

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Case IPR2024-00446
Patent 8,223,775

EXHIBIT 2003

DECLARATION OF SAMUEL H. RUSS, PH.D.

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 IPR2024-00446. I have been retained by Entropic Communications, LLC (“Entropic”), the Patent Owner in this proceeding. Petitioner is Comcast Cable Communications LLC (“Comcast” 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 Declaration signed by Dr. Sayfe Kiaei in IPR2024-00446 (Ex. 1002) (the “Kiaei Declaration”);
- iii. The prosecution history of the ’775 Patent (Ex. 1004)
- iv. The Petition by Comcast in IPR2024-00446;
- v. U.S. Pub. No. 2002/0006137 (“Rabenko”) (Ex. 1005);
- vi. U.S. Pub. No. 2004/0004974 (“Gaspar”) (Ex. 1006);
- vii. U.S. Pub. No. 2002/0091861 (“Kim”) (Ex. 1007);
- viii. Harry Newton, *Newton’s Telecom Dictionary*, (CMP Books, 18th ed. Feb. 2002) (Ex. 1008);
- ix. U.S. Pub. No. 2004/0125754 (“Johnson”) (Ex. 1009);
- x. U.S. Pub. No. 2002/0065935 (“Koperda”) (Ex. 1010);
- xi. 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);
- xii. U.S. Pub. No. 2002/0078249 (“Lu”) (Ex. 1012);
- xiii. U.S. Pub. No. 2002/0012343 (“Holloway”) (Ex. 1013);

- xiv. Andrew S. Tanenbaum, Computer Networks, (4th ed. 2003) (Ex. 1014);
- xv. U.S. Pub. No. 2002/0138678 (“Kim ’678”) (Ex. 1015);
- xvi. U.S. Pub. No. 2004/0019765 (“Klein”) (Ex. 1016);
- xvii. 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 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. Kiaei 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:

a degree in computer or electrical engineering, computer science, information systems, or a similar discipline, along with three-to-four years of experience with the design and/or implementation of cable modems within network-based content delivery systems. Additional education may substitute for professional experience, and significant work experience may substitute for formal education.

Ex. 1002 [Kiaei-Decl.] ¶ 43.

17. For the purposes of this declaration, I accept Mr. Kiaei's proposed qualifications of a POSITA. I 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. Kiaei 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 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 am not offering any legal opinions in this declaration nor am I qualified to do so. 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)

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

- Claims 1-7, 10, 12, 14-15, 18-20 based on obviousness over Rabenko (Ground A);
- Claims 1-7, 10, 12, 14-15, 18-20 based on obviousness over Rabenko in view of Gaspar (Ground B);
- Claims 1-7, 10, 12, 14-15, 18-20 based on obviousness over Rabenko in view of Kim (Ground C);

- Claims 1-7, 10, 12, 14-15, 18-20 based on obviousness over Rabenko in view of Gaspar and further in view of Kim (Ground D);
- Claims 1-7, 10, 12, 14-15 based on obviousness over each of Grounds A-D, above, further in view of Lu (Grounds E-H);
- Claim 12 based on obviousness over each of Grounds A-H, above, further in view of Klein and further in view of Kim '678 (Grounds I-P);
- Claim 8 based on obviousness over each of Grounds A-H, above, further in view of Koperda (Grounds Q-X);
- Claim 9 based on obviousness over each of Grounds Q-X, above, further in view of Johnson (Grounds Y-FF); and
- Claims 11, 13, 16-17 based on obviousness over each of Grounds A-H, above, further in view of Johnson (Grounds GG-NN).

VI. OPINIONS

A. The '775 Patent's Disclosures And Advantages Are Distinct From Rabenko.

30. The '775 patent consists of three independent claims, claims 1, 14, and 18, each of which have limitations substantially similar to each other for purposes of the subject matter I discuss in this declaration. The limitations I discuss herein with respect to claim 18 are similarly disclosed in claims 1 and 14 as far as the arguments to which I am responding are concerned, and so my opinions

with respect to the disclosures of the '775 patent and the references as they apply to claim 18 also applies to independent claims 1 and 14 as well. I note that the Petition in this proceeding (*i.e.*, item iv. in paragraph 13 above) presents arguments as to claim 18, then relies on those same arguments as to the other two independent claims, specifically, discussing claim 18 at pages 13-39, independent claim 1 at pages 41-49, and independent claim 14 at pages 61-63.

31. Each of the claims require:

Limitation 18[b]¹, to which limitation 1[b] and 14[b] are substantially similar, recites “a data networking engine implemented in a first circuit that includes at least one processor, 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;”

Limitation 18[c], to which limitation 1[c] and 14[c] are substantially similar, recites “a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable

¹ This declaration follows the Petition’s claim-limitation numbering convention.

modem functions other than the home networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, and”

Limitations 1[d], 14[c], and 18[d] recite “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,”

...

Limitation 18[f], to which limitation 1[g] and 14[e] are substantially similar for purposes of my discussion herein, 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; and”

Limitation 18[g], to which limitation 1[e] and 14[d] are substantially similar for purposes of my discussion herein, recites “a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.”

32. The ’775 Patent describes a “future **gateway cable modem** (CM).” Ex. 1001 [’775 patent] 1:13. This future “gateway cable modem will incorporate a variety of functions beyond the traditional cable modem...” *Id.* 1:20-22. As the Patent then observes, when it comes to this gateway cable modem of the future,

[p]artitioning these functions along with other cable modem functions among different computational agents is an essential issue in designing a gateway cable modem.

Id. 1:27-29. The Patent then describes a variety of goals the inventors set out to achieve in arriving at the architecture of the invention, including flexibility:

Flexib[i]lity. The architecture of the gateway cable modem should be flexible enough to allow independent software development and field-upgrade of gateway value-added services and basic DOCSIS cable modem services.

Id. 1:30-33, *see also* 1:33-40. It discusses detailed targets to provide benefits in the areas of “Performance,” “Cost” and “Software Re-Use.” *Id.* 1:41-55. The Patent then explains that its novel disclosed architecture achieves these various goals:

The present invention provides a gateway cable modem architecture that meets all of these objectives.

Id. 1:56-57.

33. The '775 Patent's inventive gateway modem architecture is centrally based on two separate “engines” into which the various functions are allocated. First is a data networking engine (“DNE”) responsible for the home networking functions—in short, for the part of the cable modem that will interface into networks on-premises. 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. This interface is expected to implement the DOCSIS set of standards, and the CME includes both a DOCSIS MAC processor and a DOCSIS controller. See, for example, the Patent at FIGS. 1-2 and the discussion accompanying those figures.

