

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BMW OF NORTH AMERICA, LLC and MERCEDES-BENZ USA, LLC,
Petitioner,

v.

STRAGENT, LLC,
Patent Owner.

IPR2021-00417
Patent 10,248,477 B2

Before STACEY G. WHITE, DANIEL J. GALLIGAN, and
JASON M. REPKO, *Administrative Patent Judges*.

GALLIGAN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

BMW of North America, LLC and Mercedes-Benz USA, LLC (collectively, “Petitioner”) filed a Petition (Paper 1, “Pet.”) challenging the patentability of claims 1–30 of U.S. Patent No. 10,248,477 B2 (Ex. 1001, “the ’477 patent”), which is assigned to Stragent, LLC (“Patent Owner”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, we determine that Petitioner has proven by a preponderance of the evidence that claims 1–30 of the ’477 patent are unpatentable. *See* 35 U.S.C. § 316(e) (2018) (“In an *inter partes* review instituted under this chapter, the petitioner shall have the burden of proving a proposition of unpatentability by a preponderance of the evidence.”).

A. Procedural History

Petitioner requested *inter partes* review on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–3, 6–8, 12–14, 17–19, 23–25, 29, 30	103(a) ¹	Miesterfeld, ² Wong, ³ Grattan, ⁴

¹ The ’477 patent claims priority through a chain of continuations to an application that was filed before the effective dates of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”) amendments to 35 U.S.C. §§ 102 and 103. Therefore, we apply the pre-AIA versions of these sections.

² US 6,141,710, issued Oct. 31, 2000 (Ex. 1009).

³ US 6,434,459 B2, issued Aug. 13, 2002 (Ex. 1010).

⁴ Nick Grattan and Marshal Brain, *Windows CE 3.0 Application Programming*, © 2001 (Ex. 1012, “Grattan”).

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
		Wense, ⁵ Nikklason ⁶
4, 5, 15, 16, 26, 27	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Boling ⁷
9, 20	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Steger ⁸
10, 21	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Stanley ⁹
11, 22	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Boling, Steger, Stanley
28	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Boling, Stanley

Pet. 7. Patent Owner filed a Preliminary Response. Paper 7 (“Prelim. Resp.”). We instituted trial on all grounds of unpatentability. Paper 9 (“Inst. Dec.”), 53.

During the trial, Patent Owner filed a Response (Paper 13, “PO Resp.”), Petitioner filed a Reply (Paper 17, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 19, “PO Sur-reply”).

An oral hearing was held on April 20, 2022, a transcript of which appears in the record. Paper 28 (“Tr.”).

⁵ H.-C. von der Wense and A.J. Pohlmeier, “Building Automotive LIN Applications,” © 2001 (Ex. 1013, “Wense”).

⁶ WO 02/054163 A1, published July 11, 2002 (Ex. 1014).

⁷ Douglas Boling, *Programming Microsoft Windows CE*, © 1998 (Ex. 1016, “Boling”).

⁸ US 2003/0040881 A1, filed July 12, 2002, published Feb. 27, 2003 (Ex. 1017).

⁹ US 4,099,255, issued July 4, 1978 (Ex. 1018).

In support of its challenges, Petitioner relies on the testimony of Vijay K. Madiseti, Ph.D. Ex. 1004. Patent Owner relies on the testimony of Jeffrey A. Miller, Ph.D. Ex. 2001.

B. Real Parties in Interest

Petitioner identifies the following real parties in interest: BMW of North America, LLC, BMW Manufacturing Co., LLC, Bayerische Motoren Werke, AG, Daimler AG, Daimler North America Corp., Mercedes-Benz USA, LLC, Mercedes-Benz U.S. International, Inc., Mercedes-Benz Vans, LLC, and Daimler Trucks North America LLC. Pet. 1.

Patent Owner identifies itself as the real party in interest. Paper 5, 1.

C. The '477 Patent and Illustrative Claim

The '477 patent “relates to the field of distributed control and monitoring systems,” which “may optionally apply to electronic vehicle communication and control systems, real-time monitoring systems, industrial automation and control systems, as well as any other desired system.” Ex. 1001, 1:28–34.

Claim 1 is illustrative and is reproduced below with bracketed identifiers added for reference in the analysis below.

1[pre]. A layered system for sharing information in an automobile vehicle, said system comprising:

[a] an automotive electronic control unit comprising a micro-processor and an operating system;

[b] a hardware abstraction layer within the electronic control unit allowing the operating system to be adapted to a specific hardware implementation as used in the electronic control unit;

[c] non-volatile memory comprising a database with a data structure;

[d] a memory manager associated with the non-volatile memory,

[e] said memory manager comprising [e(i)] an upgrade and configuration manager to configure the data structure of the non-volatile memory, [e(ii)] an event manager to capture input-output events as variables and generate new events, flags or signals, [e(iii)] a data access manager to control code update and configuration of the memory and access rights for individual applications at execution, and [e(iv)] a data integrity component to analyze stored state variables for integrity and generate events or flags if any problem occurs;

[f] the non-volatile memory further comprising instructions to:

[g] receive information in the form of a packet data unit representing datum information carried by an overall message from a first physical network selected from the group consisting of FlexRay, Controller Area Network, and Local Interconnect Network;

[h] in response to the receipt of the information, issue a storage resource request in connection with a storage resource;

[i] determine whether the storage resource is available for storing the information;

[j] determine whether a threshold has been reached in association with the storage resource request;

[k] in the event the storage resource is not available and the threshold associated with the storage resource request has not been reached, issue another storage resource request in connection with the storage resource;

[l] in the event the storage resource is available, store the information in the storage resource; and

[m] share the stored information with at least one of a plurality of heterogeneous processes including at least one process associated with a second physical network selected from the group consisting of FlexRay, Controller Area Network, and Local Interconnect Network, utilizing

a network protocol different from a protocol of the first physical network;

[n] interfaces for communication with each of FlexRay, Controller Area Network, and Local Interconnect Network networks, with each physical network in communication with a component including at least one of a sensor, an actuator, or a gateway, and with each of the FlexRay, Controller Area Network, and Local Interconnect Network interfaces comprising a corresponding network communication bus controller including a corresponding network communication bus driver;

[o] the interfaces including a first communication interface for interfacing with the first physical network, the first communication interface including a first communication interface-related data link layer component, said first communication interface configured to extract variables from the overall message communicated by the first physical network employing a first protocol and storing the packet data unit representing the datum information carried by the overall message from a first physical network in the database; and

[p] a second communication interface for interfacing with the second physical network utilizing a protocol different than the protocol of the first physical network, the second communication interface including a second communication interface-related data link layer component;

[q] wherein the automotive electronic control unit is configured such that the stored information may be shared with the second physical network by replicating the packet unit data obtained from the first physical network by composing another message configured to be communicated using the different protocol of the second physical network.

II. ANALYSIS

A. Principles of Law

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that

the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any secondary considerations, if in evidence.¹⁰ *Graham v. John Deere Co. of Kan. City*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner contends that a person of ordinary skill in the art at the relevant time “would at least have a bachelor’s degree in electrical engineering, computer engineering, or a related engineering discipline and at least two years of industry experience in the field of distributed computing or automotive engineering, or equivalent experience, education, or both” and “would also have knowledge or familiarity with in-vehicle computing.” Pet. 12–13 (citing Ex. 1004 ¶ 45).

In the Institution Decision, we adopted Petitioner’s assessment except for the phrase “at least,” which expands the ranges of education and experience indefinitely without an upper bound. Inst. Dec. 8–9.

In its Response, Patent Owner proposes that a person of ordinary skill in the art

would have had the qualifications of or equivalent to either a master’s degree in electrical engineering, computer science, or computer engineering with course work or research in embedded networking technologies or an undergraduate degree in electrical

¹⁰ Patent Owner does not present any objective evidence of nonobviousness (i.e., secondary considerations) as to any of the challenged claims.

engineering, computer science, or computer engineering with at least two years of relevant work experience in industry.

PO Resp. 7 (citing Ex. 2001 ¶ 22). Patent Owner acknowledges that this is a higher skill level than that proposed by Petitioner and states that the differences do not impact the arguments. PO Resp. 7. Patent Owner's declarant, Dr. Miller, states that his "proposed level of skill is higher than that cited in the [Institution] Decision and is thus more favorable to obviousness." Ex. 2001 ¶ 23.

We maintain our assessment from the Institution Decision as it is consistent with the '477 patent and the asserted prior art of record. *See* Inst. Dec. 8–9. As discussed below, we conclude that the claimed subject matter would have been obvious based on this level of skill, and a higher level of skill in the art, as proposed by Patent Owner, would result in the same outcome.

C. Claim Construction

We interpret claim terms using "the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b).

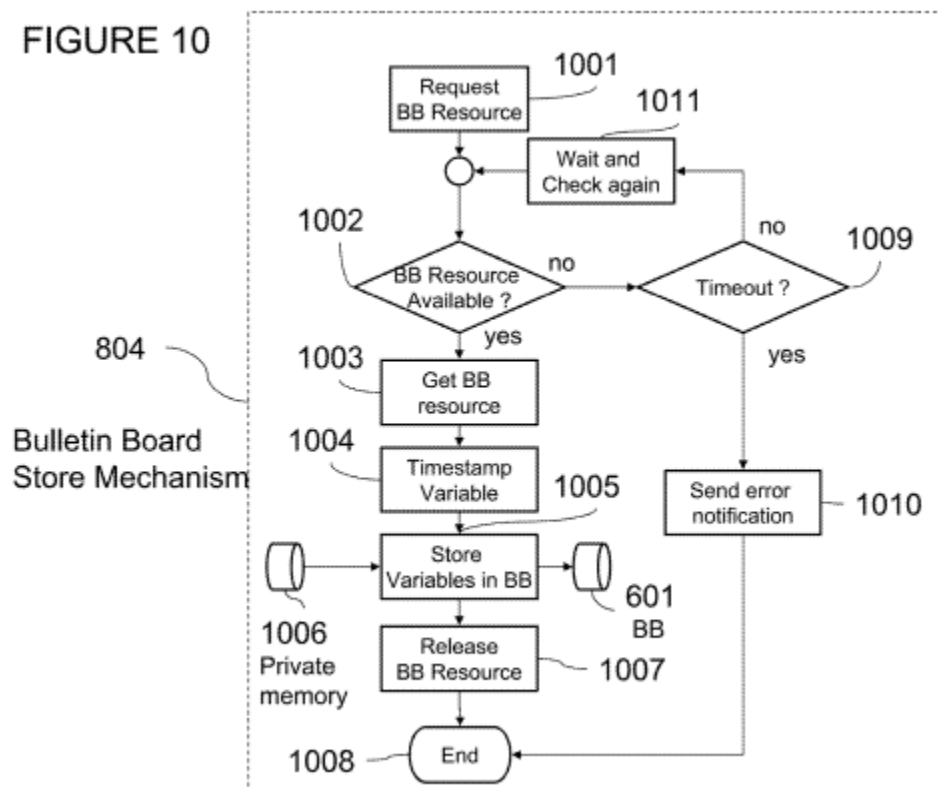
1. "Issue a Storage Resource Request"

All of the independent claims recite the phrase "issue a storage resource request." *See, e.g.*, claim 1 ("in response to the receipt of the information, issue a storage resource request in connection with a storage resource"). Patent Owner argues that "[t]he ordinary meaning of the word 'request' is (a) 'the act or an instance of asking for something'

(<https://www.merriam-webster.com/dictionary/request>); or (b) ‘the act of politely or officially asking for something.’” PO Resp. 15 (citing Ex. 2001 ¶ 69). According to Patent Owner, the Specification of the ’477 patent “uses the term ‘request’ consistently with the ordinary meaning of the term.” PO Resp. 15–16 (citing Ex. 1001, 7:52–57, 8:12–16). Patent Owner argues, therefore, that the phrase “issue a storage resource request” means that “a procedure asks permission of an entity that can grant such permission the right to store information.” PO Resp. 15–16 (citing Ex. 2001 ¶¶ 69, 71).

The Specification of the ’477 patent is instructive, and Figure 10 of the ’477 patent is reproduced below.

FIGURE 10



The ’477 patent’s Figure 10, reproduced above, is a flow chart showing a storage procedure. Ex. 1001, 7:52–53. The ’477 patent explains that, “[b]efore new data can be stored in the bulletin board, the procedure has to

request the access right to the common resource, a section of the non-volatile or volatile memory, from the operating system (1001). This is called explicit resource management.” Ex. 1001, 7:53–57, *quoted in* PO Resp. 15. Patent Owner quotes this passage but omits the next sentence, which states that, “[i]f the resource is available, the process gets the resource.” Ex. 1001, 7:58; *see* PO Resp. 15. Figure 10 shows an arrow from block 1001 captioned “Request BB Resource” to a circle and then an arrow from the circle to decision block 1002 captioned “BB Resource Available ?.”

Based on the Specification’s description, we conclude that the phrase “issue a storage request” at least encompasses checking to see if the storage resource is available. This is consistent with Patent Owner’s dictionary definition that a request is the act of asking for something. *See* PO Resp. 15. The Specification explains that, when the request is made, “[i]f the resource is available, the process gets the resource.” Ex. 1001, 7:58. Thus, according to the Specification, the act of checking availability of the resource is the issuance of the request. To the extent there is a grant of permission to store information, as suggested by Patent Owner (PO Resp. 15–16), such permission is granted if there is availability. Ex. 1001, 7:58.

Based on the foregoing, we conclude that the phrase “issue a storage request” encompasses checking to see if the storage resource is available.

