

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COX COMMUNICATIONS, INC.,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Case IPR2024-00579
Patent 8,223,775

EXHIBIT 2003

DECLARATION OF SAMUEL H. RUSS, PH.D.

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I. INTRODUCTION

1. My name is Samuel H. Russ. I have been retained as an expert witness to provide my independent opinion in regard to the matters at issue in *inter partes* review of U.S. Patent No. 8,223,775 (“the ’775 patent”) in IPR2024-00579. I have been retained by Entropic Communications, LLC (“Entropic”), the Patent Owner in this proceeding. Petitioner is Cox Communications, Inc. (“Cox” or “Petitioner”).

2. I am being compensated \$450 per hour for my time spent working in connection with this case. My compensation is in no way related to the outcome of this litigation. If called as a witness, I would testify as to the statements and opinions contained in this report.

3. I am not a legal expert and offer no opinions on the law. However, I have been informed by counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

II. QUALIFICATIONS

4. I have more than 20 years of experience in the fields of broadband cable networks and communications engineering. My professional career has been dedicated to issues relating to signal integrity, communication systems, and home networking more generally.

5. I received a Bachelor of Science in Electrical Engineering with Highest Honors from Georgia Institute of Technology in 1986 and a Ph.D. in Electrical Engineering from Georgia Institute of Technology in 1991. My Ph.D. dissertation was titled “An Information-Theoretic Approach to Analysis of Computer Architectures and Compression of Instruction Memory Usage.”

6. I am currently an Associate Professor in the Department of Electrical and Computer Engineering at the University of South Alabama. I joined the Electrical and Computer Engineering faculty in 2007. I have taught a number of classes including classes in signal integrity, embedded systems, and the design of high-speed digital systems. During that time, I won awards for excellent teaching and have been actively publishing research in signal integrity, home networking, and digital video recording (DVR) technologies.

7. I also have significant industry experience. From 1994 to 1999, I served on the faculty of Mississippi State University as an Assistant Professor in the Department of Electrical & Computer Engineering. I taught circuit board design and two-way interactive video classes, among other topics.

8. From 2000 to 2007, I was the manager in the Advanced Technologies R&D group for Scientific-Atlanta (later Cisco, now Technicolor). As part of this work, I explored major new technologies including home networking and multi-room video distribution and managed a cable set-top box (STB) design group that

designed four STB models for the cable television industry, including the Explorer 4200 (non-DVR) and 8300 (DVR) models. Both models were produced in high volumes and sold several million units. As the design-group manager, I was responsible for managing the design and prototyping activities of the group and for interfacing with other groups (especially integrated circuit design, procurement, software developers, the factory where prototypes were built, and product managers). I also maintained the hardware and mechanical development schedule.

9. While at Scientific-Atlanta, I became a staff expert in home networking, and conducted demonstrations of wireless video technology. My group explored adding home-networking features to cable set-top boxes, such as adding an Ethernet interface to the Explorer 4200. Note that the Explorer 4200 was the first Scientific-Atlanta set-top box to incorporate the DOCSIS standard, and we sold the set-top in large volumes (millions of units) to Cablevision because it supported DOCSIS. Our group also implemented a phone-line interface that could add HomePNA capability to a set-top box. I also became the company's point of contact to CableLabs as their "CableHome" standard was being developed. I also managed a group that developed a new coaxial home networking system, named "Multi-Room DVR" that routed video to multiple set-top boxes in a home over existing coaxial wiring. This coaxial system won a Technology and Engineering Emmy Award in 2013. Further, I was a staff expert in digital video recorder

(DVR) reliability, and led a team that improved the software, hardware, repair, and manufacturing processes.

10. I am the author of *Signal Integrity: Applied Electromagnetics and Professional Practice*, Springer, 1st ed. 2016, 2nd ed. 2022. I have also researched and written about video storage, multimedia broadcasting over networks, embedded systems, consumer electronics, set-top boxes, access of stored video from peer devices in a local network, electronic manufacturing systems, and other topics in video and image processing. I have authored or co-authored 32 journal articles and conference papers in these areas of video storage, video networking and consumer electronics. One of my conference papers on digital video recording won second place in a “Best Paper” competition at the 2011 International Conference on Consumer Electronics in Las Vegas, Nevada.

11. I am a named inventor on 51 patent applications that were filed while I was at Scientific-Atlanta, many of which focus on cable technology. These applications have led to 29 issued U.S. patents and 9 as European patents, including U.S. Patent No. 7,908,625 (“Networked Multimedia System”).

12. A detailed record of my professional qualifications is set forth in the attached Exhibit A, which is my *curriculum vitae*, including a list of publications, awards, research grants, and professional activities. My *curriculum vitae* also lists the matters in which I have served as an expert.

III. BASES OF OPINIONS

13. In the course of conducting my analysis and forming my opinions, I have reviewed materials including those listed below:

- i. U.S. Patent No. 8,223,775 (Ex. 1001) (“the ’775 patent”);
- ii. The prosecution history of the ’775 Patent (Ex. 1002);
- iii. The Declaration signed by Dr. James Martin in IPR2024-00579 (Ex. 1003) (the “Martin Declaration”);
- iv. The Petition by Cox in IPR2024-00579;
- v. U.S. Patent Publication No. 2003/0161333 (“Schain”) (Ex. 1005);
- vi. U U.S. Patent Publication No. 2002/0061012 (“Thi”) (Ex. 1006);
- vii. U.S. Patent Publication No. 2002/0091866 (“Perlman”) (Ex. 1007);
- viii. U.S. Patent No. 7,769,046 (“Crocker”) (Ex. 1008);
- ix. U.S. Patent No. 7,225,240 (“Fox”) (Ex. 1009);
- x. *Entropic Communications, LLC v. Charter Communications Inc.*, No. 2:22-cv-00125-JRG (E.D. Tex. June 26, 2023) (Claim Construction Memorandum Opinion and Order) (Ex. 1011);
- xi. *Entropic Communications, LLC v. Cox Communications, Inc.*, No. 2:23-cv-01049-JWH-KES (C.D. CA. Aug. 12, 2023) (Claim Construction Scheduling Order) (Ex. 1012);

- xii. Director Vidal Memorandum re: *Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation*, June 22, 2022 U.S. Pub. No. 2002/0078249 (“Memorandum”) (Ex. 1013);
- xiii. The exhibits and other documents cited herein.

IV. APPLICABLE LEGAL STANDARDS

A. Level Of Ordinary Skill In The Art

14. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art, which I understand is sometimes referred to as an “ordinary artisan” or “skilled artisan” or by the acronyms “POSITA” or “PHOSITA,” as of the time of the invention, which I understand is here assumed to be the filing date (September 30, 2003) of the ’775 patent. I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. By “relevant,” I mean relevant to the challenged claims of the ’775 patent.

15. I understand that factual indicators of the level of ordinary skill in the art include the various prior art approaches employed, the types of problems encountered in the art, the rapidity with which innovations are made, the sophistication of the technology involved, and the educational background of those actively working in the field. I understand that, in assessing the level of skill of a

person of ordinary skill in the art, one should consider the type of problems encountered in the art, the prior solutions to those problems found in the prior art references, the rapidity with which innovations are made, the sophistication of the technology, the level of education of active workers in the field, and my own experience working with those of skill in the art at the time of the invention.

16. In this case, Mr. Martin has asserted in his declaration that a person of ordinary skill in the art as of the time of the '775 patent would have had:

at least i) a bachelor-level degree in electrical engineering or an equivalent subject and three or more years of experience working in the field of cable and/or satellite signal processing and communication systems; ii) a master's-level degree in electrical engineering or an equivalent subject and one or more years of experience working in the field of cable and/or satellite television signal processing and communication systems; or iii) a Ph.D.-level degree in electrical engineering or an equivalent subject and at least some experience working in the field of cable and/or satellite television signal processing and/or communication systems. Additional education may substitute for professional experience, and significant work experience may substitute for formal education. Such academic and industry experience would be necessary to appreciate what was obvious and/or anticipated in the industry and what a POSITA would have thought and understood at the time.

Ex. 1003 [Martin-Decl.] ¶ 20.

17. For the purposes of this declaration, I accept Mr. Martin's proposed qualifications of a POSITA. To be clear, however, I do not necessarily agree with Mr. Martin's opinion in this regard and reserve the right to revisit the issue should the Petition be instituted.

18. As further discussed below, my opinions as stated in this declaration are valid even if the Board adopts a slightly different level of ordinary skill in the art. For example, as will be discussed throughout my report, even a person with the level of knowledge or experience described by Mr. Martin or adopted by the Board would not have a reasonable expectation of success in implementing certain aspects of the proposed combination as of the priority date of the '775 patent.

B. My Understanding Of Legal Standards

19. When considering the '775 patent and stating my opinions, I rely on the following legal standards as described to me by the attorneys for Entropic.

20. I understand that a patent claim is unpatentable if the claimed invention was anticipated by a prior art reference or would have been obvious to a person of ordinary skill in the art at the time of the purported invention.

21. I understand that anticipation requires that every limitation of the claim at issue be disclosed, either expressly or under principles of inherency, in a single prior art reference.

22. I understand that inherency is a legal doctrine that, to be met by a disclosure, requires that the element in question would be viewed by the POSITA as “necessarily present” in what is disclosed. I understand that such inherency may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. Instead, it must be proven that the claim limitation not expressly found in the reference necessarily follows from what is found there.

23. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the invention in view of the prior art and in light of the general knowledge in the art as a whole. I also understand that obviousness is ultimately a legal conclusion based on underlying facts of four general types, all of which must be considered: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) any objective indicia of non-obviousness, including any praise of the invention.

24. I also understand that obviousness may be established under certain circumstances by combining or modifying the teachings of the prior art. Specific teachings, suggestions, or motivations to combine any first prior art reference with a second prior art reference can be explicit or implicit, but must have existed

before the date of purported invention. I understand that prior art references themselves may be one source of a specific teaching or suggestion to combine features of the prior art, but that such suggestions or motivations to combine art may come from the knowledge that a person of ordinary skill in the art would have had.

25. I understand that a reference may be relied upon for all that it teaches, including uses beyond its primary purpose, but also including teachings that lead away from the invention. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, although the mere disclosure of alternative designs does not teach away.

26. I further understand that whether there is a reasonable expectation of success in combining references in a particular way is also relevant to the analysis.

27. I understand that it is improper to use hindsight to combine references or elements of references to reconstruct the invention using the claims as a guide. My analysis of the prior art is made from the perspective of a person of ordinary skill in the art at the time of the invention.

28. I understand that in order to be eligible as prior art in obviousness and therefore form a reference in one of the instituted grounds, a reference must be analogous art to the '775 patent. I also understand that it is Petitioner's burden to

prove that their asserted references are analogous art to the '775 patent. I am informed that in order to determine whether a reference is analogous art to the '775 patent, a two-part test is applied, (1) whether the art is from the same field of endeavor, regardless of the problem addressed and, (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved. I have been informed and understand that to discern the field of endeavor, courts have looked to the specifications of the patent and the alleged prior art reference and particularly, for example, to the respective "Background of Invention" and/or "Field of the Invention" sections when the documents in question are patents.

29. I am not offering any legal opinions in this declaration nor am I qualified to do so as a legal expert. I only consider such legal standards in framing my opinions and conclusions as well as placing assertions made by Petitioner in the Petition into the proper context. Additionally, from a subject matter perspective, I understand that the petitioner always has the burden of persuasion regarding a challenge of patentability of an invention under an inter partes review.

V. CLAIMS-AT-ISSUE (CLAIMS 1-23)

30. I understand that Petitioner has challenged the claims as follows:

- Claims 18-19 based on obviousness over Schain in view of Thi (Ground 1); and

- Claims 18-19 based on obviousness over Perlman in view of Crocker, and further in view of Fox (Ground 2).

VI. OPINIONS

A. The '775 Patent Makes Advantageous Disclosures.

31. The '775 patent sets forth numerous claims, including three independent claims, claims 1, 14, and 18. I understand that only two claims, independent claim 18 and its dependent claim 19, are at issue in this case. I note that page 1 of the Petition identifies these two claims as at issue.

32. The '775 patent discloses a “future **gateway cable modem** (CM)” that “will incorporate a variety of functions beyond the traditional cable modem[.]” Ex. 1001 [’775] 1:13, 1:20-22. As the Patent observes,

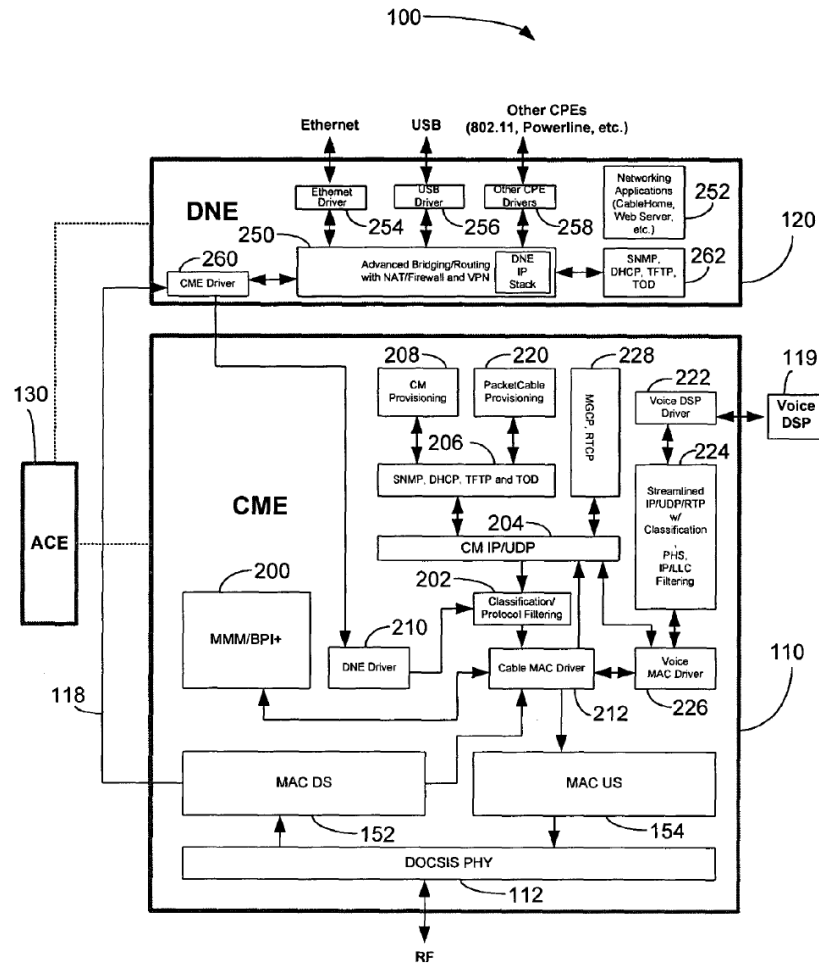
The major challenge in designing such a gateway cable modem is integration of these services with the basic cable modem functionality in an efficient and cost-effective [manner].

Ex. 1001 [’775] 1:16-18. The Patent describes a variety of goals of the architecture of the invention, relating to, *e.g.*, “Functional Partitioning,” “Performance,” “Cost” and “Software Re-Use,” and how its novel “gateway cable modem architecture...meets all of these objectives.” *Id.* 1:20-57.

33. The '775 patent’s inventive gateway modem architecture is centrally based on two separate “engines” with allocated functions. First is a data networking engine (“DNE”) responsible for home networking functions—in short,

for the part of the cable modem that will interface into networks on-premises—implemented in a “first circuit.” Second is a cable modem engine (“CME”) responsible for the cable modem functions—the interface to communication outside the premises to the cable operator and on to the internet—implemented in a “second circuit.” This interface implements the DOCSIS set of standards, and the CME includes both a DOCSIS MAC processor and a DOCSIS controller which perform distinct and specialized cable modem functions.

34. The DNE and CME are each implemented in respective circuits, each include at least one processor, and are functionally partitioned from each other as claimed: “the cable modem functions performed by the cable modem engine [CME] are completely partitioned from the home networking functions performed by the data networking engine [DNE].” Ex. 1001, cl. 18, 8:24-27. This careful partitioning is reflected in FIG. 2, showing the claimed functions of the gateway cable modem partitioned into DNE and CME:



35. The CME itself comprises several components, including a “DOCSIS MAC processor” and a “DOCSIS controller” for carrying out or controlling different portions of the functionality relating to DOCSIS-based communication.¹ The inventive architecture allows for the DOCSIS MAC processor to be

¹ In the CME of FIG. 2, exemplary DOCSIS MAC functions are represented as blocks 152 and 154, Ex. 1001 [’775] 3:19-20, and exemplary DOCSIS controller functions as blocks 200-212, *id.*, 3:26-27.

configured to process and forward downstream packets directly to the DNE without the involvement of the DOCSIS controller, in order to boost downstream throughput. Ex. 1001 [’775] 3:11-16, 8:18-22. FIG. 2 illustrates this in path 118, over which downstream packets may flow directly from downstream DOCSIS MAC 152 to the DNE without passing through any other component of the CME. *Id.*, 3:14-16. Meanwhile, the DOCSIS controller “receive[] ... PDU packets” from the DNE and “implements... DOCSIS... functions.” *Id.*, 3:21-27. This functionally partitioned system “enhanc[es]” “performance,” among other benefits. *Id.*, 4:43-55.

36. Thus, each of the claims challenged require a specified architecture with structural and functional requirements expressly recited in the claims.

37. It is my opinion that Petitioner has failed to show its first ground of Schain and Thi, which I discuss further below, teaches several aspects of the ’775 patent’s architecture, including a “DOCSIS controller,” a “DOCSIS MAC processor configured to process” and “forward” “downstream PDU packets” to the DNE “without the involvement of the DOCSIS controller,” and a DNE and CME implemented in a “first circuit” and “second circuit” respectively, as well as other missing elements. In my review of the arguments in the Petition, I see no indication presented that the cited art even recognized that these goals (*id.*, 1:19-55) are possible, much less that it aimed to meet them or disclosed this architecture.

38. It is further my opinion that Petitioner fails to show its second ground of Perlman, Crocker, and Fox satisfy this architecture, discussed further below, specifically with respect to a “first circuit” having its respective at least one processor and a “second circuit” having its respective at least one processor, a CME “configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the” DNE, a “DOCSIS MAC processor configured to process” and “forward” “downstream PDU packets” to the DNE “without the involvement of the DOCSIS controller,” a “data bus that connects the [DNE] to the [CME],” and a DNE that “perform[s] home networking functions including interfacing with customer provided equipment.”

B. The “Cable Modem Engine Including A DOCSIS Controller” (Limitation 18[h], All Claims, Ground 1).

39. Each of the claims require a “cable modem engine including a DOCSIS controller and DOCSIS MAC processor.” Ex. 1001 [’775] cl. 18.

Limitation 18[h]² recites “the cable modem engine including a DOCSIS controller and DOCSIS MAC processor.”

40. “DOCSIS” stands for Data Over Cable Service Interface Specifications. It is an elaborate, well-understood telecommunications standard

² This declaration follows the Petition’s claim-limitation numbering convention.

relating to cable television networks that helps enable high-bandwidth data transfer.

41. The Petition's Ground 1 relies solely on Schain for this limitation, arguing only disclosure rather than obviousness to add to it. Pet., 34. Since Petitioner does not assert it would be obvious to modify Schain to achieve this limitation, I do not opine on that issue in this declaration.

42. It is my opinion that the Petition fails to show Schain discloses this limitation for at least two reasons: (1) Schain does not disclose a "DOCSIS controller;" and (2) Schain's purported "DOCSIS controller" is not shown to be included in Petitioner's purported CME (Schain's "cable bridge") as claimed, but is instead said by Petitioner to be in Schain's "cable applications layer." See Pet., 29-30, 31-32.

1. "A DOCSIS Controller."

43. At the outset, I see no indication that Schain discloses a DOCSIS controller. Petitioner asserts that Schain discloses a DOCSIS controller based on "specialized controllers" that Schain discloses in its "broadband gateway 500," and that a POSITA "would recognize that one relevant 'specialized controllers' would be a DOCSIS controller." Pet., 34. More specifically, Petitioner asserts:

Schain further discloses the broadband gateway 500 including specialized controllers, e.g., a DOCSIS controller: "Any required software support for the network connectivity could be provided in ...

