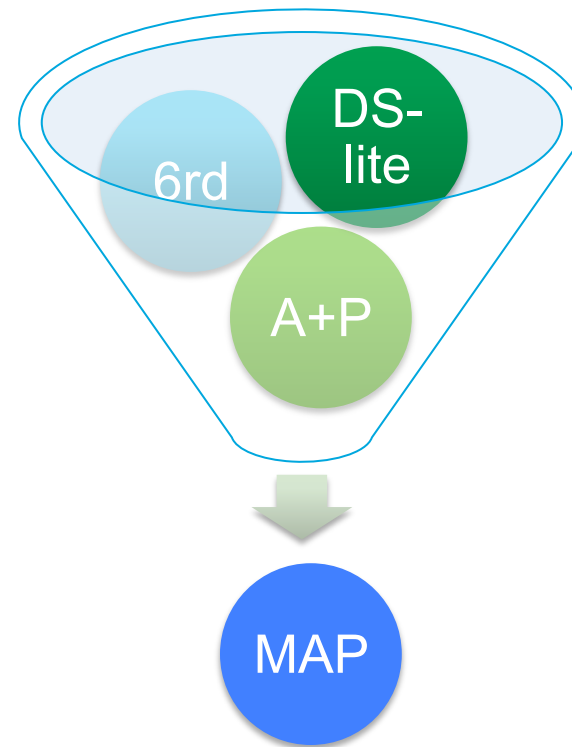


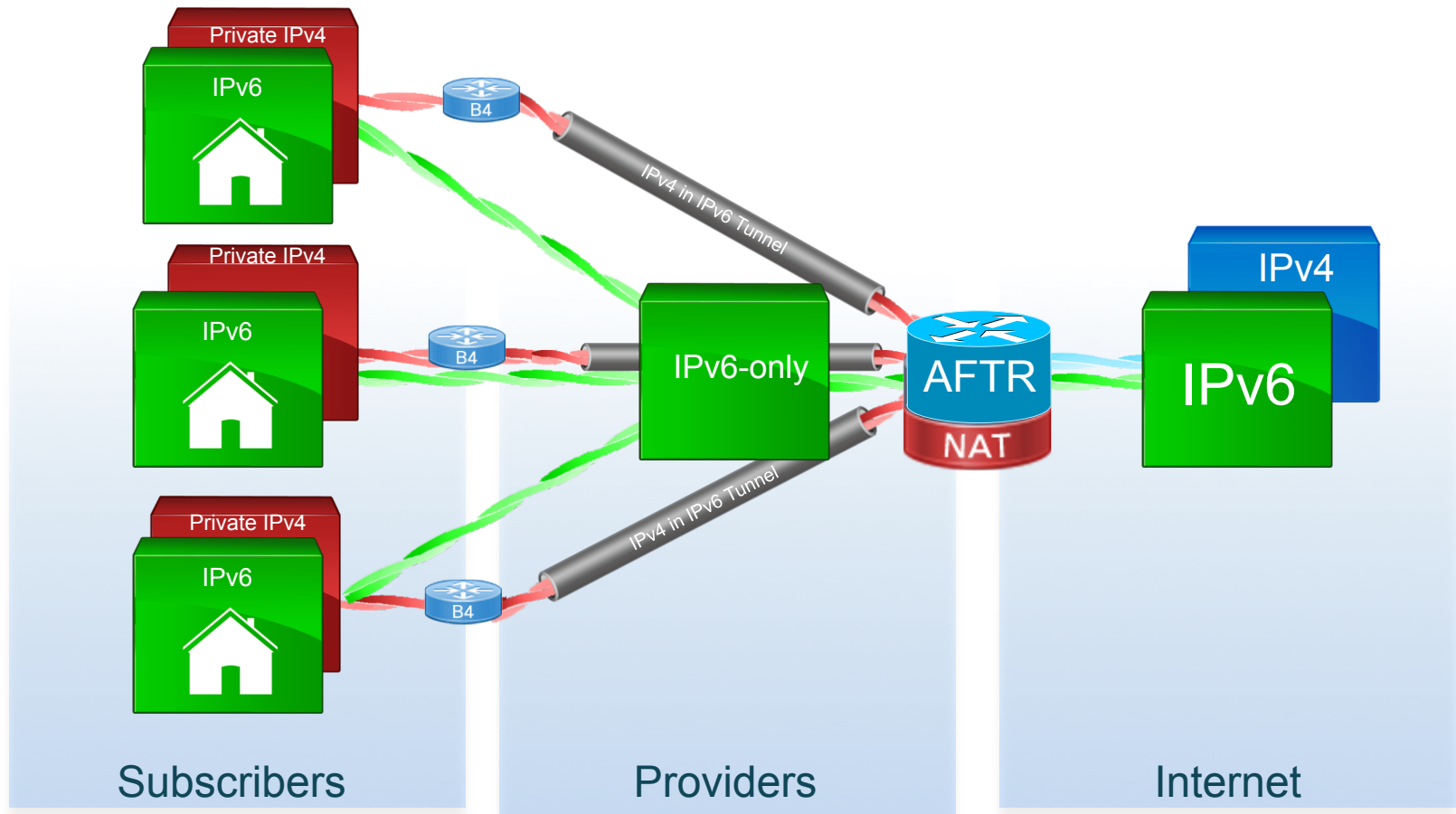
Mapping Address + Port

Mark Townsley, Cisco Fellow