2. “Bulletin Board”

Dependent claim 2 recites that “the memory comprises at least one bulletin board that stores information that may be addressed by any process of any network having access to the storage resource of the electronic control unit.” Claim 13 depends from independent claim 12 and recites the same subject matter. Claim 24 depends from independent claim 23 and recites that “the non-volatile memory comprises at least one bulletin board

that includes the stored information that is capable of being accessed by any process of any network having access to the electronic control unit.”

Petitioner argues that a bulletin board is “any data base that enables users to send and/or read electronic messages, file, and/or other data that are of general interest and/or addressed to no particular person/process.” Pet. 15 (citing Ex. 1037, 15–16 (which cites Ex. 1026, 5:10–14)). At institution, we preliminarily adopted this proposed construction because it is taken from the Specification of the ’477 patent. Inst. Dec. 11 (citing Ex. 1001, 4:45–49 (“In the context of the present description, the bulletin board may refer to any database that enables users to send and/or read electronic messages, files, and/or other data that are of general interest and/or addressed to no particular person/process.”)).

Patent Owner argues that Petitioner’s construction is wrong because, although “the specification indicates that a bulletin board ‘may’ be a database,” “a bulletin board need not be a data base as Petitioner proposes.” PO Resp. 10; *contra* Prelim. Resp. 13 (“The proper construction of the term consistent with the plain language of the claims and the Board’s prior constructions is that ‘bulletin board’ is ‘a data base that’”). Patent Owner argues that “[t]he ’477 Patent states that a bulletin board has a ‘data structure’” and, therefore, that, “[i]n the context of the claims here in issue, the term ‘bulletin board’ denotes a data structure that may be accessed by a process of any network having access to the storage resource of the electronic control unit.” PO Resp. 10–11 (citing Ex. 1001, 4:43–44; Ex. 2001 ¶ 57).

As explained below in § II.D.4, Petitioner has demonstrated unpatentability of claims 2, 13, and 24 under either parties’ proposed construction. Therefore, we need not resolve this claim construction dispute.

See Realtime Data, LLC v. Iancu, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

3. *Remaining Terms*

Based on the record developed during trial, we need not construe expressly any other claim terms to decide the issues of patentability before us.

D. Obviousness over Miesterfeld, Wong, Grattan, Wense, and Nikklason (Claims 1–3, 6–8, 12–14, 17–19, 23–25, 29, 30)

Petitioner argues that claims 1–3, 6–8, 12–14, 17–19, 23–25, 29, and 30 are unpatentable as obvious over Miesterfeld, Wong, Grattan, Wense, and Nikklason. Pet. 7, 19–73. Patent Owner opposes. PO Resp. 16–60. For the reasons discussed below, Petitioner has demonstrated unpatentability of these claims by a preponderance of the evidence.

1. Overview of Prior Art References

Miesterfeld discloses “a gateway for interfacing a vehicle data bus to an intelligent transportation system data bus, and more particularly, a gateway including a memory which the vehicle data bus and the intelligent transportation system data bus may each access in order to exchange data between the respective buses.” Ex. 1009, 1:5–10.

Wong discloses “an automobile information system that facilitates communication within clusters of components and among various clusters. Each cluster has a controller that provides a platform for supporting many diverse components.” Ex. 1010, 2:41–45. Wong discloses that a cluster controller can run the Windows CE operating system. Ex. 1010, 6:10–22.

Grattan is a publication that describes Windows CE programming.
Ex. 1012.

Wense describes communications in automotive electronic systems and focuses on the Local Interconnect Network (LIN) communication system. Ex. 1013, 10.

Nikklasson discloses “an arrangement that enables coupling, controlling and/or monitoring a number of controllable devices, preferably of different types, via a single bus,” which is preferably a controller area network (CAN) bus. Ex. 1014, 4:17–19, 5:15.¹¹

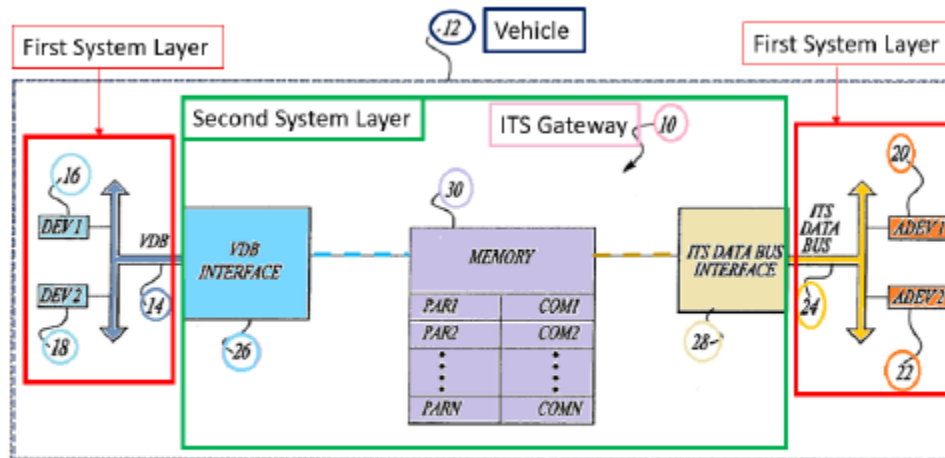
Additional disclosures of the references are discussed below in the analysis of the claims.

2. Claim 1

a) 1[pre]

The preamble of claim 1 recites “[a] layered system for sharing information in an automobile vehicle.” Petitioner argues that Miesterfeld discloses a vehicle communication system with two system layers, thereby teaching the recitation of the preamble. Pet. 19–20 (citing Ex. 1009, 1:5–6, 1:13–60, 2:66–3:49, Fig. 1; Ex. 1004 ¶¶ 61–63). Petitioner provides the following annotated version of Miesterfeld’s Figure 1 to illustrate its contentions:

¹¹ References are to the WIPO page numbers rather than the exhibit page numbers added by Petitioner.



Miesterfeld, FIG. 1 (annotated)

Pet. 20. Miesterfeld’s Figure 1 depicts intelligent transportation system (ITS) gateway 10 with vehicle data bus (VDB) 14 connected to multiple devices 16, 18 and ITS data bus 24 connected to multiple ancillary devices 20, 22. Ex. 1009, 2:66–3:16. In the annotated version of Figure 1 above, Petitioner identifies a first system layer as including VDB bus 14 and ITS data bus 24 and the devices connected to these buses. Pet. 19–20. Petitioner identifies a second system layer as VDB interface 26, ITS data bus interface 28, and memory 30. Pet. 20. Petitioner contends that Miesterfeld’s disclosure of data exchange between VDB interface 26 and ITS data bus interface 28 teaches “sharing information in an automobile vehicle,” as recited in the preamble. Pet. 20 (citing Ex. 1009, 2:66–3:49; Ex. 1004 ¶ 63).

Patent Owner does not specifically challenge Petitioner’s assertions for the preamble. *See* PO Resp.

Petitioner’s contentions and evidence for the preamble of claim 1 are persuasive, and we find Miesterfeld teaches “[a] layered system for sharing information in an automobile vehicle.”¹²

b) 1[a]

Claim 1 recites “an automotive electronic control unit comprising a micro-processor and an operating system.” Petitioner argues that Miesterfeld’s intelligent transportation system (ITS) gateway is an automotive electronic control unit (ECU) “because it is in a vehicle and controls information sharing between electronic control devices on the vehicle data bus VDB and the ITS data bus for the purpose of monitoring and controlling vehicle functions.” Pet. 20–21 (citing Ex. 1009, 1:13–40, 2:66–3:49; Ex. 1004 ¶ 64). Petitioner acknowledges that “Miesterfeld does not explicitly disclose that the ITS gateway 10 includes a microprocessor and an operating system (‘OS’),” and Petitioner relies on Wong for these teachings. Pet. 21–23. Petitioner argues that Wong’s master control unit (MCU) and secondary control units (SCUs) are electronic control units that have a micro-processor and an operating system, such as Windows CE. Pet. 21–23 (citing Ex. 1010, 1:52–60, 2:32–37, 3:25–4:40, 5:64–6:3, 6:7–35, Figs. 1, 4; Ex. 1004 ¶¶ 65–66). Petitioner argues that it would have been obvious “to implement Miesterfeld’s ITS gateway with Wong’s ECU architecture that uses a microprocessor and OS, specifically Windows CE,” and Petitioner provides several reasons that a person of ordinary skill in the art would have made this combination. Pet. 23–26. For example, Petitioner argues that this would have provided a “flexible and scaleable” system “with

¹² Based on Petitioner’s persuasive showing for the preamble, we need not decide whether the preamble is limiting.

the capability to manage complex functions,” which would have been “an improvement over the inflexible” dedicated processors in the prior art, as taught by Wong. Pet. 24, 26 (citing Ex. 1010, 1:46–51, 1:56–60, 2:32–37; Ex. 1004 ¶¶ 68, 71).

Patent Owner argues that “Petitioner’s obviousness argument fails because Petitioner has not shown that a [person of ordinary skill in the art] would have had any motivation to combine Miesterfeld and Wong, and, in fact, the two references are not truly in the same technical field.” PO Resp. 16. Before addressing Patent Owner’s particular arguments, we note that Patent Owner has clarified that it is not disputing that Miesterfeld and Wong are analogous art to the ’477 patent, notwithstanding its “same technical field” statement. *See* PO Sur-reply 1 (“Dr. Miller expressly acknowledged that Miesterfeld and Wong were in the same field.” (citing Ex. 2001 ¶ 94)), (“Patent Owner acknowledged that ‘both Miesterfeld and Wong involve automotive systems.’” (citing PO Resp. 17)); *see also* Tr. 31:18–32:6 (Patent Owner’s counsel confirming that “Patent Owner is not contesting that Miesterfeld and Wong are in the same field of endeavor as the ’477 patent”).

Patent Owner makes several arguments attempting to counter Petitioner’s proposed combination of Miesterfeld and Wong. PO Resp. 16–24. Patent Owner argues that Miesterfeld and Wong “are antagonistic to each other” and have different objectives. PO Resp. 17. Patent Owner argues that Miesterfeld is concerned with issues involving third-party device access to an automotive system and involves “a fast, low cost and simple solution.” PO Resp. 17–19 (citing Ex. 1009, 1:33–35, 1:41–42, 1:48–51, 1:52–54, 1:61–2:19, 3:13–16, 4:48–50, 7:28–60, 8:61–9:20, 9:46–67; Ex. 2001 ¶¶ 97–98). According to Patent Owner, “Miesterfeld is describing

a low-cost embedded system, and Miesterfeld does not suggest that a more general-purpose solution would be desired, much less valuable,” and “never mentions the need to, or any benefit of providing APIs to support a variety of general-purpose applications.” PO Resp. 19 (citing Ex. 2001 ¶ 98).

Patent Owner argues, on the other hand, that “Wong is dedicated to a highly functional system that does not appear interested in simplicity or cost, and does not appear to have any interest in any exchange of data even to the limited extent provided by Miesterfeld.” PO Resp. 20 (citing Ex. 1009, 2:36–38, 7:51–60). Patent Owner argues that, “[g]iven the directly opposing interests and goals of Miesterfeld and Wong,” a person of ordinary skill in the art “who accepted Miesterfeld for what Miesterfeld had proposed and his goals, would not look to a general-purpose microprocessor and OS, and, thus, would never consider Wong.” PO Resp. 22.

We disagree with Patent Owner’s arguments. Contrary to Patent Owner’s assertions, Wong expressly discloses information exchange and cost concerns. For example, as Patent Owner acknowledges, Wong discloses “an automobile information system that facilitates communication within clusters of components and among various clusters. Each cluster has a controller that provides a platform for supporting many diverse components.” Ex. 1010, 2:41–45, *quoted in* PO Resp. 3. In Wong, “any component in one cluster can share information with any component in another cluster without need for dedicated wiring or specially written code.” Ex. 1010, 3:5–8, *quoted in* Pet. 25. Wong discloses that “[c]ommunication between clusters enables increased functionality of the system and helps reduce cost, simplify information communication, and optimize functions.” Ex. 1010, 4:64–67, *cited in* Pet. Reply 6. Thus, Wong’s express disclosures refute Patent Owner’s assertion that Wong “does not appear interested in

simplicity or cost, and does not appear to have any interest in any exchange of data.” *See* PO Resp. 20.

Patent Owner also argues that Miesterfeld’s disclosure of a particular microcontroller (“HIP7030A2 surface mount package”) for use as one component of its system “speaks eloquently to Miesterfeld’s desire for low-cost, simplicity and minimal capabilities consistent with his goals” and is “entirely different” from Wong’s “highly functional system.” PO Resp. 18–20 (citing Ex. 1009, 2:36–38, 5:1–3,¹³ 7:28–60, 8:61–9:20; Ex. 2008; Ex. 2001 ¶¶ 98–100). According to Patent Owner, “Miesterfeld chose not to implement various other technologies that were available.” PO Sur-reply 7 (citing Ex. 2001 ¶ 98).

Patent Owner’s argument suggests that the obviousness inquiry is limited to the disclosure of one reference, but this effectively eviscerates the legal framework of combining the teachings of references for obviousness. Miesterfeld’s disclosure of an allegedly simple system does not foreclose its use in an obviousness combination with a reference having more sophisticated teachings. Nor does a reference have to identify in itself an area in need of improvement for that reference to be used in an obviousness combination. Rather, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

Petitioner provides a persuasive rationale to combine the teachings of Miesterfeld and Wong supported by the evidence of record. As noted above, Petitioner argues that it would have been obvious “to implement

¹³ Patent Owner cites Miesterfeld, column 4, lines 48–50, but the HIP7030A2 is mentioned at column 5, lines 1–3.