34. Each of the DNE and CME are implemented in respective circuits, each including at least one processor. The DNE and CME 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 partitioning is accompanied by independent software upgradeability as claimed, “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...” Id. 8:13-16. Indeed, insofar as I see in the record and am aware of outside the record, it is the Patent that disclosed that this decoupling and implementation with different processors of “the data networking and cable modem functions” is what makes “independent software upgrading and maintenance of these functions . . . feasible.” *Id.*, 3:58-62, 4:25-40. The Patent’s careful decision to partition functions is reflected in Figure 2, which shows the claimed functions of the gateway cable modem partitioned into DNE and CME:

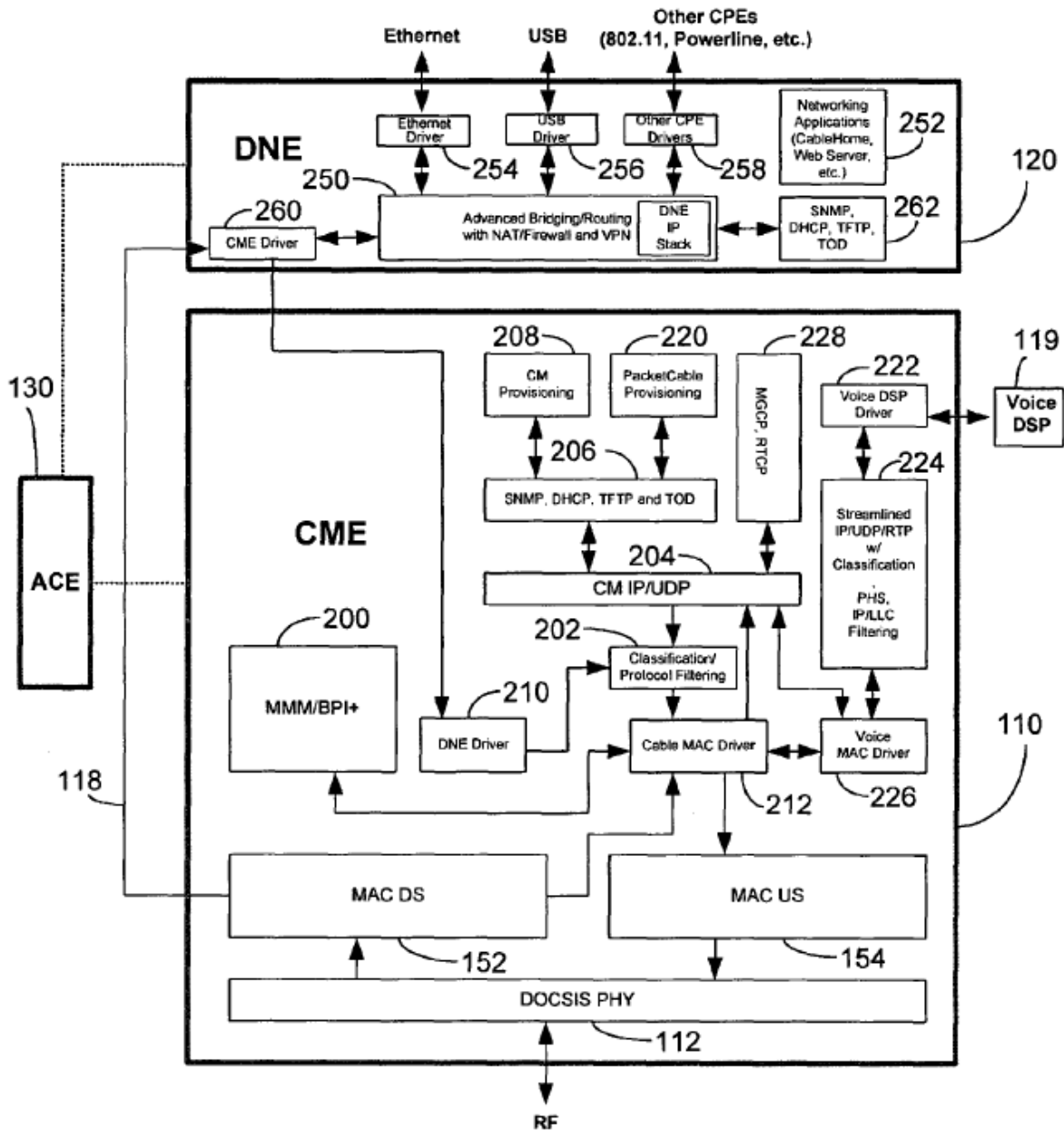


Figure 2

Ex. 1001 [’775] FIG. 2.

35. The claimed CME comprises a “DOCSIS MAC processor” and a “DOCSIS controller,” for carrying out or controlling different portions of the

functionality relating to DOCSIS-based communication. Exemplary DOCSIS MAC functions in the CME are represented in FIG. 2 as blocks 152 and 154. *Id.*, 3:19-20. Exemplary DOCSIS controller functions in the CME are blocks 200-212. *Id.*, 3:26-27.

36. The inventive architecture also allows for the DOCSIS MAC processor to forward downstream packets directly to the DNE without the involvement of the DOCSIS controller, to boost downstream throughput. *Id.*, 3:11-17, 8:18-22. This is illustrated in Fig. 2 of the '775 patent by path 118, over which downstream packets may flow from downstream DOCSIS MAC 152 to the DNE without passing through any other component of the CME. *Id.* 3:14-16, FIG. 2.

37. I see no disclosures in Rabenko, or in the other references relied upon by the Petition, which describes anything resembling a DNE or CME. Instead, I note that the Petition extracts isolated components, which it groups in certain ways unsupported by the references, and which are ultimately inconsistent with its own later reasoning.

38. The '775 patent, thus, focuses on partitioning or, broadly speaking, decoupling, as a major aspect of its system, which it indicates is necessary to provide several of its recited benefits to future cable modem systems.

**B. A “Cable Modem Engine Including A DOCSIS Controller”
(Limitations 1[c]/14[c]/18[e], All Claims, All Grounds).**

39. Each of the independent claims require a “cable modem engine including a DOCSIS controller.” Ex. 1001 [’775] cls. 1[c], 14[c], 18[e].

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

Limitation 1[c] requires “...the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller...”

Limitation 14[c] requires “...wherein the cable modem engine includes a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller;”

40. “DOCSIS” stands for Data Over Cable Service Interface Specifications. It is known to be a telecommunications standard relating to cable television networks that enables high-bandwidth data transfer.

