

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

JUNIPER NETWORKS, INC.,
Petitioner,

v.

MONARCH NETWORKING SOLUTIONS LLC,
Patent Owner.

U.S. Patent No. 8,451,845

“Method of Receiving a Data Packet in an IPv6 Domain, an Associated Device and
an Associated Home Gateway”

IPR2024-00565

PETITION FOR *INTER PARTES* REVIEW

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EX1013	P. Richter et al., “A Primer on IPv4 Scarcity” (Feb. 27, 2015), available at https://arxiv.org/pdf/1411.2649.pdf
EX1014	U.S. Patent Application Publication No. 2006/0146870 to Harvey et al. (“Harvey”)
EX1015	RFC 2460, “Internet Protocol, Version 6 Specification” (Dec. 1998), available at https://datatracker.ietf.org/doc/html/rfc2460
EX1016	RFC 1884, “IP Version 6 Addressing Architecture” (Dec. 1995), available at https://datatracker.ietf.org/doc/html/rfc1884

EX1017	RFC 3587, “IPv6 Global Unicast Address Format” (Aug. 2003), available at https://www.rfc-editor.org/rfc/pdf/rfc3587.txt.pdf
EX1018	Pete Loshin, “IPv6: Theory, Protocol, and Practice” (2d Ed. 2004)
EX1019	U.S. Patent No. 7,391,768 to Samprathi et al. (“Samprathi”)
EX1020	T. Rooney, “IPv4-to-IPv6 Transition Strategies,” INS (Feb. 2007), available at https://www.hpc.mil/images/hpcdocs/ipv6/migration_white_paper_1e5eb697-e7d7-4f62-9452-0121aa0ff0f1.pdf
EX1021	H. Yeom et al., “IP Multiplexing by Transparent Port-Address Translator,” 10th USENIX System Administration Conference (LISA X) (Sept. 29, 1996), available at https://www.usenix.org/conference/lisa-96/ip-multiplexing-transparent-port-address-translator
EX1022	A. Reitz, “The Dynamic Port Reservation Protocol,” Univ. Ill. at Urbana-Champaign (2001), available at http://redefine.dyndns.org/~andyr/documents_and_writings/thesis/docs/areitz_msthesis.pdf
EX1023	Y. Zhu et al., “Stateless Mapping and Multiplexing of IPv4 Addresses in Migration to IPv6 Internet,” Institute of Electrical and Electronics Engineers (“IEEE”) (Nov. 2008), available at https://ieeexplore.ieee.org/document/4698208
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	2008), available at https://www.ietf.org/proceedings/72/slides/behave-5.pdf (“IVI Presentation”)
EX1029	R. Bush et al., “A Better Approach than Carrier-Grade-NAT,” Columbia Univ. (Sept. 2008), available at https://academiccommons.columbia.edu/doi/10.7916/D89S1ZWC
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EX1032	C. Huitema, “Teredo: Tunneling IPv6 over UDP Through NATs,” Internet Engineering Task Force (“IETF”) (February 2006), available at https://datatracker.ietf.org/doc/html/rfc4380
EX1033	Petition for <i>Inter Partes</i> Review, <i>Cisco Sys., Inc. v. Monarch Networking Sol’ns LLC</i> , IPR2020-01679, Paper 2 (PTAB Oct. 1, 2020)
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EX1037	X. Li et al., “Forwarding IPv4 Traffics in Pure IPv6 Backbone with Stateless Address Mapping,” IEEE (Apr. 2006), available at https://ieeexplore.ieee.org/document/1687557 (“Li”)
EX1038	X. Li, “Bi-directional Address Borrowing (IVI),” IETF (June 21, 2008) (“Li-2”)
EX1039	Certified Translation of CN Patent No. 1525699 to Wu et al. (“Wu”)
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EX1041	R. Bush, “IPv4 / IPv6 Coexistence Mechanisms” (Oct. 26, 2008)
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EX1051	Correspondence from lowekamp@sipeerior.com (Nov. 14, 2007), available at https://mailarchive.ietf.org/arch/msg/sipping/70F4vroEAckioD214LTt2FJpInk/

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EX1054	Correspondence from andrew.dolganow@alcatel-lucent.com (Feb. 11, 2008), available at https://mailarchive.ietf.org/arch/msg/pwe3/ceWfUIVFI-tMV-l_ueo7HcNCums/
EX1055	Correspondence from victor.pascual.avila@gmail.com (Feb. 23, 2008), available at https://mailarchive.ietf.org/arch/msg/p2psip/P71OF43ons3EYw7UKg0_u3M_tww/
EX1056	October 8, 2006 Capture of IETF Datatracker, available at https://web.archive.org/web/20061008141652/https://datatracker.ietf.org/public/pidtracker.cgi
EX1057	US Patent No. 7,752,334 B2 to Paunikar; filed October 15, 2002, published April 15, 2004 (“Paunikar”)
EX1058	Trevor J. Baumgartner et al., Implementation of A Network Address Translation Mechanism Over IPv6 (June 2004)
EX1059	Andrew S. Tanenbaum, Computer Networks (4 th Ed. 2003)
EX1060	RFC 1919, Classical versus Transparent IP Proxies (March 1996), available at https://datatracker.ietf.org/doc/html/rfc1919
EX1061	Unified EPR (Control No. 90/019,246), filed on September 8, 2023
EX1062	RFC 1631, “The IP Network Address Translator (NAT)” (1994), available at https://datatracker.ietf.org/doc/html/rfc1631
EX1063	RFC 3022 (Traditional NAT), dated January 2001, available at

	https://datatracker.ietf.org/doc/html/rfc3022
EX1064	M. Wasserman, “IPv6-to-IPv6 Network Address Translation (NAT66),” (October 2008), available at https://www.ietf.org/archive/id/draft-mrw-behave-nat66-00.txt
EX1065	https://ipinfo.io/AS24348
EX1066	https://ipinfo.io/AS24349

LIST OF CLAIMS

Claim	Limitation
1[pre]	A method of receiving an IPv6 data packet in an IPv6 domain connected to an IPv4 domain, said packet comprising an IPv6 destination address and an IPv6 source address, said method being executed in a home gateway adapted to connect a user terminal to said IPv6 domain, and comprising the following steps:
1[a]	identifying an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address and a destination port number
1[b]	if necessary, regularizing at least one of the IPv6 source address and the IPv6 destination address of the data packet by replacing said at least one IPv6 address, the replacement process belonging to a group comprising replacement of a constructed address with a native address and replacement of a native address with a constructed address, and modifying the data packet using the regularized address; and
1[c]	routing the modified data packet to its destination.
5[pre]	The method according to claim 1, wherein when the data packet comes from the IPv4 domain and goes to said user terminal, the step of regularizing the destination address comprises the following steps:
5[a]	searching an address translation table of the gateway for an entry associating with said constructed destination address a native destination address;
5[b]	if an entry is found, replacing the constructed destination address of the data packet with the native destination address from that entry.
6	The method according to claim 5, further comprising a step of verifying that the destination port number of the data packet and the destination port number contained in the constructed destination address match.

Claim	Limitation
7	A non-transitory computer program product that is at least one of downloadable from a communications network and stored on a computer-readable medium and executable by a microprocessor, comprising program code instructions for executing the method according to claim 1 of receiving a data packet in an IPv6 domain.
8[pre]	A device for receiving an IPv6 data packet in an IPv6 domain connected to an IPv4 domain, said packet comprising an IPv6 destination address and an IPv6 source address, said device for use in a home gateway adapted to connect a user terminal to said IPv6 domain, comprising:
8[a]	means for identifying an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number;
8[b]	means for regularizing, if necessary, at least one of the IPv6 source address and the IPv6 destination address of the data packet by replacing said at least one IPv6 address, the replacement process belonging to a group comprising replacement of a constructed address with a native address and replacement of a native address with a constructed address, and modifying the data packet using the regularized address; and
8[c]	means for routing the modified data packet to its destination.

I. INTRODUCTION

Juniper Networks, Inc. (“Petitioner”) requests IPR of claims 1 and 5-8 (“Challenged Claims”) of U.S. Patent No. 8,451,845 (the “’845 patent”).¹

II. MANDATORY NOTICES

A. Real Party-in-Interest (37 C.F.R. §42.8(b)(1))

Petitioner certifies that the real party-in-interest is Juniper Networks, Inc.

B. Related Matters (37 C.F.R. §42.8(b)(2))

1. Related District Court Proceedings

As of the filing date of this Petition, the ’845 patent is or has been involved in the following district court proceedings:

- *Monarch Networking Solutions LLC v. Cisco Systems, Inc. and Charter Communications, Inc.*, Case No. 2:20-cv-00015 (E.D. Tex.)
- *Monarch Networking Solutions LLC v. Juniper Networks, Inc.*, Case No. 1:23-cv-00670-TSE-LRV (E.D. Va.), transferred to the Northern District of California as *Monarch Networking Solutions LLC v. Juniper Networks, Inc.*, Case No. 4:23-cv-05076 (N.D. Cal.).

Petitioner is currently unaware of any other lawsuits involving the ’845 patent.

2. Related Patent Office Proceedings

¹ The pre-AIA statutory framework applies.

As of the filing date of this Petition, the '845 patent is or has been involved in the following patent office proceedings:

- *Cisco Systems, Inc. v. Monarch Networking Solutions LLC*, IPR2020-01679 (filed October 1, 2020)
- *Ex Parte* Reexamination of Patent Application No. 90/019,246, EX1010

C. Lead and Back-up Counsel and Service Information

Petitioner provides the following counsel and service information. Pursuant to 37 C.F.R. §42.10(b), a Power of Attorney accompanies this Petition.

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III. REQUIREMENTS FOR IPR

A. Payment of Fees

The undersigned authorizes the Office to charge the fee required for this petition to Deposit Account No. 50-5708.

B. Grounds for Standing

Petitioner certifies that the '845 patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR challenging the claims. Petitioner certifies that the prohibitions of §§315(a)-(b) are inapplicable.

C. Statement and Relief Requested

Petitioner requests review and cancelation of the Challenged Claims:

Prior Art References
Li (EX1037), IEEE paper published in April 2006; prior art under §102(b).
Li-2 (EX1038) IETF paper published June 21, 2008; prior art under §102(a)
Paunikar (EX1057) US Patent No. 7,752,334 B2; filed October 15, 2002, published April 15, 2004; prior art under §102(b)
Wu (EX1039), CN Patent No. 1525699A; filed September 17, 2003; published September 1, 2004; prior art under §102(b).

Ground	Claims	Description
1	1, 5-8	Obvious in view of Li, Li-2
2	1, 5-8	Obvious in view of Li
3	1, 5-8	Obvious in view of Li or Li and Li-2 in further view of Paunikar
4	1, 5-8	Obvious in view of Li, Wu, and Paunikar

IV. TECHNOLOGY BACKGROUND

A. IPv4 and IPv6 Addresses

IPv4 addresses consist of 32-bits. EX1003, ¶¶29-31. An example address is 172.16.254.1. *Id.*, ¶29.

An IPv4 packet typically encapsulates a TCP or a UDP header which contains 16-bit port numbers. *Id.*, ¶30.

By the time of the '845 patent, it was well-understood that IPv4 addresses would soon run out. *Id.*, ¶31; EX1001, 1:61-62. IPv6 was developed to address this issue. EX1003, ¶32.

An IPv6 address is 128-bits long. *Id.*, ¶33. An example of an IPv6 address is FE80:CD00:0000:0CDE:1257:0000:211E:729C. *Id.*

B. IPv4/IPv6 Transition Mechanisms

The most striking difference between IPv4 and IPv6 is the expansion of the size of the IP address. EX1003, ¶35. IPv6, however, is **not** inherently compatible

with IPv4 and many transition mechanisms were developed to permit interoperability. *Id.*, ¶36.

1. Converting IPv4 Addresses into IPv6 Addresses to Allow IPv4 Hosts to Communicate with IPv6 Hosts

One of the most common methods of communicating between IPv4 devices and IPv6 devices involved converting an IPv4 address into an IPv6 address. EX1003, ¶37. Multiple prior art references disclose converting IPv4 addresses into IPv6 addresses; for example, constructing an IPv6 address by concatenating an IPv6 prefix with an IPv4 address. *Id.*, ¶¶38-39 (discussing EXS1019-1020).

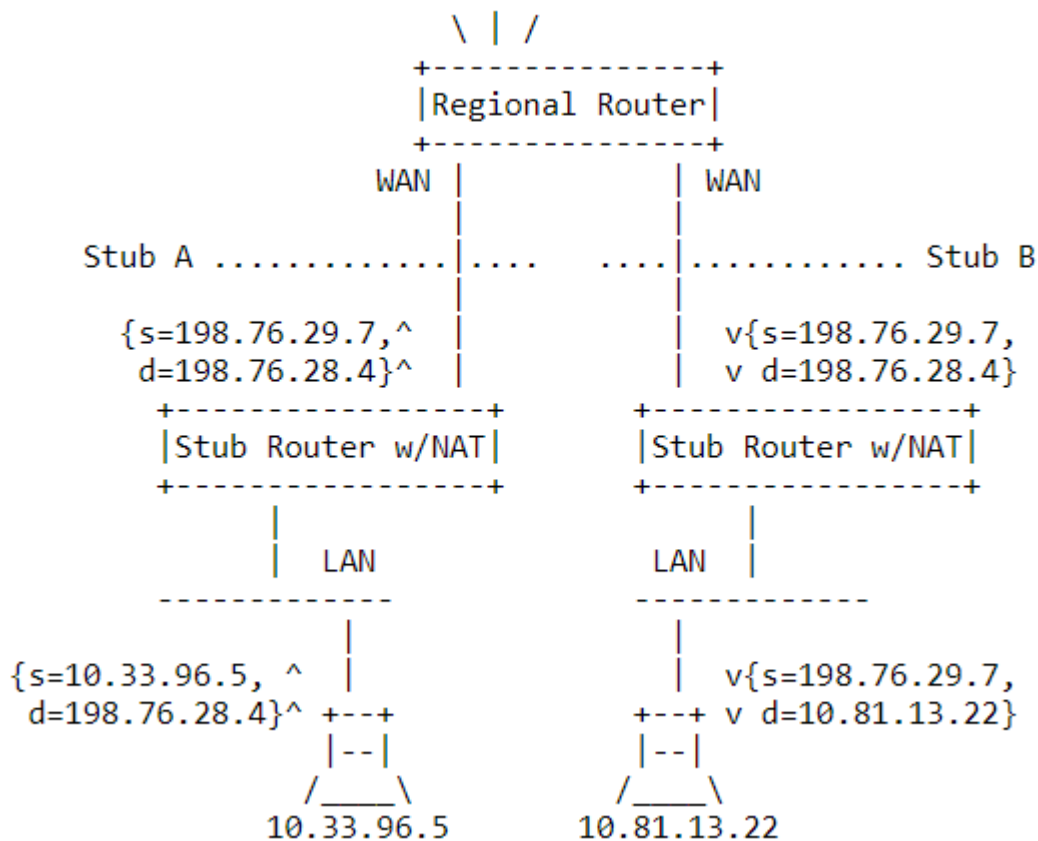
2. Using Port Information to Prevent IPv4 Exhaustion

Although converting IPv4 addresses into IPv6 addresses solves the compatibility issue, it does not solve the issue of IPv4 addresses running out. EX1003, ¶40. By the priority date of the '845 patent, POSITAs understood that computers typically utilize only a small portion of their available port numbers. *Id.*, ¶41. Thus, POSITAs proposed solving the IPv4-exhaustion problem by sharing a single IPv4 address among multiple hosts and uniquely distinguishing the hosts by assigning them distinct port numbers. *Id.*, ¶¶41-43 (discussing EXS1021-1025); *see also* ¶¶44-49 (discussing EXS1026-1029, 1030-1033).

C. Network Address Translation/Port Address Translation (“NAT/NAPT”)

NAT/NAPT allows for IP addresses within a local network (*e.g.*, “a stub domain”) to be reused. EX1003, ¶51. It performs this process using a network

router (*e.g.*, “stub router w/NAT”), wherein the source IP address of outbound data traffic is translated to a globally unique source address. *Id.* Inbound traffic can similarly be translated from a globally unique destination address to a reusable local destination address. *Id.* Figure 2 of RFC 1631 demonstrates this process:



RFC 1631, Figure 2.

EX1062, 3; *see also* EX1003, ¶52. While the image above illustrates an IPv4-to-IPv4 translation, by the time of the '845 patent POSITA were also aware that NAT could be used for IPv6-to-IPV6 translation. *See, e.g.*, EX1058, 61 (“NAT for IPv6”), 89 (same); EX1064 (same).

V. OVERVIEW OF THE '845 PATENT

A. Priority

The '845 patent was filed on June 16, 2009, and claims priority to a French Application filed June 30, 2008. *Id.* No priority date analysis is necessary, however, because the relied-upon prior art pre-dates June 30, 2008.

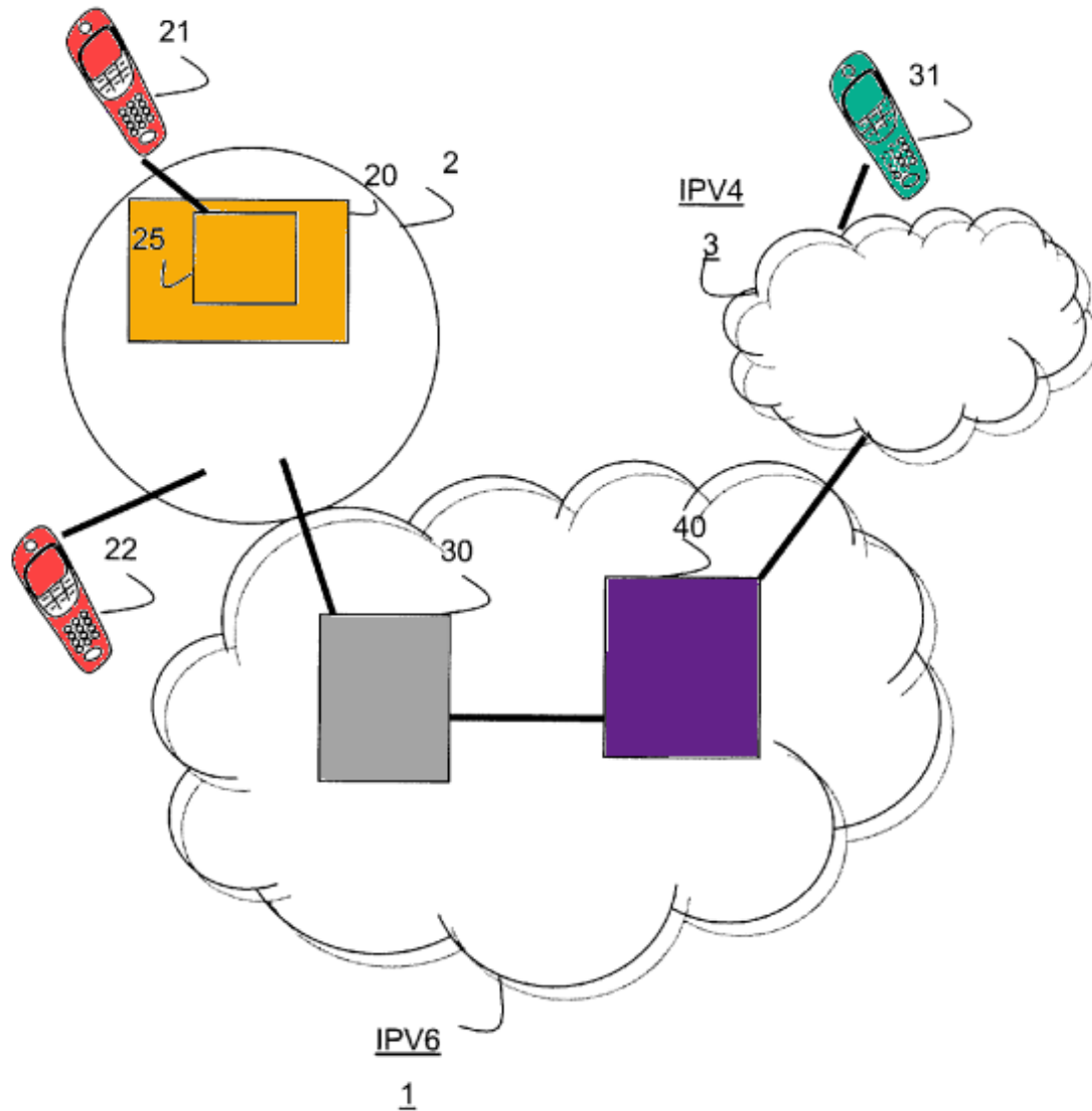
B. Specification

The '845 Patent describes an IP network for transmitting data packets from a source terminal identified by a source address to a destination terminal identified by a destination address. EX1001, 1:17-21. It explains that a “home gateway” interconnects a private domain (*e.g.*, a private network such as a home network or a business network) and a public domain. EX1001, 1:40-48, 4:46-47.