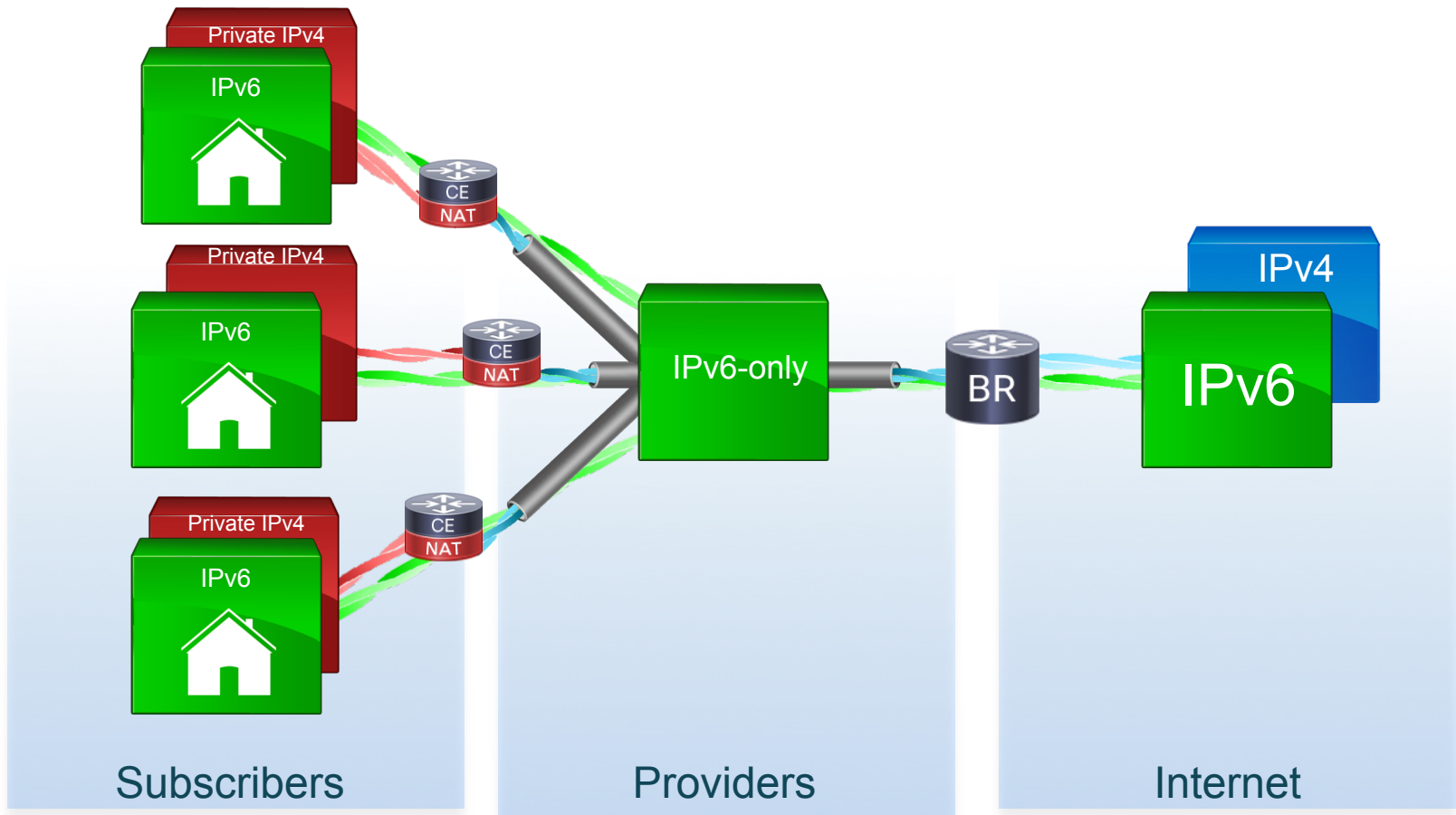
RIPE 65, September 24, 2012



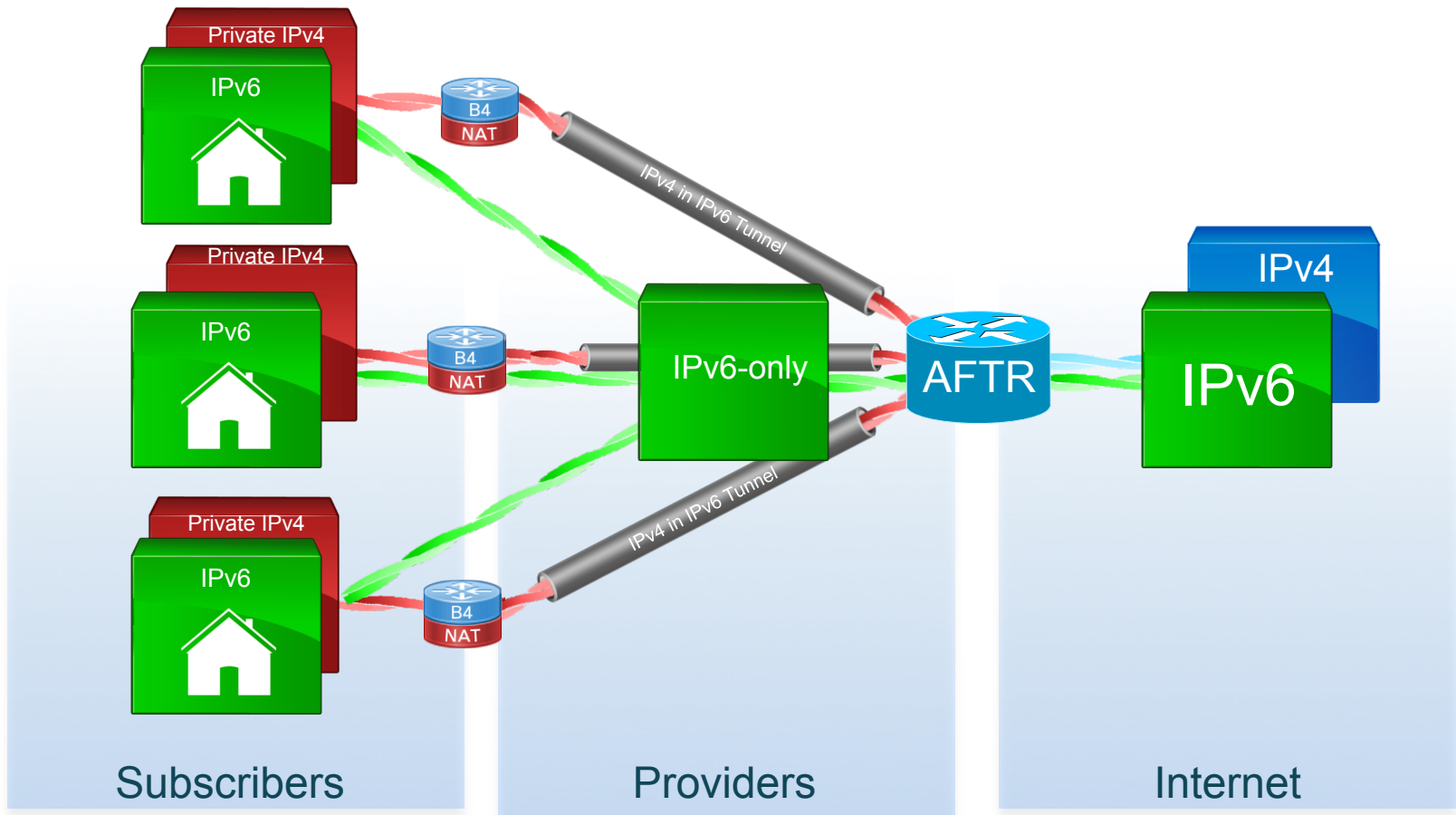
Dual Stack Lite (DS-Lite)



Mapping Address + Port (MAP)




