

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. 8,451,844

“Method of Receiving a Data Packet Coming from an IPv4 Domain in an IPv6
Domain, an Associated Device, and Associated Access Equipment”

IPR2024-00485

PETITION FOR *INTER PARTES* REVIEW

I.	INTRODUCTION	1
II.	MANDATORY NOTICES	3
A.	Real Party-in-Interest (37 C.F.R. §42.8(b)(1)).....	3
B.	Related Matters (37 C.F.R. §42.8(b)(2)).....	3
1.	Related District Court Proceedings.....	3
2.	Related Patent Office Proceedings.....	4
C.	Lead and Back-up Counsel and Service Information	4
III.	REQUIREMENTS FOR IPR	5
A.	Payment of Fees	5
B.	Grounds for Standing	5
C.	Statement and Relief Requested.....	5
IV.	TECHNOLOGY BACKGROUND.....	6
A.	IPv4 and IPv6 Addresses.....	6
B.	IPv4/IPv6 Transition Mechanisms.....	7
1.	Converting IPv4 Addresses into IPv6 Addresses to Allow IPv4 Hosts to Communicate with IPv6 Hosts	7
2.	Using Port Information to Prevent IPv4 Exhaustion	7
3.	Combining the Above Two Ideas	8
V.	OVERVIEW OF THE '844 PATENT	8
A.	Priority	8
B.	Specification.....	8
C.	Original Prosecution.....	9
D.	Patent Office Proceedings	9

VI.	LEVEL OF ORDINARY SKILL IN THE ART	10
VII.	CLAIM CONSTRUCTION	10
VIII.	FOUNDATIONS	14
A.	Ground 1: Claims 1-10 Would Have Been Obvious in View of Li and Li-2	14
1.	Li (EX1037)	14
2.	Li-2 (EX1038)	19
3.	The Li-Li-2 Combination	24
4.	Motivations to Combine Li and Li-2	25
5.	Claim 1	28
6.	Claim 2	39
7.	Claim 3	39
8.	Claim 4	44
9.	Claim 5	44
10.	Claim 6	47
11.	Claim 7	52
12.	Claim 8	56
13.	Claim 9	58
14.	Claim 10	61
B.	Ground 2: Claims 1-10 Would Have Been Obvious in View of Li	62
1.	Evidence of Simultaneous Invention Demonstrates The Obviousness Of Modifying Li	62
2.	Motivations to Modify Li	64

3.	Claim 1	64
4.	Claim 2	64
5.	Claim 3	65
6.	Claim 4	66
7.	Claim 5	66
8.	Claim 6	66
9.	Claim 7	67
10.	Claim 8	67
11.	Claim 9	67
12.	Claim 10	67
C.	Ground 3: Claims 1-10 Would Have Been Obvious in View of Li and Wu	67
1.	Wu (EX1039)	67
2.	The Li-Wu Combination	68
3.	Motivations to Combine Li and Wu	69
4.	Evidence of Simultaneous Invention Demonstrates The Obviousness Of Combining Li And Wu	70
5.	Claim 1	70
6.	Claim 2	72
7.	Claim 3	72
8.	Claim 4	73
9.	Claim 5	73
10.	Claim 6	73
11.	Claim 7	73

12.	Claim 8.....	73
13.	Claim 9.....	74
14.	Claim 10.....	74
IX.	DISCRETIONARY DENIAL IS NOT APPROPRIATE	74
A.	Discretionary Denial Under 35 U.S.C. §314(a) Is Not Appropriate.....	74
B.	Discretionary Denial Under 35 U.S.C. §325(d) Is Not Appropriate.....	74
1.	Step One of Advanced Bionics	74
2.	Step Two of Advanced Bionics	76
X.	CONCLUSION.....	80
	CERTIFICATE OF WORD COUNT	81
	CERTIFICATE OF SERVICE	82

PETITIONER’S EXHIBIT LIST

EX1001	U.S. Patent No. 8,451,844 to Mohamed Boucadair et al. (“’844 patent”)
EX1002	Prosecution History of U.S. Patent No. 8,451,844 (“’844 Prosecution History”)
EX1003	Declaration of Dr. Samrat Bhattacharjee under 37 C.F.R. §1.68
EX1004	<i>Curriculum Vitae</i> of Dr. Bhattacharjee
EX1005	Declaration of Dr. Sylvia Hall-Ellis under 37 C.F.R. §1.68
EX1006	<i>Curriculum Vitae</i> of Dr. Hall-Ellis
EX1007	Declaration of Alexa Morris under 37 C.F.R. §1.68
EX1008	Declaration of Ron Bonica under 37 C.F.R. §1.68
EX1009	Declaration of Alexa Morris under 37 C.F.R. §1.68
EX1010	Partial <i>Ex Parte</i> Reexamination History of the ’844 patent as U.S. Application No. 90/014,717
EX1011	RFC 791, “Internet Protocol Specification” (Sept. 1981), available at https://datatracker.ietf.org/doc/html/rfc791
EX1012	RFC 793, “Transmission Control Protocol” (Sept. 1981), available at https://datatracker.ietf.org/doc/html/rfc793
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
EX1024	U.S. Patent No. 8,032,639 to King et al. (“King”)
EX1025	U.S. Patent No. 8,019,889 to Biswas et al. (“Biswas”)
EX1026	X. Li et al., “Bi-Directional Address Borrowing (IVI)” (June 23, 2008)
EX1027	X. Li et al., “Prefix-Specific and Stateless Address Mapping (IVI) for IPv4/IPv6 Coexistence and Transition,” IETF (July 6, 2008), available at https://datatracker.ietf.org/doc/html/draft-xli-behave-ivi-00
EX1028	X. Li et al., “Prefix-Specific and Stateless Address Mapping (IVI) for IPv4/IPv6 Coexistence and Transition,” IETF-72, Dublin (July 29,

	2008), available at https://www.ietf.org/proceedings/72/slides/behave-5.pdf
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
EX1030	U.S. Patent Application Publication No. 2004/0190549 to Huitema et al. (“Huitema”)
EX1031	U.S. Patent No. 7,149,225 to Thubert et al. (“Thubert”)
EX1032	C. Huitema, “Teredo: Tunneling IPv6 over UDP Through NATs,” Internet Engineering Task Force (“IETF”) (Sept. 17, 2002), available at https://www.ietf.org/archive/id/draft-ietf-ngtrans-shipworm-08.txt
EX1033	Petition for <i>Inter Partes</i> Review, <i>Cisco Sys., Inc. v. Monarch Networking Sol’ns LLC</i> , IPR2020-01678, Paper 2 (PTAB Oct. 1, 2020)
EX1034	Patent Owner’s Preliminary Response, <i>Cisco Sys., Inc. v. Monarch Networking Sol’ns LLC</i> , IPR2020-01678, Paper 6 (PTAB Feb. 16, 2021)
EX1035	Institution Decision, <i>Cisco Sys., Inc. v. Monarch Networking Sol’ns LLC</i> , IPR2020-01678, Paper 9 (PTAB Mar. 31, 2021)
EX1036	Claim Construction Memorandum and Order, <i>Monarch Networking Sol’ns LLC v. Cisco Sys., Inc.</i> , No. 2:20-cv-00015-JRG (E.D. Tex. Jan. 7, 2021)
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), available at https://www.ietf.org/staging/draft-xli-ivi-00-7430-cancelled.txt (“Li-2”)
EX1039	Certified Translation of CN Patent No. 1525699 to Wu et al. (“Wu”)
EX1040	CN Patent No. 1525699 to Wu et al.

EX1041	R. Bush, “IPv4 / IPv6 Coexistence Mechanisms” (Oct. 26, 2008)
EX1042	Monarch’s Opposition to Juniper’s Motion to Transfer, <i>Monarch Networking Solutions LLC v. Juniper Networks, Inc.</i> , No. 1:23-cv-670-TSE-LRV (E.D. Va. Oct. 3, 2023), ECF No. 52
EX1043	Complaint, <i>Monarch Networking Sol’ns LLC v. Juniper Networks, Inc.</i> , No. 1:23-cv-670-TSE-LRV (E.D. Va. May 23, 2023), ECF No. 1
EX1044	Screenshot IETF Staging Folder, available at https://www.ietf.org/staging/
EX1045	R. Bonica, “draft-kumar-mpls-fec-to-nhlfe-mib-00,” IETF (Jan. 7, 2010), available at https://www.ietf.org/staging/draft-kumar-mpls-fec-to-nhlfe-mib-00-16143-cancelled.txt
EX1046	Correspondence from badra@isima.fr (Oct. 9, 2007), available at https://mailarchive.ietf.org/arch/msg/ngo/6JM4rSBIZM8Ajw02luUG4OqSrmQ/
EX1047	Correspondence from dirk.hugo@t-systems.com (Oct. 12, 2007), available at https://mailarchive.ietf.org/arch/msg/multimob/H8V3v2MvxhYRhjqOKSN7mhM39Q8/
EX1048	Correspondence from dirk.hugo@t-systems.com (Oct. 25, 2007), available at https://mailarchive.ietf.org/arch/msg/multimob/FvyjLiCNdh88V2I3Fm8B21vMtkA/
EX1049	Correspondence from asaeda@sfc.wide.ad.jp (Nov. 12, 2007), available at https://mailarchive.ietf.org/arch/msg/multimob/6Zj-nouoPaLdo46ART2ZGWMJqkE/
EX1050	Correspondence from fluffy@cisco.com (Nov. 13, 2007), available at https://mailarchive.ietf.org/arch/msg/tools-development/CPLnZyjcureXq6j6mII5eTZF1Zo/
EX1051	Correspondence from lowekamp@sipeerior.com (Nov. 14, 2007), available at

	https://mailarchive.ietf.org/arch/msg/sipping/70F4vroEAckioD214LTt2FJpInk/
EX1052	Correspondence from lowekamp@sipeerior.com (Nov. 17, 2007), available at https://mailarchive.ietf.org/arch/msg/behave/yUKKzuhlhnKkRRC0V_zGXEkRP4/#
EX1053	Correspondence from schierl@hhi.fhg.de (Nov. 19, 2007), available at https://mailarchive.ietf.org/arch/msg/mmusic/4FxACR25hKzg59oSR-uSoqoSjc0/
EX1054	Correspondence from andrew.dolganow@alcatel-lucent.com (Feb. 11, 2008), available at https://mailarchive.ietf.org/arch/msg/pwe3/ceWfUIVFI-tMV-1_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

LIST OF CHALLENGED CLAIMS

Claim	Limitation
1[pre]	A method of receiving a data packet from an IPv4 domain in an IPv6 domain, said data packet comprising an IPv4 destination address and a destination port number, said method comprising the following steps:
1[a]	constructing an IPv6 destination address by concatenating an operator prefix, said IPv4 destination address, and the destination port number;
1[b]	generating an IPv6 data packet from the IPv6 constructed destination address and the received IPv4 packet; and
1[c]	routing the generated IPv6 data packet in the IPv6 domain using the IPv6 constructed destination address, said constructed address belonging to a range of IPv6 addresses routable to an interconnection equipment of the IPv6 domain with the IPv4 destination address.
2	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 in an IPv6 domain a data packet from an IPv4 domain.
3[pre]	A method of sending a data packet from an IPv6 domain to a destination address of an IPv4 domain, said packet comprising an IPv6 destination address of the packet constructed by concatenating an operator prefix, the IPv4 destination address, and a destination port number, said method executing the following steps on reception of the data packet:
3[a]	extracting the IPv4 destination address and the destination port number from the IPv6 destination address;
3[b]	generating an IPv4 data packet from the IPv6 data packet, said packet including said IPv4 destination address and said destination port number; and
3[c]	routing the IPv4 data packet to its IPv4 destination.

Claim	Limitation
4	A non-transitory computer program product that is at least one of downloadable from a communications network and/or stored on a computer-readable medium and/or executable by a microprocessor, comprising program code instructions for executing the method according to claim 3 of sending a data packet from an IPv6 domain to a destination address of an IPv4 domain.
5[pre]	A device for receiving a data packet from an IPv4 domain in an IPv6 domain, said data packet comprising an IPv4 destination address and an IPv4 destination port number, said device comprising:
5[a]	means for constructing an IPv6 destination address by concatenating an operator prefix, said IPv4 destination address, and the destination port number;
5[b]	means for generating an IPv6 data packet from the IPv6 constructed destination address and the received IPv4 packet; and
5[c]	means for routing the generated IPv6 data packet in the IPv6 domain using the IPv6 constructed destination address, said constructed address belonging to a range of IPv6 addresses routable to an interconnection equipment of the IPv6 domain with the IPv4 destination address.
6[pre]	Access equipment to an IPv6 domain comprising an interface with at least one IPv4 domain, further comprising:
6[a]	a device according to claim 5 for receiving a data packet coming from an IPv4 domain in the IPv6 domain; and
6[b]	a device for sending a data packet from an IPv6 domain to an IPv4 domain, said packet comprising an IPv6 destination address of the packet constructed by concatenating an operator prefix, the IPv4 destination address, and a destination port number, said device, on reception of the data packet, making use of:
6[c]	means for extracting the IPv4 destination address and the destination port number from the IPv6 destination address;

Claim	Limitation
6[d]	means for generating an IPv4 data packet from the IPv6 data packet, said packet including said IPv4 destination address and said destination port number; and
6[e]	means for routing the IPv4 data packet to its IPv4 destination.
7	IPv6 domain access equipment according to claim 6, wherein the IPv4 is a public network, said equipment comprising first means for advertising to the IPv4 domain IPv4 addresses of network equipments connected to the IPv6 domain and second means for advertising in the IPv6 domain IPv6 addresses constructed from IPv4 addresses of the IPv4 domain.
8	IPv6 domain access equipment according to claim 6, wherein the IPv4 domain is a private network, the access equipment is a home gateway adapted to connect user terminals of the private network to the IPv6 domain.
9	IPv6 domain access equipment according to claim 8, comprising means for obtaining an IPv4 address, a range of port numbers, and a range of authorized IPv6 addresses, said range of IPv6 addresses being constructed by concatenating an operator prefix, said IPv4 address, and the range of authorized IPv4 port numbers.
10[pre]	A device for sending a data packet from an IPv6 domain to an IPv4 domain, said packet comprising an IPv6 destination address of the packet constructed by concatenating an operator prefix, the IPv4 destination address, and a destination port number, said device, on reception of the data packet, making use of:
10[a]	means for extracting the IPv4 destination address and the destination port number from the IPv6 destination address;
10[b]	means for generating an IPv4 data packet from the IPv6 data packet, said packet including said IPv4 destination address and said destination port number; and
10[c]	means for routing the IPv4 data packet to its IPv4 destination.

I. INTRODUCTION

Juniper Networks, Inc. (“Petitioner”) requests IPR of claims 1-10 of U.S. Patent No. 8,451,844 (the “’844 patent”).¹

Long before the ’844 patent was filed, it was well-understood that IPv4 addresses would be exhausted. A new standard, IPv6, was created to provide a larger address space. However, IPv4 and IPv6 are not natively compatible with one another, and the transition from IPv4 to IPv6 was slow. Thus, IPv4-to-IPv6 transition technologies were developed to dynamically convert IPv4 addresses and packets into IPv6 addresses and packets.

While these transition technologies made IPv4 networks interoperable with IPv6 networks, they did not address the issue of IPv4 addresses running out—each IPv4 host still occupied a public IPv4 address. But a solution already existed for that problem as well: Multiple hosts could share a single public IPv4 address while using a port number to uniquely identify each host.

The ’844 patent merely combines these two well-established ideas by constructing an IPv6 address from (1) an IPv6 prefix, (2) an IPv4 address, and (3) a port number.