“specially designed controllers (not shown).” Ex. 1005, ¶61; Ex. 1003, ¶90. Skilled artisans would recognize that one relevant “specially designed controller” would be a DOCSIS controller. Ex. 1003, ¶¶90-92.

Pet., 34 (quoting Ex. 1005 [Schain] [0063]). However, I see no indication that a DOCSIS controller would be necessarily present in the “specially designed controllers (not shown)” in Schain’s “broadband gateway 500” in Schain’s architecture. I also see no indication that a DOCSIS controller would be necessary for Schain to function in accordance with Schain’s disclosure.

44. These “specially designed controllers” are mentioned in Schain only once, and according to Schain are “not shown” in Schain. It is not apparent that such a controller would need to be a DOCSIS controller. Schain discloses:

Also coupled to the common bus 515 is a set of output connections for the broadband gateway 500. For example, if the broadband gateway 500 provides connectivity to a computer or computer network via an Ethernet port or a USB port, then coupled to the common bus 515 would be appropriate circuitry (540 and/or 545) for an Ethernet or USB port. Any required software support for the network connectivity could be provided in the CPU 520, ***or in specially designed controllers (not shown)***. If the broadband gateway 500 supports wireless connectivity, then an appropriate wireless circuit 550 and an analog front end (AFE) 555, along with an antenna 560 would be present.

Ex. 1005 [Schain] [0063]; *see* Pet., 34.

45. As can be seen in the excerpt above, Schain states that such “specially designed controllers,” if any, would be used for “support for the network connectivity” described “to a computer or computer network via an Ethernet port or a USB port.” In my opinion, none of these stated functions would necessarily suggest to the POSITA reading Schain that one of these “specially designed controllers” would be a DOCSIS controller, nor does it disclose the number or type of circuits used to implement these functions. I note that, for one thing, no discussion of “DOCSIS” functions appears in Schain’s brief discussion of what the “specially designed controllers” intended use would be.

2. “Includ[ed]” In The CME.

46. Even if one of Schain’s “specially designed controllers” were a DOCSIS controller, I see no indication that it would (let alone that it necessarily would) be part of Schain’s “cable bridge,” the purported CME. The Petition asserts that the claimed cable modem engine (“CME”) is met by Schain’s “cable bridge 315.” Pet., 29-30. Limitation 18[h] recites that the CME “includ[es] a DOCSIS controller.” Therefore, in order for Schain’s cable bridge to meet the claimed CME, it would need to include (among other things) “a DOCSIS controller.” However, I see no indication that the Schain discloses such a DOCSIS controller

included in Schain's purported CME (Schain's "cable bridge"), or any specification of where the "specially designed controllers" may be found.

47. The section of the Petition arguing that Schain discloses limitation 18[h] (which, as noted above, is the limitation that recites the requirement of the CME "including a DOCSIS controller") appears to assert that this required "DOCSIS controller" would be implicitly located in Schain's "cable applications layer." Pet., 35. Petitioner asserts:

Schain describes a "cable applications layer" which implements the DOCSIS socket-based processes" Ex. 1005, ¶¶32; Ex. 1003, ¶91. A POSITA would have understood the cable application layer to implement VoIP functionality, since the PacketCable Component Reference Model defines VoIP as a component that operates outside of a cable modem while requiring the QoS features available in cable modems in 2002. VoIP is, and has always been, considered an "application." Ex. 1003, ¶91. A POSITA would have understood that the functions of the 'cable applications layer' are analogous to VoIP, and the 'DOCSIS controller' is located within the 'cable applications layer.' Ex. 1003, ¶91.

Pet., 35.

48. As an initial matter, I see no indication that Schain would necessarily have a "DOCSIS controller" located in the "cable applications layer." As noted above, Schain does not purport to disclose a "DOCSIS controller" at all and the Petition asserts at most that the POSITA would understand such a DOCSIS

controller to be among the “specially designed controllers (not shown)” briefly mentioned by Schain without being shown or described. Here, the Petition additionally asserts that this supposed DOCSIS controller would be in Schain’s “cable applications layer.” But the Petition does not appear to contain any arguments explaining why any functions the “specially designed controllers” perform would supposedly necessarily or naturally result in one such controller, that is purportedly a “DOCSIS controller,” be part of Schain’s “cable applications layer.”

49. Even if Schain did disclose a DOCSIS controller as claimed and even if it did disclose that the DOCSIS controller were located in Schain’s cable applications layer, that would appear to me to foreclose the DOCSIS controller being a component included in the CME, as the claim requires. As just noted above, the Petition asserts that the claimed CME is met by Schain’s “cable bridge 315.” But I note that Schain’s “**cable applications layer 325**” is not shown to overlap with its “**cable bridge 315**,” as can be seen in Schain’s annotated Figure 3:

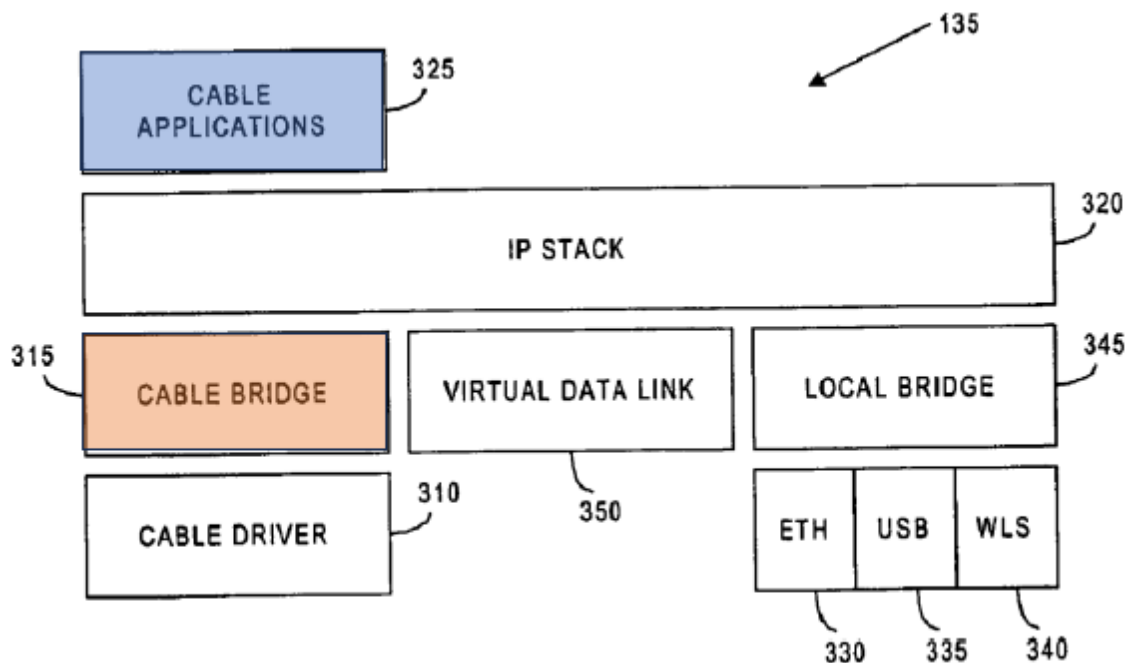


Figure 3

Ex. 1005 [Schain] Fig. 3 (annotated); *see also id.*, Figs. 2a-2b & 4, [0031]-[0032], [0037]-[0038], [0047]-[0048] (discussing positions of “cable applications layer” and “cable bridge”). Figure 3 depicts Schain’s cable applications layer 325 and cable bridge 315 as two different components, and even depicts another component (IP stack 320) between them. Moreover, Schain’s disclosures at [0047] and [0048] further indicate that the cable applications layer and cable bridge are distinct.

There, Schain states:

[0047] Above the two bridges is a single **IP** stack **320** that is shared by both bridges. Since both bridges share the **IP** stack **320**, it performs the processing of packets provided by either bridge. It is possible to share the **IP** stack **320** between the two bridges since each bridge is

essentially responsible for any processing of packets that do not cross the interface, and therefore the **IP** stack **320** does not need to process any localized packet traffic. The shared **IP** stack **320** reduces the redundancy inherent in a dual-bridge architecture, such as one displayed in **FIG. 2b**. Above the shared **IP** stack **320** on the broadband modem portion is a cable applications layer **325**. The cable applications layer **325** is similar to other cable application layers previously discussed.

[0048] When packets need to cross the local network and external network interface, i.e., a packet with a local network source address and an external network destination address (and vice versa, a packet from an external device with the destination address being the global **NAT** address pertaining to an internal device's address), a virtual data link **350** connecting the local bridge **345** to the cable bridge **315** (and vice versa) is used. The virtual data link **350** permits packets needing to cross the interface to move from one portion of the broadband gateway **135** to the other. For example, a local packet addressed to some destination in the external network will cross the virtual data link **350** and enter the cable bridge **315**. According to a preferred embodiment of the present invention, packet filtering (including address filtering) and network address translation can be performed in the virtual data link **350**. The virtual data link **350** is a natural place to perform the packet filtering and network address translation due to its position in the partition of the two bridges. This will be done either internally within the virtual data link **350** or by the virtual data link providing the packet to a dedicated module for packet processing (e.g.

NAT and firewall modules). After entering the cable bridge **315**, the packet is injected into the external network via the cable driver **310**.

[0049] According to a preferred embodiment of the present invention, the transfer of the packet in the virtual data link **350** may be implemented as simply as a transfer of a memory address. For example, a packet that needs to cross the virtual data link **350** is stored in memory. In fact, it is normal to store packets in memory and therefore, does not require any additional operations. The memory address of the packet in the memory is transferred from one bridge to the other bridge via the virtual data link **350**. The address of the packet is provided to the virtual data link **350** by the source bridge (for example, the local bridge **345**) and is in turn provided to the receiving bridge (for example, the cable bridge **315**). The receiving bridge then simply references the memory location specified in the address. The packet has just traversed the virtual data link **350** without actually being moved. This technique involves minimum data transfer. Any packet filtering and network address translation, along with other operations such as firewall functionality, can be performed after the memory address is provided to the virtual data link **350** and before it is given to the destination bridge.

Ex. 1005 [Schain] [0047]-[0049].

50. Thus, even if Petitioner's assertion that Schain's "specially designed controller" was a DOCSIS controller was correct, and even if it was placed in the cable applications layer 325 of Schain, Petitioner then fails to show that Schain

discloses limitation 18[h] as required, as there is no indication that the “DOCSIS controller” as part of the “cable applications layer 325” would also be part of the “cable bridge 315,” Petitioner’s purported CME.

51. Thus, it is my opinion that Petitioner has not shown that Schain meets the claimed “DOCSIS controller,” or that it is included in the CME, as claimed.

C. A “DOCSIS MAC Processor Configured To... Forward The Processed Packets Directly To The [DNE] Without The Involvement Of The DOCSIS Controller” (Limitation 18[i], All Claims, Ground 1).

52. Each of the claims require that the DOCSIS MAC processor of the CME be “configured to process downstream PDU packets and forward the processed packets directly” to the DNE “without the involvement of the DOCSIS controller.” Ex. 1001 [’775] cl. 18. Limitation 18[i] recites

“the DOCSIS MAC processor configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput”.

53. As this limitation requires the existence of a DOCSIS controller, it is not met for similar reasons discussed above, as Schain does not disclose a DOCSIS controller.

54. I note that the Petition asserts Schain discloses this limitation, or alternatively that the addition of the Thi reference to Schain renders this limitation

obvious. For the reasons indicated below, I see no indication that either Schain alone or the Schain-Thi combination teaches this limitation.

1. Schain Does Not Disclose Limitation 18[i].

55. Limitation 18[i] requires, among other things, that the DOCSIS MAC processor” included in the CME be “configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller.” The Petition asserts that Schain alone meets this limitation:

Schain discloses forwarding packets between the two bridges. “[T]he entire packet may be passed. The source bridge can write the entire contents of the packet into the memory space of the virtual data link 315 and the virtual data link 315 passes the packet onto the destination bridge.” Ex. 1005, ¶50; Ex. 1003, ¶94. Alternatively, “the transfer of the packet in the virtual data link 350 may be implemented as simply as a transfer of a memory address. . . . The memory address of the packet in the memory is transferred from one bridge to the other bridge via the virtual data link 350.” Ex. 1005, ¶49; Ex. 1003, ¶94. Schain explains that “[t]hrough the use of separate modules, interaction between the processing performed by the two bridges is reduced. . . . By reducing the interaction, there is a reduced chance of errors resulting from unintended corruption of data and memory.” Ex. 1005, ¶49. Further, “[t]he reduction in the interaction between the modules also permits better balancing the processing resources . . .

[which] makes it easy to achieve maximum overall processing rate and efficiency.” *Id.*

Pet., 35-36.

56. Thus, the Petitioner asserts that “Schain discloses or at least implies that the PDU packets are transmitted directly from the cable bridge to the local bridge without involvement of the DOCSIS controller.” Pet., 36. The Petition asserts that this is enabled by Schain’s disclosure of transferring packets from a “source bridge” to a “destination bridge.”

57. I note that nowhere in the Petition’s assertions on this point does Petitioner even mention the DOCSIS MAC processor, which is what is required by the claim to process and forward the PDU packets downstream to the purported DNE. The Petition only asserts that packets are “transferred from one bridge to the other bridge via the virtual data link 350,” but does not describe how this purported transfer would involve the DOCSIS MAC processor, if at all. *Id.*, 36 (citing Ex. 1005 [Schain] [0049]). Thus, it is my opinion that the Petitioner has not shown Schain discloses this limitation.

58. Even if the DOCSIS MAC processor processes and forwards the packets, the Petition does not appear to address whether such packets are forwarded **directly** to the purported DNE (Schain’s local bridge, see Pet., 27-28). The Petition asserts the packets are forwarded between the two bridges, as quoted

above, Pet., 36-37, but does not there state that they are forwarded directly or present any argument why they necessarily would (or could) be passed directly. Indeed, I see no support from the Petition that this transfer is done “directly.” Nor do I see evidence of a “direct[]” transfer in Schain. Thus, it is my opinion that, because the Petition has not shown that there is a direct transfer from the purported CME (Cable Bridge) to the purported DNE (Local Bridge), Schain does not satisfy this limitation.

59. In sum, I see neither an argument nor a showing that, based on this disclosure, Schain discloses the claimed forwarding of packets “directly” by the purported DOCSIS MAC processor of the purported CME to the purported DNE without involvement of the purported DOCSIS controller.

2. Adding Thi Does Not Add Limitation 18[i].

60. The Petition alternatively asserts that Schain in view of Thi would render this limitation obvious. Petitioner asserts that “[t]o the extent the Board finds that Schain does not explicitly disclose processing and forwarding downstream PDU packets without the involvement of the DOCSIS controller,” “this is disclosed by Thi.” Pet., 36. I note that the Petitioner specifically asserts that “this [limitation] is disclosed by Thi,” but does not seem to present any argument in the Petition that the combined disclosures of Thi and Schain disclose this limitation or, failing that, render it obvious to an ordinary artisan. Reviewing the

arguments based on Thi that Petitioner presents as to this limitation, my opinion is that I see no indication that Thi, in the context of this combination and this limitation, discloses or otherwise meets this limitation, since, in particular, Thi does not disclose a DOCSIS controller nor a DNE. My opinion on Petitioner's arguments and Thi are set forth in further detail below.

a. Thi's Voice And Data Processor Is Not A "DOCSIS Controller" And Does Not Control DOCSIS Functions.

61. The Petition asserts that Thi discloses this limitation because its voice and data processor is a DOCSIS controller. Specifically, Petitioner states:

Thi also discloses a "voice and data processor 160" which "supports the exchange of voice, as well as fax and modem The voice and data processor may be implemented with . . . **voice over packet based networks.**" Ex. 1006, ¶147 (*emphasis added*), *see also* FIG. 3 below; Ex. 1003, ¶99. The voice and data processor 160 **is a DOCSIS controller** as described in the '775 Patent, in which the DOCSIS controller is "configured to implement VoIP functionality," Ex. 1001, 6:4-5, *see also* 2:8-11; Ex. 1003, ¶99.

Pet., 37.

62. I understand from the Petition's arguments that the basis for Petitioner's assertion that Thi discloses the claimed "DOCSIS controller" is based on Thi's "voice and data processor 160" (or "voice/data processor"). Petitioner's stated reasoning is that because the DOCSIS controller of the '775 patent is "configured to implement VoIP functionality," and because the voice and data

processor “may be implemented with ... voice over packet based networks,” it would therefore be a DOCSIS controller. Pet., 37. Yet I see no indication that Thi’s voice and data processor is necessarily a “DOCSIS controller” as claimed.

63. There is no indication identified by Petitioner that Thi’s voice and data processor “controls” any DOCSIS functions in Thi. There is no express disclosure in Thi that the voice and data processor participates in any DOCSIS operations. The voice and data processor’s name indicates that it processes voice, such as voice packets. But whether the voice and data processor includes voice packet functionality does not determine whether or not it is a DOCSIS controller. As I discussed before, DOCSIS is a standard relating to cable television networks. To the contrary, the POSITA would have clearly understood that merely processing and transporting voice over a packet based network does not make something a “DOCSIS controller.” If Thi’s voice and data processor were a DOCSIS controller simply because it processes and transports voice in a packet-based system, every voice and data processor in every system using DOCSIS would appear to be a DOCSIS controller. That would not be correct. There are myriad components in innumerable systems that are “used for” processing and transporting voice over packet based networks but have nothing to do with DOCSIS and do not involve controlling any DOCSIS functions. For example, under the petitioner’s logic, a 3G cell phone is a DOCSIS controller. It implements

voice functions over a packet-based cellular network. This is obviously wrong – a cell phone has nothing to do with the DOCSIS standard.

64. As is indicated in the name, the POSITA would have understood that the claimed “DOCSIS controller” would control DOCSIS functions. The ’775 patent supports this understanding. It provides expressly disclosed examples in embodiments of such control, including the processing of management messages to/from the DOCSIS MAC, and MAC address learning. Ex. 1001 [’775] 3:26-38. Tellingly, the Thi reference cites none of these functions.

65. In contrast to the ’775 patent’s disclosure of DOCSIS control by its claimed “DOCSIS controller,” the Petition points to no disclosures indicating that Thi’s voice and data processor “controls” anything, much less any DOCSIS functions or the DOCSIS MAC. Thi’s disclosures are not shown to point to any “control” aspect of the voice and data processor.

