

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED
Petitioner

v.

NETWORK SYSTEM TECHNOLOGIES, LLC,
Patent Owner

Case: IPR2024-00343
U.S. Patent No. 7,594,052

PETITIONER'S REPLY

TABLE OF CONTENTS

I.	Claim Construction – “Interconnect Means”	1
II.	Radulescu2004 (Ex-1005) Is Prior Art	2
A.	Petitioner Complied With the Board’s Rules	2
B.	The Evidence Shows Public Accessibility	2
1.	IEEE Xplore	2
2.	2004 DATE Conference	5
III.	OCP (Ex-1006) Is Prior Art	7
IV.	GROUND 1 – Anticipation by Radulescu2004	8
A.	Radulescu2004’s Communication Service Request is “Based On” an Address Range As Claimed	8
B.	Radulescu2004 Discloses “Mapping” As Claimed	11
V.	GROUND 2 – Obviousness in View of Radulescu2004 and OCP	14
A.	A POSA Would Have Been Motivated to Use Address Ranges as the Claimed “Communication Service Identification”	14
B.	A POSA Would Have Been Motivated to Use Threads as the Claimed “Communication Service Identification”	15
C.	OCP and Radulescu2004’s Connections Are Compatible	17
D.	The Claimed Mapping Is Also Obvious in View of Radulescu2004 and OCP	18
VI.	GROUND 3 – Anticipation by Weber	19
A.	Weber Discloses a Single “Integrated Circuit”	19

B.	Weber Discloses the Claimed “Communication Service Identification”	20
C.	Weber Discloses the Claimed “Interconnect Means” Even Under PO’s Construction	21
1.	A Hop is a Link with a Node on Each End.....	21
2.	Weber’s Bus-With-Interfaces Is a “Network” Even Under PO’s Definition	23
D.	Weber Discloses the Mapping Means Structure (Claims 1-5, 7).....	25
VII.	GROUND 4 – Obviousness in View of Weber and Radulescu2004.....	26
A.	It Would Have Been Obvious to Implement a Weber-Radulescu2004 Combination on a Single Integrated Circuit.....	26
B.	It Would Have Been Obvious to Use Radulescu2004’s NoC in Weber	26

TABLE OF AUTHORITIES

Cases

<i>Celeritas Technologies Ltd. v. Rockwell International Corp.</i> , 150 F.3d 1354 (Fed. Cir. 1998).....	20
<i>Conoco Inc. v. Dept. of Energy</i> , 99 F.3d 387 (Fed. Cir. 1996).....	4
<i>Hulu, LLC v. Sound View Innovations, LLC</i> , IPR2018-01039, Paper 29 (P.T.A.B. Dec. 20, 2019).....	3, 4
<i>Intel Corp. v. FG SRC LLC</i> , IPR2020-01449, Paper 53 (March 1, 2022)	7
<i>Intel Corp. v. Pact XPP Schweiz AG</i> , IPR2020-00525, Paper 38 (P.T.A.B. Aug. 9, 2021).....	7
<i>Intel Corp. v. PACTXPP Schweiz AG</i> , 61 F. 4 th 1373 (Fed. Cir. 2023).....	16, 27
<i>Kinetic Concepts, Inc. v. Smith & Nephew, Inc.</i> , 688 F.3d 1342 (Fed. Cir. 2012).....	16
<i>KSR Int'l Co. v. Teleflex Inc.</i> , 550 U.S. 398 (2007).....	16, 18
<i>Microsoft Corp. v. IPA Techs. Inc.</i> , IPR2019-00837, Paper 42 (P.T.A.B. Oct. 22, 2020)	4
<i>Mylan Pharms. Inc. v. Merck Sharp & Dohme Corp.</i> , 50 F.4th 147 (Fed. Cir. 2022).....	16
<i>Samsung Electronics Co., Ltd. v. Network System Technologies, LLC</i> , IPR2024-00338, Paper 10 (P.T.A.B. June 21, 2024).....	2
<i>Tetra Tech Canada Inc., v. Georgetown Rail Equip. Co.</i> , IPR2019-00619, Paper 12 (P.T.A.B. Aug. 26, 2019).....	2

<i>VidStream LLC v. Twitter, Inc.</i> , 981 F.3d 1060 (Fed. Cir. 2020).....	3
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<i>Winner Int’l Royalty Corp. v. Wang</i> , 202 F.3d 1340 (Fed. Cir. 2000).....	27, 28
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Rules

35 U.S.C. §112(6)	1
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PETITIONER’S EXHIBIT LIST

Exhibit	Description
Ex-1001	U.S. Patent No. 7,594,052
Ex-1002	File History of U.S. Patent No. 7,594,052
Ex-1003	Declaration of Dr. Marwan Hassoun
Ex-1004	Curriculum Vitae of Dr. Marwan Hassoun
Ex-1005	A. Rădulescu, et al. " <i>An Efficient On-Chip Network Interface Offering Guaranteed Services, Shared-Memory Abstraction, and Flexible Network Configuration</i> ," Proceedings of the Design, Automation and Test in Europe Conference and Exhibition, 2004 (“Rădulescu2004”)
Ex-1006	Open Core Protocol Specification, Release 1.0, OCP-IP Association (2001) (“OCP”)
Ex-1007	U.S. Patent Publication No. 2002/0129173 A1 (“Weber”)
Ex-1008	U.S. Patent No. 5,948,089 (“Wingard”)
Ex-1009	Networks on Chip; Axel Jantsch, Hannu Tenhunen (Eds.). Kluwer Academic Publishers, Boston (2003) (“Jantsch”)
Ex-1010	A. Rădulescu, et al. " <i>Communication Services for Networks on Chip</i> ," Philips Research Laboratories, Eindhoven, The Netherlands, SAMOS, II(), 275–299 (2002) (“Rădulescu2000”)
Ex-1011	J. Dielissen, et al. " <i>Concepts and Implementation of the Philips Network-on-Chip</i> ," Philips Research Laboratories, Eindhoven, The Netherlands (2003) (“Dielissen”)
Ex-1012	Declaration of Nikil Dutt, Ph.D. Under 37 C.F.R. §1.68
Ex-1013	Affidavit of Nathaniel E. Frank-White, Records Request Processor at the Internet Archive
Ex-1014	Declaration of Sylvia Hall-Ellis, Ph.D.
Ex-1015	Plaintiff Network System Technologies, LLC’s Responses to Qualcomm’s First Set of Requests for Admission (Nos. 1-9), <i>Network System Technologies, LLC v. Qualcomm Inc. et al.</i> , 1:22-cv-01331 (W.D. Tex.)