¹ The pre-AIA statutory framework applies to the ’844 patent.

But even that combination was widely known and disclosed. For example, an IEEE paper (“Li”) discusses constructing IPv6 addresses by concatenating (1) **an IPv6 prefix**, (2) **an IPv4 address**, and (3) 32 bits of unused “padding.” Li’s authors then published another paper (“Li-2”) that expanded on this disclosure by replacing the unused padding with **a port number**. Thus, as illustrated in the image below—from a presentation the Li authors gave describing their method—an IPv6 address (**orange** box on the right) is constructed 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)²:

```

- 202.38.108.2#81 --> IPv6=2001:250:ffca:266c:0200::81#81
- 202.38.108.2#82 --> IPv6=2001:250:ffca:266c:0200::82#82
- 202.38.108.2#83 --> IPv6=2001:250:ffca:266c:0200::83#83
- 202.38.108.2#84 --> IPv6=2001:250:ffca:266c:0200::84#84

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² IPv6 addresses are typically expressed in hexadecimal format, while IPv4 addresses are expressed in dotted-quad notation. Consistent with this notation, the example shows the **IPv4 address** in the received data packet written in dotted-quad notation (202.38.108.2) while the **IPv4 address** in the constructed IPv6 address is written in hexadecimal (ca:266c:0200). As shown in this Petition, the translation does not alter the IPv4 address itself—the IPv4 address on the left (202.38.108.2) is the exact same 32-bit address as that on the right (ca:266c:0200).

And other prior art papers, such as CN Patent No. 1525699A (“Wu”), also teach constructing an IPv6 address from (1) an IPv6 prefix, (2) an IPv4 address, and (3) a port number:

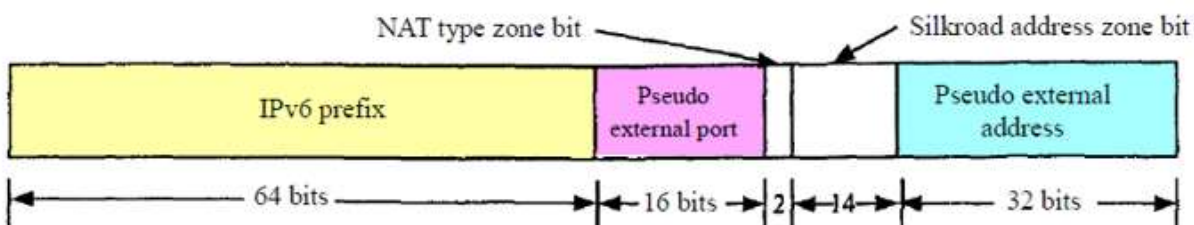


Fig. 1

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 '844 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. 3:23-cv-05076-RFL (N.D. Cal.).

Petitioner is currently unaware of any other lawsuits involving the '844 patent.

2. Related Patent Office Proceedings

As of the filing date of this Petition, the '844 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. 90/014,717, EX1010³

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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³ Thousands of pages of irrelevant prior art documents have been removed from EX1010 for convenience.

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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 hereby certifies that the '844 patent is available for IPR and that Petitioner is not barred or estopped from requesting IPR challenging the claims of the '844 patent. Petitioner further certifies that the prohibitions of 35 U.S.C. §§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 pre-AIA 35 U.S.C. §102(b).	
Li-2 (EX1038), IETF Internet Draft published on June 21, 2008; prior art under pre-AIA 35 U.S.C. §102(a).	
Wu (EX1039), CN Patent No. 1525699A; filed September 17, 2003; published September 1, 2004; prior art under pre-AIA 35 U.S.C. §102(b).	

Ground	Claims	Description
1	1-10	Obvious in view of Li and Li-2
2	1-10	Obvious in view of Li
3	1-10	Obvious in view of Li and Wu

IV. TECHNOLOGY BACKGROUND

A. IPv4 and IPv6 Addresses

IPv4 addresses consist of 32-bits and is typically represented by four groupings of decimal numbers. EX1003, ¶29. An example of an IPv4 address is 172.16.254.1. *Id.*

An IPv4 packet typically encapsulates a TCP or a UDP header which contains 16-bit port numbers. *Id.*, ¶30. Port numbers identify the specific process that sends and receives the data. *Id.*

By the time of the '844 patent, it was well-understood that IPv4 addresses would soon run out. *Id.*, ¶31; EX1001, 1:61-62. A new standard—IPv6—was therefore developed to address this issue. EX1003, ¶¶31-32.

An IPv6 address is 128-bits long and is typically represented by eight groupings of hexadecimal numbers. *Id.*, ¶¶32-34. An example of an IPv6 address is FE80:CD00:0000:0CDE:1257:0000:211E:729C. *Id.*, ¶33.

B. IPv4/IPv6 Transition Mechanisms

The most striking difference between IPv4 and IPv6 is the tremendous 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 IPv6 to be deployed alongside IPv4. *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 involves 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 '844 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).

3. Combining the Above Two Ideas

Several prior art references, including those discussed in the invalidity grounds below, disclose combining these two ideas. EX1003, ¶44. Particularly, the prior art teaches constructing an IPv6 address by concatenating an IPv6 prefix, an IPv4 address, and a port number. *Id.*, ¶¶45-48 (discussing EXS1026-1032, 1038).

V. OVERVIEW OF THE '844 PATENT

A. Priority

The '844 patent was filed as U.S. Patent Application No. 13/001,850 on December 29, 2010, and claims priority to a French Application filed June 30, 2008. EX1001, 1:9-13. No priority date analysis is necessary, however, because the relied-upon prior art pre-dates June 30, 2008.

B. Specification

The '844 patent describes routing data packets between IPv4 and IPv6 domains. EX1001, 2:61-3:11. “The general principle of the invention relies on” receiving an IPv4 data packet and then “constructing an IPv6 address from [the received] IPv4 address, a predetermined operator prefix, and [the received] port

number.” *Id.*, 6:13-15. The constructed IPv6 data packet is then routed across the IPv6 domain. *Id.*, 10:59-63, 14:1-16. The ’844 patent discloses a similar process in reverse—from IPv6 to IPv4. *Id.*, 11:16-41. EX1003, ¶¶50-52.

C. Original Prosecution

During original prosecution, the Examiner issued a single Office Action on December 3, 2012 that included claim objections and a rejection under 35 U.S.C. §112. EX1002, 65-69.⁴ The Office Action did not include any prior art rejections. Following minor claim amendments, the Examiner allowed claims 1-10. *Id.*, 45-46.

D. Patent Office Proceedings

On October 1, 2020, Cisco Systems, Inc. filed a petition for IPR challenging claims 1-10. EX1033. On March 31, 2021, the Board denied the Petition under *Fintiv*. EX1035, 10. The Board did not address the merits of the petition.

On April 2, 2021, Cisco filed an *ex parte* reexamination (“EPR”) challenging claims 1-10. EX1010, 384. The Examiner analyzed three prior art references during the EPR: US2005/0286553 (“Wetterwald”), RFC 2460, and US2004/0190549 (“Huitema”). The Examiner found that “while Wetterwald does explicitly teach the constructing an IPv6 destination address by concatenating an operator prefix with

⁴ Exhibit citations typically refer to the page stamped on the bottom right of each exhibit, following the words “Juniper Exhibit.”

said IPv4 destination address[,] Wetterwald only refers to RFC 2460 when referencing port numbers” and “RFC 2460 does not refer to the port numbers.” *Id.*, 13-14. The Examiner also found that “Huitema is silent on whether the port number and destination address were part of the IPv6 address routed across the IPv6 domain.” *Id.*, 14.

In sum, the Examiner concluded that the prior art discloses constructing an IPv6 address by concatenating two of the three elements recited in the claims, but not the third element (*i.e.*, the destination port number). *Id.* The prior art in this Petition, which was not considered, discloses forming a destination IPv6 address using the destination port number.

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. EX1003, ¶¶53-55. Lack of professional experience can be remedied by additional education, and vice versa. *Id.*

VII. CLAIM CONSTRUCTION

The parties have not yet submitted claim construction proposals in the co-pending district court litigation between Patent Owner and Petitioner.

In a prior district court litigation, however, Patent Owner proposed constructions and the district court construed the '844 patent's terms. EX1036. Petitioner identifies these prior constructions below, which are being applied for the purposes of this proceeding.

Claim(s)	Term	Construction
1, 3, 5-6, 10	"IPv4 destination address"	"address formatted according to Internet Protocol version 4 indicating a destination"
1, 3, 5-6, 9-10	"concatenating"	"appending one item to the end of another so as to form a single unit in a contiguous pattern"
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, 3, 5-6, 10	"destination port number"	"number indicating a logical point of connection with a destination device."
1, 3, 5-6, 9-10	"operator prefix"	"a prefix assigned to an Internet Service Provider by its Regional Internet Registry"
1, 5	"an interconnection equipment of the IPv6 domain" / "with the IPv4 destination address"	"a router of the IPv6 domain" / "with the IPv6 constructed destination address including the IPv4 destination address"
5	"means for constructing"	Function: "constructing an IPv6 destination address by concatenating an operator"

		prefix, said IPv4 destination address, and the destination port number” Structure: “access node 40 with a device 25 that includes a processor programmed to perform the step of constructing an IPv6 destination address by concatenating an operator prefix, said IPv4 destination address, and the destination port number as illustrated in Figures 2 and 4”
5	“means for generating”	Function: “generating an IPv6 data packet from the IPv6 constructed destination address and the received IPv4 packet” Structure: “access node 40 with a device 25 that includes a processor programmed to perform the step of encapsulating the received IPv4 packet in an IPv6 packet or translating the received IPv4 packet IPv4-in-pt into an IPv6 packet”
5	“means for routing”	Function: “routing the generated IPv6 data packet in the IPv6 domain using the IPv6 constructed destination address” Structure: “access node 40 with a device 25 that includes a processor programmed to perform the step of routing the IPv6 data packet using the IPv6 routing core of the access node”
6, 10	“means for extracting”	Function: “extracting the IPv4 destination address and the destination port number from the IPv6 destination address” Structure: “home gateway 20 with a device 26 that includes a processor programmed to perform the step of determining whether the IPv6 data packet is a standard IPv6

		packet or an IPv6 packet encapsulating an IPv4 packet using the header of the received packet”
6, 10	“means for generating”	Function: “generating an IPv4 data packet from the IPv6 data packet, said packet including said IPv4 destination address and said destination port number” Structure: “home gateway 20 with a device 26 that includes a processor programmed to perform the step of de-encapsulating the IPv4 packet contained in the packet IPv6 data packet to yield the IPv4 destination address and the destination port number”
6, 10	“means for routing”	Function: “routing the IPv4 data packet to its IPv4 destination” Structure: “home gateway 20 with a device 26 that includes a processor programmed to perform the step of routing the IPv4 data packet to its IPv4 destination by processing the IPv4 data packet with the internal address translation table (NAT table) of the home gateway”
7	“first means for advertising”	Function: “advertising to the IPv4 domain IPv4 addresses of network equipment connected to the IPv6 domain” Structure: “a dual-stack router that includes a processor programmed to perform the step of advertising to an IPv4 domain, IPv4 addresses of network equipment connected to the IPv6 domain”
7	“second means for advertising”	Function: “advertising in the IPv6 domain IPv6 addresses constructed from IPv4 addresses of the IPv4 domain”

		Structure: “a dual-stack router that includes a processor programmed to perform the step of advertising in the IPv6 domain, IPv6 addresses constructed from IPv4 addresses of the IPv4 domain”
9	“means for obtaining”	Function: “obtaining an IPv4 address, a range of port numbers, and a range of authorized IPv6 addresses” Structure: “the home gateway 20 or access router 30 serving home gateway 20 that includes a processor programmed to perform the step of obtaining an IPv4 address, a range of port numbers, and a range of authorized IPv6 addresses”

VIII. GROUNDS

A. Ground 1: Claims 1-10 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, ¶57.

(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 ’844 patent’s priority date of June 30, 2008. EX1005, ¶¶44-48, 57; EX1003, ¶¶58-59. 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 concerns the transition between IPv4 and IPv6. EX1037, 1. Li proposes mapping IPv4 packets into IPv6 packets (or vice versa) “automatically at the edge of the IPv6 backbone.” EX1037, 1; EX1003, ¶60. Li depicts the following network configuration as one embodiment that implements its invention:

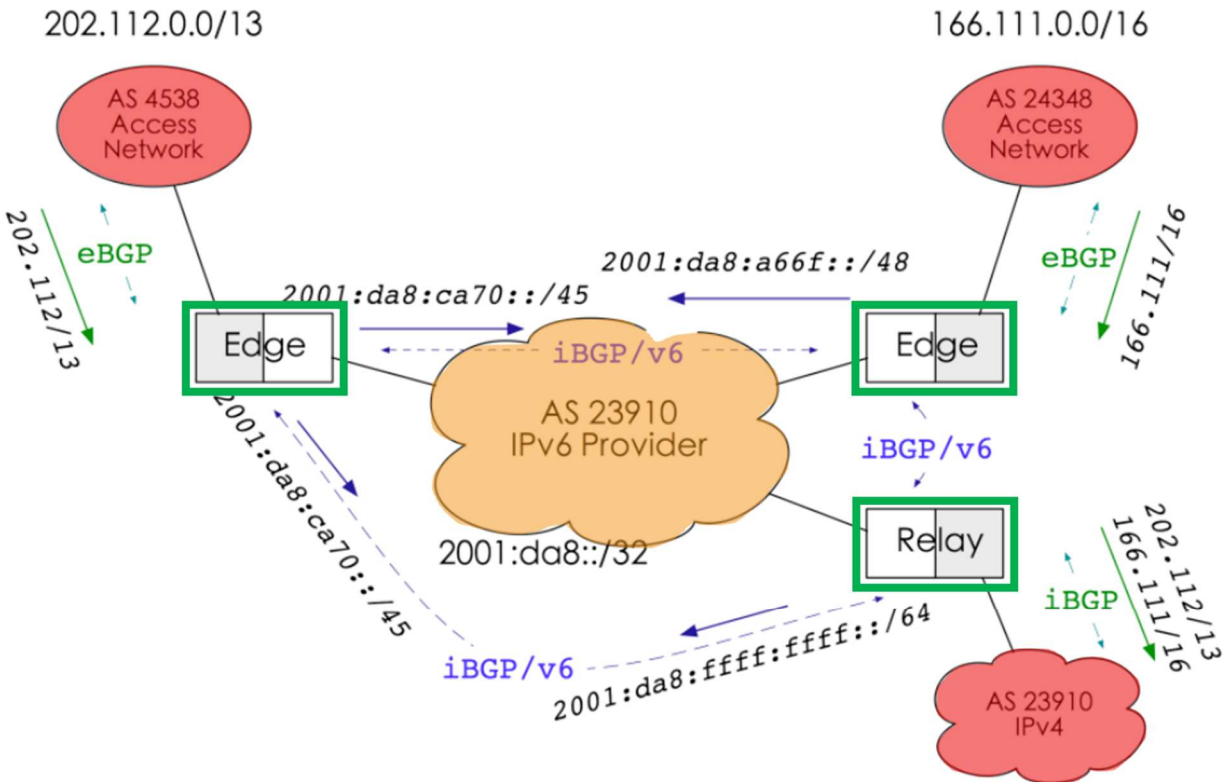


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7 (highlighted). At the center of the network is an IPv6 domain (orange) that routes incoming data packets. *Id.*, 3, 6-7. Surrounding the IPv6 domain are several IPv4 domains (red), called access networks. *Id.* Edge routers and edge relays (surrounded by green borders) straddle the IPv6 domain and the IPv4 domains. *Id.* These “IPv4-IPv6 edge routers” implement the disclosed invention and convert IPv4 data packets into IPv6 data packets and vice versa. *Id.*, 2-4. EX1003, ¶61.

The grounds in this petition walk through an example of sending a data packet from an IPv4 host in the top-left IPv4 domain, through the IPv6 domain, to an IPv4 host in the top-right IPv4 domain:

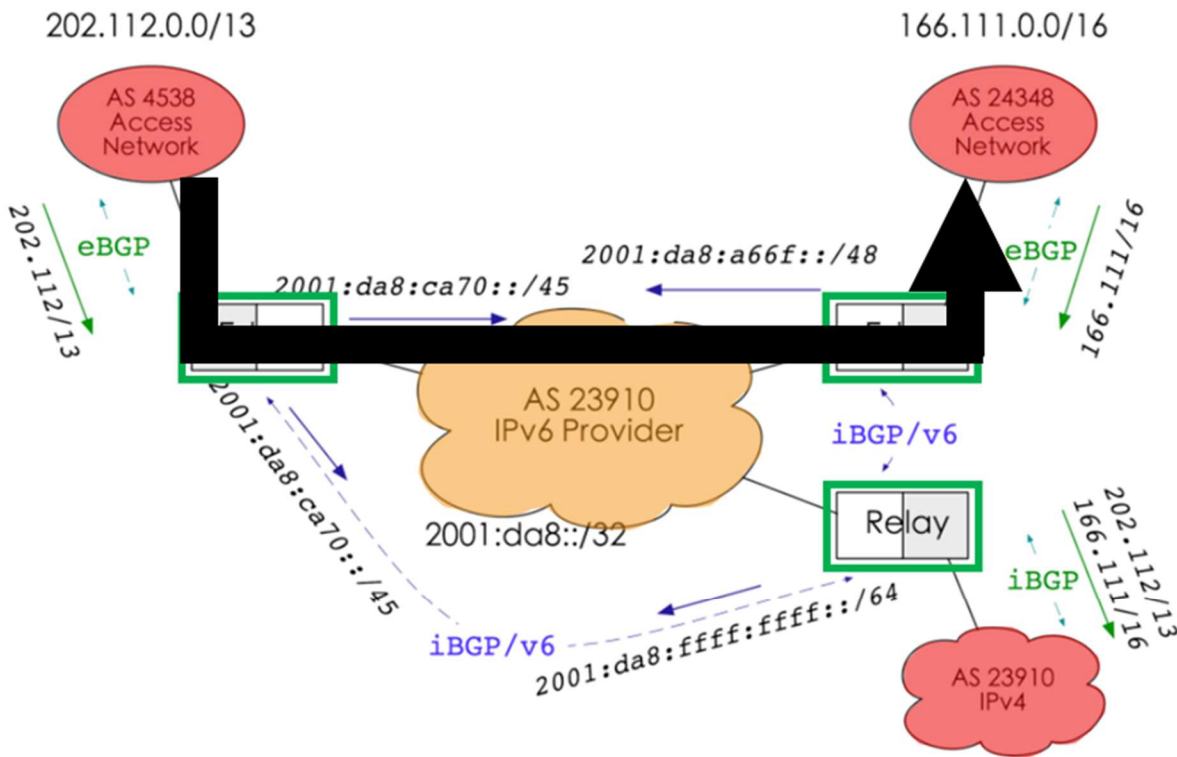
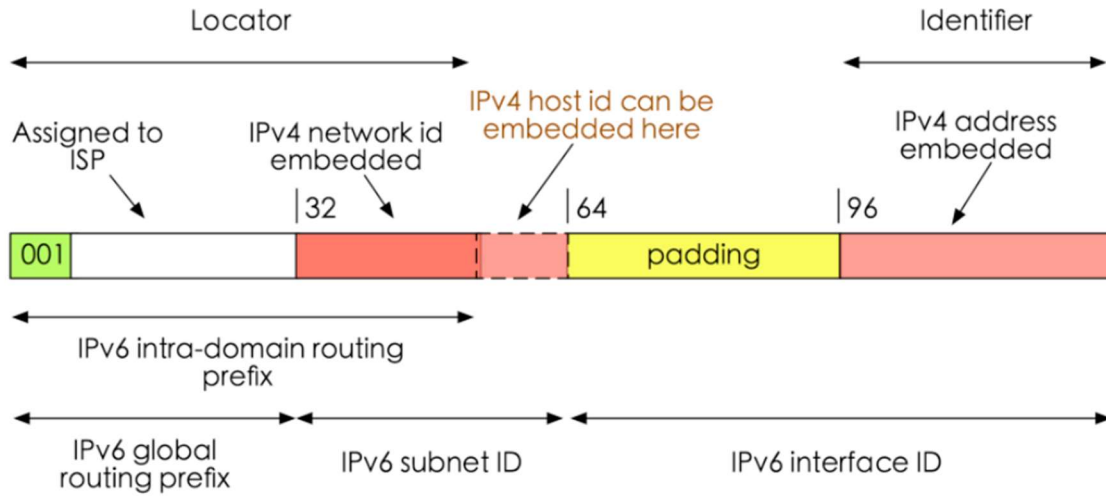


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7 (highlighted and annotated). EX1003, ¶62.

To convert IPv4 data packets into IPv6 data packets during this routing process, the edge routers and edge relays implement a process called “address mapping.” EX1037, 3. According to Li, “[i]t is simple to map an IPv4 prefix into an IPv6 one.” *Id.* Li provides an example of one such mapping:



Id. This mapping includes an “IPv6 global routing prefix,” an “IPv4 address,” and 32 bits of “padding” *Id.* EX1003, ¶63.

Li provides 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). For example, the third row in Table 1 is an IPv6 address containing an IPv6 prefix (blue), the IPv4 address from the left side in hexadecimal notation (red),^{5, 6} and zero padding (yellow). *Id.*; EX1003, ¶64.

Thus, Li teaches constructing an IPv6 destination address by concatenating an IPv6 prefix, an IPv4 destination address, and zero padding. EX1003, ¶65. Li acknowledges that its invention “is just a small step” and “is an extensible foundation” that could be modified further to address the problem of IPv4 address exhaustion. EX1037, 2.

2. Li-2 (EX1038)

Li-2 is an IETF Internet Draft titled Bi-directional Address Borrowing (IVI). EX1038; EX1003, ¶66.

⁵ The translation from dotted-quad to hexadecimal is aesthetic. EX1003, ¶64. The translation does not alter the IPv4 address itself—the IPv4 address on the left is the exact same 32-bit address as the one on the right. *Id.*

⁶ For technical reasons that are not relevant to this petition, the IPv4 address is repeated twice in the constructed IPv6 address. EX1003, ¶64 n.5.

(a) Li-2 Is Prior Art Under §102(a)

Li-2 is prior art under at least pre-AIA §102(a) because it was publicly available before the '844 patent's priority date of June 30, 2008. EX1008, ¶¶4-12; EX1003, ¶¶67-69; 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, ¶¶67-68. 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 can 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. *Id.*, ¶¶4-5; EX1009, ¶¶7, 10. This staging folder is publicly accessible without a password. EX1008, ¶¶4, 6; EX1009, ¶10. Even today, the draft remains publicly accessible in the staging folder, titled "draft-xli-ivi-00-7431-

cancelled.txt.”⁷: <https://www.ietf.org/staging/>. See also EX1044; EX1008, ¶8; EX1009, ¶11. And the staging folder 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. POSITA 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 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

⁷ 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 remain publicly accessible in the IETF staging folder. *Id.*; see EX1009, ¶11.

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) (“Whether or not the website itself had been indexed by 1999 (through search engines or otherwise), the uncontested evidence indicates that a person of ordinary skill

interested in electronic voting would have been independently aware of the Risks Digest as a prominent forum for discussing such technologies.”).

(b) Overview of Li-2

Li-2 describes much of what is disclosed in Li; for example, constructing an IPv6 address by concatenating an IPv6 prefix, IPv4 address, and zero padding:

IVI Address Mapping

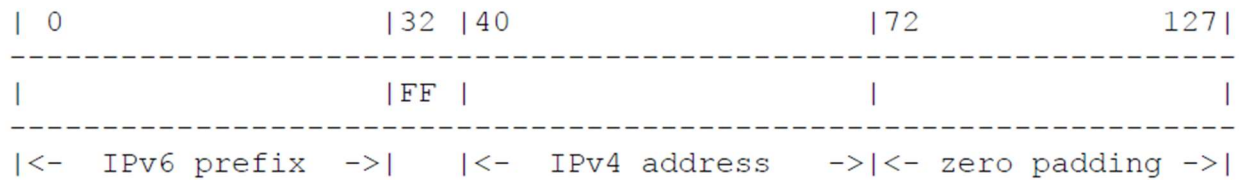


Figure 1

EX1038, 6; EX1003, ¶¶70-71. However, Li-2 recognizes that this addressing scheme does not solve the problem of IPv4 address depletion. EX1038, 14. Li-2 thus expands upon the 2006 paper by introducing an idea of “port multiplexing.” *Id.*; EX1003, ¶¶72-76.

Port multiplexing works by replacing the “least significant bits” of the constructed IPv6 address—currently occupied by unused zero padding—with a port number. EX1038, 14. Li-2 explains that port multiplexing allows a “single borrowed IPv4 address” to “be used for multiple IVI6(i) addresses” by distinguishing hosts with a port number. *Id.*

In fact, just one month later, the authors of Li and Li-2 provided examples of this stateless mapping algorithm in an IETF conference presentation. EX1028; EX1007, ¶11 (confirming public accessibility); EX1005, ¶¶53-57 (same). These examples further confirm that Li-2 teaches concatenating the destination port number to the IPv6 destination address by replacing unused zero padding. EX1003, ¶74. For example, the authors provided the following examples:

```
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). 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, 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. EX1003, ¶74-75; EX1038, 14.

3. The Li-Li-2 Combination

In the Li-Li-2 combination, Li teaches the general network structure. EX1003, ¶77. Li further teaches constructing an IPv6 destination address by concatenating an IPv6 prefix, an IPv4 destination address, and 32-bits of zero

padding (and the reverse process from IPv6 to IPv4). *Id.* Li-2 supplements Li's disclosures by replacing Li's unused zero padding with a destination port number in order to mitigate IPv4 address exhaustion. *Id.* Thus, in the Li-Li-2 combination, Li would operate in its disclosed manner but would further implement Li-2's teaching of including port numbers in constructed IPv6 addresses. *Id.*

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, ¶78.

First, the prior art includes express teachings that would have led a POSITA to combine Li and Li-2. EX1003, ¶79. 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 expressly discloses these teachings and explains that they are the underlying motivation for Li-2's port multiplexing extension of the original Li paper. EX1038, 4, 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, since Li-2 is an extension of Li authored by the same inventors of the original Li paper. EX1003, ¶79.

Second, this combination would have involved applying a known technique to a known device ready for improvement to yield predictable results. EX1003, ¶80. The '844 patent can be seen as an obvious improvement of Li. *Id.* Although Li solves the issue of IPv4-IPv6 interoperability, it does not solve the issue of IPv4 address exhaustion. *Id.* Li-2 describes a well-known technique for improving Li's base device. Namely, Li-2 explain that destination port numbers can be used to extend the IPv4 address space and slow IPv4 address depletion. *Id.*, ¶81. For example, Li-2 similarly explains that concatenating destination port numbers to construct an IPv6 destination address further "increase[s] the utilization ratio of the public IPv4 address," allowing "a single borrowed IPv4 address" to "be used for multiple IPv6(i) addresses." EX1038, 14. Li-2 explains that this extension, called "port multiplexing," is important because "public-IPv4 address is a scarce resource" and "the effective use of the IPv4 address is important" for its addressing scheme. *Id.* Li-2 also explains that its disclosures carry several other advantages, like "end-to-end transparency, being globally routable, incremental deployable, having multi-homing support and being able to use the global IPv4 addresses effectively." *Id.*, 4.

A POSITA not only could have applied the known improvement technique from Li-2 to Li, but a POSITA actually *did* apply this technique, and the results would therefore not only have been predictable to a POSITA but are explicitly described in Li-2. EX1003, ¶81; EX1038, 14.

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, ¶82. 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, as described in Li-2. EX1003, ¶82; *see* EX1038, 14.

Fourth, this combination would have involved combining prior art elements according to known methods to yield predictable results. EX1003, ¶83. Li and Li-2 recite all elements of the '844 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 '844 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, ¶¶84-85; EX1001, 1:17-21, 2:46-64; EX1037, 1; EX1038, 4.

5. Claim 1

(a) 1[pre]

To the extent the preamble is limiting, Li discloses limitation 1[pre]: “a method of receiving a data packet [*e.g.*, **“IPv4 traffics” received by the top-left edge router in Figure 7 that are destined for a host in the top-right IPv4 access network**] from an IPv4 domain [*e.g.*, **top-left IPv4 access network**] in an IPv6 domain [*e.g.*, **IPv6 domain**], said data packet comprising an IPv4 destination address [*e.g.*, **received IPv4 destination address that corresponds to a host in the top-right IPv4 access network**] and a destination port number [*e.g.*, **received destination port number**], said method comprising the following steps.” EX1003, ¶¶86-94. The elements of this limitation are broken down below.

A method of receiving a data packet from an IPv4 domain in an IPv6 domain: Figure 7 depicts an embodiment of a network that facilitates communications between hosts:

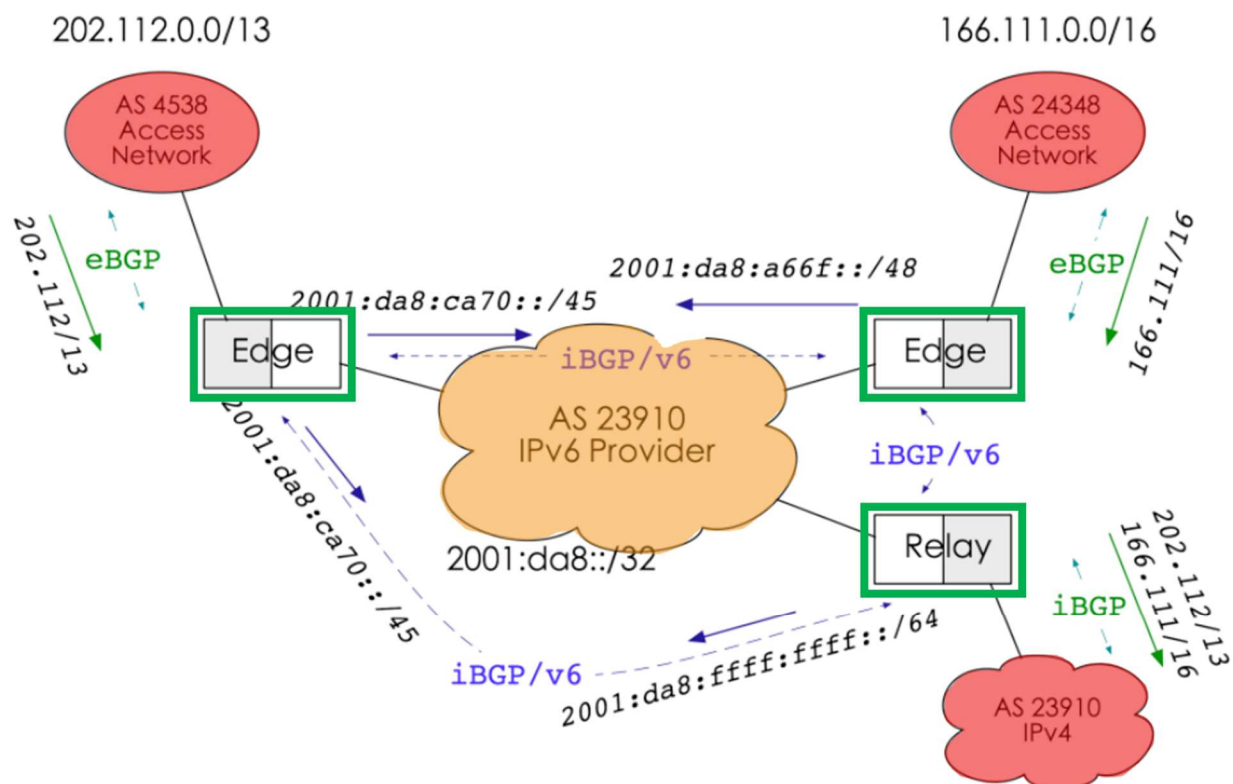


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7 (highlighted). The grounds in this petition walk through 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 large black arrow below:

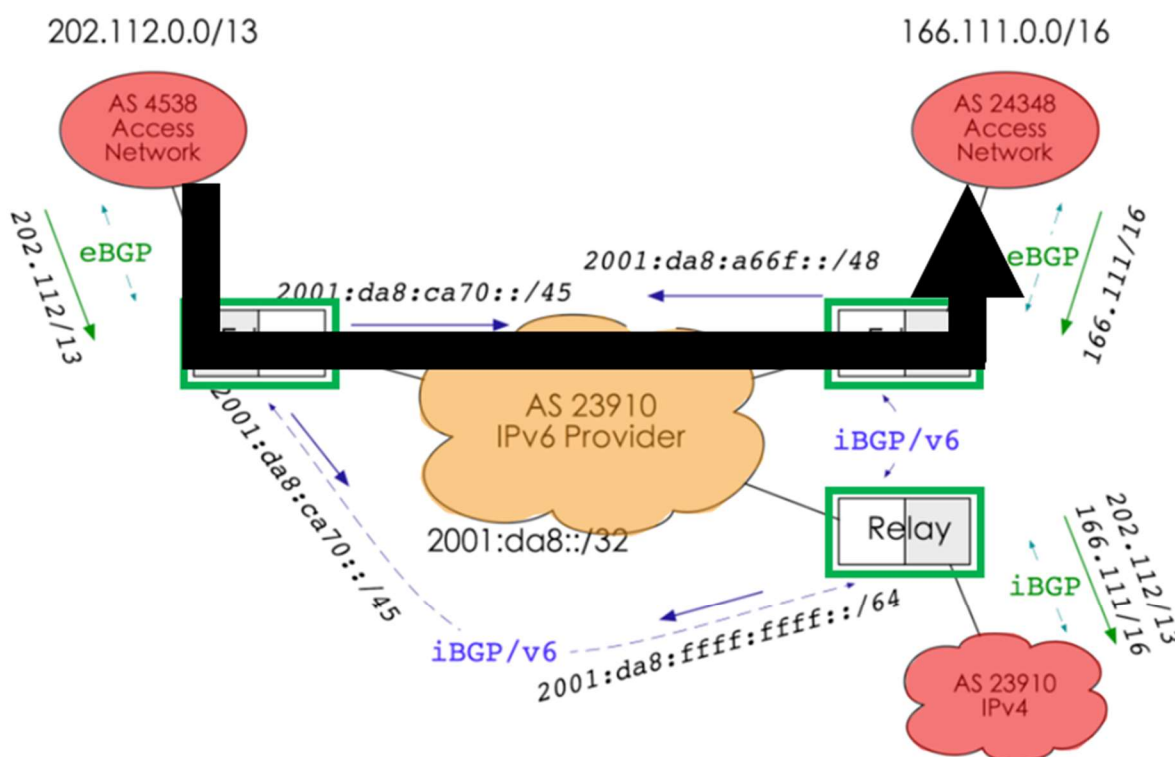


Figure 7. IPv4-over-IPv6 transition for access networks

Id., 7 (highlighted and annotated). At the center of the network is an IPv6 domain (orange) that routes communications between the surrounding IPv4 domains (red). *Id.* Edge routers (surrounded in a green box) straddle the IPv6 domain and the IPv4 domains with which they are associated. *Id.* 4, 7.

Li discloses that the edge routers (e.g., the edge router in the top left corner) receive data packets from an IPv4 domain, namely the IPv4 access networks (e.g., the AS 4538 Access Network in the top-left corner). EX1003, ¶88; EX1037, 4-5. The edge routers (e.g., the edge router in the top left corner) are in an IPv6 domain. EX1003, ¶89. Indeed, Li discloses that “[a]n edge router is a dual-stack node”

(EX1037, 4) and illustrates the edge router having an interface to the IPv6 network (*id.*, Fig. 7). Similarly, the '844 patent explains that the access node 40 that receives the data packet in the IPv6 domain is a “Dual-Stack (IPv4 and IPv6) router” that interfaces with the IPv4 and IPv6 domains. EX1001, 9:48-56.

Patent Owner did not seek a construction of the term “domain” in the prior litigation against Cisco, and the court did not construe the term. EX1036. However, Patent Owner has previously argued in an IPR that the “domain” should be construed to mean “a network or subnetwork and its address space that are under common control.” EX1034, 20-21. Patent Owner further argued that two networks that are controlled by the same entity cannot be separate domains under the '844 patent's use of the term. *Id.*, 27-29. Patent Owner's previously offered construction and arguments regarding the term “domain” are incorrect. EX1003, ¶90. The '844 patent defines “domain” at the very beginning of its specification, explaining that “[a] telecommunications network administered by an operator is also referred to as a domain.” EX1001, 1:30-31. The '844 patent never requires the IPv4 domains and the IPv6 domain to each be controlled by distinct entities. EX1003, ¶91. In fact, the '844 patent does not at all indicate that networks controlled by the same entities do not qualify as “domains” in the '844 patent. *See generally* EX1001. A first IPv4 network, a second IPv4 network, and an IPv6 network are a first IPv4 domain, a second IPv4 domain, and an IPv6 domain respectively even if they are administered

by the same operator because, under the '844 patent's definition of "domain" they are each "telecommunications network[s] administered by an operator." EX1003, ¶90.

Regardless, Li discloses an IPv4 and an IPv6 "domain" even under Patent Owner's construction. *Id.*, ¶91. Li states that its teachings can "fit the requirements of forwarding IPv4 traffic in an inter-domain environment." EX1037, 1, 3, 6. Li further teaches that the inter-domain environment can include "customer IPv4" domains and an "IPv6 provider" domain, and that Figure 7 discloses an example of an "inter-domain environment." *Id.*, 6-7. A POSITA would understand Li's IPv4 customer network and IPv6 provider network to disclose IPv4 and IPv6 domains because the domains in Li are separate networks controlled by different entities. EX1003, ¶91.

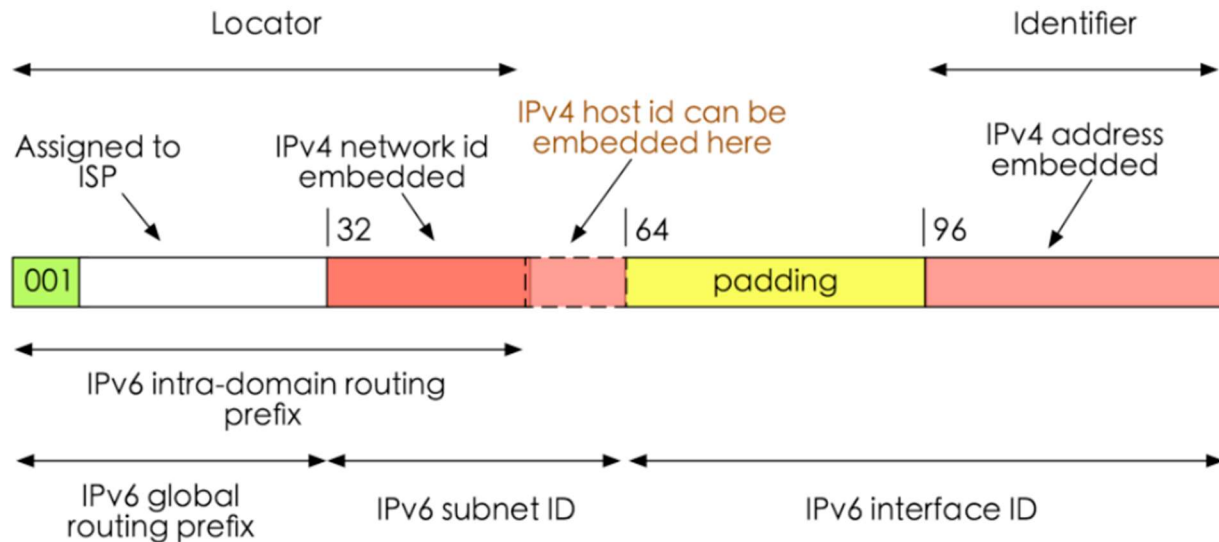
said data packet comprising an IPv4 destination address and a destination port number, said method comprising the following steps: Li discloses that edge routers receive and process "IPv4 packets." EX1037, 1, 3. An IPv4 packet includes a destination address field and may further encapsulate a TCP or UDP header that includes a port number. *See* §IV.A. And Li's experimentation section explains that the IPv4 packets include destination addresses and further discusses using "UDP-based protocols" and "TCP-based applications," which include port numbers.

EX1003, ¶¶92-94; EX1037, 5-6. Additionally, Li-2 discloses data packets that contain port numbers. EX1038, 11, 14, 18.

(b) 1[a]

Li and Li-2 render obvious limitation 1[a]: “constructing an IPv6 destination address [*e.g.*, **Li’s translated IPv6 address that corresponds to a host in the top-right IPv4 access network**] by concatenating an operator prefix [*e.g.*, **Li’s IPv6 global routing prefix**], said IPv4 destination address [*e.g.*, **Li’s received IPv4 destination address that corresponds to a host in the top-right IPv4 access network**], and the destination port number [*e.g.*, **Li’s received destination port number in light of Li-2’s teachings**].” EX1003, ¶¶95-106.

Li teaches “address mapping” in which “IPv4 source *and destination addresses* in a packet can be translated into their IPv6 version.” EX1037, 3 (emphasis added). Figure 2 of Li discloses an IPv6 address constructed with Li’s address mapping:



Id.

The first 32 bits of the constructed IPv6 address are an IPv6 global routing prefix that is assigned to the IPv6 domain. *Id.*; EX1003, ¶97. Li’s IPv6 global routing prefix corresponds to the ’844 patent’s “operator prefix.” EX1003, ¶97. The district court construed “operator prefix” to mean “a prefix assigned to an Internet Service Provider by its Regional Internet Registry.”⁸ EX1036, 25. Li’s IPv6 global routing prefix satisfies the court’s construction: Li explains that “[t]hrough out this paper, it is assumed that an Internet service provider who would like to apply this

⁸ Monarch requested the court construe “operator prefix” according to its “plain and ordinary meaning.” EX1036, 12. The IPv6 prefix in Li satisfies this proposed construction for the same reasons discussed above. EX1003, ¶97 n.8; *see* EX1001, 9:9-10.

approach holds at leas[t] one IPv6 prefix not smaller than /32.” EX1037, 2. And Li further discloses that “IPv6 prefixes [are] allocated by the provider.” *Id.*, 7. In fact, Figure 2 expressly states that the “IPv6 global routing prefix” is “Assigned to ISP [Internet Service Provider].” *Id.*, 3.

The next 32 bits (up to bit 64)⁹ of the constructed IPv6 address is the received IPv4 destination address. *Id.*; EX1003, ¶98.

The 32 bits after that (up to bit 96) is “padding,” in which empty space is filled with 0s. EX1037, 3. Thus, Li’s “address mapping” involves concatenating—which Patent Owner agreed to define as “appending one item to the end of another so as to form a single unit in a contiguous pattern”—(1) an IPv6 prefix, (2) an IPv4 destination address, and (3) padding. EX1003, ¶¶99-100; EX1036, 13. As shown in Figure 2 discussed above, Li explicitly teaches appending these pieces of information to the end of one another to form a single unit in a contiguous pattern. EX1003, ¶¶100-104.

In sum, Li teaches “constructing an IPv6 destination address by concatenating an operator prefix [*e.g.*, **IPv6 global routing prefix**], said IPv4 destination address [*e.g.*, **received IPv4 destination address that corresponds to a host in the top-right IPv4 access network**].”

⁹ Or, alternatively, the last 32 bits. EX1037, 3; *see* n.6.

Although Li does not expressly disclose further concatenating “the destination port number,” it would have been obvious to do so in view of Li-2. EX1003, ¶¶104-106. Li-2 teaches that a constructed IPv6 destination address may be formed by concatenating the received destination port number. EX1003, ¶105. Specifically, Li-2 describes “port multiplexing”—an extension of Li that constructs an IPv6 destination address by not only concatenating an IPv6 prefix and IPv4 destination address but further concatenating a destination 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, ¶106. Indeed, that’s exactly what Li-2 teaches: “The mapping scheme is to use the least significant bits in the IIVI6(i) to define the multiple mapping and combine the tran[s]port-layer port number to uniquely perform the mapping from IIVI4(i) to IIVI6(i).” EX1038, 14. Thus, in the Li-Li-2 combination Li’s edge router would construct an IPv6 destination address by concatenating an operator prefix, said IPv4 destination address, and the destination port number. EX1003, ¶106.

(c) 1[b]

Li further teaches limitation 1[b]: “generating an IPv6 data packet from the IPv6 constructed destination address and the received IPv4 packet.” EX1003, ¶¶107-108. For instance, Li explains that its “edge router is a dual-stack node,

extended with the ability of translating routing messages and *modifying packet IP versions between IPv6 and IPv4.*” EX1037, 4 (emphasis added). In fact, the inventors implemented a server that performs Li’s disclosed invention, and the inventors noted that, in the constructed system, “[a] 1480-byte IPv4 packet will become a 1500-byte IPv6 packet after the translation.” *Id.*, 6. The generated IPv6 packet includes the constructed IPv6 destination address. *Id.*, 3-4; EX1003, ¶108.

(d) 1[c]

Li teaches limitation 1[c]: “routing the generated IPv6 data packet in the IPv6 domain using the IPv6 constructed destination address, said constructed address [*e.g.*, **constructed IPv6 address**] belonging to a range of IPv6 addresses [*e.g.*, **range of IPv6 addresses corresponding to devices in the top-right IPv4 access network**] routable to an interconnection equipment [*e.g.*, **top-right edge router that services the IPv4 access network**] of the IPv6 domain [*e.g.*, **IPv6 domain**] with the IPv4 destination address.” EX1003, ¶¶109-113. The elements of this limitation are broken down below:

routing the generated IPv6 data packet in the IPv6 domain using the IPv6 constructed destination address. Li explains that it describes “a new technique of forwarding IPv4 traffics *in pure IPv6 backbone*” by using the constructed IPv6 destination address. EX1037, 1 (emphasis added); *see also* EX1037, 1-5. Further, a POSITA would have understood that the generated IPv6 data packet is routed

through the IPv6 domain according to the constructed IPv6 destination address. EX1003, ¶110.

said constructed address belonging to a range of IPv6 addresses routable to an interconnection equipment of the IPv6 domain with the IPv4 destination address. The '844 patent suggests that an “interconnection equipment” is equipment that sits between an IPv4 and IPv6 domain and can route data packets between those domains. EX1001, 7:16-21, 14:1-26. And the district court construed “an interconnection equipment of the IPv6 domain” to mean “a router of the IPv6 domain.” EX1036, 29. Patent Owner had also requested to construe the term as “a routing or switching device in the IPv6 domain.” *Id.*, 25. Li’s edge routers and edge relays correspond to the “interconnection equipment” because they similarly interconnect the IPv4 and IPv6 domains and route data packets between those domains. EX1037, 1-3; EX1003, ¶111; *see* §VIII.A.5.a.