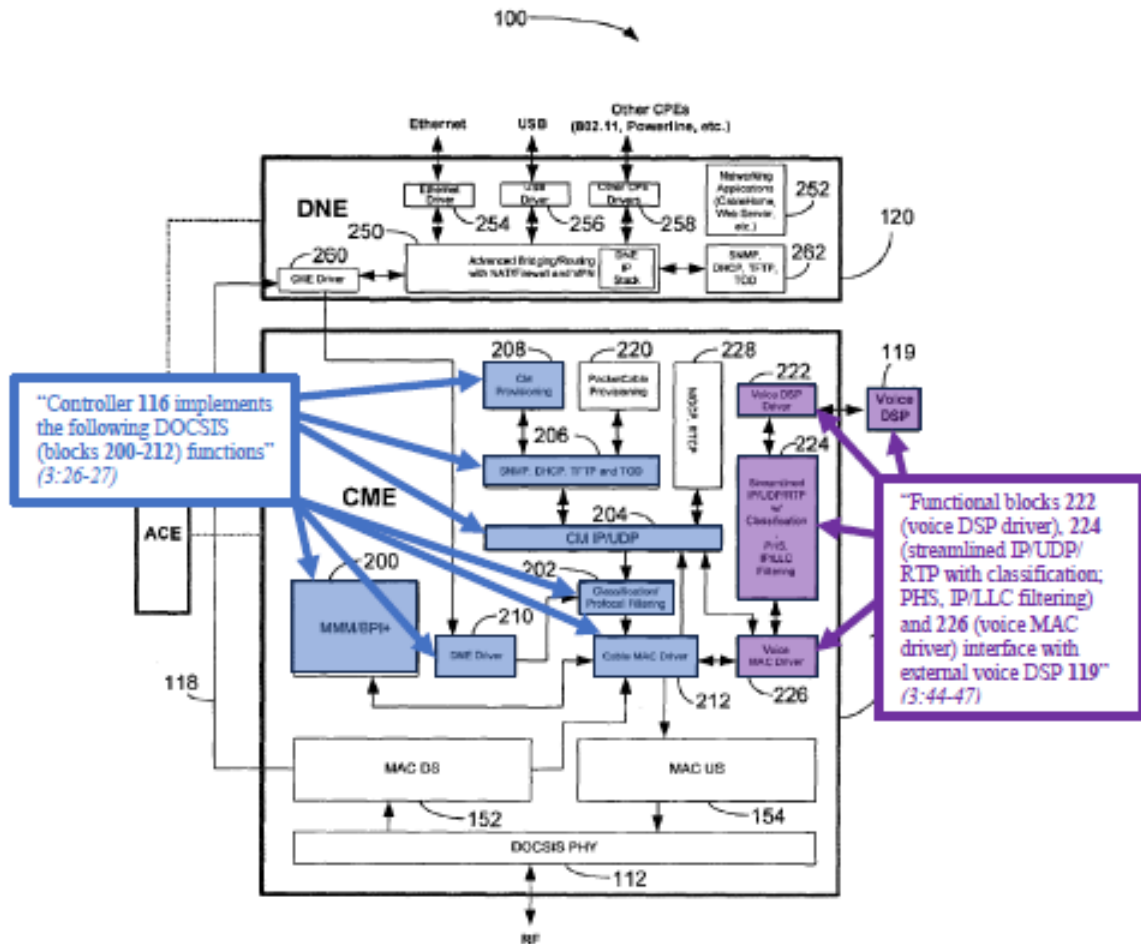
66. The ’775 patent discloses that, in an embodiment, the DOCSIS controller “implements the following **DOCSIS** (blocks 200-212) **functions**.” Ex. 1001 [’775] 3:26-48. Separately from this disclosure of “DOCSIS functions” (citation omitted), the patent additionally discloses that the “controller 116 also implements all PacketCable functionality ... represented by functional blocks 220-228,” including “blocks 222 (voice DSP driver), 224 ... and 226 (voice MAC driver) [which] **interface with external voice DSP 119**.” *Id.*

67. The “PacketCable VoIP functionality” that may be implemented by the DOCSIS controller in this embodiment in the ’775 patent is not necessary for the DOCSIS controller to be a DOCSIS controller. PacketCable is an optional part of the DOCSIS standard. This DOCSIS controller would be a DOCSIS controller regardless of whether it performs any voice packet processing. The patent discloses that this additional VoIP functionality is added to improve performance by “minimiz[ing]” “latency and jitter of voice packets,” *Id.*, 3:39-41. Thus, VoIP functionality is not a requirement of the DOCSIS controller, but is an addition to the “DOCSIS functions” it would otherwise perform.

68. That Thi’s voice and data processor is not shown to be a DOCSIS controller just because Thi indicates that it has voice functionality is further highlighted by the fact that the ’775 patent distinguishes between the voice processing functions and DOCSIS functions of the DOCSIS controller. The ’775 patent discloses that for advantageous performance, VoIP (voice over IP) functionality may be relocated within the Cable Modem Engine. Ex. 1001 [’775] 4:19-24. Specifically, “to minimize the latency and jitter of voice packets,” the VoIP functions may be added to the DOCSIS controller. *Id.*, 3:39-41. This is sensible—tight integration reduces processing and travel time for these real-time voice packets, or as the Patent puts it, “the data path for voice packets is laid entirely within cable modem engine 110 and is optimized to reduce delay and

jitter.” *Id.*, 4:55-57. But **adding** VoIP processing to a CME does not affect whether or not it has a DOCSIS controller. *Compare, e.g., id.*, cl. 1 (reciting a DOCSIS controller as a CME component) *with* cl. 3 (further reciting VoIP functionality embedded in the CME) *and* cl. 6 (reciting “wherein all VoIP functionality is implemented in the DOCSIS controller”). Otherwise, as I already noted above, every VoIP processor would have to be considered a “DOCSIS controller,” contrary to what the POSITA would have understood to be true.

69. The ’775 patent further discloses the importance of the separate DOCSIS controller, which performs specific functions of a conventional DOCSIS cable modem system. The Patent illustrates that the DOCSIS control functions are not VoIP functions in Fig. 2. There, exemplary DOCSIS control functions are blocks 200-212 in Figure 2. *Id.*, 3:26-27 (“Controller 116 implements the following DOCSIS (blocks **200-212**) functions”). Meanwhile the VoIP functions are blocks 222, 224, 226 and external DSP 119. *Id.*, 3:44-47 (“Functional blocks 222 (voice DSP driver), 224 (streamlined IP/UDP/RTP with classification; PHS, IP/LLC 45 filtering) and 226 (voice MAC driver) interface with external voice DSP 119”).



Ex. 1001 [’775] Fig. 2 (annotated). I have not been pointed to, and have not located, any indications that these separately shown DOCSIS and voice functional blocks have any overlap that might support the notion that Thi’s voice and data processor could, by virtue of being a voice and data processor with voice functions as described by Thi, implicitly be a DOCSIS component, let alone a DOCSIS controller.

70. Based on the lack of any demonstration that Thi’s “voice and data processor” constitutes the claimed “DOCSIS controller,” the Petition appears to me to fail to demonstrate that Thi discloses limitation 18[i] which requires

“forward[ing] the processed packets directly to the data networking engine *without the involvement of the DOCSIS controller.*”

71. To recap, the ‘775 patent expressly discloses a list of functions carried out by its DOCSIS controller, and a POSITA would understand that these functions are necessary for a complete implementation of the DOCSIS standard. Thi’s voice and data processor, conversely, discloses none of these functions. For the above-discussed reasons, it is my opinion that Petitioner has not shown that Thi’s voice and data processor is the claimed “DOCSIS controller,” and thus that it could disclose forwarding packets to the DNE while bypassing the “DOCSIS controller.”

b. Thi’s Data Encryption Security (DES) Is Not Shown To Be A DNE.

72. The Petition also asserts that Thi’s data encryption security (DES) would be a DNE, to which packets must be sent directly as the claims require. I disagree that this has been shown. Specifically, the Petitioner asserts:

In Thi, the PDUs are processed and routed downstream using the MAC processor. Ex. 1006, ¶170, 122; Ex. 1003, ¶103. “The downstream DES 284 receives data packets and control signals from the header processor” and “decrypts packets using [a] key” in the “baseline privacy header.” Ex. 1006, ¶171; Ex. 1003, ¶105. Figure 3 of Thi shows the MAC processor right next to the DES 284, and the voice and data processor 160 is “at the other end.” Ex. 1006, FIG. 3 (*above*), ¶146; Ex. 1003, ¶104. A POSITA would understand the DES

284 of Thi is equivalent to the claimed data networking engine, as the function of the data networking engine as well as the DES is to perform security processing of the forwarded packet. See Ex. 1001, 3:49-53 (“Data networking engine 120 is responsible for all data networking processing including advanced multi-port bridging/routing with NAT/firewall and VPN (block 250) and home networking applications”); Ex. 1006, ¶¶170-171; Ex. 1003, ¶105.

Pet., 39. Thus, the Petitioner asserts that Thi’s “downstream DES 284” is “equivalent to” a DNE because it performs security processing of the forwarded packet.

73. It is my opinion that it has not been shown that Thi’s DES would be considered by the POSITA to be “equivalent” to a DNE as claimed.

74. An exemplary DNE is described in the ’775 patent, detailing an engine which performs more functions than security processing on packets.

According to the ’775 patent, in an embodiment:

Data networking engine **120** is responsible for all data networking processing including advanced multi-port bridging/routing with NAT/firewall and VPN (block **250**) and home networking applications (CableHome, Web Server, etc.) (block252). In one implementation, the entire embedded portal services (PS) functionality of the CableHome specification is contained within data networking engine **120**, with the CableHome functionality being completely decoupled from the PacketCable and DOCSIS functionality provided by cable modem engine **110**. As a result of the

virtual de-coupling from cable modem engine 110, data networking engine 120 can be independently software-upgraded without impacting the functionality of cable modem engine 110 (and vice versa).

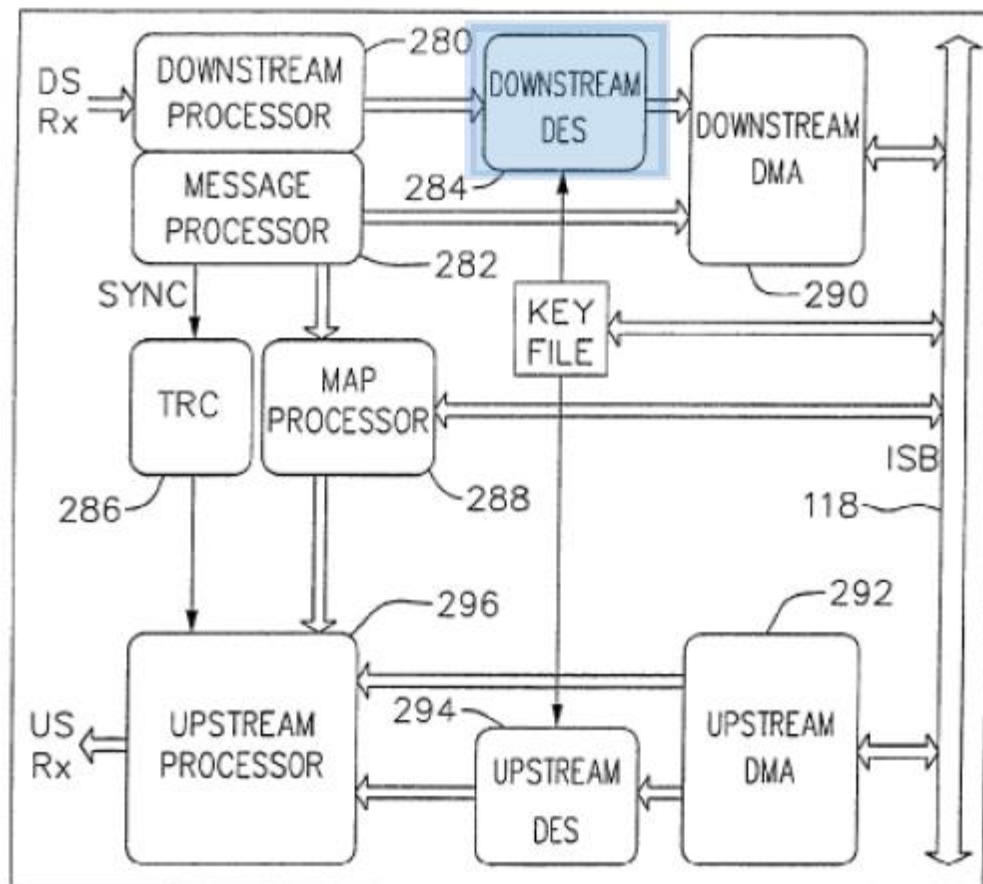
As seen in FIG. 1, data networking engine is capable of additional CPE functionality such as Ethernet, USB and other LAN I/F communications (802.11, Bluetooth, Powerline, etc.), with appropriate CPE drivers 254, 256, 258 being provided to support such communications. Additionally, cable modem engine driver 260 communicates with cable modem engine 110 and functional block 262 provides SNMP, DHCP, TFTP and TOD functionality.

Ex. 1001 [’775] 3:49-4:3. While a component need not perform all of the exemplary functions of the DNE which are disclosed in the ’775 patent, I see no explanation in the Petition of why or how performing security processing on the forwarded packet could be sufficient to render Thi’s DES a DNE as claimed or the equivalent of a DNE as claimed. This is because performing security processing and/or encryption on packets is not enough to make something a DNE.

75. In fact, it appears to me from Thi’s disclosure that Thi’s “downstream DES 284” would, if anything, be part of a component that the claim requires be included in the CME, not the DNE. Specifically, Thi discloses that its downstream DES 284 is part of Thi’s DOCSIS MAC, but the claims require that the “DOCSIS MAC processor” be included in the CME. For example, Thi’s Figure 7, illustrating

a “block diagram of a **DOCSIS media access controller (MAC)**” (Ex. 1006 [Thi] [0020]), depicts its downstream DES 284 as a component of its DOCSIS MAC:

FIG. 7



Ex. 1006 [Thi] Fig. 7 (annotated). I see no indication that the Petition addresses this fact.

76. As already discussed above, however, the claims require that the “DOCSIS MAC processor” be part of the CME, and that the CME must be implemented on a “second circuit” while the DNE be implemented on a “first

circuit,” where the DNE and CME are functionally partitioned from one another. See limitations 18[a], 18[c]-[d], 18[h], 18[k]; ¶¶ 33-35, 39 *supra*. This would not appear to be possible if the DNE was a component within the CME. Thi’s disclosures indicate this very contradiction: that the downstream DES (the purported DNE) is in the CME, not separated from the CME as the claims require. Thus, if Thi’s DES were a DNE it would be part of the CME, not separated from the CME as the claims require. Worse yet, there is no conceivable way to equate a DES engine (a fixed-function engine that performs a specific type of encryption) to an entire DNE (an engine that usually performs a long list of expressly disclosed networking functions.) Frankly, a POSITA would find this purported equivalency ludicrous – they are completely unlike.

c. No Motivation Or Expectation Of Success Is Shown.

77. Even if Thi’s voice and data processor were a DOCSIS controller, and its DES were a DNE, and its alleged DNE were not part of the DOCSIS MAC processor of the CME, I see no indication that the POSITA would be motivated to apply Thi’s teachings to Schain to meet this limitation, because I see no disclosure identified in Schain of a voice and data processor or similar component, and the Petition does not address why a POSITA would be motivated to add such a processor to Schain or, indeed, have a need or use for it. Indeed, I note that nowhere in Schain is the ability to process voice packets (VoIP) even discussed.

See generally Ex. 1005 [Schain]. Thus, there is no apparent reason to apply Thi's voice and data processor teachings to Schain.

78. Additionally, I see no explanation in the Petition why the POSITA would be motivated to modify Schain by applying Thi's DES, the alleged DNE which would also be part of the alleged CME (discussed above) (Ex. 1006 [Thi] Fig. 7), to Schain's architecture such that it is placed on a separate circuit and functionally partitioned from the CME, all while packets are routed directly to the DNE while bypassing the voice and data processor that was also added to Schain. In contrast, claims require that the DNE be on a separate circuit from, and functionally partitioned from, the CME. Ex. 1001 ['775] cl. 18[h]. Nor do I see any explanation why a POSITA would expect success in its efforts to do this. Thus, it appears to me that modifying Schain in the manner proposed by Petitioner uses the benefit of hindsight, by analyzing how the '775 patent's system was implemented and modifying Schain to become a similar system.

79. Thus, it is my opinion that the Petition has not shown Thi discloses a DNE to which packets must be forwarded. Therefore, because Thi does not disclose this limitation, the addition of its teachings to Schain similarly would not meet this limitation.

**D. A “Data Networking Engine Implemented In A First Circuit”
And A “Cable Modem Engine Implemented In A Second Circuit”
(Limitations 18[a], [c], All Claims, Ground 1).**

80. Each of the claims require a “data networking engine implemented in a first circuit” and “a cable modem engine implemented in a second circuit.” Ex. 1001 [’775] cl. 18.

Limitation 18[a] recites “a data networking engine implemented in a first circuit that includes at least one processor;”

Limitation 18[c] recites “a cable modem engine implemented in a second circuit that includes at least one processor;”

81. I understand that Petitioner relies solely on Schain in its ground 1 assertion that these limitations are met. (For instance, the section of the Petition devoted to arguing that Limitation 18[a] is met by this ground begins with the statement “Schain discloses element 18a,” and the only reference that it cites is Schain.)

82. Petitioner asserts that Schain discloses these limitations, pointing to Schain’s claim 1. Based on my review of Petitioner’s arguments, I disagree. Indeed, based on my review, it seems apparent that the Petition only asserts that Schain discloses “a circuit” on which both its cable bridge, the purported CME, and the local bridge, the purported DNE, are implemented, rather than there being a “first circuit” and “second circuit.” There is further no indication that the Petition is arguing Schain’s cable bridge and local bridge are implemented on separate sub-

circuits, or specifically a “first circuit” and “second circuit.” Since Petitioner does not make an assertion that it would be obvious to modify Schain to have multiple circuits, I do not opine on whether Schain could be modified to have multiple circuits at this time or whether there would have been, at the time the claimed invention was made, a reason for an ordinary artisan to modify Schain to have the claimed multiple circuits in the manner recited in limitations 18[a] and [c].

83. Petitioner argues that Schain’s “local bridge 345,” which Petitioner relies upon to meet the claimed DNE, is allegedly “implemented in a circuit” as claimed. The aspect of Schain on which Petitioner relies for this assertion is claim 1 of Schain:

The local bridge is implemented in a circuit: “A circuit comprising ... a local bridge. Ex. 1005, claim 1; Ex. 1003, ¶61.

Pet., 26.

84. Petitioner argues that Schain’s “cable bridge 315,” which Petitioner relies on to meet the claimed CME, is also “implemented in a circuit,” again relying upon Schain’s claim 1:

Per claim 1 of Schain, the cable bridge (also referred to as a broadband bridge) is implemented in a circuit: “a broadband bridge ... containing circuitry.” Ex. 1005, claim 1; Ex. 1003, ¶72.

Pet., 29.

85. Thus, to allegedly show a DNE “implemented in a first circuit” **and** a CME “implemented in a second circuit,” Petitioner and its expert rely solely on Schain’s claim 1, without further explanation. Schain’s claim 1, however, simply discloses “a circuit,” which includes both the alleged DNE and alleged CME, not two separate circuits implementing these two alleged engines. Ex. 1005 [Schain] cl. 1. Based on my review of the Petition, Petitioner does not appear to grapple with these disclosures in Schain or argue that Schain teaches the alleged DNE and CME may be implemented on more than one circuit. As reproduced below, Schain’s claim 1 recites “[a] circuit comprising” both “a broadband bridge” (*i.e.*, the alleged CME) and “a local bridge” (*i.e.*, the alleged DNE)”:

What is claimed is:

1. A circuit comprising:

a broadband modem coupled to a broadband medium, the broadband modem comprising:

a broadband bridge coupled to a broadband connection, the broadband bridge containing circuitry to filter packets;

a first Internet protocol (IP) layer coupled to the broadband bridge, the first IP layer to process data packets according to an Internet protocol;

a residential gateway comprising:

a local bridge coupled to a network connection, the local bridge containing circuitry to filter packets;

a second IP layer coupled to the local bridge, the second IP layer to process data packets according to the Internet protocol; and

the circuit further comprising a virtual data link coupled at a first end to the broadband bridge and at a second end to the local bridge, the virtual data link to allow packets from one bridge to cross into the other.

Ex. 1005 [Schain] cl. 1 (annotated).

86. I see no indication that the Petition even asserts that Schain's broadband bridge and local bridge of claim 1 would be implemented on a "first circuit" and "second circuit" based on the single circuit disclosed in Schain's claim 1.

87. It is not clear to me that Petitioner in fact asserts that Schain discloses a "first circuit" and a "second circuit," even though the claims expressly require them. The Petition makes statements that do not expressly use "first circuit" and

“second circuit” when discussing what Schain discloses. Instead, the Petition’s actual statements in question are that each of Schain’s bridges are “implemented in a circuit.” Pet., 26, 29. This language appears consistent with them sharing a single circuit, which, as noted above, is not what the claims require, but, as also noted above, appears to be what Schain actually discloses. In contrast, ’775 patent’s claim 18 clearly requires a “first circuit” on which the DNE is implemented and a “second circuit” on which the CME is implemented. This architecture is expressed in the ’775 patent and is tied with the benefits of the ’775 patent’s teachings. See ¶¶ 33-35 *supra*.

88. It is my opinion that the Petition has failed to show that Schain discloses a DNE “implemented in a first circuit,” a CME “implemented in a second circuit,” and that the two circuits are “separate from” each other.