41. Each of the grounds presented by the Petition relies on the Rabenko reference. Pet., 9-10. Only the Rabenko reference is relied upon by the Petition for the above limitations. Pet., 31-34, 46-47, 48, 62-63. I note that the Petition only asserts Rabenko discloses the limitations, and that there is no assertion by Petitioner or Dr. Kiaei that Rabenko alternatively renders obvious these limitations. *Id.* It is my opinion that Petitioner and its expert, Dr. Kiaei, have not shown that Rabenko discloses a CME including a DOCSIS controller.

42. I understand that the basis for Petitioner's assertion that Rabenko discloses the claimed "DOCSIS controller" is based on Rabenko's "voice and data processor" (or "voice/data processor"). Petitioner's reasoning is that "[l]ike the 'DOCSIS controller' of the '775 patent, Rabenko's voice and data processor 136/213 is used for processing and transporting voice over packet based networks." Pet., 31. Yet I see no indication that Rabenko's voice and data processor is a DOCSIS controller, at least as far as the Petition points to or I am aware of. There is no indication that Rabenko's voice and data processor "controls" any DOCSIS functions in Rabenko. There is no disclosure that the voice and data processor participates in any DOCSIS operations at all. Instead, as its name indicates, it processes voice packets. But whether the voice and data processor includes voice packet functionality does not determine whether or not it is a DOCSIS controller. Merely processing and transporting voice over a packet based network simply does not make something a "DOCSIS controller." If Rabenko's voice and data processor were a DOCSIS controller simply because it processes and transports voice in a packet-based system, one could not avoid the absurd result that every voice and data processor in every system using DOCSIS on Earth would be a DOCSIS controller. 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.

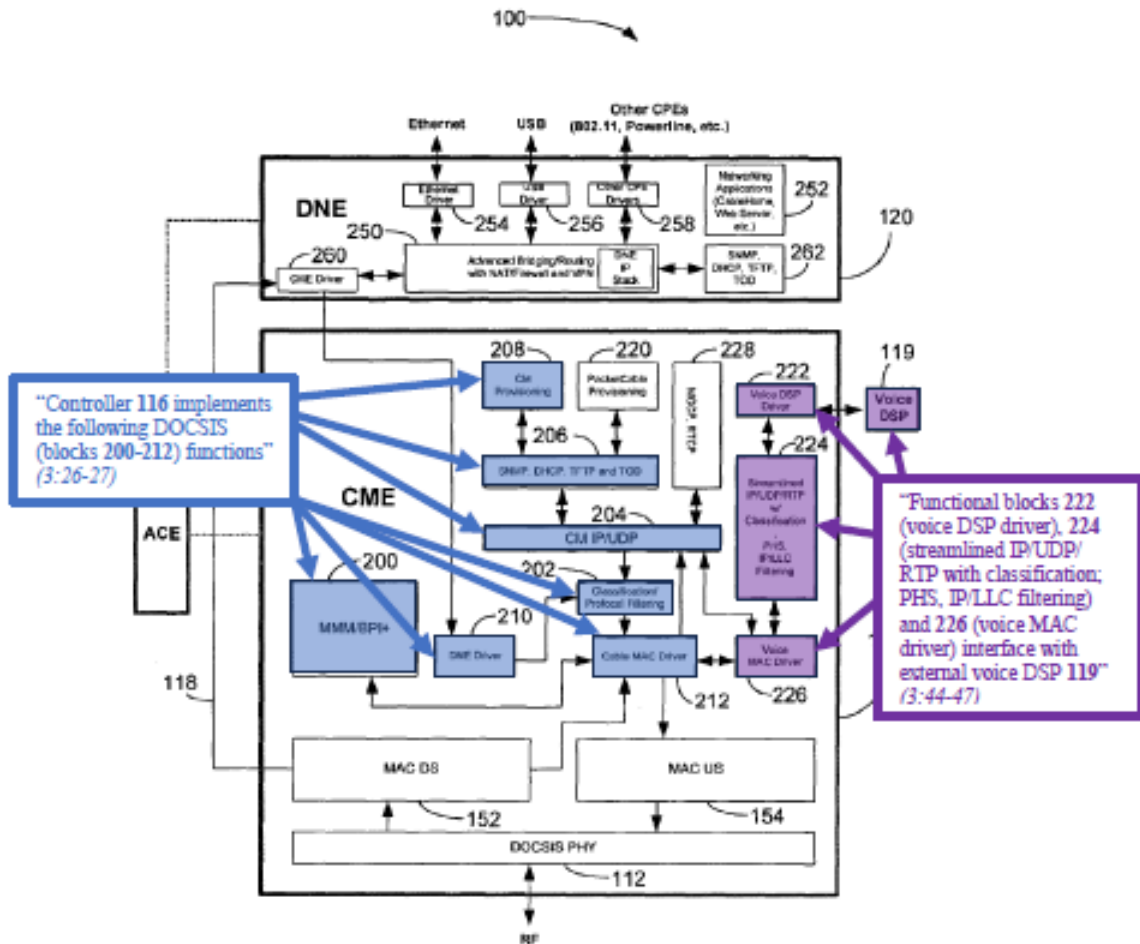
43. As is indicated in the name, the DOCSIS controller must “control” DOCSIS functions. The Patent provides examples of such control, including the processing of management messages to/from the DOCSIS MAC, and MAC address learning. Ex. 1001 [’775] 3:26-38.

44. The Petition points to no disclosures indicating that Rabenko’s voice and data processor “controls” anything, much less any DOCSIS functions or the DOCSIS MAC. These disclosures do not point to any “control” aspect of the voice and data processor.

45. That Rabenko’s voice and data processor is not a DOCSIS controller is further shown 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 preexisting CME or DOCSIS controller does not convert a processor that **only** performs voice functions and **not** DOCSIS functions into a DOCSIS controller. Otherwise, as I already noted above, every VoIP processor becomes a “DOCSIS controller.”

46. The ’775 patent 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, and *vice versa*. 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 located, any indications that these separately shown DOCSIS and voice functional blocks have any overlap supporting the notion that Rabenko’s voice and data processor could implicitly be a DOCSIS component, let alone a DOCSIS controller.

47. The ’775 patent discloses that the DOCSIS controller in an embodiment, “implements the following **DOCSIS** (blocks 200-212) **functions**.” Ex. 1001 [’775] 3:26-48. Separately from this disclosure of “DOCSIS functions” (citation omitted), it additionally discloses that the “controller 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.***” Ex. 1001 [’775] 3:26-48.

48. The “PacketCable VoIP functionality” that may be implemented by the DOCSIS controller in this embodiment is not necessary for the DOCSIS controller to be a DOCSIS controller. It is a DOCSIS controller regardless of whether it performs any voice packet processing. The patent discloses that this additional functionality is added to improve performance by “miniz[ing]” “latency and jitter of voice packets.” *Id.*, 4:20-24. Thus, VoIP functionality is not a requirement of the DOCSIS controller, but is an addition to the “DOCSIS functions” it performs.