Lightweight 4 over 6*



*draft-cui-software-b4-translated-ds-lite-08

Imagine the Internet without any IP address aggregation



IPv4 CIDR Chart **RIPE NCC**

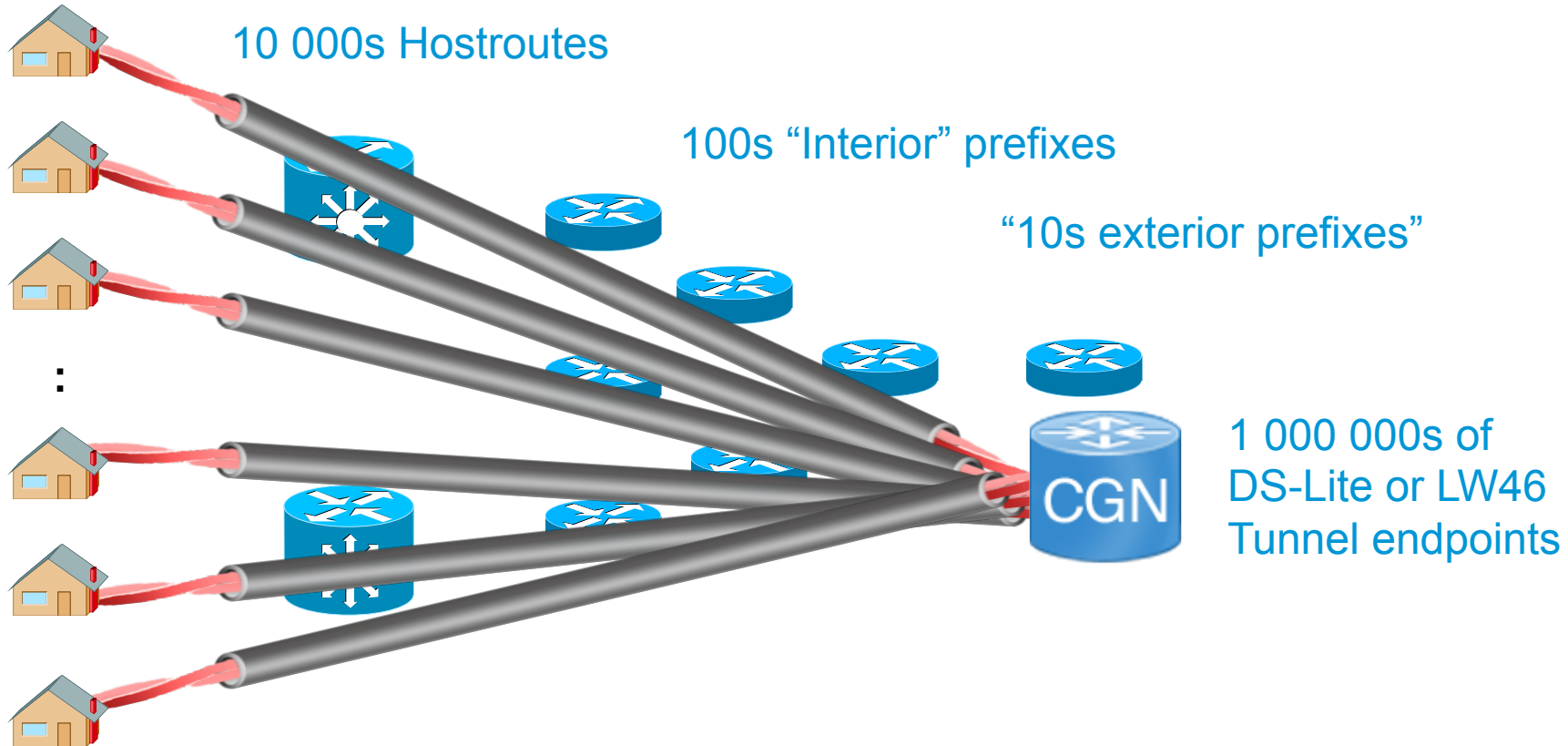
IP Addresses	Bits	Prefix	Subnet Mask
1	0	/32	255.255.255.255
2	1	/31	255.255.255.254
4	2	/30	255.255.255.252
8	3	/29	255.255.255.248
16	4	/28	255.255.255.240
32	5	/27	255.255.255.224
64	6	/26	255.255.255.192
128	7	/25	255.255.255.128
256	8	/24	255.255.255.0
512	9	/23	255.255.254.0
1 K	10	/22	255.255.252.0
2 K	11	/21	255.255.248.0
4 K	12	/20	255.255.240.0
8 K	13	/19	255.255.224.0
16 K	14	/18	255.255.192.0
32 K	15	/17	255.255.128.0
64 K	16	/16	255.255.0.0
128 K	17	/15	255.254.0.0
256 K	18	/14	255.252.0.0
512 K	19	/13	255.248.0.0
1 M	20	/12	255.240.0.0
2 M	21	/11	255.224.0.0
4 M	22	/10	255.192.0.0
8 M	23	/9	255.128.0.0
16 M	24	/8	255.0.0.0
32 M	25	/7	254.0.0.0
64 M	26	/6	252.0.0.0
128 M	27	/5	248.0.0.0
256 M	28	/4	240.0.0.0
512 M	29	/3	224.0.0.0
1024 M	30	/2	192.0.0.0
2048 M	31	/1	128.0.0.0
4096 M	32	/0	0.0.0.0

K = 1,024 • M = 1,048,576

Contact Registration Services:
hostmaster@ripe.net • lir-help@ripe.net www.ripe.net