Miesterfeld's ITS gateway with Wong's ECU architecture that uses a microprocessor and OS, specifically Windows CE," and that this combination would have provided a "flexible and scaleable" system "with the capability to manage complex functions," which would have been "an improvement over the inflexible" dedicated processors in the prior art, as taught by Wong. Pet. 23–24, 26 (citing Ex. 1010, 1:46–51, 1:56–60, 2:32–37; Ex. 1004 ¶¶ 68, 71). Wong supports this motivation by disclosing "a system design that is flexible and scaleable, with the capability to manage complex functions." Ex. 1010, 2:35–37; *see also* Ex. 1010, 4:40–43 (disclosing that the cluster architecture "provides maximum flexibility and allows additional functionality to be added as new components to the system without having to redesign the entire system"). As noted above, Wong also discloses that, in its cluster architecture, "[c]ommunication between clusters enables increased functionality of the system and helps reduce cost, simplify information communication, and optimize functions." Ex. 1010, 4:64–67, *cited in* Pet. Reply 6. Thus, Wong discloses several benefits to its disclosed architecture, which we find would have motivated a person of ordinary skill in the art to combine "Wong's ECU architecture that uses a microprocessor and OS" with Miesterfeld's teachings, as proposed by Petitioner. *See* Pet. 23. Patent Owner's argument that "a [person of ordinary skill in the art] who accepted Miesterfeld for what Miesterfeld had proposed and his goals, would not look to a general-purpose microprocessor and OS, and, thus, would never consider Wong" (PO Resp. 20) is legally unavailing because the person of ordinary skill in the art is not confined to the proposals and goals of only one reference.

For the reasons explained above and based on the full trial record, we find that a person of ordinary skill in the art would have been motivated to

combine Wong’s teachings of an ECU architecture that uses a microprocessor and an OS with the teachings of Miesterfeld in the manner asserted by Petitioner, and we find that the combination of Miesterfeld and Wong teaches “an automotive electronic control unit comprising a microprocessor and an operating system.”

c) 1[b]

Claim 1 recites “a hardware abstraction layer within the electronic control unit allowing the operating system to be adapted to a specific hardware implementation as used in the electronic control unit.” Petitioner argues that “[i]mplementing Miesterfeld’s gateway with Wong’s automotive controller architecture that uses a microprocessor and OS, specifically Windows CE, would include a hardware abstraction layer, or HAL as they are commonly referred to,” citing Wong’s HAL 46. Pet. 27 (citing Ex. 1010, 6:1–3, 6:10–11, 6:55–58, 7:3–9, 7:20–27, 7:35–40, Figs. 4, 5; Ex. 1004 ¶¶ 72–73); *see* Ex. 1010, 6:55–58 (“The operating system 110 contains a shell 128, application programming interfaces (APIs) 130–136, a kernel 138, device driver interfaces (DDIs) 140–144, and a hardware abstraction layer (HAL) 146.”). Petitioner contends that “HAL 146 allows a device driver to support the same device on all hardware platforms, which allows for variations in hardware platforms (using different processors) without requiring a separate version of the operating system for each one.” Pet. 27–28 (citing Ex. 1010, 7:20–27, 7:35–40).

Other than its arguments directed to the combination of Miesterfeld and Wong, addressed above in § II.D.2.b, Patent Owner does not dispute Petitioner’s contentions for this limitation. *See* PO Resp.

Petitioner's contentions and evidence are persuasive, and we find that Wong's HAL 146 teaches a hardware abstraction layer and that the asserted combination of Miesterfeld and Wong teaches recitation 1[b].

d) 1[c]

Claim 1 recites "non-volatile memory comprising a database with a data structure." Petitioner argues that Miesterfeld's memory 30 is a database with a data structure and that, although "Miesterfeld does not explicitly state that the memory 30 is non-volatile memory," it would have been obvious to implement the memory in non-volatile memory such as a flash drive or a disk drive. Pet. 28–30 (citing Ex. 1009, 3:17–49, Fig. 1; Ex. 1012, 22–23; Ex. 1011, 1:18–24; Ex. 1004 ¶¶ 75–76). Petitioner argues that using non-volatile memory would provide the benefit of allowing data to be retained if the power is lost. Pet. 29–30 (citing Ex. 1011, 1:18–24).

Other than its arguments directed to the combination of Miesterfeld and Wong, addressed above in § II.D.2.b, Patent Owner does not dispute Petitioner's contentions for this limitation. *See* PO Resp.

Based on Petitioner's contentions and evidence, we conclude that the subject matter of recitation 1[c] would have been obvious.

e) 1[d] and 1[e]

Claim 1 recites "a memory manager associated with the non-volatile memory." Petitioner argues that its proposed "combination of Miesterfeld's gateway with Wong's microprocessor and OS controller architecture renders the inclusion of a memory manager associated with the non-volatile memory obvious." Pet. 30 (citing Ex. 1004 ¶ 77). In particular, Petitioner argues that "Wong's OS kernel is responsible for managing all attached memory" and, therefore, is a memory manager. Pet. 30–31 (citing Ex. 1010, 1:52–56, 6:10–22, 7:3–8, Figs. 4, 5). Wong discloses that OS "kernel 138 provides

the base operating system functionality” and “is responsible for memory management.” Ex. 1010, 7:3–6.

Claim 1 recites that the “memory manager” comprises “an upgrade and configuration manager,” “an event manager,” “a data access manager,” and “a data integrity component.” Petitioner argues that the Windows CE memory manager of Wong in combination with Miesterfeld would have included these components, relying on Grattan’s disclosures of Windows CE’s functionality. Pet. 32–38.

For the recited “upgrade and configuration manager to configure the data structure of the non-volatile memory,” Petitioner argues that “Grattan discloses that the Windows CE memory manager includes ActiveSync,” which includes data updating features that teach this subject matter. Pet. 33–34 (citing Ex. 1012, 134, 136, 146–51; Ex. 1004 ¶ 80).

Petitioner relies on Grattan’s disclosures of threads and events in combination with Miesterfeld and Wong to teach “an event manager to capture input-output events as variables and generate new events, flags or signals.” Pet. 34–35 (citing Ex. 1012, 38, 63–69, 75, 80–81; Ex. 1004 ¶¶ 81–82). Grattan discloses that “[t]hreads are created by applications to . . . [w]ait for some event to occur, such as termination of a process or receipt of information through a communications channel” and gives as an example a thread that is “reading data from the Internet.” Ex. 1012, 38, 63–64.

Petitioner relies on Grattan’s disclosures of Windows CE’s message queueing capabilities that can update data and control data access to applications in combination with Miesterfeld and Wong to teach “a data access manager to control code update and configuration of the memory and access rights for individual applications at execution.” Pet. 35–37 (citing

Ex. 1012, 107–09, 112–14, 118–19, 125–28; Ex. 1004 ¶¶ 83–86).

Petitioner’s declarant, Dr. Madisetti, testifies that “[b]y controlling the access of applications to messages for data on the device to be ‘updated’ or for new information to be ‘downloaded,’ Windows CE thus provides ‘a data access manager to control code update and configuration of the memory and access rights for individual applications at execution.’” Ex. 1004 ¶ 86 (citing Ex. 1012, 107–08).

Petitioner relies on certain of Grattan’s disclosures relating to transactions and data synchronization in combination with Miesterfeld and Wong to teach “a data integrity component to analyze stored state variables for integrity and generate events or flags if any problem occurs.” Pet. 37–38 (citing Ex. 1012, 131, 160; Ex. 1004 ¶¶ 87–89).

Patent Owner argues that Petitioner’s contentions for recitations 1[d] and 1[e] fail because they go against the goals and intentions of the Miesterfeld patent and the Miesterfeld inventor. *See* PO Resp. 24 (“Miesterfeld’s goals are stated in his patent. He did not want the attributes that Petitioner seems intent on imposing on him.”), 27 (“Miesterfeld created a system and gateway with a specific goal in mind, and achieved that goal by a careful selection of elements.”), 27 (asserting that “Petitioner’s arguments to combine Miesterfeld, Wong and Grattan defeat Miesterfeld’s goal and means” and “do exactly what the Miesterfeld inventor had specifically intended to avoid.”), 27 (arguing that the asserted combination “completely eviscerates the system that Miesterfeld had intended to build”).

These arguments suggest that the obviousness inquiry is limited to the intentions of the inventor of one prior art reference or to the specific goals set forth in a prior art reference, but this is not the correct legal framework. “Rather, the test [for obviousness] is what the combined teachings of the

references would have suggested to those of ordinary skill in the art.” *MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1294 (Fed. Cir. 2015). As discussed above for recitation 1[a], we find that a person of ordinary skill in the art would have been motivated to use an operating system based on Wong’s teachings (*see* § II.D.2.b above), and Petitioner’s contentions for recitations 1[d] and 1[e] rely on functionality that is part of the Windows CE operating system, which Wong discloses as a “preferred operating system.” Pet. 30–31; Ex. 1010, 6:18–21 (“One preferred operating system is a ‘Windows’ brand operating system sold by Microsoft Corporation, such as ‘Windows CE’ . . .”). Petitioner relies on Grattan for evidence of Windows CE functionality. Pet. 32–33 (“The Windows CE memory manager added to Miesterfeld, as discussed above, would have included an upgrade and confirmation manager, event manager, and data integrity component, as further evidenced by Grattan, detailed below.”).

Petitioner argues that it would have been obvious to use a Windows CE OS’s memory manager “to facilitate efficient memory use of storage of files and database.” Pet. 31–32. Patent Owner argues “Miesterfeld did not want ‘to facilitate efficient memory use of storage of files.’” PO Resp. 24–25. We need not speculate on what Miesterfeld’s inventor wanted because we find that a person of ordinary skill in the art would have been motivated to make the asserted combination to effect efficient memory use. *See* Ex. 1004 ¶ 78 (Dr. Madisetti testifying that a person of ordinary skill in the art would have understood that Wong has a memory manager and that it would have been obvious to implement Windows CE’s memory manager).

Based on Petitioner’s persuasive contentions and evidence, summarized above, we find that the combination of Miesterfeld, Wong, and

Grattan teaches “a memory manager” having “an upgrade and configuration manager,” “an event manager,” “a data access manager,” and “a data integrity component,” as recited in limitations 1[d] and 1[e], and that a person of ordinary skill in the art would have been motivated to combine Wong’s and Grattan’s memory manager teachings with Miesterfeld for the reasons explains above. Thus, we conclude that the subject matter of recitations 1[d] and 1[e] would have been obvious.

f) 1[f]

Claim 1 further recites that “the non-volatile memory . . . compris[es] instructions to” perform the operations recited in 1[g]–1[m], which we address below in § II.D.2.h. Petitioner argues that it would have been obvious to use non-volatile memory in Miesterfeld based on Wong’s disclosure of storing computer code in non-volatile memory and that storing instructions “in non-volatile memory prevents loss of the instructions each time the system is powered down or loses power.” Pet. 38–40 (citing Ex. 1009, 1:13–3:1, 3:18–47, Fig. 1; Ex. 1010, 6:4–22, 6:36–43, Fig. 4, Ex. 1011, 1:18–24, Ex. 1012, 22–23; Ex. 1004 ¶¶ 90, 92).

Patent Owner argues that “Miesterfeld does not describe storing data in any persistent way” nor “mention any instructions executed by the system.” PO Resp. 28 (citing Ex. 1009, 8:65; Ex. 2001 ¶ 117). According to Patent Owner, “[g]iven that Miesterfeld was Petitioner’s only support for limitation 1[f], which is necessary to also support limitations 1[g]-1[m], the failure of Miesterfeld to actually disclose the element means that none of limitations 1[f] through 1[m] are in the prior art.” PO Resp. 29.

We disagree with Patent Owner’s argument because Petitioner does not rely only on Miesterfeld for the recited “non-volatile memory.” Rather, as set forth above, Petitioner argues that it would have been obvious to use a

non-volatile memory in Miesterfeld based on the teachings of Wong. *See* Pet. 38–40.

Patent Owner states that “Petitioner’s argument has already been adequately analyzed and dissected in” previous Board decisions “that considered this limitation under current law in the context of identical limitations in similar claims in a patent in the same family and in response to exactly the same evidence as Petitioner cites here.” PO Resp. 28–29 (citing Ex. 2002, 13–14; Ex. 2003, 13–15; Ex. 2004, 13–15). Patent Owner’s representation is incorrect because Wong was not part of the asserted grounds in those cases. *See* Ex. 2002, 6 (asserted grounds in IPR2021-00726); Ex. 2003, 6–7 (asserted grounds in IPR2021-00727); Ex. 2004, 6–7 (asserted grounds in IPR2021-00728).

Based on the full trial record, we find persuasive Petitioner’s contentions that it would have been obvious to store instructions in non-volatile memory based on the teachings of Miesterfeld and Wong to “prevent[] loss of the instructions each time the system is powered down or loses power.” *See* Pet. 39 (citing Ex. 1010, 6:4–22, 6:36–43; Ex. 1012, 22–23; Ex. 1011, 1:18–24; Ex. 1004 ¶ 92). Wong expressly discloses that “code . . . to manage data flow among the components” is “stored in the non-volatile memory.” Ex. 1010, 6:36–40, *quoted in* Pet. 39. Thus, the combination of Miesterfeld and Wong teaches storing instructions in non-volatile memory, and we find that a person of ordinary skill in the art would have been motivated to combine this teaching of Wong with Miesterfeld to prevent the loss of the instructions when the system is powered down or loses power. *See* Ex. 1004 ¶ 92.

g) First and Second Physical Networks

Claim 1 recites “a first physical network selected from the group consisting of FlexRay, Controller Area Network, and Local Interconnect Network” and “a second physical network selected from the group consisting of FlexRay, Controller Area Network, and Local Interconnect Network.” Claim 1 also recites that the first and second physical networks use different network protocols.