Exhibit	Description
Ex-1016	Defendant’s Opening Claim Construction Brief, <i>Network System Technologies, LLC v. Qualcomm Inc. et al.</i> , 1:22-cv-01331 (W.D. Tex.)
Ex-1017	Network System Technologies, LLC’s Response to Defendants’ Joint Opening Claim Construction Brief, <i>Network System Technologies, LLC v. Qualcomm Inc. et al.</i> , 1:22-cv-01331 (W.D. Tex.)
Ex-1018	Declaration of Gordon Macpherson, Director, Board Governance & Policy Development of The Institute of Electrical and Electronics Engineers, Incorporated (“IEEE”)
Ex-1019	Declaration of Nathaniel E Frank-White, Records Request Processor at the Internet Archive
Ex-1020	U.S. Patent No. 7,366,818 (“Rădulescu”)
Ex-1021	P. Guerrier et al., " <i>A generic architecture for on-chip packet-switched interconnections</i> ," Proceedings Design, Automation and Test in Europe Conference and Exhibition 2000 (2000)
Ex-1022	William J. Dally et al., " <i>Route Packets, Not Wires: On-Chip Interconnection Networks</i> ," Proceedings – Design Automation Conference (2001)
Ex-1023	Shashi Kumar et al., " <i>A Network on Chip Architecture and Design Methodology</i> ," IEEE Computer Society Annual Symposium (2002)
Ex-1024	José Duato et al., <i>Interconnection Networks, An Engineering Approach</i> . Revised Printing (2003)
Ex-1025	Luca Benini et al., " <i>Powering Networks on Chips, Energy-efficient and reliable interconnect designs for SoCs. Proceedings of the International Symposium on Systems Synthesis</i> " (2001)
Ex-1026	Andrew S. Tanenbaum, <i>Computer Networks</i> , Third Edition (1996)
Ex-1027	Network System Technologies, LLC’s Sur-Reply Claim Construction Brief, <i>Network System Technologies, LLC v. Qualcomm Inc. et al.</i> , 1:22-cv-01331 (W.D. Tex.)
Ex-1028	Declaration of Peter M. Kohlhepp in Support of Petitioner’s Unopposed Motion for <i>Pro Hac Vice</i> Admission
Ex-1029	[intentionally omitted]

Exhibit	Description
Ex-1030	Reply Declaration of Dr. Marwan Hassoun
Ex-1031	Welcome to DATE '04 message
Ex-1032	Dr. Luca Benini homepage
Ex-1033	DATE '04 Call for Papers
Ex-1034	Third Amended Initial Disclosures by Network System Technologies, LLC, <i>Network System Technologies, LLC v. Qualcomm Inc. et al.</i> , 1:22-cv-01331 (W.D. Tex.)
Ex-1035	IEEE Xplore Conference Proceedings Search
Ex-1036	DATE Conference press release
Ex-1037	[Intentionally omitted]
Ex-1038	Reply Declaration of Dr. Nikil Dutt
Ex-1039	Pasricha et al. "Fast Exploration of Bus-based On-chip Communication Architectures." CODES+ISSS '04: Proceedings of the 2nd IEEE/ACM/IFIP International Conference on Hardware/Software Codesign and System Synthesis, September 8-10, 2004
Ex-1040	DATE Press Releases webpage and DATE06 PRESS SLIDES
Ex-1041–1049	[Intentionally Omitted]
Ex-1050	Deposition Transcript of Nader Bagherzadeh, dated December 12, 2024
Ex-1051	Horak, Ray (Ed.). <i>Webster's New World Telecom Dictionary</i> (excerpts)
Ex-1052	<i>The Authoritative Dictionary of IEE Standard Terms</i> . Published by Standards Information Network IEEE Press, 7 th ed. (excerpts)
Ex-1053	Tadaaki Yamauchi, et al., "The hierarchical multi-bank DRAM: a high-performance architecture for memory integrated with processors," <i>Proceedings Seventeenth Conference on Advanced Research in VLSI</i> , Ann Arbor, MI, USA, 1997, pp. 303-319
Ex-1054	TriCore™ 1.3 32-bit Unified Processor Core, <i>Architecture Overview Handbook, V1.3.3</i> (May 2002)
Ex-1055	TMS320C6000 Technical Brief (February 1999)

Exhibit	Description
Ex-1056	Harry K. Charles, et al., “Very Large Scale Integrated Circuitry,” <i>Johns Hopkins APL Technical Digest</i> , Volume 7, Number 3 (1986)
Ex-1057	F. Vahid and T. Givargis, “Platform tuning for embedded systems design” <i>Computer</i> , vol. 34, no. 02, pp. 112-114, (March 2001)
Ex-1058	The Microprocessor Today, <i>IEEEMicro</i> , pp. 32-44 (December 1996)
Ex-1059	U.S. Copyright Office Public Catalog entry for 2004 Design, Automation and Test in Europe conference and exhibition: proceedings
Ex-1060	Declaration of Sage Kruse
Ex-1061	IEEE Conference Proceedings “Metrics” (compilation)
Ex-1062	Kees Goossens’s Publications Page
Ex-1063	Kees Goossens’s BibTex Page
Ex-1064	Kees Goossens’s Research Page
Ex-1065	Design, Automation and Test in Europe DATE ’04, Proceedings (DATE Conference Archives, excerpts)
Ex-1066	Design, Automation and Test in Europe DATE ’04, Proceedings Volume II (Library of Congress copy, excerpts)
Ex-1067	Design, Automation and Test in Europe DATE ’04, Proceedings (Table of Contents, IEEE Computer Society Digital Library)
Ex-1068	Declaration of Sylvia D. Hall-Ellis, Ph.D.
Ex-1069	IEEE Xplore Celebrates 15 years of Information Driving Innovation (April 24, 2005)
Ex-1070	Library of Congress Catalog Item Information, Design, Automation and Test in Europe Conference and Exhibition 2004: proceedings

Patent Owner (“PO”) argues that Radulescu2004 and OCP are not prior art, but multiple independent sources of evidence confirm they are.

For Grounds 1 and 2, PO seeks to read in limitations to overcome the inventors’ own prior publication. But PO’s narrow reading is not supported, and the claims are also obvious in view of the OCP specification.

For Grounds 3 and 4, PO tries to avoid Weber by arguing a network must be *further* limited in ways that are not supported by the patent or the evidence.

I. Claim Construction – “Interconnect Means”

The Board’s preliminary determination that “interconnect means” is governed by §112(6) was correct. Disclosure of exemplary interconnect structures does not overcome the presumption. To the contrary, such disclosure is necessary to comply with §112(6).

Petitioner respectfully disagrees with the Board’s preliminary determination that the corresponding structure should be limited to a “network.” The term the specification distinguishes from a “mere” bus, switch, or point-to-point wire is “network,” not “interconnect.” Ex-1001, 1:48-54, 2:31-42; Ex-1030, ¶¶9-15. But patentee chose to use the broader claim term “interconnect means,” rather than “network” or “network means.”

It is unnecessary, however, for the Board to expressly determine whether the corresponding structure is limited to a “network” to resolve this IPR. For Grounds

1 and 2, PO does not dispute that Radulescu2004 discloses a network. For Grounds 3 and 4, as discussed below, Weber discloses a “network” even under PO’s construction. *Infra*, §VI.C.

II. Radulescu2004 (Ex-1005) Is Prior Art

A. Petitioner Complied With the Board’s Rules

PO’s cases (Paper 38, 27) are inapposite and non-precedential. Each concerned evidence cited, without explanation, in a post-institution paper (not the Petition), and in most cases the evidence was unrelated to public accessibility and was ultimately rejected on the merits as unpersuasive. As explained below, that is not the case here. In cases like this, the Board has repeatedly rejected PO’s argument. *E.g.*, *Samsung Electronics Co., Ltd. v. Network System Technologies, LLC*, IPR2024-00338, Paper 10 at 29 (P.T.A.B. June 21, 2024); *Tetra Tech Canada Inc., v. Georgetown Rail Equip. Co.*, IPR2019-00619, Paper 12 at 19 (P.T.A.B. Aug. 26, 2019).