49. Thus, there is no indication that voice packet processing, such as in Rabenko, is among the “DOCSIS” functions of the claimed invention’s DOCSIS controller.”

50. The lack of any demonstration that Rabenko’s “voice and data processor” constitutes the claimed “DOCSIS controller” appears to me to mean that the Petition has also failed to demonstrate that Rabenko discloses limitations 18[f], 1[f], and 14[e] which require “forward[ing] the processed packets directly to the data networking engine *without the involvement of the DOCSIS controller.*” This is because the Petition’s arguments for these elements of the claims seem to expressin depend on showing that Rabenko’s voice and data processor is the

claimed “DOCSIS controller.” The Petition relies on a supposed “bypass communication path” (identified by Petitioner in **purple** on Rabenko’s Figure 1b below) running from a component of the Petition’s alleged CME (identified by Petitioner in **blue**) **directly to** a component of the alleged DNE (identified by Petitioner in **green**) to show “forward[ing]” of “the processed packets” from the “**DOCSIS MAC Processor**” to the “**cable modem engine**” “**directly to the data networking engine**”:

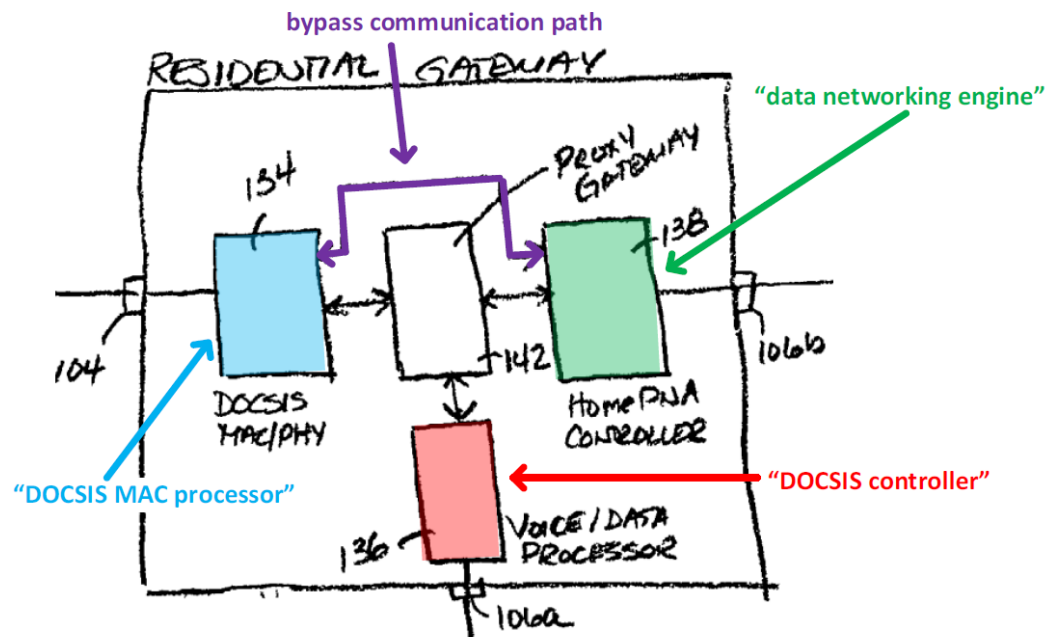


Figure 1b of Rabenko [Ex. 1005]
(as excerpted and annotated by Petitioner, Pet., 32-33)

Petitioner asserts that this “bypassing” is done by Rabenko “without the involvement of the DOCSIS controller” by asserting that “Fig[ure] 1b shows that voice/data processor 136/213 (**red**) (the claimed ‘DOCSIS controller’) is

bypassed” by data packets sent “directly to (via the control flow line in **purple** . . .) HomePNA controller 138 (**green**) (part of the claimed ‘data networking engine’).” Pet., 32 (color emphasis in original, underlining added).

51. Yet, since Petitioner fails to show the voice and data processor 136 in Figure 1b of Rabenko is the “DOCSIS controller,” the Petitioner’s arguments relying on the involvement of the purple “**control flow line**” in Figure 1b are, as far as I see, without merit since without it, there is no indication that there is forwarding of processed packets directly to the DNE “without the involvement of the DOCSIS controller.” *Id.*

52. 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. Rabenko, conversely, discloses none of these functions. For the above-discussed reasons, it is my opinion that Petitioner has not shown that Rabenko’s voice and data processor is the claimed “DOCSIS controller,” or that Rabenko discloses forwarding packets to the DNE while bypassing the “DOCSIS controller.”

C. The DNE And CME On “Separate” “First” And “Second Circuit[s]” With “Completely Partitioned” Respective Functions (All Claims, All Grounds).

53. Each of the independent claims require a data networking engine and cable modem engine implemented on a “first” and “second” “circuit,” respectively,

with the “second circuit being separate from the first circuit,” and the “cable modem functions” of the CME being “completely partitioned” from the “home networking functions” of the DNE. The CME includes a “DOCSIS MAC processor configured to process downstream PDU packets and **forward** the processed packets directly to the [DNE] **without the involvement** of the [CME’s] DOCSIS controller.” *E.g.*, Ex. 1001 [’775] 3:11-16, cl. 18[f], 1[f], 14[e] (similar). And the CME is “configured to enable upgrades to its **software** in a manner that is **independent** of upgrades to the software of the data networking engine.” *Id.*, cls. 1[d], 14[c], 18[d]:

- Limitation 18[b], to which limitation 1[b] and 14[b] are substantially similar, recites “a data networking engine implemented in a first circuit that includes at least one processor, 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;”
- Limitation 18[c], to which limitation 1[c] and 14[c] are substantially similar, recites “a cable modem engine implemented in a second circuit that includes at least one processor, the second circuit being separate from the first circuit, the cable modem engine programmed with software that when executed by the at least one processor of the second circuit causes the cable modem engine to perform cable modem functions other than the home

networking functions performed by the data networking engine, the cable modem functions including interfacing with cable media, and”

...

- Limitation 18[g], to which limitation 1[e] and 14[d] are substantially similar, recites “a data bus that connects the data networking engine to the cable modem engine, wherein the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine.”

54. The Petition relies solely on Rabenko for the aspects of the above-referenced limitations concerning a “first circuit,” “second circuit,” and “completely partitioned” functions. I note Petitioner only asserts that Rabenko discloses these aspects of the above-discussed limitations and does not make any assertions that it would be obvious to modify Rabenko for the previously mentioned aspects of these limitations. It is my opinion that the Petition has failed to show Rabenko discloses these limitations.