Petitioner identifies Miesterfeld’s VDB 14 as the “first physical network” and Miesterfeld’s ITS data bus 24 as the “second physical network.” Pet. 40–41, 56–57. As Petitioner points out (Pet. 41), Miesterfeld does not expressly disclose FlexRay, CAN, and LIN, but it does disclose that “[p]referably, VDB 48, VDB transceiver 60, and VDB interface 62 are configured to implement the J1850 configuration as prescribed by the Society of Automotive Engineers (SAE) *or any other industry standard as may be required.*” Ex. 1009, 4:6–10 (emphasis added). Wense discloses that “[s]everal multiplex protocols have [been] established in the car and each of the protocols has its specific domain,” including FlexRay, CAN and LIN. Ex. 1013, 11, *cited in* Pet. 41–42. Petitioner contends that it would have been obvious to a person of ordinary skill in the art to have implemented Miesterfeld’s vehicle data bus (VDB) 14 (alleged “first physical network”) “to utilize known bus architectures, like CAN, FlexRay, or LIN, because, as Wense teaches, each was a commonly-used and well-known vehicle data bus for controlling the same and related types of vehicle networks for controlling various different vehicle systems addressed by Miesterfeld.” Pet. 44 (citing Ex. 1009, 4:7–10; Ex. 1013, 11; Ex. 1004 ¶ 99). For the claimed “second physical network,” Petitioner similarly argues that it would have been obvious to implement ITS data bus 24 as

FlexRay, CAN, or LIN for the same reasons as discussed with respect to VDB 14. Pet. 56–57 (citing Ex. 1009, 1:13–30, 3:2–8, 4:5–10, 8:66–9:1, 9:55–57; Ex. 1013, 11; Ex. 1004 ¶ 110). Petitioner further contends that “it would have been obvious to enable data exchange using a network protocol from the ITS data bus 24 different from the VDB 14 to account for and facilitate vehicle communication and control across different groups of devices and vehicle systems.” Pet. 57 (citing Ex. 1009, 1:13–30, 3:2–8, 8:66–9:1; Ex. 1013, 11; Ex. 1004 ¶ 110; Ex. 1047 ¶¶ 31, 40, 48; Ex. 1052, 1:27–32, 3:49–57).

Patent Owner disputes Petitioner’s reasoning, arguing that “Miesterfeld did not suggest any interest or desire ‘to account for and facilitate vehicle communication and control across different groups of devices and vehicle systems’” and that “Petitioner fails to show any prior art expressing such an interest.” PO Resp. 40 (citing Ex. 2001 ¶ 154). Patent Owner further argues that Petitioner’s reasoning “is directly opposite of what Miesterfeld intended when he designed his system to accommodate.” PO Resp. 40 (citing Ex. 2001 ¶ 154).

We disagree with Patent Owner’s arguments. As an initial matter, as stated above, the correct legal framework for obviousness does not involve divining the intention of an inventor of a prior art reference but, rather, involves determining “what the combined teachings of the references would have suggested to those of ordinary skill in the art.” *MCM*, 812 F.3d at 1294. Moreover, the plain disclosure of Miesterfeld shows that there *was* an interest in data communication between different vehicle systems: “With the proliferation of electronic control systems, vehicle designers seek to facilitate data exchange within each respective control system and,

optionally, between respective control systems.” Ex. 1009, 1:24–28, *cited in* Pet. 55.

Other evidence of record confirms that communication between different networks, including CAN, FlexRay, and LIN, was known in the art at the relevant time. For example, Petitioner cites the following disclosure of a prior art reference in the same field:

Control of the devices in the vehicle to implement desired features may be divided into controllers by function (powertrain, braking, steering, etc.), by location (engine compartment, seat, door, etc.) or in combinations thereof. The controller for each of the functions/zones may share information with other controllers using a shared-access serial bus. The bus usually follows an industry standard such as J1850, CAN, LIN, Flexray, MOST and the like, well known to those of skill in the art. Multiple, independent busses may be used. In that case, one of the controllers may act as a gateway *for information between the incompatible busses*.

Ex. 1052,¹⁴ 1:21–32 (emphasis added), *cited in* Pet. 45, 56–58. This is further evidence that inter-network communication was known in the art at

¹⁴ U.S. Patent 6,934,612 B2, filed June 18, 2003. The ’477 patent claims priority through a chain of continuations to a non-provisional application filed on December 15, 2003. Ex. 1001, code (63), 1:8–24. The ’477 patent lists a provisional application filed on December 17, 2002 (Ex. 1001, code (60)), but there is no presumption that a patent is entitled to the benefit of a provisional application. *See Dynamic Drinkware, LLC, v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1380 (Fed. Cir. 2015) (stating that “creat[ing] a presumption that a patent is entitled to the benefit of the filing date of its provisional precursor . . . would be unsound because the PTO does not examine provisional applications as a matter of course; such a presumption is therefore not justified”). Petitioner argues that the ’477 patent is not entitled to the filing date of the provisional application. Pet. 10. Patent Owner does not respond to this argument. *See* PO Resp. We determine that Exhibit 1052 is prior art under 35 U.S.C. § 102(e)(2) because it has a filing date that is earlier than the December 15, 2003, filing date of the ’477 patent.

the relevant time. Patent Owner argues that, due to an alleged failure of explanation, Petitioner cannot rely on this exhibit for any purpose other than as evidence of an “agreed proposition” that “automotive companies utilized different networks, and, in particular, FlexRay, CAN and LIN networks, in automobiles with each network being designed for ‘controlling different groups of devices and vehicle systems.’” PO Resp. 48–49 & n.2. We disagree that Petitioner’s reliance on Exhibit 1052 is improper. Petitioner cites this reference in discussing several limitations. *See* Pet. 44–45 (1[g]), 56–57 (1[m]), 58 (1[n]). The express disclosure of the cited portion of Exhibit 1052 refutes Patent Owner’s argument that Petitioner provided no prior art expressing an interest in vehicle communication across vehicle systems. *See* PO Resp. 40. Petitioner’s reliance on Exhibit 1052 is appropriate, and, indeed, such evidence of the state of the art is an integral part of an obviousness analysis. *See Koninklijke Philips N.V. v. Google LLC*, 948 F.3d 1330, 1337 (Fed. Cir. 2020) (“[T]he inquiry into whether any ‘differences’ between the invention and the prior art would have rendered the invention obvious to a skilled artisan necessarily depends on such artisan’s knowledge.”).

Patent Owner also argues that Miesterfeld’s ITS data bus provides an interface for third party devices and, therefore, is “entirely different” from “VDB and FlexRay, CAN and LIN.” PO Resp. 38–39. According to Patent Owner,

[g]iven the significant differences between the VDB/FlexRay/CAN/LIN busses on the one hand and the third party ITS busses on the other hand, there is no rational reason why any [person of ordinary skill in the art] would have used Miesterfeld’s system, which was specifically designed as a gateway between a VDB bus and a third party ITS bus, to act as a gateway between two VDB-type busses.

PO Resp. 40 (citing Ex. 2001 ¶ 152).

Patent Owner’s argument fails to appreciate the combined teachings of the art. Miesterfeld discloses communication between devices connected to two different busses. There is no dispute that FlexRay, CAN, and LIN were well-known automotive networks at the relevant time. *See, e.g.*, PO Resp. 35 (stating that Wense “identifies several known automobile busses,” including CAN, FlexRay, LIN, and MOST), 37 (“Wense points out that FlexRay, CAN and LIN are automotive busses in the sense that they communicate information necessary for the normal functioning of an automobile. Each bus serves certain uses or domains, and each utilizes a different protocol than the other two.”). As Petitioner points out (Pet. 45), Provisional Patent Application 60/434,018 (“the ’018 provisional application”), to which the ’477 patent claims priority, states that “[t]he automotive industry has developed the Controller Area Network (CAN) in the 1980s and subsequently added new communication bus systems such as MOST, IDB, LIN, and FlexRay.” Ex. 1003, 2.

Furthermore, Miesterfeld suggests that each of VDB and ITS data bus can use various different network technologies. For example, Miesterfeld discloses that, “[p]referably, VDB 48, VDB transceiver 60, and VDB interface 62 are configured to implement the J1850 configuration as prescribed by the Society of Automotive Engineers (SAE) *or any other industry standard as may be required.*”). Ex. 1009, 4:6–10 (emphasis added), *quoted in part in* Pet. 41. Similarly, Miesterfeld discloses that “the present invention enables any of a number of ITS data buses, such as D²B, USB, IDB, Firewall, and the like.” Ex. 1009, 9:55–58, *quoted in part in* Pet. 56.

We find Petitioner’s reasoning to combine persuasive. As the Supreme Court has stated, “when a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than yield a predictable result.” *KSR*, 550 U.S. at 416. Petitioner’s contention is simply that, given Miesterfeld’s disclosure of communication between automotive networks on different data busses that can accommodate different technologies, it would have been obvious to a person of ordinary skill in the art to use well-known automotive networks, such as CAN, FlexRay, and LIN. Pet. 44, 56–57. And, as noted above, Petitioner contends that “it would have been obvious to enable data exchange using a network protocol from the ITS data bus 24 different from the VDB 14 to account for and facilitate vehicle communication and control across different groups of devices and vehicle systems.” Pet. 57 (citing Ex. 1009, 1:13–30, 3:2–8, 8:66–9:1; Ex. 1013, 11; Ex. 1004 ¶ 110; Ex. 1047 ¶¶ 31, 40, 48; Ex. 1052, 1:27–32, 3:49–57). The record evidence discussed in detail above supports Petitioner’s rationale, including Miesterfeld’s own disclosure of inter-network communication between different automotive networks (Ex. 1009, 1:24–28, 4:6–10, 9:55–58) and Patent Owner’s acknowledgement that CAN, FlexRay, and LIN were known at the relevant time (PO Resp. 35, 37). *See also* Ex. 1003, 2 (“The automotive industry has developed the Controller Area Network (CAN) in the 1980s and subsequently added new communication bus systems such as MOST, IDB, LIN, and FlexRay.”).

Patent Owner argues that the asserted prior art does not enable sharing data between networks that utilize different protocols and that “it would not have been a trivial matter to design an ECU to store and interchange data with three or more interfaces with different protocols.” PO Resp. 47 (citing

Ex. 2001 ¶¶ 168–169). According to Patent Owner, “there is no indication in any of Petitioner’s cited prior art that such a concept was even contemplated, much less that the prior art enabled an ECU with three interfaces much less sharing of information amongst three different automotive networks using different protocols.” PO Resp. 47.

We disagree with this argument because the evidence of record demonstrates that exchanging data between networks utilizing different protocols was known at the relevant time:

The bus usually follows an industry standard such as J1850, CAN, LIN, Flexray, MOST and the like, well known to those of skill in the art. Multiple, independent busses may be used. In that case, one of the controllers may act as a gateway *for information between the incompatible busses*.

Ex. 1052, 1:27–32 (emphasis added), *cited in* Pet. 45, 56–58. Indeed, the inventors of the ’477 patent acknowledged this in the ’018 provisional application, which states that there were known automotive bus systems, including CAN, FlexRay, LIN, and MOST, and that “[e]ach of those communication bus systems create a singular communication and computing environment that cannot bridge into other networks below the application program level.” Ex. 1003, 2. The ’018 provisional application then states that, “[t]o implement this inter-network communication, the industry has defined several types of gateways or bridges. This approach involves translation of the various network protocol layers from one form to another” Ex. 1003, 3. Thus, the evidence of record, including the statements of the ’477 patent inventors, demonstrate that communication between busses that use different protocols, including CAN, FlexRay, and Lin, was known at the relevant time. *See Qualcomm Inc. v. Apple Inc.*, 24 F.4th 1367, 1376 (Fed. Cir. 2022) (stating that “a patentee’s admissions

about the scope and content of the prior art provide a factual foundation as to what a skilled artisan would have known at the time of invention”).

Based on the foregoing, we find persuasive Petitioner’s contentions that it would have been obvious to a person of ordinary skill in the art to implement Miesterfeld’s VDB 14 as any one of FlexRay, CAN, and LIN and to implement ITS data bus 24 as a different network from VDB 14 but chosen from FlexRay, CAN, and LIN.

