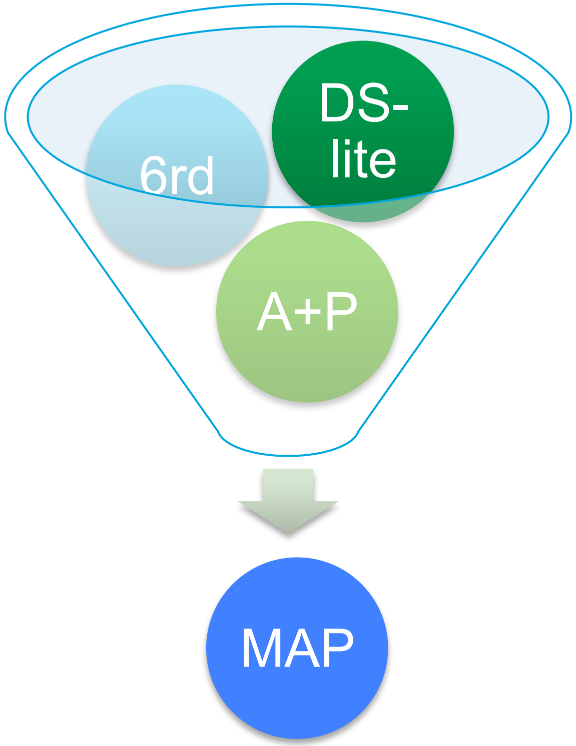
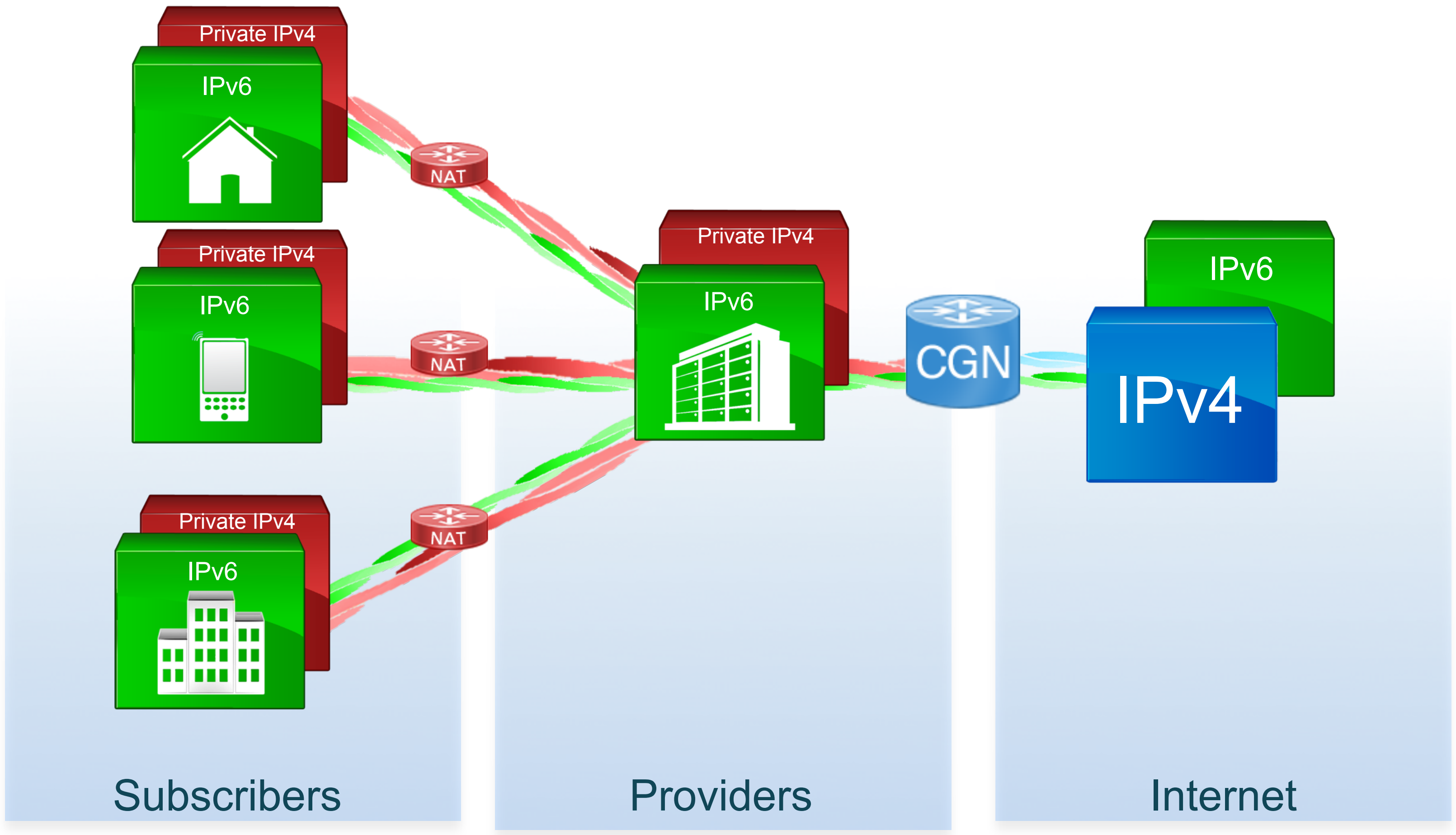
Mapping Address + Port