55. The partitioned architecture of the ’775 patent, having separate data networking and cable modem engines with different processors, having a distinct DOCSIS controller and DOCSIS MAC processor, and “completely partitioning” “the home networking functions” of the DNE from “the cable modem functions” of the CME, is a significant focus of the ’775 patent, as shown by its specification.

Ex. 1001 [’775] 2:13-19 (“The data networking engine is completely decoupled from the cable modem engine. In one implementation, the VoIP functionality provided by the cable modem is in accordance with the PacketCable specification and the data networking functionality provided by the data networking engine is in accordance with the CableHome specification.”), 2:24-27 (“[t]he data networking engine is partitioned from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.”), 3:53-58 (“This is made possible by exploiting the asymmetric nature of the DOCSIS US/DS **152** and **154**. In addition, the data path for voice packets is laid entirely within cable modem engine **110** and is optimized to reduce delay and jitter.”), 4:25-28 (“Flexibility. Since the data networking and cable modem functions are decoupled and implemented in different processors **110** and **120**, independent software upgrading and maintenance of these functions is feasible.”).

56. As the patent explains, this decoupled architecture entails numerous advantages. This includes enabling, *inter alia*, independent software development and upgrades. Ex. 1001 [’775] 3:58-62 (“As a result of the virtual de-coupling from cable modem engine **110**, data networking engine can be independently software-upgraded without impacting the functionality of cable modem engine **110** (and vice versa).”), 4:25-40 (“Flexibility. Since the data networking and cable

modem functions are decoupled and implemented in different processors **110** and **120**, independent software upgrading and maintenance of these functions is feasible. 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 PacketCable E-MTA can be implemented with minimum impact on the cable modem.”).

57. Increased performance is also enabled as a result of the partitioning and decoupling:

Performance. System **100** is able to support a large number of simultaneous data-application sessions originated from/terminated on multiple CPE devices. Its performance is enhanced by the pipe-lining nature of system **100**: the processing-intensive functions of the cable modem and data networking are rationally distributed among three different processors: DOCSIS MAC processor **114** (ARM #2); DOCSIS controller **116** (ARM #1); and data networking engine **120** (ARM #3), according to their orders in the packet flow. To further boost downstream throughput, the downstream PDU packets are

directly forwarded from the DOCSIS MAC processor **114** to the data networking engine **120** without going through DOCSIS controller **116**. This is made possible by exploiting the asymmetric nature of the DOCSIS US/DS **152** and **154**. In addition, the data path for voice packets is laid entirely within cable modem engine **110** and is optimized to reduce delay and jitter.

Ex. 1001 [’775] 4:41-57.

58. Another beneficial result of the decoupling and partitioning is that there is better partitioning of specific complex functions, as well as less delay and jitter:

Functional Partitioning. Cable modem **100** completely partitions data networking functions (advanced bridging/routing, NAT/firewall, VPN, web server and CableHome applications) from DOCSIS cable modem functionality. This is accomplished by localizing data networking functions in the data networking engine processor and localizing cable modem functions in the cable modem engine processor. Additionally, PacketCable VoIP functionality (embedded MTA) is implemented within cable modem engine **110** to address the facts that embedded MTA is closely coupled with cable modem MAC services and that the latency and jitter of voice packets needs to be minimized.

Ex. 1001 [’775] 4:13-24.

59. The claimed separation and partitioning also facilitates increased throughput by allowing the DOCSIS MAC processor to forward data packets

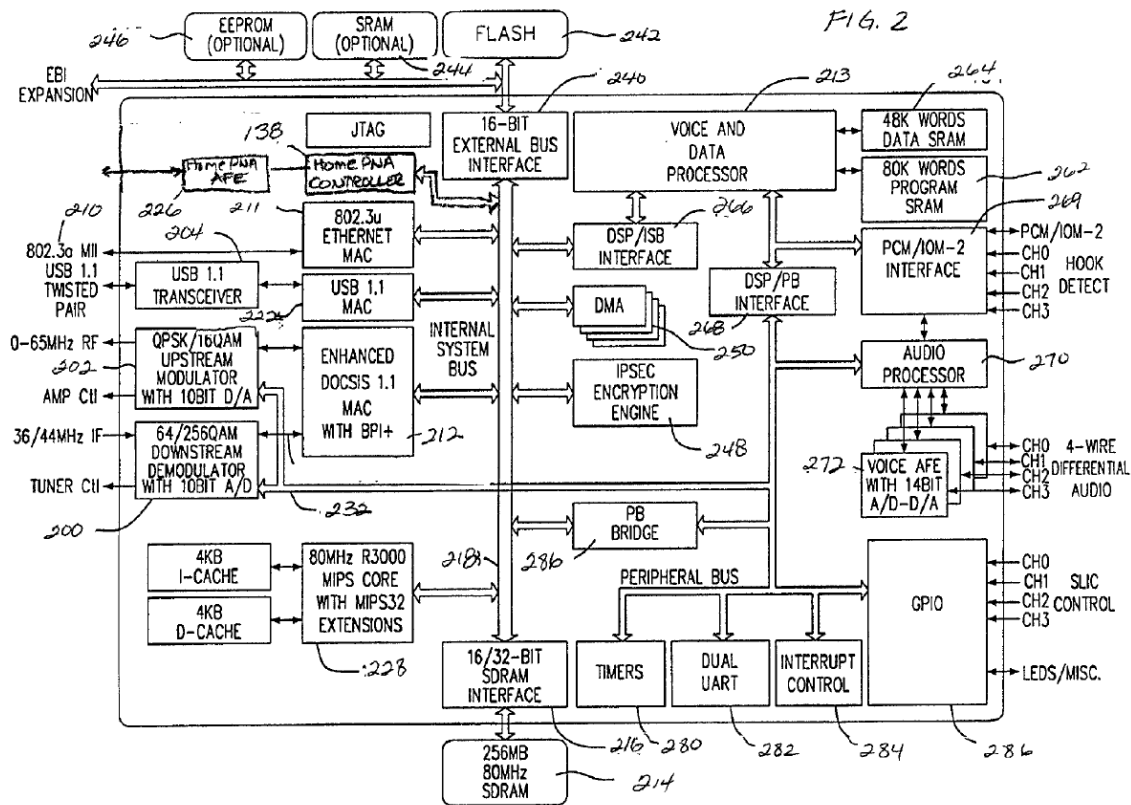
directly to the DNE without the involvement of the CME's DOCSIS controller.