The '845 Patent explains that if an IPv6-configured device in an IPv6 domain transmits an IPv6 packet to an IPv4 configured terminal in an IPv4 domain, the packet must be translated to an IPv4 packet, and vice versa. EX1001, 3:18-48. To enable this communication, the patent discloses that an IPv6 address is constructed by concatenating an IPv6 prefix, an IPv4 address, and a port number. EX1001, 3:7-9, 3:30-48, 7:18-20.

For instance, in Figure 1 an IPv4 terminal (green) may communicate with an IPv6 terminal (red). The access node (purple) may receive a packet sent from an IPv4 terminal (green) and construct an IPv6 address by concatenating an IPv6 prefix, an IPv4 address, and a port number. The packet with the constructed address is then

routed to a gateway (orange) through an access router (grey) where the constructed address is replaced with a native address and then routed to an IPv6 terminal (red):



EX1001, 11:6-61; EX1003, ¶59.

C. Original Prosecution

During original prosecution, the Examiner issued a single Office Action that included a rejection under 35 U.S.C. §112. EX1002, 392. The Office Action did

not include any prior art rejections. Following minor claim amendments, the Examiner allowed claims 1-10 with a statement of reasons for allowance repeating limitations 1[a]-[c]. *Id.*, 16.

D. Patent Office Proceedings

On October 1, 2020, Cisco Systems, Inc. filed a petition for IPR challenging claims 1 and 5-8. EX1033. On January 26, 2021, the Board granted the parties' request for termination due to settlement. EX1034. The Board did not address the merits of the petition.

On September 8, 2023, Unified Patents, LLC requested *ex parte* reexamination ("EPR") challenging claims 1 and 5-8. EX1061 (Control No. 90/019,246). On December 5, 2023, the examiner granted the reexamination. EX1010. The examiner found the following references raised substantial questions of patentability: U.S. Patent No. 7,245,622 ("Huitema"); Kong et al., "Design and Implementation of IPv6-IPv4 Protocol translation System Using Dynamic IP Address" ("Kong"); U.S. Patent Publication 2004/0107287 ("Ananda"); U.S. Patent No. 7,639,686 ("Wetterwald"); and RFC 4380, "Teredo: Tunneling IPv6 over UDP through Network Address Translations (NATs)." *Id.* The examiner noted that while some of the references were previously set forth in the IPR2020-01679, the proceeding was terminated prior to institution, therefore the examiner considers this combination to not have been previously considered by the Patent Office.

An initial office action has not yet issued. *See* Control No. 90/019,246.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) in June 2008 would have had a Bachelor of Science degree in electrical engineering, computer engineering, computer science, or a related subject, and three years of work experience in computer networking, including experience with the IPv4 and IPv6 protocols, or a related field. Lack of professional experience can be remedied by additional education, and vice versa. EX1003, ¶62.

VII. CLAIM CONSTRUCTION

The parties have not yet submitted claim construction proposals in the co-pending district court litigation. However, in a prior district court litigation brought by Patent Owner, the claims of the ’845 patent were construed as follows:

Claim(s)	Term	Construction
1, 8	“IPv4 destination address”	“address formatted according to Internet Protocol version 4 indicating a destination”
1, 8	“concatenating”	“appending one item to the end of another so as to form a single unit in a contiguous pattern”
1, 8	“home gateway”	“any equipment for interconnecting a private network and a network operated by a service provider, the private network being either a home network or a business network”
1, 6, 8	“destination port number”	“number indicating a logical point of connection with a destination device”

1, 2, 5, 8	“regularizing”	Plain and ordinary meaning
1, 8	“if necessary”	“if the IPv6 source address is classified as a native address or if the IPv6 destination address is a constructed address”
1, 8	“modifying the data packet using the regularized address”	Plain and ordinary meaning
1, 8	“the replacement process belonging to a group comprising replacement of a constructed address with a native address and replacement of a native address with a constructed address”	Plain and ordinary meaning
8	“means for identifying an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number”	Function: “identifying an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number” Corresponding Structure: “the home gateway 20 that includes a processor programmed to perform the step of identifying an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number”
8	“means for regularizing, if necessary, at least one of the IPv6 source address and the IPv6 destination address of the data packet by replacing said at least one IPv6 address, . . . and modifying the data packet using the regularized address”	Function: “regularizing at least one of the IPv6 source address and the IPv6 destination address of the data packet and modifying the data packet using the regularized address” Corresponding Structure: “the home gateway 20 that includes a processor programmed to perform the step of regularizing at least one IPv6 address when:

		1. if the IPv6 source address is a native address, then the program executes the steps of choosing an IPv6 constructed source address whose source port number is in the authorized range assigned to the home gateway 20; and modifying the data packet by replacing the native source address with the constructed source address as illustrated in steps R21 and R22 of Figure 5; or 2. if the IPv6 destination address is a constructed address, then the program executes the steps of searching a translation table of the home gateway 20 and locates a native destination address associated with the constructed destination address; verifying that the transport level destination port of the data packet agrees with the destination port number contained in the destination address of the packet; and modifying the data packet by replacing the constructed destination address with the native destination address as illustrated in steps R'21, R'22, and R'23 of Figure 8"
8	"means for routing the IPv6 data packet to its destination"	Function: "routing the IPv6 data packet to its destination" Corresponding Structure: "the home gateway 20 that includes a processor programmed to perform the step of routing the IPv6 data packet to its destination"

EX1036. Patent Owner applies these constructions for purposes of this Petition.

VIII. GROUNDS

A. Ground 1: Claims 1, 5-8 Would Have Been Obvious in View of Li and Li-2

1. Li (EX1037)

Li is an IEEE publication titled “Forwarding IPv4 Traffics in Pure IPv6 Backbone with Stateless Address Mapping.” EX1037; EX1003, ¶64.

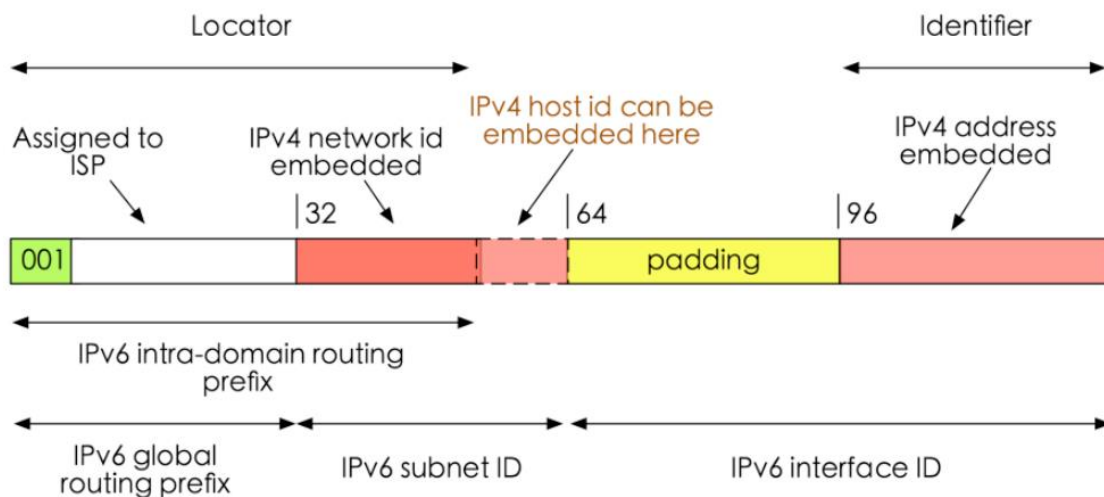
(a) Li Is Prior Art Under §102(b)

Li is prior art under at least pre-AIA §102(b) because it was publicly available more than one year before the ’845 patent’s priority date. EX1005, ¶¶44-48, 57. EX1003, ¶¶64-65. Petitioner has submitted a librarian declaration establishing that MARC records confirm that Li was catalogued by the University of Washington and the Library of Congress on January 25, 2007, and accessible to the public on that date. EX1005, ¶¶45-48. Further, the Board has held that the copyright date that is disclosed on the face of an IEEE paper—in this case, 2006—is the date that the paper was made publicly accessible. *Ericsson, Inc. v. Intellectual Ventures I LLC*, IPR2014-00527, Paper 41, at 10-12 (PTAB May 18, 2015). IEEE Xplore also confirms that Li was publicly accessible by October 23, 2006, the “Date Added to IEEE Xplore.” EX1005, ¶44.

(b) Overview of Li

Li discloses a process for mapping IPv4 packets into IPv6 packets (or vice versa). EX1037, 4 (“An edge router manipulates the IP headers for the packets passing through it from IPv6 to IPv4 or vice versa.”), Fig. 4. The process involves “address mapping,” which constructs an IPv6 source and IPv6 destination address from an IPv4 source and destination address. *Id.*

In particular, Li teaches that address mapping constructs an IPv6 address from an IPv4 address by concatenating a 32-bit IPv6 prefix, a 32-bit IPv4 address, and 32 bits of zero-padding. EX1003, ¶¶66-68. Figure 2 provides an example of how an IPv6 address is constructed from an IPv4 address using Li's mapping technique:



EX1037, 3. The constructed IPv6 address begins with an “IPv6 global routing prefix” (bits 0-31), it is then followed by an “IPv4 address” (bits 32-63), and then 32 bits of zero “padding” (bits 64-95). *Id.* EX1003, ¶67. For reasons not relevant here, the IPv4 address may also be repeated at the end of the IPv6 address (bits 96-127). *Id.*

Li provides further examples of address mapping in Table 1:

TABLE I. SOME ADDRESS MAPPING EXAMPLES

IPv4 prefix/address	IPv6 prefix/address
202.112.0.0/13	2001:da8:ca70::/45
166.111.0.0/16	2001:da8:a66f::/48
166.111.172.1	2001:da8:a66f:ac01::a66f:ac01

EX1037, 3 (highlighted). In this mapping, Li constructs an IPv6 address in the right column by appending an IPv6 prefix (2001:da8) to the IPv4 address or address range in the left column. EX1003, ¶68. Note that IPv4 addresses are typically represented in dotted-quad notation, whereas IPv6 addresses are represented in hexadecimal notation, so while the IPv4 address on the left side appears different from the right side, they are actually the same. *Id.* For example, the third row in Table 1 contains the IPv4 address 166.111.172.1. EX1037, 3. Converting this address from dotted-quad notation to hexadecimal yields the following result:

166 **111** **172** **1**
 ↓ ↓ ↓ ↓
a6 **6f** **ac** **1** = **a66f:ac01**

EX1003, ¶68. Thus, the resulting IPv6 address is 2001:da8:a66f:ac01::a66f:ac01, where “2001:da8” is the IPv6 prefix, “a66f:ac01” is the IPv4 address in hexadecimal notation, and the notation “::” represents zero-bit padding, in which bits 64 to 95 are zeros. *Id.*

Figure 7 of Li depicts the following network configuration as one embodiment that implements its invention:

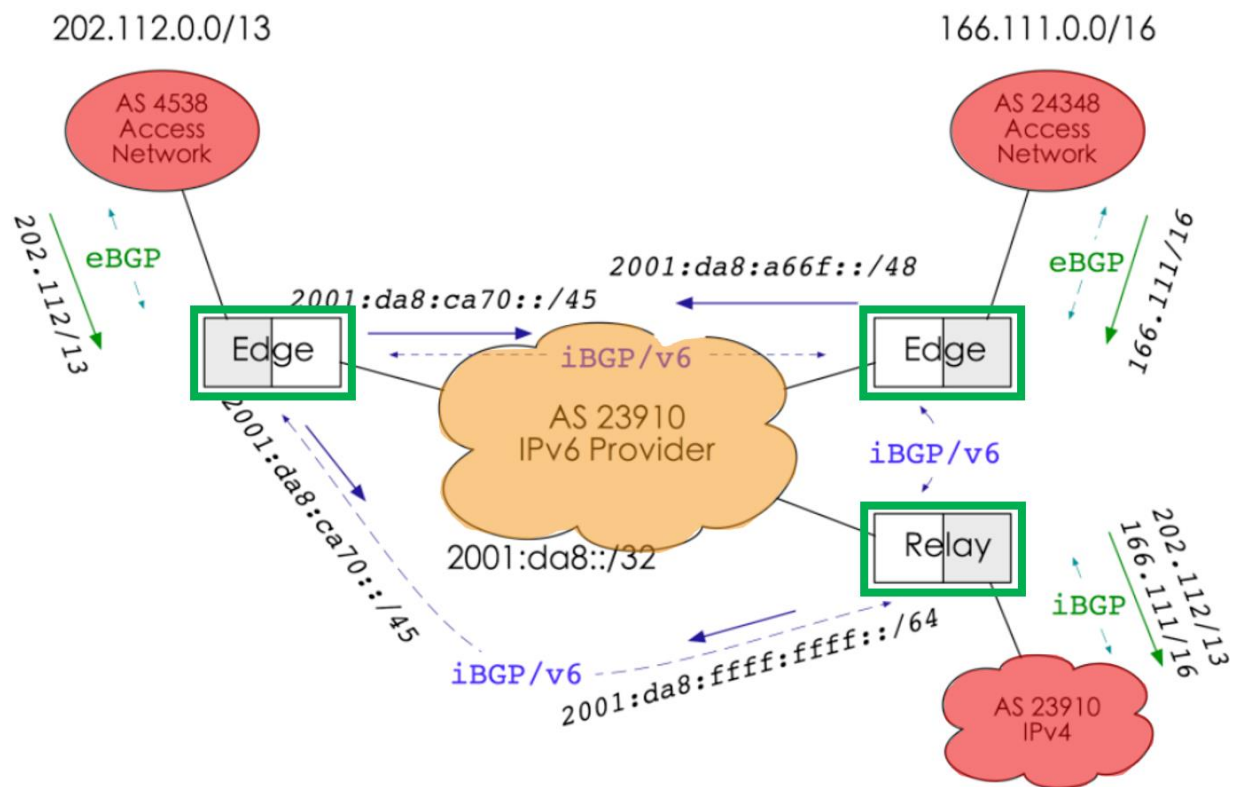


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7. At the center of the network is an IPv6 domain (orange). *Id.*, 3. Surrounding the IPv6 domain are several IPv4-only domains (red), called access networks. *Id.* Edge routers and edge relays (surrounded by green borders)

interconnect the IPv6 domain and the IPv4 domains. *Id.* In this embodiment, Li's edge routers are deployed on the boundary of the access network and the provider backbone and implement the address mapping. EX1037, 4 ("An edge router manipulates the IP headers for the packets..."), 4 ("The routers at the edge of IPv4 subnets and the IPv6 backbone perform the functionality of mapping addresses"), 7 ("Relays and edge routers are doing the header mapping as is described in Fig. 4."), 9 ("The edge router... translates headers for all packets coming in or going out of the access network.").

Figure 11 builds upon Figure 7 by disclosing that the IPv6 provider network (AS23910) may be connected to native IPv6 access networks that support IPv4:

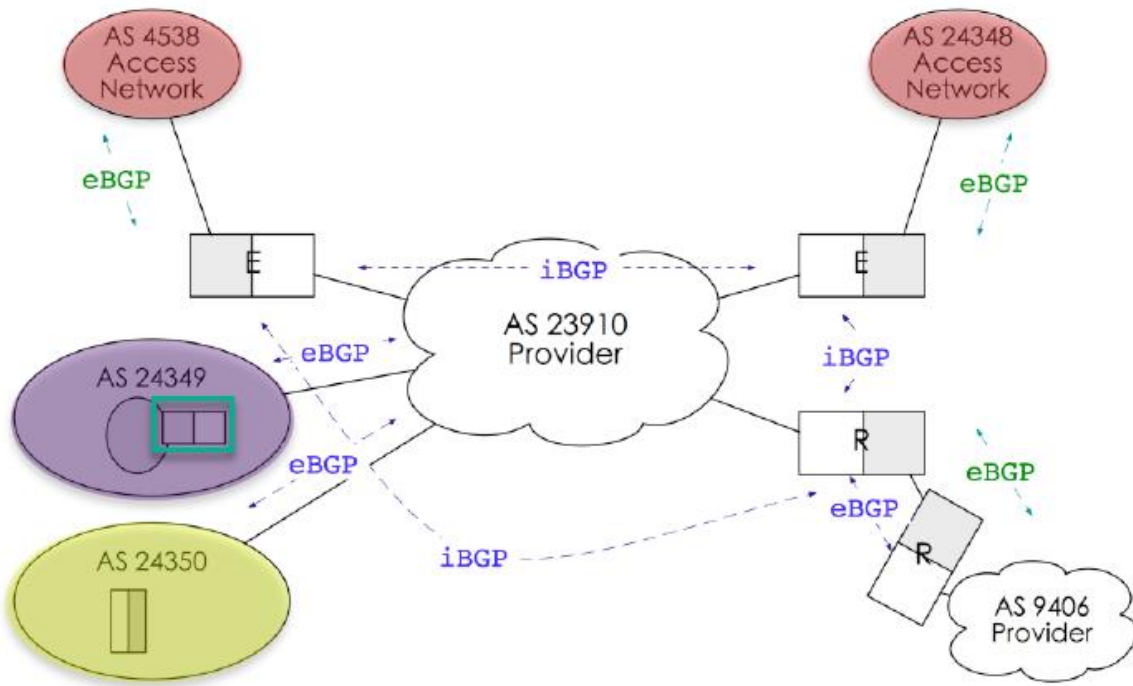


Figure 11. Migration with 3 steps

EX1037, 9 (highlighting added). For instance, Figure 11 shows the “3 typical stages in migration,” wherein the first stage is IPv4-only domains (AS24348 and AS4538, the second stage is migration to “a native IPv6 access network containing a small group of IPv4 subnets” (AS24349) and a third stage is migration to “native IPv6 access network containing separated dual-stack hosts” (AS24350). *Id.*, 9-10. Li discloses that for native IPv6 access networks, a router within the access network (*e.g.*, the router surrounded by a green box) may implement the address mapping rather than an edge router on the border of the IPv6 and IPv4 networks. *Id.*, 10 (“The route mapping and header mapping will be performed within the scope of the access network AS24349”); EX1003, ¶¶69-71.

2. Li-2 (EX1038)

Li-2 is an IETF Internet Draft titled Bi-directional Address Borrowing (IVI). EX1038; EX1003, ¶72.

(a) Li-2 Is Prior Art Under §102(b)

Li-2 is prior art under at least pre-AIA §102(a) because it was publicly available before the '845 patent's priority date of June 30, 2008. EX1008, ¶¶4-12; EX1009, ¶¶10-11.

As disclosed on the face of the document, Li-2 was submitted to the IETF on June 21, 2008. EX1038, 1. The IETF is a standards organization that is committed to making its documents publicly available and searchable. EX1003, ¶74. Each year, thousands of individuals participate in the IETF, including in 2008. EX1008, ¶9.

Petitioner submits a declaration from the IETF confirming that Li-2 was uploaded to the IETF website on June 21, 2008, and could be accessed by any participant in the IETF (or general public). EX1009, ¶¶10-11. Petitioner also submits a declaration from Juniper engineer, Ron Bonica, who has been a member of the IETF since 1998 and is the chair of the IPv6 Operations group. EX1008, ¶¶1-3. Mr. Bonica has submitted over one-hundred RFCs and also confirms that Li-2 was accessible as of June 21, 2008. *Id.*, ¶¶1-12. As the IETF and Mr. Bonica confirm, in 2008 when an author submitted an Internet Draft to the IETF it was added

to a staging folder. EX1008, ¶¶4-5; EX1009, ¶¶7, 10. This staging folder was publicly accessible without a password. EX1008, ¶¶4, 6; EX1009, ¶10. The draft remained publicly accessible in the staging folder, titled “draft-xli-ivi-00-7431-cancelled.txt.”² See also EX1044 (screenshot of IETF website captured on 12/7/2023); EX1008, ¶8; EX1009, ¶11. Indeed, the draft was publicly accessible until just this year, when the IETF updated the staging folder to remove prior drafts, including Li-2. EX1008, ¶4. And the staging folder (EX1044) indicates that Li-2 was “last modified” on June 21, 2008, which means it was publicly accessible as of that date. EX1008, ¶8; see EX1009, ¶10-11.