B. The Evidence Shows Public Accessibility

PO does not contend it is entitled to a date earlier than March 17, 2004. The overwhelming evidence shows that Radulescu2004 was accessible to a POSA exercising reasonable diligence before that date.

1. IEEE Xplore

Radulescu2004 was made available to POSAs by March 8, 2004 via IEEE Xplore. Evidence includes (1) conventional indicia of publication such as

established publisher, copyright, ISSN, price (Ex-1005, 1, Ex-1018, ¶¶4-5, Ex-1068, ¶¶21-22)); (2) "Date Added to IEEE Xplore" of "08 March 2004" (Ex-1018, 4); and (3) an IEEE supporting declaration, including testimony that IEEE's ordinary business practice was to make technical articles "available for public download" through Xplore (Ex-1018, ¶¶5-10). This is more than sufficient.

Contrary to PO's argument, neither cataloging nor indexing is required. *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 9-10 (P.T.A.B. Dec. 20, 2019) (precedential). A document is publicly accessible if it "has been disseminated or otherwise made available to the extent that persons interested and ordinarily skilled in the subject matter or art exercising reasonable diligence, can locate it." *Id.* 10-11. And "when there is an established publisher there is a presumption of public accessibility as of the publication date." *VidStream LLC v. Twitter, Inc.*, 981 F.3d 1060, 1065 (Fed. Cir. 2020). Here, IEEE is an established publisher; PO has not rebutted the presumption.

More than the presumption, the evidence also shows that a POSA in early 2004 frequently reviewed publications on IEEE Xplore for information on relevant technologies such as System-on-Chip, particularly proceedings from a prestigious conference like DATE 2004. Ex-1012, ¶¶3, 5-6 and Ex-1038, ¶¶6-8, 10-16 (Dr. Dutt); *see also* Ex-1030, ¶99 (Dr. Hassoun, same); Ex-1068, ¶¶11-18 (Xplore

available at universities, reasonably accessible to POSAs); Ex-1035 (conference proceedings by title on Xplore).

PO's argument that IEEE's metrics show no full-text views prior to 2011 (Paper 38, 36) does not rebut the presumption, much less overcome the additional evidence. Exhibit 2064 at best indicates IEEE may not have begun *tracking* full text views until 2011. Ex-1060, ¶¶2-4; Ex-1061. Moreover, public accessibility does not require showing actual views. *Hulu*, IPR2018-01039, Paper 29, 10. The lack of an Internet Archive *capture* of the url currently hosting Radulescu2004 before 2018 (Ex-2079, Ex-2080) is not evidence Radulescu2004 was not online before 2018 (on that or a different url), particularly when other evidence shows it was. *See Microsoft Corp. v. IPA Techs. Inc.*, IPR2019-00837, Paper 42 at 51-52 (P.T.A.B. Oct. 22, 2020). Moreover, additional evidence corroborates. Ex-2062 (“[m]eanwhile, you will find current proceedings at IEEE Xplore”); Ex-1038, ¶12 (IEEE practice to publish proceedings on Xplore shortly after conference).

Finally, unlike the *Lister* case PO cites, here there is evidence “pertaining to the general practices” of IEEE. Mr. MacPherson's un rebutted testimony indicates he is familiar with IEEE publishing practices in the relevant time. *E.g.*, Ex-1018, ¶¶1-11; Ex-2069, 8:22-11:9, 21:20-22:15; *see also Conoco Inc. v. Dept. of Energy*, 99 F.3d 387, 391 (Fed. Cir. 1996) (“custodian or other qualified witness...need not

be the person who prepared or maintained the records...as long as the witness understands the system used to prepare the records”).

2. 2004 DATE Conference

The evidence also shows Radulescu2004 was publicly available to POSAs through physical distribution to over 500 attendees at the February 16-20, 2004 DATE conference.

PO’s allegations that Dr. Dutt is biased and/or lacks “personal knowledge” are without merit. Dr. Dutt is an independent third-party Professor. Ex-2061, 1. The three grants and one publication PO identifies were all years before this case. Ex-2061, 31-36. Moreover, his un rebutted testimony is that he personally attended DATE 2004, where he and over 500 other attendees received physical copies of the proceedings that he personally knew had to include “all the papers” accepted for DATE 2004, including Radulescu2004. Ex-1012, ¶¶7, 9-11, 13-16, 22 and Ex-1038, ¶¶8, 16-17; Ex-2067, 31:7-36:18, 43:3-8, 50:3-53:1, 62:6-71:10 (same).

DATE 2004 was also publicized to and attended by POSAs. *See* Paper 11, 10 (defining POSA). DATE was “an important conference in the computer chip design field” and Radulescu2004 was presented at a session called “Networks on Chip Design.” Ex-1012, ¶¶5-6, p.18; *see also* Ex-1038, ¶¶6-7, 16 (DATE publicized to, attended by POSAs); Ex-1031 (“systems on chip”); Ex-1033 (“VLSI and Systems-on-Chip”); Ex-1036 (“focus day” for “design of Systems-on-

Chips”); Ex-1065, 12 (“Foreword” touting “System-on-Chip Technologies”). Dr. Dutt, a POSA, attended DATE 2004 (Ex-1038, ¶¶3-5, 8, 17; Ex-1012, ¶¶2-3, 5-6, 11), and named inventors Goossens and Radulescu had papers presented there (Ex-1062, 13-14).

PO’s contention that Dr. Dutt “admitted” attendees were not allowed to distribute the Proceedings “without permission” (Paper 38, 30) is highly misleading. Dr. Dutt merely said conference papers were subject to “copyright,” but “otherwise, they’re publicly available to anyone who registered at the conference.” Ex-2067, 39:18-40:40:7.

Finally, PO’s contention that Dr. Dutt’s testimony “lacks corroboration” is not true, as Dr. Dutt explains. Ex-1038, ¶¶8-9; Ex-1012, ¶¶19-23. Examples-- corroborating publication via both IEEE Xplore and at the conference—include:

- Kees Goossens’ “Publications” page identifying Radulescu2004 as published “February 2004” at DATE by IEEE. Ex-1062, 14-15; Ex-1063 and Ex-1064, 1-2 (same); *see also* Ex-1034, 5.
- The DATE conference archive of proceedings. Ex-1012, pp.9-48 and Ex-1065, 1, 8; *see also* Ex-1038, ¶9 (DATE archive considered reliable)).
- IEEE testimony. Ex-1018, ¶11; Ex-2069, 12:18-25, 21:11-22:9.
- Ex-1059 (U.S. Copyright Office record showing “2004-02-16” as “Date of Publication”); Ex-1068, ¶25 (same).

- Ex-1066, 1, 3-4, 15-20 (Library of Congress (“LOC”) copy), and Ex-1070 (corresponding LOC catalog record); Ex-1068, ¶¶19-23 (same).
- Ex-1067, 1, 3 (Computer Society Digital Library); Ex-1068, ¶24 (same).