89. I now turn from Ground 1 to Ground 2.

E. “A First Circuit That Includes At Least One Processor” And “A Second Circuit That Includes At Least One Processor,” “Separate From The First Circuit” (Limitations 18[a], [c]-[d], All Claims, Ground 2).

90. Each of the claims require a “data networking engine implemented in a first circuit that includes at least one processor,” “a cable modem engine implemented in a second circuit that includes at least one processor,” and that “the second circuit be[] separate from the first circuit. Ex. 1001 [’775] cl. 18.

Limitation 18[a] recites “a data networking engine implemented in a first circuit that includes at least one processor;”

Limitation 18[c] recites “a cable modem engine implemented in a second circuit that includes at least one processor;”

Limitation 18[d] recites “the second circuit being separate from the first circuit.”

91. I understand that Petitioner is asserting that Perlman discloses these limitations, and alternatively that Crocker discloses these limitations and that Perlman would be modified based on Crocker’s teachings.

1. Perlman’s “Logics”

92. I understand Petitioner asserts that Perlman discloses these limitations wherein its MPEG-2 logic is a purported DNE, the DOCSIS logic is a purported CME, and that the CPU 225 is a processor for both the DNE and the CME. Pet., 46, 53. Specifically, Petitioner states:

Perlman describes a “MPEG-2 logic 234 for processing multimedia cable/television channels, or “processing the incoming multimedia content.” Ex. 1007, ¶¶23-24; Ex. 1003, ¶¶129-133. This MPEG-2 logic is a data networking engine. Ex. 1003, ¶129. Perlman also discloses “software executed by the CPU 225” which is configured to select the MPEG-2 logic when appropriate. Ex. 1007, ¶28. A POSITA would understand a CPU to be a processor. Ex. 1003, ¶130.

Pet., 46. Thus, the Petition asserts that Perlman’s MPEG-2 logic” is purportedly the DNE, and **CPU 225** “which is configured to select the MPEG-2 logic when

appropriate” is purportedly the “at least one processor” of the DNE’s circuit. Pet., 46 (citing Ex. 1007 [Perlman] [0028]).

Perlman describes “DOCSIS logic 235 for processing packetized data according to the DOCSIS standard.” Ex. 1007, ¶23. The DOCSIS logic is a cable modem engine. Ex. 1003, ¶148. Perlman also discloses “software executed by the CPU 225” configured to select the DOCSIS logic when appropriate. Ex. 1007, ¶28. A POSITA would understand a CPU to be a processor. Ex. 1003, ¶149.

Pet., 53. Thus, the Petition asserts that Perlman’s “DOCSIS logic” is purportedly the CME, and Perlman purportedly “discloses ‘software executed *by the CPU 225*’ configured to select the DOCSIS logic when appropriate,” so the “CPU [is] a processor” of the purported CME’s circuit. Pet., 53.

93. The Petition asserts that, based on these arguments, while the purported DNE and CME are separate aspects of Perlman, the purported “at least one processor” of the “first circuit” and the “at least one processor” of the “second circuit” are purportedly the same CPU 225. I disagree, at least because having the processor of the first circuit and the processor of the second circuit be met by the same processor does not appear to meet the claim language of the ’775 patent’s limitations 18[a], [c], and [d]. The ’775 patent requires not just that there be a processor in a “first circuit” and a processor in a “second circuit,” but that the two circuits be “separate from” another. If the two circuits must be “separate” from

each other, and each circuit includes a processor, it follows that the circuits must have separate processors. Thus, the claims require “at least one processor” apiece for each of the first circuit (which includes the DNE) and second circuit (which includes the CME). The ’775 patent’s disclosure supports this conclusion, because that is what it discloses. Moreover, the ’775 patent indicates that part of what makes the advantages of its invention possible is that it can pipe-line particular functions to particular processors to improve performance. Ex. 1001 [’775] 4:41-57. Because the claims require two separate circuits each including at least one processor, the two processors cannot be one and the same. Thus, Perlman’s CPU 225, as the purported “at least one processor” for both the DNE “implemented in a first circuit” and the CME “implemented in a second circuit,” does not meet the claim limitations.

94. Furthermore, I note that the Petition does not appear to address why Perlman’s purported DNE (its MPEG-2 logic) and CME (its DOCSIS logic) would be implemented in a “first circuit” and “second circuit” respectively. The Petitioner states that “a POSITA would understand that the MPEG-2 logic and DOCSIS logic [] could be implemented on separate circuits.” Pet., 56. Petitioner then refers to an annotated version of Perlman’s Figure 2a for supposed support:

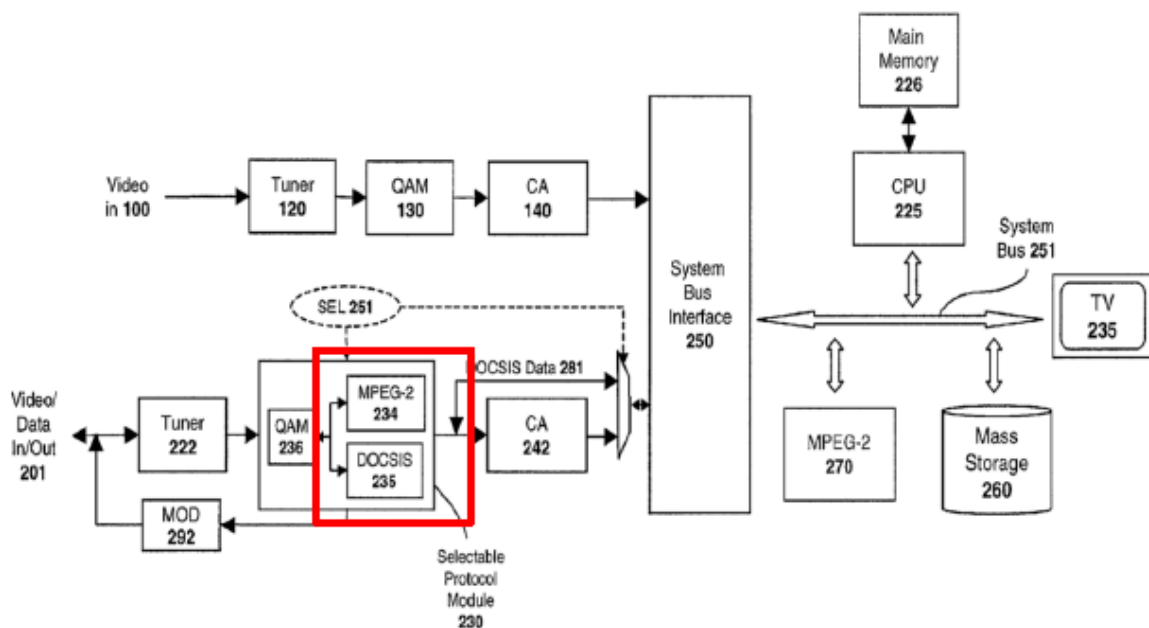


FIG. 2a

Pet., 56. I see nothing identified in Perlman, however, supporting the conclusion that the MPEG-2 logic and DOCSIS logic “could be implemented” in a “first circuit” and “second circuit.” This figure 2a of Perlman does not appear to me to provide support for that conclusion. Instead, while it depicts the MPEG-2 logic and the DOCSIS logic of Perlman as different boxes, both those boxes are depicted as being in the same module (“Selectable Protocol Module 230”). Perlman expressly describes this module as “a selectable protocol module including QAM/MPEG logic and Data Over Cable Service Interface Specification (‘DOCSIS’) logic.” Ex. 1007 [Perlman] [0012]. I am pointed to no indication that these two “logic[s]” would be on more than one circuit despite being expressly included in the selfsame

“module.” Thus, I am unpersuaded by Petitioner’s assertion that Perlman discloses a “first circuit” and “second circuit” based on these citations to disclosures associated with Figure 2a of Perlman.

2. Crocker’s “Line Cards.”

95. The Petition alternatively asserts that it would be obvious to modify Perlman’s MPEG-2 logic and DOCSIS logic with Crocker’s line cards 735 and 731, respectively, to achieve a “first circuit” that is “separate from” a “second circuit.” Pet., 47-48, 53-54, 56-58. The Petitioner asserts that “[a] line card was known in the art to be a circuit” (*id.*, 47-48, 53-54), and that the POSITA would have been motivated to modify Perlman’s MPEG-2 logic and DOCSIS logic with Crocker’s line cards 735 and 731. Specifically, Petitioner asserts:

A POSITA would be motivated to modify the MPEG logic of Perlman with the line cards 735 of Crocker. Ex. 1003, ¶137. The MPEG logic and line cards 735 have similar functionality, and the configuration of the line cards 735 on a first circuit that includes at least one processor would increase the flexibility of the system described in Perlman, which is one of Perlman’s stated goals, as well as a goal of Crocker. Ex. 1007, ¶ 10-11; Ex. 1008, 3:42-45; Ex. 1003, ¶¶137-138. “[I]mplementing the MPEG logic on a separate circuit, such that the hardware is isolated from other components, would make it easier to modify and update just the MPEG logic without affecting any other components of the system.” Ex. 1003, ¶137. Moreover, “during the early 2000’s, . . . MPEG-4 technology quickly emerged as

foundational to the broadcast community's adoption of the Internet Protocol. . . . these events would manifest to economic incentives for relevant equipment to leverage the chipsets and circuitry becoming available in the timeframe." *Id.*

Pet., 48.

A POSITA would have been motivated to modify the DOCSIS logic of Perlman with the line cards 731 of Crocker such that the DOCSIS logic is implemented in a second circuit that includes at least one processor. Ex. 1003, ¶155. This is because the DOCSIS logic and line cards 731 have similar functionality, and the configuration of the line cards 731 on a first circuit that includes at least one processor would increase the flexibility of the system described in Perlman by making any updates or modifications easier and quicker, which is one of Perlman's stated goals, as well as a goal of Crocker. Ex. 1007, ¶ 10-11; Ex. 1008, 3:42-45; Ex. 1003, ¶¶155-157.

Pet., 55.

A POSITA would have been motivated to modify the system in Perlman with a first circuit separate from the second circuit as in Crocker. In both Perlman and Crocker, the data networking and cable modem engines have separate functionalities, and are shown as separate components. Ex. 1007, ¶23; Ex. 1008, 15:43-52; Ex. 1003, ¶166. By implementing the two engines of Perlman on fully separate circuits, as in Crocker, the flexibility and efficiency of the system would be furthered, which is a goal of both Perlman and Crocker. Ex. 1007, ¶¶10-11; Ex. 1008, 3:42-45; Ex. 1003, ¶166. Thus, a POSITA

would have been motivated to modify Perlman based on Crocker to achieve that goal of a more flexible system. Ex. 1003, ¶166

Pet., 58.

96. Based on my review of these arguments, I understand a crux of Petitioner’s assertion that each of these three limitations is met by this combination to be that the POSITA would have been motivated to modify Perlman in view of Crocker’s disclosed line cards, and would be able to achieve these modifications, because Perlman’s MPEG-2 logic and DOCSIS logic have “similar functionality” to the line cards, and such a modification “would increase the flexibility of the system described in Perlman.” *Id.*, 48, 55, 58. However, I disagree that it is shown that the POSITA would have been motivated to modify Perlman in this way using Crocker’s technology.

97. The Petitioner concludes that the MPEG-2 logic and DOCSIS logic have “similar functionality” to the line cards 735 and 731, but I do not see any indication that the Petition explains where these similarities lie. The Petition does not point to overlapping functions between them, nor does it explain how their functions are even similar.

98. It is further unclear whether Perlman’s MPEG-2 logic and DOCSIS logic are software or hardware, and thus whether a POSITA even **could** modify them using Crocker’s line cards, which are hardware. I note that Perlman only

discloses the format of one of its other “logic” elements, the “selection logic” which may be software, hardware, firmware, or a combination of them:

[0028] The selection logic **250, 251** described herein may be embodied in software executed by the CPU **225** and configured to select between MPEG-2 logic **232, 234** and DOCSIS logic **233, 235** based on the actions of the user. Alternatively, the selection logic **250, 251** may be embodied in any combination of hardware (e.g., an application-specific integrated circuit (“ASIC”)), software and/or firmware while still complying with the underlying principles of the invention.

Ex. 1007 [Perlman] [0028]. Importantly, this passage addresses a different “selection logic” and not MPEG-2 or DOCSIS. I do not see any discussion by the Petitioner of the form the MPEG-2 logic and DOCSIS logic are proposed to take. Thus, it is not possible to judge whether Perlman and Crocker are “similar” such that a POSITA would actually be motivated to, or successful in, making this combination proposed by the Petitioner.

99. Indeed, the POSITA would understand that Perlman and Crocker’s systems do not have “similar functionalit[ies].” Petitioner asserts Perlman is a cable modem (CM) system (Pet., 15), but Crocker is explicitly a cable modem termination system (CMTS) (Pet., 16-17; Ex. 1008 [Crocker] 1:50-52). A CMTS is “essentially the antonym” to a cable modem system, as a CMTS is the system used by a cable provider while a cable modem system is used by the subscriber in their

home, and so exist at essentially opposite sides of the network. A CMTS handles vastly different functions than a CM, since it is designed to interface with dozens of CMs, not to *be* a CM.

100. Specifically, a CMTS is designed connect, on one hand, the Internet at large and, on the other hand, a network of cable modems. It also provides specialized management services, such as scheduling upstream transmissions, and specific radio-frequency functions such as ranging. A cable modem is designed to connect the radio-frequency channel (connected to the CMTS) to users of the Internet inside the home, including, *e.g.*, cable set-top boxes (like the ones I designed) and home computers. CMTSs are considerably more expensive. Because they are designed to interface to hundreds or thousands of cable modems, they need extremely high reliability (which is why they have line cards). CMs are designed to be very inexpensive, so that cable operators can purchase thousands of them and lease them to subscribers. In other words, a CMTS and a CM are vastly different. In fact, other than the fact that they share a two-way radio connection over coaxial cable, they have essentially no similarity.

101. Indeed, likening a cable modem system to a CMTS is like saying the knowledge, organization, or technology useful to ***make*** a movie (*e.g.* writing, directing, editing, camera crews, etc.) is the same as that which is useful to ***view*** a movie (*e.g.*, a television, sound system, and DVD player). Given this important

distinction, a POSITA would not be motivated to combine Perlman and Crocker. Perlman's intended purpose is to have a "multimedia system capable of selection between different network protocols for transmitting and receiving data and multimedia content" which is performed in "a more flexible, efficient and intelligent manner." Ex.-1007 [Perlman] [0002], [0011]. The addition of Crocker's line cards to Perlman is the opposite of a "flexible, efficient and intelligent manner," as Perlman does not use line cards or need to service cable modems. Indeed, adding a separable line card would seem to dramatically increase costs, including connectors and separate circuit boards needed to implement it. A POSITA, tasked with designing a cable modem, would understand CMTSs (since cable modems interface with them) and would also understand that it would not provide any useful teachings about designing a cable modem. Again, Perlman's basic principle of operation is to manage multimedia communications and network protocols. Adding hardware in the form of Crocker's line cards would unnecessarily complicate its system, as Perlman is not designed to manage multiple CM systems or implement line cards, but rather to select between multimedia channels and receive and transmit multimedia content

102. As to the Petition's other proposed motivation for why a POSITA would modify Perlman in view of Crocker, that it would "increase the flexibility" of Perlman's system, I see no explanation by the Petitioner of why, supposedly, the

addition of Crocker would increase flexibility. The excerpt of Crocker at 3:43-45, on which the Petition relies for its assertion, states that it is “desirable to improve upon the interoperability of hardware and/or software components in access networks in order to accommodate new and emerging network applications and technologies.” Ex. 1008 [Crocker] 3:43-45. But I see no explanation in the Petition as to how this quotation from Crocker would have motivated the POSITA to modify these disclosures of Perlman with Crocker’s line cards to meet the limitation, or how such a modification would actually result in increased flexibility of Perlman’s system.

103. Further, Perlman’s intended purpose is to have a “multimedia system capable of selection between different network protocols for transmitting and receiving data and multimedia content” which is performed in “a more flexible, efficient and intelligent manner.” Ex. 1007 [Perlman] [0002], [0011]. The addition of Crocker’s line cards to Perlman is the opposite of a “flexible, efficient and intelligent manner,” as Perlman does not use line cards or need to service cable modems.

104. Indeed, in customer premises equipment, such as a set-top box or cable modem, the addition of a separable line card dramatically increases costs (e.g. the costs of connectors and separate circuit boards). During my time at Scientific-Atlanta, my team devoted considerable effort to get rid of extra circuit

boards, cables, and connectors. Re-implementing a single circuit board as multiple boards with split functions is a step backwards in the consumer-electronic world. Thus, I conclude that is not shown that the POSITA would have been so motivated or have had a reasonable expectation of achieving the desired outcome by such a modification.

105. Thus, it is my opinion that a POSITA would not be motivated to modify Perlman in view of Crocker, or have a reasonable expectation of success in doing so.

F. A CME “Configured To Enable Upgrades To Its Software In a Manner That Is Independent Of Upgrades To The Software Of The [DNE]” (Limitation 18[g], All Claims, Ground 2).

106. Each claim requires “the cable modem engine configured to *enable upgrades* to its *software* in a manner that is *independent* of upgrades to the software of the data networking engine.” Ex. 1001 [’775] cl. 18:

Limitation 18[g] recites “the cable modem engine configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine.”

107. The Petitioner relies on Perlman, Crocker, and Fox for this limitation.

1. Neither Perlman Nor Crocker Disclose Independently Upgrading Software Of The Alleged CME From Software Of the Alleged DNE.

108. The Petition first asserts Perlman and Crocker each disclose this limitation. But I see no discussion in either Perlman or Crocker regarding

upgrading the software of their systems, much less any discussion that the purported CME and DNE of each can have its software upgraded independently.

a. Perlman

109. I understand that the Petition asserts Perlman discloses this limitation based on the ability of its selection logic to choose between using the MPEG-2 logic and DOCSIS logic. Specifically, the Petition asserts:

Perlman describes “selection logic 250 [that] switches between MPEG-2 logic 232 for receiving multimedia content and DOCSIS logic 233 for processing packetized DOCSIS data/content.” Ex. 1007, ¶27; Ex. 1003, ¶¶184-191. “Thus, the embodiment illustrated in FIG. 2b provides two separate communication channels (one unidirectional channel and one two-way channel) which process content and data under the DOCSIS standard when selected by selection logic 250-251. *Id.* Since the MPEG-2 logic 232 and DOCSIS logic 233 use separate communication channels and perform separate functions, the MPEG-2 logic 232 and DOCSIS logic 233 can be independently upgraded. Ex. 1003, ¶185.

Pet., 63-64. I disagree, however, that it is shown that this disclosure of Perlman would have been understood by the POSITA to indicate that Perlman’s system could be independently upgraded as claimed. The presence of alternate communications paths does not prove the existence of independent upgrades.

110. Nor do I see any showing or identification in the Petition, or any disclosure in Perlman, that the software of Perlman’s MPEG-2 logic or its DOCSIS

logic are even upgradable to begin with, much less configured for independent upgradability. The Petition asserts that, because of this separation of communication channels and functions disclosed in Perlman, the software of Perlman's system "**can** be independently upgraded," as quoted above. Pet., 63-64. In my view, based on the Petition's arguments, this conclusion does not follow. Perlman is silent on the matter of upgradability of its components. There is no indication that Perlman allows for **any** upgradability, much less independent upgradability of its components. Thus, it is my opinion that the POSITA would not have understood Perlman's system to be configured for such upgradability at all, much less configured to perform the more technically nuanced upgrading of the software of the one component independent of the other. To underscore this point, a POSITA would understand that an MPEG-2 processor is not upgradable at all. It performs a fixed function, MPEG-2 decoding. For example, in all of the set-top boxes I designed, none of the MPEG-2 processors were capable of any sort of software upgrade or change. Indeed, MPEG-2 transport has remained in use to this day, even with more modern video encoding standards such as MPEG-4.

b. Crocker

111. The Petition alternatively relies on Crocker, stating that the addition of Crocker's line cards to Perlman meets this limitation. The Petition bases this on

the conclusion that Crocker's line cards can be physically replaced. Specifically, the Petition states:

Similarly, in Crocker, the line cards 731 and 735 are physically separate, as described above with respect to element 18d. Ex. 1008, 2:43-55, FIG. 7; Ex. 1003, ¶187. Since the line cards 731 and 735 are installed on physical separate circuitry, updates to the software of one can be effected independently of updates to the other at least by physically replacing either circuit. Ex. 1003, ¶188.