POSITAs exercising reasonable diligence could locate the Li-2 reference in the staging folder. POSITAs were aware of the IETF’s staging folder at the time, especially because the IETF is a preeminent standards-setting organization. EX1008, ¶9. Indeed, the record is replete with multiple e-mails that POSITAs sent to each other, which reference the staging folder. *Id.* (discussing EXS1046-1055). POSITAs would have monitored the IETF’s staging folder for new document

² The authors of Li-2 eventually cancelled the draft, which is why “cancelled” appears in the filename. EX1008, ¶11. This doesn’t affect its public accessibility—cancelled drafts remained publicly accessible in the IETF staging folder. *Id.*; see EX1009, ¶11.

uploads and browsed the staging folder for documents relevant to the networking field. *Id.*, ¶¶9-10.

Further, Li-2 is titled “draft-xli-ivi-00-7431-cancelled.txt.” *Id.*, ¶10. A POSITA would have recognized that “xli” represents the primary author’s name, X. Li or Dr. Xing Li. *Id.* A POSITA would have recognized Dr. Li’s name, as he had authored numerous influential networking papers at the time, including papers on IPv4 and IPv6 and the transition between the two protocols. *Id.* A POSITA would have further recognized that ‘ivi’ refers to the IPv4 to IPv6 transition technology, IVI. *Id.* Thus, a POSITA would have been aware from the document’s name in the staging folder that Li-2 is pertinent to IPv4 to IPv6 transition mechanisms and other networking developments. *Id.*

Moreover, once a draft is uploaded to the IETF, it is added to the IETF Datatracker, which is a sophisticated tool that allows users to search drafts by several criteria, including working group, author, and technical area. *Id.*, ¶11 (discussing EX1056); see EX1009, ¶11. Thus, POSITAs would not only be able to find Li-2 in the staging folder as of June 21, 2008, but Li-2 would have also been indexed on the IETF Datatracker and a POSITA would have been able to find Li-2 using the IETF Datatracker’s search function. EX1008, ¶¶11-12.

Accordingly, for the reasons discussed above, Li-2 is prior art under at least pre-AIA §102(a) because it was accessible to members of the interested public in a

manner that a POSITA could have readily located it. *See, e.g., Voter Verified, Inc. v. Premier Election Solutions, Inc.*, 698 F.3d 1374, 1380 (Fed. Cir. 2012).

(b) Overview of Li-2

Like the 2006 Li paper above, (EX1037), Li-2 describes an address mapping (called “IVI address mapping”) in which an IPv6 address is constructed by concatenating an IPv6 prefix, an IPv4 address, and zero padding:

IVI Address Mapping

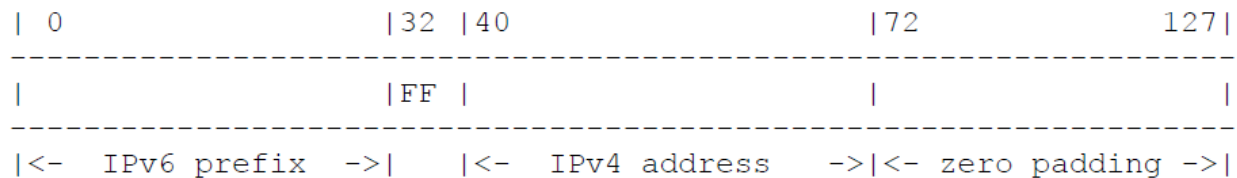


Figure 1

EX1038, 6. However, Li-2 recognizes that this addressing scheme does not solve the problem of IPv4 address depletion. “Since public-IPv4 address is a scarce resource, the effective use of the IPv4 address is important for IVI scheme.” *Id.*, 14.

Li-2 therefore expands upon the 2006 paper by introducing an idea of “port multiplexing.” *Id.* Port multiplexing works by further concatenating a port number to the end (*i.e.*, the “least significant bits”) of the constructed IPv6 address, replacing unused zero padding. *Id.* (“The mapping scheme is to use the least significant bits in the IVI6(i) to define the multiple mapping and combine the transport-layer port number to uniquely perform the mapping from IVI4(i) to IVI6(i).”). For instance,

Li describes a “1-to-1” port multiplexing in which there is a single port number for each constructed IPv6 address. *Id.*; see also *id.* (disclosing a “one-to-many mapping” where the same port number may be used with multiple constructed IPv6 addresses). An example of the “1-to-1” mapping is illustrated in the image below from a presentation the authors provided to the IETF less than a month after publishing Li-2:

```
202.38.108.2#81 --> IVI61=2001:250:ffca:266c:0200::81#81
202.38.108.2#82 --> IVI61=2001:250:ffca:266c:0200::82#82
202.38.108.2#83 --> IVI61=2001:250:ffca:266c:0200::83#83
202.38.108.2#84 --> IVI61=2001:250:ffca:266c:0200::84#84
```

EX1028, 22 (highlighted); EX1028; EX1007, ¶11 (confirming public accessibility); EX1005, ¶¶53-57 (same). The first, blue box is the IPv6 prefix. EX1003, ¶74; EX1038, 6. The second, red box is a flag indicating the address has been constructed according to IVI. EX1003, ¶74; EX1038, 6. The third, purple box is the IPv4 address from the left side (*i.e.*, the received IPv4 packet), translated from dotted-quad to hexadecimal. EX1003, ¶74; EX1038, 6. The fourth, yellow box is zero padding. EX1003, ¶74; EX1038, 6. And the fifth, gray box is the port number from the left side (*i.e.*, the received IPv4 packet). EX1003, ¶74-75; EX1038, 14.

3. The Li-Li-2 Combination

Li teaches the general network structure and the steps of receiving a data packet from an IPv4 domain in an IPv6 domain. EX1003, ¶84. Li further teaches

constructing an IPv6 address by concatenating an IPv6 prefix, an IPv4 address, and 32-bits of zero padding, as well as the step of regularizing an address by replacing a constructed address with a native address. *Id.* Li-2 supplements Li's disclosures by teaching concatenating a destination port number to the end of the constructed IPv6 address (replacing any unused zero padding as necessary) in order to uniquely identify IPv4 hosts and mitigate IPv4 address exhaustion. *Id.* Thus, the Li-Li-2 combination would implement address mapping to construct IPv6 addresses by concatenating an IPv6 prefix, an IPv4 destination address and a destination port number. *Id.* The address mapping would be implemented by the edge routers of Li and routers within a native IPv6 network such as the router within AS24349.

4. Motivations to Combine Li and Li-2

A POSITA would have been motivated to combine the teachings of Li and Li-2 and would have had a reasonable expectation of success of doing so. EX1003, ¶¶85-90.

First, a POSITA would have been motivated to combine the two references because Li-2 is an extension of Li. EX1003, ¶86. The references name the same authors. EX1037, 1; EX1038, 1. Both describe techniques for IPv4 to IPv6 transition that were developed as part of “the China Education and Research Network (“CERNET”) under the framework of the China Next generation Internet (CNGI) project.” EX1037, 10; EX1038, 17. Indeed, Li describes a gateway

implementation for CERNET/CNGI that performs address mapping (EX1037, 10) and Li-2 describes a further implementation of this “IVI gateway” that was “deployed between CERNET... and CNGI-CERNET2” that uses an evolution of this “IVI address mapping” (EX1038, 6, 17). In fact, Li explains that its initial system “is just a small step” and “is an extensible foundation” that could be modified further. EX1037, 2.

Second, the prior art includes express teachings that would have led a POSITA to combine Li-2’s teachings regarding “port multiplexing” with Li. EX1003, ¶87. Several prior art documents expressed a need to not only make IPv4 domains interoperable with IPv6 domains in order to smooth the transition from IPv4 to IPv6, but also a need to slow IPv4 address exhaustion by sharing a single public IPv4 address among multiple hosts. See §IV.B. Based on the information in the prior art, a POSITA would have known that (1) IPv4 addresses could be converted into IPv6 addresses to allow for IPv4-IPv6 interoperability, (see §IV.B.1); and (2) port numbers could be used to share a single public IPv4 address among multiple hosts, (see §IV.B.2). Indeed, Li-2 explains that these teachings are an underlying motivation for Li-2’s port multiplexing extension of the original Li paper. EX1038, 14. A POSITA would have had a reasonable expectation of success in combining Li and Li-2, especially because a POSITA actually *did* succeed in combining these references. EX1003, ¶87.

Third, the combination merely involves the straightforward application of replacing unused padding in Li's constructed IPv6 address with the destination port number, as taught by Li-2. EX1003, ¶88. Li-2 shows that this substitution and its function was known in the art, and describes the function of this substitution. *Id.*; EX1038, 14. And the results would have been predictable, as a POSITA actually *did* make this substitution. EX1003, ¶88; *see* EX1038, 14.

Fourth, this combination would have involved combining prior art elements according to known methods to yield predictable results. EX1003, ¶89. Li and Li-2 recite all elements of the '845 claims, as described in the claim-by-claim analysis below. *Id.* A POSITA could have combined the elements as claimed by known methods, which are described in Li-2. *Id.* In fact, Li-2 is an extension of the ideas described in the original Li reference and was published by the same authors that published the original Li paper in 2006. *Id.*

Finally, Li, Li-2, and the '845 patent are analogous art because the references are in the same field of endeavor as each other, *i.e.*, computer networking and the IPv4-to-IPv6 transition. EX1003, ¶90.

5. Claim 1

(a) 1[pre]

Li discloses 1[pre]: “a method of receiving an IPv6 data packet in an IPv6 domain connected to an IPv4 domain, said packet comprising an IPv6 destination

address and an IPv6 source address, said method being executed in a home gateway adapted to connect a user terminal to said IPv6 domain, and comprising the following steps.” EX1003, ¶90. The elements of this limitation are broken down below.

A method of receiving an IPv6 data packet in an IPv6 domain connected to an IPv4 domain: Li discloses a method of receiving an IPv6 data packet in an IPv6 domain connected to an IPv4 domain. Two examples are discussed below.

First, Li discloses an IPv4 host in AS4538 that sends a data packet to a host in AS24348, as depicted by the black arrow below:

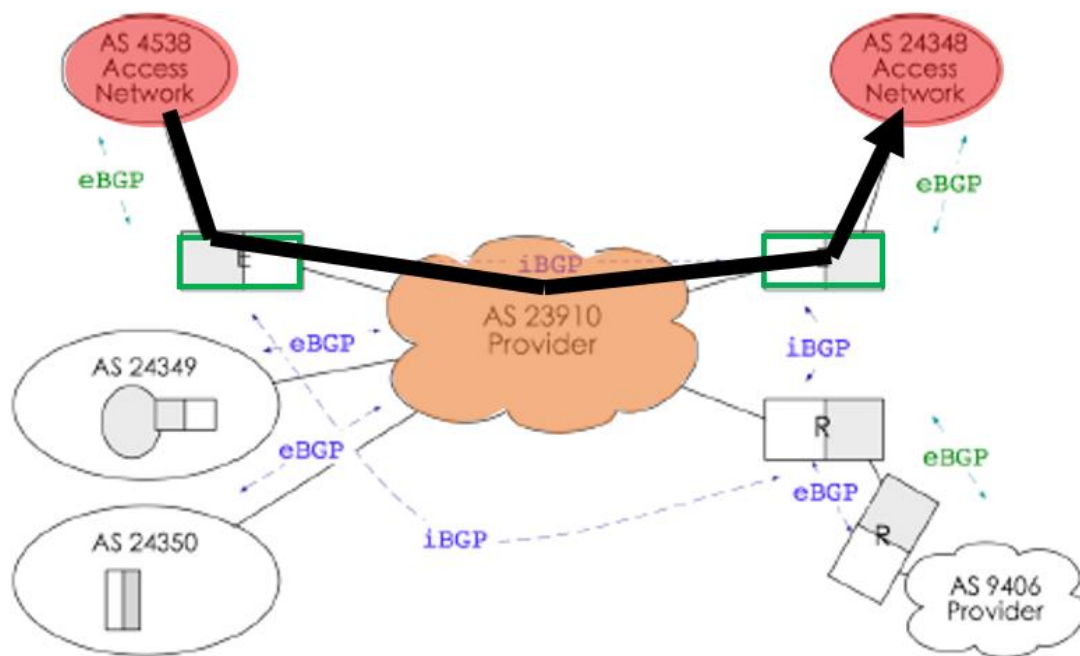


Figure 11. Migration with 3 steps

EX1037, 9 (highlighted and annotated), 7 (Figure 7 illustrating similar architecture); EX1003, ¶93. In this example, AS2390 is an IPv6 domain (orange) that connects the IPv4-only domains (red) via edge routers (green).

Li discloses that the edge routers are configured to receive IPv6 data packets. The edge router's role is "an access gateway that provides connectivity for a certain IPv6 block." EX1037, 4. Li states that "[a]n edge router is a dual-stack node, extended with the ability of translating routing messages and modifying packet IP versions between IPv6 and IPv4." *Id.* A POSITA would understand a dual-stack node is a device that receives IPv4 and IPv6 packets. EX1003, ¶94; *see also* EX1037, 4 ("An edge router manipulates the IP headers for the packets passing through it from IPv6 to IPv4 or vice versa.").

The IPv6 data packets are received in an IPv6 domain. EX1003, ¶95. Each edge router has an IPv6 interface for receiving IPv6 packets, and utilizes an IPv6 prefix (*e.g.*, 2001:da8) of the IPv6 domain (AS23910). EX1037, 7, 9. Thus, Li discloses that an edge router (*e.g.*, the edge router in the top right of Figure 11) receives IPv6 data packets in the IPv6 domain on its IPv6 interface. EX1003, ¶95.

Second, Li also discloses an IPv4 host in AS4538 sends a data packet to a host in a "native IPv6 access networks" (*e.g.*, AS24349 in purple) via the IPv6 network (orange):

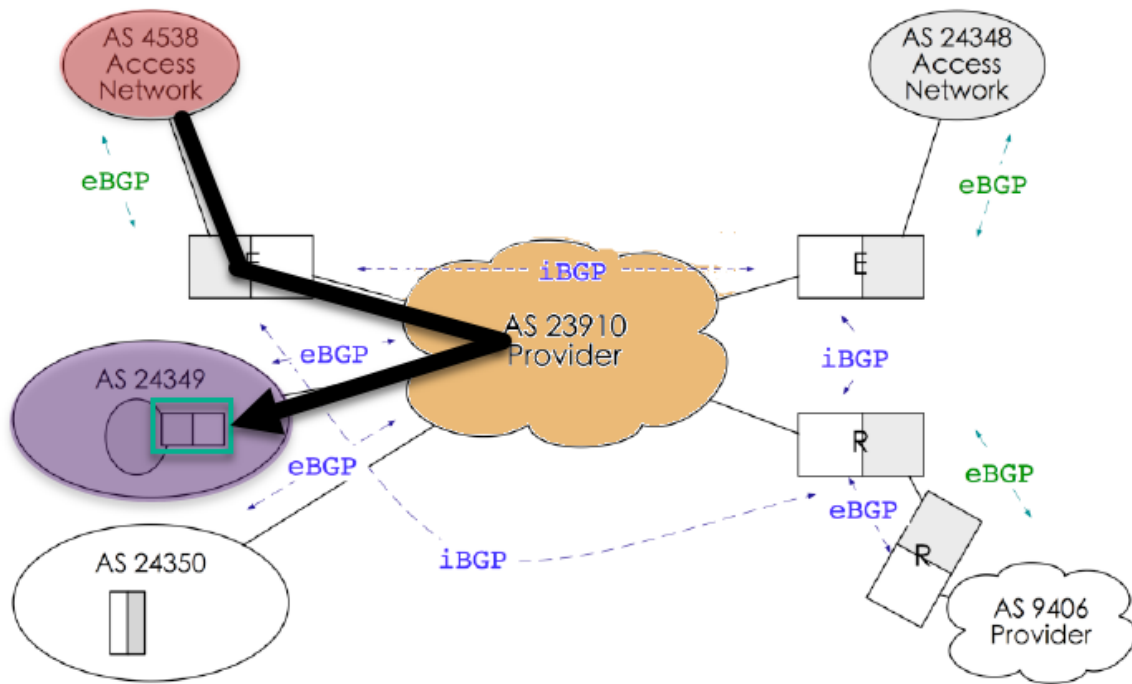
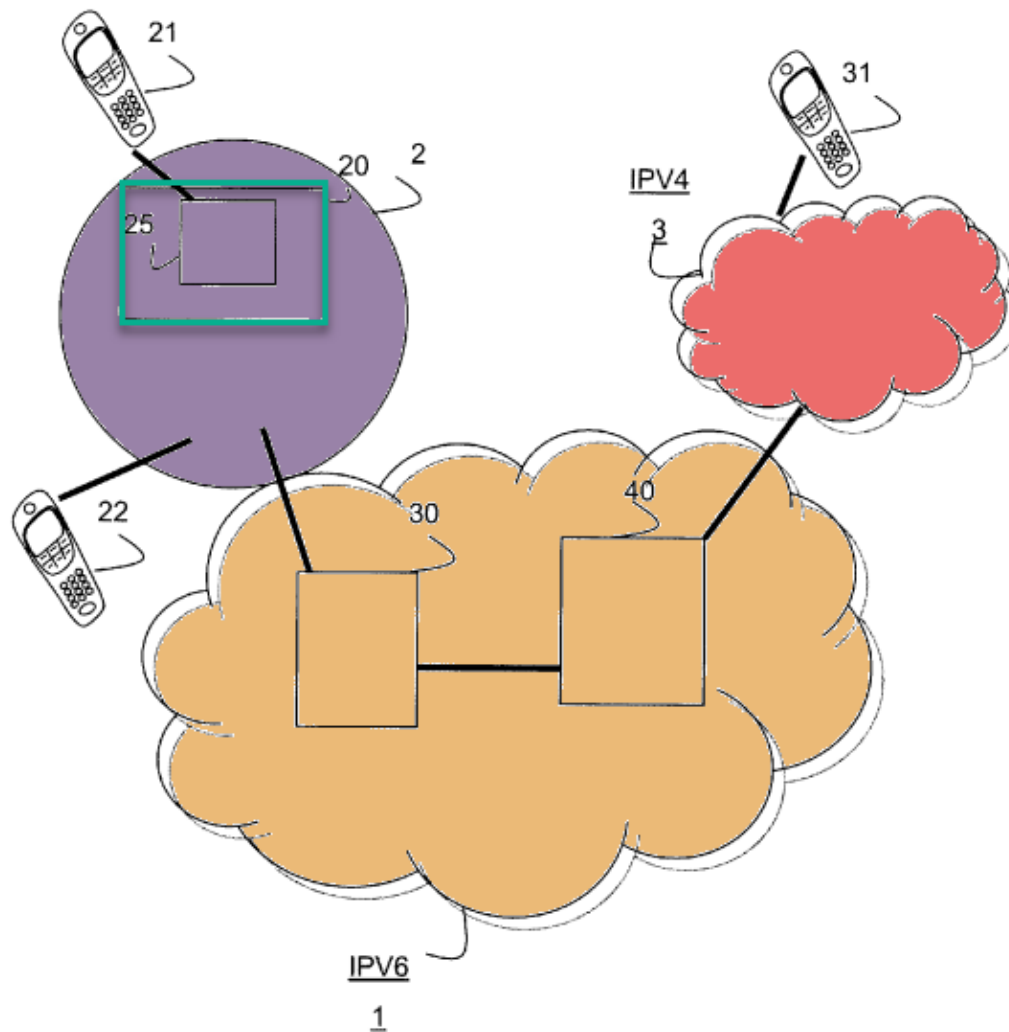