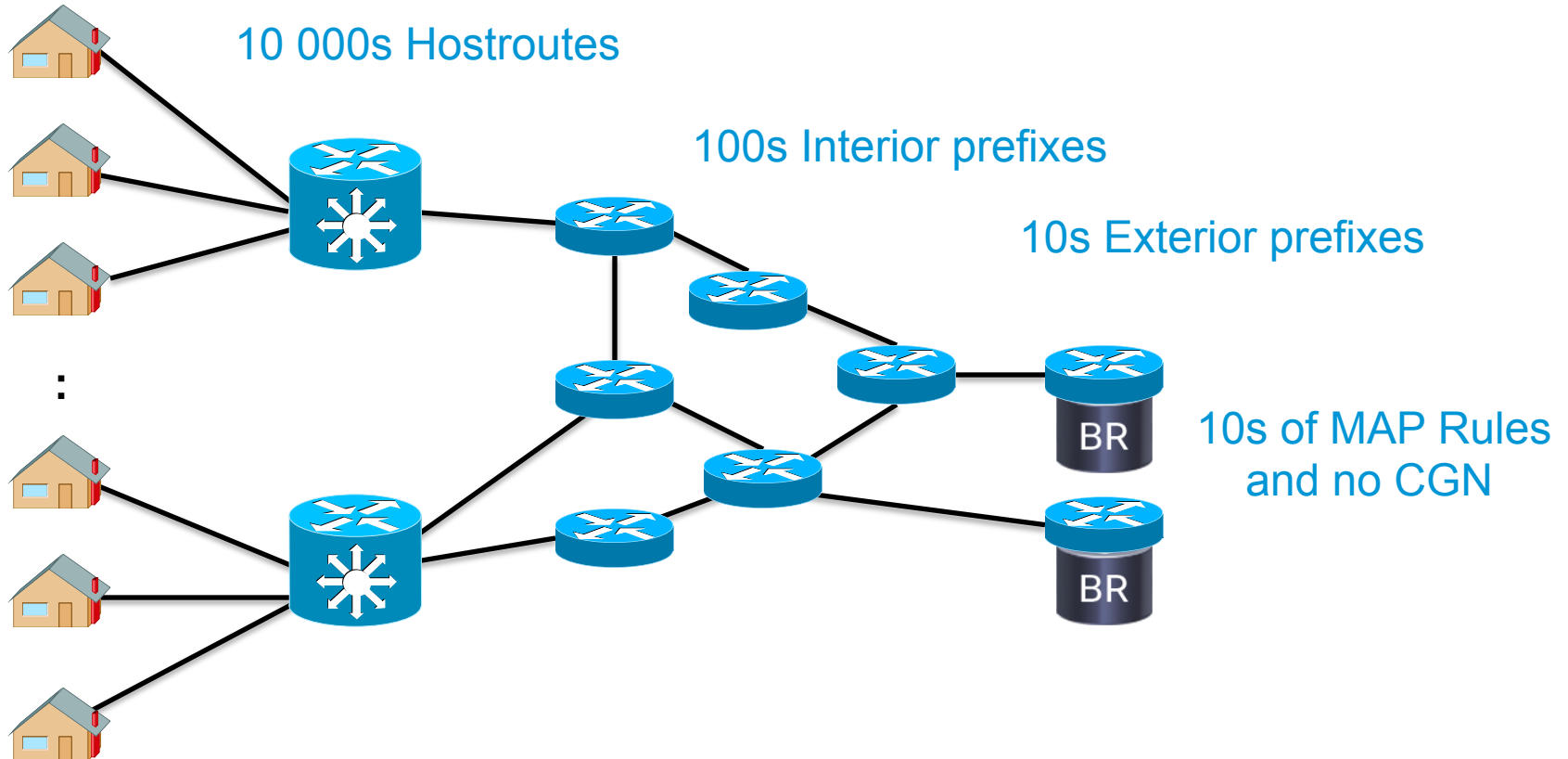
DS-Lite/LW46 – No IP Aggregation

1 000 000s of Subscribers



MAP Exploits IPv6 Aggregation

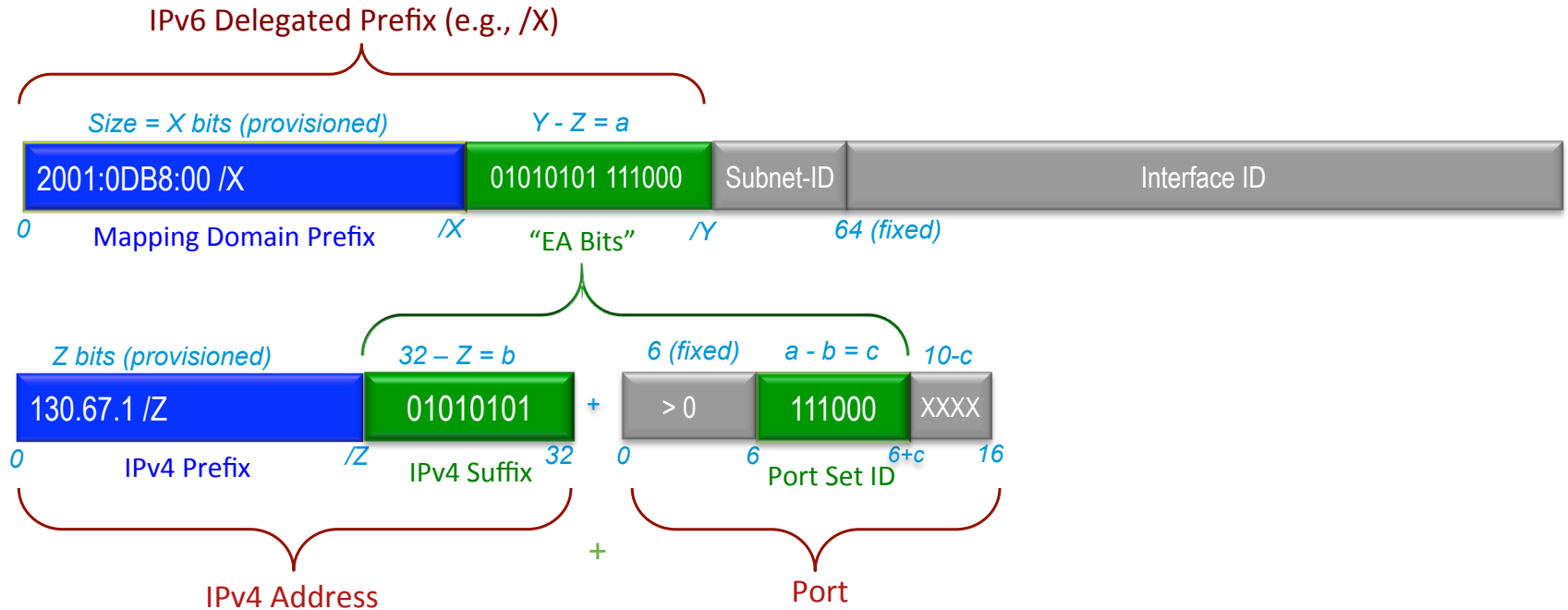
1 000 000s of Subscribers



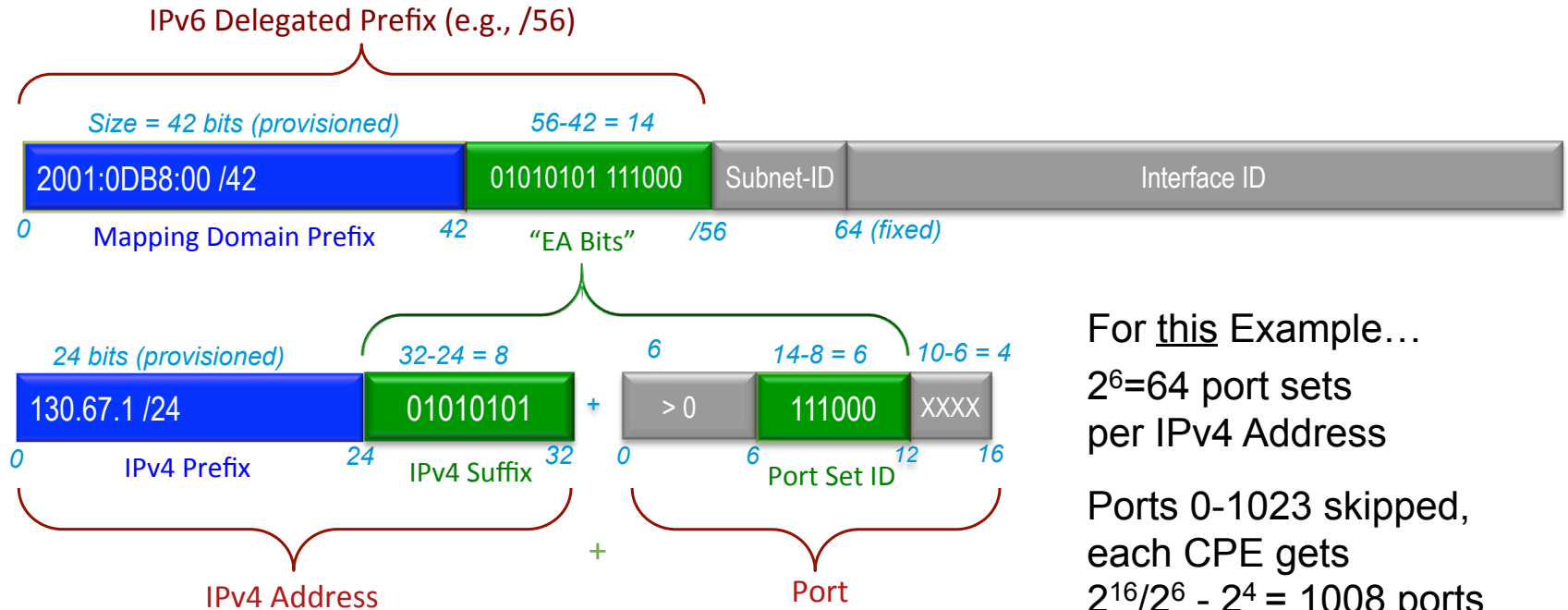
MAP 3-Step Tutorial

- ① IPv6 to IPv4+Port Mapping
- ② Stateless Border Relay
- ③ Packet Flow and Forwarding

① IPv6 → IPv4 + Port Mapping



① IPv6 → IPv4 + Port Mapping



For this Example...

$2^6=64$ port sets
per IPv4 Address

Ports 0-1023 skipped,
each CPE gets
 $2^{16}/2^6 - 2^4 = 1008$ ports

One IPv4 /24 serves
 $2^{(6+8)} \approx 16,384$ (vs. ≈ 256)
subscribers



MAP Simulation Tool (beta)

[Video tutorial](#)
[Highly editable elements](#)
[Add a new MAP rule](#)
[Remove all MAP rules](#)
[Load rules from text](#)
[Save rules to text](#)
[Create a link to these rules](#)

Paste previously saved set of rules here.

Rule 0

[Delete](#)
[Advanced](#)
[Example](#)
/56

IPv6

2001:db8:9500:0

/40

EA Bits
(16 = 8 + 8)
Subnet
(8)

Interface ID (64)

IPv4 : Port

198.51.100.0 /24

Suffix
(8)

:

(4)
PSID
(8)
(4)
256 IPv4 addresses, **65536** users, **240** ports each (1:256)

In order to help us understand how this tool is being used and to improve it in the future, it will periodically save anonymous usage information for analysis. This does NOT include your IP address or any other information not needed by the tool itself. If you wish, you may override this by unchecking the box below.

 Data collection is currently on.

MAP Simulation tool created by [Arthur Lacoste](#) of Cisco Systems based on [this IETF draft](#).

A [quick video tutorial](#) for this tool is available on youtube.

Please send comments, bug reports, and other feedback to : [map46-tool-feedback\[at\]external.cisco.com](mailto:map46-tool-feedback[at]external.cisco.com)

Last updated: 6/19/2012



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MAP Calculator
Cisco IPv6 Project





★★★★★ (2)


INSTALL