Li discloses that its interconnection equipment (*e.g.*, its edge routers or edge relays) serve a range of IPv6 addresses that correspond to IPv4 addresses within their associated domain. EX1003, ¶112. For example, Li explains that its edge routers and edge relays service IPv4 access networks. EX1037, 3-4. The access networks contain multiple devices. EX1003, ¶112. The notation used in Figure 7 and Table 1 of Li indicates that each edge router serves a range of IPv4 addresses. EX1003, ¶112; EX1037, 3, 7. For example, the notation “202.112.0.0/13” means that the edge

router in the top-left of Figure 7 serves a range of IP addresses that start with “202.112,” designated by the “/13”. EX1003, ¶112.

The range of IPv6 addresses constructed from this range of IPv4 addresses are “routable to” the edge relays and edge routers serving those addresses. *Id.*, ¶113. The district court construed “with the IPv4 destination address” to mean “with the IPv6 constructed destination address including the IPv4 destination address.” EX1036, 29. Li’s IPv6 constructed destination address includes the IPv4 destination address. *See* §VIII.A.5.b.

6. Claim 2

Li further discloses the additional limitation of claim 2. EX1003, ¶114. For instance, Li describes “in-lab experiments” that use “5 computers.” EX1037, 5. A POSITA would have known that these computers comprise memory and a processor, which they use to perform the steps in claim 1, executed by processing program code instructions. EX1003, ¶114.

7. Claim 3

(a) 3[pre]

To the extent the preamble is limiting, Li and Li-2 render obvious limitation 3[pre]: “a method of sending a data packet [*e.g.*, **Li’s IPv6 data packet that is constructed by the top-left edge router of Figure 7**] from an IPv6 domain [*e.g.*, **Li’s IPv6 domain**] to a destination address of an IPv4 domain [*e.g.*, **Li’s IPv4 destination address in the top-right IPv4 access network**], said packet comprising

an IPv6 destination address of the packet constructed by concatenating an operator prefix [e.g., **Li's IPv6 global routing prefix**], the IPv4 destination address [e.g., **Li's received IPv4 destination address that corresponds to a host in the top-right IPv4 access network**], and a destination port number [e.g., **Li's received destination port number in light of Li-2's teachings**], said method executing the following steps on reception of the data packet.” EX1003, ¶¶115-117.

Li describes a network that facilitates communications between hosts. Figure 7 depicts an embodiment of the network:

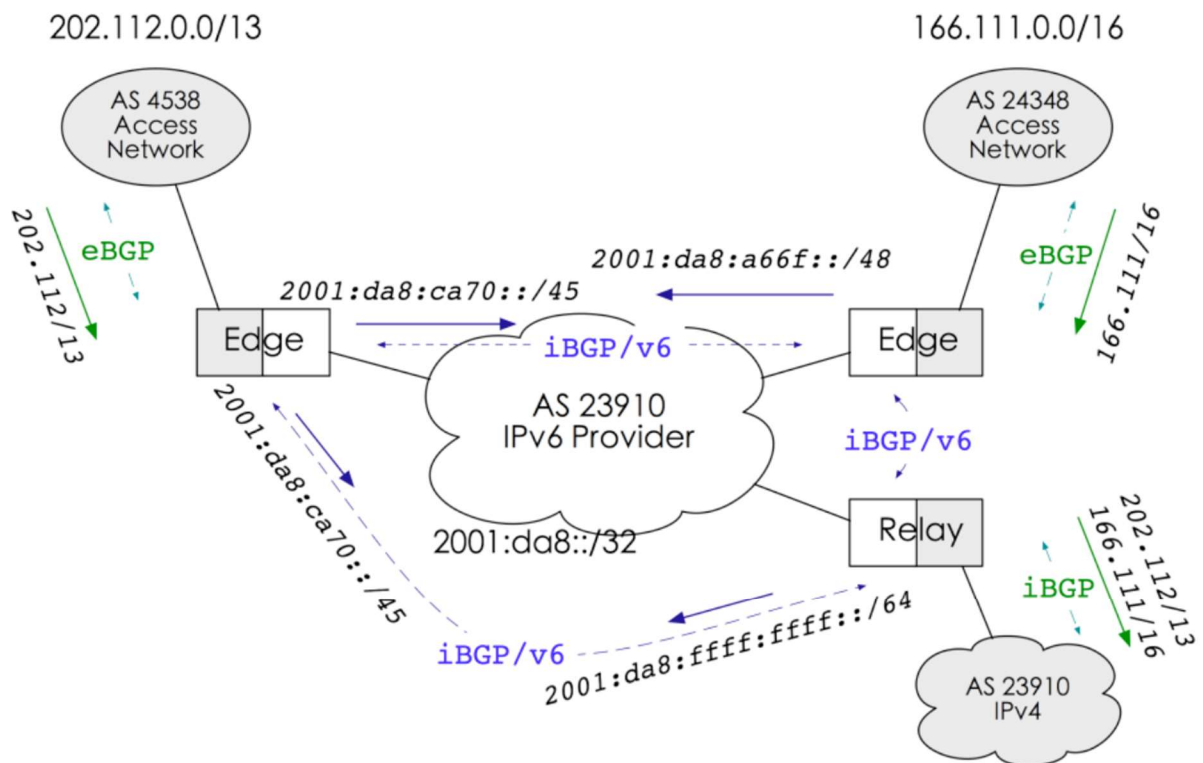


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7. Li discloses edge routers that straddle an IPv4 domain and an IPv6 domain. *See* §VIII.A.5. These edge routers, like the edge router in the top-left of Figure 7, construct IPv6 data packets and route them through an IPv6 domain to other edge routers, like the edge router in the top-right or the edge relay in the bottom-right of Figure 7. *Id.* These data packets are intended for IPv4 hosts in an IPv4 domain and ultimately get routed to the host associated with the corresponding IPv4 address. *Id.*

Li in combination with Li-2 renders obvious an IPv6 data packet that has an IPv6 destination address constructed by concatenating an operator prefix, the IPv4 destination address, and a destination port number. *See* §VIII.A.5.b.

(b) 3[a]

Li and Li-2 render obvious limitation 3[a]: “extracting the IPv4 destination address [*e.g.*, **Li’s top-right edge router, extracting the received IPv4 destination address**] and the destination port number [*e.g.*, **Li’s destination port number in light of Li-2’s teachings**] from the IPv6 destination address [*e.g.*, **Li’s constructed IPv6 address that is received by the top-right edge router**].” EX1003, ¶¶118-120.

Li explains that it not only teaches mapping an IPv4 address to an IPv6 address but also the reverse, mapping an IPv6 address back into an IPv4 address. EX1037, 1 (“IPv4 packets are mapped into IPv6 (or vice versa)...”). For example, the top-

left edge router in Li's Figure 7 can transform IPv4 addresses into IPv6 addresses and then route the corresponding IPv6 data packets to the top-right edge router. *Id.*, 3; EX1003, ¶119. The top-right edge router can then extract the IPv4 destination addresses from the received IPv6 data packets and then route the resulting IPv4 data packets to the correct IPv4 hosts. EX1037, 3; EX1003, ¶119. A POSITA would have understood that for the edge router to route the data packet to its IPv4 destination, it would extract the IPv4 destination address from the received IPv6 destination address. EX1003, ¶119. In fact, Li's experimentation section explains that the end result of its invention is "a real IPv4 packet captured on the host" that is the intended recipient of the data packet. EX1037, 6.

A POSITA would have found it obvious to apply the teachings of Li-2 to Li such that Li's edge router would extract both the IPv4 destination address and the destination port number from the IPv6 destination address. EX1003, ¶120. In other words, upon receipt of the data packet, Li's edge router would convert the IPv6 data packet into an IPv4 data packet and use the information in the IPv6 data packet, including the IPv4 destination address and the destination port number, to route the resulting IPv4 data packet to the correct IPv4 host. *Id.*

(c) 3[b]

Li and Li-2 render obvious limitation 3[b]: "generating an IPv4 data packet [*e.g.*, **Li's top-right edge router, generating an IPv4 data packet**] from the IPv6

data packet [*e.g.*, **Li's IPv6 data packet that is received by the top-right edge router**], said packet including said IPv4 destination address [*e.g.*, **Li's IPv4 destination address that corresponds to a host in the top-right IPv4 access network**] and said destination port number [*e.g.*, **Li's destination port number in light of Li-2's teachings**].” EX1003, ¶¶121-123.

Li teaches generating an IPv6 data packet from an IPv4 data packet. *See* §VIII.A.5.c. Li further teaches that it can do the reverse and generate IPv4 data packets from IPv6 data packets. EX1037, 1. A POSITA would have understood that the IPv4-to-IPv6 process disclosed in Li could be reversed to teach an IPv6-to-IPv4 process. EX1003, ¶122. For example, Li teaches and depicts the process of mapping an IPv4 header into an IPv6 header. EX1037, 4. To do the opposite, a POSITA would merely have to perform the reverse process—extract information from the IPv6 header and place that information in the appropriate location of the IPv4 header. EX1003, ¶122.

A POSITA would have found it obvious to further use the extracted destination port number, as discussed in the combination above, to generate the IPv4 data packet. *Id.*, ¶123. A POSITA would have understood that to maintain end-to-end communications, Li's edge router would need to extract the destination port number from the constructed IPv6 destination address, and then use that destination

port number to identify the destination IPv4 host and route the data packet accordingly. *Id.*

(d) 3[c]

Li teaches limitation 3[c]: “routing the IPv4 data packet [*e.g.*, **the top-right edge router, routing the constructed IPv4 data packet**] to its IPv4 destination [*e.g.*, **an IPv4 host in the top-right IPv4 access network**].” EX1003, ¶124. Li explains that its invention “deliver[s] IPv4 traffics” via edge routers that “can perform proper routing.” EX1037, 1, 3. Similarly, Li’s experimentation section describes an experiment in which the disclosed edge routers deliver IPv4 data packets to IPv4 hosts. *Id.*, 5-6.

8. Claim 4

Li further discloses the additional limitation of claim 4; *i.e.*, a non-transitory computer program that performs claim 3’s methods. EX1003, ¶125; *see* §§VIII.A.6-7.

9. Claim 5

(a) 5[pre]

To the extent the preamble is limiting, Li teaches limitation 5[pre]: “a device [*e.g.*, **edge router**]” that performs the claimed steps. EX1003, ¶126; *see* §VIII.A.5.a.

(b) 5[a]

Li and Li-2 render obvious the claimed steps, performed on an edge router. EX1003, ¶¶127-128; *see* §VIII.A.5.b. The district court construed the structure of “means for constructing” as “access node **40** with a device **25** that includes a processor programmed to perform the” limitation. EX1036, 59. Patent Owner had requested the broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or a dedicated router.” *Id.*, 49. Li’s edge router satisfies both constructions. EX1003, ¶127. The ’844 patent explains that access node **40** is a dual-stack router that is used to communicate between the IPv6 domain and the IPv4 domain. EX1001, 7:4-10, 9:48-56, Fig. 1. Li’s edge routers correspond to access node **40**. EX1003, ¶127. Indeed, Li explains 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.” EX1037, 4. Additionally, “the routers at the edge between IPv4 subnet and IPv6 backbone can perform proper routing and header processing.” *Id.*, 3. A POSITA would have further known that edge routers use a processor to perform the claimed steps. EX1003, ¶127. And a POSITA would have known that the edge router contains conventional computer and router hardware elements. *Id.*

Patent Owner and the court construed the function as “constructing an IPv6 destination address by concatenating an operator prefix, said IPv4 destination

address, and the destination port number.” EX1036, 49, 59. Li and Li-2 render obvious this function, performed on an edge router. *See* §VIII.A.5.b.

(c) 5[b]

Li teaches the claimed steps, performed on an edge router. EX1003, ¶129; *see* §VIII.A.5.c. The district court construed the structure of “means for generating” as “access node **40** with a device **25** that includes a processor programmed to perform the step of encapsulating the received IPv4 packet in an IPv6 packet or translating the received IPv4 packet IPv4-in-pt into an IPv6 packet.” EX1036, 59. Patent Owner had requested the broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or a dedicated router.” *Id.*, 49. Li’s edge routers correspond to access node **40** and Patent Owner’s broader “device” construction, and the edge routers use a processor to perform the claimed steps. EX1003, ¶129; *see* §VIII.A.9.b. In line with this construction, Li explains that “[a]n edge router manipulates the IP headers for the packets passing through it from IPv6 to IPv4 or vice versa. There are two possible ways of header manipulation: encapsulation and translation.” EX1037, 4. Patent Owner and the court construed the function as “generating an IPv6 data packet from the IPv6 constructed destination address and the received IPv4 packet.” EX1036, 49, 59. Li teaches this function, performed on an edge router. *See* §VIII.A.5.c.

(d) 5[c]

Li teaches the claimed steps, performed on an edge router. EX1003, ¶130; *see* §VIII.A.5.d. The district court construed the structure of “means for routing” as “access node **40** with a device **25** that includes a processor programmed to perform the” limitation. EX1036, 60. Patent Owner had requested the broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or a dedicated router.” *Id.*, 50. Li’s edge routers correspond to access node **40** and Patent Owner’s broader “device” construction, and the edge routers use a processor to perform the claimed steps. EX1003, ¶130; *see* §VIII.A.9.b. Patent Owner and the court construed the function as “routing the generated IPv6 data packet in the IPv6 domain using the IPv6 constructed destination address.” EX1036, 50, 60. Li teaches this function, performed on an edge router. *See* §VIII.A.5.d.

10. Claim 6

(a) 6[pre]

To the extent the preamble is limiting, Li teaches limitation 6[pre]. EX1003, ¶131. The ’844 patent explains that “access equipment” connects “to an IPv6 domain” and includes “an interface with at least one IPv4 domain.” EX1001, 4:31-32. “This kind of access equipment therefore interconnects the IPv6 domain to which it belongs and to a neighboring IPv4 domain.” *Id.*, 4:39-47. The ’844 patent discloses that “this access equipment may be a network equipment of any type, provided that it has a network interface between an IPv6 and an IPv4 domain.” *Id.*

Similarly, Li teaches edge routers and edge relays that interface with both an IPv6 domain and an IPv4 domain:

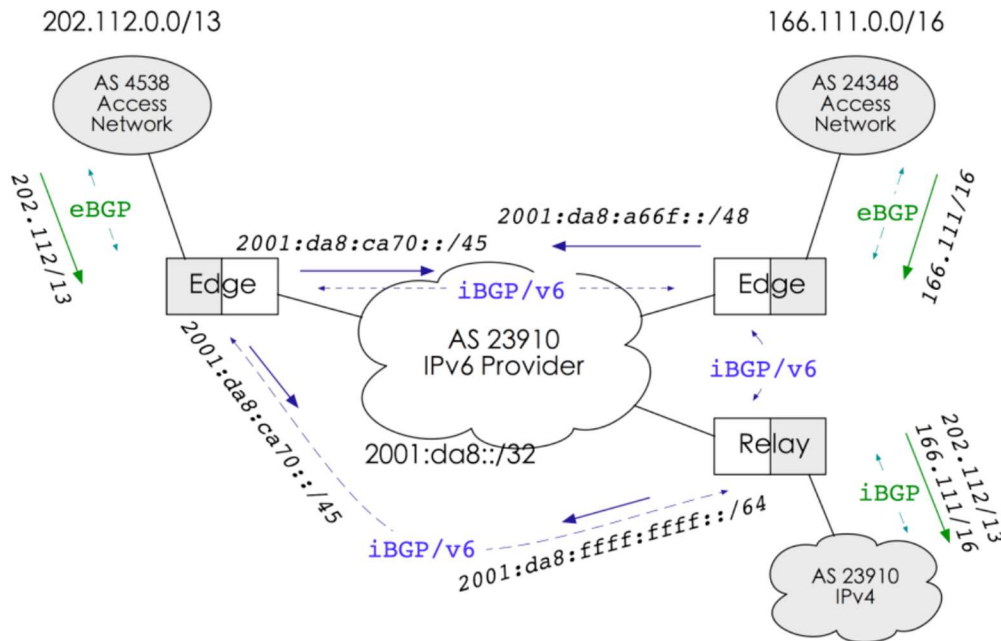


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7; *see also* §§VIII.A.5.a, VIII.A.5.d.