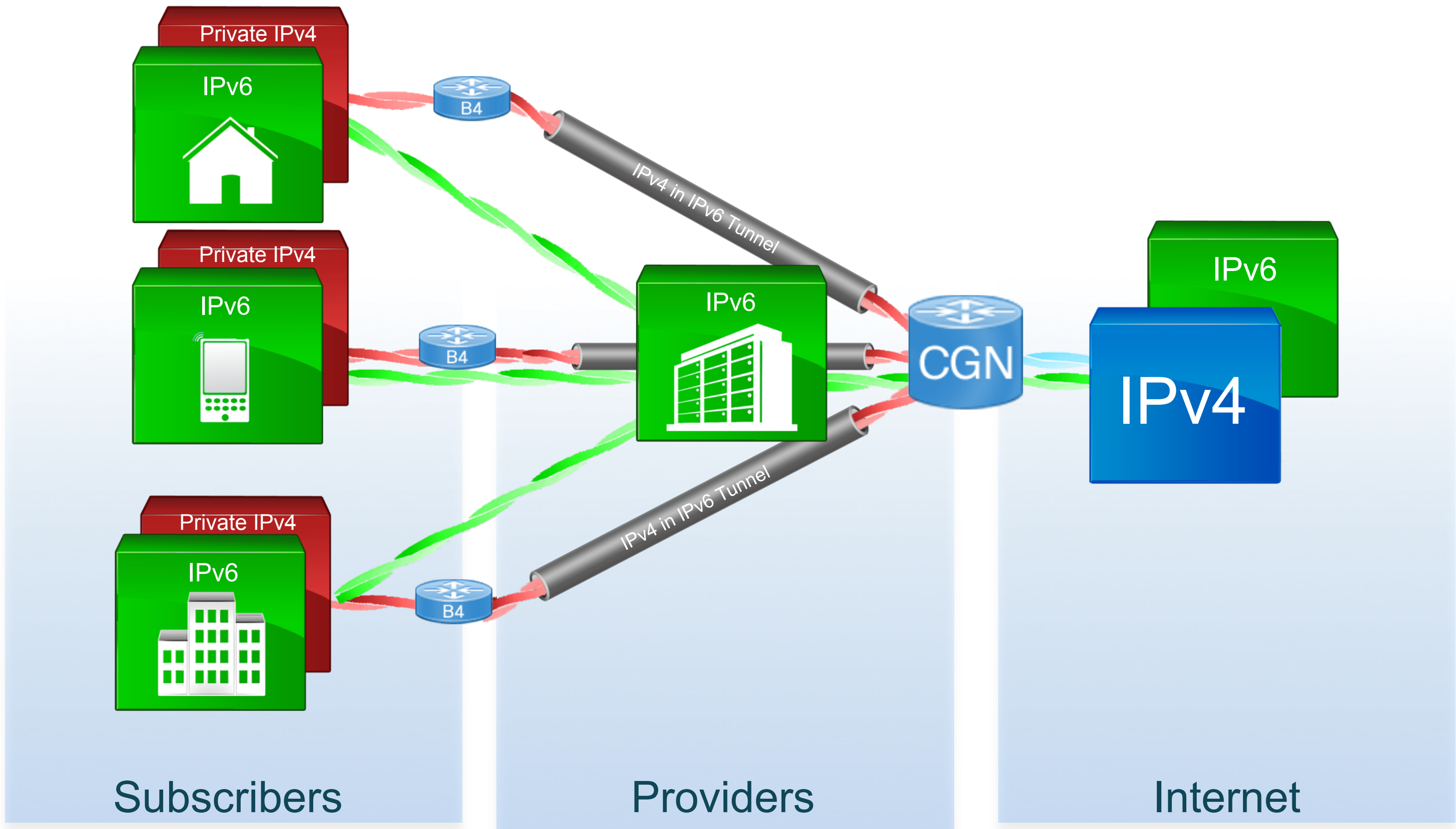
Mark Townsley, Cisco Fellow

Swiss Network Operators Group, May 2012

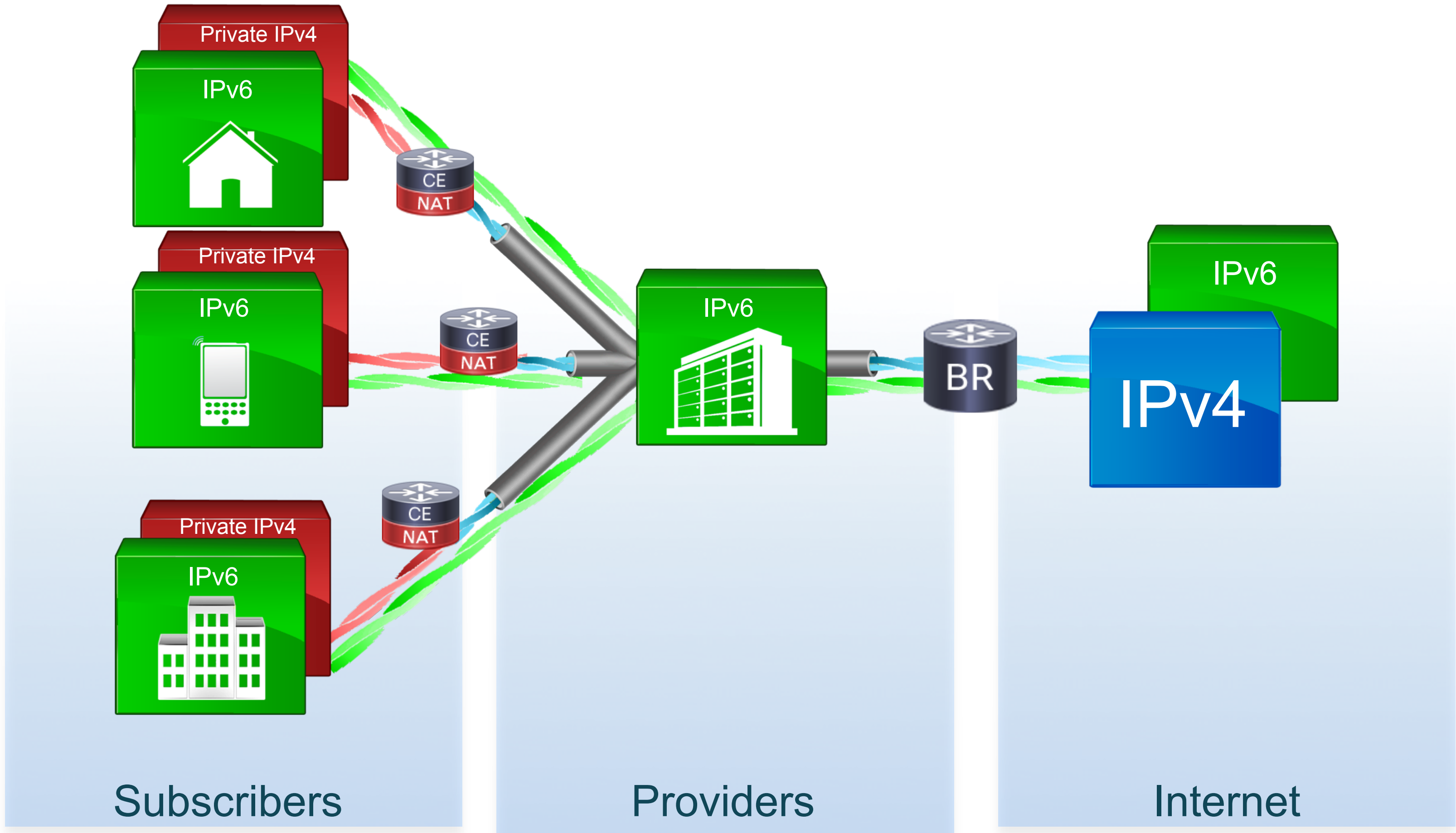
IPv4 via Dual-Stack and NAT444



IPv4 via Dual Stack Lite (DS-Lite)



IPv4 via Mapping Address + Port (MAP)



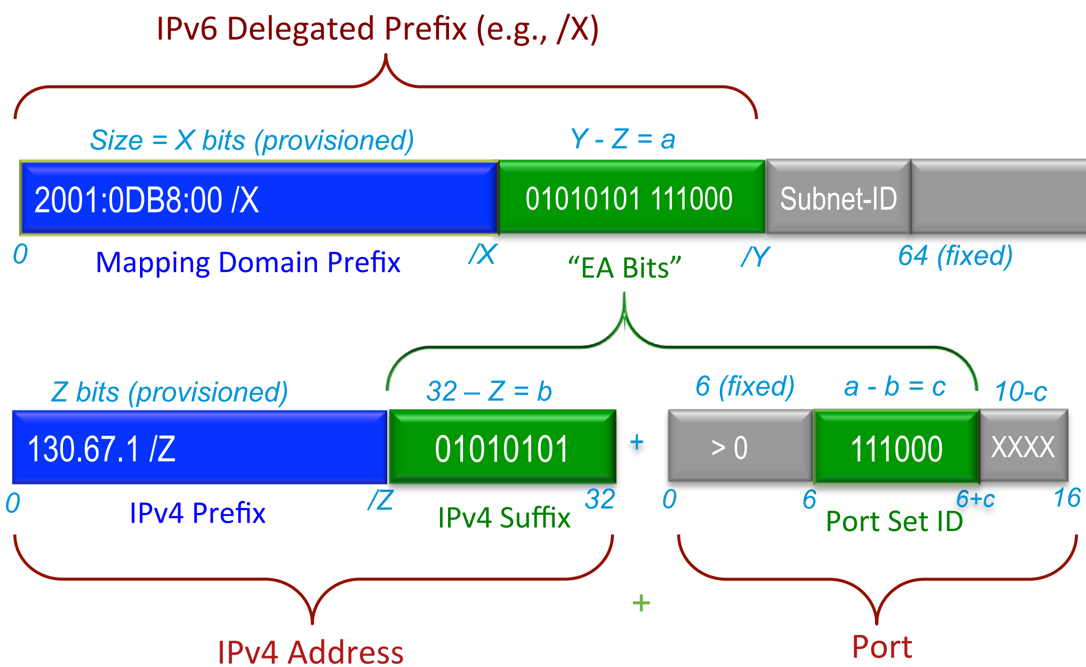
MAP Deep Dive:

① IPv6 to IPv4+Port Mapping (Tool Demo!)

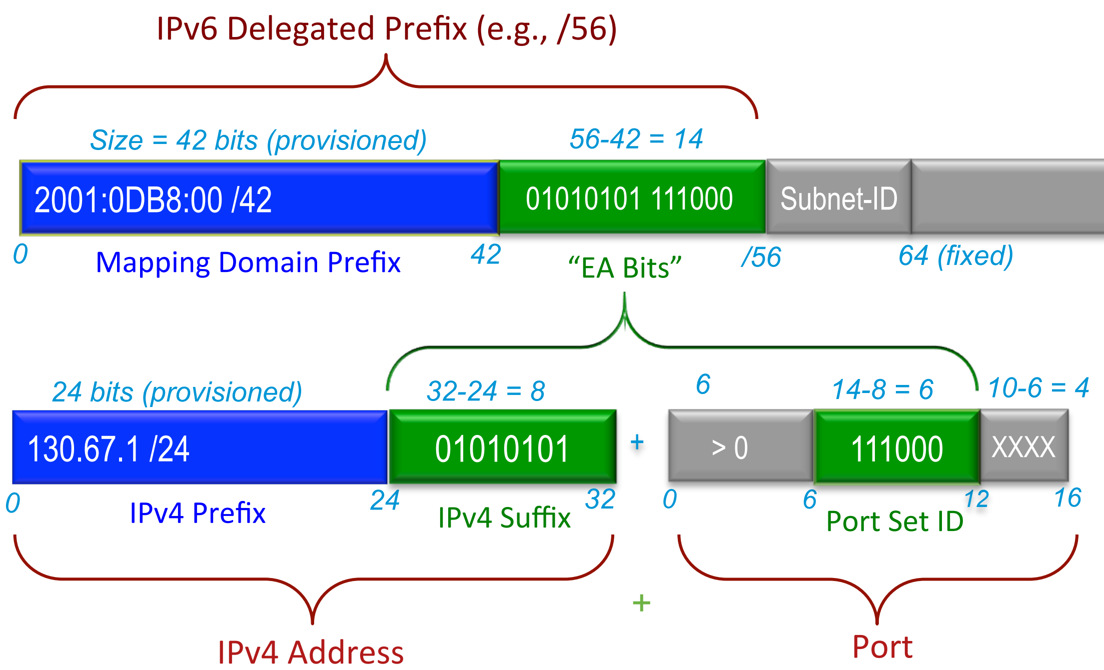
② Encapsulation and Packet Flow

③ Stateless Border Relays

① IPv6 → IPv4 + Port Mapping



① IPv6 → IPv4 + Port Mapping



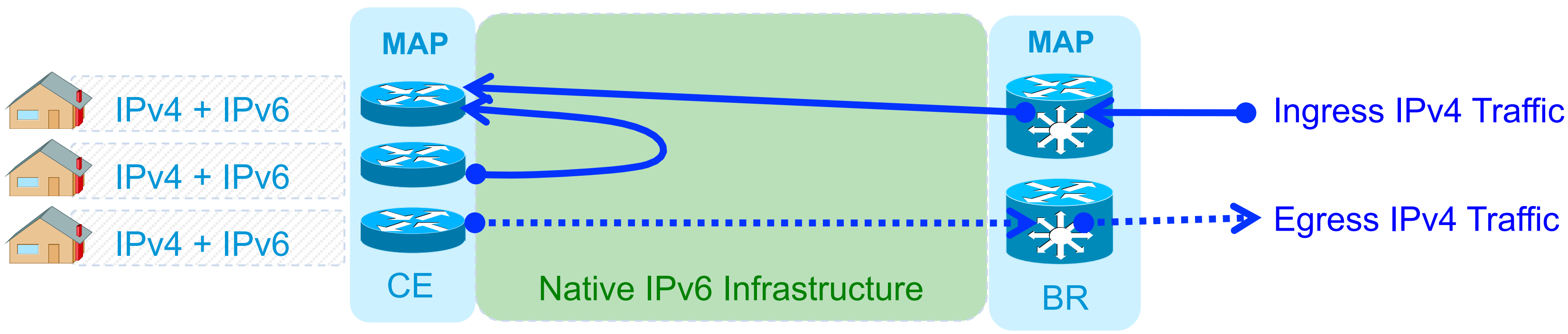
For <u>this</u> Example…

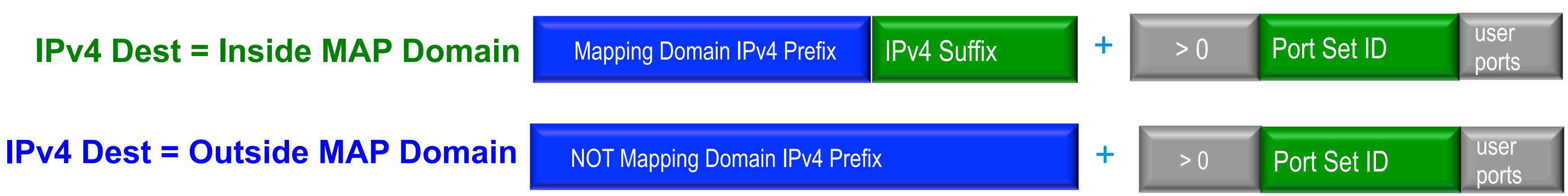
2^6=64 port sets per IPv4 Address

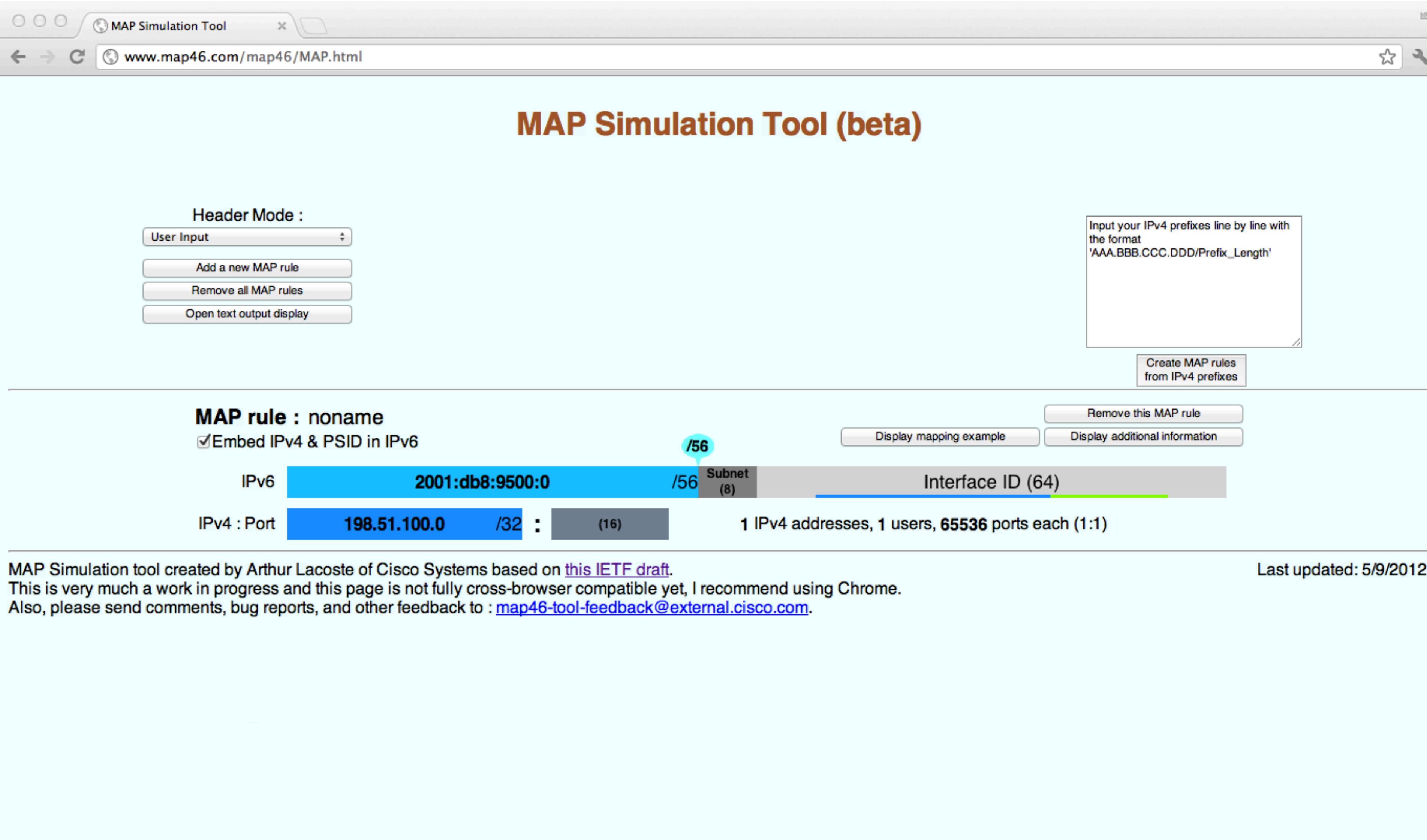
Ports 0-1023 skipped, each CPE gets $2^{16}/2^6 - 2^4 = 1008$ ports

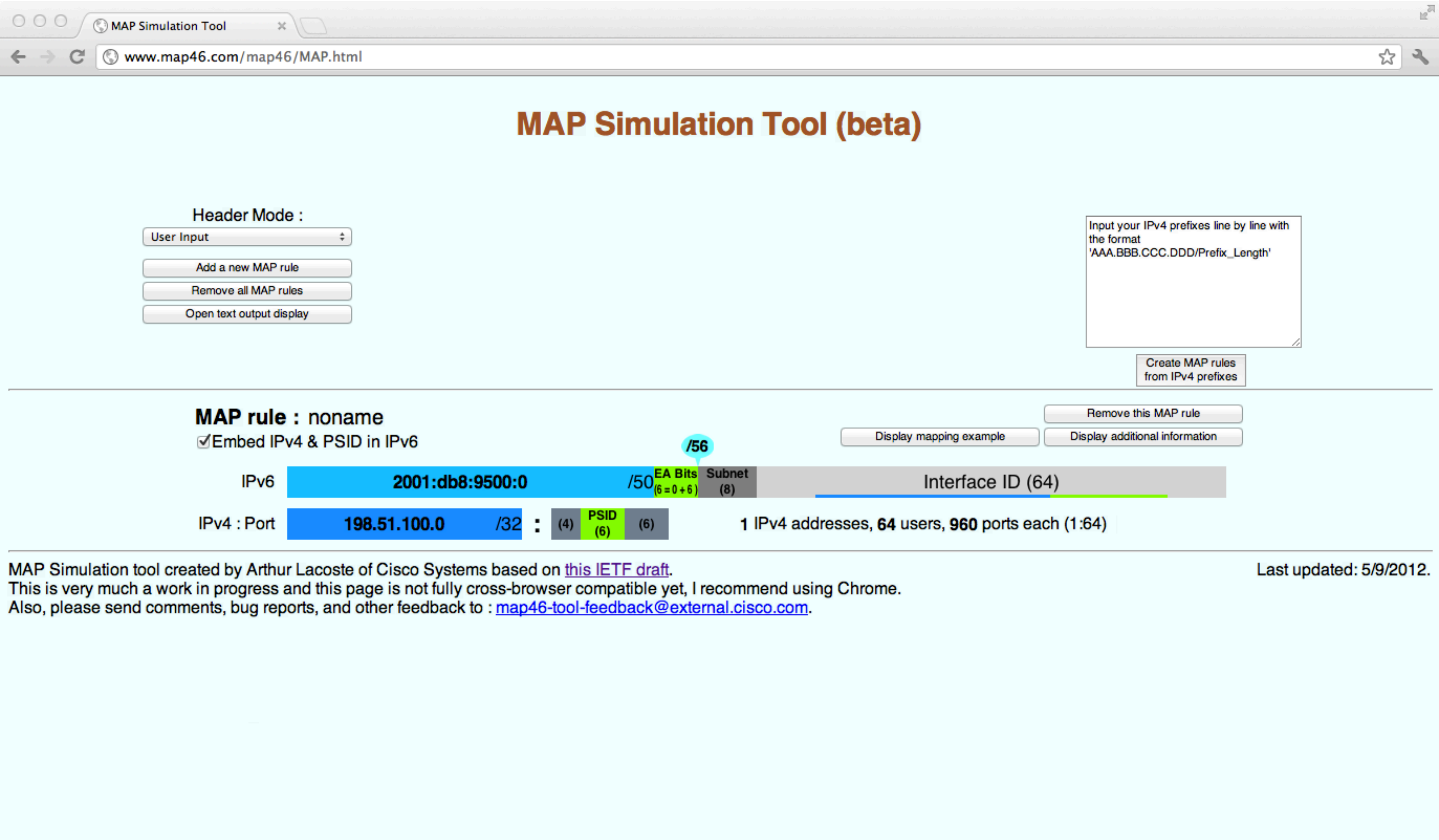
One IPv4 /24 serves $2^{(6+8)} \approx 16,384$ (vs.≈256) subscribers

② Encapsulation and Packet Flow






MAP Simulation Tool
www.map46.com/map46/MAP.html
MAP Simulation Tool (beta)
Header Mode :
User Input
Add a new MAP rule
Remove all MAP rules
Open text output display
Input your IPv4 prefixes line by line with the format 'AAA.BBB.CCC.DDD/Prefix_Length'
Create MAP rules from IPv4 prefixes
MAP rule : noname
Embed IPv4 & PSID in IPv6
Remove this MAP rule
Display mapping example
Display additional information
/56
IPv6
2001:db8:9500:0
/56
Subnet (8)
Interface ID (64)
IPv4 : Port
198.51.100.0
/32
:
(16)
1 IPv4 addresses, 1 users, 65536 ports each (1:1)
MAP Simulation tool created by Arthur Lacoste of Cisco Systems based on this IETF draft.
Last updated: 5/9/2012.
This is very much a work in progress and this page is not fully cross-browser compatible yet, I recommend using Chrome.
Also, please send comments, bug reports, and other feedback to : map46-tool-feedback@external.cisco.com.