Figure 11. Migration with 3 steps

EX1037, 9 (highlighting added). In this example, the access gateway (green box) is implemented within AS24349, which Li describes as a “native IPv6 access network contain[s] a small group of IPv4 subnets.” *Id.*, 10 (“The route mapping and header mapping will be performed within the scope of the access network AS24349”). Because the router is implemented within the “native IPv6 access network” and receives IPv6 packets, a POSITA would understand that it receives packets in an IPv6 domain (EX1003, ¶96). In fact, this example is similar to the architecture illustrated in Figure 1 of the ’845 patent, which discloses an IPv4 network (red) connected to an IPv6 network (purple) having a gateway (green) via an IPv6 network (orange):



EX1001, Fig. 1; EX1003, ¶96.

said data packet comprising an IPv6 destination address and an IPv6 source address: As discussed above, Li’s edge routers receive IPv6 data packets that are routed across a “pure IPv6 backbone” (e.g., AS2391). EX1037, 1 (“IPv4 packets are mapped into IPv6 (or vice versa) automatically at the edge of the IPv6 backbone.”). Data traffic routed across a pure IPv6 network possesses an IPv6 source address and an IPv6 destination address. EX1003, ¶97. Indeed, Li discloses that in the outbound

direction an edge router (*e.g.*, edge router in the top left of Figure 11) receives an IPv4 packet from an IPv4 domain and uses Li's address mapping to construct an IPv6 data packet containing IPv6 "source and destination addresses" that it routes through AS23910. See EX1037, 3 ("IPv4 source and destination addresses in a packet can be translated into their IPv6 version"), Table 1 (showing IPv4 addresses being translated to IPv6 addresses). Li illustrates this translation in Figure 4:

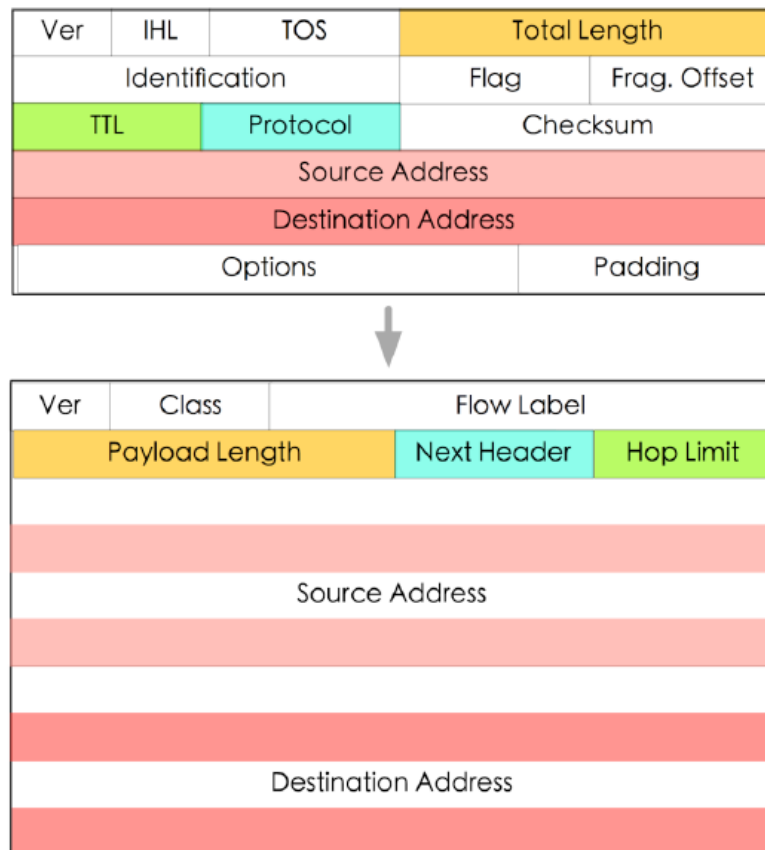


Figure 4. Mapping the header from IPv4 to IPv6

EX1037, 4; EX1003, ¶98. Li also teaches that the opposite process occurs in the inbound direction, with an edge router receiving an IPv6 packet with the constructed

IPv6 addresses. EX1037, 4 (“An edge router manipulates the IP headers for the packets passing through it from IPv6 to IPv4 or vice versa.”).

said method being executed in a home gateway adapted to connect a user terminal to said IPv6 domain, and comprising the following steps:

Patent Owner agreed and the Texas court construed “home gateway” to mean “any equipment for interconnecting a private network and a network operated by a service provider, the private network being either a home network or a business network.” EX1036, 13. Figure 11 of Li discloses a “home gateway.” EX1003, ¶101.

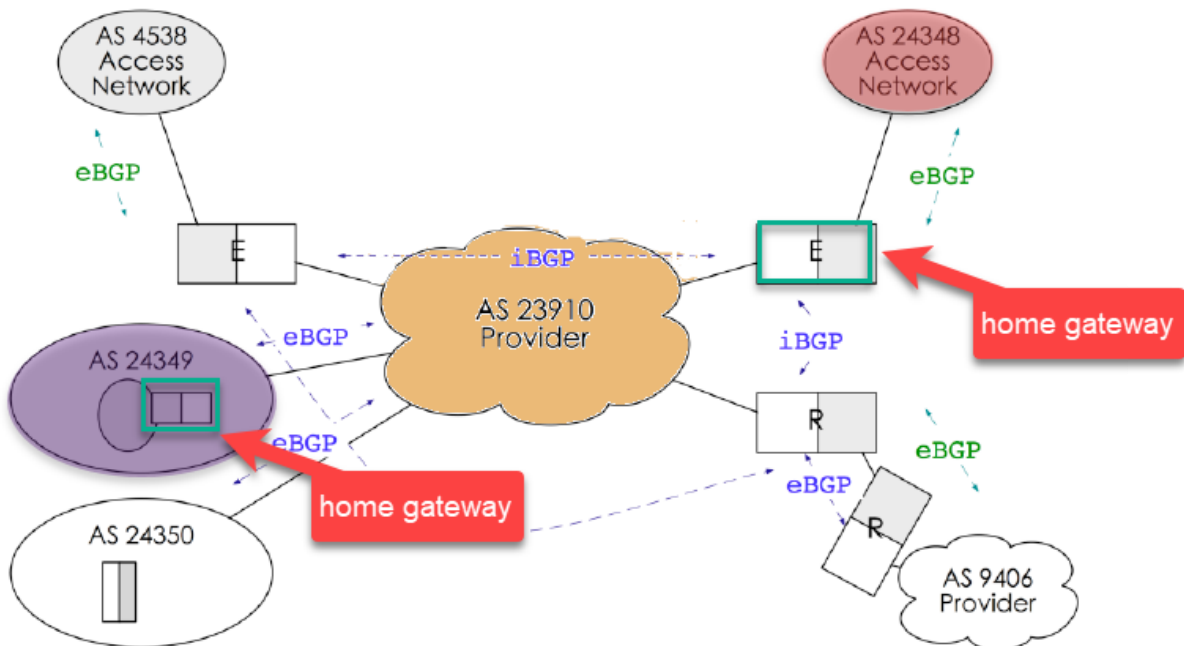


Figure 11. Migration with 3 steps

EX1003, ¶¶101-102; see also EX1037, 4 (“For the IPv6 backbone, the edge router plays the role of an access gateway...”).

The edge router in the top right of Figure 11 interconnects an IPv4-only network (red) and an IPv6 network (orange). EX1037, 7. Similarly, the gateway within AS24349 interconnects the IPv6 access network (purple) with the IPv6 provider network (orange). *Id.* The IPv6 provider network is that of a service provider. *Id.*, 6 (“access networks send their IPv4 traffics to each another via the pure-IPv6 backbone of their service provider.”). The connected access networks may be that of a “customer of the provider.” *Id.* (“IPv4-only customer networks is connected to the IPv6 backbone.”), 3, 7. A home network or the network of a business are examples of a customer network, and those networks may be implemented as private networks. EX1035 (U.S. Patent No. 7,624,195, filed on May 8, 2003), Fig. 1 (illustrating “edge router” connecting hosts (illustrating edge router 125 connecting home network to provider network 105), 3:42-59 (“edge routers 125a, 125b and 125c may be in the form of customer premises equipment (CPE), such as a cable modem, which may be coupled to one or more hosts 130a, 130b and 130c, such as PCs.”); EX1003, ¶102. Thus, Li’s edge routers are “home gateways” under the Texas court’s construction.

Moreover, Li’s home gateways are adapted to connect a user terminal to the IPv6 domain. EX1003, ¶¶103-104. A POSITA would understand that the IPv4-only access network AS24348 (red) and IPv6 access network AS24349 (purple) include various host devices (e.g., computers) that are “user terminals.” *Id.*;

EXS1065-1066 (disclosing that AS24348 and AS24349 are networks for Peking University and Tsinghua University). A POSITA would also understand that the user terminals are connected to the IPv6 domain (AS23910 and/or AS24349) through Li's gateway. For instance, Figure 5 of Li also discloses that user terminals (*e.g.*, "Host A" and "Host D") in the IPv4 domain are connected to the IPv6 domain via Li's home gateway (*e.g.*, "edge routers B and C"), such that they can communicate with one another. EX1037, 5. Thus, Li's edge router and access gateways (home gateways) are adapted to connect hosts (user terminals) to the IPv6 domain (AS23910 and/or AS24349). EX1003, ¶105.

(b) 1[a]

Li and Li-2 render obvious limitation 1[a]: "identifying an IPv6 destination address [*e.g.*, **Li's constructed IPv6 address**] constructed by concatenating an IPv6 prefix [*e.g.*, **Li's IPv6 global routing prefix**], an IPv4 destination address [*e.g.*, **Li's IPv4 destination address**], and a destination port number [*e.g.*, **Li-2's destination port number**]." EX1003, ¶106.

When an IPv4 host within AS4538 sends an IPv4 packet to a host in access network AS24348 (red) or AS24349 (purple), the IPv4 packet is received at the top left edge router in Figure 11 of Li and its IPv4 header is translated from IPv4 to IPv6 so that the packet may be routed through the IPv6 provider network (orange):

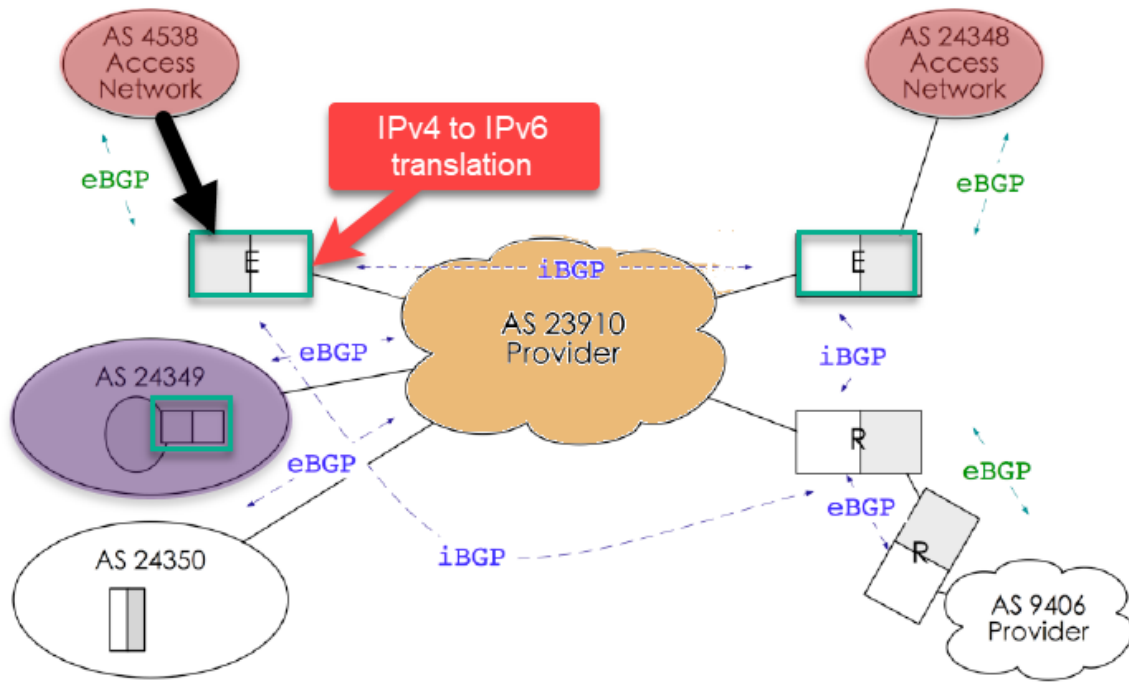


Figure 11. Migration with 3 steps

EX1037, 7, 9; EX1003, ¶107. The top left edge router performs IPv4 to IPv6 header translation as illustrated in Figure 4 of Li:

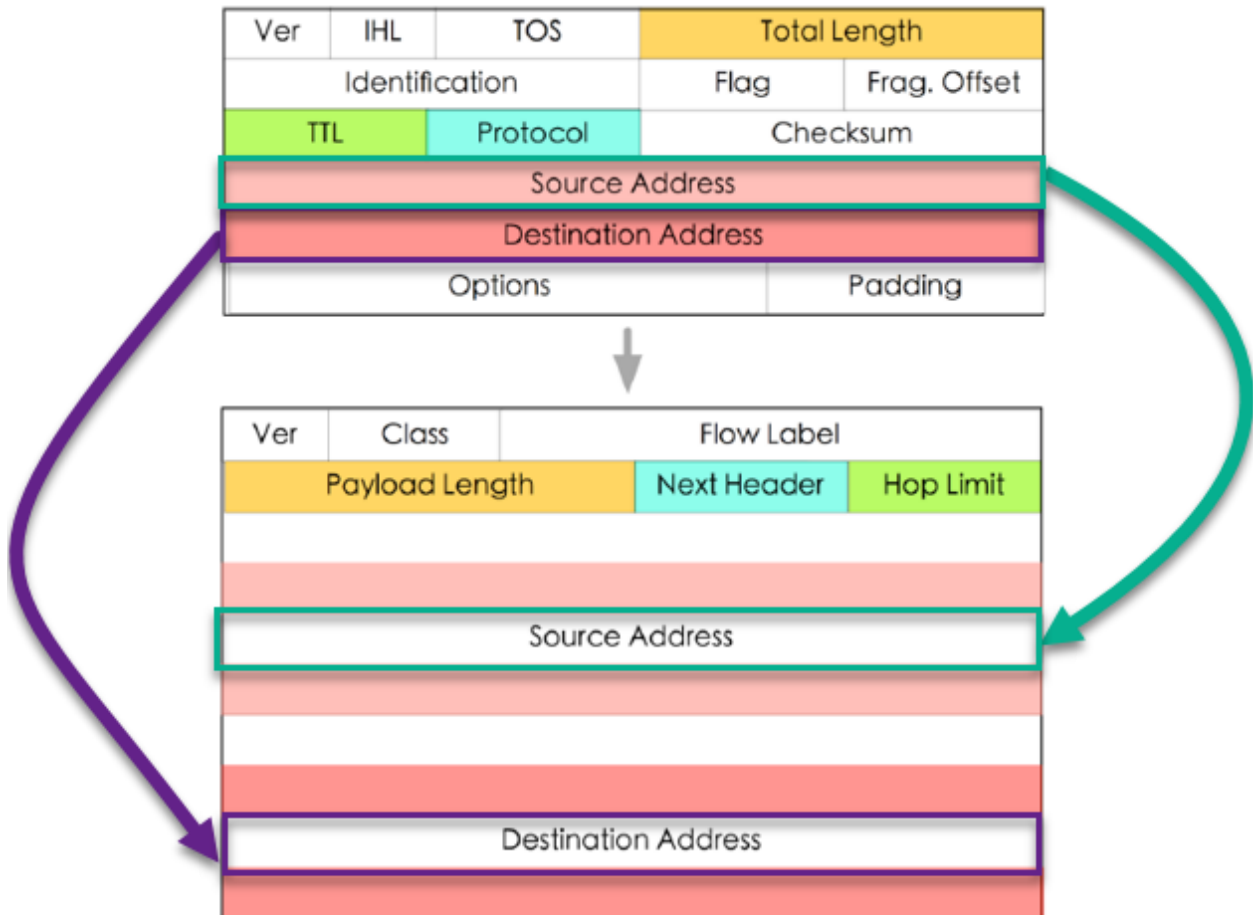
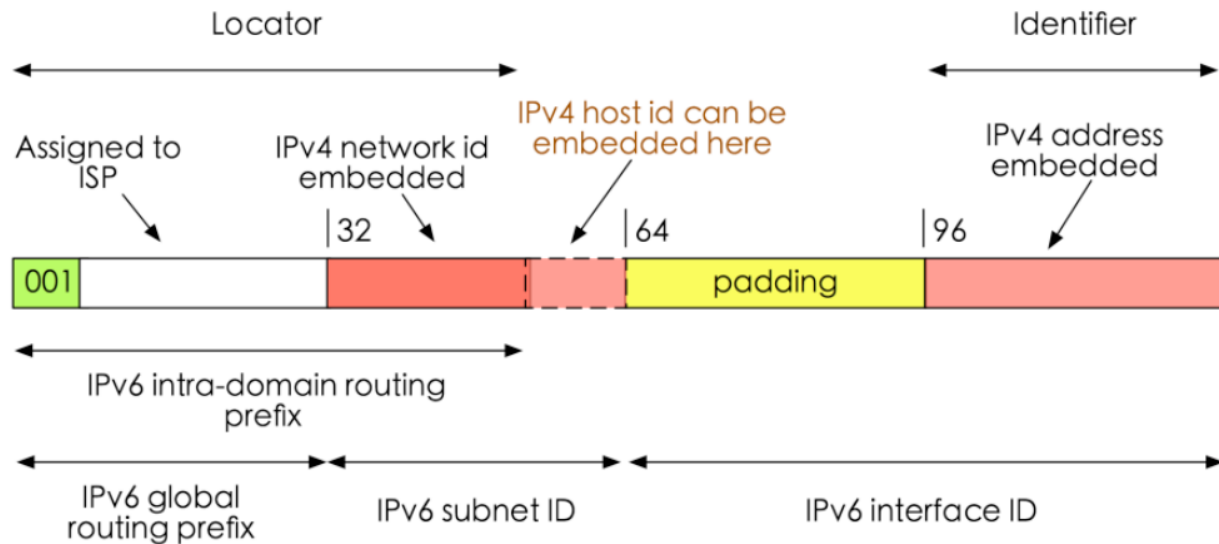


Figure 4. Mapping the header from IPv4 to IPv6

EX1037, 4 (annotated); EX1003, ¶107. The IPv4 source address is replaced with an IPv6 source address (green) and the IPv4 destination address is replaced with an IPv6 destination address (purple). EX1037, 4. The IPv6 source and destination addresses are constructed using the address mapping scheme of Li and Li-2, which concatenates an IPv6 prefix, an IPv4 address and, when modified by Li-2, a port number. EX1003, ¶107.

For instance, Li discloses an “address mapping” method where “IPv4 source and destination addresses in a packet can be translated into their IPv6 version.”

EX1037, 3. Figure 2 of Li discloses an IPv6 address (e.g., an IPv6 destination address) constructed with Li's address mapping:



EX1037, 3. The first 32 bits are an IPv6 global routing prefix that is assigned to the IPv6 domain by an “ISP [Internet Service Provider].” *Id.*, 3 (“IPv6 prefixes [are] allocated by the provider”). Li’s IPv6 global routing prefix corresponds to the ’845 patent’s “IPv6 prefix.” EX1003, ¶108. The next 32 bits (up to bit 63)³ of the constructed IPv6 address is an IPv4 address. EX1037, 3 (“IPv4 ... destination address[] in a packet can be translated into their IPv6 version...”), 5 (“IPv4 ... destination address is sometimes copied twice at the translation.”). The 32 bits after that (up to bit 95) is “padding,” in which empty space is filled with 0s. *Id.*

³ Or, alternatively, the last 32 bits. EX1037, 3.