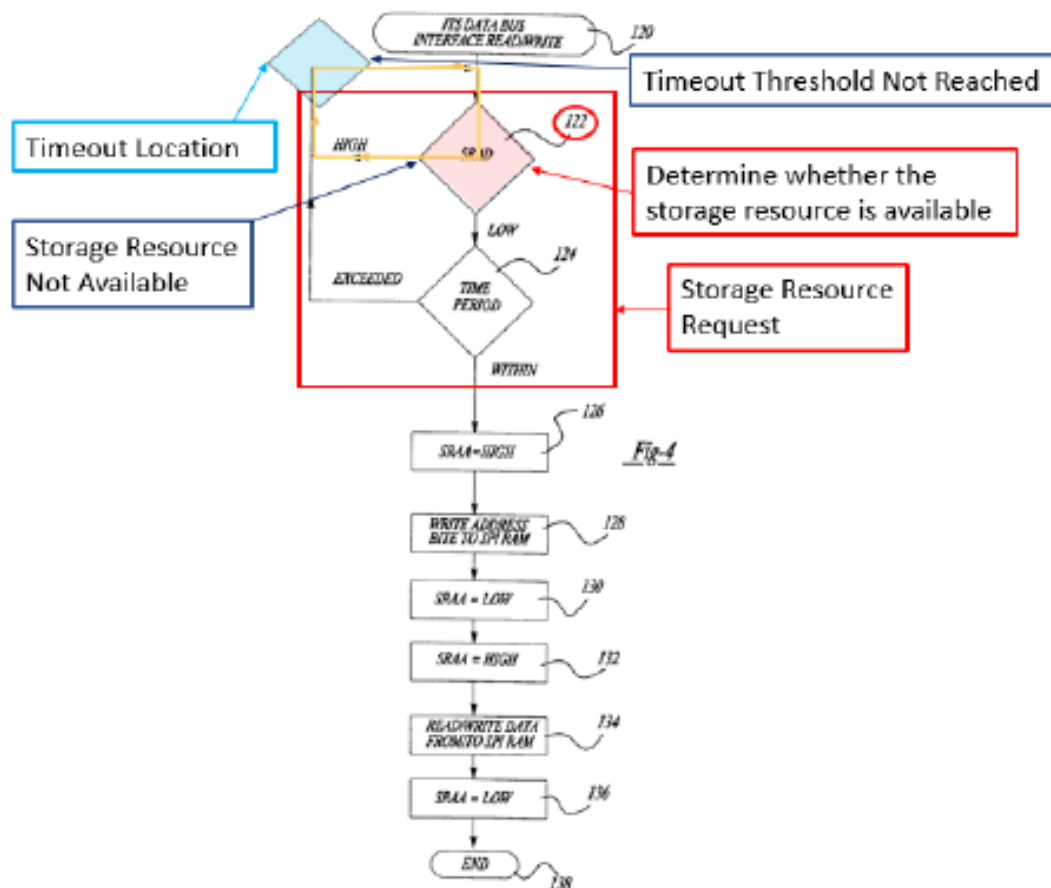
h) 1[g]–1[m]

Claim 1 recites that the non-volatile memory has instructions to perform the operations recited in limitations 1[g] through 1[m], which generally involve receiving information from the first network, storing the information, and sharing the information with a process associated with the second network utilizing a different protocol from the first network. Petitioner argues that Miesterfeld’s disclosure of a system that exchanges data between VDB 14 and ITS data bus 24 teaches much of this subject matter. *See* Pet. 40–56.

For recitation 1[g] (“receive information in the form of a packet data unit representing datum information carried by an overall message from a first physical network selected from the group consisting of FlexRay, Controller Area Network, and Local Interconnect Network”), Petitioner argues that Miesterfeld discloses receiving messages from either VDB 14 or ITS data bus 24 and that these messages would be packet data when VDB 14 and ITS data bus 24 are implemented as FlexRay, CAN, or LIN, as discussed in the preceding section, because these are packet networks. Pet. 40–44 (citing Ex. 1009, 1:62–2:15, 2:66–3:1, 3:18–25, 3:40–43, 3:59–64, Fig. 1; Ex. 1004 ¶¶ 93, 96, 97; Ex. 1020 ¶¶ 193–198, 201, 233, Fig. 31;

Ex. 1021, 8:52–53, 9:3–7, 12:60–64, Fig. 2; Ex. 1022, 3:16–17, 3:41–43, 3:50–55, Fig. 1).

To illustrate its contentions for recitations 1[h] through 1[l], Petitioner refers to Miesterfeld’s Figure 4, an annotated version of which is reproduced below.



Miesterfeld, FIG. 4 (annotated)

Pet. 53. Figure 4 of Miesterfeld is a flow diagram of the procedure for reading and writing data to a memory (Ex. 1009, 2:56–57), and Petitioner provides various annotations in the figure above.

In the annotated version of Miesterfeld’s Figure 4 reproduced above, Petitioner labels blocks 122 and 124 as “Storage Resource Request,” and Petitioner argues that “Miesterfeld’s ‘attempts to access [serial peripheral

interface random access memory (SPI RAM)] 64’ is a ‘storage resource request in connection with a storage resource,’” as recited in 1[h]. Pet. 45–46 (citing Ex. 1009, 3:64–66, 3:26–39; Ex. 1004 ¶ 100), 53. Petitioner argues that Miesterfeld’s test of the SPI RAM Access Denied (SRAD) line in block 122 “determine[s] whether the storage resource is available for storing the information,” as recited in 1[i]. Pet. 46–47.

For recitation 1[j] (“determine whether a threshold has been reached in association with the storage resource request”), Petitioner makes two arguments. First, Petitioner argues that determining whether a time period has been exceeded in block 124 of Miesterfeld’s Figure 4 teaches this subject matter. Pet. 48–49 (citing Ex. 1009, 6:40–45, Fig. 4; Ex. 1004 ¶ 102). For recitation 1[k], which is conditioned on “the threshold” in recitation 1[j], Petitioner does not rely on Miesterfeld’s block 124 threshold determination. Rather, Petitioner relies on its second position for how the threshold of 1[j] is met by the prior art. Pet. 52–53. Therefore, we do not address Petitioner’s first argument for recitation 1[j].

Second, Petitioner argues that it would have been obvious at the relevant time to include a timeout in the loop from block 122 in Miesterfeld’s Figure 4 so that, if the process using the memory does not or cannot relinquish it, then the requesting process does not continue spinning in the loop. Pet. 49–51 (citing Ex. 1012, 51–61, Table 6.1; Ex. 1009, 6:36–49, Fig. 4; Ex. 1004 ¶¶ 103–105). Petitioner illustrates this modification in its annotated version of Miesterfeld’s Figure 4, reproduced in the discussion above, by coloring the loop from block 122 yellow and illustrating a “Timeout Location” in that loop. Pet. 51 (reproducing annotation version of Miesterfeld’s Figure 4). In support of its obviousness position, Petitioner cites disclosures in Grattan regarding the benefits of timeouts to prevent

deadlocks and also cites testimony from its declarant, Dr. Madiseti. Pet. 49–51 (citing Ex. 1012, 51–61, Table 6.1; Ex. 1009, 6:36–49, Fig. 4; Ex. 1004 ¶¶ 103–105). Petitioner argues that, if the timeout has not been reached and the SRAD is high, the process of Figure 4 will look back to test the SRAD signal line again, thereby teaching recitation 1[k] (“in the event the storage resource is not available and the threshold associated with the storage resource request has not been reached, issue another storage resource request in connection with the storage resource”). Pet. 52.

Petitioner argues that Miesterfeld teaches recitation 1[l] (“in the event the storage resource is available, store the information in the storage resource”) by disclosing writing data to the SPI RAM in block 134 of Figure 4. Pet. 53–54 (citing Ex. 1009, 6:30–59, Fig. 4; Ex. 1004 ¶ 107); *see* Ex. 1009, Fig. 4 (block 134 (“READ/WRITE DATA FROM/TO SPI RAM”)).

For the operation of “shar[ing] the stored information with at least one of a plurality of heterogeneous processes including at least one process associated with a second physical network” in recitation 1[m], Petitioner argues that Miesterfeld discloses that “stored information is shared with a process associated with (e.g., communicating on) the other physical network by making the stored information accessible to the process through memory read/write operations.” Pet. 54–55 (citing Ex. 1009, 1:24–28, 1:62–2:15, 2:66–3:1, 3:18–25, 3:40–43, 3:59–64).

Patent Owner disputes Petitioner’s contentions with respect to recitation 1[h] (“in response to the receipt of the information, issue a storage resource request in connection with a storage resource”). In particular, Patent Owner argues that Petitioner’s contentions fail because “[t]esting the state of a signal line is not a request under any reasonable construction of

‘issue a storage resource request.’” PO Resp. 33. We disagree with Patent Owner’s argument. For the reasons discussed above in § II.C.1, we conclude that the phrase “issue a storage request” includes checking to see if the storage resource is available, which is what Miesterfeld discloses. With reference to Figure 4, Miesterfeld explains that, “[w]hen ITS data bus interface 58 attempts to access SPI RAM 64 such as for reading or writing ITS data bus interface 58 must first test the SRAD signal line as shown at block 122.” Ex. 1009, 6:33–36. If the SRAD signal is low, then the RAM is available, but if the SRAD signal is high, then the RAM is unavailable because the vehicle data bus (VDB) interface is accessing it. Ex. 1009, 6:36–40. This is consistent with the ’477 patent’s description of requesting a resource. In particular, for the store and retrieve procedures of Figures 10 and 11, respectively, the ’477 patent discloses that a resource request checks to see if the resource is available and, if it is available, the procedure gets the resource, or if not, it checks availability again. Ex. 1001, 7:52–60, 8:12–19, Figs. 10, 11. Each of Figures 10 and 11 has a decision block captioned “BB Resource Available ?.” Ex. 1001, Figs. 10 (block 1002), 11 (block 1103).

Patent Owner also argues that, even if Miesterfeld’s signal line test teaches issuing a request, it is not performed “in response to the receipt of the information,” as recited in limitation 1[h]. We disagree with this argument because, as Petitioner points out (Pet. Reply 11–12) Miesterfeld’s Figure 4 depicts a process by which the data bus accesses the memory to read from it or write to it, which means that the data bus, in the case of a write operation, received information to store. Ex. 1009, 6:31–33 (“FIG. 4 depicts a block diagram of the sequence for ITS data bus interface 62 reading/writing from/to SPI RAM 64.”).

Patent Owner also argues that the prior art does not teach sharing data between networks using different protocols and, therefore, that Petitioner's obviousness contentions for recitation 1[m] fail. PO Resp. 34–48. Our findings and conclusions in the preceding section regarding the use of different networks in Miesterfeld address Patent Owner's arguments as to recitation 1[m].

Based on Petitioner's persuasive contentions and evidence, discussed above, we conclude that the subject matter recited in limitations 1[g] through 1[m] would have been obvious to a person of ordinary skill in the art. In particular, Miesterfeld discloses a “a data exchange system between VDB 14 and ITS data bus 24.” Ex. 1009, 3:18–20. As Petitioner proposes and as discussed above, it would have been obvious to implement VDB 14 and ITS data bus 24 as FlexRay, CAN, or LIN. As discussed above, Miesterfeld's Figure 4 (as modified by Petitioner) shows how each data bus accesses and stores received information in the memory such that a data exchange between the busses can occur.

i) 1[n]

Claim 1 recites that the system comprises

interfaces for communication with each of FlexRay, Controller Area Network, and Local Interconnect Network networks, with each physical network in communication with a component including at least one of a sensor, an actuator, or a gateway, and with each of the FlexRay, Controller Area Network, and Local Interconnect Network interfaces comprising a corresponding network communication bus controller including a corresponding network communication bus driver.

Petitioner argues that it would have been obvious for Miesterfeld's modified system “to include interfaces for all three of FlexRay, CAN, and LIN because Miesterfeld contemplates that a vehicle may have three or more

systems needing to communicate with each other, and a vehicle may have all three of FlexRay, CAN, and LIN networks for controlling different groups of devices and vehicle systems.” Pet. 58–59 (citing Ex. 1009, 1:13–30, 3:2–8, 8:66–9:1; Ex. 1013, 11; Ex. 1004 ¶ 112). Petitioner further argues that “it would have been obvious to a [person of ordinary skill in the art] to implement Miesterfeld’s system such that each of the FlexRay, CAN, and LIN interfaces include a corresponding network communication bus controller including a corresponding network communication bus driver, as taught by Nikklason.” Pet. 59–60 (citing Ex. 1014, 4:17–19, 5:15, 7:28–32, 8:2, 9:8–11, Ex. 1004 ¶ 114); *see* Ex. 1004 ¶ 114 (“[T]he claim recites nothing more than using controllers and drivers which is the standard implementation that a [person of ordinary skill in the art] would expect.”).

Patent Owner contends that “Petitioner’s arguments fail for multiple reasons.” PO Resp. 49. For example, Patent Owner argues that “Wense discloses individual automotive busses and teaches that each bus has its specific uses and domains” but does not suggest, or provide a reason to include, interfaces to multiple networks on an ECU. PO Resp. 49 (citing Ex. 2001 ¶¶ 139–140, 150, 155–156, 174). And Patent Owner argues that “Miesterfeld does not disclose FlexRay, CAN or LIN, and does not disclose a system with three different networks in communication with a single ECU. Indeed, Miesterfeld’s memory is designed for at most two networks.” PO Resp. 51 (citing Ex. 2001 ¶ 179).

We disagree with Patent Owner’s arguments. As an initial matter, claim 1 does not require communication with three different networks. Rather, as Petitioner correctly points out, “claim 1 merely requires first and second networks including interfaces for each of FlexRay, CAN, and LIN to accommodate use of any of FlexRay, CAN, and LIN by the first and second

networks.” Pet. Reply 18. Furthermore, Patent Owner’s arguments fail to appreciate the combined teachings of the references. As discussed in detail above in § II.D.2.g, communication between different automotive networks was known at the relevant time, as evidenced by Miesterfeld. *See* Ex. 1009, 1:24–28 (“With the proliferation of electronic control systems, vehicle designers seek to facilitate data exchange within each respective control system and, optionally, between respective control systems.”). Furthermore, as Petitioner correctly points out (Pet. 58–59), Miesterfeld discloses various vehicle systems, such as engine and transmission, vehicle impact, and door lock networks. *See, e.g.*, Ex. 1009, 1:23–25 (“Other vehicle systems may[]be similarly controlled, such as transmission, instrumentation, vehicle impact systems, and the like.”), 3:5–9 (“VDB 14, and devices, 16, 18 are typically assembled as part of the vehicle and sold with the vehicle and control vehicle operations such as engine operation, transmission operation, instrumentation operation, and the like.”), 8:66–9:1 (disclosing “a request for a door lock command”). Wense discloses that CAN, FlexRay, and LIN correspond to the types of operations identified in Miesterfeld. For example, Wense discloses that CAN deals with the “engine control network,” that FlexRay deals with “safety control systems, such as braking and steering,” and that “[t]ypical applications for LIN are in the area of cost critical distributed body electronics,” such as a “complete door subsystem.” Ex. 1013, 11, 14. Thus, Wense discloses the well-known networks that would be used for the systems identified by Miesterfeld.