The totality of the evidence shows Radulescu2004 was made available to POSAs exercising reasonable diligence prior to March 17, 2004, both on IEEE Xplore and at the conference itself. The Board has consistently found similar IEEE conference papers to be printed publications. *E.g.*, *Intel Corp. v. FG SRC LLC*, IPR2020-01449, Paper 53, 31-36 (P.T.A.B. March 1, 2022); *Intel Corp. v. Pact XPP Schweiz AG*, IPR2020-00525, Paper 38 at 17 (P.T.A.B. Aug. 9, 2021). It should do the same here.

III. OCP (Ex-1006) Is Prior Art

PO’s challenge to Ex-1006 highlights the improperly high standard of proof PO seeks to impose. The ’052 patent itself repeatedly identifies OCP as an “existing” protocol. *E.g.*, Ex-1001, 6:30-38, 8:41-46. And Radulescu2004 refers to OCP Release 2.0 as an existing protocol. Ex-1005, 6 n.18. As PO’s expert acknowledged, “Release 2.0 came after Release 1.0.” Ex-1050, 161:1-2. Ex-1006 also bears conventional indicia of publication. Ex-1006, 4 (e.g., “©2001 OCP-IP Association,” part number, print notice); Ex-1013, 8 (same). This alone meets Petitioner’s burden. And here there is more:

- Ex-1019, 5 (“OCP 1.0...freely available” from www.ocpip.org by October 2003 via click-through license);¹
- Ex-1013 (OCP 1.0 publicly available on Dr. Benini website as of August 2003); *see also* Ex-1038, ¶19 and Ex-1032 (Dr. Benini known in field);
- Ex-1009, 45 (2003 Goossens textbook chapter citing “Open core protocol specification, 2001”), 102, 111;
- Ex-1038, ¶¶18-20 (OCP accessible to POSAs prior to March 2004);
- Ex-1050, 35:25-36:4, 37:6-16 (PO’s expert admitting OCP “available” to POSAs prior to 2004).

Given this wealth of un rebutted evidence, PO’s assertion that Petitioner has not met its burden is baseless.

IV. GROUND 1 – Anticipation by Radulescu2004

A. Radulescu2004’s Communication Service Request Is “Based On” an Address Range As Claimed

PO argues, and the Board appears to have preliminarily agreed, that to meet [6.pre.2] and the similar limitation in claims 1 and 7, communication service

¹ PO argues that OCP contains a statement of “confidentiality” and “restricted use.” Paper 38, 38. What PO cites is merely boilerplate indicating availability to *licensed* users. *See* Ex-1019, 5.

requests must contain an address range or thread. Paper 38, 39-42; Paper 11, 25-26. But that is not what the claim says. Claim 6 only requires that requests be “based on” a communication service identification that is either an address range or thread. Ex-1001, 10:9-15. PO’s interpretation of “based on” as “contains” improperly imports a requirement that was not claimed. Ex-1030, ¶¶22-25.

PO’s decision to broadly claim requests “based on” (rather than “containing”) an address range or thread is consistent with the description of the purported invention in the ’052 patent specification. Ex-1030, ¶24. Indeed, *the specification never discloses that the service request itself contains an address range. Id.* It states that the invention is based on “mapping the identification means” of existing protocols, and that the identification means are “communication threads *and addresses*.” Ex-1001, 4:15-21 (emphasis added); Ex-1030, ¶24. The specification then consistently describes that *addresses*, not address ranges, are included in requests and used in the mapping process. Ex-1001, 6:48-53, 5:61-6:3, 4:18-21; Ex-1030, ¶25. This is consistent with the depiction in Fig. 2A:

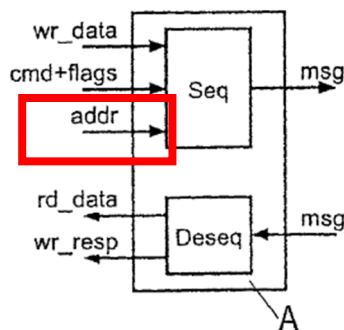


FIG.2A

Ex-1001, 6:48-53, Fig. 2A (annotated); Ex-1030, ¶25. Referring to the virtually identical figure in Radulescu2004, PO's expert testified that a POSA "would immediately recognize that 'addr'" represents an address, and not an address range." Ex-2070, ¶156. PO's expert could not point to any disclosure in the '052 patent indicating that the request itself contains an address range. Ex-1050, 112:12-113:15; Ex-1030, ¶25.

PO asserts that mapping "via address ranges" is shown in Figure 4. Paper 38, 5-6. But nothing in Figure 4 or the description of it indicates that service requests sent by a module contains an address range. Ex-1030, ¶26. Instead, Figure 4 shows a table of address ranges and associated connections stored within the network interface:

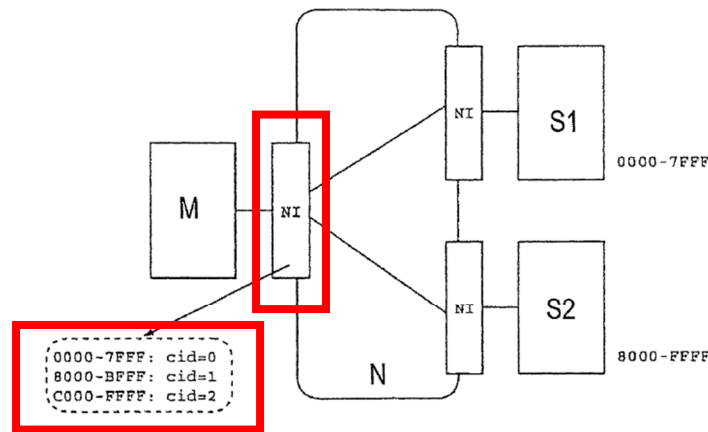


FIG.4

Id.; Ex-1001, Fig. 4 (annotated). Service requests from master M containing “identification means” such as “addresses” are sent to an adapter unit within the network interface NI. Ex-1001, 5:61-6:3; 4:18-21. The NI then uses the address in the request and the address ranges stored in the NI to map the requests to a connection. Ex-1001, 8:7-40; Ex-1030, ¶26. In other words, the service request sent by master M is “based on” an address range in the sense that the request contains an address corresponding to one of the address ranges stored in the NI. *Id.*

This is exactly what Radulescu2004 discloses (unsurprising given it describes the same *Æ*thereal NoC). Ex-1030, ¶27. The “address range” assigned to each slave is stored (e.g., “configurable”) in the narrowcast module, which—like in the ’052 patent—is in the network interface. Ex-1005, 4; Ex-1003, ¶124; Ex-1030, ¶27; Paper 3, 24-25. The communication service requests in Radulescu2004 are “based on” these address ranges because the requests contain an address that, using the address ranges “configured” in the narrowcast module, correspond to “the slave for which the transaction is destined.” *Id.*

B. Radulescu2004 Discloses “Mapping” As Claimed

PO again argues that Radulescu2004 does not disclose a “communication service identification” (Paper 38, 43), which is wrong for the reasons discussed in the previous section.