Li's "address mapping" involves concatenating—construed by the Texas court to mean “appending one item to the end of another so as to form a single unit in a contiguous pattern”—these pieces of information. EX1003, ¶109; EX1036, 13. This is shown in Table 1, which provides examples of Li's address mapping:

TABLE I. SOME ADDRESS MAPPING EXAMPLES

IPv4 prefix/address	IPv6 prefix/address
202.112.0.0/13	2001:da8:ca70::/45
166.111.0.0/16	2001:da8:a66f::/48
166.111.172.1	2001:da8:a66f:ac01::a66f:ac01

EX1037, 3. The left column contains IPv4 addresses or address ranges, represented in dotted-quad notation. EX1003, ¶109. The right column contains translated IPv6 addresses or address ranges, represented in hexadecimal notation. *Id.* In this example, the IPv6 domain is assigned an IPv6 prefix of 2001:da8. EX1037, 3. In the outbound direction, when an edge router receives a data packet, it concatenates the IPv6 prefix with the IPv4 address shown in the left column. *Id.*

For instance, as Table 1 shows, the third row maps an IPv4 destination address of 166.111.172.1, which corresponds to a host in AS24348, to an IPv6 destination address of 2001:da8:a66f:ac01::a66f:ac01. EX1037, 3; *see also id.*, 7 (Fig. 7 showing AS24348 hosts have a network prefix of 166.111.0.0/16); EX1003, ¶110.

The double-colon notation—“::”—in the IPv6 address indicates that the numbers following each colon are zeros; thus, the IPv6 address 2001:da8:a66f:ac01::a66f:ac01 is equivalent to 2001:da8:a66f:ac01:0:0:a6f:ac01. EX1003, ¶110.

The constructed IPv6 address begins with the IPv6 prefix: 2001:da8. *Id.*, ¶111; *see also* EX1037, 3. The IPv4 address (“166.111.172.1”) follows next, and is written in hexadecimal notation (“a66f:ac01”)—the IPv4 address is also repeated at the end, for reasons not relevant to this petition. *Id.* ¶111; *see also* EX1037, 3. And the “0:0” are the zero padding shown in Figure 2. EX1003, ¶111; EX1037, 3. Thus, Li teaches “an IPv6 destination address constructed by concatenating an IPv6 prefix, [and] an IPv4 destination address.”

Although Li does not expressly disclose further concatenating “a destination port number,” it would have been obvious to do so in view of Li-2. EX1003, ¶112. Li-2 teaches a similar address mapping scheme (which it calls “IVI address mapping”) as that disclosed in Li. But Li-2 expands Li by further disclosing that a constructed IPv6 address may also include a destination port number. Specifically, Li-2 describes “port multiplexing”—an extension of Li that constructs an IPv6 address by not only concatenating an IPv6 prefix and IPv4 address but further concatenating a port number. EX1038, 14.

A POSITA would have recognized that there is more than sufficient space to further include a 16-bit destination port number in Li's constructed IPv6 destination address by replacing 16 bits of the zero padding with the destination port number. EX1003, ¶113. Indeed, that's exactly what Li-2 teaches: "The mapping scheme is to use the least significant bits in the IVI6(i) to define the multiple mapping and combine the tran[s]port-layer port number to uniquely perform the mapping from IVI4(i) to IVI6(i)." EX1038, 14. In fact, in a presentation to the IETF describing Li-2 the authors presented examples of Li-2's stateless mapping algorithm. EX1028. These examples further confirm that Li-2 constructs a destination IPv6 address (orange box on the right) by concatenating (1) an IPv6 prefix with (2) an IPv4 address and (3) a port number in a received data packet (purple box on the left):

```
- 202.38.108.2#81 --> IVI61=2001:250:ffca:266c:0200::81#81
- 202.38.108.2#82 --> IVI61=2001:250:ffca:266c:0200::82#82
- 202.38.108.2#83 --> IVI61=2001:250:ffca:266c:0200::83#83
- 202.38.108.2#84 --> IVI61=2001:250:ffca:266c:0200::84#84
```

EX1028, 22 (highlighted); *see also* §VIII.A.2; EX1003, ¶¶80, 113.

As Li-2 also explains, the "ff" that sits between the IPv6 prefix and the IPv4 address in the constructed IPv6 address is an identifier indicating that the address is a constructed "IVI" address. EX1038, 6 (illustrating "FF" between "IPv6 prefix" and "IPv4 address" and stating that it is "the identifier of IVI."); EX1003, ¶114. In

other words, in the combined Li-Li-2 combination, Li's edge router (*e.g.*, the edge router in the top left of Figure 11) would construct an IPv6 destination address by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number, as recited in this limitation. EX1003, ¶114. The edge router on the top left of Figure 11 would then route the data packet with the constructed IPv6 address to Li's "home gateway" via the IPv6 network. EX1037, 6 ("Fig. 7 summarizes the scenario where access networks send their IPv4 traffics to each another via the pure-IPv6 backbone of their service provider. In the Figure, two IPv4 native ASes are attached to the provider IPv6 AS with the help of edge routers..."), 5 (Figure 5(a) showing Edge Router B sending IPv6 packet to Edge Router C).

For instance, in the example discussed above the edge router in the top left of Figure 11 routes the IPv6 packet to the edge router on the top right of Figure 11 that serves a host having the IPv4 address 166.111.172.1 (which is within access network AS24348 whose network prefix is 166.111.0.0):

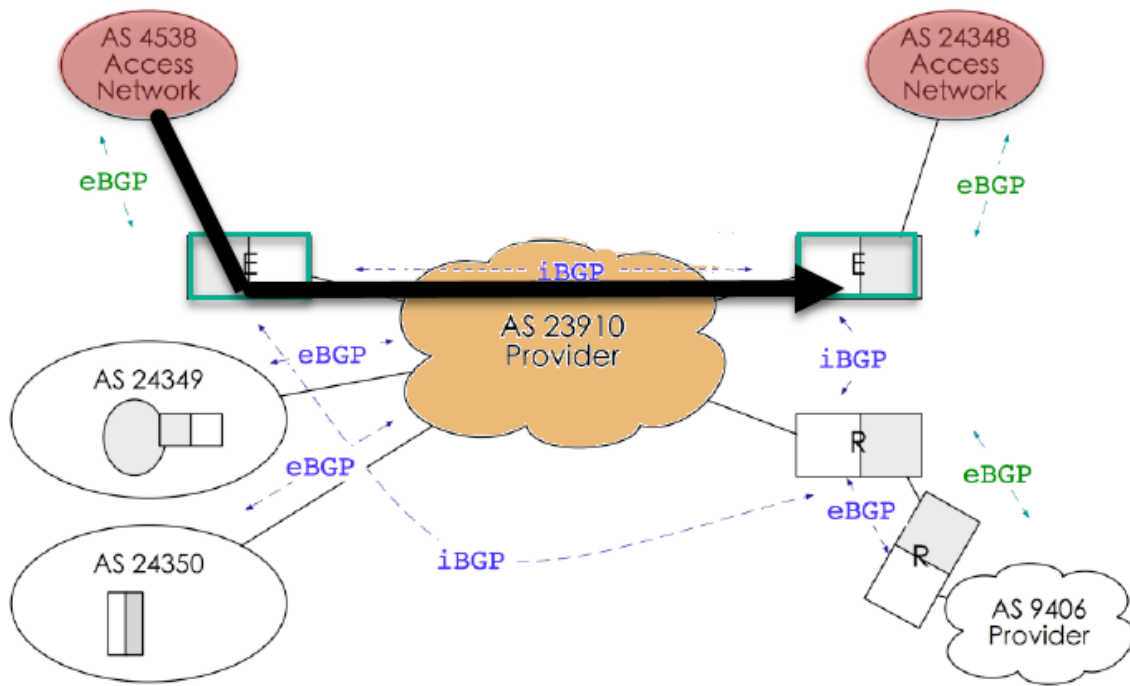


Figure 11. Migration with 3 steps

EX1003, ¶115; *see also* EX1037, 7 (Fig. 7 showing AS24348 hosts have a network prefix of 166.111.0.0/16). The edge router in the top right receives the packet and identifies that it has an IPv6 address that was constructed using the IVI scheme. EX1038, 6 (“bit 32 to bit 39 are all one’s as the identifier of IVI”; Figure 1 illustrating the IVI identifier as “FF”); EX1003, ¶115.

Alternatively, if the IPv6 packet is destined for a host within the access network AS24349, then the edge router in the top left of Figure 11 would route the IPv6 packet to the edge router that is within AS24349, as shown below:

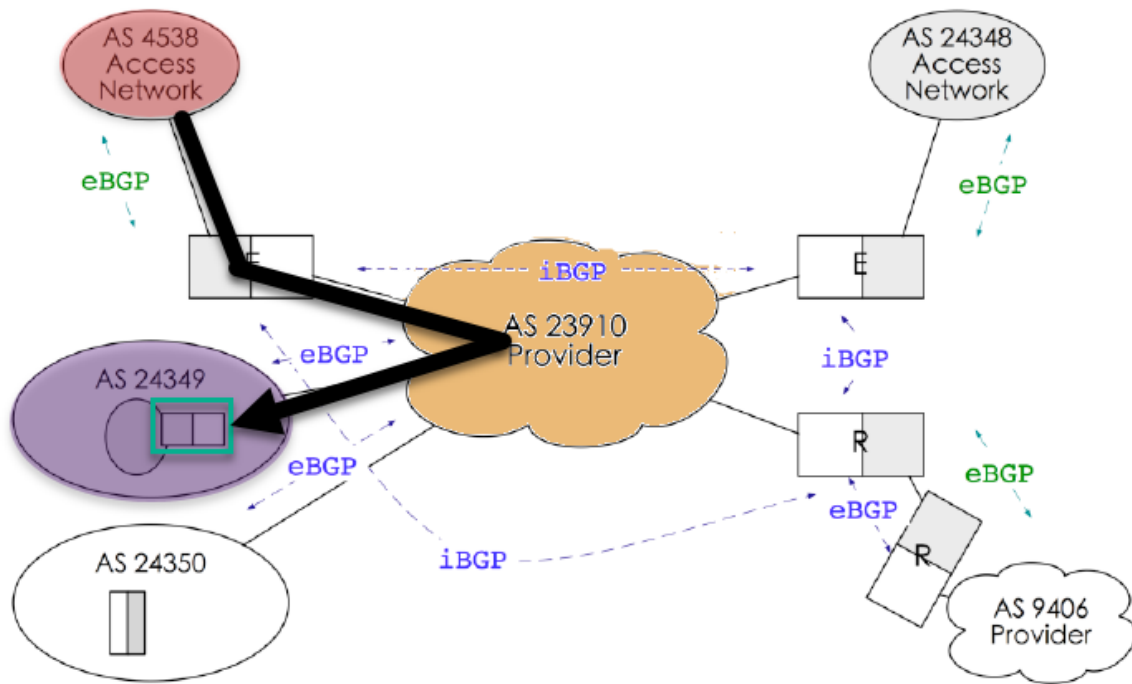
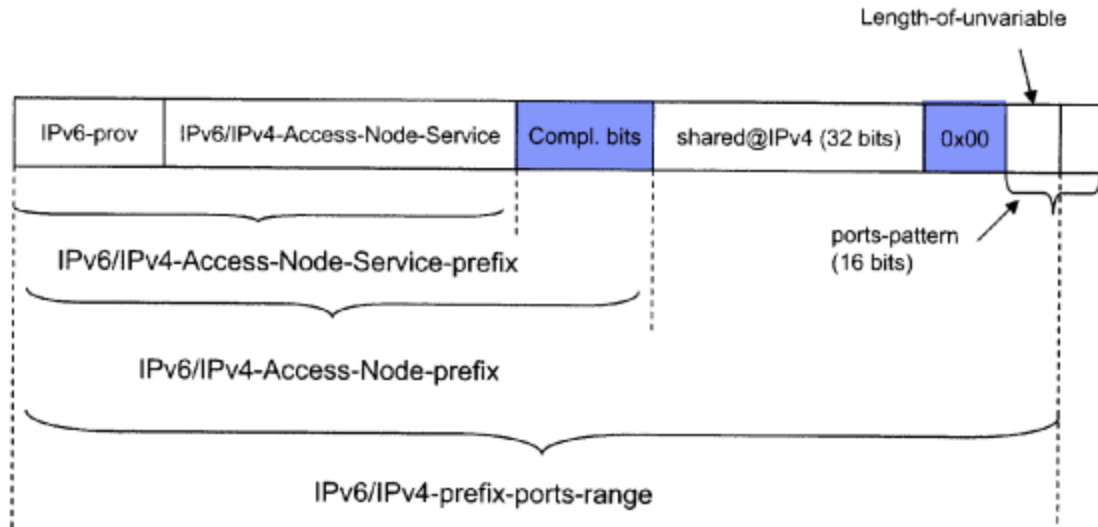


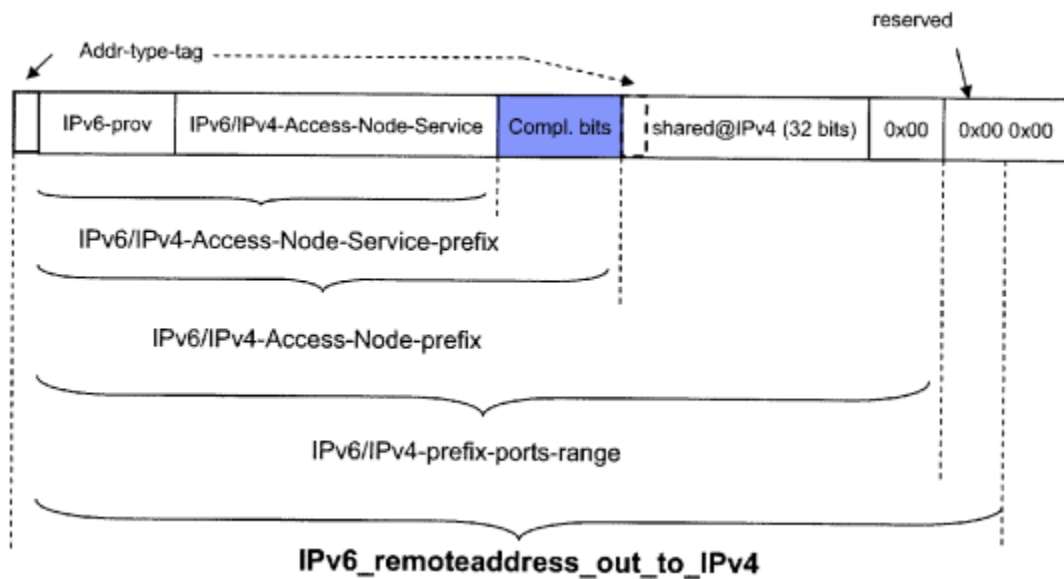
Figure 11. Migration with 3 steps

EX1037, 9 (highlighting added); EX1003, ¶116.

To the extent Patent Owner argues that Li-2 does not disclose “concatenating” because Li-2 teaches that there are intervening bits between the IPv6 prefix and the IPv4 address (*e.g.*, the FF field denoting that the address is a constructed IVI address), the Board should reject this argument. The ’845 Patent show exemplary constructed addresses that have similar intervening data fields separating between the claimed elements of the constructed address:



EX1001, Fig. 2.



EX1001, Fig. 4.

(c) 1[b]

Li and Li-2 disclose and render obvious the limitation 1[b]: “if necessary, regularizing at least one of the IPv6 source address and the IPv6 destination address of the data packet by replacing said at least one IPv6 address, the replacement

process belonging to a group comprising replacement of a constructed address with a native address and replacement of a native address with a constructed address, and modifying the data packet using the regularized address.” EX1003, ¶117.

This limitation requires either (1) regularizing the IPv6 source address by replacing the IPv6 source address, or (2) regularizing the IPv6 destination address by replacing the IPv6 destination address. The Texas court construed “regularizing” to have its “plain and ordinary meaning.” See EX1036, 29-33. More specifically, at Patent Owner’s urging, the court adopted a broad view of the plain meaning. Indeed, in the Texas litigation Patent Owner proposed that the plain meaning of “regularizing” is nothing more than “conforming [the IP address] to the destination IP domain.” *Id.*, 29 (“Plaintiff argues that regularizing is nothing more than conforming IP addresses by either replacing a native address with a constructed one, or vice versa.”). Patent Owner stated that the “regularizing” step [1] includes changing IPv6 addresses into IPv4 addresses and vice versa, and [2] does *not* require a NAT table. *Id.*, 30 (“Plaintiff argues that the specification also describes the home gateway transforming packets from IPv6 into IPv4 and vice versa.”), 31 (“Plaintiff contends that NAT tables are not a necessary part of regularizing the address(es), because the claims are not limited to IPv6-to-IPv6 connections.”). The Texas court accepted Patent Owner’s view of the plain meaning. *Id.*, 31 (“The independent claims do not require a NAT table”), 32 (“The specification indicates that the claims

are not as limited” to IPv6-to-IPv6 translations). Under the Texas court and Patent Owner’s construction, Li and Li-2 disclose the step of “if necessary, regularizing....” EX1003, ¶118.

First, as discussed in connection with limitation 1[a], Li discloses an example in which an IPv4 host in the top-left IPv4 access network sends a data packet to an IPv4 host in the top-right IPv4 access network, as depicted by the black arrow below:

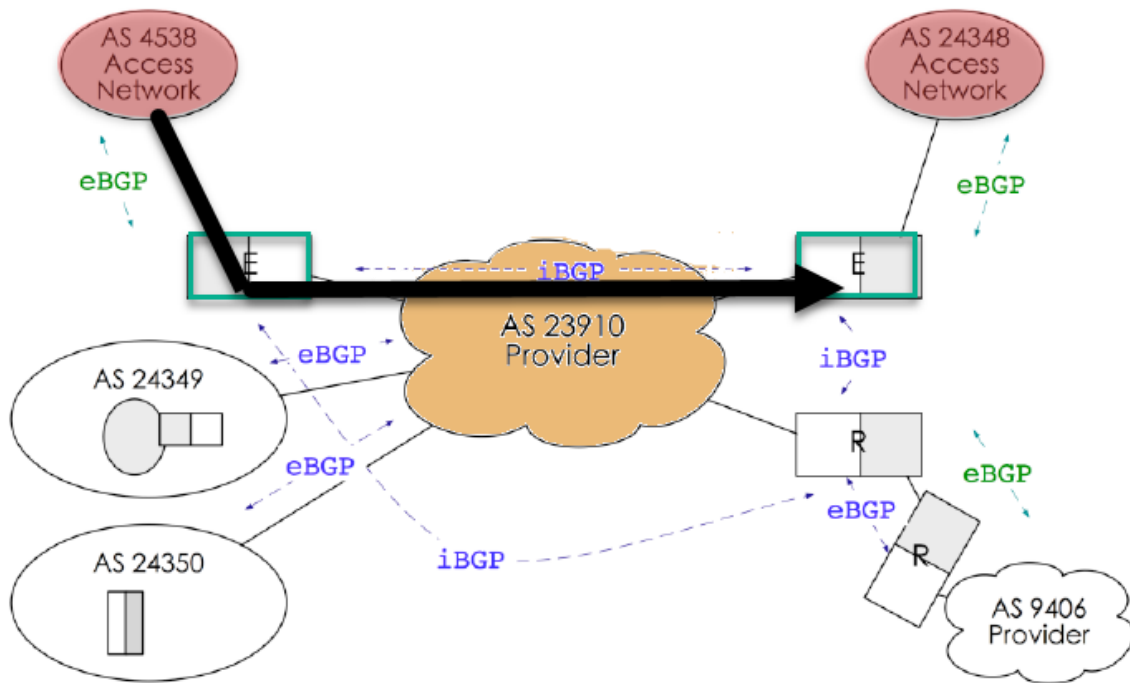


Figure 11. Migration with 3 steps

EX1003, ¶119; *see also* §VIII.A.5.a. The edge router on the top right of Figure 11 receives IPv6 packets with an IPv6 address constructed using the address translation scheme of Li and Li-2 (referred to as the “IVI address mapping”). *Id.* The edge router identifies that it has an IPv6 address that was constructed using the IVI

scheme. EX1038, 6 (“bit 32 to bit 39 are all one’s as the identifier of IVI”; Figure 1 illustrating IVI identifier as “FF”); EX1003, ¶119. The edge router then conforms the IP addresses to the destination IPv4 domain (AS24348) by replacing the constructed IPv6 addresses with IPv4 addresses. EX1003, ¶120. Indeed, in the example above the edge router in the top right receives the IPv6 packet and inverses the IVI address mapping in order to send the packet to the IPv4 domain. EX1037, 4 (“An edge router manipulates the IP headers for the packets passing through it from IPv6 to IPv4 or vice versa”); *see also* EX1038, 11 (Figure 5 showing IPv6-to-IPv4 translation); EX1028, 19 (explaining that IPv6 to IPv4 translation applies the “inverse” IVI address mapping). For instance, in the example above the edge router inverses the IVI address mapping for the constructed IPv6 destination address of 2001:da8:a66f:ac01::a66f:ac01 (discussed in connection with Limitation 1[a]) by replacing it with the native destination IPv4 address of 166.111.172.1, as indicated by the red arrow in the image below:

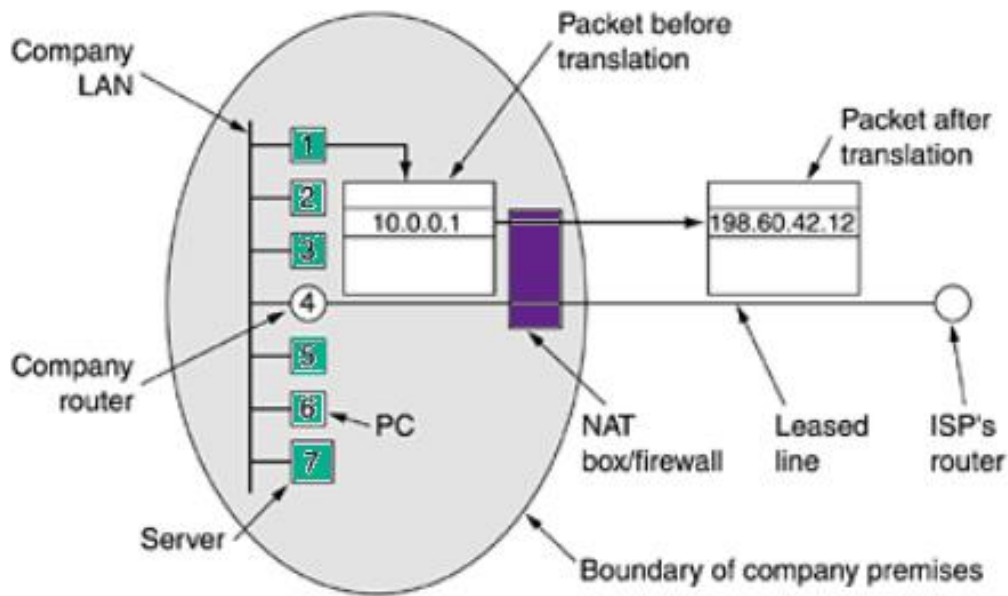
TABLE I. SOME ADDRESS MAPPING EXAMPLES

IPv4 prefix/address	IPv6 prefix/address
202.112.0.0/13	2001:da8:ca70::/45
166.111.0.0/16	2001:da8:a66f::/48
166.111.172.1	2001:da8:a66f:ac01::a66f:ac01

EX1037, 3 (red arrow added); *see also* EX1037, 5 (Figure 5(a) showing Edge Router C conforming IPv6 to IPv4 before sending packet to Host D); EX1003, ¶120. The edge router then modifies the data packet by using the regularized address (*e.g.*, 166.111.172.1) as the IPv4 destination address in the IPv4 header, and routes it to the IPv4 domain. *See* EX1037, 4; EX1038, 11 (Figure 5); EX1028, 19; EX1003, ¶120.

Second, as mentioned above, under the construction proposed by Patent Owner and adopted by the Texas Court, regularizing does *not* require a NAT table. However, Li-2 also teaches that NAT can be integrated into its system as part of the regularizing step. EX1038, 18 (“IPv4 NAT can easily be integrated into the system.”). By the date of the ’845 patent, POSITAs were well-aware of NAT and would have been motivated to include NAT in a system like Li and Li-2. EX1001, 1:56-60 (“This table is known to the person skilled in the art as a NAT (network address translation) table.”); EX1058, 7 (“NAT features such as address hiding are valuable.”); EX1003, ¶121.

IPv4 NAT translates public IPv4 addresses to private IPv4 addresses. EX1003, ¶122; *see also* §IV.C. The image below shows a NAT (purple) within a customer network having multiple user terminals (green):



EX1059, 340. “Within the company premises, every machine has a unique address of the form 10.x.y.z” (its private IPv4 address), which is converted to a public IPv4 address (198.60.42.12) by a “NAT” when communicating outside of the internal network. *Id.*; see also *id.*, 341 (“On the way back, packets undergo the reverse mapping.”); EX1003, ¶122. While the image above illustrates the NAT and company router as separate devices, POSITAs understood that “[i]t is also possible to integrate the NAT box into the company’s router.” EX1059, 453; EX1003, ¶122.

Thus, in view of the general knowledge of a POSITA, it would have been obvious to implement NAT within the access gateway of AS24349 (green box):

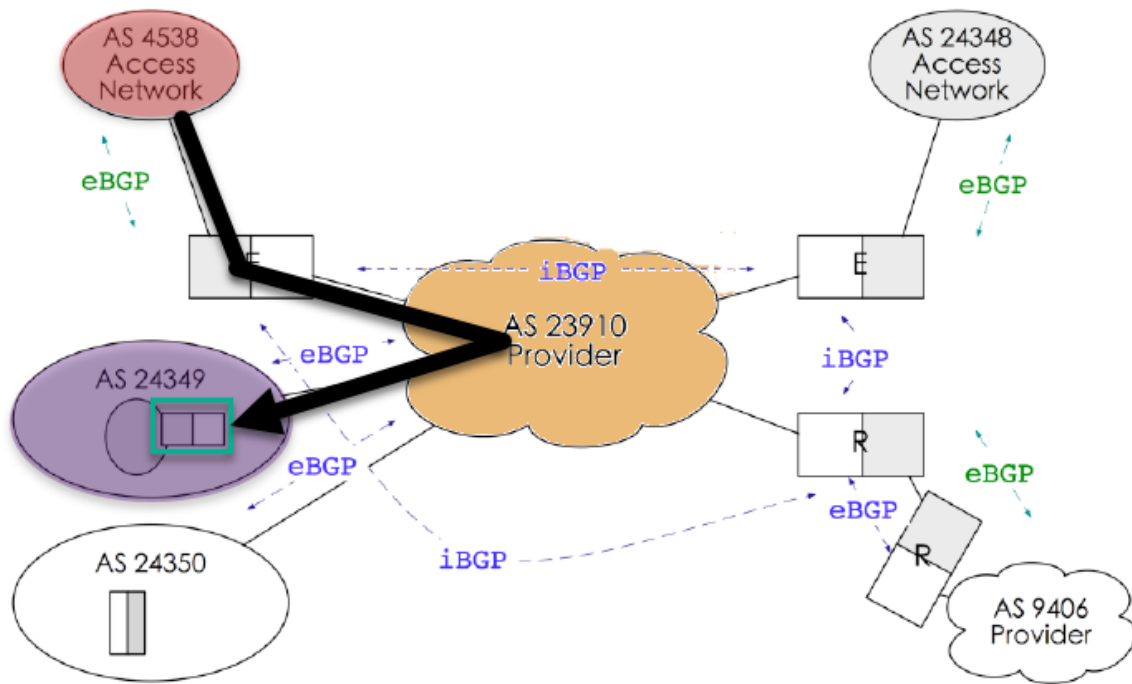


Figure 11. Migration with 3 steps

EX1037, 9 (highlighting added); EX1003, ¶123. In particular, Li describes AS24349 as an “IPv6 access network containing a small group of IPv4 subnets” (EX1037, 9-10). EX1037, 9. Thus, a POSITA would have understood that when communicating with the IPv4 subnets, the edge router in AS24349 (green box) would inverse the IVI mapping scheme to return the public destination IPv4 address embedded in the constructed destination IPv6 address—in the same manner that was just discussed in relation to the IPv4 only domain in the top right (AS24348). EX1003, ¶124. After Li’s router receives and translates the constructed IPv6 address to a native public IPv4 address by reversing the IVI address mapping, “IPv4 NAT can easily be integrated into the system” to further translate the native IPv4 address

to a private IPv4 address. *Id.* The data packet would then be routed with the private IPv4 address to its destination, namely the IPv4 host that is allocated that private IPv4 address. *Id.*

(d) 1[c]

Li further discloses “routing the modified data packet to its destination.” EX1003, ¶125. As discussed in the prior limitation, Li and Li-2 disclose regularizing and modifying a data packet. A POSITA would understand Li to teach that the modified data packet is routed to the address in the destination IP address field. *Id.*, ¶125. Indeed, Figure 5(a) of Li illustrates an example in which the edge router C routes a packet to its destination IP address, namely host D. EX1037, 5.

6. Claim 5

(a) 5[pre]

Li and Li-2 render obvious limitation 5[pre]: “The method according to claim 1, wherein when the data packet comes from the IPv4 domain and goes to said user terminal, the step of regularizing the destination address comprises the following steps”. EX1003, ¶126.

For example, with reference to Figure 11 below, Li discloses that the router within the native IPv6 AS24349 network (purple) receives an IPv6 packet, where the IPv6 packet was originally transmitted as an IPv4 packet from AS4538 (red):

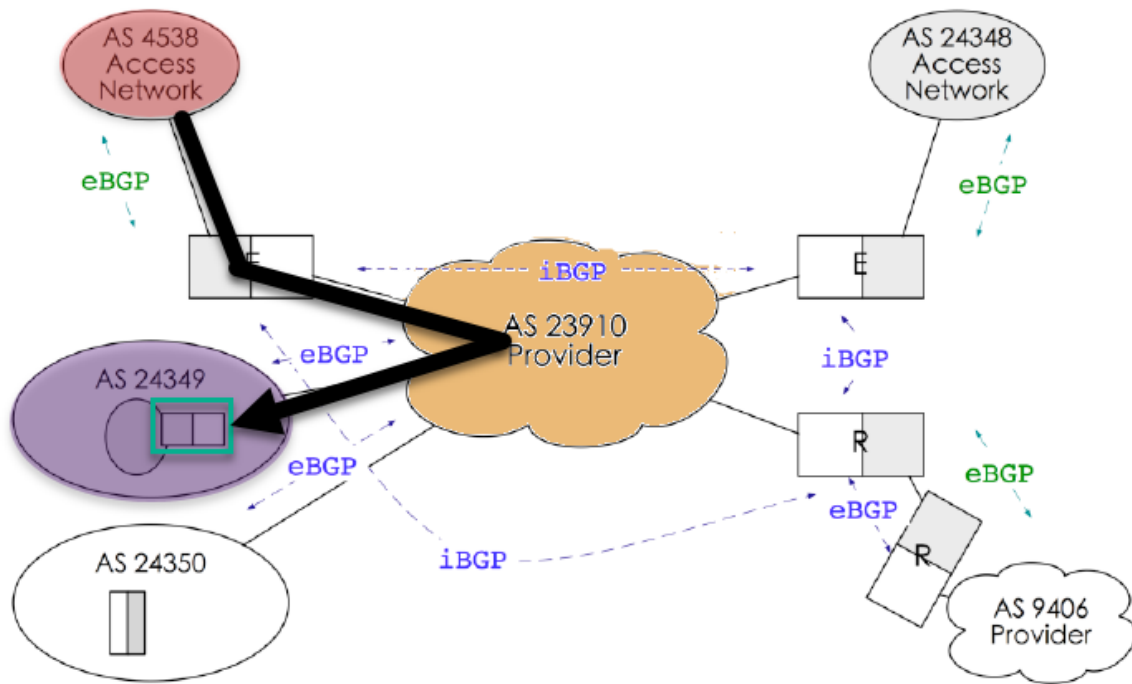


Figure 11. Migration with 3 steps

EX1037, 9 (highlighting added); EX1003, ¶127. When the router in the AS24349 network receives the IPv6 packet, it translates the constructed IPv6 address to a native public IPv4 address by reversing the IVI address mapping and may also integrate IPv4 NAT to further translate the native IPv4 address to a private IPv4 address. See §VIII.A.5.c. The IPv4 packet is then routed to a host within the AS24349 that is associated with the private IPv4 address (“user terminal”). *Id.*

(b) 5[a]

Li and Li-2 disclose and render obvious “searching an address translation table of the gateway for an entry associating with said constructed destination address a native destination address.” EX1003, ¶128.

Li-2 teaches that after the router in AS24349 translates the constructed IPv6 address to a native public IPv4 address by reversing the IVI address mapping, “IPv4 NAT can easily be integrated into the system” to further translate the native IPv4 address to a private IPv4 address. EX1038, 18. EX1003, ¶129. A POSITA would have understood that IPv4 NAT utilizes an address translation table that would include an association between private IPv4 destination addresses (“native destination addresses”) and public IPv4 addresses contained in the constructed IPv6 destination addresses (“said constructed destination address”), allowing Li’s router to perform the public-to-private IPv4 translation. EX1059, 340 (“When a packet arrives at the NAT box from the ISP, the source port in the TCP header is extracted and used as an index into the NAT box’s mapping table. From the entry located, the internal IP address and original TCP Source port are extracted and inserted into the packet. Then both the IP and TCP checksums are recomputed and inserted into the packet. The packet is then passed to the company router for normal delivery using the 10.x.y.z address.”); *see also* EX1001, 1:56-60 (“This table is known to the person skilled in the art as a NAT”); §IV.C.

(c) 5[b]

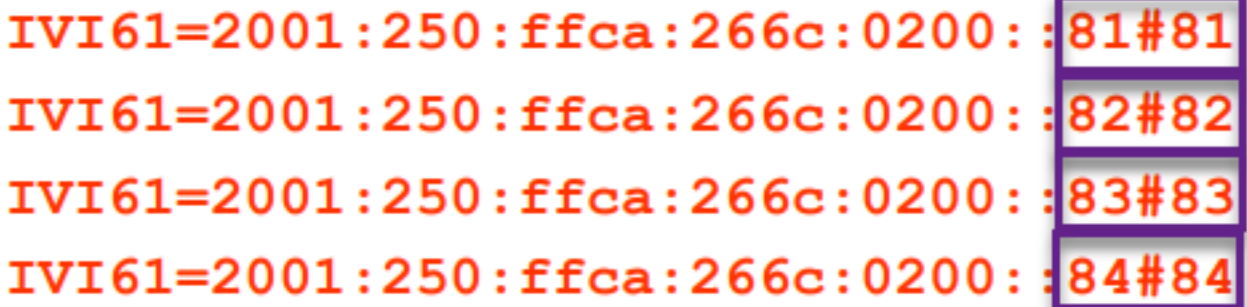
Li and Li-2 disclose and render obvious “if an entry is found, replacing the constructed destination address of the data packet with the native destination address from that entry.” EX1003, ¶130. As described in connection with Limitations 5[a]-

[b], Li-2 teaches that after the router in AS24349 translates the constructed IPv6 address to a native public IPv4 address by reversing the IVI address mapping, “IPv4 NAT can easily be integrated into the system” to translate the public IPv4 address to a private IPv4 address, if an entry is found in the NAT table. EX1038, 18; EX1059, 340-341; EX1003, ¶130.

7. Claim 6

The combination of Li and Li-2 disclose and render obvious “[t]he method according to claim 5, further comprising a step of verifying that the destination port number of the data packet and the destination port number contained in the constructed destination address match.” EX1003, ¶131.

For example, Li-2 discloses that the destination port number of the data packet and the destination port number contained in the constructed destination address should match. EX1038, 14. In particular, Li discloses that its IVI address mapping uses “the transport-layer port number [i.e., destination port number of the data packet] to uniquely perform the mapping from IVI4(i) to IVI6(i).” *Id.* For instance, the image below illustrates examples of destination IPv6 addresses constructed using Li-2’s IVI address mapping, and confirms that the destination port number in the constructed address is to match the destination port number in the data packet:



IVI61=2001:250:ffca:266c:0200::81#81
IVI61=2001:250:ffca:266c:0200::82#82
IVI61=2001:250:ffca:266c:0200::83#83
IVI61=2001:250:ffca:266c:0200::84#84

EX1028, 22 (highlighted); EX1003, ¶132.

A POSITA would have also found it obvious to verify that the port numbers match. EX1003, ¶133. By the time of the alleged invention of the '845 patent, POSITAs understood that such a comparison would be useful to identify errors and security issues. *Id.* For instance, Li-2 references RFC 4380. EX1038, 38. RFC 4380 explains that when receiving a constructed address (a Teredo address) a comparison of the port number in the transport layer header and the port number in the constructed address is useful in detecting “spoofed” packets. EX1032 at 28-29 (“client compares the mapped IPv4 address and mapped port in the source address with the source IPv4 address and source port of the packet.”); EX1003, ¶133. Similarly, the '845 patent teaches that its system verifies port numbers to protect against spoofed packets. *See* EX1001, 13:60-14:2 (explaining that router “verifies” port numbers to confirm “there is no spoofing” in “a standard manner in accordance with a principle already used for IPv6 native traffic.”).

8. Claim 7

Li discloses “[a] non-transitory computer program product that is at least one of downloadable from a communications network and stored on a computer-readable medium and executable by a microprocessor, comprising program code instructions for executing the method according to claim 1 of receiving a data packet in an IPv6 domain.” EX1003, ¶134. As described above, Li and Li-2 disclose that their method is implemented as part of a gateway (or edge router). EX1037, 3, 7; *see also* EX1038, 17 (“IVI gateway based on the Linux implementation has been deployed”); *see also* EX1037, 5 (describing “in-lab experiments” performed on “5 computers”). A POSITA would have known that a gateway comprises memory (a compute readable medium) and a microprocessor, and that it stores in memory program code instructions that are executed to perform its operations. EX1003, ¶134.

9. Claim 8

(a) 8[pre]

Li teaches “a device for receiving an IPv6 data packet in an IPv6 domain connected to an IPv4 domain, said packet comprising an IPv6 destination address and an IPv6 source address, said device for use in a home gateway adapted to connect a user terminal to said IPv6 domain.” *See* (§VIII.A.5.a). For instance, Li’s edge routers, such as the edge router connecting AS24348 or the edge router within AS24349, are a “home gateway” that satisfies limitation 8[pre] for the reasons discussed in connection with claim 1:

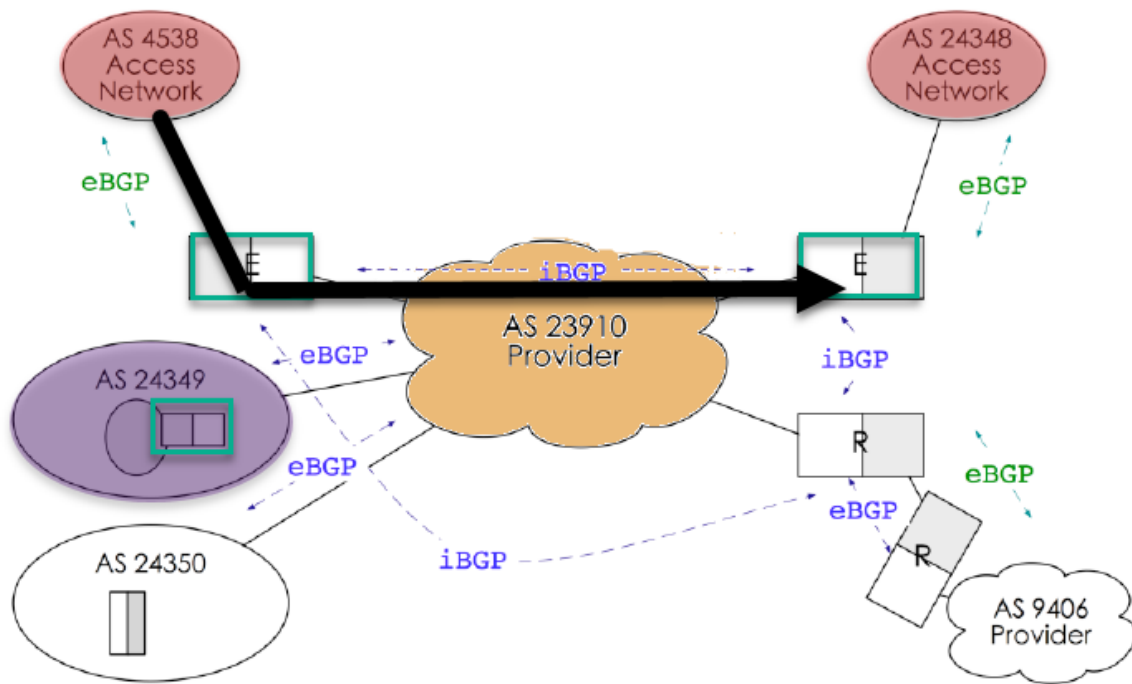


Figure 11. Migration with 3 steps

EX1037, 9 (highlighting added); EX1003, ¶136.