(b) 6[a]

Li teaches a device, an edge router, that performs the steps in claim 5.

EX1003, ¶132; *see* §VIII.A.9.

(c) 6[b]

Li teaches the claimed steps, performed on an edge router. EX1003, ¶133; *see* §VIII.A.7.a. The '844 patent discloses a device for sending packets that includes conventional hardware elements found in a computer or router. EX1001, 12:58-65. A POSITA would have known that Li's edge routers and edge relays include the

conventional hardware elements described in the '844 patent; for example, a processor, RAM, ROM, and telecommunications means. EX1003, ¶133; *see* §VIII.A.9.b.

(d) 6[c]

Li and Li-2 render obvious the claimed steps. EX1003, ¶¶134-136; *see* §VIII.A.7.b. The district court construed the structure of “means for extracting” as “home gateway **20** with a device **26** that includes a processor programmed to perform the step of determining whether the IPv6 data packet is a standard IPv6 packet or an IPv6 packet encapsulating an IPv4 packet using the header of the received packet.” EX1036, 70. Patent Owner had requested the much broader construction of “a home gateway or access node with a device” that includes “hardware elements conventionally found in a standard computer or dedicated router.” *Id.*, 60. Patent Owner agreed to construe “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.” *Id.*, 13.

Li’s edge router corresponds to the court’s narrow “home gateway” construction and Patent Owner’s much broader “device” construction. EX1003, ¶135; *see* §VIII.A.9.b. In particular, the edge router interconnects a private network—*i.e.*, the IPv4 access network that it services—and a network operated by

a service provider—*i.e.*, the IPv6 domain. EX1003, ¶135. Indeed, Li explains that the IPv4 access networks are “customer networks.” EX1037, 6. A POSITA would have understood that these customer networks would typically be home or business networks. EX1003, ¶135. Li further explains that an “Internet service provider” is “apply[ing] this approach” on its IPv6 domain. EX1037, 2-3, 6-7. And a POSITA would have understood that as part of the extraction process, the edge router would need to first determine whether the incoming data packet is a standard IPv6 packet that does not require extraction or a constructed IPv6 packet that does require extraction. EX1003, ¶135. Indeed, Li teaches that the edge routers can perform “header manipulation” via “encapsulation” and that the invention can work with “native IPv6 applications” (*i.e.*, standard IPv6 data packets). EX1037, 4, 9-10.

Patent Owner and the court construed the function as “extracting the IPv4 destination address and the destination port number from the IPv6 destination address.” EX1036, 60, 70. Li and Li-2 render obvious this function, performed on an edge router. *See* §VIII.A.7.b.

(e) 6[d]

Li and Li-2 render obvious the claimed steps, performed on an edge router. EX1003, ¶¶137-138; *see* §VIII.A.7.c. The district court construed the structure of “means for generating” as “home gateway **20** with a device **26** that includes a processor programmed to perform the step of de-encapsulating the IPv4 packet

contained in the packet IPv6 data packet to yield the IPv4 destination address and the destination port number.” EX1036, 71. Patent Owner had requested the much broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or dedicated router.” *Id.*, 61. Li’s edge router corresponds to home gateway **20** and Patent Owner’s broader “device” construction, and it uses a processor to perform the claimed steps. EX1003, ¶137; *see* §VIII.A.9.b. In particular, Li explains that its edge routers can convert IPv4 packets into IPv6 packets and vice versa via encapsulation. EX1037, 4.

Patent Owner proposed construing the function as “generating an IPv4 data packet from the IPv6 data packet.” EX1036, 61. The court agreed but further required “said packet including said IPv4 destination address and said destination port number.” *Id.*, 71. Li and Li-2 render obvious this function, performed on an edge router. *See* §VIII.A.7.c.

(f) 6[e]

Li teaches the claimed steps, performed on an edge router. EX1003, ¶¶139-140; *see* §VIII.A.7.d. The district court construed the structure of “means for routing” as “home gateway **20** with a device **26** that includes a processor programmed to perform the step of routing the IPv4 data packet to its IPv4 destination by processing the IPv4 data packet with the internal address translation table (NAT table) of the home gateway.” EX1036, 71. Patent Owner had requested

the much broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or dedicated router.” *Id.*, 61. Li’s edge router corresponds to home gateway **20** and Patent Owner’s broader “device” construction, and it uses a processor to perform the claimed steps. EX1003, ¶139; *see* §VIII.A.9.b. Indeed, Li explains that the edge router can encapsulate data packets “similar to what a NAT-PT gateway does.” EX1037, 4. Li explains how the edge router can map IPv6 entries into a “route table.” *Id.*

Patent Owner and the court construed the function as “routing the IPv4 data packet to its IPv4 destination.” EX1036, 61, 71. Li teaches this function, performed on an edge router. *See* §VIII.A.7.d.

11. Claim 7

Li further teaches the additional limitation of claim 7: “IPv6 domain access equipment according to claim 6 [*e.g.*, **an edge relay**], wherein the IPv4 is a public network [*e.g.*, **the IPv4 Internet**], said equipment comprising first means for advertising to the IPv4 domain IPv4 addresses of network equipments connected to the IPv6 domain [*e.g.*, **edge relay advertising IPv4 addresses of network equipment connected to the IPv6 domain to the IPv4 domain via IBGP**] and second means for advertising in the IPv6 domain IPv6 addresses constructed from IPv4 addresses of the IPv4 domain [*e.g.*, **edge relay advertising addresses in the**

IPv4 Internet to the IPv6 domain via IBPG/v6].” EX1003, ¶¶141-147. The elements of this claim are broken down below:

IPv6 domain access equipment according to claim 6. Li teaches IPv6 domain access equipment, which for this claim is an edge relay. *See* §VIII.A.10.a.

wherein the IPv4 is a public network. Li explains that its invention works with the IPv4 Internet. EX1037, 3, 8. A POSITA would have known that the Internet is a public network. EX1003, ¶143.

said equipment comprising first means for advertising to the IPv4 domain IPv4 addresses of network equipments connected to the IPv6 domain. Patent Owner requested—and the court agreed—the function of “first means for advertising” to be construed as “advertising to the IPv4 domain IPv4 addresses of network equipment connected to the IPv6 domain.” EX1036, 72, 77. The ’844 patent specifically describes advertising routes via IGP and BGP. EX1001, 14:1-4, 14:24-25, 8:39-44, Fig. 1. Li also describes using EBGP peers and IBGP to advertise IP addresses throughout the network, as shown in Figures 7 and 8:

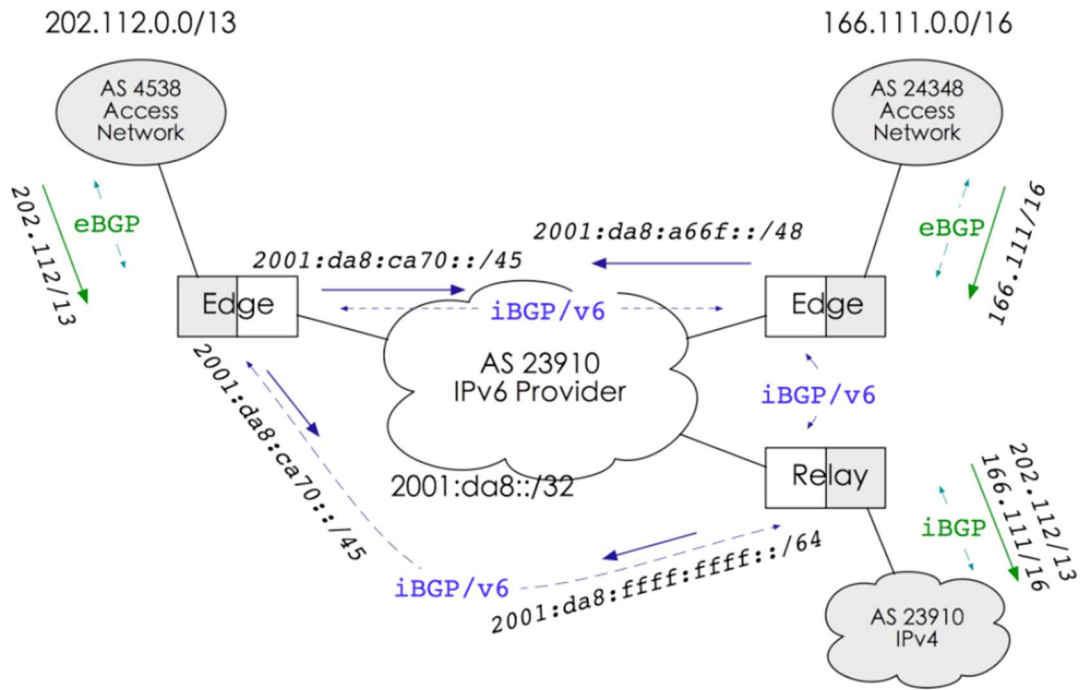


Figure 7. IPv4-over-IPv6 transition for access networks

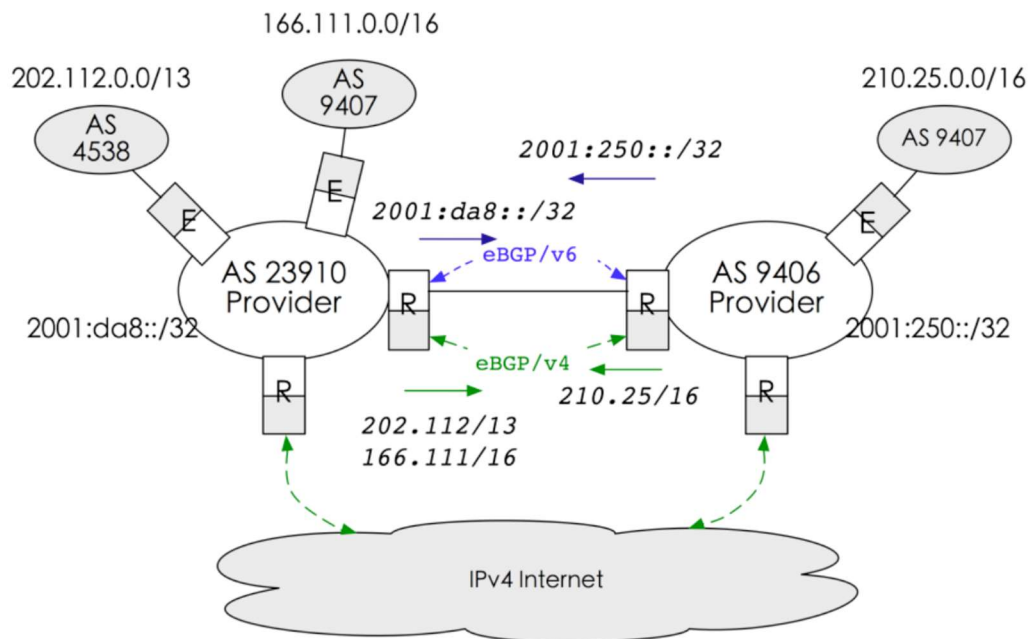


Figure 8. Transition in inter-domain environment

EX1037, 6-8. Indeed, a POSITA would have known that in order for hosts in the IPv4 Internet to communicate with Li's edge routers, the edge relay would need to advertise the serviceable addresses. EX1003, ¶144.

The district court construed the structure of “first means for advertising” as “a dual-stack router that includes a processor programmed to perform the” limitation. EX1036, 77. Patent Owner had requested the much broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or a dedicated router.” *Id.*, 72. Li's edge routers and edge relays are dual-stack routers that satisfy the court's construction and Patent Owner's more general “device” construction, and they use processors to perform the claimed steps. EX1003, ¶145; *see* VIII.A.9.b.

and second means for advertising in the IPv6 domain IPv6 addresses constructed from IPv4 addresses of the IPv4 domain. Patent Owner requested—and the court agreed—the function of “second means for advertising” to be construed as “advertising in the IPv6 domain IPv6 addresses constructed from IPv4 addresses of the IPv4 domain.” EX1036, 72, 77-78. Li discloses such advertising via EBGp and IBGP. EX1037, 6-8. Indeed, a POSITA would have known that in order for Li's edge routers to communicate with hosts in the IPv4 Internet, the edge relay would need to advertise the serviceable addresses. EX1003, ¶146.

The district court construed the structure of “second means for advertising” as “a dual-stack router that includes a processor programmed to perform the” limitation. EX1036, 77-78. Patent Owner had requested the much broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or a dedicated router.” *Id.*, 72. Li’s edge routers and edge relays are dual-stack routers that satisfy the court’s construction and Patent Owner’s more general “device” construction, and they use processors to perform the claimed steps. EX1003, ¶147; *see* §VIII.A.9.b.

12. Claim 8

Li further teaches the additional limitation of claim 8: “IPv6 domain access equipment according to claim 6 [*e.g.*, **edge router**], wherein the IPv4 domain is a private network [*e.g.*, **IPv4 access network**], the access equipment is a home gateway [*e.g.*, **edge router**] adapted to connect user terminals [*e.g.*, **IPv4 hosts**] of the private network to the IPv6 domain [*e.g.*, **the IPv6 domain**].” EX1003, ¶¶148-152. The elements of this claim are broken down below:

IPv6 domain access equipment according to claim 6. Li teaches IPv6 domain access equipment, which for this claim is an edge router. *See* §VIII.A.10.a.

wherein the IPv4 domain is a private network. Li explains that its invention works with IPv4 access networks. EX1037, 3, 7. A POSITA would have known that the IPv4 access network in Li is a private network. EX1003, ¶150.

the access equipment is a home gateway adapted to connect user terminals of the private network to the IPv6 domain. Patent Owner and Cisco had agreed to construe “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. The IPv4 access network is a private network, and a POSITA would have known that the private network is typically either a home network or a business network, especially in light of Li’s explicit disclosures that the IPv4 access networks are “customer networks” that are distinct autonomous systems from the “Internet service provider’s” IPv6 domain. EX1037, 2-3, 6-7; EX1003, ¶151; *see* §VIII.A.10.d.