Ex. 1001 [’775] 3:11-16 (“To increase downstream throughput, all processing of DS PDU (protocol data unit) packets is done within processor 114 without involving controller 116. After being processed, DS PDU packets are forwarded by processor 116 directly to data networking engine 120 along path 118, bypassing controller 116.”), cl. 18[f]/1[f].

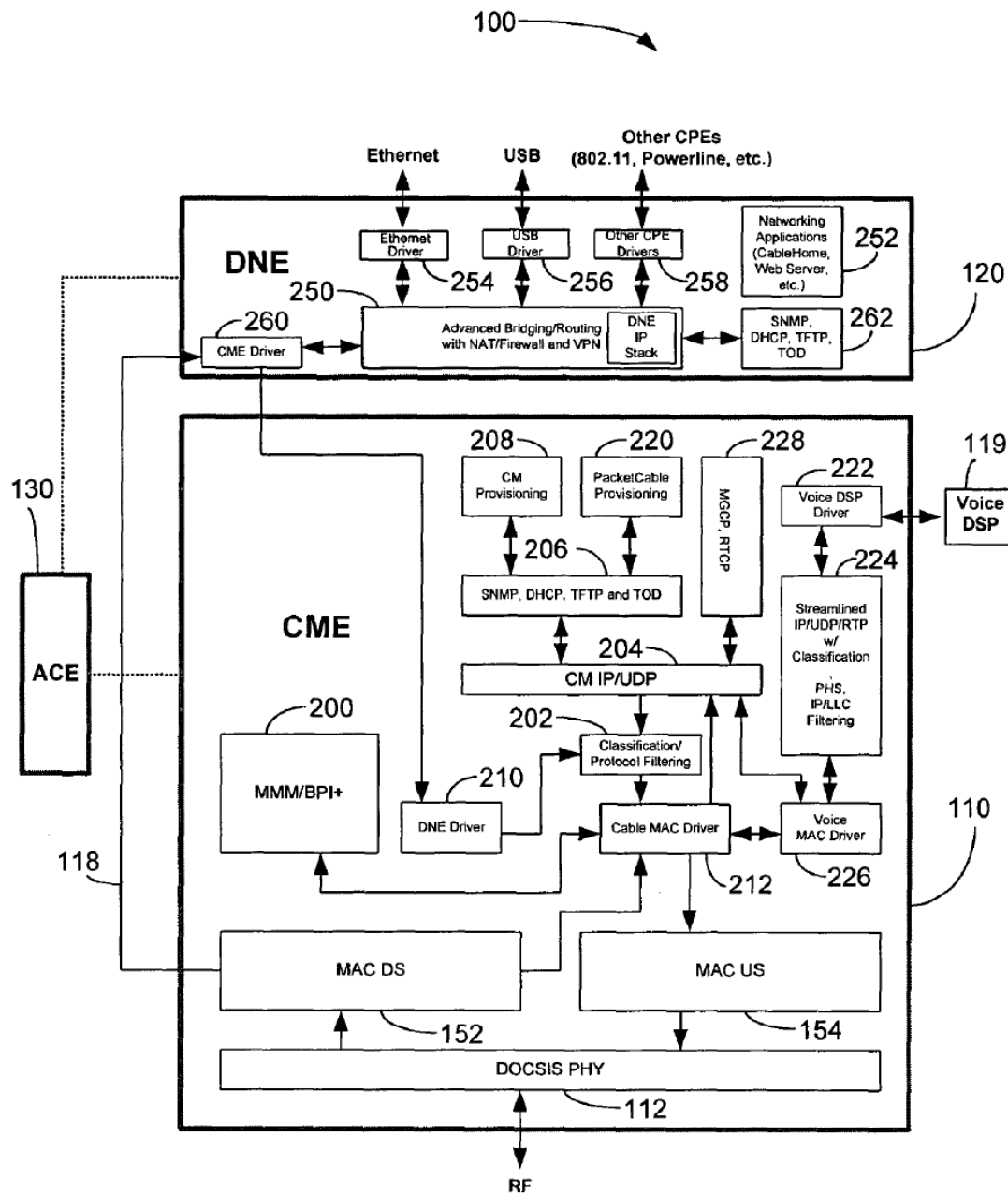
60. The claimed architecture thus accomplishes (Ex. 1001 [’775] 1:55-56) the design intentions set forth by the Patent from the outset (*id.*, 1:20-55).

61. Rabenko discloses a communications system including a plurality of media terminal adapters, a telephone line, and a gateway configured to exchange voice and data packets between a network and each of the media terminal adapters over the telephone line, which may include a residential gateway with a cable modem. Ex. 1005 [Rabenko] [0004], [0033]. Rabenko focuses significantly upon “supporting multiple voice channels” on “a single wire pair.” *Id.*, title (capitalization altered), [0003]-[0005], [0036], [0041].

62. Thus, Rabenko arrives at an architecture as shown in its Figure 2, on which the Petition relies heavily in its reliance on Rabenko as well. *See, e.g.*, Pet., 24, 35, 46, 47, 51, 52, 74. I note that Rabenko’s Figure 2 does not appear to me to depict any division into structures (*i.e.*, engines) at all, let alone the specific two engines disclosed and claimed in the Patent:



Ex. 1005 [Rabenko] Fig. 2. Rabenko stands in stark contrast to the '775 Patent's FIG. 2 in this regard, which clearly depicts and discloses a DNE in a first circuit partitioned from a CME in a second circuit:



Ex. 1001 [’775] Fig. 2.