(b) 8[a]

The Texas court construed this means limitation as discussed in §VII. Li and Li-2 render obvious this limitation under the Texas construction. EX1003, ¶138. For instance, Li and Li-2 disclose a home gateway that identifies an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number.” See §VIII.A.5.b; EX1003, ¶137. Li discloses that its “gateway” is implemented on computers and using the Linux operating system. EX1037, 3, 7; *see also* EX1038, 17; *see also* EX1037, 5.

A POSITA would, therefore, understand that the gateway includes a processor programmed with computer instruction for performing the identifying step.

(c) 8[b]

The Texas court construed this means limitation as discussed in §VII. Li and Li-2 render obvious this limitation under the Texas construction. For instance, Li and Li-2 disclose a home gateway. *See* §VIII.A.5.c; EX1003, ¶139. Li's home gateway identifies IPv6 packets with an IPv6 destination address constructed using the IVI address mapping. EX1038, 6 ("bit 32 to bit 39 are all one's as the identifier of IVI"; Figure 1 illustrating the IVI identifier as "FF"); EX1003, ¶140. The home gateway then regularizes the constructed address by inverting the IVI address mapping to obtain the embedded IPv4 address, and may further implement NAT to search a translation table for a native destination address associated with the constructed destination address (a private IPv4 address). *See* §VIII.A.5.c. To protect against spoofing, a POSITA would have also found it obvious to verify that the transport level destination port of the data packet agrees with the destination port number contained in the destination address of the packet (*See* §VIII.A.7), and to modify the packet by replacing the constructed destination address with the native IPv4 destination address if there is a match (*See* §VIII.A.5.(d)). EX1003, ¶140.

(d) 8[c]

The Texas court construed this means limitation as discussed in §VII. Li and Li-2 render obvious a home gateway that includes means for routing under the Texas court's construction. See §VIII.A.5.d; EX1003, ¶141.

B. Ground 2: Claims 1, 5-8 Would Have Been Obvious in View of Li

To the extent Patent Owner attempts to argue that Li-2 is not prior art, the Challenged Claims are still obvious based on Li in view of the common knowledge of a POSITA. EX1003, ¶142.

1. Evidence of Simultaneous Invention Demonstrates The Obviousness Of Modifying Li

“Independently made, simultaneous inventions, made ‘within a comparatively short space of time,’ are persuasive evidence that the claimed apparatus ‘was the product only of ordinary mechanical or engineering skill.’” *Geo. M. Martin Co. v. All. Mach. Sys. Int’l LLC*, 618 F.3d 1294, 1305 (Fed. Cir. 2010). Here, evidence of simultaneous invention further indicates that a POSITA would have been motivated to modify Li to construct a IPv6 destination address by concatenating a IPv6 prefix, an IPv4 destination address, and a destination port number. EX1003, ¶143.

Li-2 is at minimum evidence of simultaneous invention. As discussed in Ground 1, Li-2 was publicly available as of June 21, 2008 and discloses a port multiplexing technique which is used to construct an IPv6 address containing an IPv6 prefix, a destination IPv4 address, and a destination port number. See §VIII.A.2.

Similarly, on July 6, 2008, just one week after the '845 patent's priority date, the authors of the Li and Li-2 references submitted another IETF publication ("IVI Memo"). EX1027; EX1005, ¶¶49-52, 57; EX1007, ¶10. The IVI Memo also discloses using "port multiplexing" to construct an IPv6 address with a destination port number. EX1027, 7-8, 18-20; EX1003, ¶145.

In the following months the authors of the Li references continued to explain that port multiplexing could be used to "combine address with the port number," and provided examples of port multiplexing, discussed above. EX1028, 20-22; EX1003, ¶146; *see also* §VIII.A.2.b; EX1005, ¶¶53-57; EX1007, ¶11.

Other groups also disclosed this idea. EX1003, ¶149. For instance, in September 2008, Randy Bush described an approach called "Address + Port," in which an IPv6 address is constructed by concatenating an IPv6 prefix, IPv4 address, and port number. EX1029, 1-3. Bush identified several related works in the same field, explaining that "[t]here is a long history of treating port numbers as part of the network address." *Id.*, 4. Similarly, in an October 2008 presentation Mr. Bush discussed forming an IPv6 "dest[ination]" address by combining (1) a well-known prefix ("WKP") with a (2) "dest[ination]" IPv4 address, wherein the destination IPv4 address "is A+P [an address and port number]":

- BR receives IPv4 packet w/ src/dest
- Encapsulates in IPv6 packet
 - src = WKP+src
 - dest = WKP+dest
- But note that dest is A+P

EX1041, 21 (highlighted).

2. Motivation To Combine Li With The General Knowledge Of A POSITA

A POSITA would have been motivated to combine the teachings of Li with the general knowledge of a POSITA to arrive at a constructed IPv6 address that concatenates a port number, and would have had a reasonable expectation of success of doing so for much of the same reasons described in Ground 1. *See* §VIII.A.4; *see also* EX1003, ¶¶150-155. In the combined system, Li would construct an IPv6 destination address by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number. *Id.*

3. Claim 1

(a) 1[pre]

Li teaches the elements of limitation 1[pre]. *See* §VIII.A.5.a; EX1003, ¶156.

(b) 1[a]

Li teaches limitation 1[a] with the exception of “a destination port number.” See §VIII.A.5.b. A POSITA would have found it obvious in view of the general knowledge of a POSITA to modify Li to replace 16 bits of its unused padding with a destination port number. EX1003, ¶157; §VIII.B.2.

(c) 1[b]

Li in view of the general knowledge of a POSITA renders obvious the regularizing step of limitation 1[b]. See §VIII.A.5.c; EX1003, ¶158.

Li discloses that its edge routers receive IPv6 packets and replace the constructed IPv6 addresses with IPv4 addresses by inverting the address mapping. *Id.* In view of the general knowledge of a POSITA, it would have been obvious to further regularize the address by using IPv4 NAT, such that the IPv4 address is further translated from a public IPv4 address to a private address IPv4 address. *Id.*

A POSITA would have been well-aware of NAT at the time and its operation. See §IV.C. A POSITA would have also recognized that NAT would have improved a system like Li by, for instance, helping to slow IPv4 exhaustion and allowing Li’s access networks to hide their networks internal architecture and addresses. EX1003, ¶158; *see also* EX1058, 7 (“NAT features such as address hiding are valuable.”); *see also* EX1060 (RFC 1919) at 14 (“Address hiding is generally viewed as a Good Thing”). Evidence of simultaneous invention shows that not only would a POSITA have been motivated to make this modification and would have been successful in

doing so, but POSITAs at the time of invention were actively modifying Li in such a manner. *See, e.g.*, EX1038 (Li-2), 18 (“IPv4 NAT can easily be integrated into the system.”).

(d) 1[c]

Li in view of the general knowledge of a POSITA renders obvious limitation 1[c]. *See* §VIII.A.5.d; EX1003, ¶159.

4. Claim 5

(a) 5[pre]

Li in view of the general knowledge of a POSITA renders obvious the additional limitations of claim 5. *See* §VIII.A.6.a; EX1003, ¶160.

(b) 5[a]

Li in view of the general knowledge of a POSITA renders obvious the additional limitation of claim 5[a]. *See* §VIII.A.6.b; EX1003, ¶161.

(c) 5[b]

Li in view of the general knowledge of a POSITA renders obvious the additional limitation of claim 5[b]. *See* §VIII.A.6.c; EX1003, ¶162.

5. Claim 6

Li in view of the general knowledge of a POSITA renders obvious the additional limitation of claim 6. *See* §VIII.A.7; EX1003, ¶163.

6. Claim 7

Li in view of the general knowledge of a POSITA renders obvious the additional limitation of claim 7. See §VIII.A.8; EX1003, ¶164.

7. Claim 8

(a) 8[pre]

Li teaches all the elements of limitation 8[pre]. See §VIII.A.9.a; EX1003, ¶165.

(b) 8[a]

Li teaches limitation 8[a] except for identifying a destination port number. See §VIII.A.9.b. A POSITA would have found it obvious to modify Li to identify the destination port number of the IPv6 address. See §VIII.B.1-2. EX1003, ¶166.

(c) 8[b]

Li in view of the general knowledge of a POSITA renders obvious limitation 8[b]. See §VIII.A.9.c, VIII.B.3.c. EX1003, ¶167.

(d) 8[c]

Li in view of the general knowledge of a POSITA renders obvious limitation 8[c]. See §VIII.A.9.d, VIII.B.3.d. EX1003, ¶168.

C. Ground 3: Claims 1, 5-8 Would Have Been Obvious in View of Li alone or in view of Li-2 in further view of Paunikar

To the extent Patent Owner attempts to argue that Li or Li-2 do not render obvious implementing NAT as part of the regularizing step, the Challenged Claims

are still obvious based on Li and Li-2 (Ground 1) or Li (Ground 2) in view of U.S. Patent 7,752,334 (“Paunikar”). EX1003, ¶¶169-172.

1. Paunikar (EX1057)

Paunikar discloses that “[t]raditionally NAT has two modes of operation—basic NAT and Network Address Port Translation (NAPT)” that “both provide benefits to the network provider and/or network user.” *Id.*, 1:40-2:11. Paunikar discloses an “intelligent network address translator” that can analyze data packets “based on packet type (i.e., protocol and destination address) and decide[], based on the packet type, what mode of network address translation will be applied.” *Id.*, 5:18-33; EX1003, ¶169.

Figure 3 of Paunikar describes an embodiment of the system:

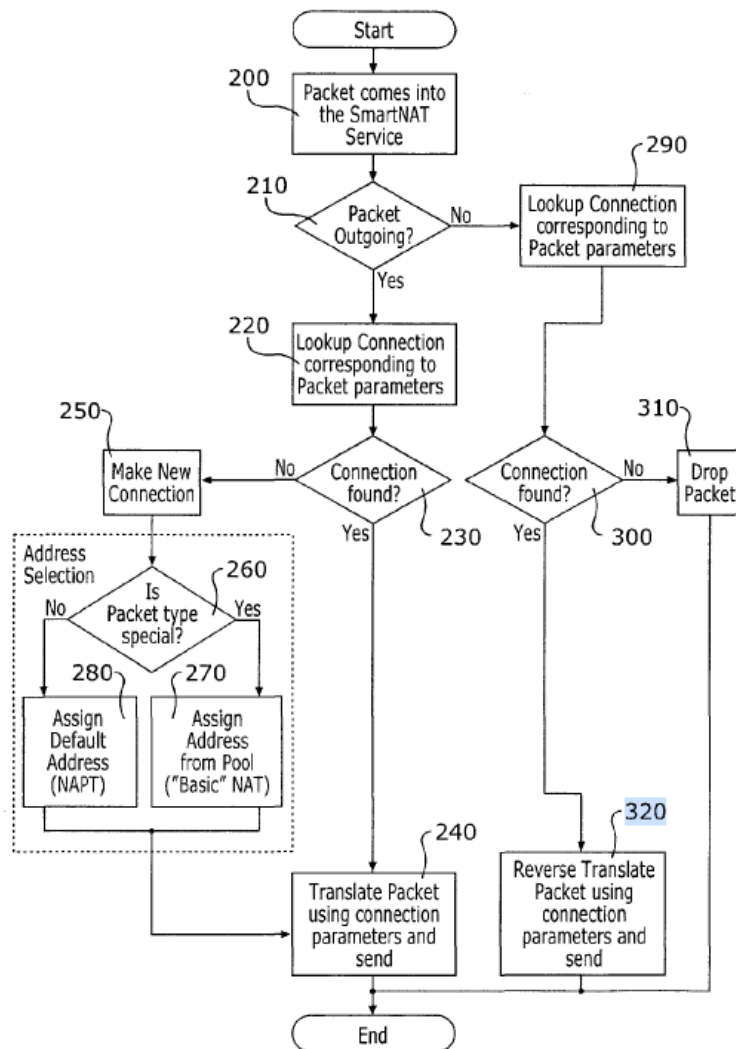


FIG. 3

EX1057, Fig. 13, 8:51-58. A packet arrives at a SmartNAT service associated with a gateway which begins analysis of the data packet. For an outgoing packet, if the SmartNAT system evaluates whether the IP address exists in the connection memory. *Id.*, 9:13-15. If a connection is found in the translation table, the system performs a translation in step 240 and completes the connection. *Id.*, 9:7-12. If no connection is found in the memory, the data packet creates a new entry for the

source address. *Id.*, 9:13-15. If the packet is “special” (*i.e.*, having characteristics defined by a network administrator), the SmartNAT system performs a basic NAT by assigning a translated address from the pool of available public IP addresses and enters that connection into the NAT table. Otherwise, NAPT is performed by assigning a public IP address with a specific source port. *Id.*, 9:33-40. EX1003, ¶171.

For an incoming packet, the data packet travels through the path denoted by steps 290, 300, and 320. At step 290, the system determines if the incoming packet corresponds with an address in the network. EX1057, 9:41-46. If a connection to the network is found (*i.e.*, “Yes” at step 300), then the SmartNAT system “reverse translates” the packet and communicates it with the private network. *Id.*, 9:54-57; EX1003, ¶172.

2. The Li-Li-2-Paunikar Combination

Grounds 1 and 2 demonstrate that Li and Li-2 disclose and render obvious receiving a data packet from an IPv4 domain in an IPv6 domain and identifying an IPv6 address constructed by concatenating an IPv6 prefix, a destination IPv4 address, and a destination port number. EX1003, ¶173. Moreover, Li-2 expressly discloses that NAT can be integrated into its system as part of “regularizing.” Although a POSITA at the time would have been aware of how NAT operates, it would also have been obvious to combine the teachings of Paunikar regarding NAT.

EX1003, ¶173. Thus, in the Li-Li-2-Paunikar combination, Li would operate in its disclosed manner but would further implement Li-2's teaching of including port numbers in constructed IPv6 addresses. When a data packet with a Li-Li-2 construction interacts with a gateway, Paunikar discloses how the gateway would regularize the data packet with NAT.

3. Motivations to Combine Li, Li-2, and Paunikar

A POSITA would have been motivated to combine the teachings of Li, Li-2, and Paunikar and would have had a reasonable expectation of success. EX1003, ¶¶174-177.

First, the prior art includes express teachings that would have led a POSITA to combine Li, Li-2, and Paunikar. EX1003, ¶175. For instance, as discussed above, several prior art documents expressed a need to not only make IPv4 domains interoperable with IPv6 domains in order to smooth the transition from IPv4 to IPv6, but also a need to slow IPv4 address exhaustion. See §IV.B. A POSITA would have known that to address IPv4 address exhaustion NAT functionality could be applied to map public addresses to private networks and vice-versa (see §IV.C). Further, the prior art explains that NAT provides additional benefits beyond conserving addresses, such as improved security. EX1003, ¶176. For instance, Paunikar explains that companies may employ NAT to “ensure security since each outgoing or incoming request must go through a

translation process that also offers the opportunity to qualify or authenticate the request or match it to previous requests.” EX1057, 1:22-31. Other prior art references similarly explain that NAT improves security by, for instance, “mask[ing] the internal IP addresses of an Intranet.” EX1058, 7 (“While IPv6 does not need NAT for connectivity, other NAT features such as address hiding are valuable.”); *see also* EX1060 (RFC 1919) at 14 (“Address hiding is generally viewed as a Good Thing, since one of the purposes of deploying proxies is to disclose as little information about an internetwork as possible.”).

Second, this combination would have involved applying a known technique to a known device ready for improvement to yield predictable results. Paunikar discloses the application of NAT functionality. *See generally*, EX1057. By the time of the alleged invention, NAT were well-known techniques. EX1003, ¶177. A POSITA could clearly have applied the techniques from Paunikar to Li’s system in order to obtain various benefits, such as masking the internal architecture of a network. *Id.* The combination would have been straightforward and yielded predictable results, as Li-2 itself indicates that NAT was a “basic requirement” of its system. EX1038, 18.

4. Claim 1

(a) 1[pre]

As discussed under Ground 1, Li teaches all the elements of limitation 1[pre].
See §VIII.A.5.a; EX1003, ¶178.

(b) 1[a]

Li teaches limitation 1[a] with the exception of “a destination port number.”
See §VIII.A.5.b. A POSITA would have found it obvious to modify Li or combine Li with Li-2 to replace 16 bits of its unused padding with a destination port number.
See §VIII.A.5.b, VIII.B.1-2; EX1003, ¶179.

(c) 1[b]

To the extent Patent Owner argues that Li or Li-2 does not disclose or render obvious limitation 1[b], this limitation was at least obvious in further view of Paunikar. EX1003, ¶180. The combined system would perform “if necessary, regularizing at least one of the IPv6 source address and the IPv6 destination address [*e.g.*, **Li’s constructed IPv6 destination address**] by replacing said at least one IPv6 address [*e.g.*, **Paunikar’s NAT and NAPT system replace the constructed IPv6 destination address with an internal IP destination address**], the replacement process belonging to a group comprising replacement of a constructed address with a native address and replacement of a native address with a constructed address, and modifying the data packet using the regularized address [*e.g.*, **the modified packet uses the internal IP destination address**].” EX1003, ¶180.

Li and Li-2 disclose that after receiving an IPv6 packet with an IPv6 destination address, the home gateway (*i.e.*, the edge router or access gateway of Figure 11) reverses the address translation to conform the IPv6 address to a public IPv4 address. See §VIII.A.5.c. It would have been obvious to further regularize the IPv4 address in view of Paunikar. EX1003, ¶181. Figure 3 of Paunikar describes Paunikar's regularizing process:

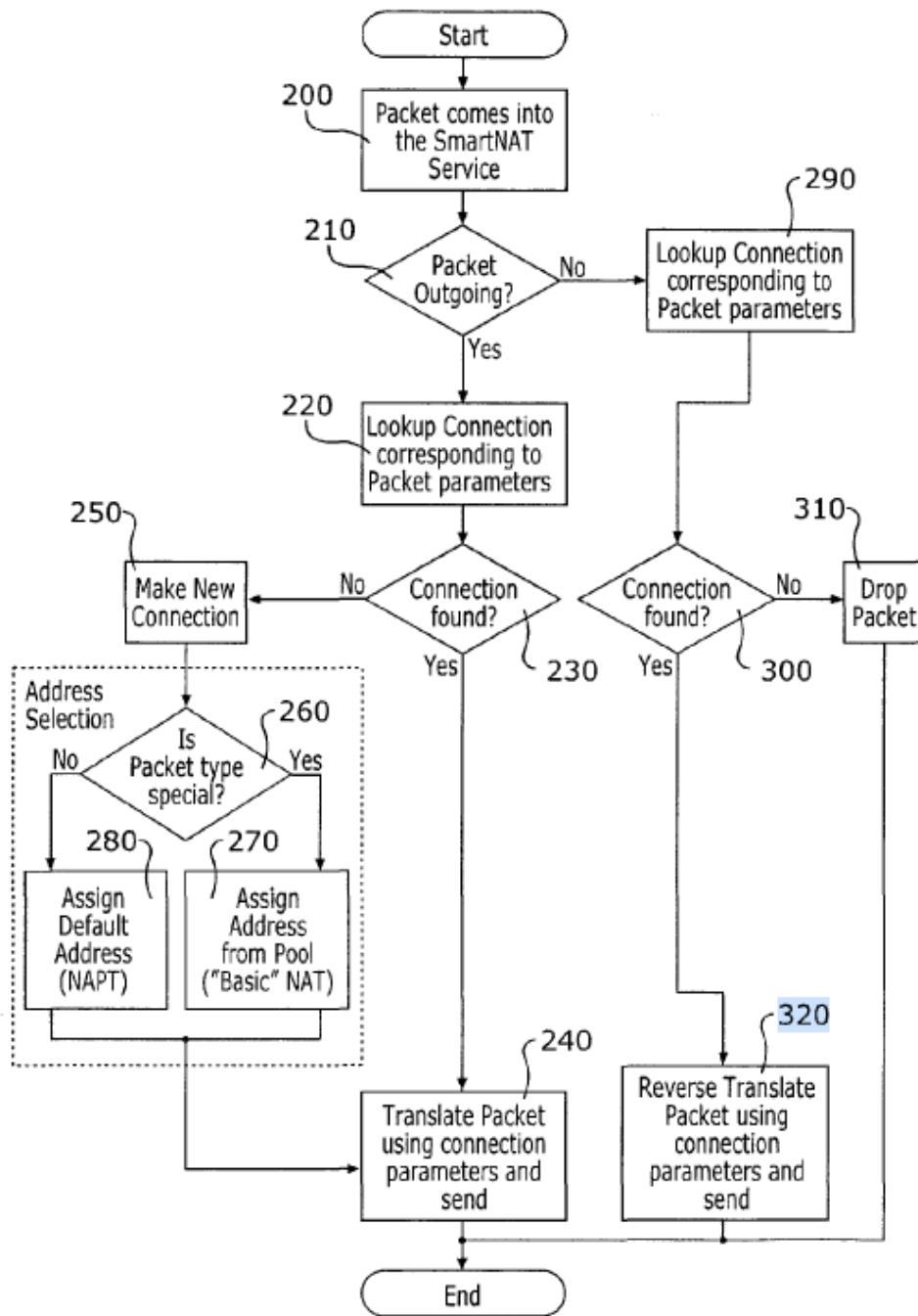


FIG. 3

EX1057, Fig. 3. For an incoming packet, at step 290, the system determines if the incoming packet corresponds with an address in the network (*i.e.*, determine if

regularizing the address is necessary). *Id.*, 9:41-46. If a connection to the network is found (*i.e.*, “Yes” at step 300), then the SmartNAT system “reverse translates” (*i.e.*, regularizes the destination packet by replacing the public IPv4 address with a private IP address) the data packet and communicates it with the private IPv4 address to the destination host. *Id.*, 9:54-57, Fig. 3 (step 320, “reverse translate packet using connection parameters and send”); *see also* Fig. 2 (step 190).