As shown in Li’s Figure 7, the edge routers connect user terminals of the IPv4 access networks to the IPv6 domain:

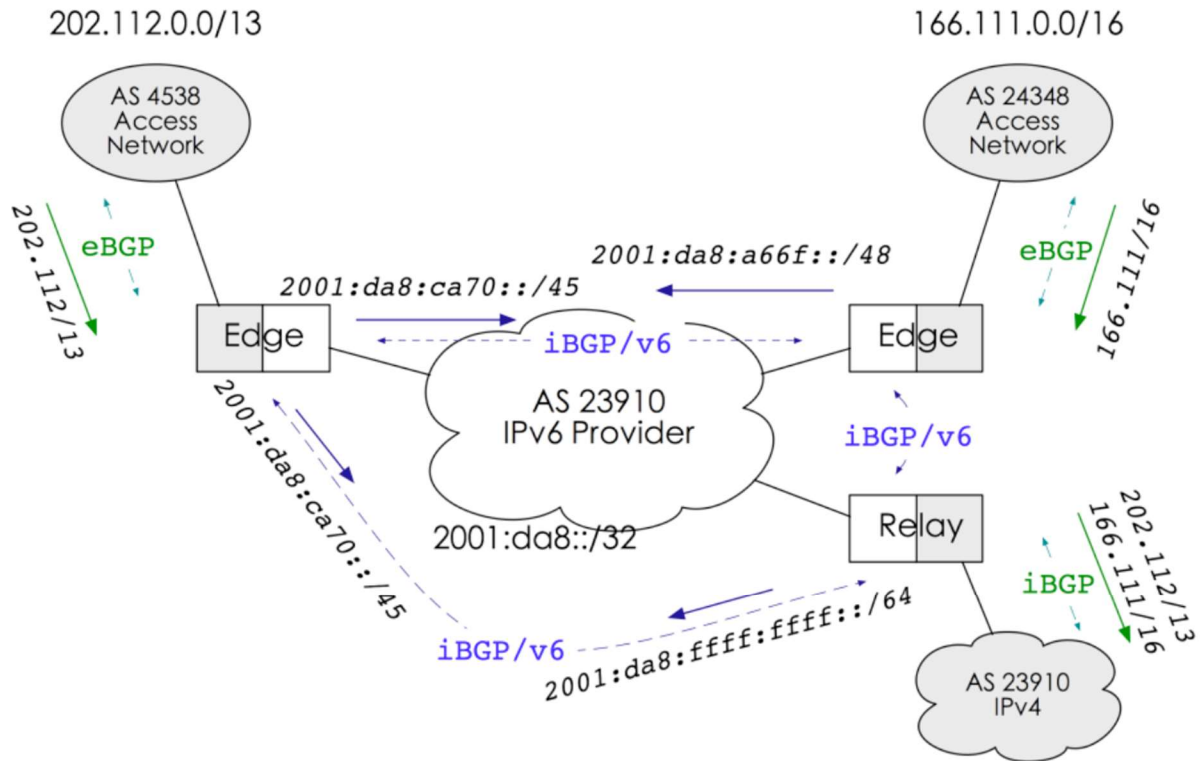


Figure 7. IPv4-over-IPv6 transition for access networks

EX1037, 7. For example, the IPv4 access network includes IPv4 hosts that send messages through the edge router to other hosts. *See id.*, 3, 6.

13. Claim 9

Li and Li-2 further render obvious the additional limitation of claim 9. EX1003, ¶¶153-155. Li and Li-2 render obvious an IPv6 domain access equipment (e.g., **an edge router**) that obtains an IPv4 address, a port number, and then uses that information to construct an IPv6 address. *See* §VIII.A.5. Li and Li-2 further render obvious constructing IPv6 addresses by concatenating an operator prefix, an IPv4 address, and port numbers. *See* §VIII.A.5.b.

Patent Owner requested—and the court agreed—to construe the function of “means for obtaining” as “obtaining an IPv4 address, a range of port numbers, and a range of authorized IPv6 addresses.” EX1036, 78, 80. Li discloses that the edge routers can obtain IP addresses and other information using Border Gateway Protocol (“BGP”). EX1037, 6. Li explains that BGP “provides useful information” to the edge routers, including network prefixes. *Id.* The BGP Routing Information Base (“RIB”) “provides a way of automatically distributing the list” of addresses and other information provided by BGP. *Id.*, 7. And that list can be cached “in order to accelerate the processing speed.” *Id.* Figure 7 of Li depicts edge routers sending and receiving ranges of constructed IPv6 addresses via BGP:

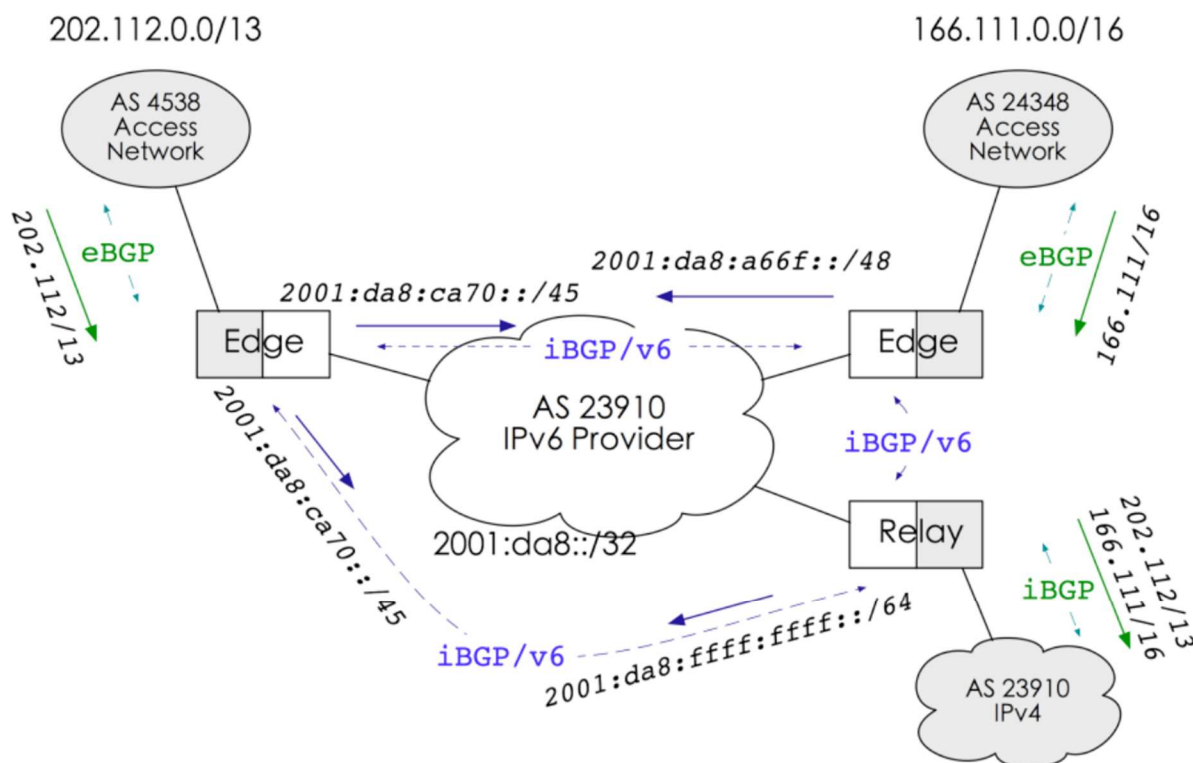


Figure 7. IPv4-over-IPv6 transition for access networks

Id., 7. For example, “2001:da8:ca70::/45”—advertised away from the top-left edge router and obtained by the top-right edge router—is a constructed IPv6 address range comprising an IPv6 prefix and a range of IPv4 addresses. EX1003, ¶154. A POSITA would have found it obvious for the edge routers to further advertise and obtain the range of port numbers used so that other edge routers would be able to identify IPv4 hosts that are assigned port numbers. *Id.* Further, Li-2 also explains that its routes “can be learned/inserted by dynamic routing protocols in the IVI gateway neighboring (IGP) or peering (BGP).” EX1038, 7-8. A POSITA would have therefore understood that these protocols could be used to advertise the

constructed IPv6 addresses that comprise destination port numbers, as disclosed in Li-2. *Id.*, 14.

The district court construed the structure of “means for obtaining” as “the home gateway **20** or access router **30** serving home gateway **20** that includes a processor programmed to perform the” limitation. EX1036, 80 Patent Owner had requested the much broader construction of “a device” that includes “hardware elements conventionally found in a standard computer or a dedicated router.” *Id.*, 78. Li’s edge routers correspond to the ’844 patent’s home gateway and Patent Owner’s more general “device” construction, and they use a processor to perform the claimed steps. EX1003, ¶155; *see* §VIII.A.9.b.

14. Claim 10

(a) 10[pre]

To the extent the preamble is limiting, Li teaches limitation 10[pre]: “a device [*e.g.*, **edge router**]” that performs the claimed steps. EX1003, ¶156; *see* §VIII.A.7.a.

(b) 10[a]

EX1003, ¶¶157-158; *see* §§VIII.A.7.b, VIII.A.10.d.

(c) 10[b]

EX1003, ¶159-160; *see* §§VIII.A.7.c, VIII.A.10.e.

(d) 10[c]

EX1003, ¶161-162; *see* §§VIII.A.7.d, VIII.A.10.f.

B. Ground 2: Claims 1-10 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 alone in view of the common knowledge in the art. EX1003, ¶163.

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

It is well-established that “[i]ndependently 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 form an IPv6 address that includes the destination port number. EX1003, ¶164.

Li-2 is at minimum evidence of simultaneous invention. As discussed in Ground 1, Li-2 discloses a port multiplexing technique which is used to construct an IPv6 address containing an operator prefix, the destination IPv4 address, and the destination port number.

Similarly, on July 6, 2008, just one week after the ’844 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, ¶165.

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, ¶167-169; *see also* §VIII.A.2; EX1005, ¶¶53-57; EX1007, ¶11.

Other groups also disclosed this idea. EX1003, ¶170; *see* §IV.B.3. 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. Motivations to Modify Li

A POSITA would have been motivated to modify the teachings of Li 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; EX1003, ¶¶171-177.

3. Claim 1

Li teaches claim 1 except for concatenating a destination port number. *See* §VIII.A.5. A POSITA would have found it obvious to modify Li to replace 16 bits of its unused padding with a destination port number in order to share a single IPv4 address among multiple hosts, thereby slowing IPv4 address exhaustion. EX1003, ¶¶178-181; *see* §§VIII.B.1-2.

4. Claim 2

See §VIII.A.6.

5. Claim 3

(a) 3[pre]

To the extent the preamble is limiting, Li teaches limitation 3[pre] except for concatenating a destination port number to construct the IPv6 destination address. *See* §VIII.A.7.a. A POSITA would have found it obvious to modify Li to replace 16 bits of its unused padding with a destination port number in order to share a single IPv4 address among multiple hosts, thereby slowing IPv4 address exhaustion. EX1003, ¶183; *see* §§VIII.B.1-2.

(b) 3[a]

Li teaches limitation 3[a] except for extracting the destination port number from the IPv6 address. *See* §VIII.A.7.b. A POSITA would have found it obvious to modify Li to also extract the destination port number in the IPv6 address in order to identify the intended recipient of the data packet. EX1003, ¶184; *see* §VIII.B.2. In a network that shares a global IPv4 address among multiple hosts to prevent IPv4 address exhaustion, the IPv4 address itself is not enough to uniquely identify the recipient host. EX1003, ¶184. Rather, the combination of IPv4 address and port number are used to uniquely identify hosts, thereby extending the IPv4 address space. *Id.*; *see* §IV.B.2-3. Evidence of simultaneous invention supports modifying Li in such a manner. *See* §VIII.B.1.

(c) 3[b]

Li teaches limitation 3[b] except for including the destination port number in the generated IPv4 data packet. *See* §VIII.A.7.c. A POSITA would have found it obvious to modify Li to include the extracted destination port number in the generated IPv4 data packet. EX1003, ¶185; *see* §VIII.B.2. In particular, a POSITA would have understood that (1) in this network configuration, the destination port number is used to uniquely identify the recipient host and (2) the destination port number indicates the process of the recipient host that should receive the data packet. EX1003, ¶185. Evidence of simultaneous invention supports modifying Li in such a manner. *See* §VIII.B.1.

(d) 3[c]

See §VIII.A.7.d.

6. Claim 4

See §VIII.A.8.

7. Claim 5

Li teaches claim 5 except for concatenating the destination port number. *See* §VIII.A.9. A POSITA would have found it obvious to modify Li to concatenate the destination port number. EX1003, ¶¶188-191; *see* §VIII.B.3.b.

8. Claim 6

Li teaches claim 6 except for extracting the destination port number and including it in the generated IPv4 data packet. EX1003, ¶¶192-197; *see* §VIII.A.10.

A POSITA would have found it obvious to modify Li to extract the destination port number and include it in the generated IPv4 data packet. *See* §VIII.B.5.b-c.

9. Claim 7

See §VIII.A.11.

10. Claim 8

See §VIII.A.12.

11. Claim 9

See §VIII.A.13.

12. Claim 10

Li teaches claim 10 except for extracting the destination port number and including it in the generated IPv4 data packet. EX1003, ¶¶201-204; *see* §VIII.A.14. A POSITA would have found it obvious to modify Li to extract the destination port number and include it in the generated IPv4 data packet. *See* §VIII.B.5.b-c.

C. Ground 3: Claims 1-10 Would Have Been Obvious in View of Li and Wu

1. Wu (EX1039)

Wu (EX1039) 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 of June 30, 2008. *See* §V.A. Wu 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 teaches a “new tunnel technology in the transition period from IPv4 Internet to IPv6 Internet.” EX1039, 2; EX1003, ¶205. Wu describes a dual-stack client that constructs an IPv6 address by concatenating different pieces of information, as shown in Figure 1:

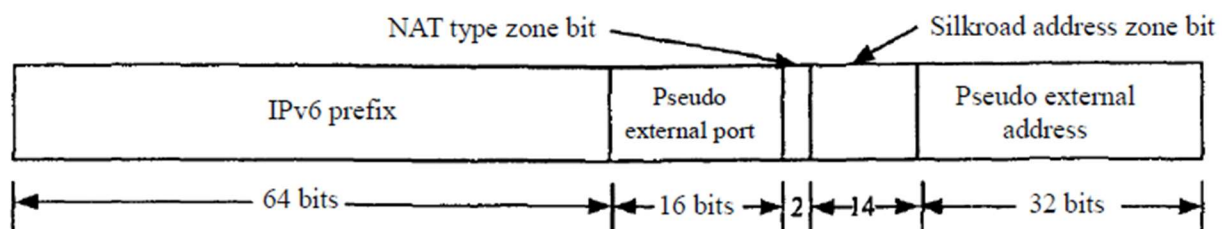


Fig. 1

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. *Id.*; *see* EX1003, ¶206. 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 IPv4 address. *Id.*, 12; EX1003, ¶206.

2. The Li-Wu Combination

In the Li-Wu combination, Li teaches the general network structure and the steps of receiving a data packet from an IPv4 domain in an IPv6 domain and constructing an IPv6 address by concatenating an IPv6 prefix, an IPv4 address, and

padding. EX1003, ¶207. Wu supplements Li's disclosures by teaching replacing 16 bits of the 32-bit zero padding with a destination port number in order to uniquely identify hosts and mitigate IPv4 address exhaustion. *Id.*

3. Motivations to Combine Li and Wu

A POSITA would have been motivated to combine the teachings of Li and Wu and would have had a reasonable expectation of success in doing so for much of the same reasons described in ground 1. EX1003, ¶¶208-214; *see* §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, ¶¶209-210; *see* §VIII.A.4. For instance, the prior art teaches the need to mitigate IPv4 address exhaustion. EX1003, ¶209; *see* §§IV.A, IV.B.2. 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, ¶209; *see* §IV.B.2-3. 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, ¶209.

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, ¶211; *see* §VIII.A.4.

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, ¶212; *see* §VIII.A.4.

Finally, Li, Wu, and the ’844 patent are analogous art. EX1003, ¶213-214; EX1001, 1:17-21, 2:46-64; EX1037, 1; EX1039, 9.

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 ’844 claims. *See* §VIII.B.1.