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Create MAP rules from IPv4 prefixes
MAP rule : noname
Embed IPv4 & PSID in IPv6
Remove this MAP rule
Display mapping example
Display additional information
/56
IPv6
2001:db8:9500:0
/50
EA Bits (6=0+6)
Subnet (8)
Interface ID (64)
IPv4 : Port
198.51.100.0
/32
:
(4)
PSID (6)
(6)
1 IPv4 addresses, 64 users, 960 ports each (1:64)
MAP Simulation tool created by Arthur Lacoste of Cisco Systems based on this IETF draft.
Last updated: 5/9/2012.
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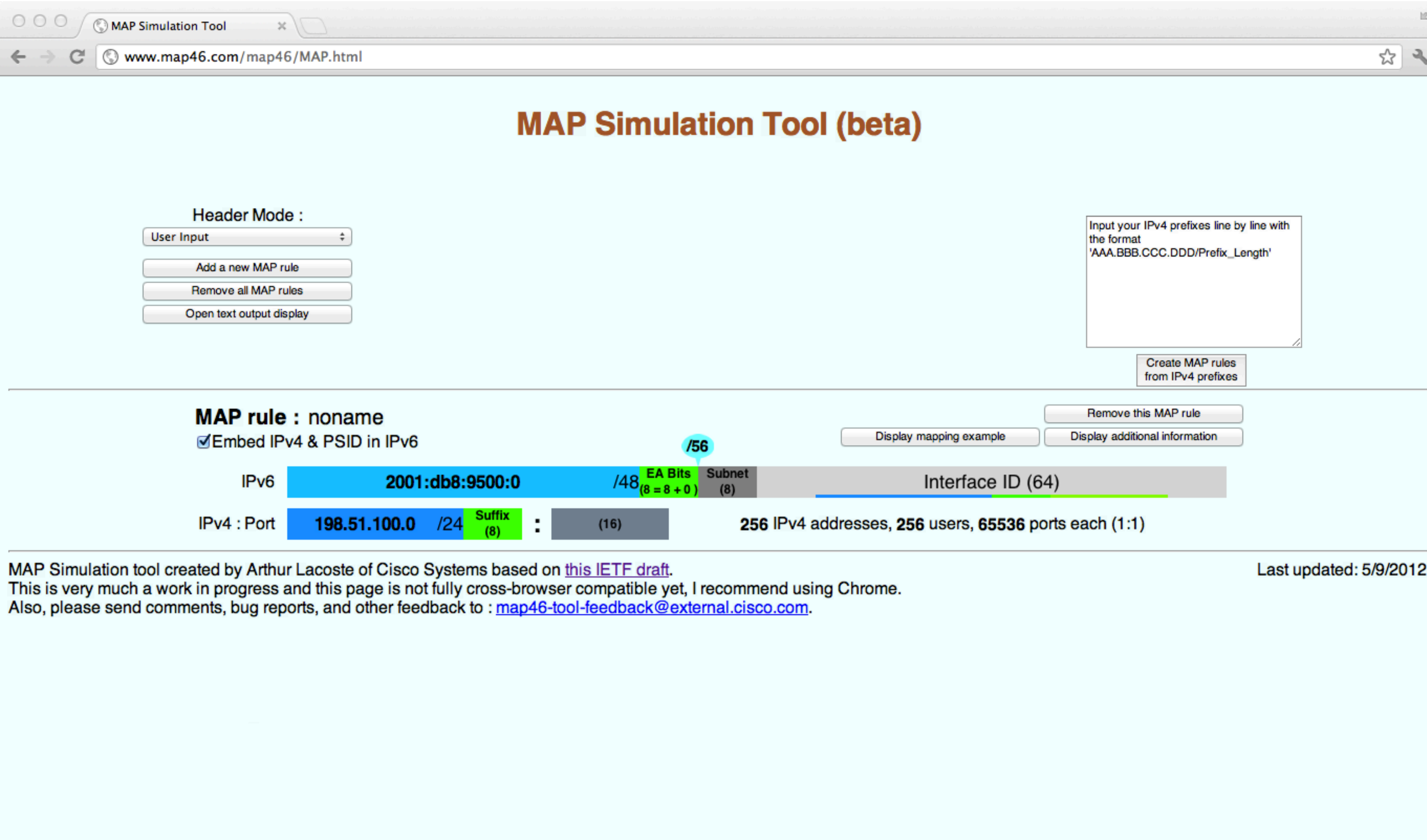
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www.map46.com/map46/MAP.html
MAP Simulation Tool (beta)
Header Mode :
User Input
Add a new MAP rule
Remove all MAP rules
Open text output display