In view of these disclosures of Miesterfeld and Wense and other evidence of record regarding inter-network communication (*see* § II.D.2.g above), we agree with Petitioner that

it would have been obvious to include interfaces for all three of FlexRay, CAN, and LIN because Miesterfeld contemplates that a vehicle may have three or more systems needing to communicate with each other, and a vehicle may have all three of FlexRay, CAN, and LIN networks for controlling different groups of devices and vehicle systems.

Pet. 58–59. We find that the combined teachings of Miesterfeld and Wense, discussed above, would have suggested to a person of ordinary skill in the art interfaces to three networks such as FlexRay, CAN, and LIN. *See MCM*, 812 F.3d at 1294 (“[T]he test [for obviousness] is what the combined teachings of the references would have suggested to those of ordinary skill in the art.”).

Patent Owner also argues that “[n]othing in Nikklason relates to this limitation 1[n] at least because of Nikklason requires a single protocol for all components, while the limitation requires different protocols between all the components.” PO Resp. 52–53 (citing Ex. 2001 ¶ 183). But Petitioner relies on Nikklason to show that “a corresponding network communication bus controller including a corresponding network communication bus driver” was a well-known implementation for network interfaces “to help transfer messages across communication media.” Pet. 59 (citing Ex. 1004 ¶ 113). Thus, Petitioner does not rely on Nikklason for the purpose suggested in Patent Owner’s arguments. We find that Nikklason discloses a bus controller and a bus driver, specifically for CAN, but also suggests other bus types. Ex. 1014, 7:31–32 (“In case a CAN-bus (Controller Area Network) is used, the bus controller is a CAN-bus controller and the bus driver is a CAN-bus driver.”), 8:2 (“Clearly, other bus types can be employed . . .”). We agree with Petitioner’s contention that having a network communication bus controller with a network communication bus driver would have been an

obvious implementation. In doing so, we credit Dr. Madisetti's testimony that "the claim recites nothing more than using controllers and drivers which is the standard implementation that a [person of ordinary skill in the art] would expect" (Ex. 1004 ¶ 114) because it is consistent with the evidence of record, including the disclosure of Nikklason discussed above. *See* Pet. 60 (discussing other evidence of device drivers).

Based on Petitioner's persuasive contentions and evidence, discussed above, we conclude that the subject matter recited in limitation 1[n] would have been obvious to a person of ordinary skill in the art.

j) 1[o]

Claim 1 further recites

the interfaces including a first communication interface for interfacing with the first physical network, the first communication interface including a first communication interface-related data link layer component, said first communication interface configured to extract variables from the overall message communicated by the first physical network employing a first protocol and storing the packet data unit representing the datum information carried by the overall message from a first physical network in the database.

Petitioner argues that Miesterfeld's modified system has data link layer components to get information into and off the physical layer. Pet. 61–62. According to Petitioner, "a fundamental and required component of systems implementing FlexRay, CAN, and LIN included a communication interface-related data link layer component to get information onto/off of the physical layer." *See* Pet. 61–62 (citing Ex. 1009, Fig. 1; Ex. 1044, 5–6, 10–13, 20; Ex. 1045, 3–11, Ex. 1046, 1, 5, 7, 9; Ex. 1020 ¶¶ 542, 544; Ex. 1021, Figs. 9–10; Ex. 1022, Figs. 1–2; Ex. 1013, 10–13; Ex. 1052, 1:21–32, 3:39–57, 4:9–25, 5:27–6:39, Fig. 6; Ex. 1003, 7, Fig. 2; Ex. 1004 ¶ 116).

Petitioner argues that Miesterfeld teaches that the interface is “configured to extract variables” and store data in the database, citing Miesterfeld’s disclosure of examining data to determine where to store it. Pet. 62 (citing Ex. 1009, 3:18–25, 3:40–49, 4:6–17; Ex. 1004 ¶ 117).

In its post-institution briefing, Patent Owner does not dispute Petitioner’s contentions for recitation 1[o]. *See* PO Resp.

Petitioner’s contentions and evidence, summarized above, are persuasive. The evidence cited above supports Petitioner’s contention that “systems implementing FlexRay, CAN, and LIN included a communication interface-related data link layer component to get information onto/off of the physical layer.” *See* Pet. 61. For example, Forest¹⁵ describes a “FlexRay communication Controller-Host Interface (CHI)” that “is the interface between the higher layers and the data link layer.” Ex. 1020 ¶¶ 541–542. We also agree with Petitioner’s assertion that Miesterfeld teaches extracting variables and storing data in the database. *See* Pet. 62. For example, Miesterfeld discloses the following:

VDB interface 62 controls data flow between VDB 48 and SPI RAM 64. In particular, VDB interface 62 *examines data* on VDB 48 to determine if it is pertinent to ITS data bus 56 and to determine the appropriate location in SPI RAM 64 to write the data. In such instances, *VDB interface 62 writes its data to a selected, specific memory location.*

Ex. 1009, 4:11–17 (emphasis added).

Having considered the full trial record, we conclude that the subject matter of recitation 1[o] would have been obvious to a person of ordinary skill in the art.

¹⁵ EP 1 355 456 A1, published Oct. 22, 2003 (Ex. 1020).

k) 1[p]

Claim 1 further recites “a second communication interface for interfacing with the second physical network utilizing a protocol different than the protocol of the first physical network, the second communication interface including a second communication interface-related data link layer component.” Petitioner refers to its contentions for recitation 1[m] regarding the use of different networks and protocols and argues that

it would have been obvious to implement ITS data bus interface 28 to interface with the ITS data bus 24 using a protocol different than the protocol of the VDB 14 to enable data exchange accounting for and facilitate vehicle communication and control across different groups of devices and vehicle systems.

Pet. 63–64 (citing Ex. 1009, 1:13–30, 3:2–8, 8:66–9:1; Ex. 1013, 11; Ex. 1047 ¶¶ 31, 40, 48; Ex. 1052, 1:27–32, 3:49–57; Ex. 1004 ¶ 119). Petitioner further argues that a person of ordinary skill in the art “would understand that the ITS data bus interface 28 would include a communication interface-related data link layer component.” Pet. 64 (citing Ex. 1044, 5–6, 10–13, 20; Ex. 1045; Ex. 1046, 1, 5, 7, 9; Ex. 1020, 117; Ex. 1021, Figs. 9–10; Ex. 1022, Figs. 1–2; Ex. 1013, 10–13; Ex. 1052, 1:21–32, 3:39–57, 4:9–25, 5:27–6:39, Fig. 6; Ex. 1003, 7; Ex. 1004 ¶ 119).

Patent Owner refers to its arguments for recitation 1[m]. PO Resp. 54. For the reasons discussed above in § II.D.2.g, we find persuasive Petitioner’s contentions that it would have been obvious to a person of ordinary skill in the art to implement Miesterfeld’s VDB 14 as any one of FlexRay, CAN, and LIN and to implement ITS data bus 24 as a different network from VDB 14 but chosen from FlexRay, CAN, and LIN. We also find persuasive Petitioner’s contention that the communication interface would include a communication interface-related data link layer component.

See Pet. 64; Ex. 1004 ¶ 119 (Dr. Madisetti testifying that a person of ordinary skill in the art “would understand that the ITS data bus interface 28 would include a communication interface-related data link layer component.”).

Having considered the full trial record, we conclude that the subject matter of recitation 1[p] would have been obvious to a person of ordinary skill in the art.

l) 1[q]

Claim 1 further recites that “the automotive electronic control unit is configured such that the stored information may be shared with the second physical network by replicating the packet unit data obtained from the first physical network by composing another message configured to be communicated using the different protocol of the second physical network.” Petitioner argues that Miesterfeld’s disclosure of preparing a VDB message for transmission teaches “composing another message,” as recited in the claim. Pet. 65–66 (citing Ex. 1009, 3:18–4:21, 8:35–38; Ex. 1004 ¶¶ 121–122). Petitioner also cites the ’018 provisional application to show that translating between different network protocols was known. Pet. 64–65 (citing Ex. 1003, 2–3, 6–7).

Patent Owner argues that Petitioner relies only on Miesterfeld to teach the subject matter of recitation 1[q] but that Miesterfeld’s VDB and ITS data bus operate using the same protocol. PO Resp. 54. We disagree with Patent Owner’s argument because Petitioner’s contentions are based on the combined teachings of the references. Indeed, Petitioner begins its contentions for recitation 1[q] by arguing that “Miesterfeld’s *modified* gateway receives data and commands.” Pet. 64 (emphasis added). As

discussed above in § II.D.2.g, the evidence demonstrates that it would have been obvious for the first and second networks to use different protocols.

Petitioner's contentions and evidence, summarized above, are persuasive. In particular, as discussed above in § II.D.2.h, Petitioner demonstrates that "shar[ing] the stored information" with a process on the second network, as recited in limitation 1[m], would have been obvious. As Petitioner correctly asserts (Pet. 65), Miesterfeld discloses preparing a VDB message for transmission. Ex. 1009, 8:35–38. Furthermore, as discussed in detail in the Institution Decision, the '018 provisional application indicates that a known way to communicate between networks was to compose messages by adding header information for various layers so that they can be transmitted to other networks. *See* Inst. Dec. 41–42. In particular, the '018 provisional application discloses the following background as the state of the art at that time:

To implement this inter-network communication, the industry has defined several types of gateways or bridges. This approach involves translation of the various network protocol layers from one form to another, see figure 2. Following the classical approach of digital communications, in each step towards abstraction from the physical transportation layer, the protocol stack adds an additional header to the message sent through the network.

Ex. 1003, 3. Referring to its Figure 2 (not shown), the '018 provisional application further states that, in "the well-known OSI data communication process," the "layers are represented in a message by 'header' bits that contain information about that layer of the network being used to send the message." Ex. 1003, 7. "To communicate between two heterogeneous networks, this process must then be repeated in reverse by adding back the header information for the various layers of the second network, and

eventually putting the message onto the second network's physical link.”

Ex. 1003, 7. Thus, the state of the art described in the '018 provisional application supports Petitioner's contention that inter-network messaging was well-known at the relevant time.

Having considered the full trial record, we conclude that the subject matter of recitation 1[q] would have been obvious to a person of ordinary skill in the art.

m) Claim 1 Conclusion

For the reasons discussed above, Petitioner has proven by a preponderance of the evidence that the subject matter of claim 1 would have been obvious to a person of ordinary skill in the art.

3. Independent Claims 12, 23, 30

Independent claim 12 is directed to “[a] layered system for sharing information in an automobile vehicle,” and it recites subject matter similar to claim 1 and also recites Media Oriented Systems Transport (MOST) as one of the available networks and interfaces, in addition to FlexRay, CAN, and LIN. Petitioner argues that MOST was a known substitute for D²B, which Miesterfeld identifies as an ITS data bus, and that it would have been obvious to use MOST in the system of Miesterfeld. Pet. 69–70 (citing Ex. 1013, 11; Ex. 1009, 9:55–58; Ex. 1047 ¶¶ 31, 40, 48; Ex. 1052, 1:21–32; Ex. 1004 ¶ 128); *see* Ex. 1013, 11 (identifying MOST, D2B, and FireWire protocols as “the top candidates in the area of Infotainment”).¹⁶ Independent

¹⁶ Although claim 12 recites MOST as one network option, claim 12 affirmatively claims interfaces only for FlexRay, CAN, and LIN. Claim 12 later recites “with each of the FlexRay, Controller Area Network, Local Interconnect Network and *Media Oriented Systems Transport interfaces* comprising a corresponding network communication bus controller including a corresponding network communication bus driver” (emphasis

claims 23 and 30 recite subject matter similar to claim 1, and Petitioner refers to its contentions for claim 1. Pet. 71–73.

Patent Owner does not raise additional arguments concerning these claims but, rather, argues that Petitioner’s contentions fail for the reasons addressed above with respect to claim 1. *See* PO Resp. 59–60.

Having considered the full record developed during trial, we are persuaded by Petitioner’s contentions and evidence, and we conclude that the subject matter of claims 12, 23, and 30 would have been obvious to a person of ordinary skill in the art.

4. Claims 2, 13, 24

Claims 2 and 13 depend, respectively, from claims 1 and 12 and recite that “the memory comprises at least one bulletin board that stores information that may be addressed by any process of any network having access to the storage resource of the electronic control unit.” Claim 24 depends from claim 23 and recites that “the non-volatile memory comprises at least one bulletin board that includes the stored information that is capable of being accessed by any process of any network having access to the electronic control unit.”

Petitioner argues that Miesterfeld’s disclosure of memory 30 teaches this subject matter because both VDB 14 and ITS data bus 24 can store information in memory 30 and retrieve information from it. Pet. 66–67 (citing Ex. 1009, 3:18–4:31; Ex. 1004 ¶ 123), 70, 73.

added). To the extent a MOST interface is required in claim 12, we conclude that such an interface would have been obvious with the use of the well-known MOST protocol. *See* Pet. 57–60, 69–70.