5. Claim 1

Li teaches claim 1 except for concatenating a destination port number. EX1003, ¶¶216-220; *see* §VIII.A.5. Wu teaches that a constructed IPv6 address may be formed by concatenating the received destination port number. EX1003, ¶¶217-218. Specifically, Wu teaches a “Silkroad client”—which, like the Edge Router in Li, is a dual-stack client that has both IPv4 and IPv6 capabilities (EX1039, 11)—

that constructs an IPv6 address by concatenating an IPv6 prefix, an IPv4 address, and a port number:

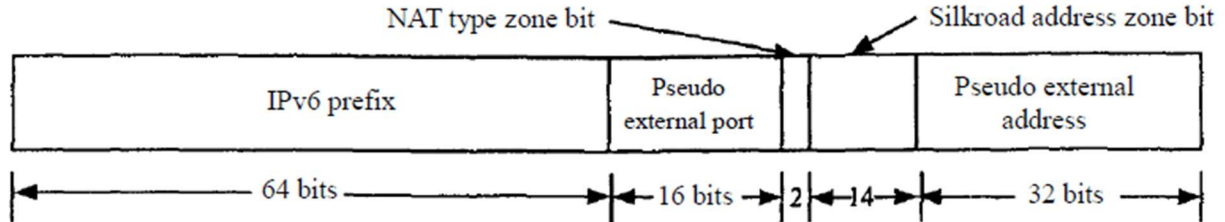
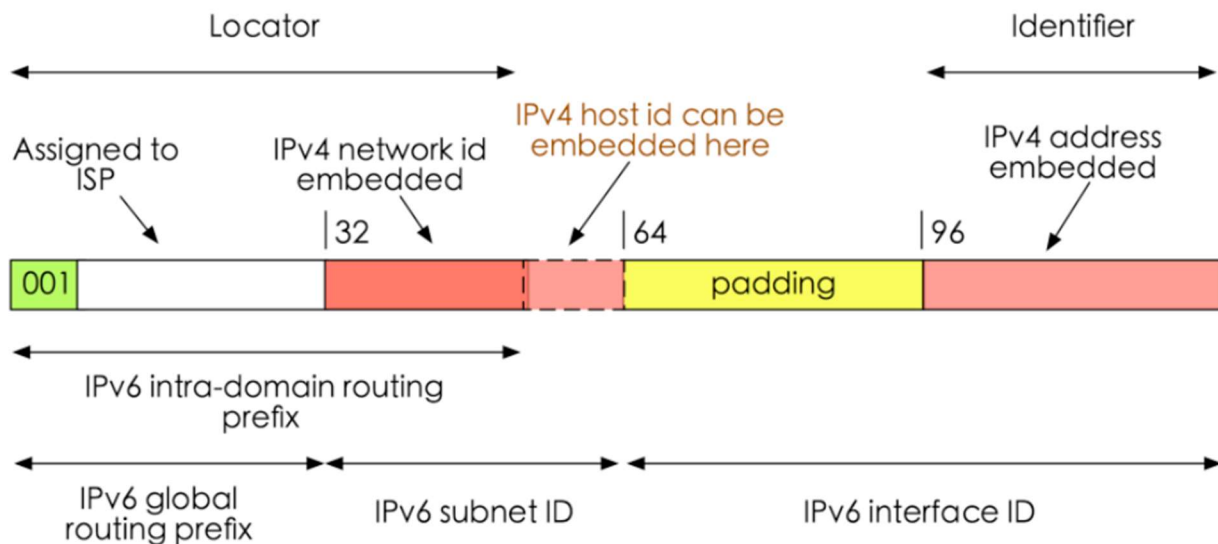


Fig. 1

EX1039, Fig. 1, 9-12.

Li already teaches that its IPv6 address concatenates 32-bits of zero padding (bits 64-96) following the operator 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 in Li's address

by replacing 16-bits of the unused padding. EX1003, ¶218. As such, a POSITA would have been motivated to combine Li and Wu. *See* §§VIII.C.3-4.

6. Claim 2

See §VIII.A.6.

7. Claim 3

(a) 3[pre]

To the extent the preamble is limiting, Li teaches limitation 3[pre] except for concatenating a destination port number. EX1003, ¶222; *see* §VIII.A.7.a. Li in combination with Wu renders obvious concatenating a destination port number. *See* §VIII.C.5. A POSITA would have been motivated to combine Li and Wu. *See* §§VIII.C.3-4.

(b) 3[a]

Li teaches limitation 3[a] except for extracting the destination port number from the IPv6 address. *See* §VIII.A.7.b. Wu discloses a server that receives an IPv6 data packet and then “extracts the external address and external port from the destination IPv6 address.” EX1039, 14. A POSITA would have found it obvious to apply the teachings of Wu to Li such that Li’s edge router would extract both the IPv4 destination address and the destination port number from the IPv6 destination address to route the IPv4 data packet to the correct IPv4 host. EX1003, ¶223. A POSITA would have been motivated to combine Li and Wu. *See* §§VIII.C.3-4.

(c) 3[b]

Li teaches limitation 3[b] except for including the destination port number in the generated IPv4 data packet. *See* §VIII.A.7.c. A POSITA would have found it obvious, in light of Wu's teachings, to further use the extracted destination port number to generate the IPv4 data packet. EX1003, ¶224; *see* §VIII.C.3-4. In particular, a POSITA would have understood that (1) in this network configuration, the destination port number is used to uniquely identify the recipient host and (2) the destination port number indicates the process of the recipient host that should receive the data packet. EX1003, ¶224.

(d) 3[c]

See §VIII.A.7.d.

8. Claim 4

See §VIII.A.8.

9. Claim 5

See §VIII.A.9.

10. Claim 6

See §§VIII.A.10; VIII.C.7.b-c.

11. Claim 7

See §VIII.A.11.

12. Claim 8

See §VIII.A.12.

13. Claim 9

See §VIII.A.13.

14. Claim 10

See §§VIII.A.14; VIII.C.7.b-c.

IX. DISCRETIONARY DENIAL IS NOT APPROPRIATE

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

In addition to the strong merits presented herein, Petitioner also hereby provides a *Sotera*-type 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); *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

At step one, Li (EX1037), Li-2 (EX1038), and Wu (EX1039) were not considered or cited during original prosecution of the '844 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

At step one, no references—including Li, Li-2, and Wu—were considered during the previous IPR filed by Cisco that involved the '844 patent. EX1033, 10.

(c) EPR

At step one, Li-2 was not cited at all during EPR. EX1010. This alone weighs heavily against denial because the specific combination presented in this petition was not and could not have been considered. *Graco Inc. v. Dorneanu*, IPR2022-00942, Paper 6, at 8 (PTAB Oct. 21, 2022) (finding Patent Owner's §325(d) argument “not persuasive” because “the Examiner did not cite, let alone apply” the prior art references “in rejecting any claim”); *Tesla, Inc. v. Arsus, LLC*, IPR2022-01216, Paper 9, at 7 (PTAB Dec. 23, 2022). As shown above, Li-2 explicitly teaches including a destination port number in the constructed IPv6 address that is routed

across the IPv6 domain and is therefore not cumulative of the considered prior art. *See* §VIII.A.5; EX1010, 14.

Additionally, although Li and Wu were cited in an Information Disclosure Statement during EPR, the Examiner did not consider or analyze these references during prosecution. EX1010, 45-47. In the allowance, the Examiner instead focused on other references, Wetterwald, RFC 2460, and Huitema. *Id.*, 10. These considered references, which the Examiner determined do not teach including a port number in the constructed IPv6 address, are not substantially similar to Li or Wu, which do teach this claim element.

2. Step Two of Advanced Bionics

Because Petitioner presents new arguments and combinations in this petition, it is unnecessary to analyze step two. Additionally, the Examiner made material errors in evaluating the considered art.

(a) Original Prosecution

There is no reason to proceed to step two due to the lack of rejection under either §§ 102 or 103 during prosecution. Regardless, the Office materially erred by not considering Li, Li-2, and Wu.

(b) Cisco IPR

There is no reason to proceed to step two due to the lack of substantive analysis in the final written decision. Regardless, the Office materially erred by not considering Li, Li-2, and Wu.

(c) EPR

There is no reason to proceed to step two because Li-2 was not even cited during EPR, and although Li and Wu were cited in an IDS, they were never analyzed by the Examiner.

Regardless, the Office materially erred in its decision. A lack of “any evidence showing discussion or application of the previously presented reference by the Examiner during prosecution” weighs against denying institution, especially if the petitioner “show[s] the Office erred by overlooking something persuasive.” *Quasar Sci., LLC v. Colt Int’l Clothing, Inc.*, IPR2023-00614, Paper 8, at 7-8 (PTAB Oct. 12, 2023). During reexamination, the Examiner confirmed claims 1-10 after analyzing only Wetterwald, RFC 2460, and Huitema. EX1010, 12-14.

The Examiner materially erred by not considering Li, Li-2, and/or Wu. The Examiner did not at all consider Li-2 during EPR. Further, the Board has previously determined that examiners materially err when references are cited in an IDS but not materially considered in a rejection or allowance. *See, e.g., Halliburton Energy Servs., Inc. v. US Well Servs., LLC*, IPR2021-01538, Paper 9, at 15 (Mar. 16, 2022); *Cellco*, IPR2020-01117, Paper 10, at 12-13. Indeed, the fact that an asserted prior art reference “was not the basis of rejection” or approval weighs strongly against exercising discretion under §325(d). *Cellco*, IPR2020-01117, Paper 10, at 13.

Assuming *arguendo* that the considered references are substantially similar to Li, Li-2, or Wu, then discretionary denial is still not warranted because the Examiner materially erred when he asserted—without citing to or analyzing any specific portion of Huitema—that Huitema “is silent on whether the port number and destination address were part of the IPv6 address routed across the IPv6 domain.” EX1010, 14.

Huitema describes a “client **101**” that “constructs its own IPv6 address, which in this example may be ‘PREF:102:304::FBFE:BFFA:F9F8.’” EX1030, ¶55. “[T]he ‘FBFE’ in the example IPv6 address is the mapped port 1025 exclusive OR’ed with hexadecimal number ‘FFFF.’” *Id.* In other words, Huitema explicitly discloses constructing an IPv6 address by concatenating a port number.

Huitema further discloses including the constructed IPv6 address (which includes a port number) in an IPv6 data packet that is routed across the IPv6 domain. *Id.*, ¶55-75. Figure 2, for example, illustrates communications that contain the constructed address (represented as “TEREDO(64.5.6.7:1025)”) between client **101** and client **201** “*residing in the IPv6 Internet.*” *Id.*, ¶60 (emphasis added).

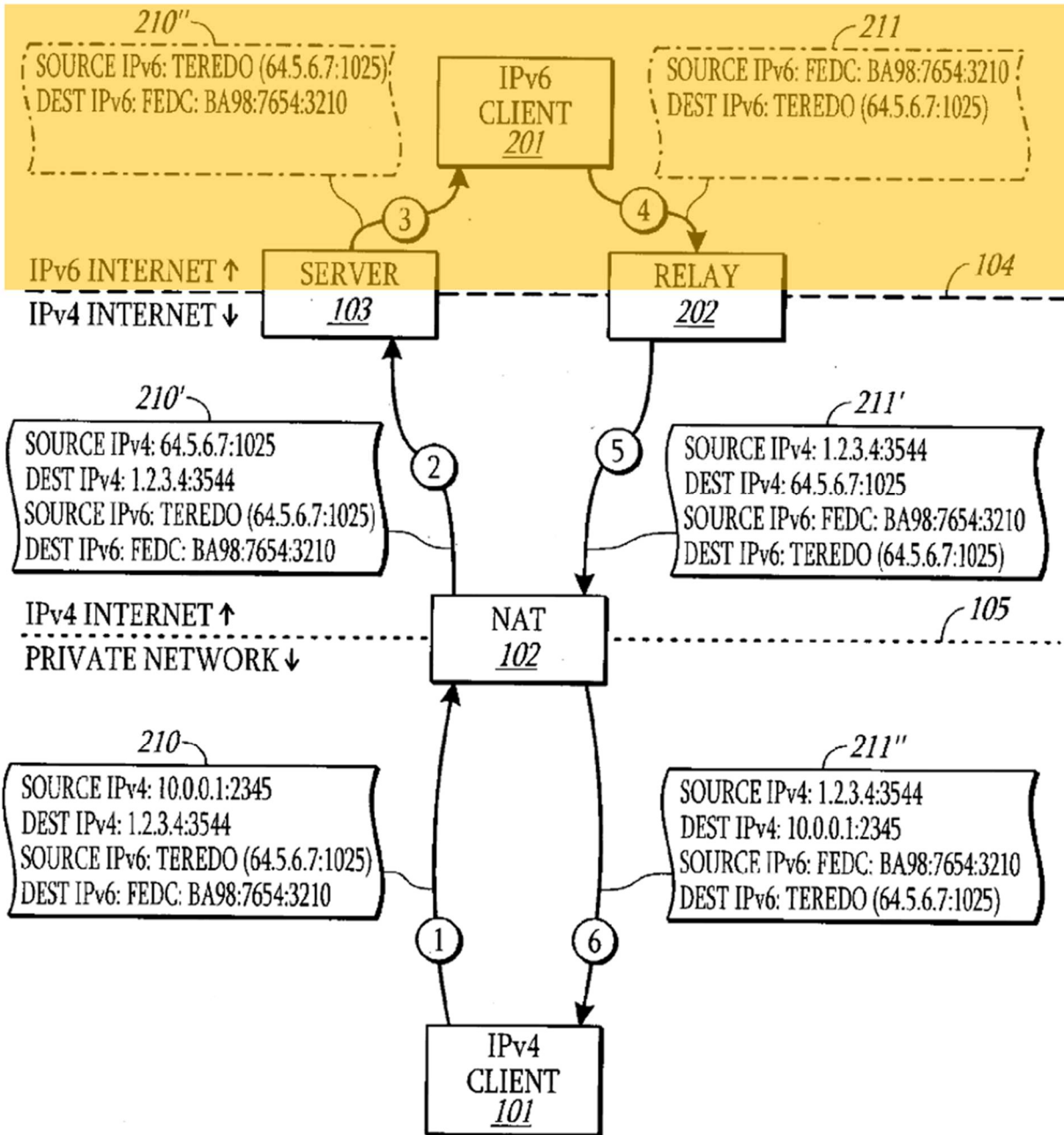


FIG. 2

Id., Fig. 2 (IPv6 domain highlighted). To the extent the Board determines that Huitema is similar, the Examiner materially erred by overlooking Huitema's disclosure of including a port number in the constructed IPv6 address that is routed

across the IPv6 domain. *See Parse Biosciences, Inc. v. 10x Genomics, Inc.*, IPR2023-00876, Paper 7, at 13-16 (PTAB Oct. 13, 2023); *Ericsson Inc. v. Koninklijke KPN NV*, IPR2023-00526, Paper 10, at 7-8 (PTAB Oct. 2, 2023).

X. CONCLUSION

Petitioner asks that the Board order IPR and cancel the Challenged Claims.

Date: January 23, 2024

By: /s/ James Glass

Quinn Emanuel Urquhart & Sullivan, LLP

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 13,969. 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.

Date: January 23, 2024

Respectfully submitted,

By: /s/ James Glass

Attorney for Petitioner Juniper Networks, Inc.

CERTIFICATE OF SERVICE

The undersigned certifies service pursuant to 37 C.F.R. §§ 42.6(e) and 42.105 on the Patent Owner on a thumb drive by Federal Express of a copy of this Petition for *Inter Partes* Review and supporting materials at the correspondence address of record for the '844 patent:

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