PO's argument that Radulescu2004 does not disclose mapping to "a connection based on a set of connection properties" (Paper 38, 43-44) is also unfounded. Radulescu2004 undisputedly discloses the use of connections, each having a set of connection properties. *E.g.*, Ex-1005, Abstract, 1 ("connections... configured for specific properties"). These connections allow for "differentiated traffic classes" by "select[ing] on which connection a message is supplied or consumed." Ex-1005, 3, *see also id.*, 1-2, 4, 6; Ex-1003, ¶¶139-140, 124, 131-133, 97; Ex-1030, ¶¶30-31. Because each connection has connection properties, the mapping of a service request to one of the point-to-point connections in the narrowcast shell is to "a connection based on a set of connection properties" as claimed. Paper 3, 30-31; Ex-1005, 1-4; Ex-1003, ¶¶140-143; Ex-1030, ¶30.

PO's argument is nothing more than a repackaged version of the argument that was preliminarily rejected in the Institution Decision. PO's preliminary response argued that the claims require that connection properties be assigned at the time service requests are mapped by the network interfaces, and exclude a fixed hardware configuration where properties are assigned "prior to their use." Paper 7, 46-50. The Board correctly rejected this argument, finding no basis in the claim language to exclude such a fixed configuration. Paper 11, 21-24, 29-30; Ex-1030, ¶31. PO's current argument wrongly seeks to impose the same sort of restriction. The mapping of a service request is "to a connection based on a set of

connection properties” even if those connection properties were assigned to the connection prior to the mapping. Ex-1030, ¶32. This is also supported by the prosecution history of the ’052 patent, which found this limitation met by similar inventor publications describing the Philips *Æthereal* NoC. Paper 3, 8, 31; Ex-1002, 79-82, 119-123; Ex-1011, §2.2.1, §2.2.2, Figs. 1, 7; Ex-1010, 14; Ex-1030, ¶33.

Not only does Radulescu2004 show mapping as claimed, it is no different than the mapping described in the ’052 specification. Ex-1030, ¶34. The ’052 patent only describes using the address to determine which connection to send a request over – connection properties are not used. Ex-1001, 4:15-21, 5:61-6:3, 8:7-20; Ex-1030, ¶34; Ex-1003, ¶¶141-142. Figure 4 (which PO argues shows the mapping step) shows a map of address ranges and corresponding connections stored in the network interface:

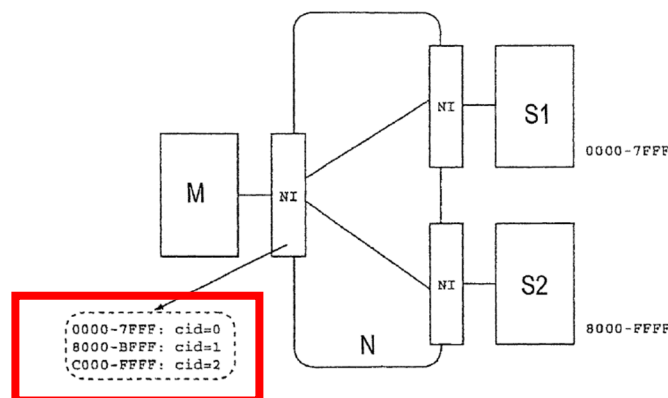


FIG.4

Ex-1030, ¶34. The '052 patent describes that mapping via address ranges is done based on an association between address ranges and connections; it does not mention any connection properties. Ex-1001, 8:7-20; Ex-1030, ¶35; Ex-1003, ¶¶64-66, 141-142. Connection properties are taken into account in the '052 patent and in Radulescu2004 in the same way—during creation of the connections. *Compare* Ex-1001, 5:43-52, 6:4-19 *with* Ex-1005, 1 §1, 2 §2; *see also* Ex-1003, ¶¶61-63, 92, 96, 99, 131-133; Ex-1030, ¶36.

V. GROUND 2 – Obviousness in View of Radulescu2004 and OCP

A. A POSA Would Have Been Motivated to Use Address Ranges as the Claimed “Communication Service Identification”

OCP teaches two addressing signals that can be used in combination: MAddr (identifies “the slave-dependent address of the resource targeted by the current transfer”), and MAddrSpace (“indicate[s] the address region of a transfer”). Ex-1006, 24, 26; Ex-1030, ¶38. As explained in the Petition, even if the Board concludes that Radulescu2004 does not expressly teach that the service request is “based on” an address range, it would have been obvious to do so in view of OCP’s teaching of using MAddrSpace and MAddr signals. Paper 3, 41-43; Ex-1030, ¶38.

PO does not dispute that MAddrSpace identifies an address range. PO’s assertion that Petitioner provided “no reason why a POSITA would...use the optional MAddrSpace signal in Radulescu2004” (Paper 38, 50) is incorrect. The Petition explains that a POSA would have been motivated to achieve backwards

compatibility with OCP, as expressly taught by Radulescu2004. Paper 3, 37; Ex-1005, 1, §1; Ex-1003, ¶¶154-155. An interconnect designed to provide “backward compatibility” with OCP would need to support all signals employed in OCP, including optional ones such as MAddrSpace. Ex-1030, ¶¶39-40; Ex-1006, 38 (MAddr and MaddrSpace are “always” part of a request if these signals are required); Ex-2068, 77:1-11 (“a system that implements these extensions would need to have [them]”). A POSA would therefore have been motivated to include and make use of the MAddrSpace signal. Ex-1030, ¶¶38-40.

B. A POSA Would Have Been Motivated to Use Threads as the Claimed “Communication Service Identification”

Regardless of whether Radulescu2004 discloses service requests based on *address ranges*, it would have been obvious in view of OCP to transmit service requests based on *threads*. Paper 3, 43-44; Ex-1003, ¶¶156-160, 169, 172; Ex-1030, ¶¶41-46. A POSA would have been motivated to use OCP’s threading specifically because threading was a known functionality in on-chip communications that was known to have substantial benefits. Paper 3, 38-44 Ex-1003, ¶¶156-160, 169-173; Ex-1030, ¶¶41, 44.

The fact that MThreadID is referred to as “optional” in OCP (Paper 38, 45-46) does not overcome Petitioner’s showing of obviousness. Ex-1030, ¶¶42-43. As discussed in the previous section, a POSA would know that to provide “backward compatibility” with OCP as taught by Radulescu2004, the interconnect would need

to support all signals of OCP, including optional ones. Ex-1030, ¶43. Moreover, Petitioner provided *unrebutted* evidence of *why* a POSA would be motivated to use OCP's threads, including "support[ing] many different burst styles," "support[ing] concurrent activity, and out-of-order completion of transfers," and "enabl[ing] busy targets...to prioritize requests." Paper 3, 38; Ex-1003, ¶¶156-160; Ex-1030, ¶44. Threads were also known to beneficially allow implementation of specific communication properties such as ordering and priority. Paper 3, 40; Ex-1003, ¶¶169-170; Ex-1030, ¶44. PO does not dispute that these benefits of threads were known or that a POSA would have wanted them.