Pet., 64. I disagree with the Petition's conclusion that the addition of Crocker to Perlman meets this limitation, for at least two reasons. I note that Petitioner does not assert, and Crocker does not disclose, the ability to upgrade software. Nor does Crocker disclose the ability to physically replace its line cards. Nor is physically replacing hardware is the same as upgrading software.

112. As an initial matter, the Petition neither points to, nor does Crocker appear to disclose, an ability for Crocker's line cards to be physically replaced. The Petition and its expert merely conclude they can be because they are installed on "physical[ly] separate circuitry." Pet., 64. That, however, does not follow. The POSITA would have understood that such physical circuitry is often made a permanent part of a computing device in such a way that it cannot be replaced except with difficulty, if at all.

113. Even if Crocker did disclose the ability to physically replace its hardware, I also see no indication that the combination of Perlman in view of Crocker would achieve the limitation requiring independent upgradability of software because the portions of Crocker's disclosure to which the Petition points are about replacing hardware, and upgrading software is not the same as replacing hardware. Indeed, replacing hardware is a well-respected alternative to a software upgrade in the art; it might even be said to teach away from software upgradability.

114. The '775 patent addresses the advantages of upgrading software, as opposed to replacing hardware. For example, the architecture of the '775 patent which allows for upgradability of software allows for easier development and use of software-partnering models:

From a development standpoint, the architecture can facilitate different software-partnering models, such as complete in-house development, software-components licensing and OEM vendor-differentiating design. In particular, data networking engine **120** provides third parties and OEMs with a dedicated computational platform to develop advanced services outside of the baseline cable modem and VoIP/PacketCable services, minimizing their support dependency on the cable modem provider. Moreover, the software architecture within cable modem engine **110** is designed in a modular way so that the Packet Cable E-MTA can be implemented with minimum impact on the cable modem.

Ex. 1001 ['775] 4:28-40.

115. Additionally, the '775 patent contemplates how, since hardware of the chips would not need to be replaced when upgrading the software, there would be “only a small incremental hardware cost/functional increase over current stand-alone cable modem chips.” Ex. 1001 ['775] 4:58-60. Thus, requiring hardware replacement, as Petitioner proposes is possible in Crocker, as opposed to upgrading software, as in the '775 patent, would result in higher costs anytime changes to the system needed to be implemented. For example, I often fought against hardware partitioning in my role at Scientific-Atlanta because adding connectors and separate circuit boards necessarily increases costs. The connectors also reduce reliability and force the consumer to “fiddle with” the hardware of their equipment. Therefore, replacing hardware is not synonymous with allowing upgradability of software, as it both does not render the same advantages and instead adds disadvantages.

116. Notably, I see no explanation in the Petition of why, supposedly, teachings of replacing hardware would be understood by the POSITA to apply to upgrading software as claimed. Thus, it is my opinion that adding what Petitioner asserts is possible in Crocker (allegedly replaceable hardware) to Perlman would not result in satisfying the limitation requiring independent upgradability of software which the claims require.

117. There is further no indication that, even if replacing hardware was considered to be the same as upgrading software, Crocker's teachings **could** be obviously and successfully applied to Perlman to achieve the claimed limitation. Moreover, even if it could, I do not see it shown that the POSITA would be motivated to do so. The ability to replace hardware, as the Petition asserts Crocker discloses, would be a ready alternative to update a system rather than upgrading software. I see no reason that the POSITA would have been motivated to upgrade software when the entire functional module is replaceable, as adding the ability to upgrade software of one module independently of other modules would be likely to not be worth the trouble it would take to develop and make sure works within the system if the components can be independently replaced.

118. Thus, in my opinion the POSITA is not shown to have had a motivation to modify Perlman or a reasonable expectation of success in achieving the claimed invention with the addition of Crocker's purported teachings to Perlman.

2. Fox Is Not Analogous Art To The '775 Patent.

119. The Petition argues that a combination of the Fox reference with Perlman and Crocker renders limitation 18[g] obvious. Pet., 63-64. I understand that for a reference to be considered in an obviousness analysis, it must be

analogous art. It is my opinion that Fox is not in the same “field of endeavor” as the ’775 patent.

120. The Petition asserts that Fox is analogous to the ’775 patent because “both relate to techniques for efficient networking.” Pet., 18. For purposes of this declaration, I will accept for the sake of argument the Petition’s classification of Fox’s field of endeavor as “techniques for efficient networking.” However, the ’775 patent’s field is one of “gateway cable modem” systems, not efficient networking. This is shown in various aspects of the ’775 patent.

121. For example, the ’775 patent is titled “Architecture for a flexible and high-performance gateway cable modem.” Its Abstract describes a “cable modem system and architecture.” Its “Field of the Invention” says “The present invention relates to cable modems and, in particular, relates to a cable modem system having a functionally partitioned and flexible architecture.” Ex. 1001 [’775] 1:7-9. Its Background section focuses upon a “future gateway cable modem” (*id.*, 1:13) and “designing ... a gateway cable modem” (*id.*, 1:16-17), and indicates that “[t]he present invention provides a gateway cable modem architecture that meets” certain “objectives” (*id.*, 1:56-57). Its “Summary of the Invention” says “[t]he present invention provides a gateway cable modem” and that “[o]ne embodiment of the invention is a cable modem system ...” *Id.*, 1:61-66. Its drawings relate to “a block diagram of a gateway cable modem” and a “functional block diagram

implementing the cable modem architecture of Fig. 1.” *Id.*, 2:42-45. And its claims recite a “cable modem system” (*id.*, cls. 1, 18) or “method of cable modem operation.” (*id.*, cl. 14).

122. Moreover, I note that the Petition itself appears to repeatedly state that the ’775 patent’s field of endeavor is gateway cable modems. Pet., 12 (stating “Schain is from the same field of endeavor as the ’775 Patent, as both relate to cable modem systems.”), 14 (stating that “Thi is from the same field of endeavor as the ’775 Patent, as both relate to cable modem systems.”), 25 (stating that “Perlman is from the same field of endeavor as the ’775 Patent, as both relate to cable modem systems.”).

123. Fox, on the other hand, does not mention any cable modems. This is, indeed, a fact suggesting that the POSITA would not have had a reason to apply Fox’s teachings to Perlman’s cable modem teachings.

124. It is my opinion that the ’775 patent and Fox are not in the same field of endeavor.

125. Thus, it is my opinion that Petitioner’s combination of Perlman, Crocker, and Fox do not disclose or render obvious the above-referenced limitation.

G. The CME’s “DOCSIS MAC Processor Configured To... Forward The Processed Packets Directly To The [DNE] Without The Involvement Of The DOCSIS Controller” (Limitation 18[i], All Claims, Ground 2).

126. Each of the claims require that the CME include a DOCSIS MAC processor and DOCSIS controller, and that the DOCSIS MAC processor be “configured to process downstream PDU packets and forward the processed packets directly” to the DNE “without the involvement of the DOCSIS controller.” Ex. 1001 [’775] cl. 18.

Limitation 18[h] recites “the cable modem engine including a DOCSIS controller and DOCSIS MAC processor.”

Limitation 18[i] recites “the DOCSIS MAC processor configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput”.

127. The Petition relies on a combination of Perlman and Crocker for these limitations. Pet., 65-67. The Petition contends that these limitations would be met by modifying Perlman, where Perlman already discloses processing packetized DOCSIS data. Pet., 66 (“Perlman’s ‘DOCSIS logic 233 [is] for *processing* packetized DOCSIS data/content.’ Ex. 1007 [Perlman] ¶27; Ex. 1003 [Martin-Decl.] ¶197.”). But I note that the claims require not only “processing packets,” but also that the packets be “forward[ed]” to the DNE. I see no indication that the Petitioner contends Perlman discloses (or renders obvious) forwarding the

processed packets, nor that Perlman discloses (or renders obvious) “direct[ing]” “forward[ing]” of “downstream PDU packets...to the data networking engine without the involvement of the DOCSIS controller.” Pet., 66-67. On the contrary, splitting a DOCSIS system’s architecture into three components so that distinct functions may be “pipe-lin[ed]” to specific processors to improve performance and allow packet bypass was an innovation of the ’775 patent, and this innovation is not found in Perlman. See Section VI.A; Ex.-1001 [’775] 2:55-58, 4:41-57. Thus, I see no indication that the Petitioner shows (or even expressly asserts) that Perlman, alone, discloses or renders obvious forwarding the processed packets to the purported data networking engine without involvement of the DOCSIS controller.

128. I am aware of no express disclosure in Perlman of either a DOCSIS MAC processor or a DOCSIS controller. I note the Petition does not assert such disclosure, but instead asserts both the DOCSIS MAC processor and DOCSIS controller would have been obvious to add, asserting that the “POSITA would have been motivated to include conventional components such as a controller and processor in the DOCSIS component of Perlman in order to process the data.” Pet., 66. But I see no discussion in the Petition as to why these two components would supposedly be considered “conventional.” I am aware of no reason to think it was. It was, as far as I am aware, the ’775 patent which split a DOCSIS system into three components so that distinct functions may be “pipe-lin[ed]” to specific

processors in order to improve performance and allow packet bypass, was one of the *innovations* of its invention. See ¶¶ 33-35, 93 *supra*; Ex. 1001 [’775] 2:55-58, 4:41-57. Thus, it is my opinion that it is not shown that the DOCSIS controller and distinct DOCSIS MAC processor would be “conventional” components to be added to Perlman. At most, the petition’s assertion of this arrangement in Perlman is fueled by hindsight, and not by any teaching arising from Perlman itself.

129. The Petition alternatively asserts that Perlman modified in view of Crocker would render obvious the invention. I disagree.

130. The Petition asserts:

Crocker also describes forwarding packets to the line card 735 for data networking: “packets are forwarded by the forwarding engine to a data network interface 735a.” Ex. 1008, 14:66-15:2; Ex. 1003, ¶¶198-200. ***Although the forwarding engine is not pictured as part of the line card 731, it would be a trivial modification*** to have the DOCSIS processor 855 of the line card 731 perform this function. Ex. 1003, ¶200.

A skilled person would have understood the well-known problem of minimizing path lengths to minimize latencies. Ex. 1003, ¶201. Minimizing latencies would create a more efficient system due to reduced delays. *Id.* The DOCSIS controller of Crocker performs separate functionality from that of the DOCSIS MAC processor. *Id.* Including this unrelated component in the forwarding of PDU packets would unnecessarily create a longer path for the data packets, leading

to more latency and a less efficient system. *Id.* Thus, it would have been obvious to a POSITA to forward the downstream PDU packets without the involvement of the DOCSIS controller.

Pet., 67.

131. I note that the Petition acknowledges Crocker’s “forwarding engine” is not shown as part of the “DOCSIS MAC,” the component which the claims require must process and forward the packets directly to the DNE. *Id.* (emphasized by bold italics). The Petition asserts that this deficiency can be remedied by making a “trivial modification” to Crocker’s architecture, such that the DOCSIS MAC processor is what forwards packets. As an initial matter, I note that Crocker never refers to its processor 855 as a “DOCSIS processor,” nor does the Petition explain why it refers to processor 855 as a “DOCSIS processor.” I further do not see any explanation for why this would be a trivial modification or how a POSITA would go about modifying the DOCSIS MAC processor to take on these new functions of the “forwarding engine.”

132. Thus, it is my opinion that a POSITA would not modify Crocker to have the purported DOCSIS MAC processor capable of “forwarding,” as the Petition does not explain exactly why or how a POSITA could achieve this modification or what makes it trivial.

133. I further disagree that a POSITA would be motivated to modify Perlman in view of Crocker in this manner. I note that I see no explanation in the

Petition as to why, supposedly, a POSITA would have a reason to add the capability described in Crocker to Perlman. This is especially true given my earlier discussion regarding how Perlman discloses neither a DOCSIS MAC processor nor a DOCSIS controller. *See* ¶ 128 *supra*. Without those components already existing in Perlman, it is unclear why a POSITA would have had any motivation to look to Crocker to modify Perlman to allow for forwarding between a DOCSIS MAC processor, which did not exist in Perlman, without involvement of a DOCSIS controller, which also did not exist in Perlman.

134. I understand that the Petition’s theory for modifying Perlman in view of Crocker with respect to these limitations is reliant on the “data network interface” of Crocker, which is supposedly part of the DNE that the downstream PDU packets of the limitation must be forwarded to in order to meet the claim. Pet., 50-51. The Petition argues that the “data network interface” of Crocker (the component the packets would allegedly be forwarded to), and Perlman’s “MPEG-2 logic,” are part of the combination that supposedly renders obvious the DNE. Pet., 49-53. There is no explanation, however, how these teachings in Perlman and Crocker would be combined to meet the forwarding without involvement of a DOCSIS controller limitation, including, specifically, how the modifications to Crocker’s purported DOCSIS MAC processor to allow it to take on the role of the “forwarding engine” and forward packets could then be carried over to modify

Perlman's system, which, I once again note, does not already include a DOCSIS MAC processor or DOCSIS controller.

135. The Petition also does not explain how a "data network interface" (of Crocker) has anything to do with MPEG-2, *i.e.*, the combination's purported DNE, including how or why a POSITA would incorporate it into Perlman's MPEG-2 logic. Nor does the Petition explain what the "data network interface" would be used for, how the combination would work, etc. Given this lack of explanation, it is my opinion that it is not shown that the POSITA not have had a reasonable expectation of success in making this combination as Petitioner proposes.

136. Thus, it is my opinion that Petitioner's Perlman and Crocker combination do not disclose or render obvious these limitations.

H. "A Data Bus That Connects The Data Networking Engine To The Cable Modem Engine" (Limitation 18[j], All Claims, Ground 2).

137. Each claim requires that the CME be connected to the DNE via a "data bus." Ex. 1001 [’775] cl. 18. Specifically, Limitation 18[j] recites "a ***data bus*** that connects the data networking engine to the cable modem engine."

138. The Petition relies upon Perlman in view of Crocker for this limitation in Ground 2. Pet., 67-69. I disagree that this limitation is shown to be met.

139. The Petition first asserts that Perlman discloses the required data bus based on the lines connecting the MPEG-2 logic and DOCSIS logic in Perlman's Figure 2a. Specifically, the Petition asserts:

Perlman shows the MPEG-2 logic 232 and DOCSIS logic 233 connected. Ex. 1007, FIG. 2a; Ex. 1003, ¶204.

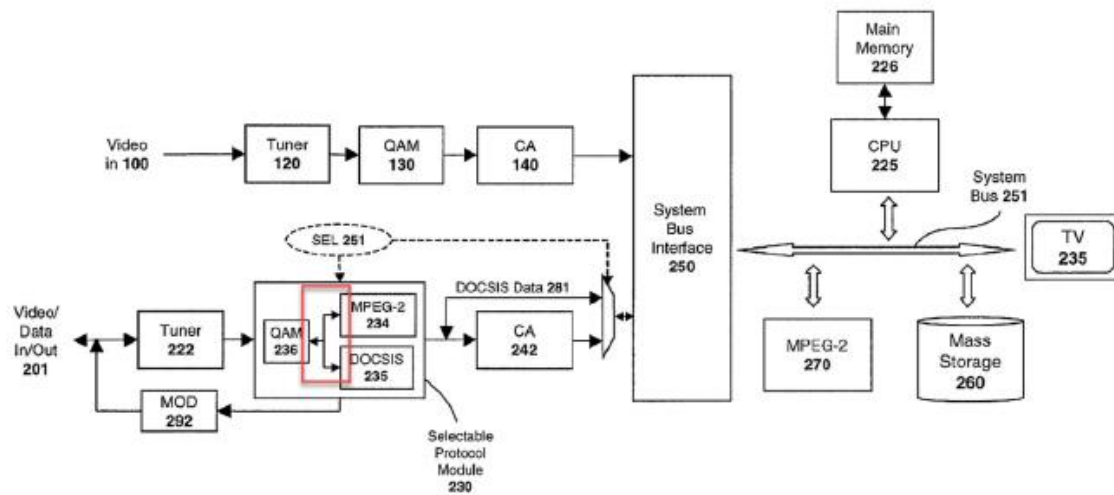


FIG. 2a

Pet., 67-68. Based on the Petition’s discussion and annotation of this figure of Perlman, I understand the Petition to conclude that Perlman’s connector “could be a bus.” Pet., 69. First, I see no citation in the Petition that Perlman even discloses a connector between the MPEG-2 logic and DOCSIS logic. This is because Perlman contains no such disclosure.

140. Indeed, it is clear from the figure as drawn that the output of the QAM demodulator flows into either the MPEG-2 decoder or DOCSIS block, and never flows between the two. This is very important because it is clear that there is no mechanism to send information (e.g. packets) from one to the other – the QAM sends its information into one or the other, and the two do not communicate with

each other. Data only flows in one direction, from QAM to either one block or the other, or from those blocks into the QAM. While the QAM must be connected to the DOCSIS and the QAM must be connected to the MPEG-2, there is no disclosed mechanism by which the DOCSIS is connected to the MPEG-2—nor are they shown to have any reason to. This is because Perlman teaches the MPEG-2 logic and DOCSIS logic perform distinct functions and only one is “selected” by the “selection logic 251” for a respective purpose. Ex. 1007 [Perlman] [0023] (“MPEG-2 logic ... process[es] multimedia cable/television channels and DOCSIS logic ... process[es] packetized data according to the DOCSIS standard”); *see also id.*, [0024]-[0025]. Thus, there is no indication that there is **any** connector between Perlman’s MPEG-2 logic to its DOCSIS logic, much less any indication of a need for the claimed “data bus” since these two modules do not communicate at all.

141. The Petition does not even show that the line connecting the MPEG-2 logic and DOCSIS logic is necessarily a physical connector. It does not even purport to address the question whether it is or could be. As I previously discussed at ¶ 98, it is unclear in Perlman’s disclosure whether the MPEG-2 logic and DOCSIS logic are software, hardware, or a combination of them. Thus, if the MPEG-2 logic and DOCSIS logic are software, then a POSITA would understand that any “connector” between them would not be physical, and thus would not be the claimed “data bus.”

142. I further see no citations in the Petition showing that Perlman discloses the possibility that these connectors could be a bus, let alone would necessarily be a bus. I note that Perlman does disclose buses, but does not describe the connection between these two elements as a bus. Perlman expressly designates two components related to buses in it Figure 2a: system bus interface 250 and system bus 251. Perlman has no further express disclosure regarding buses, especially not for this purported connector between its MPEG-2 logic and DOCSIS logic.

143. For the above reasons, it is my opinion that it is not shown that the POSITA would have understood the purported connector in Perlman between the MPEG-2 logic and DOCSIS logic to be a data bus.

144. Next, the Petition asserts that Crocker discloses a “data bus” connecting its “line cards 731 and 753 [sic],” citing Crocker’s Figure 7. Pet., 68-69. The Petition asserts:

Crocker explains that the “lines cards . . . may be configured to use at least one common dedicated line or back plane (e.g. 745). Ex. 1008, 16:33-36; Ex. 1003, ¶206. Such connectors can include, “for example, a backplane line or system bus.” Ex. 1008, 15:15-18; Ex. 1003, ¶207.

Pet., 69. However, I note that Crocker does not include any express disclosure of what the connecting line between line card 731 and 735 is. The citation relied upon by the Petition regarding the possibility of a “system bus” is directed to the

connection between Crocker's "Routing Engine A 701a ... to Routing Engine B 701b," which is instead **connector 746** of Fig. 7. Ex. 1008 [Crocker] 15:15-18. I have further annotated the Petition's annotated version of Figure 7 to illustrate where this connector is located in Crocker.