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★★★★★ (97)
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- 

IP Network Calculator
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★★★★★ (33)
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- PERMISSIONS

Description

MAP Calculator is a tool designed to help you deal with MAP (Mapping Address and Port), IETF's last IPv4 - IPv6 stateless tunneling solution. The spec for MAP is being edited by the Softwire Working Group and is available here : <http://datatracker.ietf.org/doc/draft-ietf-softwire-map/>

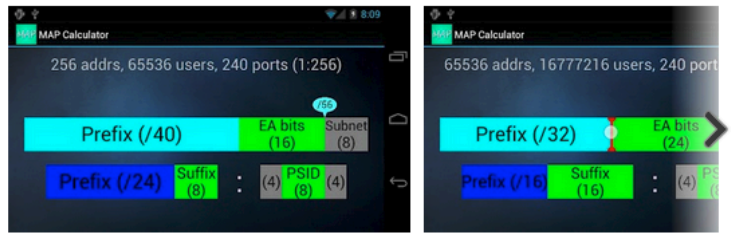
MAP Calculator features :

- Immediately understand how IPv6 and IPv4+Port are mapped thanks to an intuitive graphical representation
- Get a feeling of the trade-offs through a clear display of core information (addresses used, customers supported, service level)

[Visit Developer's Website](#) [Email Developer](#)

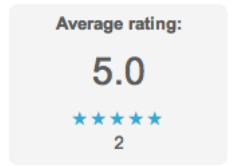
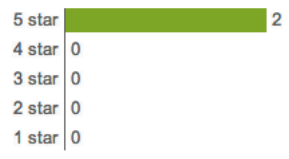
MORE

App Screenshots



User Reviews [Write a Review >](#)

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 Tweet

ABOUT THIS APP

RATING:
★★★★★ (2)

UPDATED:
June 20, 2012

CURRENT VERSION:
1.00

REQUIRES ANDROID:
4.0 and up

CATEGORY:
Tools

INSTALLS:
50 - 100

SIZE:
91k

PRICE:
Free

CONTENT RATING:
Everyone

iTunes Preview

What's New What is iTunes What's on iTunes iTunes Charts How To

Cisco MAP Calculator

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By Cisco

Open iTunes to buy and download apps.



[View In iTunes](#)

+ This app is designed for both iPhone and iPad

Free

Category: [Business](#)
Released: Sep 17, 2012
Version: 1.0
Size: 0.6 MB
Language: English
Seller: Cisco
© 2012 Cisco Systems, Inc.
All Rights Reserved.
[Rated 4+](#)

Requirements: Compatible with iPhone 3GS, iPhone 4, iPhone 4S, iPhone 5, iPod touch (3rd generation), iPod touch (4th generation), iPod touch (5th generation) and iPad. Requires iOS 5.1 or later.