Input your IPv4 prefixes line by line with the format 'AAA.BBB.CCC.DDD/Prefix_Length'
Create MAP rules from IPv4 prefixes
MAP rule : noname
Embed IPv4 & PSID in IPv6
Remove this MAP rule
Display mapping example
Display additional information
/56
IPv6
2001:db8:9500:0
/48
EA Bits (8 = 8 + 0)
Subnet (8)
Interface ID (64)
IPv4 : Port
198.51.100.0
/24
Suffix (8)
:
(16)
256 IPv4 addresses, 256 users, 65536 ports each (1:1)
MAP Simulation tool created by Arthur Lacoste of Cisco Systems based on this IETF draft.
This is very much a work in progress and this page is not fully cross-browser compatible yet, I recommend using Chrome.
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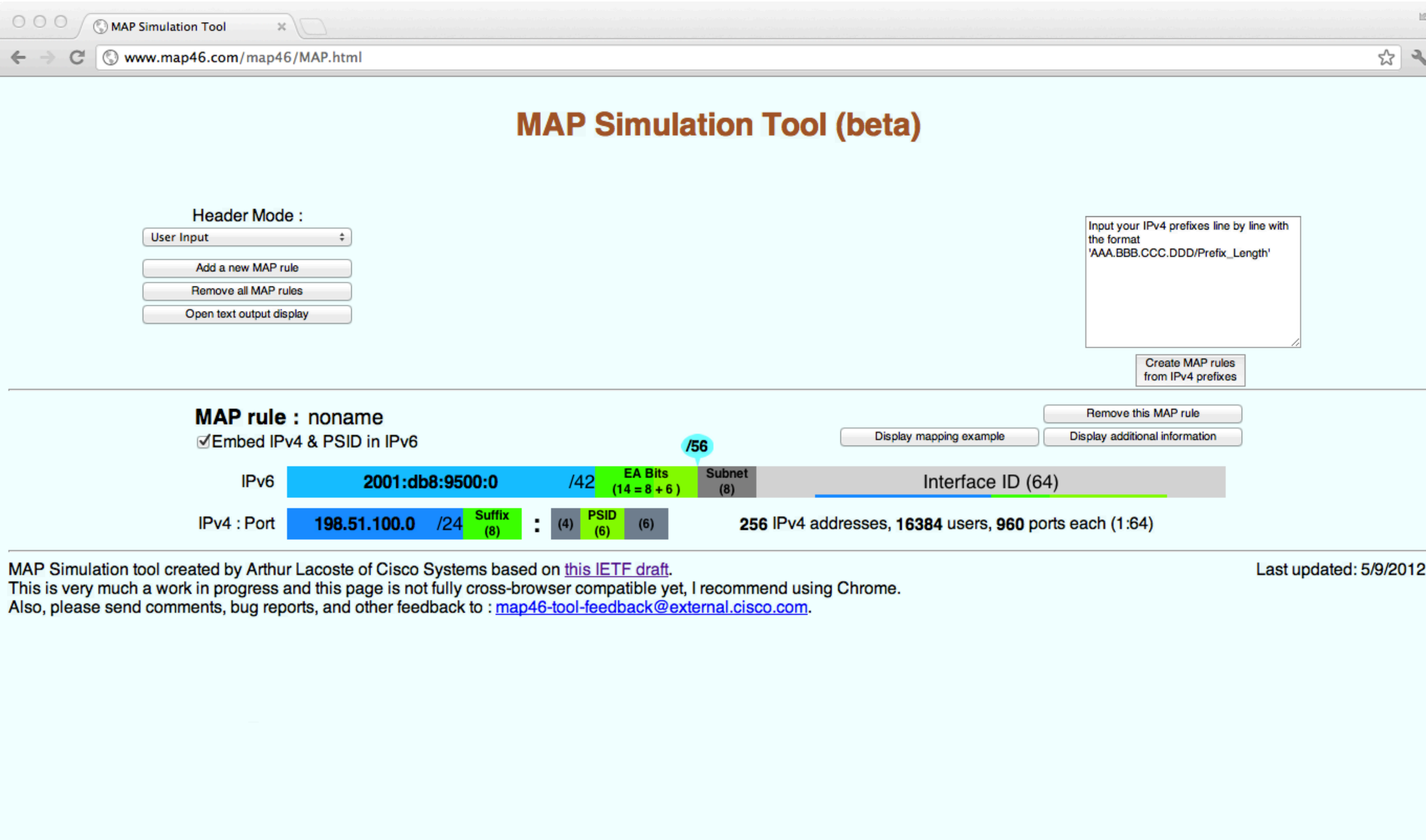
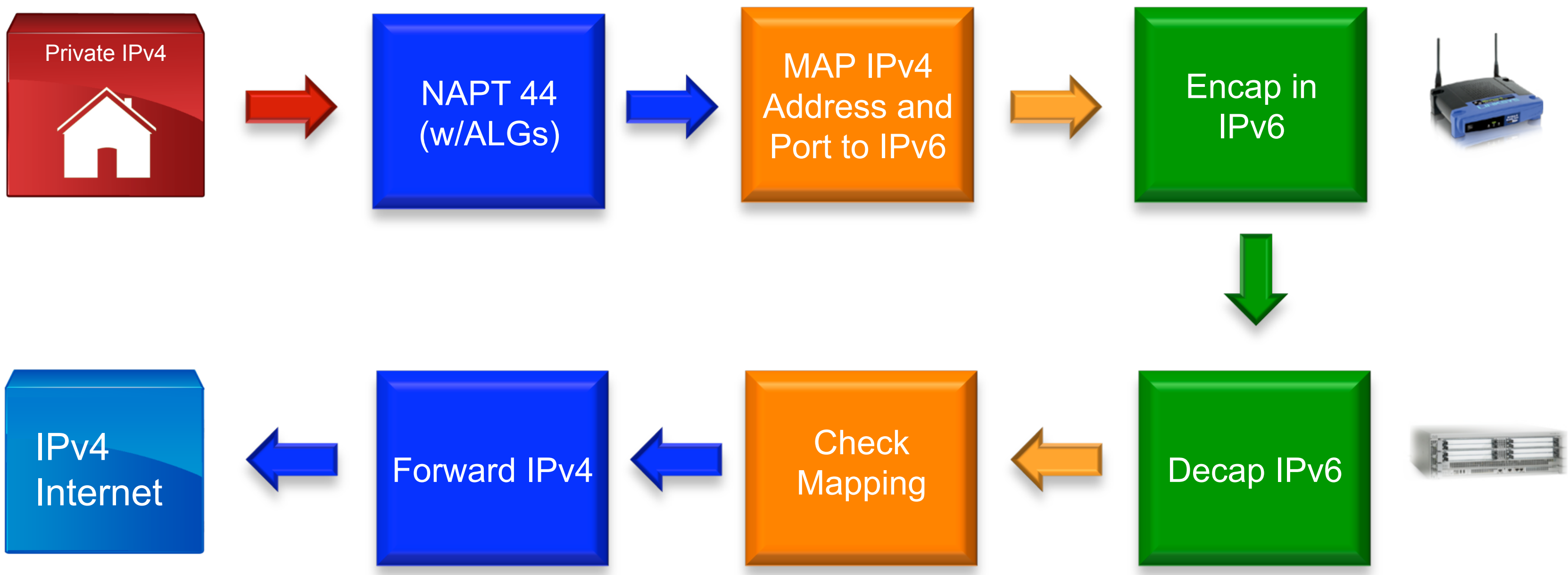
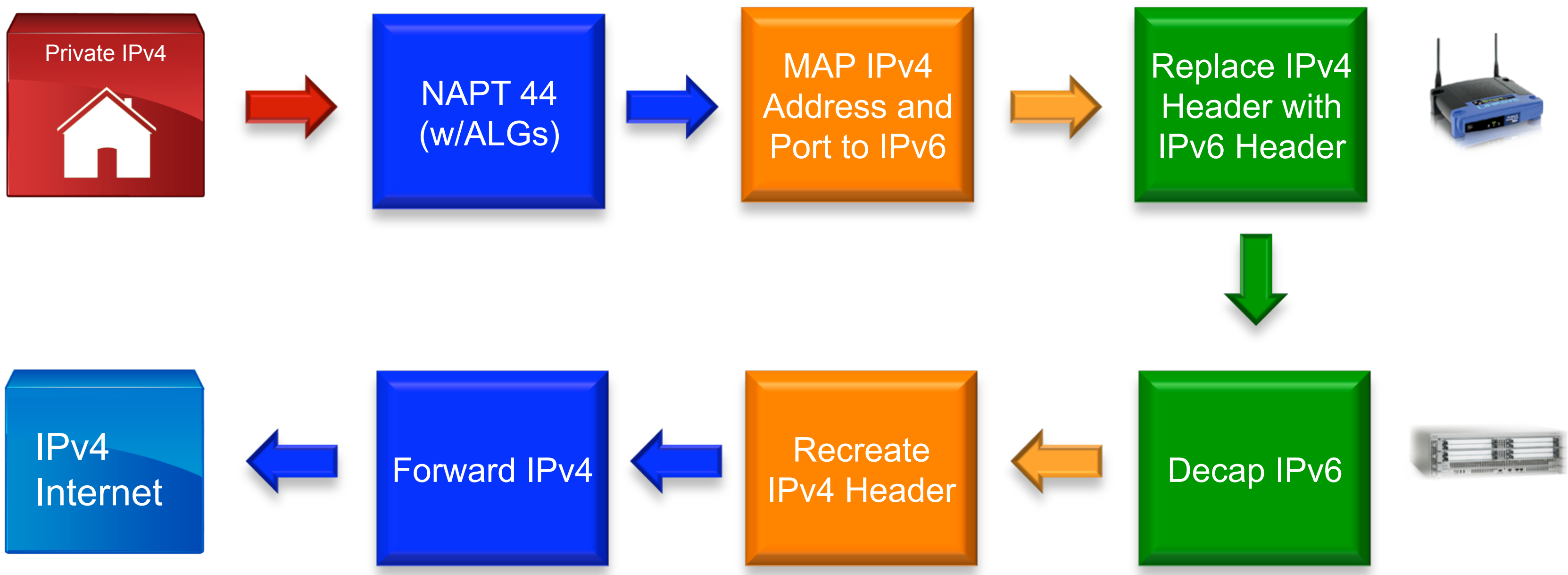