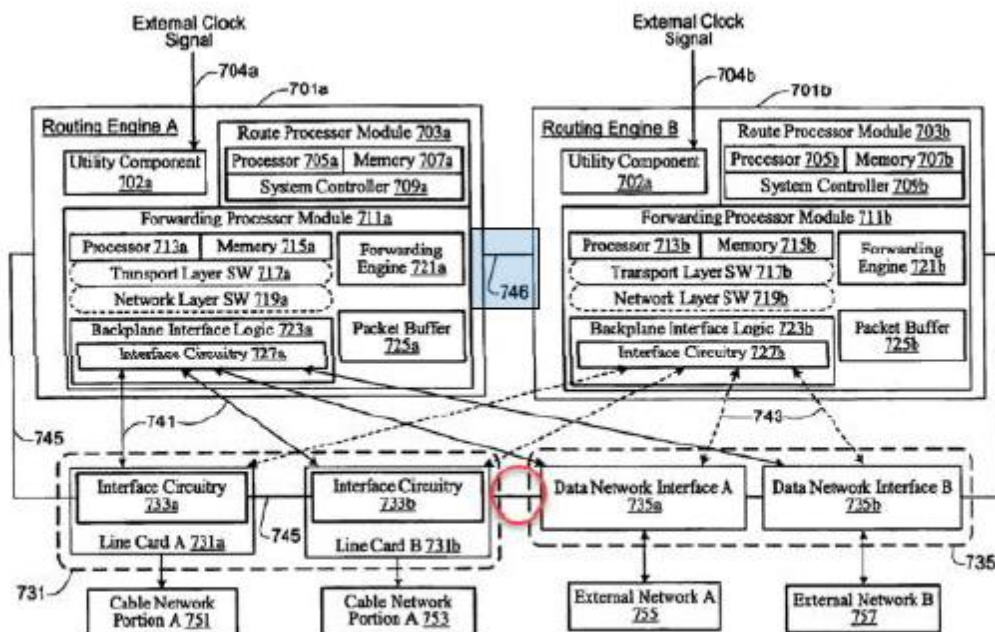


Figure 7 700

Ex. 1008 [Crocker] Fig. 7 (annotated). I see nothing in Crocker disclosing that the connecting line between line card 731 and 735 is a data bus, as Crocker's only express disclosure of something that even possibly might be such a bus is connecting line 746, and Crocker does not describe it as such a bus.

145. Even if Crocker's connector 746 were a data bus as claimed, I see no indication that a POSITA would be motivated to modify Perlman given that teaching from Crocker. The Petition asserts:

Thus, Perlman and Crocker disclose connecting the engines, and disclose that such a connector could be a bus. Accordingly, in view of Crocker and Perlman, a POSITA would have been motivated to connect the engines, e.g., with conventional means such as a data bus, so that they can pass data from one to the other. Ex. 1003, ¶209.

Pet., 69. Thus, the Petition asserts, the POSITA would have found it obvious to modify Perlman to add a data bus to connect its MPEG-2 logic and DOCSIS logic because, supposedly, it would be "conventional" and would allow data to pass from one to the other. But I note that, as discussed above, Perlman's system does not necessarily disclose any physical connector between its purported CME (its DOCSIS logic) and purported DNE (its MPEG-2 logic), and moreover, it is unclear if the MPEG-2 logic and DOCSIS logic are software, hardware, or a combination of the two and, moreover, that there is any communications at all between the two. Having the claimed data bus in Perlman's system might

unnecessarily complicate Perlman's system with what appears to be no discernible benefit. Indeed, the Petition fails to show or even assert any specific reason for the POSITA to pass data between the MPEG-2 logic and

DOCSIS logic. I again note that the MPEG-2 logic and DOCSIS logic are selected alternatives of the other to perform their distinct functions, where only one can be chosen based on the input from the user. Ex. 1007 [Perlman] [0023] (“MPEG-2 logic ... process[es] multimedia cable/television channels and DOCSIS logic ... process[es] packetized data according to the DOCSIS standard”); *see also id.*, [0024]-[0025]. There is no disclosure in Perlman of any interaction between the MPEG-2 logic and DOCSIS logic, or any reason data would need to flow between them, and so there is no feasible reason that a POSITA would be motivated to connect them to each other via a data bus. Thus, it is my opinion that a POSITA would not be motivated to modify Perlman to add yet another data bus.

146. The Petition has also failed to show a reasonable expectation of success for the POSITA to add Crocker’s purported data bus to Perlman. The Petition does not appear to address how this could be successfully done, or describe what form it supposedly could successfully take. For similar reasons as I discussed above, such an addition may complicate Perlman’s system, adding additional cost and unforeseen technical complications.

147. Thus, it is my opinion that neither Perlman nor Crocker disclose the above-referenced limitation.

I. The “Data Networking Engine” That “Perform[s] Home Networking Functions Including Interfacing With Customer Provided Equipment” (Limitations 18[a]-[b], All Claims).

148. Each of the claims require a “data networking engine implemented in a first circuit” where “the data networking engine [] perform[s] home networking functions including interfacing with customer provided equipment.” Ex. 1001 [’775] cl. 18.

Limitation 18[a] recites “a data networking engine implemented in a first circuit that includes at least one processor;”

Limitation 18[b] recites “the data networking engine programmed with software that when executed by the at least one processor of the first circuit causes the data networking engine to perform home networking functions including interfacing with customer provided equipment;”

149. The Petition asserts that Perlman discloses these limitations, and alternatively that Crocker discloses these limitations and would be combined with Perlman. I disagree.

150. First, the Petition contends that “[t]he combination of Perlman and Crocker disclose” a DNE. Pet., 46. It is my opinion that no such data networking engine is disclosed in either Perlman or Crocker.

151. Regarding Perlman, its alleged DNE, the MPEG-2 logic, does not perform the same functions that the ’775 patent describes an exemplary DNE is

capable of. The exemplary DNE, as I discussed at ¶ 74 and as described in the '775 patent, is described as being “responsible for all data networking including advanced multi-port bridging/routing with NAT/firewall and VPN ... and home networking applications.” See Ex. 1001 [’775] 3:49-53. As a further example, in certain embodiments, “as seen in Fig. 1, [the] data networking engine is capable of additional CPE functionality such as Ethernet, USB and other LAN I/F communications ... with appropriate CPE drivers ...” *Id.*, 3:63-66. While a system need not perform all of these functions to qualify as a DNE, I see no explanation in the Petition as to any capability in MPEG-2 logic which remotely looks like any of these examples, nor does the Petition offer any explanation. Instead, the Petition asserts that Perlman’s MPEG-2 logic can process multimedia channels and incoming multimedia content, but does not explain why that would be sufficient for it to be considered a DNE given the broad disclosures in the ’775 patent regarding its other capabilities. Pet., 49-50.

152. There is no basis for asserting that an MPEG-2 decoder performs any networking functions at all. To a POSITA, an MPEG-2 decoder implements a processor that decodes compressed digital video into uncompressed digital video. Indeed, in broadcast video, *e.g.*, such video is broadcast – it has no source or destination fields in its packets. If anything, broadcast MPEG-2 teaches away from conventional networking. MPEG-2 decoders perform no network functions such as

processing addresses, correlating MAC addresses to physical ports, performing bridging or routing functions, etc. In other words, there is no basis for asserting that Perlman implements any sort of DNE.

153. Further, a POSITA would readily grasp that an MPEG-2 processor performs literally none of the recited functions of an exemplary DNE (“all data networking including advanced multi-port bridging/routing with NAT/firewall and VPN ... and home networking applications”). Further, MPEG-2 decoders output to video systems, such as an HDMI connector or analog video connector. Such decoders do not interface to “additional CPE functionality such as Ethernet, USB and other LAN I/F communications.” It is an MPEG-2 decoder, not a networking engine. Thus, it is my opinion that Perlman’s MPEG-2 logic is not shown to be a DNE.

154. Nor do I see any indication that Perlman’s MPEG-2 logic performs the explicitly recited functions of a DNE, that it “perform[] home networking functions including interfacing with customer provided equipment. The Petition asserts that it performs “home networking functions” because it processes multimedia cable television channels and incoming multimedia content. Pet., 49-50. Petitioner also contends that:

Further “if a user is watching a first cable channel via tuner 120 and decides to concurrently record a second cable channel or watch the second channel on a separate display or picture-in-picture window, the

second tuner 222 will lock on to the second channel responsive to the user's request and the selection logic 251 will select the MPEG-2 logic 234 . . . for processing the incoming multimedia content from the second channel.” Ex. 1007, ¶24.

Further, Perlman describes that using prior art systems, “a user is able to concurrently receive two cable broadcast channels while communicating over the Internet (e.g., sending email, browsing Web pages, downloading interactive content related to a particular TV program, ... etc.).” Ex. 1007, ¶28.

Pet., 50. I see no indication that Perlman’s MPEG-2 logic performs home networking functions including interfacing with customer provided equipment.

Rather, Perlman’s CA module 242, at most, appears to perform these functions and interfaces with equipment in the subscriber’s home and, even then, only to locally co-located equipment such as a television set. Ex. 1007 [Perlman], [0023]-[0024].

To a POSITA, distribution of decoded video from the output of an MPEG-2 decoder over a home network would be a bug, not a feature – it is actually a blatant security issue.

155. The distinction between Perlman’s MPEG-2 logic functions and the functions of the DNE of the ’775 patent is shown by Perlman’s disclosures that Perlman’s MPEG-2 processes the channels and content but ultimately does not interface with customer provided equipment. Ex. 1007 [Perlman] [0023] (“MPEG-2 logic 234 ... process[es] multimedia cable/television channels ...”), [0024] (“the

selection logic 251 will select the MPEG-2 logic 234 ... for processing the incoming multimedia content from the second channel.”). It is a different component, Perlman’s CA 242 processor, depicted in annotated Fig. 2 below, that interfaces with the customer provided equipment. *Id.* (“The CA module 242 of this embodiment will then operate on the incoming multimedia content as described above (*i.e.*, providing access to the channel/content only if the user has the right to view it).”).

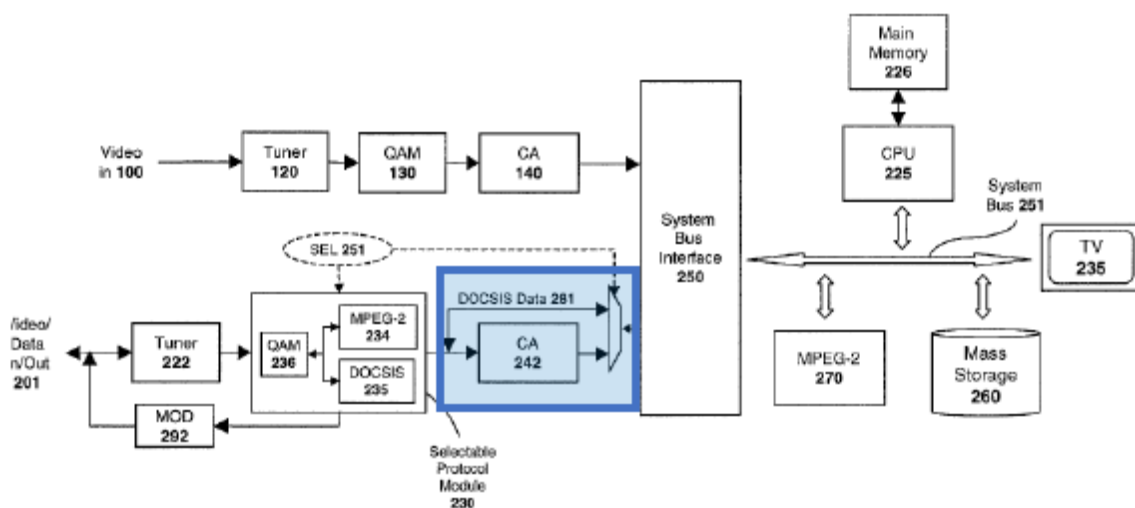


FIG. 2a

Ex. 1007 [Perlman] Fig. 2a (annotated). As can also be seen in the figure above, MPEG-2 interfaces with CA 242 and there is no indication that MPEG-2 “interfaces” with consumer premises equipment, such as the TV. To the extent the CA does interface with a TV, it is over a direct connection, such as an HDMI

connector, and not over a network. Again, sending decoded video over a network is a major security issue.

156. The Petition alternatively asserts that Crocker discloses a DNE based on its “line cards 735.” Pet., 46. Specifically, the Petition asserts:

To the extent that the Board finds that does not disclose a data networking engine implemented in a first circuit that includes at least one processor, one is disclosed by Crocker. Ex. 1003, ¶131. Crocker describes “line cards 735,” which “may interface with packet-switched networks, thereby connecting the cable modem system with the Internet.” Ex. 1008, 15:60-65; Ex. 1003, ¶132. Line cards 735 include a “data network interface 735a [which] functions as an interface component between external data sources and the cable system.” Ex. 1008, 15:53-55, FIG. 7; Ex. 1003, ¶132. The line card 735, including the data network interface 735a, therefore is a data networking engine. Ex. 1003, ¶133.

Pet., 46-47. The Petition appears to conclude from this that, because line card 735 “functions as an interface component between external data sources and the cable system,” it supposedly must be a DNE as claimed. I disagree. A DNE is not met simply by anything that “interfaces” with “external data sources” and the “cable system.”

157. I see no evidence cited in the Petition that Crocker’s line card 735 performs any “data networking processing” based on the exemplary processing discussed above. Petitioner relies on the card’s “data network interface 735a,” but

that only acts as an “*interface*” and is not shown to perform such “data networking processing.” Ex. 1008 [Crocker], 15:2, 15:53-55.

158. “Interfacing” with a cable system is not listed in any of the exemplary functions of a DNE which the ’775 patent discloses (already discussed above), and so would not be enough to indicate a data networking engine. Nor is interfacing with the Internet, an example of an “external data network” in Crocker, a function of a DNE. Ex. 1008 [Crocker] 15: 16:26-32 (designating an example of an “external data network” as “the Internet”). Nowhere does Petitioner point to disclosure that “data network interface 735a” performs any functions that would be associated with data networking, or how data network interface 735a interacts with home networking applications or customer provided equipment. Thus, Petitioner has not shown that Crocker’s line card 735, with its data network interface 735a, is a DNE.

159. Even if Crocker’s line card 735 was considered to be a DNE, there is no indication that it would perform *home* networking functions including interfacing with customer provided equipment, as Crocker is a cable modem termination system (CMTS), not a cable modem system. The Petition asserts:

Further, to the extent that the Board determines that Perlman does not describe the MPEG logic as performing home networking functions including interfacing with customer provided equipment, this element is disclosed by Crocker, which describes the line cards 735 as

performing home networking functions. The line cards 735 connecting the CMTS to external networks 755 and 757 “utilize different types of communication protocols (e.g., Ethernet, Frame Relay, ATM, TCP/IP, etc.).” Ex. 1008, 15:50-53; Ex. 1003, ¶142. The “data network interface,” driven by the line cards discussed above, “may include hardware and software for interfacing to various networks.” In particular, “a data network interface may be implemented on a line card as part of a conventional router for a packet-switched network.” Ex. 1008, 15:57-62; Ex. 1003, ¶143. “Using this type of configuration, the CMTS is able to send and/or receive IP packets to and from the data network interface using, for example, network layer software 719a.” Ex. 1008, 15:62-65.

Crocker describes such data networking including interfacing with customer provided equipment, such as computer systems 932 and other wireless devices 956 for home networking:

[A] local area network (LAN) 930 . . . may be further connected to one or more computer systems 932. Another wireless device may be a portable/wireless computer system 954, which is able to transmit and receive information to the Head End via uplink and downlink channels 907 and 909. Other wireless devices 956 may include, for example, wireless telephones, handheld computing devices, etc.

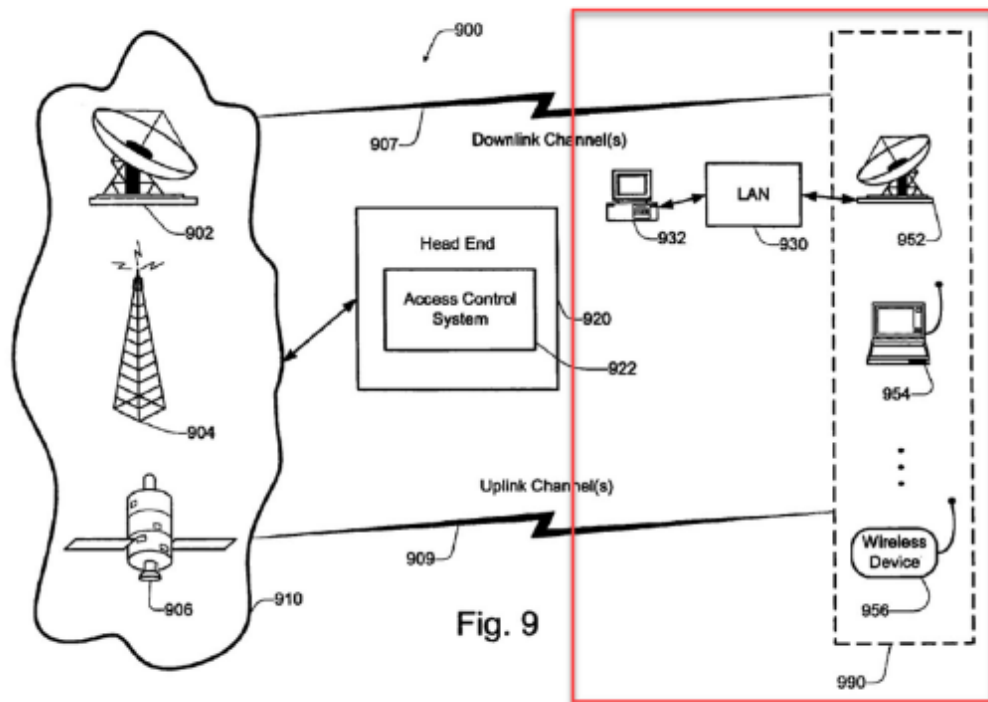


Fig. 9

Ex. 1008, 22:11-222, FIG. 9 (annotated).

Pet., 50-52.

160. I disagree with the Petition’s assertion that Crocker discloses a “data networking engine” that “interfac[es] with *customer provided equipment*.”

Crocker is a CMTS, not a cable modem. Ex. 1008 [Crocker] 1:50-52 (“the Head End complex 102 typically includes a *Cable Modem Termination System* (CMTS)”). A CMTS is not the same thing as a cable modem system. Indeed, a CMTS and CM exist at opposite sides of a cable network and are essentially antonyms. Whereas the cable modem is at the subscriber’s side, the CMTS is at the

head-end—the cable provider’s side. Ex. 2004 []³ 2 (“A cable modem termination system (CMTS) at the cable operator end (also known as head-end)” vs. a “Cable modem (CM) which is located at the subscribers end”). Thus, because Crocker’s system is at the cable provider’s side, or the head-end, the “data network interface” allegedly disclosed in Crocker is not configured to interface with **customer** provided equipment (such as Internet-enabled devices in a customer’s building) but instead interfaces with an **external network** at the cable headend, such as the internet.

161. A CMTS, thus, handles different functions than a CM. It is designed to interface with dozens of CMs, not to *be* a CM. The CMTS is “where video signals are collected and modulated in a frequency stack known as a channel lineup” which are “sent to every home in the franchise area.” Ex. 2005 [IEEE-Magazine] 202. The CMTS is not involved with any particular customer’s equipment: to the contrary, it collects and modulates signals to be sent **to** cable modems, which perform their own functions. A CM, in contrast, interfaces with the CMTS itself and **customer provided equipment**, where the CM “will receive an IP packet from host customer premises equipment (CPE), typically over Ethernet, and will add link encryption, mediate access to the return path, and finally modulate the data onto the cable network.” *Id.*

³ <https://www.thegeekstuff.com/2012/05/docsis-introduction/>

162. Thus, because Crocker's CMTS supports interactions with cable modems downstream of it, and external networks upstream of it, there is no interfacing between a CMTS and devices in the subscriber's home. As the POSITA would have understood, it is the cable modem's function to interface with customer provided equipment, while in contrast a CMTS would not have interfaced with the equipment provided by individual customers. Therefore, Crocker cannot disclose a "data networking engine" which interfac[es] with customer provided equipment" because there **is no** customer provided equipment to interface with the CMTS at the head-end of Crocker's network.