Customer Ratings

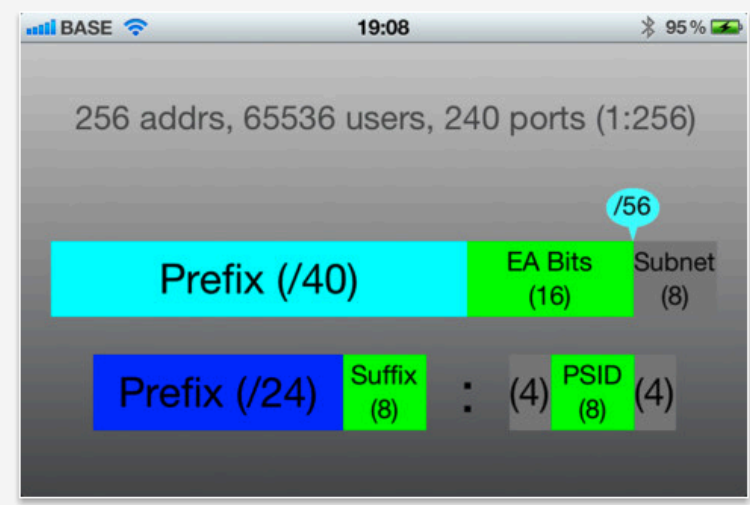
Description

MAP Calculator allows you to quickly visualize different layouts of the address space partitioning for the MAP port mapping algorithm

[Cisco MAP Calculator Support](#)

Screenshots

iPhone | iPad



Customer Reviews

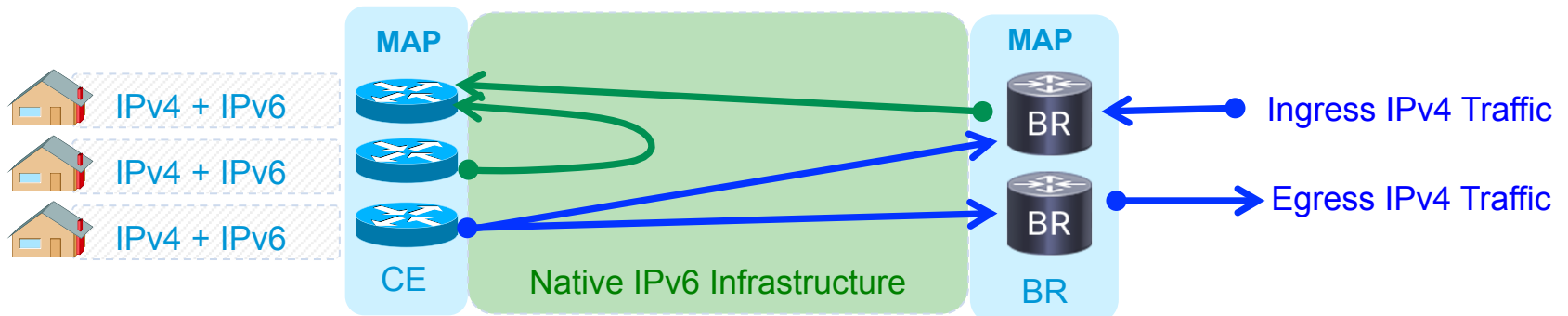
haji ★★★★★
by Haji Danger
good work

② Stateless Border Relays



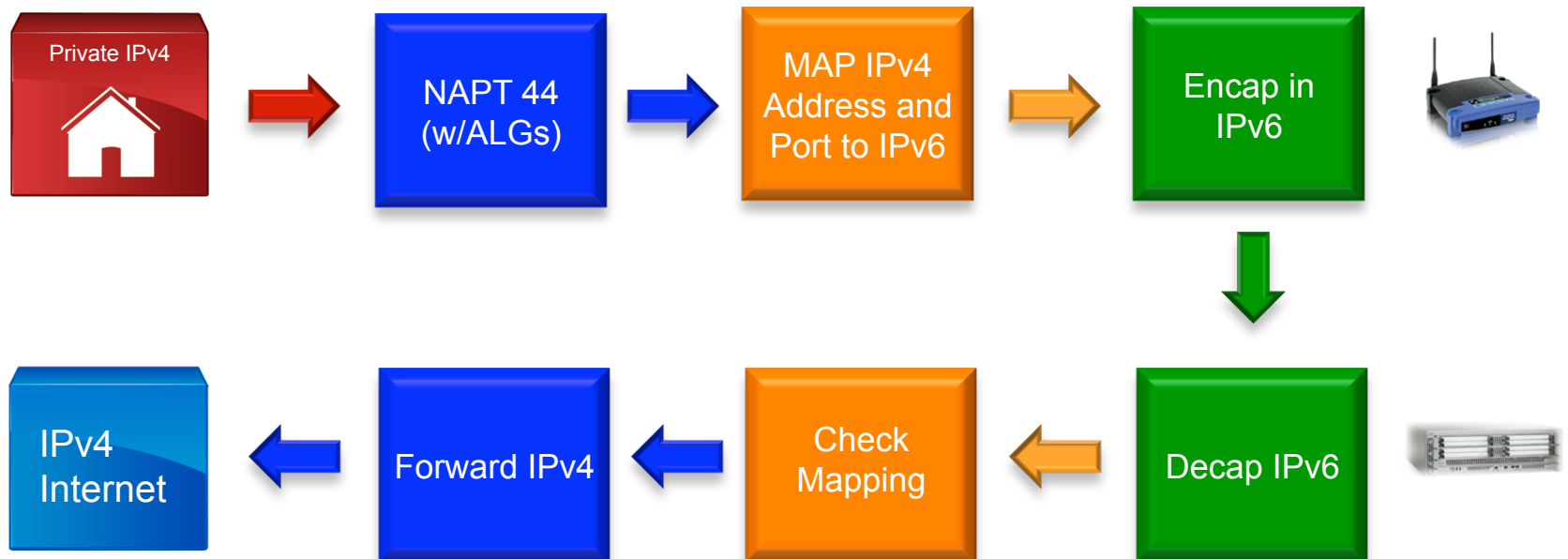
- Handle traffic to/from a given MAP domain
- Reachable via anycast, “built-in” load-balancing
- Each MAP rule is similar to a single LW46 entry, but MAP rules allow for aggregation
- Processed inline with normal IP traffic (at least on Cisco’s ASR9K)
- Scales according to traffic and number of rules only, not number of users or number of users per rule