(d) 1[c]

The combined system of Li, Li-2 and Paunikar discloses and renders obvious limitation 1[c]. *See* §VIII.A.5.d.

5. **Claim 5**

(a) 5[pre]

Li, Li-2 and Paunikar render obvious limitation 5[pre]: “The method according to claim 1, wherein when the data packet comes from the IPv4 domain [*e.g.*, **AS4538**] and goes to said user terminal [*e.g.*, **hosts of AS24348 or AS24349**], the step of regularizing the destination address comprises the following steps: [**Paunikar’s NAT/NAPT translation**].” EX1003, ¶185. As discussed (§VIII.A.5.a), Li teaches an IPv4 domain connected to IPv4 hosts wherein data packets travel from the IPv4 domain to the IPv4 hosts. EX1037, 6, 7.

(b) 5[a]

Paunika teaches limitation 5[a]. EX1003, ¶189. Figure 3 of Paunika teaches a system for a SmartNAT translation service for incoming and outgoing data packets (*i.e.*, translating destination or source addresses). EX1057, Fig 3.

For an incoming data packet, after Li inverses the address mapping for the constructed IPv6 address Paunika may further process the incoming data packet through a lookup connection table to identify an entry associated with the constructed destination address (*i.e.*, the regularizing processes searches the address translation table for an existing entry associated with the destination address). *Id.*, 4:45-51 (“In order to reverse translate the incoming data packets, the system may include a connection lookup table to determine connection parameters for incoming data packets and a reverse translator module that performs reverse network address translation on incoming data packets based on the determined connection parameters in the connection lookup table.”), 9:51-57; *see also* EX1058, 16-18; EX1003, ¶190.

(c) 5[b]

Paunika teaches limitation 5[b]. EX1003, ¶191. Figure 3 of Paunika discloses, “if an entry is found, replacing the [] destination address of the data packet with the native destination address from that entry.” As the lookup table analyzes the packet parameters of the data packet discussed *supra* (§VIII.C.5.b), if an entry associated with the destination is found (*e.g.*, “yes” path between blocks 300 and 320 of figure 3), the SmartNAT service translates the destination address (*i.e.*,

replaces the destination address with a native destination address). EX1057, 9:51-57 (“If an entry is found in the corresponding connection memory... reverse translate the data packet back to the original private network address”); EX1003, ¶191.

6. Claim 6

The combination of Li, Li-2, and Paunikar disclose “[t]he method according to claim 5, further comprising a step of verifying that the destination port number of the data packet and the destination port number contained in the constructed destination address match.” EX1003, ¶192. As discussed in connection with Ground 1, a POSITA would have also found it obvious to verify that the destination port numbers match in order to identify errors and security issues, such as spoofed packets. EX1003, ¶193; EX1032 at 28-29.

7. Claim 7

Li and Li-2 disclose the additional limitations of claim 7. §VIII.A.8. Similarly, Paunikar teaches the disclosed methods can occur on “other types of operating systems, computing platforms, computer programs, and/or general-purpose machines.” EX1057, 5:58-61. A POSITA would recognize that the programmed functions are executed by processing program code instructions. EX1003, ¶194.

8. Claim 8

(a) 8[pre]

Li teaches all the limitations of 8[pre]. See §VIII.A.9.a; EX1003, ¶195.

(b) 8[a]

Li teaches the limitation 8[a] except identifying a destination port number. See §VIII.A.9.b. A POSITA would have found it obvious to modify Li in view of the general knowledge of a POSITA and/or Li-2 such that the home gateway identifies an IPv6 destination address constructed by concatenating a destination port number. See §VIII.B.1-2, VIII.A.9.b.

(c) 8[b]

The Texas court construed this means limitation as described in §VII. Li and Paunikar teach a home gateway that includes a processor programmed to perform the step of regularizing. See §VIII.A.9.c, VIII.C.5-6.

(d) 8[c]

Li and Paunikar teach limitation 8[c]. See §VIII.A.9.d, VIII.C.4.d.

D. Ground 4: Claims 1, 5-8 Would Have Been Obvious in View of Li, Wu, and Paunikar

1. Wu (EX1039)

Wu was filed on September 17, 2003 and issued on September 1, 2004. Wu is prior art under at least pre-AIA §102(b) because it was publicly available more than one year before the '844 patent's priority date. Wu (EX1039) is a certified English translation of CN Patent No. 1525699A, and is cited throughout the petition to identify relevant aspects of CN Patent No. 1525699A (EX1040).

Wu describes a dual-stack client that constructs an IPv6 address by concatenating different pieces of information, as shown in Figure 1:

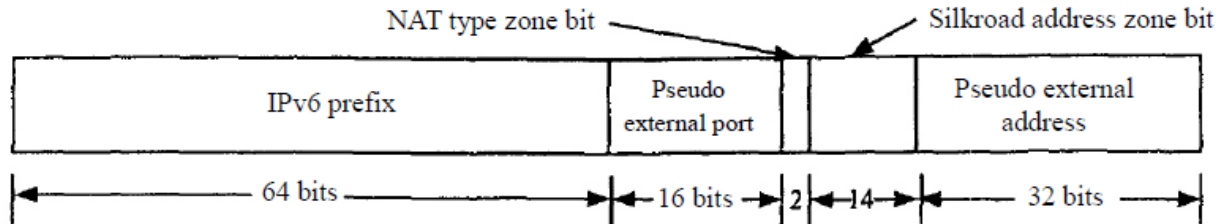


Fig. 1

EX1039, Fig. 1. The first 64-bits of the constructed IPv6 address correspond to an IPv6 prefix. *Id.*, 11. The next 16-bits correspond to the external port number, which can be obfuscated by using a bit-wise operation. *Id.*; see EX1003, ¶200. The next 2-bits indicate the type of NAT used in the network. EX1039, 11. The next 14-bits are padded with 0s, reserved for a “Silkroad address.” *Id.* And the final 32-bits correspond to the external address, which can be obfuscated by using a bit-wise operation. *Id.*, 12; EX1003, ¶200.

2. The Li-Wu-Paunikar Combination

To the extent Patent Owner argues Li in combination with the knowledge of a POSITA and/or Li-2 does not render obvious an IPv6 destination address constructed by concatenating an IPv6 prefix, an IPv4 destination address, and a destination port number,” it would have nevertheless been obvious to do so in view of Wu. EX1003, ¶202.

3. Motivations to Combine Li, Wu, and Paunikar

A POSITA would have been motivated to combine the teachings of Li and Wu and would have had a reasonable expectation of success. EX1003, ¶203; *see also* §VIII.A.4.

First, the prior art includes express teachings that would have motivated a POSITA to combine the references in the manner proposed. EX1003, ¶204. For instance, the prior art teaches the need to mitigate IPv4 address exhaustion. EX1003, ¶204. One known way of addressing this exhaustion was to extend the IPv4 address space by sharing an IPv4 address among many hosts and using port numbers to uniquely identify those hosts. EX1003, ¶204. Including the destination port number in the constructed IPv6 address would therefore have allowed hosts to share an IPv4 address with the added benefit of maintaining end-to-end connectivity (*i.e.*, the hosts could be uniquely identified by their assigned port number). EX1003, ¶204.

Second, a POSITA would have been particularly motivated to apply Wu to Li because the combination would have been of a known technique (*i.e.*, Wu’s teaching of constructing an IPv6 address by concatenating a port number) to a known device (*i.e.*, Li’s edge router that already constructs IPv6 addresses by concatenating information, including 32 bits of unused padding) to yield a predictable result (*i.e.*, an edge router that can construct an IPv6 address that includes a destination port number in place of 16 bits of the unused padding). EX1003, ¶206.

Third, this combination would have been obvious because it is a simple substitution of one known element (*i.e.*, 16 bits of unused padding) for another (*i.e.*, a destination port number) to obtain predictable results (*i.e.*, connecting IPv4 and IPv6 networks while mitigating IPv4 address exhaustion). EX1003, ¶207.

4. Evidence of Simultaneous Invention Demonstrates The Obviousness Of Combining Li And Wu

As discussed above, there are multiple examples of POSITAs simultaneously inventing the '845 claims. See §VIII.B.1.

5. Claim 1

(a) 1[pre]

Li teaches the elements of limitation 1[pre]. See §VIII.A.5.a; EX1003, ¶210.

(b) 1[a]

Li teaches limitation 1[a] with the exception of “a destination port number.” §VIII.A.5.b; EX1003, ¶211. Wu teaches that a constructed IPv6 address may be formed by concatenating a destination port number. EX1003 ¶211. For instance, Wu teaches that a “Silkroad client”—which, like the edge routers in Li, is a dual-stack client that has both IPv4 and IPv6 capabilities (EX1039, 11)—constructs an IPv6 address by concatenating an IPv6 prefix, an IPv4 address, and a port number:

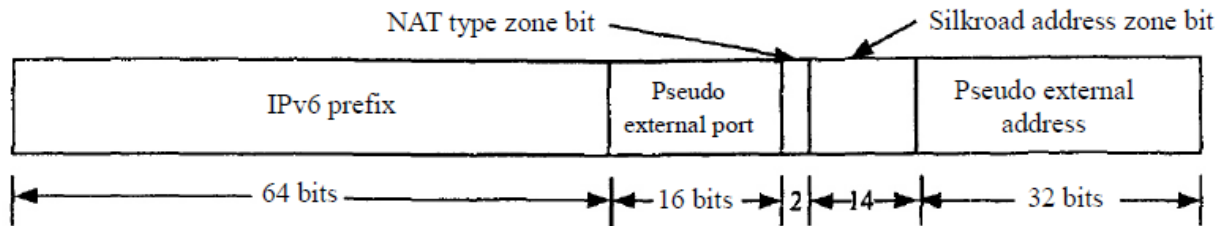
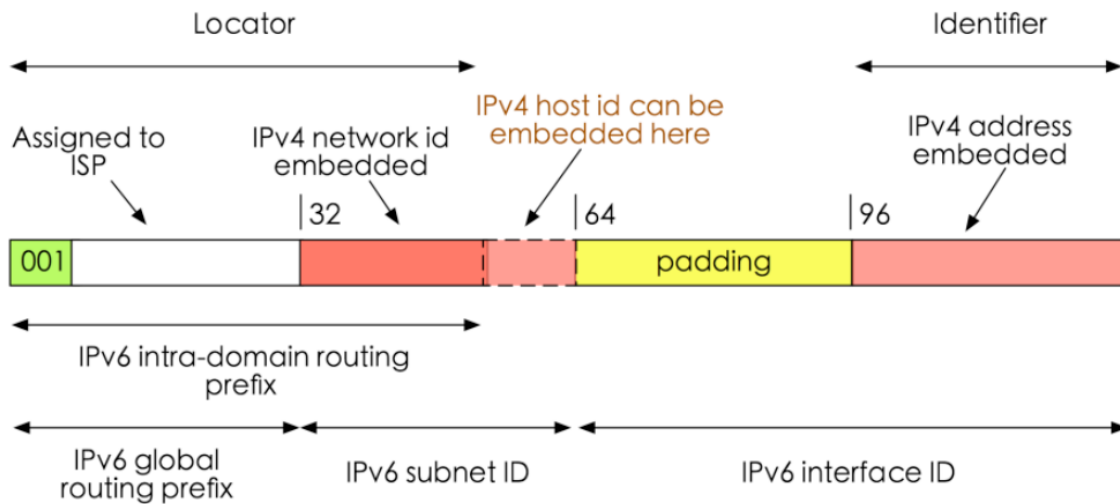


Fig. 1

EX1039, Fig. 1, 9-12. A POSITA would have found it obvious to apply this teaching to Li's constructed IPv6 address. EX1003, ¶211.

Indeed, Li already teaches that its IPv6 address concatenates 32-bits of zero padding (bits 64-96) following the IPv6 prefix and IPv4 address:



EX1037, 3. Thus, a POSITA would have recognized that there is more than sufficient space to further include a 16-bit destination port number. EX1003, ¶212.

(c) 1[b]

Paunikar and Li teach limitation 1[b]. See §VIII.C.4.c.

(d) 1[c]

Paunikar and Li teach limitation 1[b]. *See* §VIII.C.4.d.

6. Claim 5

(a) 5[pre]

Li and Paunikar teaches the additional limitations of claim 5. *See* §VIII.C.5.a.

(b) 5[a]

Paunikar teaches limitation 5[a]. *See* §VIII.C.5.b.

(c) 5[b]

Paunikar teaches limitation 5[b]. *See* §VIII.C.5.c.

7. Claim 6

Li renders obvious the additional limitations of claim 6. *See* §VIII.C.6.

8. Claim 7

Li and Paunikar teach the additional limitation of claim 7. *See* §VIII.C.7.

9. Claim 8

(a) 8[pre]

Li teaches the limitation 8[pre]. *See* §VIII.A.9.a.

(b) 8[a]

Li teaches the limitation 8[a] except identifying a destination port number.

See §VIII.A.9.b. However, Wu teaches identifying a destination port number. *See* §VIII.D.5.b.

(c) 8[b]

Li and Paunikar teach the limitation 8[b]. *See* §VIII.C.8.c.

(d) 8[c]

Li and Paunikar teach limitation 8[c]. *See* §VIII.C.8.d.

IX. DISCRETIONARY DENIAL IS NOT APPROPRIATE

A. Discretionary Denial Under 35 U.S.C. § 314(a) Is Not Appropriate

Petitioner provides a *Sotera* stipulation and stipulates that if the Board institutes IPR, Petitioner will not pursue in the district court litigation any ground raised or that could have reasonably been raised in the petition. This stipulation precludes discretionary denial under § 314(a). *See* Director Vidal Memorandum, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation, at 3-5, 7-8 (June 21, 2022).

B. Discretionary Denial Under 35 U.S.C. §325(d) Is Not Appropriate

The Board should not exercise its discretion under §325(d). *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, at 7 (PTAB Feb. 13, 2020). This analysis employs a two-prong framework: (1) whether the arguments presented in the previous action are the same or substantially the same as those previously presented to the Office; and (2) if so, whether the petitioner has demonstrated a material error by the Office in its prior consideration of those arguments. *Id.* Within these prongs, the Board considers several non-exclusive factors from *Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-015786, Paper 8 (PTAB Dec. 15, 2017).

1. Step One of *Advanced Bionics*

Petitioner's arguments and prior art are neither the same nor substantially the same art or arguments previously before the Office.

(a) Original Prosecution

Li (EX1037), Li-2 (EX1038), Wu (EX1039), and Paunikar (EX1057) were not considered or cited during original prosecution of the '845 patent, weighing heavily against denial. *See generally* EX1002; *see also Cellco P'ship v. Huawei Device Co.*, IPR2020-01117, Paper 10, at 13 (PTAB Feb. 3, 2021). These references are also materially different from the references considered because they render obvious the Challenged Claims. *See Amperex Tech. Ltd. v. Maxell, Ltd.*, IPR2021-01442, Paper 16, at 13-16 (PTAB Apr. 12, 2022).

(b) Cisco IPR

No references—Li, Li-2, Wu, and Paunikar—were considered during the previous IPR filed by Cisco. *See* EX1033. Moreover, the Cisco IPR was terminated prior to institution as a result of settlement. EX1034 (Decision: Settlement Prior to Institution). The merits of the Cisco prior art were not considered by the Board. *Id.*

(c) EPR

On September 8, 2023, Unified Patents, LLC requested *ex parte* reexamination ("EPR") of the '845 patent. EX3100. Unified Patents is not involved in this petition, and Petitioner is not involved in the Unified Patents EPR. The Board should not exercise its discretion under §325(d) to deny this petition.

First, §325(d) should not apply because the co-pending EPR is in its early stages at the time of this IPR filing. *See* Control No. 90/019,246. Indeed, while the EPR has been granted, an initial Office Action has not issued. *Id.* Thus, §325(d) should not apply. *See, e.g., Mueller Sys. v. Rein Tech*, IPR2020-00099, Paper 9, 10-14 (PTAB May 12, 2020) (§325(d) did not apply to prior art submitted in pending reexamination that had not yet resulted in an office action).

Second, the EPR does not include any of the grounds that are presented in this petition. *See Nintendo Co. v. Polaris PowerLED Techs., LLC*, IPR2023-00778, Paper 9, 48-49 (PTAB Oct. 18, 2023) (reexamination proceeding did not weight in favor of denying institution because “the reexamination proceeding does not include any of the alleged grounds of obviousness presented in the Petition.”). Indeed, the Unified EPR presents invalidity grounds based on different grounds. [1] Huietma anticipation (Ground 1) or obviousness (Ground 2), [2] Kong anticipation (Ground 3) or obviousness (Ground 4), and [3] Ananda in view of Wetterwal and RFC 4380 (Ground 5). EX1061.

2. Step Two of *Advanced Bionics*

Because Petitioner presents new arguments and combinations in this petition, it is unnecessary to analyze step two. However, even if the same or substantially the same art was previously presented to the Office somehow, the Examiner made material errors in evaluating the art.

(a) Original Prosecution

There is no reason to proceed to step two due to the lack of a prior art rejection during prosecution. *See* §V.C. Regardless, the Office materially erred by not considering Li, Li-2, Wu, and Paunikar.

(b) Cisco IPR

There is no reason to proceed to step two because the Cisco IPR was terminated prior to institution due to settlement. *See* EX1034.

(c) EPR

There is no reason to proceed to step two because Li, Li-2, Wu, and Paunikar are not cited in the EPR or analyzed by the examiner. Additionally, the considered references are not substantially similar to Li, Li-2, Wu, or Paunikar.

To the extent the references or arguments in the EPR are deemed to be the same or substantially the same as those in this petition (they are not), it would be material error for the Examiner to find the Challenged Claims patentable for the reasons discussed in this petition.

X. CONCLUSION

Petitioner asks that the Patent Office order IPR of claims 1, 5-8.

Date: February 9, 2024

By: /s/ James Glass
Lead Counsel for Petitioner
Reg. No. 46,729

CERTIFICATE OF WORD COUNT

Pursuant to 37 C.F.R. §42.24(d), Petitioner hereby certifies, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,970. Pursuant to 37 C.F.R. §42.24(d), this word count excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing.

Respectfully submitted,

Date: February 9, 2024

Respectfully submitted,

By: /s/ James Glass

Attorney for Petitioner Juniper Networks, Inc.

CERTIFICATE OF SERVICE

The undersigned certifies, under 37 C.F.R. §§42.105 and 42.6, that service was made on the Patent Owner as detailed below.

Date of service February 9, 2024

Manner of service Federal Express

Documents served Petition for Inter Partes Review, including Exhibit List; Exhibits 1001-1066

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