163. Even if Crocker were found to disclose the required DNE, I see no indication that a POSITA would have been motivated to modify Perlman using Crocker's teachings or would have had a reasonable expectation of success in doing so. My reasoning for this conclusion is for the same reasons that the POSITA is not shown to be motivated to or have success in applying Crocker's line cards to Perlman's system, discussed at ¶¶ 96-105 *supra*. This is because, as I discussed there, there is no indication why Perlman's MPEG-2 logic supposedly has similar functionality to Crocker's line card 735, nor any explanation as to what benefits would be rendered to Perlman by such a modification. In other words, a POSITA, tasked with improving a cable modem, would never look to the design of a CMTS to improve its design.

164. Thus, it is my opinion that neither Perlman nor Crocker disclose or render obvious the claims.

165. In my opinion, for at least these reasons, Petitioner and its expert, Mr. Martin, fail to demonstrate that its references in grounds 1 and 2 disclose or render obvious the challenged claims of the '775 patent.

VII. CONCLUSION

166. At this stage of the proceedings, my opinions are preliminary and limited to the issues on which I have been asked to form an opinion. I may further develop these opinions or offer additional opinions after a decision to institute, should the Board decide to do so.

167. Although my complete opinions are set forth above, for convenience I summarize several points of my opinions in conclusion. For the foregoing reasons, based on my expertise and experience and the record of this case that I have reviewed, it is my opinion that:

- Claims 18-19 are not obvious over Schain in view of Thi;
- Claims 18-19 are not obvious over Perlman in view of Crocker, and further in view of Fox.

168. I understand that my opinions discussed above support a legal conclusion that claims 18-19 are nonobvious.

In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

I hereby declare that all statements made herein of my own knowledge are true and all statements made herein on information and belief were and are believed by me to be true, and that all statements herein were and are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that any such willful false statements may jeopardize the validity of the application or any patents issued thereon.

Respectfully submitted,

Dated: June 27, 2024



Samuel H. Russ, Ph.D.

EXHIBIT A

Curriculum Vitae of Dr. Samuel H. Russ

Personal

Mailing Address: 150 Student Services Dr., SH 4119, Mobile, AL 36688
Phone: (251) 461-1378
e-mail: sruss@southalabama.edu
Citizenship: U.S.

Education

Ph.D. in Electrical Engineering, Georgia Institute of Technology, 1991.
Thesis Title: *An Information-Theoretic Approach to Analysis of Computer Architectures and Compression of Instruction Memory Usage*
Thesis Advisor: Dr. Cecil O. Alford
Bachelor's of Electrical Engineering (with Highest Honor), Georgia Institute of Technology, 1986.

Employment

University of South Alabama

2007 – Present

Interim Chair, Department of Electrical and Computer Engineering (2015-2016)

Associate Professor, Department of Electrical and Computer Engineering (2011-present)

Assistant Professor, Department of Electrical and Computer Engineering

Developing new class in signal integrity, developing cross-disciplinary collaborative research efforts, updating labs and class materials, teaching both undergraduate and graduate classes.

Scientific-Atlanta (Later Cisco, Now Technicolor)

2000 - 2007

Manager, Advanced Technologies R&D, Explored major new technologies including home networking and multi-room video distribution; oversaw construction of prototypes and demonstrations; demonstrated technologies at trade shows and to stock analysts; managed group of approximately 10 designing set-top boxes for the cable television industry including all phases of high-volume electronic design including layout, high-speed digital design, emissions considerations, gate array conversion, and designing with custom ASICs; supervised cross-functional team to increase hard drive reliability; wrote numerous patent applications. Products deployed widely, including Time Warner Cable and Cablevision.

IVI Checkmate (Now Ingenico)

1999 – 2000

Matrix Manager, Electrical Engineering, Supervised staff of approximately 6 electrical engineers, oversaw assignments, allocated time across multiple projects, worked to coordinate project schedules with priorities, assisted in sales and other customer communications.

Staff Electrical Engineer, Oversaw major design overhaul of touch-pad payment system including embedded-systems design, power-system design, and system layout and schematic capture. System deployed widely at Wal-Mart, Home Depot, and others.

Mississippi State University

1994 - 1999

Thrust Leader, Computing Systems Research Thrust and Systems Integration Group, NSF Engineering Research Center -- Coordinate research plans and NSF reporting for 6 faculty and 3 full-time staff, assist in development of strategic plans and pursuit of funding opportunities, oversight of development of the ERC-wide integrated testbed. Managed multi-year research project in distributed computing that included 11 students and 5 faculty.

Assistant Professor, Department of Electrical & Computer Engineering -- Developed all-new graduate class in circuit board design, authored textbook chapter, developing new undergraduate lab, pioneered teaching classes over 2-way interactive video.

Dickerson Vision Technologies (Now Cognex)**1992 - 1994**

Director of Manufacturing--Oversaw the development and implementation of a manufacturing plan for the company.

Senior Applications Engineer--Developed firmware and user-interface software for the company's proprietary hardware, Assisted in development of machine vision system hardware, Assisted in sales duties.

Georgia Institute of Technology**1987 - 1991**

Graduate Research Assistant--Helped design five VLSI chips while developing two custom CPU's, Silicon-compiler-based computer chip design, including initial design, full functional simulation, size and timing optimization, and manufacturing test development.

Publications**Books**

1. Samuel H. Russ, *Signal Integrity: Applied Electromagnetics and Professional Practice*, Springer, 2016. (Textbook)
2. Samuel H. Russ, *Signal Integrity: Applied Electromagnetics and Professional Practice*, Second Edition, Springer, 2022. (Textbook)

Book Chapters

1. Samuel H. Russ, "High-Speed Digital Effects", Chapter 10 of John Kraus and Daniel Fleisch, *Electromagnetics with Applications, Fifth Edition*, McGraw-Hill, 1998. (Textbook)
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1. Samuel Russ, "The Threat of Malicious Circuit-Board Alteration: Attack Taxonomy and Examples," *Electronic Device Failure Analysis*, Vol. 23, Issue 3, August 2021, pp. 13-22.
2. Mink DM, McDonald J, Bagui S, Glisson WB, Shropshire J, Benton R, Russ S. Near-Real-Time IDS for the U.S. FAA's NextGen ADS-B. *Big Data and Cognitive Computing*. 2021; 5(2):27. <https://doi.org/10.3390/bdcc5020027>
3. S. H. Russ and J. Gatlin, "Ways to hack a printed circuit board: PCB production is an underappreciated vulnerability in the global supply chain," *IEEE Spectrum*, vol. 57, no. 9, pp. 38-43, Sept. 2020.
4. Samuel H. Russ, Cade C. Cashen, Thomas Thomas, and Roma Hanks, "Smart Grid Architecture for Unobtrusive Home Health Monitoring," *National Social Science Journal*, Vol. 44, No. 1, 2015, pp. 62-68.
5. Samuel H. Russ, Tho D. Ha, and Jonathan H. Shapiro, "Simulation-based Optimization of Wear Leveling for Solid-State Disk Digital Video Recording," *IEEE Transactions on Consumer Electronics*, Vol. 60, No. 3, Nov. 2014, pp. 363-367.
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7. Samuel H. Russ and Ramesh Nallur, "Digital Video Recording onto Solid-State Disks: Feasibility and Lifetime Estimation", *IEEE Transactions on Consumer Electronics*, Vol. 57, No. 2, May 2011, pp. 558-563.
8. Samuel H. Russ and Sasan Haghani, "802.11g Packet-Loss Behavior at High Sustained Bit Rates in the Home", *IEEE Transactions on Consumer Electronics*, Vol. 55, No. 2, May 2009, pp. 788-791.
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- Performance Limits”, *IEEE Transactions on Consumer Electronics*, Vol. 55, No. 1, Feb. 2009, pp. 132-138.
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 11. Roger L. King, Samuel H. Russ, Aric B. Lambert, Donna S. Reese, “An artificial immune system model for intelligent agents”, *Future Generation Computer Systems*, Volume 17, Issue 4, pp. 335 - 343 (January 2001).
 12. Dr. Samuel H. Russ, Jonathan Robinson, Matt Gleeson, Brad Meyers, and Chun-Heong Tan, “Using Hector to Run MPI Programs over Networked Workstations”, *Concurrency - Practice and Experience*, Vol. 11, No. 4, pp. 189-204 (1999).
 13. Russ, S.H. Reece, K. Robinson, J. Meyers, B. Rajan, D. Rajagopalan, L. Chun-Heong Tan, “Hector: an agent based architecture for dynamic resource management”, *IEEE Concurrency*, Vol. 7, No. 2, pp. 47-55, Apr-Jun 1999.
 14. Dr. Samuel H. Russ, Jonathan Robinson, Dr. Brian K. Flachs, and Bjorn Heckel, “The Hector Distributed Run-Time Environment”, *IEEE Transactions on Parallel and Distributed Systems*, Vol. 9, No. 11, pp. 1102-1114 (1998).
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1. U.S. Patent Number 6,748,080, “Apparatus for entitling remote client devices”, Samuel Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, June 8, 2004.
2. U.S. Patent Number 7,181,010, “Apparatus for entitling remote client devices”, Samuel Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, February 20, 2007.
3. U.S. Patent Number 7,360,233, “Broadcast carousel system access for remote home communication terminal”, Samuel Russ, Michael Gaul, and Anthony Wasilewski, April 15, 2008.
4. U.S. Patent Number 7,360,235, “Systems and methods for operating a peripheral record/playback device in a networked multimedia system”, David Davies, Samuel Russ, and Irvan Krantzler, April 15, 2008.
5. U.S. Patent Number 7,499,822, “Analog set-top calibration patterns in manufacturing”, Leo Montreuil, Wayne B. Williams, Samuel H. Russ, and Robert Kriete, March 3, 2009.
6. U.S. Patent Number 7,505,592, “Apparatus for entitling and transmitting service instances to remote client devices”, Samuel H. Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, March 17, 2009.
7. U.S. Patent Number 7,516,470, “Locally-updated interactive program guide”, Samuel H. Russ and Michael Gaul, April 7, 2009.
8. U.S. Patent Number 7,826,711, “Digital Video Disc (DVD) Player or Digital Video Recorder (DVR) Playback with Memory”, Samuel H. Russ, Nov. 2, 2010.
9. U.S. Patent Number 7,849,486, “Networked subscriber television distribution”, Samuel H. Russ, David Lett, Jonathan Robinson, and Michael Gaul, Dec. 7, 2010.
10. U.S. Patent Number 7,860,250, “Apparatus for entitling and transmitting service instances to remote client devices”, Samuel H. Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, Dec. 28, 2010.
11. U.S. Patent Number 7,861,272, “Networked subscriber television distribution”, Samuel H. Russ, David Lett, Jonathan Robinson, and Michael Gaul, Dec. 28, 2010.
12. U.S. Patent Number 7,870,584, “Interactive program guide with selectable updating”, Samuel H. Russ and Michael Gaul, Jan. 11, 2011.
13. U.S. Patent Number 7,876,998, “DVD playback over multi-room by copying to HDD”, William Wall and Samuel H. Russ, Jan. 25, 2011.

14. U.S. Patent Number 7,908,625, "Networked multimedia system", Neil C. Robertson, David B. Lett, Samuel H. Russ, Bohdan S. Prus, Michael A. Gaul, and Ajith N. Nair, March 15, 2011.
15. U.S. Patent Number 7,937,737, "Field qualification of disk drives in consumer electronics devices", Samuel H. Russ and Mark R. Murray, May 3, 2011.
16. U.S. Patent Number 7,961,780, "Generated set top calibration patterns in manufacturing", Leo Montreuil, Wayne B. Williams, Samuel H. Russ, and Robert Kriete, Jun. 14, 2011.
17. U.S. Patent Number 7,978,720, "Digital media device having media content transfer capability", Samuel H. Russ, Christopher L. Stallings, July 12, 2011.
18. U.S. Patent Number 8,046,806, "Multiroom point of deployment module", William E. Wall, Samuel H. Russ, Oct. 25, 2011.
19. U.S. Patent Number 8,127,236, "Proximity detection using wireless connectivity in a communications system", Paul J. Claussen, Ajith N. Nair, and Samuel H. Russ, Feb. 28, 2012.
20. U.S. Patent Number 8,181,205, "PVR Channel and PVR IPG Information", Samuel H. Russ, Michael A. Gaul, and Dariusz S. Kaminski, May 15, 2012.
21. U.S. Patent Number 8,208,796, "Systems and methods for prioritizing the storage location of media data", Bohdan Prus and Samuel H. Russ, June 26, 2012.
22. U.S. Patent Number 8,280,229, "DVD playback over multi-room by copying to HDD", William E. Wall and Samuel H. Russ, October 2, 2012.
23. U.S. Patent Number 8,295,338, "Generated set top calibration patterns in manufacturing", Leo Montreuil, Wayne B. Williams, Samuel H. Russ, and Robert A. Kriete, October 23, 2012.
24. U.S. Patent Number 8,364,015, "Stretch and zoom bar for displaying information", Samuel H. Russ and Gary Hibbard, January 29, 2013.
25. U.S. Patent Number 8,549,567, "Media content sharing over a home network", Samuel H. Russ, David B. Lett, Jonathan Robinson, Michael A. Gaul, October 1, 2013.
26. U.S. Patent Number 8,627,385, "Systems and methods for operating a peripheral record playback device in a networked multimedia system", David B. Davies, Samuel H. Russ, Irvan J. Krantzler, January 7, 2014.
27. U.S. Patent Number 8,966,550, "Home communication systems," David B. Davies, Samuel H. Russ, Irvan J. Krantzler, February 24, 2015.
28. U.S. Patent Number 9,762,970, "Access of stored video from peer devices in a local network," David B. Davies, Samuel H. Russ, and Irvan J. Krantzler, September 12, 2017.
29. U.S. Patent Number 10,412,439, "PVR Channel and PVR IPG Information", Samuel H. Russ, Michael A. Gaul, and Dariusz S. Kaminski, Sep. 10, 2019.

European Patents

1. European Patent Number EP1543680B1, "Locally-updated interactive program guide", Samuel Russ and Michael Gaul, Feb. 17, 2010.
2. European Patent Number EP1673937B1, "Proximity detection using wireless connectivity in a communications system", Paul Claussen, Ajith Nair, and Samuel Russ, April 21, 2010.
3. European Patent Number EP1604523B1, "Method for determining the encryption of a service content depending on the fidelity of the reformatting of said content", Samuel Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, Nov. 21, 2012.
4. European Patent Number EP1552699B1, "Networked multimedia system", Neil Robertson, David Lett, Samuel Russ, Bohdan Prus, Michael Gaul, and Ajith Nair, Dec. 18, 2013.
5. European Patent Number EP1334617B1, "Networked Subscriber Television Distribution", Samuel Russ, David Lett, Jonathan Robinson, and Michael Gaul, April 1, 2015.
6. European Patent Number EP1920601B1, "Multiroom Point of Deployment Module," William Wall and Samuel Russ, May 4, 2016.
7. European Patent Number EP1510033B1, "Apparatus for Entitling Remote Client Devices," Samuel H. Russ, Michael Gaul, Anthony Wasilewski, and Howard Pinder, Aprl 26, 2017.
8. European Patent Number EP1540946B1, "Broadcast Carousel System Access for Remote Home

Communications Terminal via a Gateway Device,” Samuel Russ, Michael Gaul, and Anthony Wasilewski, April 18, 2018.

9. European Patent Number EP2008280B1, “Method and Device for Prioritizing the Storage Location of Media Data,” Bohdan Prus and Samuel Russ, September 26, 2018.

Conference Papers

1. S.H. Russ, M. Khan, S. Latif, “Surreptitiously Adding a WLAN Antenna to a Printed Circuit Board” 2022 IEEE Physical Assurance and Inspection of Electronics (PAINE), Huntsville, AL, USA, 2022.
2. J. Todd McDonald, Rebecca C. Clark, Lee M. Hively, and Samuel H. Russ. 2022. “Phase space power analysis for PC-based rootkit detection.” In *Proceedings of the 2022 ACM Southeast Conference (ACM SE '22)*. Association for Computing Machinery, New York, NY, USA, 82–90. <https://doi.org/10.1145/3476883.3520212>
3. S. H. Russ, " Surreptitiously Adding a Microcontroller to a Printed Circuit Board," 2021 IEEE Physical Assurance and Inspection of Electronics (PAINE), Washington, DC, USA, 2021.
4. S.H. Russ, “Circuit Board Security Vulnerabilities and Counteractions”, IPC APEX EXPO 2021.
5. S. H. Russ, "Techniques to Thwart Surreptitiously Altered PCBs," 2020 IEEE Physical Assurance and Inspection of Electronics (PAINE), Washington, DC, USA, 2020, pp. 1-4.
6. S. H. Russ, E. Spencer, T. Scroggins, and S. Latif, “Power-Efficient Software Architecture for a CubeSat System”, *2020 SoutheastCon*, Raleigh, NC, USA, 2020, pp. 1-6.
7. A. Russ, S. H. Russ, E. Spencer and M. Frank, "Motor Controller and Reaction Wheel for CubeSat," *2019 SoutheastCon*, Huntsville, AL, USA, 2019, pp. 1-3.
8. F. Lorenzo, J. T. McDonald, T. R. Andel, W. B. Glisson and S. Russ, "Evaluating Side Channel Resilience in iPhone 5c Unlock Scenarios," *2019 SoutheastCon*, Huntsville, AL, USA, 2019, pp. 1-7
9. E. Spencer, D. Clark, S. Russ, *et al.*, "First results from a time domain impedance probe for measuring plasma properties in the ionosphere," 2017 IEEE 60th International Midwest Symposium on Circuits and Systems (MWSCAS), Boston, MA, 2017, pp. 1284-1287.
10. E. Spencer, D. Clark, R. Gollapalli, S. Russ and B. Kerrigan, "A System On Chip design for fast time domain impedance spectroscopy," 2017 IEEE 60th International Midwest Symposium on Circuits and Systems (MWSCAS), Boston, MA, 2017, pp. 124-127.
11. Ramya Manikyam, J. Todd McDonald, William R. Mahoney, Todd R. Andel, and Samuel H. Russ, “Comparing the effectiveness of commercial obfuscators against MATE attacks,” *Proceedings of the 6th Workshop on Software Security, Protection, and Reverse Engineering (SSPREW '16)*, 2016, Article 8. DOI: <https://doi.org/10.1145/3015135.3015143>
12. Samuel Russ, Tho Ha, and Jonathan Shapiro, “Simulation of Digital Video Recording to Maximize Solid-State Disk Lifetime,” *Proceedings of the 2014 International Conference on Consumer Electronics*, Jan. 10-13, 2014, pp. 562-563.
13. Thomas Thomas, Cade Cashen, and Samuel Russ, “Leveraging Smart Grid Technology for Home Health Care”, *Proceedings of the 2013 International Conference on Consumer Electronics*, Jan. 11-14, 2013, pp. 276-277.
14. Cade Cashen, Samuel Russ, and Thomas Thomas, “Using a Wireless LAN to Perform Motion Detection”, *Proceedings of the 2013 International Conference on Consumer Electronics*, Jan. 11-14, 2013, pp. 63-64.
15. Nicklaus Thomas, David Evans, and Samuel Russ, “A Markovian Algorithm for Creating Immersive Public-Speaking Audiences”, *Proceedings of the 2013 International Conference on Consumer Electronics*, Jan. 11-14, 2013, pp. 384-385.
16. Samuel H. Russ, “Podcasting to Improve Software Usage”, *Proceedings of the 2012 ASEE Southeastern Section Conference*, April 1-3 2012, Starkville, MS, Paper ID 605.
17. Samuel H. Russ, “Using Student ID Numbers to Create Customized Homework Problems”,

Proceedings of the 2012 ASEE Southeastern Section Conference, April 1-3 2012, Starkville, MS, Paper ID 606.