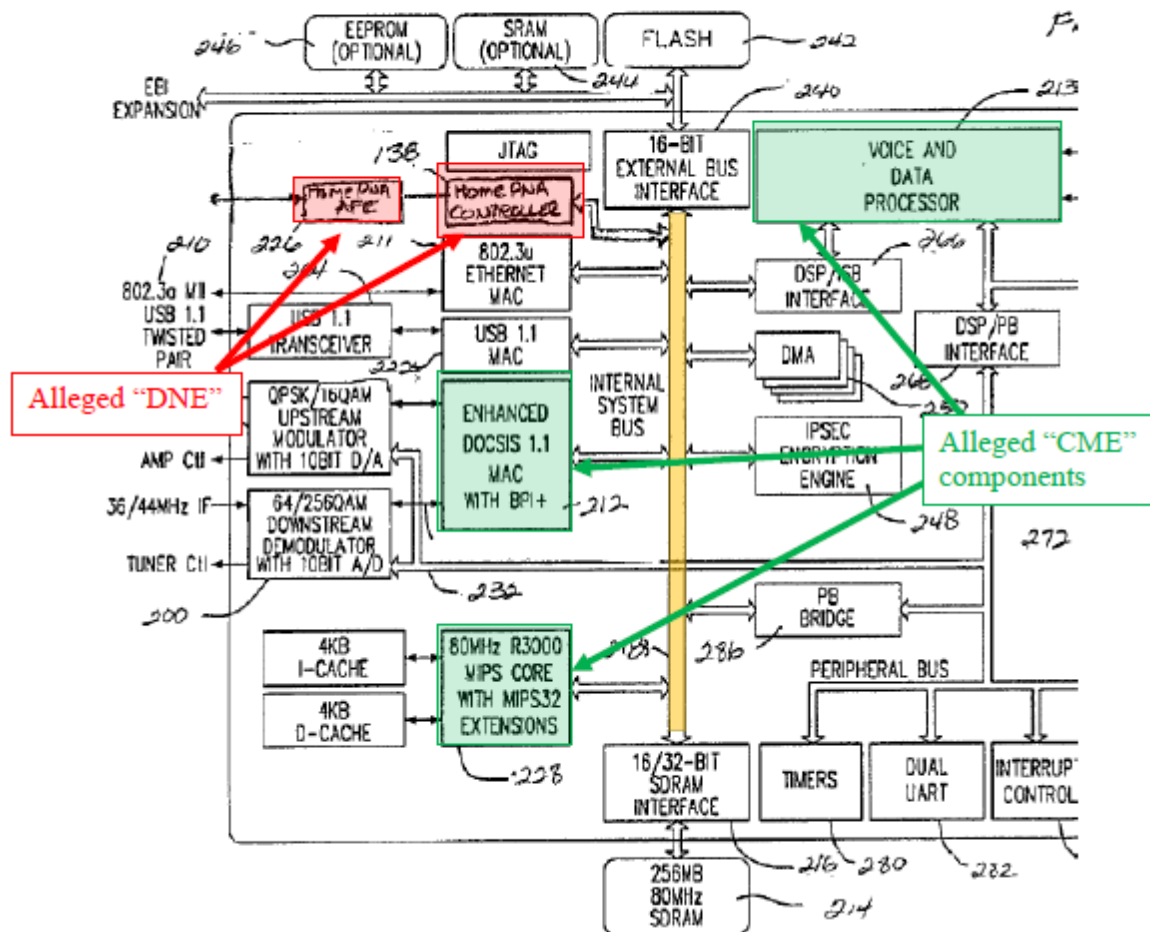
63. I understand Petitioner contends that Rabenko discloses a DNE “implemented in a first circuit” (limitations 1[b], 14[b], 18[b]) and a CME “implemented in a second circuit,” with “the second circuit” “separate from the first circuit” (limitations 1[c], 14[c], 18[c]). Yet I see no showing in the Petition

that Rabenko implements a DNE on a “first circuit” and a CME on a “second circuit,” let alone that they are “separate” circuits, where the components of one engine do not rely on components of the other engine while performing their respective DNE or CME functions.

64. Petitioner asserts the claimed “[DNE] implemented in a first circuit” to be collectively met by two components of Rabenko: its HomePNA controller 138, and its Analog Front End (AFE) 226. Pet., 14-15 (“Rabenko discloses HomePNA controller 138 ... that, along with AFE 226, functions as the ‘data networking engine’”), 16 (“Rabenko’s HomePNA controller 138 and AFE 226 are the claimed ‘first circuit.’”). Petitioner asserts three more components of Rabenko to collectively meet the claimed “[CME] implemented in a second circuit”: DOCSIS MAC 134/212, proxy gateway 142 (which Petitioner contends includes the MIPS core 228), and voice/data processor 136/213. Pet., 21 (“Rabenko discloses DOCSIS MAC 134/212, a proxy gateway 142 and voice/data processor 136/213 (collectively, the claimed ‘cable modem engine’) ...”), 24-25 (contending that the MIPS core is a part of proxy gateway 142).

65. I note that the Petition then asserts that these alleged CME components (boxed in **green** below), are on a “separate” “second circuit” from the two alleged DNE components (boxed in **red** below). Pet., 21; see Pet., 23 (“As shown in Fig. 1b above, Rabenko discloses that DOCSIS MAC 134/212 (**blue**),

proxy gateway 142, and voice/data processor 136/213 (**red**) ('second circuit') are **separate components** from HomePNA controller 138 and AFE 226 ('first circuit'). Ex. 1005, Fig. 1b.''). [The quote from the Petition references a different diagram with different coloring than the figure shown below.]



Ex. 1005 [Rabenko] Fig. 2 (annotated). I see no satisfactory explanation or support cited by the Petition as to why the grouping of Rabenko's components

asserted to comprise the purported CME would then be separate and apart from the grouping of components asserted to comprise the purported DNE. The only grounds for calling the alleged “DNE” and “CME” “separate” would apply equally to the components within the Petition’s DNE or CME, suggesting that no “circuits” corresponding to the claimed DNE and CME exist in Rabenko. For instance, the POSITA would neither learn nor find it obvious that Voice and Data Processor 213 is part of the same CME as MIPS R3000 core 228, yet be considered separate from HomePNA Controller 138. I further note that the Petition’s identification of the alleged DNE does not include any sort of CPU or processor core.

66. Thus, it appears the Petition imposes its own selection of components, with no significant explanation and in what appears to be an arbitrary manner, as shown by Rabenko’s annotated Figure 2 above. Ex. 1005 [Rabenko] Fig. 2 (annotated); see Pet.,14, 21, 24.

67. I note that the Petition avoids characterizing the remaining components, placing them in neither the purported DNE or CME, or in any other type of grouping. For example, I see no indication that the Petition offers any reason that the POSITA would either learn or find it obvious that Rabenko’s voice and data processor 213 is part of a “cable modem engine” that also includes MIPS R3000 core 228, pictured on Figure 2 almost as far as possible from processor 213,

yet being considered separate from HomePNA controller 138, pictured on Figure 2 almost as close as possible to processor 213.

68. The clear difference between Rabenko and the '775 patent, including the arbitrary nature of the Petition's characterization of Rabenko, is made further apparent by the Petition's later attempt to categorize these groupings of the purported DNE and CME as "separate" and "completely partitioned" in order to satisfy other aspects of the claims. That the constituent components are "shown in Fig. 1b" of Rabenko as separate (Pet., 23)—a fact which posed no obstacle when the Petition wanted to **group** those same "separate" components into supposed structures or "engine[s]" to meet **those** requirements of the claims. A POSITA would not reach this conclusion looking at Rabenko's disclosures and figures.