MAP Simulation Tool
www.map46.com/map46/MAP.html
MAP Simulation Tool (beta)
Header Mode :
User Input
Add a new MAP rule
Remove all MAP rules
Open text output display
Input your IPv4 prefixes line by line with the format 'AAA.BBB.CCC.DDD/Prefix_Length'
Create MAP rules from IPv4 prefixes
MAP rule : noname
Embed IPv4 & PSID in IPv6
Remove this MAP rule
Display mapping example
Display additional information
/56
IPv6
2001:db8:9500:0
/42
EA Bits (14 = 8 + 6)
Subnet (8)
Interface ID (64)
IPv4 : Port
198.51.100.0
/24
Suffix (8)
:
(4)
PSID (6)
(6)
256 IPv4 addresses, 16384 users, 960 ports each (1:64)
MAP Simulation tool created by Arthur Lacoste of Cisco Systems based on this IETF draft.
Last updated: 5/9/2012.
This is very much a work in progress and this page is not fully cross-browser compatible yet, I recommend using Chrome.
Also, please send comments, bug reports, and other feedback to : map46-tool-feedback@external.cisco.com.

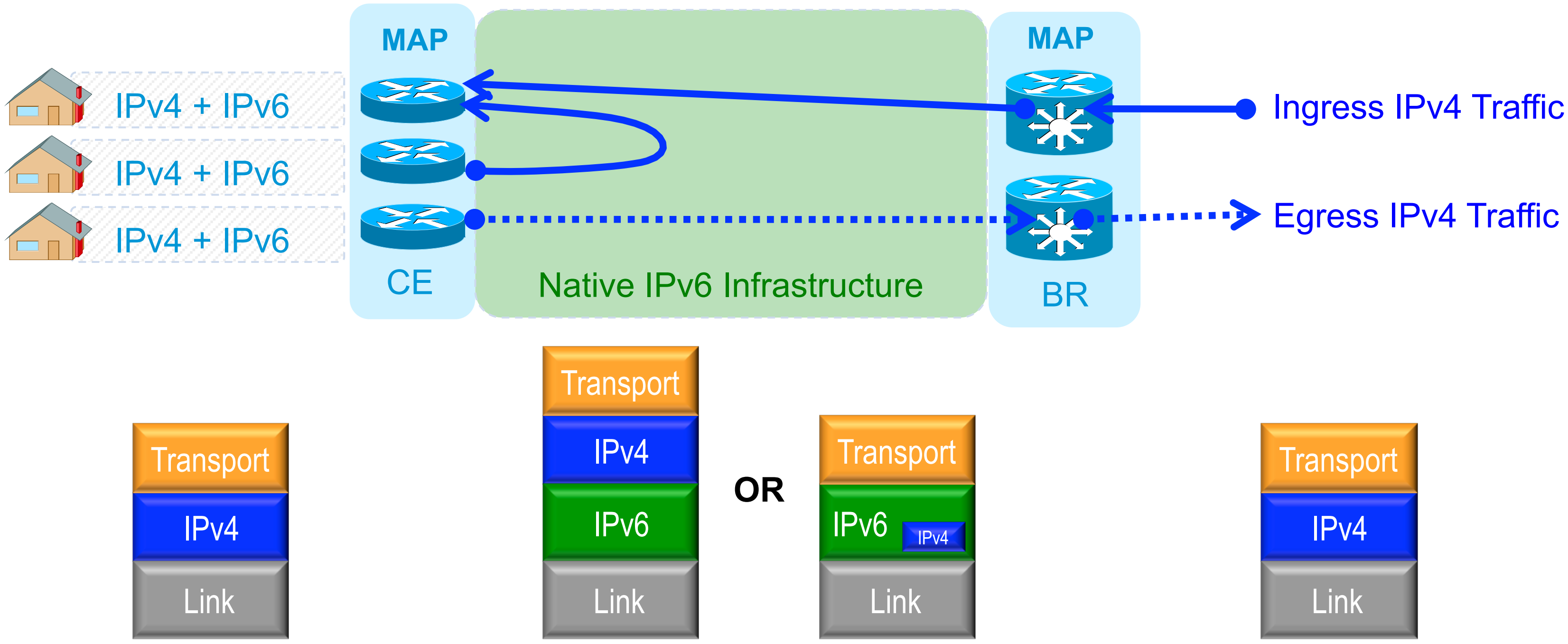
Forwarding (Encapsulation, MAP-E)



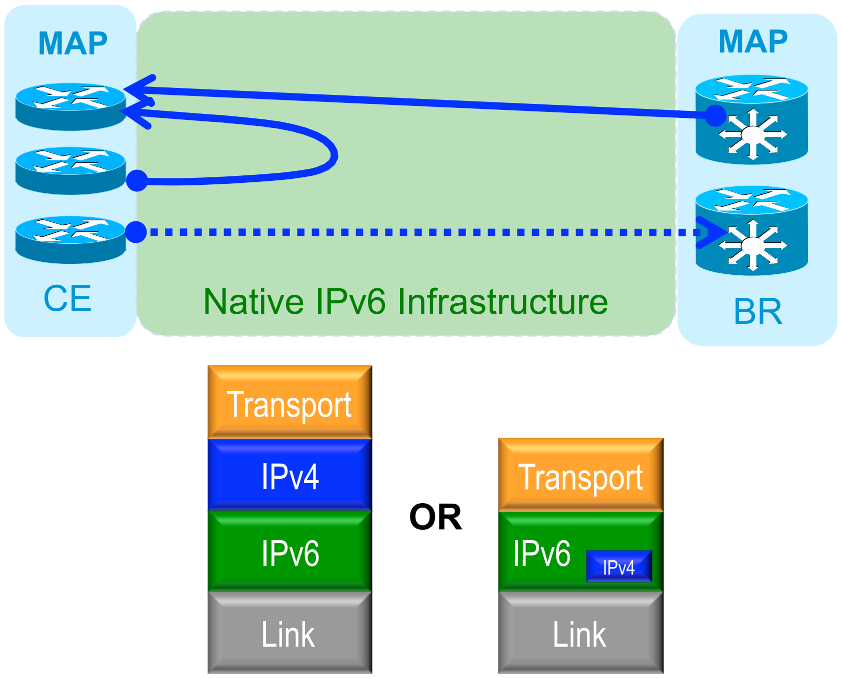
Forwarding (Translation, MAP-T)