18. Samuel H. Russ and Ramesh Nallur, "Digital Video Recording Onto Solid-State Disks", *2011 Digest of Technical Papers, 2011 International Conference on Consumer Electronics*, pp. 495-496. (2nd place in best paper contest, 2011.)
19. Mohammad Mushtaq, Samuel H. Russ, and Mohammad S. Alam, "Variable FEC to Reduce ECC Overhead in Digital Video Transmission", *2011 Digest of Technical Papers, 2011 International Conference on Consumer Electronics*, pp. 215-216.
20. Samuel H. Russ and Salim Alsharif, "Behavior of HomePlug AV Traffic At High Sustained Bit Rates in the Home", *2011 Digest of Technical Papers, 2011 International Conference on Consumer Electronics*, pp. 682-683.
21. Samuel H. Russ, Viswakalyan Perepa, Silas Leavesly, and Bret Webb, "Novel Low-Cost Salinity Sensor for Embedded Environmental Monitoring", *Proceedings of IEEE Southeastcon 2010*, March 18-21, 2010, pp. 53-56.
22. Samuel H. Russ and Kung-Hsien Chen, "Thermally Conductive Circuit Boards", *Proceedings of the 59th Electronic Components and Technology Conference (ECTC 2009)*, May 2009, pp. 465-468.
23. Samuel H. Russ and Sasan Haghani, "Behavior of 802.11g Traffic at High Sustained Bit Rates in the Home", *2009 Digest of Technical Papers, 2009 International Conference on Consumer Electronics, Jan. 2009*, pp. 423-424.
24. Samuel H. Russ, and Ramesh Nallur, "A Framework for Calculating Fundamental DVR Performance Limits", *2009 Digest of Technical Papers, 2009 International Conference on Consumer Electronics, Jan. 2009*, pp. 51-52.
25. Samuel H. Russ, "Home Networking: Extending Cable's Reach", *The Complete Technical Paper Proceedings from NCTA*, 2001, pp. 160-165.
26. Samuel H. Russ, Rashid Jean-Baptiste, Tangirala Shailendra Krishna Kumar, and Marion G. Harmon, "Transparent Real-Time Monitoring in MPI", *IPPS/SPDP Workshops 1999*, in *Parallel and Distributed Processing*, Lecture Notes in Computer Science, vol. 1586, Springer-Verlag, 1999, pp. 1327-1334.
27. Roger L. King, Aric B. Lambert, Samuel H. Russ, and Donna S. Reese, "The Biological Basis of the Immune System as a Model for Intelligent Agents", *IPPS/SPDP Workshops 1999*, in *Parallel and Distributed Processing*, Lecture Notes in Computer Science, vol. 1586, Springer-Verlag, 1999, pp. 156-164.
28. Aric Lambert, Roger King, Sam Russ, and Donna Reese, "Intelligent Control Agents for Resource Management of Heterogeneous Parallel Computing", *Computational Intelligence for Modeling, Control, and Automation (CIMCA 98) in Concurrent Systems Series*, vol. 55, IOS Press, 1999, pp. 116-121.
29. Samuel H. Russ and Adam Gaither, "Developing An Integrated Environment for Computational Field Simulation", *Object-Oriented Methods for Inter-Operable Scientific and Engineering Computing: Proceedings of the 1998 SIAM Workshop*, pp. 50-57.
30. Samuel H. Russ, Ioana Banicescu, Sheikh Ghafoor, Bharathi Janapareddi, Jonathan Robinson, and Rong Lu, "Hectiling: An Integration of Fine and Coarse-Grained Load-Balancing Strategies", *Proceedings of the Seventh International Symposium on High Performance Distributed Computing*, August 1998, IEEE Computer Society, pp. 106-113.
31. Samuel H. Russ, "An Architecture for Rapid Distributed Fault Tolerance", 3rd International Workshop on Embedded High-Performance Computing, in J. Rolim, Editor, *Parallel and Distributed Processing*, Lecture Notes in Computer Science, vol. 1388, Springer-Verlag, 1998, pp. 925-930.
32. Dr. Samuel H. Russ, Brad Meyers, Jonathan Robinson, Matt Gleeson, Laxman Rajagopalan, Chun-Heong Tan, and Bjørn Heckel, "User-Transparent Run-Time Performance Optimization",

Proceedings of the 2nd International Workshop on Embedded HPC Systems and Applications, Geneva, April 1997.

33. J. Robinson, S.H. Russ, B. Flachs, and B. Heckel, "A Task Migration Implementation of the Message-Passing Interface", *Proceedings of the 5th High Performance Distributed Computing Conference (HPDC-5)*, August 1996, IEEE Computer Society, pp. 61-68.
34. S.H. Russ, B. Flachs, J. Robinson, and B. Heckel, "Hector: Automated Task Allocation for MPI", *Proceedings of the 10th International Parallel Processing Symposium*, April, 1996, IEEE Computer Society, pp. 344-348.
35. W.S. Tan, C.O. Alford, and S.H. Russ, "GT-EP: A Novel High-Performance Real-Time Architecture", *Proceedings of the 18th International Symposium on Computer Architecture*, May 1991, pp. 12-21.

Reports

1. Aric B. Lambert, Roger L. King, Samuel H. Russ, Donna S. Reese, "Adaptive Analysis for the Design of Hardware Agents Using the Artificial Immune System Model for Resource Management of Heterogeneous Systems", Miss. State Technical Report No. MSSU-COE-ERC-98-10, Aug. 1998.
2. Daniel H. Linder, Robert B. Reese, Jon Robinson, and Samuel H. Russ, "JavaCADD: A Java-based Server and GUI for Providing Distributed ECAD Services", Mississippi State University Technical Report No. MSSU-COE-ERC-98-07, May 1998.
3. Samuel H. Russ, "Using Hector in an Architecture for Rapid Distributed Fault Tolerance", Mississippi State Technical Report No. MSSU-EIRS-ERC-97-17, December 1997.
4. Samuel H. Russ, Jonathan Robinson, Matt Gleeson, and Jose Figueroa, "Dynamic Communication Mechanism Switching in Hector", Mississippi State Technical Report No. MSSU-EIRS-ERC-97-8, September 1997.
5. Samuel H. Russ, Brian Flachs, Jonathan Robinson, and Bjorn Heckel, "Hector: Automated Task Allocation for MPI", Mississippi State Technical Report No. MSSU-EIRS-ERC-95-6, September, 1995.

Funded Grants and Contracts

University of South Alabama

1. National Space Grant Foundation, Aug. 2018-May 2019, "Automation Infrastructure for Gateway Biological Laboratory," PI, \$28,062.
2. Nfina (Local Mobile Company), March 2018 – March 2019, "Redhawk", PI, \$119,881.
3. NASA, May 2016 – Present, "Spatially Resolved Measurements Of Plasma Density Irregularities In The Ionosphere F Region For Scintillation Studies", Co-I, \$100,000.
4. Marine Environmental Science Consortium (GRI), Jan. 2011-Dec. 2011, "Conductivity Based In-Situ Hydrocarbon Sensor", PI, \$9,338.
5. University of South Alabama Research Council (USARC), Feb. 2008 – Feb. 2009, "Instrumentation of Hurricane Forecast Models for Performance Optimization", \$5,000 for one year.

Mississippi State University

1. National Science Foundation, April 1998-March 1999, "An ERC-CREST Partnership in Distributed and Computational Systems", PI, \$100,000/year, renewable for 5 years.
2. Office of Naval Research, Nov. 1996-Nov. 1998, "Distributed Visualization and Virtual Environments for Oceanography and Meteorology", Co-PI, \$200,000.

3. U.S. Army Waterways Experiment Station, July 1996-July 1999, "Efficient Parallel Wave Modeling", PI, \$200,000, Funded under CHSSI (Common HPC Scalable Software Initiative) of the DoD. (\$50,000 actually funded.)

4. NSF Engineering Research Center for Computational Field Simulation, April 1995- May 1999, "Heterogeneous Computing Testbed (CA 8)", PI, By year: \$34,983/\$70,111/\$55,916. Funded through NSF Engineering Research Center.

Dickerson Vision Technology

1. Small Business Innovations Research Program of the NSF, Division of Industrial Interface, September 1993 - February 1994, Award No. III-9260914. (\$50,000 Phase I contract conducted at Dickerson Vision Technologies.)

Technology Transfer and Licensing

Hector Distributed Run-Time Environment licensed by MPI Software Technology, Inc., Starkville, MS in June 1998 (while at Mississippi State University)

Students Advised (Major Professor)

Level	At USA	At MSU
Ph.D.	--	0
Masters	3	9

Courses Created and Enhanced

University of South Alabama

EE 264 Microprocessor Systems and Interfacing – Replaced 68HC11 with Freescale 9S12 architecture and redesigned the entire course, Introduced use of 68HC11 simulator and accompanying podcast to enhance student's ability to visualize microprocessor operation

EE 268 Digital Logic Design Lab – Updated one lab experiment

EE 368 Microprocessor Systems Lab – Developed all-new sequence to tie EE 368 to senior projects with hands-on experiments like motors, photocells, and servomotors.

EE 401 Introduction to ECE Design – Completely overhauled the first-semester senior project course. Added lectures on professionalism, career development, and legal aspects of engineering. Structured the course so that reports would lead up to their senior-project reports.

EE 404 ECE Design – Completely overhauled the second-semester senior project course by requiring better projects and adding material on giving effective presentations. Obtained very enthusiastic response from the department's Industrial Advisory Board.

EE 446 – Obtained donation of boards from Freescale and redesigned all of the experiments to develop more interesting demonstrations and to switch from assembly language to C.

EE 457/557 – Developing series of podcasts to augment in-class lectures with materials related to embedded systems and professional development.

EE 469/569 Advanced Digital System Design – Developed all-new course in high-speed circuit board design from an electromagnetics perspective, and authored a textbook for the course. Added a lab experience in 2009.

EE 560 Advanced Computer Architecture – Selected new textbook for the class and developed lecture materials to match

EG 101 – Developed systematic curriculum shared by all sections including “checklists” for instructors, handouts, and lecture materials. Introduced motors project, which has become the most popular EG 101 project.

Mississippi State University

EE 8993 High Speed Digital Design -- Offered on video nationwide, it features pioneering treatment of high-speed circuit board design from an electromagnetics perspective. Material from the class has been included in one of the best-known electromagnetics textbooks, and it continues to be one of the most popular graduate classes in the department.

EE 4743 Computer Aided Digital Design -- Added breakthrough educational technology to permit remote access to logic synthesis capabilities. Offered on live two-way video starting Fall 1998.

Courses Taught

University of South Alabama

EE 220, Circuit Analysis I, 1 course.
EE 263, Digital Logic Design, 2 courses.
EE 264, Microprocessor Sys-Interfacing, 4 courses.
EE 268, Digital Logic Design Lab, 1 course.
EE 368, Microprocessor Sys Interf Lab, 14 courses.
EE 401, Intro Elec and CpE Design - W, 7 courses.
EE 404, Elec and Comp Eng Designs-W, 7 courses.
EE 440, HDL Logic Synthesis, 1 course.
EE 446, Embedded System Design Lab, 2 courses.
EE 457, Embedded System Design, 10 courses.
EE 469, Signal Integrity, 5 courses.
EE 534, VLSI Design Systems, 1 course.
EE 540, HDL Logic Synthesis, 1 course.
EE 548, Computer-Network Security, 5 courses.
EE 557, Adv. Embedded System Design, 8 courses.
EE 560, Adv Computer Architecture, 3 courses.
EE 569, Signal Integrity, 5 courses.
EG 101, Intro to Engineering & Design, 5 courses.
EG 231, Intro to Ethics and Economics, 2 courses.

Mississippi State University

Number Description	Class Description
EE 2111 Electrical Lab I	Accompanies introductory digital class
EE 2713 Digital Devices	Introductory digital class
EE 4723 Microcomputers II	Microcontroller interfacing
EE 4743 Computer Aided Digital Design	VHDL, logic design, and synthesis
EE 8993 High-Speed Digital Design	Signal integrity and high-speed design

Honors and Awards

University of South Alabama College of Engineering “Teacher of the Year” 2015

Mobile Area Council on Engineering “Engineering Educator of the Year” 2015

Technology and Engineering Emmy® Award, 2012, for “Pioneering Development of Multi-Room DVR.” Awarded to Cisco. I managed the groups that built the first prototypes, gave public demonstrations, wrote numerous patent applications, and developed the first mass-production set-top containing Multi-Room DVR.

2nd Place in “Best Paper – Storage Category” at ICCE 2011. The paper is “Digital Video Recording Onto Solid-State Disks” as noted in Conference publications above.

Attendee, “Top Prof” Banquet – University of South Alabama chapter of Mortar Board, 2009,2010

Tau Beta Pi Engineering Professor of the Year – University of South Alabama chapter of Tau Beta Pi, 2008. One of two highest awards in the College of Engineering for teaching, and the only award voted on by honor students in the College.

Finalist, 53rd International Science and Engineering Fair, 1983, Albuquerque, NM.

Professional Activities

Expert Witness Engagements

Case	Jurisdiction and Case Number	Year(s)	Witness for	Expert Reports	Dep.	Trial	IPR* Rep.
WNE Holdings v. Rockwell Automat.	Southern District of Alabama	2011	Plaintiff	1	0	0	0
Personalized Media Corp. (PMC) v. Echostar	Eastern District of Texas	2010-2015	Plaintiff	2	3	0	0
Pegasus v. DirecTV et al.	Delaware	2011-13	Plaintiff	1	0	0	0
Apple v. Samsung	Int’l Trade Commission 337-TA-796	2012	Respondent	4	1	1	0
EON v. MobiTV et al.	Delaware	2013	Defendant	1	1	0	0
PMC v. Zynga	Eastern District of Texas	2013	Plaintiff	1	5	0	4
OpenTV v. Netflix	Delaware	2014	Defendant	0	0	0	0
Kaplan v. OnForce	N.D. California	2014	Defendant	0	0	0	1
Intellectual Ventures v. J.P. Morgan Chase	Southern District of New York	2013-2019	Defendant	2	2	0	0
PMC v. Amazon	Delaware	2014-2015	Plaintiff	1	9	0	5
Better Mouse Corp. v. Steelseries et al.	Eastern District of Texas	2015-2016	Plaintiff	2	0	1	0
SyncPoint v. Nintendo et al.	Eastern District of Texas	2015	Plaintiff	2	1	0	0
TQ Beta v. Dish	USPTO (IPR)	2016	Defendant	1	1	0	0
Script v. ADT et al.	Eastern District of Texas	2016	Plaintiff	2	2	0	0
Sony v. Pace	USPTO (IPR)	2016	Defendant	0	1	0	4
PMC v. Apple	EDTX and USPTO (IPR)	2016-Now	Patent Owner	2	1	1	2
PMC v. Samsung	Eastern District of Texas	2016	Patent Owner	2	0	0	0
Music Choice v. Stingray	Eastern District of Texas	2016-now	Plaintiff	2	2	0	4

Case	Jurisdiction and Case Number	Year(s)	Witness for	Expert Reports	Dep.	Trial	IPR* Rep.
Broadcom v. AMD	USPTO (IPR)	2016	Petitioner	0	0	0	1
Tech Pharmacy v. Alixa et al.	Eastern District of Texas	2017	Plaintiff	2	2	1	0
Rovi v. PMC	Eastern District of Texas, Arbitration	2017	Defendant	0	1	0	0
Implicit v. Trend Micro	Eastern District of Texas	2017	Defendant	2	1	0	0
Implicit v. Palo Alto	Eastern District of Texas	2018	Defendant	1	1	0	0
Invensas v. Samsung	Eastern District of Texas	2018	Plaintiff	2	1	0	0
Selective Signals v. Palo Alto	USPTO (IPR)	2018-Now	Petitioner	0	1	0	1
Rovi Tivo v. Various	Canada	2018-Now	Plaintiff	0	0	0	0
Implicit v. Netscout	Eastern District of Texas	2018-Now	Defendant	0	0	0	0
Rovi Tivo v. Comcast	USPTO (IPR)	2019-2020	Plaintiff	0	4	0	5
Rovi Tivo v. Comcast	ITC	2019-2020	Petitioner	2	1	1	0
American Patents v. Various	Eastern District of Texas	2019-Now	Plaintiff	0	0	0	0
BBiTV v. OpenTV	California	2019	Defendant	0	0	0	0
Roku v UEI	USPTO (IPR)	2019-Now	Petitioner	0	6	0	8
MV3 v Roku	Western District of Texas	2019-2020	Defendant	2	2	1	0
BBiTV v Dish	USPTO (IPR)	2019-2020	Petitioner	0	3	0	6
PMC v Google	Eastern District of Texas	2020	Plaintiff	1	1	0	0
PMC v Netflix	Southern District of New York	2020-Now	Plaintiff	2	0	0	0
UEI v Roku <i>et al.</i>	ITC	2020-2021	Respondent	1	1	1	0
BBiTV v Dish	Western District of Texas	2020-2021	Defendant	1	5	0	6
Flexiworld v Amazon <i>et al.</i>	Western District of Texas	2020-Now	Defendant	0	0	0	0
Flexiworld v Roku	Western District of Texas	2021-2022	Defendant	2	0	0	0
Roku v UEI <i>et al.</i>	ITC	2021-2022	Complain.	1	0	1	0
Roku v DivX	USPTO (IPR)	2021-Now	Petitioner	0	0	0	1
Apple v Identity	USPTO (IPR), Ex	2022-	Patent	2	1	0	6

Case	Jurisdiction and Case Number	Year(s)	Witness for	Expert Reports	Dep.	Trial	IPR* Rep.
	Parte Re-Exam, Western District of Texas	Now	Owner				
Audi v Aprese	USPTO (IPR)	2022-Now	Petitioner	0	0	0	2
paSafeShare	Ex Parte Re-Exam, Western District of Texas	2021-Now	Patent Owner, Plaintiff	0	0	0	3
PerfectVision v PPC Broadband	USPTO (IPR)	2022-Now	Petitioner	0	0	0	1
Google v Nobots	USPTO (IPR)	2022-Now	Patent Owner	0	2	0	4
Fall Line v Various	Eastern District of Texas	2022-Now	Plaintiff	2	1	0	0
Assa Abloy v CPC	USPTO (IPR)	2023-Now	Patent Owner	0	2	0	4
IOENGINE v Roku	Western District of Texas	2023-Now	Defendant	5	2	0	0
Gratuity v Toast	USPTO (IPR)	2023-Now	Petitioner	0	0	0	1

* Includes reports submitted for IPRs, CBMRs, and Re-Exams

Invited Lectures

“Real-time Monitoring in MPI”, Florida A&M University, Tallahassee, FL, August 1998

Consulting

Consulted with various investment firms concerning telecommunications market, 2007 – ongoing
Cox Communications – DVR Reliability – 2015

Society Memberships

Institute of Electrical and Electronic Engineers (Senior Member), IEEE Consumer Electronics Society, IEEE Computer Society, Eta Kappa Nu, Tau Beta Pi, Phi Kappa Phi, Gamma Beta Phi
Secretary, Northeast Mississippi Subsection of the IEEE, 1994-95

Article Reviewer

Computers and Electrical Engineering, Supercomputing '94, IEE Transactions, Concurrency: Practice and Experience, International Parallel Processing Symposium, IEEE Transactions on Education, IEEE Transactions on Parallel and Distributed Systems, ICT 2012, ICAEE 2012

Proposal Reviewer

Army Research Office, National Science Foundation, U.S. Department of Energy

University Service

Chair, Search Committee, ECE Department – Search for Assistant Professor positions, 2008-now (chair since 2011)

Member, ECE Department Undergraduate Affairs Committee, 2015-now

Member, College of Engineering Academic Standards Committee, 2016-now

Member, Search Committee, College of Engineering – Search for 2 Associate Dean positions, 2015

Member, Search Committee, College of Engineering – Search for Associate Dean positions, 2008-09

Member, University of South Alabama Council on International Education, 2008-15

Chairman, ECE Department “Open House” Committee, 2008-09
Conducted open house and other demonstrations for the department, 2008-now
Chairman, ECE Department Recruiting and Retention Committee, 2007-08
Updated and conducted experiment for ACE program, 2007
Member, Hearin Undergraduate Committee, 1998
Department Coordinator, United Way Campaign, 1995
Award Referee, 1995 Instructional Paper Award, MSU College of Engineering