PO argues that "Radulescu2004 already has" the benefits of threading. Paper 38, 48. Even if PO's assertion were true, just because there is one known way to obtain known benefits does not mean that other ways are not obvious. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007); *Intel Corp. v. PACTXPP Schweiz AG*, 61 F. 4th 1373 1380 (Fed. Cir. 2023). The cases cited by PO do not apply here, as in those cases there was no evidence of *any* motivation to combine. *See Mylan Pharms. Inc. v. Merck Sharp & Dohme Corp.*, 50 F.4th 147, 156 (Fed. Cir. 2022); *Kinetic Concepts, Inc. v. Smith & Nephew, Inc.*, 688 F.3d 1342, 1369 (Fed. Cir. 2012) ("[t]he record is devoid of any reason [to] combine").

Moreover, PO's assertion is not, in fact, true. Radulescu2004 teaches ordering and differentiated service classes *within* its NoC. Ex-1005, 1-3; Ex-1030,

¶45. OCP masters use threads to indicate that a request has certain properties (such as ordering, burst type, and priority). Ex-1030, ¶45; Ex-1006, 46, 181. As discussed in the Petition, when the master uses a communication protocol that supports threading (such as OCP), a POSA would have been motivated to use threads as a communication service identification. Paper 3, 40-42; Ex-1003, ¶¶156-161, 164-173; Ex-1030, ¶46; Ex-1006, 21-22.

Finally, PO wrongly alleges that Petitioner failed to “explain why it...would have been obvious to use OCP’s MThreadID for the claimed mapping.” Paper 38, 49. As discussed below, Petitioner did provide such analysis, and it is persuasive. *Infra*, §V(D); *see also* Paper 3, 43-44.

C. OCP and Radulescu2004’s Connections Are Compatible

PO argues that “OCP’s ‘connections’ cannot be combined with Radulescu2004’s system” because “Radulescu2004’s ‘connections’ and OCP’s ‘connections’ are different.” Paper 38, 52. PO’s argument that the connections are different is premised on the claimed “interconnect means” being limited to a packet-based network. *Id.*; Ex-2070, ¶187. As discussed below, there is no basis for reading such a limitation into the claims. *See Infra*, §VI.C.2; Ex-1030, ¶75. And regardless, Ground 2 does not call for use of *OCP*’s connections in Radulescu2004’s system. Radulescu2004 discloses the connections. Paper 3, 43 (“[6.b]...*see supra* VIII.A.4”); Ex-1030, ¶47. Whether OCP is a connectionless

communication protocol or uses packets is not an issue for compatibility with Radulescu2004. Ex-1030, ¶48. Radulescu2004 expressly teaches that it is backward compatible with OCP. *Id.* ¶¶48-49; Ex-1005, 1.

D. The Claimed Mapping Is Also Obvious in View of Radulescu2004 and OCP

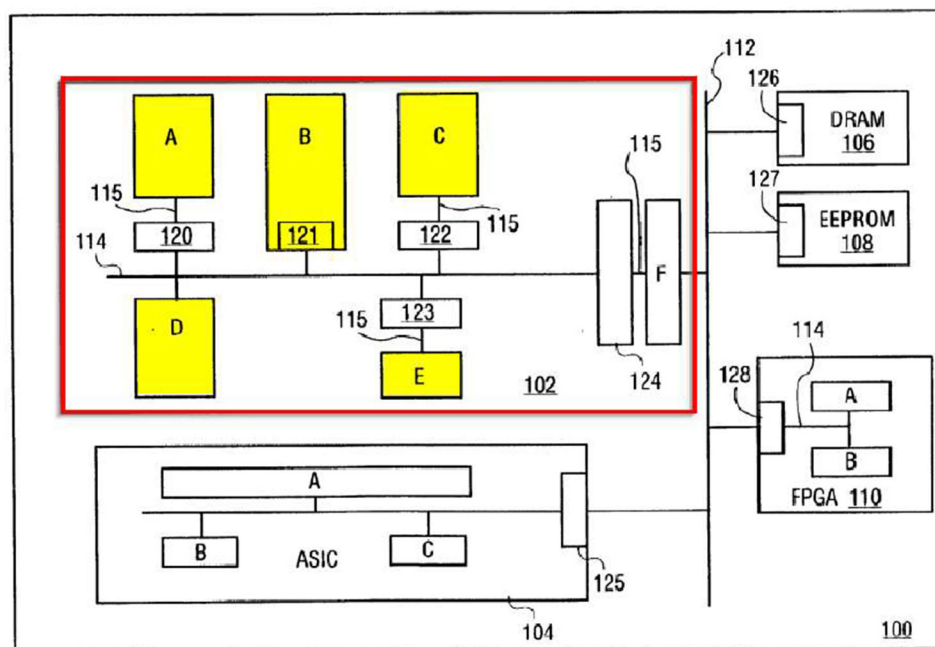
PO alleges *without any analysis whatsoever* that Petitioner has not met its burden “that OCP cures the deficiencies of Radulescu2004 with respect to the ‘mapping’ requirement.” Paper 38, 45. Even if the “mapping” element were construed as narrowly as PO is now arguing it should be, it would have been obvious in view of Radulescu2004 and OCP. OCP teaches that MThreadID is mapped to a connection identifier (MConnID), and a POSA would have found it obvious for the OCP adapter in the network interface of Radulescu2004 to map the MThreadID in requests to the analogous connections in Radulescu2004’s system. Ex-1003, ¶158; Ex-1030, ¶50; *see also KSR*, 550 U.S. at 417 (“if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.”). Moreover, mapping OCP threads to Radulescu2004’s connections was known to allow thread-based ordering and priority to be communicated through the NoC, including the *implementation* of Radulescu2004’s “differentiated traffic classes.” Paper 3, 44; Ex-1003, ¶177; Ex-1030, ¶50. A POSA would have known the whole

point of connections with ordering or high priority was for mapping of requests with those properties. Ex-1030, ¶50.

VI. GROUND 3 – Anticipation by Weber

A. Weber Discloses a Single “Integrated Circuit”

PO does not dispute that sub-system 102 of Weber is on a single integrated circuit (“IC”):



Paper 3, 48-49. That alone is sufficient to meet this limitation. *Id.*; Ex-1030, ¶51.

Moreover, Weber also expressly discloses an embodiment of FIG. 1 that integrates all sub-systems of system 100 on a single IC. Ex-1007, ¶0038 (“System 100 is an example of a system that may consist of *one* or more integrated circuits or chips.”) (emphasis added); Ex-1030, ¶52. PO’s argument that this sentence does not mean that sub-systems 102-110 can be implemented on one IC (Paper 38, 54-

56) is belied by the plain reading of the sentence and would make it redundant with other statements in Weber. Ex-1030, ¶53; Paper 3, 47-49. This is consistent with what POSAs knew at the time, as shown by expert testimony and supporting exhibits. Ex-1030, ¶¶53-60. PO's argument that putting the components on a single IC might be "unusual," "too expensive," or "too large" is unsupported by any documentary evidence—PO's expert just says so. Ex-1030, ¶¶54, 59. And even if true, it would be irrelevant, because Weber *discloses* it. Ex-1030, ¶¶52-60; *Celeritas Technologies Ltd. v. Rockwell International Corp.*, 150 F.3d 1354, 1361 (Fed. Cir. 1998) ("The fact that a modem with a single carrier data signal is shown to be less than optimal does not vitiate the fact that it is disclosed.").