Patent Owner argues as follows: “Petitioner cites and relies upon its proposed construction of ‘bulletin board.’ Petitioner’s construction of the term and the limitation are faulty, and Petitioner has not made any argument under the correct construction of the term.” PO Resp. 56; *see* PO Sur-reply 21 (“Patent Owner’s sole argument as to Claim 2 was that the Petition did not consider the correct construction of the term ‘bulletin board.’”).

Petitioner responds that, “even if the Board were to find that the claim requires [Patent Owner]’s construction, Miesterfeld still discloses it because Miesterfeld discloses a database and databases include a data structure.” Pet. Reply 21 (citing Ex. 1009, 3:18–4:31; Ex. 1054, 46:19–48:12).

We find that the asserted prior art teaches the additional subject matter of claims 2, 13, and 24 under either party’s proposed construction. Petitioner’s declarant, Dr. Madisetti, testifies that Miesterfeld’s disclosure teaches that “any network connected to ITS gateway 10 has access to the memory 30 in the ITS gateway 10 and can store data in or retrieve data from the database stored therein.” Ex. 1004 ¶ 123. We credit this testimony because it is consistent with Miesterfeld’s disclosure that “[m]emory 30 is accessible to both VDB interface 26 and ITS data bus interface 28 so that each interface will be able read from and/or write to memory 30.” Ex. 1009, 3:41–43, *quoted in* Pet. 67; *see also* Ex. 1009, 3:20–25 (disclosing that “a vehicle data bus (VDB) interface 26 reads and writes data from VDB 14” and that “ITS data bus interface 28 enables data exchange between memory 30 and ITS data bus 24”). We find that Miesterfeld teaches the additional subject matter of claims 2, 13, and 24 under Petitioner’s construction that the bulletin board is a database. Patent Owner does not dispute that Miesterfeld

teaches a database; instead, Patent Owner disagrees with this proposed construction. PO Resp. 56.

We also find that Miesterfeld teaches a “data structure” under Patent Owner’s proposed construction of “bulletin board” because a database has a data structure. *See* Pet. Reply 21 (citing Ex. 1009, 3:18–4:31; Ex. 1054, 46:19–48:12). This finding is supported by the following testimony from Patent Owner’s declarant, Dr. Miller:

A database is a specific way of storing data. And it uses specific data structures for doing that. So a database may not use all data structures that exist in the world, but it’s going to use specific data structures so that the data is organized in a specific way.

Ex. 1054, 48:7–12. Dr. Miller also testifies that “a data structure is a very broad term that can refer to many different ways of structuring data.”

Ex. 1054, 46:11–13. Miesterfeld gives examples of how data can be organized in memory 30 (Ex. 1009, 3:26–41), further demonstrating that Miesterfeld teaches a “data structure” under Patent Owner’s and Dr. Miller’s understanding.

Patent Owner also argues that claim 24 differs from claims 2 and 13 in requiring the bulletin board to include “the stored information,” as opposed to “information,” and that Petitioner’s contentions fail to address this difference in claim language. PO Resp. 63–64 (argument as to claim 28). We disagree because Petitioner’s contention is that VDB 14 and ITS data bus 24 stored the information that is received in the database (bulletin board). Therefore, Petitioner’s contentions account for the “stored information” language of claim 24.

Having considered the full trial record, we conclude that the subject matter of claims 2, 13, and 24 would have been obvious to a person of ordinary skill in the art.

5. Claims 3, 14, 25

Claims 3, 14, and 25 depend, respectively, from claims 2, 13, and 24 and recite that “a complexity of the bulletin board grows linearly with a number of networks.” Petitioner argues that, because Miesterfeld uses a common, shared storage that is connected to all system networks, as in the ’477 patent, a complexity of the bulletin board grows linearly with a number of networks. Pet. 67–68 (citing Ex. 1001, 7:1–7; Ex. 1004 ¶ 124).

Patent Owner argues that “claim 3 requires that the complexity of the bulletin board grows linearly with at least three networks” because claim 1, from which claim 3 ultimately depends, “requires that at least the three networks FlexRay, CAN and LIN be interfacing with the memory and be able to store information and share the stored information.” PO Resp. 56.

We disagree with Patent Owner’s argument because claim 1 and the other independent claims require only two networks – “first physical network” and “second physical network.” Claims 1 and 12 require “interfaces for communication with each of FlexRay, Controller Area Network, and Local Interconnect Network networks” to account for the fact that the first and second networks are selected from among these network types, as previously recited in the claims. The recitation of these interfaces, however, does not impose a requirement that the bulletin board must be accessible to three networks.

Patent Owner also argues that, “[c]ontrary to Petitioner’s assertion, the ’477 Patent does not say that a bulletin board automatically includes the limitation of claim 3.” PO Resp. 57. According to Patent Owner, “the

bulletin board approach disclosed in the specification” has this complexity characteristic, “as opposed to a bulletin board whose complexity grows as $N*(N-1)$, which is polynomial and not linear.” PO Resp. 57 (citing Ex. 2001 ¶ 199).

We disagree with this argument for two reasons. First, the ’477 patent does not distinguish its bulletin board approach from other bulletin boards in this regard. Rather, the ’477 patent states the bulletin board approach has a linearly increasing complexity, “as opposed to as [sic] $N(N-1)$ for the *gateway approach*.” Ex. 1001, 7:3–8 (emphasis added). Thus, contrary to Patent Owner’s argument, the ’477 patent distinguishes the bulletin board approach from the gateway approach. Second, Petitioner does not rely on the presence of a bulletin board alone to teach the subject matter of claim 3. Rather, Petitioner argues that, “like the ’477 patent, Miesterfeld’s modified gateway (which stores a database) comprises a bulletin board that ‘uses a common, or shared storage system that is connected to all of the system networks through network interfaces,’ and thus its complexity grows linearly with a number of networks, as claim 3 recites.” Pet. 67–68 (citing Ex. 1004 ¶ 124). The ’477 patent states that its bulletin board “approach uses a common, or shared storage system that is connected to all of the system networks through network interfaces” and that “[a] critically important feature of the bulletin board approach is that the complexity of the bulletin board grows linearly with the number of networks.” Ex. 1001, 7:1–8. Thus, Petitioner argues that Miesterfeld discloses the same common, shared storage system as the ’477 patent and, therefore, would exhibit the same complexity that is tied to such an arrangement. Pet. 67–68 (citing Ex. 1004 ¶ 124).

Patent Owner also argues that “any discussion of complexity scaling is purely speculative” with respect to Miesterfeld because it discloses only two networks. PO Resp. 57 (citing Ex. 2001 ¶ 200). The claim, however, only requires two networks. Therefore, we need not speculate on complexity with a larger number of networks, as Patent Owner does. *See* PO Resp. 57–58.

We find persuasive Petitioner’s contention that Miesterfeld’s disclosure of a shared, common storage bulletin board teaches that “a complexity of the bulletin board grows linearly with a number of networks,” as recited in claims 3, 14, and 25. In so finding, we credit Dr. Madisetti’s testimony that, “like the ’477 patent, Miesterfeld’s modified gateway (which stores a database) comprises a bulletin board that ‘uses a common, or shared storage system that is connected to all of the system networks through network interfaces’ and thus its complexity grows linearly with a number of networks.” Ex. 1004 ¶ 124.

Having considered the full trial record, we conclude that the subject matter of claims 3, 14, and 25 would have been obvious to a person of ordinary skill in the art.

6. Claims 6, 7, 17, 18

Claims 6 and 17 depend, respectively, from claims 1 and 12 and recite that “at least one of the first and the second physical networks is a multiplexing bus.” Claims 7 and 18 depend, respectively, from claims 1 and 12 and recite that “each of the first and the second physical networks is a multiplexing bus.”

Petitioner argues that its asserted combination teaches the subject matter of these claims because FlexRay, CAN, and LIN are multiplexing bus

systems, as acknowledged in the '477 patent. Pet. 68 (citing Ex. 1001, 2:64–66; Ex. 1004 ¶¶ 125–126).

Patent Owner does not dispute Petitioner's contentions for claims 6, 7, 17, and 18. *See* PO Resp.

We agree with Petitioner's contentions because, as discussed above with respect to claim 1, the asserted prior art combination teaches FlexRay, CAN, and LIN networks, which are multiplexing bus systems as acknowledged in the '477 patent. *See* Ex. 1001, 2:62–3:2 (disclosing “wired serial multiplexing bus-systems such as Controller Area Network (CAN or ISO11898), Flexray, LIN, . . . MOST”).

Having considered the full trial record, we conclude that the subject matter of claims 6, 7, 17, and 18 would have been obvious to a person of ordinary skill in the art.

7. Claims 8, 19

Claims 8 and 19 depend, respectively, from claims 1 and 12 and recite “wherein neither the first nor the second physical network is a multiplexing bus.” Petitioner argues that Miesterfeld discloses that there can be only one device on the VDB and the ITS data bus, in which case each of these busses “function[s] as a discrete and dedicated non-multiplexing bus.” Pet. 69 (citing Ex. 1009, 3:2–5, 3:54–58; Ex. 1004 ¶ 127), 70.

As we stated in the Institution Decision, there is an apparent inconsistency between claims 1 and 8 because “[i]ndependent claim 1 limits the first and second physical networks to FlexRay, CAN, [and] LIN,” all of which “[t]he '477 patent identifies . . . as ‘multiplexing bus-systems.’” Inst. Dec. 46 (citing Ex. 1001, 2:60–3:2 (disclosing “wired serial multiplexing bus-systems such as Controller Area Network (CAN or ISO11898), Flexray, LIN”)). Yet, claim 8 “prohibit[s] the first and second physical networks

from being multiplexing busses, which directly contradicts the requirement of independent claim[] 1 . . . to select from a group consisting of multiplexing busses.” Inst. Dec. 46. We noted the same inconsistency between claims 12 and 19. Inst. Dec. 46. Despite this inconsistency, we stated that,

[t]o the extent claims 8 and 19 encompass a situation where only one device is connected to each network, we are persuaded that Miesterfeld can have such a configuration, even if it can have multiple devices as well, because Miesterfeld indicates that there can be one or multiple devices connected to each of the VDB and the ITS data bus.

Inst. Dec. 46–47 (citing Pet. 69; Ex. 1009, 3:2–5, 3:54–58).

In its post-institution briefing, Patent Owner does not dispute Petitioner’s contentions for claims 8 and 19, nor did Patent Owner respond to the Institution Decision’s discussion of the inconsistency between claims 8 and 19 and their respective base claims. *See* PO Resp.

We maintain our determination from the Institution Decision. Miesterfeld discloses that “VDB 14 provides a mechanism for data exchange between *one* or plurality of devices 16, 18, one or both of which write data to or read data from VDB 14.” Ex. 1009, 3:2–5 (emphasis added), *cited in* Pet. 69. Miesterfeld also discloses that, “as described with respect to FIG. 1, vehicle 42 may include *one* or more ancillary control devices 50, 52,” which “exchange data via an intelligent transportation system (ITS) data bus 56.” Ex. 1009, 3:54–58 (emphasis added), *cited in* Pet. 69. We find that Miesterfeld’s disclosure that there can be one device on each of the VDB and the ITS data bus teaches the additional subject matter recited in claims 8 and 19.

Having considered the full trial record, we conclude that the subject matter of claims 8 and 19 would have been obvious to a person of ordinary skill in the art.

8. Claim 29

Claim 29 depends from claim 24 and recites that the system is configured to have “at least one of” numerous listed features, including that “the first physical network includes the FlexRay network.” Petitioner refers to its contentions for claim 1’s recitation that “a first physical network selected from the group consisting of FlexRay, [CAN], and [LIN].” Pet. 73. Apart from its arguments with respect to claims from which claim 29 depends, Patent Owner does not separately dispute Petitioner’s contentions for claim 29. We find that Petitioner’s showing for the independent claims meets the “FlexRay” recitation for claim 29, which only requires one of the options listed.

Having considered the full trial record, we conclude that the subject matter of claim 29 would have been obvious to a person of ordinary skill in the art.

*E. Obviousness over Miesterfeld, Wong,
Grattan, Wense, Nikklason, and Boling
(Claims 4, 5, 15, 16, 26, 27)*

Claim 4 depends from claim 1 and recites “wherein the electronic control unit comprises code for the electronic control unit to run in a diagnostic mode that allows inspection of the system, while the electronic control unit is running.” Claim 5 depends from claim 4 and recites “wherein the electronic control unit comprises code for the electronic control unit to additionally run in a debugging mode.” Claims 15 and 26 depend, respectively, from claims 12 and 23 and recite subject matter similar to

claim 4. Claims 16 and 27 depend, respectively, from claims 15 and 26 and recite subject matter similar to claim 5.

Petitioner relies on Boling’s disclosures of Windows CE functionality that allows systems to be diagnosed while running and to be debugged, and argues that it would have been obvious to implement such features in the modified Miesterfeld system. Pet. 74–76 (citing Ex. 1016, 14, 17, 22¹⁷; Ex. 1004 ¶¶ 136–137). In particular, for the “diagnostic mode” claims, Petitioner relies on Boling’s disclosures relating to testing the system, including some operations that Boling describes as debugging. Pet. 74–75 (citing Ex. 1016, 14, 17; Ex. 1004 ¶ 136). For the “debugging claims,” Petitioner cites Boling’s disclosure that Windows CE has a “FileSys” program that determines if the system is connected to a debugging station. Pet. 75–76 (citing Ex. 1016, 22; Ex. 1004 ¶ 137).