Encapsulation or Translation – Boils down to 20 bytes



Encapsulation or Translation – Boils down to 20 bytes



- Parties are entrenched on both sides of MAP-T/E vs 4rd-U debate
- Encapsulation:

  Well-understood, simple, transparent, same as stateful dual-stack lite

- Translation:

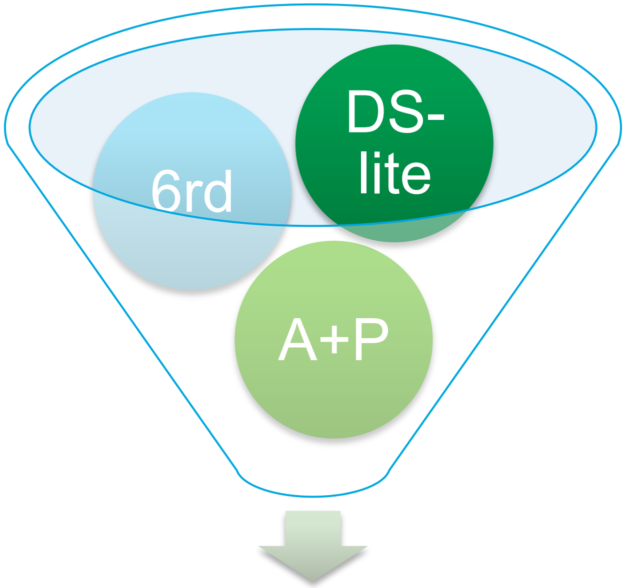
  Native IPv6 ACLs and DPI functionality not masked by IPv4 header. NAT64 code reuse. Feels like “Real IPv6.”

- 4rd-U: Somewhere between T and E
- Arguments gravitate towards speculation about what future IPv6 deployments will require and what feature availability will be

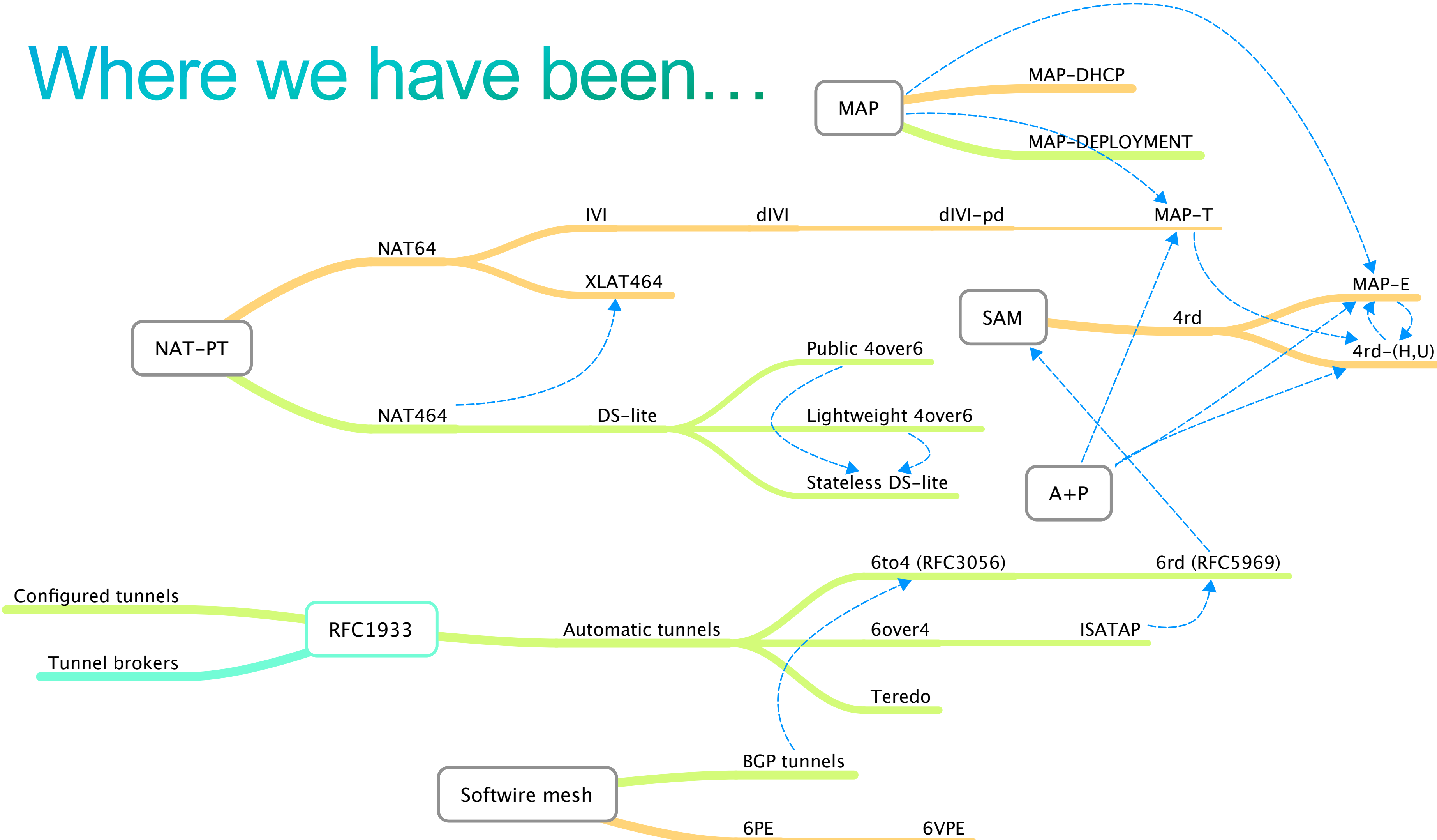
③Stateless Border Relays

- Handle traffic to/from a given MAP domain
- 1 or many mapping rules per domain, statically configured
- Reachable via anycast, “built-in” load-balancing
- Scales according to traffic and number of rules only, not number of users or number of users per rule

So Where Are We Headed With All This?



Where we have been…



MAP – Where we are going…

- In IETF, narrowed to two competing solutions "MAP" (with E and T variants) and 4rd-U
- Cautiously optimistic that the IETF will choose a path to produce a standards-track RFC for one or both of these by the end of 2012
- Cisco has ASR9K and Linksys MAP demonstration code available for you to see, final products on the way (at this rate, faster than the IETF will produce an RFC)

In Sum:

- This presentation was not about IPv6 deployment, but about IPv4 as a service over IPv6
- You must have deployed IPv6 to use any of this
- MAP solutions are proving to have very attractive scaling properties, in particular vs. NAT444 or DS-Lite
- 4rd, dIVI, MAP-T, MAP-E, 4rd-U, etc. have largely the same functionality, disagreements are over details in the big picture
- Convergence on a single RFC remains challenging, products are arriving nonetheless

Thank you.