B. Weber Discloses the Claimed "Communication Service Identification"

The claims require that the communication service identification be an address range *or* a communication thread. Ex-1001, cl.6. PO does not dispute Weber discloses a communication thread, thereby meeting this limitation.

Moreover, as discussed above, the claims do not require that address ranges be included with the requests. *Supra*, §IV.A. Weber's disclosure of an address that identifies a target having a range of addresses associated therewith meets the "based on... an address range" claim language as well. Ex-1030, ¶¶65-70; Paper 3, 52-54.

C. Weber Discloses the Claimed “Interconnect Means” Even Under PO’s Construction

PO contends that “interconnect means” is limited to a “network,” and that “network” should be construed as a “multi-hop interconnection between modules separated by one or more network nodes.” Paper 38, 15-16. Even under that construction, Weber discloses the claimed interconnect means. Ex-1030, ¶¶71-87.

1. A Hop Is a Link with a Node on Each End

The Institution Decision requested additional discussion and evidence regarding “hop.” “Hop” appears only once in the ’052 patent, in a sentence describing on-chip networks as “multi-hop” because the modules are “not directly connected,” but instead are “separated by one or more network nodes.” Ex-1001, 2:34-37.

As used in this sentence, “hop” merely describes the movement of data on links to or between nodes of a network. Ex-1030, ¶¶17-20; Ex-1051, 6-7. That is, when data traverses across a link from one module or node to another, it has “hopped.” Ex-1030, ¶¶18-20. If two modules are “directly connected” (i.e., there are zero nodes between them), there is a single hop. *Id.* But if there is at least one node between two modules, then the network is “multi-hop” because there are at least two hops—one from the first module to the intermediate node, and a second from the intermediate node to the second module. *Id.* Thus, whenever modules are not “directly connected,” the path is “multi-hop.” *Id.*

PO's argument that a hop is *only* created by a router or switch (Paper 38, 20-21) is contrary to both the '052 patent and the knowledge in the art. Ex-1030, ¶¶20-21, 79-83. Nothing in the patent states routers or switches specifically are required; to the contrary it states that a network N “may” (not “must”) include routers. Ex-1001, 5:24-25 and Ex-1030 ¶82; *see also* Ex-1050, 55:14-57:16. Moreover, both experts agree that the network interfaces (NI) of the '052 patent are part of the network. Ex-1030, ¶85; Ex-2070, ¶86. Figure 4 of the patent shows an embodiment without routers or switches, where the interfaces NI are the only network nodes separating the modules:

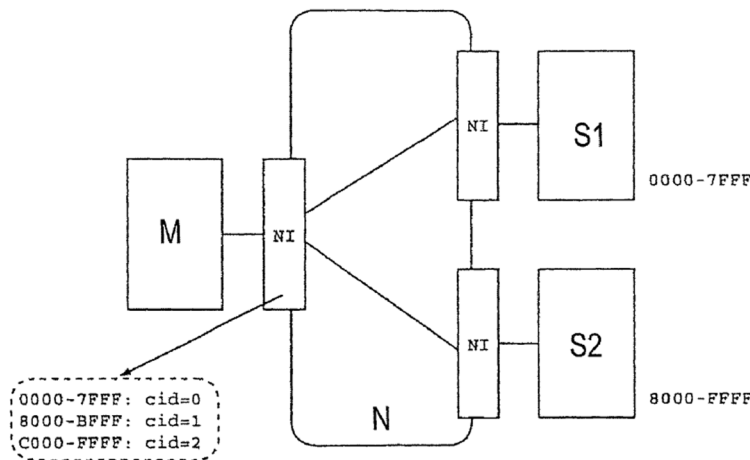


FIG.4

Ex-1030, ¶82.

None of the extrinsic evidence cited by PO suggests that switches or routers are the *only* things that create a hop. Ex-1030, ¶79; *see also*, Ex-1050, 55:3-13,

62:23-25. To the contrary, prior art publications—including those relied on by PO’s prior expert—confirm that devices other than routers or switches create hops. *E.g.*, Ex-1051, 228-229 (hop includes any device on the end of a transmission link, specifically listing bridges and hubs along with switches and routers); Ex-2010, 461 (bridges provide “hops” within a LAN); Ex-1030, ¶¶18-20.

2. Weber’s Bus-With-Interfaces Is a “Network” Even Under PO’s Definition

In Weber Figure 1, the modules (“functional blocks”) in each of sub-system 102 and system 100 are not directly connected, but instead are indirectly connected by interface modules (e.g., 120, 122-125), and bridge F, each of which are “network nodes” that create “hops.” Paper 3, 56-58.; Ex-1007, ¶¶37, 40, FIG. 1; Ex-1003, ¶¶194, 199-202; Ex-1030, ¶¶17-21, 71-72, 88. Examples include:

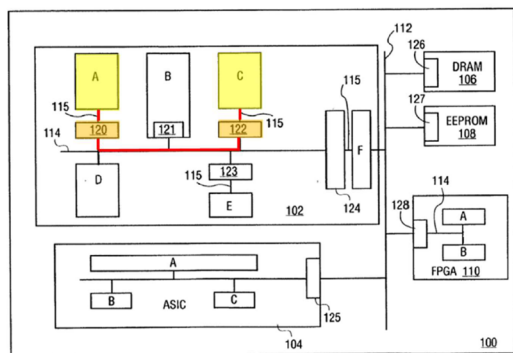


FIG. 1

(Ex-1003, ¶194)

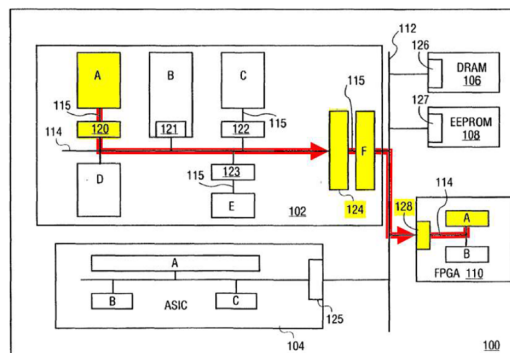


FIG. 1

(Ex-1003, ¶199)

Weber Figure 14 also similarly shows functional blocks indirectly connected to one another through communication subsystems 1435 and 1440, constituting “nodes”

providing multiple “hops.” Paper 3, 57-58; Ex-1007, ¶95, FIG. 14; Ex-1003, ¶¶199, 203-205; Ex-1030, ¶¶71-72. Each of Weber’s sub-system 102, system 100, and FIG. 14 therefore disclose a “network” even under PO’s definition. Ex-1030, ¶¶17-21, 71-88.

In this regard, it is the *interfaces* that distinguish a “network” from the “direct interconnects” criticized in the ’052 patent. Ex-1030, ¶¶82, 86-87. Weber’s bus with *interfaces* (and bridges) is not a direct interconnect and is a network as the term is used in the ’052 patent. Ex-1030, ¶¶85-87, 71-72. Indeed, the Wingard patent (incorporated by reference in Weber) teaches that interfaces in a bus system provide the key attributes of a “network” identified in the ’052 patent, including decoupling computation and communication, enabling re-use of applications and architectures, and enabling combination of modules using different protocols. Ex-1008, Abstract, 4:20-26, 15:43-59. PO and its expert admit as much. *See also* Paper 38, 65-66 (“[a] POSITA would not recognize any scalability problem in Weber” and “Weber already allows for concurrent data transmissions”); Ex-2070, 296 (Weber’s interconnect “provides the flexibility missing from traditional buses”); Ex-1030, ¶86.