③ Packet Flow and Forwarding

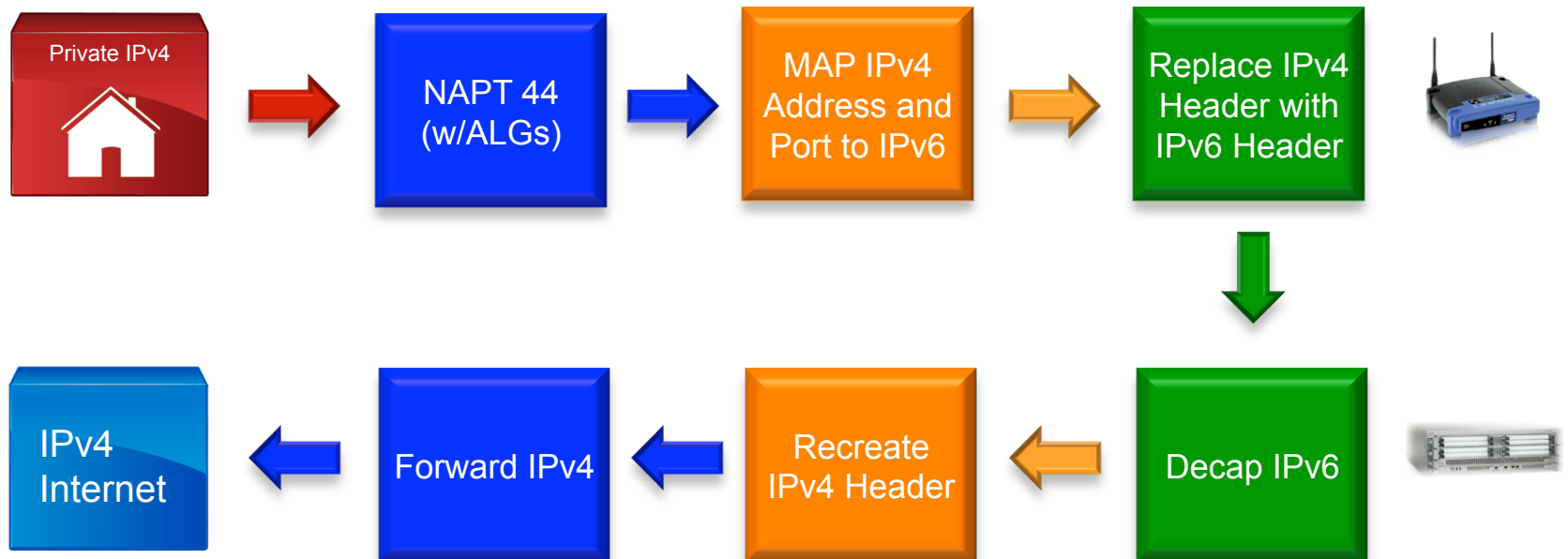


- IPv4 follows IPv6 routing within a domain (traffic destined to another subscriber does not traverse the BR)
- All other traffic sent via anycast to any MAP BR
- Forwarding is handled either by double translation (MAP-T) or encapsulation (MAP-E)

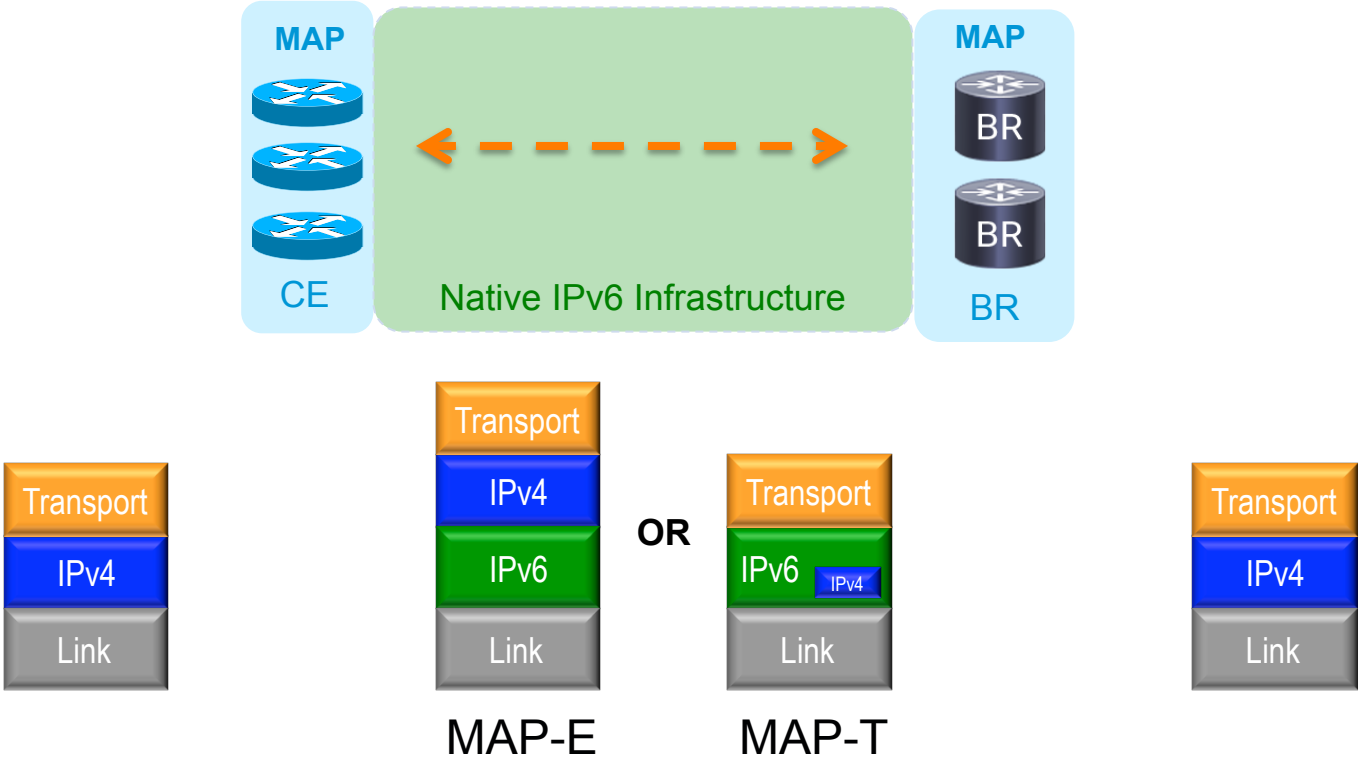
Forwarding (Encapsulation, MAP-E)