Patent Owner argues that “Boling discusses only debugging, and never mentions any diagnostic mode.” PO Resp. 60. During the trial, Patent Owner initially argued that “diagnostic mode” means “a mode, distinct from normal operation, that allows the inspection of the *health* of the system while it is running.” PO Resp. 12 (emphasis added). In a later paper, Patent Owner clarified that “nothing turns on whether the word ‘health’ is included in the construction so long as it is clear that a diagnostic program determines whether a system is operating properly.” PO Sur-reply 24. According to Patent Owner, therefore, “[d]iagnostics determines whether a system is operating properly.” PO Sur-reply 25. Patent Owner contends that

¹⁷ Petitioner’s citation to pages 909–910 of Boling appears to be in reference to Exhibit 1032, which is a 942-page exhibit. The quoted material appears on page 22 of Exhibit 1016.

“Petitioner does not point to anything that suggests that what Bolling referred to as ‘debugging’ is or includes what the ‘477 Patent meant by ‘diagnostic mode.’” PO Resp. 60.

We disagree with Patent Owner and, instead, find that Boling’s debugging disclosures teach diagnostics that determine whether a system is operating properly. Boling discloses Windows CE debugging and states that “debugging on the remote system is the only way to truly test your program” and that “nothing replaces testing on the target system.” Ex. 1016, 14, *quoted in* Pet. 74–75. System testing is performed to determine whether the system is operating properly, which meets Patent Owner’s proposed interpretation of diagnostics. Furthermore, Boling discloses that such diagnostics are performed by “step[ping] though code *running* on a remote system.” Ex. 1016, 14 (emphasis added). Therefore, in the modified Miesterfeld system, the diagnostics mode is used “while the electronic control unit is running,” as recited in the claims.

Patent Owner argues that, “even if Bolling’s ‘debugging’ included a diagnostic mode, Bolling would still be debugging or diagnosing the software, and not ‘the system’ which claim 4 requires.” PO Resp. 61. We disagree with this argument because, as Petitioner correctly points out, “software is part of and executed by the system; thus, debugging system software constitutes debugging the system.” Pet. Reply 24. The claims recite that the diagnostic mode “allows inspection of the system,” but they do not require any particular extent of inspection. The Specification of the ‘477 patent contains scant disclosure of a “diagnostic mode,” mentioning only that “[t]he emergency or debug mode lets the network run in a fail-safe reduced operation mode or in a diagnostic mode that allows inspection of the system, while it is running.” Ex. 1001, 11:36–39. The Specification

contains no further disclosure of what a diagnostic mode is or how it operates. We do not highlight this lack of disclosure to suggest that the '477 patent's description of the "diagnostic mode" is deficient but, rather, to show that this feature was so well-known that, little if any description was required for the person of ordinary skill in the art. This supports Petitioner's contention that it was well-known that operating systems like Windows CE provide a diagnostic mode. *See* Pet. 74. In this regard, the situation here is similar to the one in *Uber Technologies, Inc. v. X One, Inc.*, 957 F.3d 1334 (Fed. Cir. 2020). In finding obviousness when there were a limited number of options (server-side plotting and terminal-side plotting), the Federal Circuit noted that "the alleged novelty of the [challenged] patent is not related to the differences between server-side or terminal-side plotting" and that "[t]he specification of the [challenged] patent is *entirely silent* on how to transmit user locations and maps from a server to a user's mobile device, suggesting that a person of ordinary skill in the art was more than capable of selecting between the known methods of accomplishing this." *Uber*, 957 F.3d at 1339 (emphasis added). Here, the '477 patent is entirely silent on how to implement a diagnostic mode, suggesting at the very least that this was a well-known feature of operating systems, as Petitioner contends. *See* Pet. 74.

As noted above, for claim 5 and the other claims reciting "debugging," Petitioner cites Boling's disclosure that Windows CE has a "FileSys" program that determines if the system is connected to a debugging station. Pet. 75–76 (citing Ex. 1016, 22; Ex. 1004 ¶ 137). In particular, Petitioner argues that "Boling further teaches that the 'FileSys' program of Windows CE 'looks to see whether the system is connected to a debugging station, which is a PC running a program named CESH.' Boling, 22."

Pet. 75. Patent Owner's declarant, Dr. Miller, provides the following testimony regarding this disclosure of Boling:

None of the Petitioner's citations to Bolling, the only prior art cited by Petitioner in support of claim 5, refers to having the ECU or other host system being run in a debugging mode. The various citations to Bolling (Ex.1016 at 22 and Ex.1032 at 909-910) indicate only that there is a debugging process available which appears to be directed at debugging the Windows CE software, but nothing that would cause an ECU to run in a debugging mode.

Ex. 2001 ¶ 216. Patent Owner similarly argues that "Bolling shows debugging of the Windows CE software, but does not show any host system, much less an ECU, being run *in* a debugging mode." PO Resp. 62. Dr. Miller's testimony and Patent Owner's argument support Petitioner's contentions by showing that the cited disclosure of Boling teaches a debugging process. We fail to see a distinction between running a debugging process and running in a debugging mode. Dr. Miller testified that

"[d]ebugging is a term used by programmers to fix bugs in a system. . . . And to be able to identify a bug and then fix it, you have to be able to run the program, see what's wrong with it, make a potential fix, and then test it to see if that's going to fix the bug."

Ex. 1054 (also filed as Ex. 2010), 64:13–21, *quoted in* PO Sur-reply 25. Patent Owner argues that "[t]here is nothing in the intrinsic record that suggests that the inventors were acting as lexicographers to redefine the terms 'diagnostics' and 'debugging' as those terms were used by persons skilled in the art." PO Sur-reply 26. Thus, according to Dr. Miller's explanation that debugging involves running a program to see what is wrong and fix it, Boling's disclosure of a debugging process teaches what is

required of the claims. In Petitioner’s proposed combination, Miesterfeld’s gateway with Windows CE would have debugging capability.

Based on Petitioner’s persuasive contentions and evidence, and for the reasons explained above, we conclude that the subject matter of claims 4, 5, 15, 16, 26, and 27 would have been obvious to a person of ordinary skill in the art.

*F. Obviousness over Miesterfeld, Wong,
Grattan, Wense, Nikklason, and Steger
(Claims 9, 20)*

Claims 9 and 20 depend, respectively, from claims 1 and 12, and recite “wherein the automotive electronic control unit comprises digital input/output, an analog to digital converter, and a digital to analog converter.” Petitioner argues that “[t]hese features of an automotive ECU were well-known at the relevant time, as evidenced by, e.g., Steger (Ex-1017).” Pet. 76. Petitioner argues that

[i]t would have been obvious to a [person of ordinary skill in the art] to implement Miesterfeld’s system to include digital input/output, an analog to digital converter, and a digital to analog converter to allow for “a suite of sensors [to] be fielded” to facilitate information transfer by enabling the system to “support a heterogeneous plurality of interfaces without having to include a heterogeneous set of interface hardware components,” as taught by Steger, ¶156.

Pet. 78 (third alteration added by Petitioner) (citing Ex. 1004 ¶ 141).

Apart from its arguments with respect to independent claims 1 and 12, which we address above, Patent Owner does not address Petitioner’s contentions for claims 9 and 20 in its post-institution briefing. *See* PO Resp. 62 (“These are dependent claims and are not obvious because the claims from which these claims depend are not obvious.”).

Petitioner's contentions are persuasive. As Petitioner points out (Pet. 76–78), Miesterfeld discloses that vehicle systems receive input from various devices and sensors (Ex. 1009, 1:18–48), and Steger discloses signals from sensors can be communicated via a carrier over a network such as CAN (Ex. 1017 ¶¶ 9, 95). Steger also discloses that the sensors connect to the carrier via measurement modules, which have digital and analog input and output and can perform analog-to-digital and digital-to-analog conversion (Ex. 1017 ¶¶ 156, 270). Steger discloses that its configuration allows “a suite of sensors . . . [to] be fielded” and “support[s] a heterogeneous plurality of interfaces without having to include a heterogeneous set of interface hardware components.” Ex. 1017 ¶ 156. Based on these disclosed benefits of providing digital and analog input and output and analog-to-digital and digital-to-analog conversion capabilities, we agree with Petitioner that it would have been obvious to combine these teachings with Miesterfeld's system. *See* Pet. 76–78; Ex. 1004 ¶¶ 139–141.

Having considered the full trial record, we conclude that the subject matter of claims 9 and 20 would have been obvious to a person of ordinary skill in the art.

*G. Obviousness over Miesterfeld, Wong,
Grattan, Wense, Nikklason, and Stanley
(Claims 10, 21)*

Claims 10 and 21 depend, respectively, from claims 1 and 12, and recite “wherein the automotive electronic control unit comprises a real time clock and a watchdog.” Petitioner cites Stanley's disclosures of a watchdog timer and a real time clock and argues that

[i]t would have been obvious to a [person of ordinary skill in the art] to implement Miesterfeld's system with a watchdog timer to detect catastrophic conditions (e.g., hardware failure) based on

system inactivity and a real-time clock can commence the reading of transducers (i.e., sensors) and other operations at desired times, as taught by Stanley.

Pet. 78–79 (citing Ex. 1018, 2:4–13, 3:20–27, 3:39–62; Ex. 1004 ¶ 142).

Apart from its arguments with respect to independent claims 1 and 12, which we address above, Patent Owner does not address Petitioner’s contentions for claims 10 and 21 in its post-institution briefing. *See* PO Resp. 63 (“These are dependent claims and are not obvious because the claims from which these claims depend are not obvious.”).

Petitioner’s contentions are persuasive. Stanley discloses that,

[i]n most computer systems, mechanisms are provided for providing an interrupt in response to either a watchdog timer or a real time clock time-out. The watchdog timer is utilized to indicate catastrophic conditions such as a time out without any event taking place in the computer system, whereas the real time clock is utilized to provide time outs in order to command the commencement or termination of a particular event.

Ex. 1018, 2:6–13, *quoted in* Pet. 78. We agree with Petitioner that, based on Stanley’s disclosure regarding the inclusion of a watchdog timer and a real time clock in most computer systems, it would have been obvious to combine these teachings with Miesterfeld’s system. *See* Pet. 78–79; Ex. 1004 ¶ 142.

Having considered the full trial record, we conclude that the subject matter of claims 10 and 21 would have been obvious to a person of ordinary skill in the art.

*H. Obviousness over Miesterfeld, Wong, Grattan,
Wense, Nikklason, Boling, Steger and Stanley
(Claims 11, 22)*

Claims 11 and 22 depend, respectively, from claims 2 and 12, and recite various features that have been addressed above for other claims, such

as diagnostic and debugging modes, digital I/O, analog to digital and digital to analog converters, a real time clock, a watchdog, and code to interface with FlexRay, CAN, and LIN. Petitioner refers to its contentions for other claims that recite these features. Pet. 79.

Claims 11 and 22 additionally recite, “wherein in the event the storage resource is not available and the threshold associated with the storage resource request has been reached, the electronic control unit is configured to send a notification to a process associated with the information.”

Petitioner argues that it would have been obvious to notify a process of a timeout if the storage resource is not available because such a scenario could be indicative of other problems and a notification can help avoid program failure. Pet. 79 (citing Ex. 1012, 42–43, 54–56, 59–61; Ex. 1004 ¶ 143).

Claim 22 additionally recites code to interface with a MOST bus, which Petitioner argues would have been obvious based on Wense for the reasons explained with respect to claim 12. Pet. 79–80.

Patent Owner refers to arguments addressed above regarding other claims that recite the subject matter of claims 11 and 22 and does not offer additional arguments.

We find Petitioner’s contentions for the “wherein” clause of claims 11 and 22 persuasive for the reasons given by Petitioner, summarized above, and we refer to our findings and conclusions for other claims that recite the remaining features of claims 11 and 22. *See, e.g.*, claims 4 and 5 (§ II.E above), claim 9 (§ II.F above), claim 10 (§ II.G above).

Having considered the full trial record, we conclude that the subject matter of claims 11 and 22 would have been obvious to a person of ordinary skill in the art.

*I. Obviousness over Miesterfeld, Wong, Grattan,
Wense, Nikklason, Boling, and Stanley
(Claim 28)*

Claim 28 depends from claim 24 and recites similar additional subject matter as claim 11 except that it does not recite digital input/output and analog to digital and digital to analog converters. Thus, Petitioner does not rely on Steger in this ground. *See* Pet. 80. Patent Owner argues that Petitioner's contentions for claim 24, from which claim 28 depends, fail. PO Resp. 63–64. For the reasons discussed above in § II.D.4, we disagree. Rather, we find Petitioner's contentions for claim 24 persuasive.

For the reasons discussed in the preceding section, we find persuasive Petitioner's contentions for the additional subject matter of claim 28. Having considered the full trial record, we conclude that the subject matter of claim 28 would have been obvious to a person of ordinary skill in the art.

III. CONCLUSION¹⁸

For the reasons discussed above, we determine that Petitioner has proven, by a preponderance of the evidence, that the challenged claims are unpatentable, as summarized in the following table:

¹⁸ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–3, 6–8, 12–14, 17–19, 23–25, 29, 30	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason	1–3, 6–8, 12–14, 17–19, 23–25, 29, 30	
4, 5, 15, 16, 26, 27	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Boling	4, 5, 15, 16, 26, 27	
9, 20	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Steger	9, 20	
10, 21	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Stanley	10, 21	
11, 22	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Boling, Steger, Stanley	11, 22	
28	103(a)	Miesterfeld, Wong, Grattan, Wense, Nikklason, Boling, Stanley	28	
Overall Outcome			1–30	

IV. ORDER

Accordingly, it is

ORDERED that claims 1–30 of the '477 patent have been shown to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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