localpref 100, valid, external
        Community: 3216:3000 3216:3004 3277:3216 3549:2141 3549:30840
7500 2497 4637 1221 23456
    202.249.2.86 from 202.249.2.86 (203.178.133.115)
        Origin IGP, localpref 100, valid, external
2493 3602 812 812 4637 1221 23456
    206.186.255.223 from 206.186.255.223 (206.186.255.223)
        Origin IGP, localpref 100, valid, external
2905 701 1239 4637 4637 4637 4637 4637 4637 1221 23456
    196.7.106.245 from 196.7.106.245 (196.7.106.245)
        Origin IGP, metric 0, localpref 100, valid, external
...
```

Operational Support Systems

What happens when you have a customer / transit / peer with a 32-bit AS Number?

- What's in the route registries and what your customers tell you about their AS and what's in your OSS and your routing system will differ:
 - E.g.: **AS 1.2** needs to be auto-translated into **AS 23456** in a number of places, including in your OSS
 - Your BGP routers may need to peer with **AS 23456**, transit across **AS 23456**, and have multiple customers on **AS 23456** at the same time, while also understanding that these refer to different external parties
 - Your OSS might get terminally confused!

Mixed environments

- No dynamic capability for 16/32-bit ASN mode shift
 - You cannot flick from “16-bit OLD” to “32-bit NEW” mode within an active BGP session
 - You need to clear the session and then perform a clean start to trigger the initial capability exchange

4 Byte AS Testing

- Tests have been undertaken using closed BGP networks, and over the public Internet
- Tests of 16-bit/32-bit transition boundaries in various permutations of transits and loops
- Current announcement of 203.10.62.0/24 originating from AS 2.2 to assist others in local testing of 32-bit BGP

32-bit Path Reconstruction

```
srv0# bgpctl show rib 203.10.62.0/24
```

```
flags: * = Valid, > = Selected, I = via IBGP, A = Announced
```

```
origin: i = IGP, e = EGP, ? = Incomplete
```

flags	destination	gateway	lpref	med	aspath	origin
*>	203.10.62.0/24	147.28.0.1	100	0	0.3130	0.1239 0.4637
					0.4637	0.4637 0.4637
					0.4637	0.4637 0.1221
					1.202	i

Experiment performed on January 11 2007, with the assistance of Randy Bush and George Michaelson, using OpenBGPD 3.9 with 4Byte AS support patches as the origin and the observer points.

Resources

- IETF Specification
 - [RFC4893](#)
- OpenBGPD patches
 - <http://www.potaroo.net/tools/bgpd>
- Quagga patches
 - <http://quagga.ncc.eurodata.de/>

More up-to-date resources



The screenshot shows the homepage of the 'icons' website. The header features the 'icons' logo and the tagline 'Internet Community of Online Networking Specialists'. A navigation bar includes links for Home, IPv6 Transition, How-To Guides, Network Tools, Community, Photo gallery, and Glossary. The main content area is divided into three columns. The left column contains a list of navigation links such as Wiki Home, AS Numbers, IPv6 Transition, Security, IGovernance, Peering, How-To Guides, Network Tools, and Community. The middle column features a highlighted article titled 'Autonomous System (AS) Numbers' under the 'AS Number Feature' section. The article text states: 'Four-byte AS numbers will become more common from January 1, 2009. Is your network ready for the transition? The five RIRs will begin issuing 4-byte AS numbers by default starting next year. Go to our new 4-byte AS number information pages to get the latest advice from leading industry specialists.' Below this is a section for the 'IGF 2008 Workshop' with text: 'A workshop titled "Challenges Facing Internet Operators in Developing Countries" will take place at IGF 2008 in Hyderabad, India. Organized by APNIC in partnership with AfrinIC, AFNOG, ARIN,'. The right column contains a sidebar menu with a 'Dashboard' icon and a tree view of site sections: ASNumbers, Community, How-To Guides, ICONS Wiki (with a sub-menu including Home, .bookmarks, About ICONS, DNS Tools, Glossary, ICONS Wiki Help, and IGF2008), IPv6 Transition, Internet Exchanges & Peering, Internet Governance, Photo Gallery, Security, and Tools.

<http://icons.apnic.net>



Thank you!

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