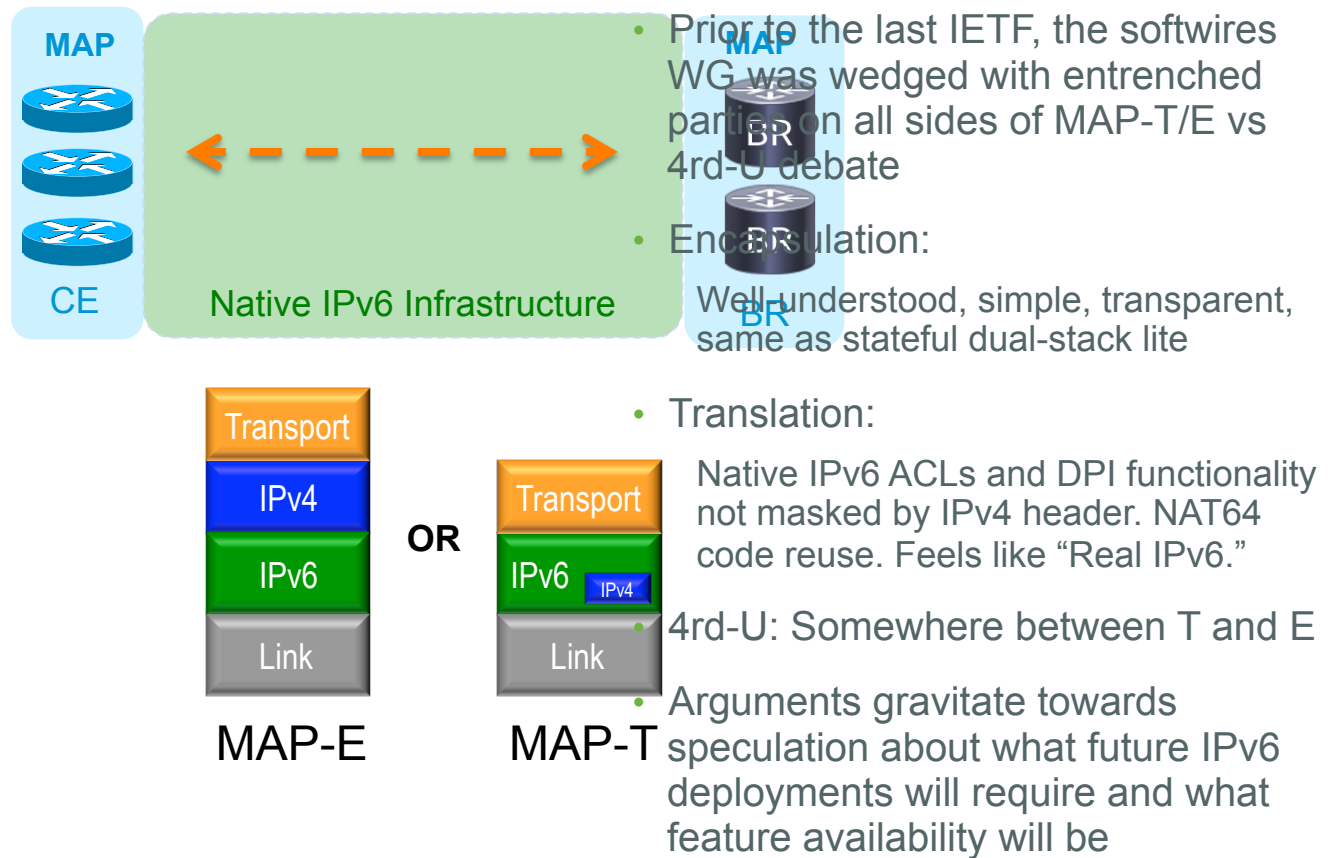
Forwarding (Translation, MAP-T)



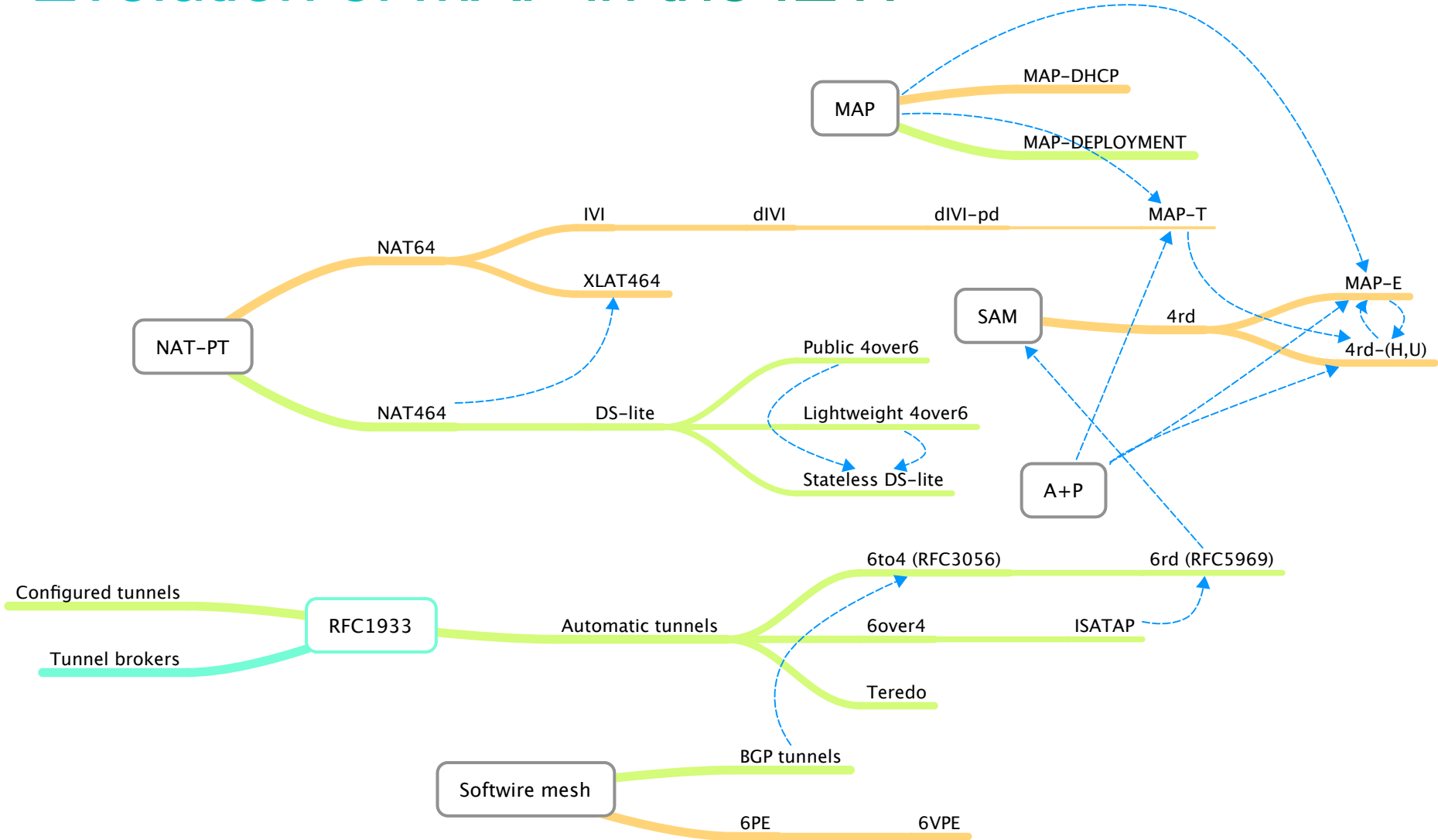
Encapsulation or Translation – Boils down to 20 bytes



Encapsulation or Translation – Boils down to 20 bytes



Evolution of MAP in the IETF



“MAP” or “MAP-T and MAP-E” ?



Standardizing MAP

- MAP-E will be published as a Standards Track RFC
- MAP-T and 4rd will likely be published as Experimental or Informational (TBD)
- There have been various interop tests from multiple vendors**

**Cisco has ASR1K, ASR9K, and Linksys MAP demonstration code available for you to see, and will begin shipping by the end of this year)

In Sum:

- You must have deployed IPv6 to use any of this
- MAP has very attractive scaling properties vs. DS-Lite or LW46
- The IETF has converged on a single Standards Track solution (MAP-E), commercial products are arriving now