PO argues that Weber does not disclose a “network” because Weber does not (i) “transmit packets,” (ii) disclose “conversion” between protocols, (iii) provide “variability” in the path between initiator and target, or (iv) employ a “router” or a

“switch.” Paper 38, 60-61. There is no basis in the claim language or specification, however, to read any of these limitations into the claims. Ex-1030, ¶¶73-83; *see also supra*, §VI.C.1. PO’s expert could not identify any definitional language in the specification that might justify reading them into the claims. *See* Ex-1050, 65:24-74:12 (packets), 60:22-61:3 (protocol conversion), 202:2-203:15 (path variability). Moreover, none of those features actually distinguish over Weber, as Weber discloses each of them. *See* Exhibit Ex 1003, ¶204 and Ex-1030, ¶84 (routers); Ex-1007, [0049], [0074] and Ex-1030, ¶77 (protocol conversion); Ex-1007, [0036], [0049]-[0054] and Ex-1030, ¶¶76 (packets); Ex-1007, [0084], [0100], [0107-0115], FIGs. 15B, 18 and Ex-1030, ¶78 (path variability). Weber discloses a “network” as that term is used in the ‘052 patent.

D. Weber Discloses the Mapping Means Structure (Claims 1-5, 7)

PO does not dispute that the structure in the ‘052 patent corresponding to the claimed mapping means is the adapter unit, or that Weber’s interface module is an adapter unit. Paper 3, 11, 66; Paper 38, 23-24, 57-59. While PO raises arguments based on sequentializing and desequentializing units within the adapter unit, PO does not argue that such sequentializing or desequentializing units are required for a mapping means. Even if disclosure of those units were required, Weber discloses the same amount of structure as the ‘052 patent. Ex-1030, ¶¶61-64.

VII. GROUND 4 – Obviousness in View of Weber and Radulescu2004

A. It Would Have Been Obvious to Implement a Weber-Radulescu2004 Combination on a Single Integrated Circuit

The Petition showed that “a POSA would have been motivated to combine the teachings of Weber with those of Rădulescu2004 in order to create *SoCs* with greater scalability and performance.” Paper 3, 68 (emphasis added). “SoC” was a known reference to a single integrated circuit. Ex-1003, ¶¶122, 185. The Petition also showed that each of Weber and Radulescu2004 disclosed claim element [6.pre.1], which recites the “integrated circuit” limitation. Paper 3, 21 (Ex-1005, Abstract, 1), 47-49 (Ex-1007, [0002], [0035], [0037]-[0040], [0050], Fig. 1), 71. And PO does not dispute that Radulescu2004 discloses a single integrated circuit or that Weber’s sub-system 102 is a single integrated circuit.

Because Weber discloses, and suggests the desirability of use on, a single integrated circuit and Radulescu2004 discloses an SoC, it would have been obvious to implement the combined teachings via a single integrated circuit. *Id.*; *see also* Ex-1003, ¶¶47, 112-113, 185, 191, 233-234; Ex-1030, ¶89.

B. It Would Have Been Obvious to Use Radulescu2004’s NoC in Weber

Contrary to PO’s assertion, the Petition adequately explained the obviousness combination. Specifically, the Petition explained that it would have been obvious to combine Weber’s SoC with Radulescu2004’s NoC comprising a router network, and explained why one would have been motivated to do so. Paper

3, 68-72 (citing evidence). Petitioner’s expert explained that the implementation would have been “routine” and well within the skill of a POSA, and PO has not provided any persuasive evidence that it would not. *E.g.*, Ex-1003, ¶242, Paper 38, §VI.F.3; Ex-2068, 125:4-128:10; Ex-1030, ¶¶93-98; *see also KSR*, 550 U.S. at 418 (“a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ”).

PO asserts that neither scalability nor performance would have motivated this combination, because Weber already provides these benefits. Paper 38, 65-69. The fact that Weber provides these benefits over traditional buses, however, does not mean that a POSA would be unmotivated to make further improvements to scalability or performance. Ex-1030, ¶90. To the contrary, Weber’s teaching that a POSA wanted improved scalability and performance further *supports* the motivation. *Id*; *Intel*, 61 F.4th at 1380.

PO also points to potential disadvantages of Radulescu2004’s NoC. Paper 38, 67-68. But as the case cited by PO explains, competing benefits “should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another.” *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000). This case is also factually different than *Winner*, where the reference being combined was silent as to any benefit over the primary reference and the primary reference also taught away. Ex-1030, ¶91; *see* Paper 3, 69-70

(citing Ex-1005, 1); *Winner*, 202 F.3d at 1349. Moreover, PO’s own exhibit provides further evidence of the known interchangeability of buses and networks. Ex-1021, Abstract; Ex-1030, ¶92.

PO also argues lack of motivation to combine because Weber’s interfaces are “incapable” of a packet-based protocol. Paper 38, 70-71. But Weber does transmit “packets” (Ex-1030, ¶¶74-76), and regardless, it would be within the routine skill of a POSA to ensure the interfaces communicated in the correct protocol. Ex-1003, ¶242; Ex-1030, ¶94.

PO’s remaining arguments fail for reasons explained in previous sections. Both Radulescu2004 and Weber disclose a communication service identification “based on” an address range as claimed. *Supra* §§IV, VI; Ex-1030, ¶¶95-96. Moreover, Weber also teaches to use threads, and Radulescu2004’s NoC is compatible with threads. *Supra* §V; Ex-1030, ¶98. Finally, both Weber and Radulescu2004 disclose the claimed mapping. *Supra* §§IV, VI; Ex-1030, ¶97.

Dated: January 17, 2025	Respectfully submitted, <u>/J. Derek Vandenburg/</u> J. Derek Vandenburg (Reg. No. 32179) Aaron W. Pederson (Reg. No. 58607) Nathan D. Louwagie (Reg. No. 70057) Ryan D. Rypka (Reg. No. 79451) Peter M. Kohlhepp (<i>pro hac vice</i>) CARLSON, CASPERS, VANDENBURGH & LINDQUIST, P. A. 225 S. Sixth Street, Suite 4200 Minneapolis, MN 55402 Phone: 612-436-9600 dvandenburg@carlsoncaspers.com apederson@carlsoncaspers.com nlouwagie@carlsoncaspers.com rrypka@carlsoncaspers.com pkohlhepp@carlsoncaspers.com <i>Attorneys for Petitioner Qualcomm Incorporated</i>
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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R § 42.69(e) and the agreement of the parties, the undersigned certifies that on January 17, 2025, a true and correct copy of the foregoing Petitioner's Reply for *Inter Partes* Review of U.S. Patent No. 7,594,052 and supporting exhibits to be served via electronic mail upon the following:

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CERTIFICATE OF COMPLIANCE

The undersigned hereby certifies that the foregoing Petitioner's Reply for *Inter Partes* Review contains 5,569 words, excluding those portions identified in 37 C.F.R. §42.24(a), as measured by the word-processing system used to prepare this paper.

/J. Derek Vandenburg/

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