69. ***If*** Rabenko's text had described these components as having the relationships or partitioning the Petition imposes, that would be one thing. But it does not: nothing in Rabenko suggests that the components the Petition identifies collectively as part of the CME should be grouped for that purpose, to meet the claim limitation that they must together constitute an "engine," and yet separate from the components Petitioner groups together as the DNE, to meet the further claim limitation that the two collections must be mutually separate. In the absence of such a disclosure, the POSITA would not distill from Rabenko the imaginary

collections of different components in Figure 2 into a “DNE” and “CME” as the Petition does.

70. Moreover, the same logic employed by the Petition would apply to the various components of Rabenko that the Petition has chosen to group together (apparently as **not** “separate”) into the purported “data networking engine,” and also to the other collection of components that the Petition has grouped together as apparently not separate into the purported “cable modem engine.” Rabenko’s Figure 1b does not show any grouping of these (apparently arbitrarily) selected groups of components into “circuits,” much less any separation between those circuits. For example, there is simply no indication whatsoever that HomePNA controller 138, on the one hand, should be implemented on a separate circuit from features 134, 136, and 142 on the other hand. Thus, I see no support whatsoever in Rabenko, in Figure 1 or elsewhere, for Petitioner’s conclusion.

71. To be clear, the issue is not how Rabenko’s Figures 1b and 2 choose to physically position the various components in their logical diagrams; it is that nothing in Rabenko’s description (or anywhere else) is shown to furnish any support or suggestion, as far as I see, that the components in these figures actually operate as groups, engines, or circuits as the Petition suggests. Rather, these groupings are simply superimposed by the Petition without any meaningful explanation upon disclosure that does not support them. Petitioner’s arguments

appear untethered from the disclosures of Rabenko, and nothing in the actual disclosure of Rabenko is shown to teach the separate circuits and partitioning required by the challenged claims. Rabenko describes each component that Petitioner claims makes up its DNE and CME *separately*, but is never shown to teach to the POSITA that these components, as disclosed in Rabenko, make up a data network engine or a cable modem engine *collectively*.

72. Rabenko teaches partitioning between several of its components that allegedly comprise the CME. I note the Petition does not cite or rely on these teachings in Rabenko; indeed, it conspicuously does not even mention them when discussing the claims' separate circuit and partitioning limitations.

73. As noted above, the Petition asserts that several components collectively make up the purported CME, including the voice and data processor and MIPS core 228 (the latter of which the Petition asserts is part of Rabenko's proxy gateway). Pet., 21-26. However, Rabenko teaches "functional partitioning of the voice and data processor 213 and the MIPS core 228," suggesting partitioning these components from one another. Ex. 1005 [Rabenko] [0074] (*"functional partitioning of the voice and data processor 213 and the MIPS core 228 can take on various forms ..."*). Thus, Rabenko teaches partitioning between what the Petition asserts are components that "collectively" make up the CME on its required separate "second circuit." See Pet., 21 (addressing components of

claimed CME), 24-25 (discussing MIPS core 228 as part of CME). And, as already discussed, it has no teaching of implementing or partitioning these components together, or in a circuit separate from that of the alleged DNE components.

74. Specifically, Rabenko states:

Those skilled in the art will appreciate that the proxy gateway functionality *may be partitioned* into a number of implementations depending of the particular application and overall design constraints. By way of example, the proxy gateway function can be implemented in the MIPS core rather than the voice and data processor. Alternatively, the proxy gateway functions can be split between the MIPS core and the voice processor.

Ex. 1005 [Rabenko] [0139]. Again, I note that the Petition does not appear to cite or rely on these teachings for its arguments with respect to Rabenko supposedly teaching the claimed DME on the first circuit and CME on the separate second circuit. The partitioning Rabenko discloses here at [0139] is with respect to functionally partitioning proxy gateway 142 functions, which is one of the components that Petitioner says is part of the “collective[]” CME, between the MIPS Core 228 and the voice and data processor, also of the purported CME. Thus, this teaching of Rabenko, too, does not disclose any partitioning between the purported CME and DNE. Rather, it teaches partitioning *between* the components that supposedly “collectively” make up the CME in a separate second circuit.

75. Rabenko further discloses that functional partitioning of its voice processor between its residential gateway and its HomePNA telephone may vary:

The exemplary voice processor is implemented in the HomePNA telephone to minimize end-to-end delay and jitter. One of skill in the art will appreciate that the ***partition of functionality of the voice processor between the residential gateway and the HomePNA telephone may vary.*** By way of example, the ***voice processor could be housed partially or entirely in the residential gateway.*** Alternatively, the voice and data processor 213 (see FIG. 2) could be used to support voice compression and decompression for communications over the HomePNA LAN in addition to supporting the conventional POTS telephone 108 connected directly to the residential gateway as shown in FIG. 1a. ***The partitioning of functionality will depend on various factors including the specific application, the overall design constraints and other relevant factors.***

Ex. 1005 [Rabenko] [0247]. Yet again, Rabenko's functional partitioning at [0247] is not between the two components Petitioner asserts make up the DNE, on the one hand, and the three components Petitioner asserts make up the CME, on the other, but just between the voice and data controller and the HomePNA telephone.

76. Based on these disclosures, in my opinion, Rabenko is familiar with the concept of functional partitioning, yet has no disclosure of either partitioning—

either “completely” or “functionally”—the collection of components of Petitioner’s purported DNE from the collection of components of Petitioner’s purported CME. In other words, when Rabenko does disclose partitioning, it is to serve completely different ends than those disclosed in the ‘775 Patent.

77. I note the Petition does not rely on or even acknowledge these functional partitioning teachings in Rabenko. Thus, it is my opinion that there is no indication, based on the Petition, that Rabenko discloses a “data networking engine” (DNE) “implemented in a first circuit” and a “cable modem engine” (CME) “implemented in a second circuit,” with “the second circuit” “separate from the first circuit.” Since there is no assertion in the Petition that it would be obvious to modify Rabenko to meet these limitations, I decline to opine at this time. If it is found that the Petition does, somehow, assert obviousness, I reserve the right to respond substantively.

78. I understand the Petition asserts that Rabenko, alone, discloses limitations 1[e], 14[d], and 18[g], which requires “complete[] partition[ing]” of the home networking functions performed by the DNE from the cable modem functions performed by the CME. I reproduced this limitation previously in Section VI.A. I see no indication in the Petition that Rabenko discloses this limitation. I note, once again, that the Petition relies solely on the assertion that

Rabenko discloses this limitation and does not assert that it would be obvious to modify Rabenko.

79. All claims expressly require “a data bus that connects the data networking engine to the cable modem engine wherein the **cable modem functions** performed by the cable modem engine are **completely partitioned from the home networking functions** performed by the data networking engine.” Ex. 1001 [’775] cls. 1, 14, 18 (*i.e.*, limitations 18[g]/1[e]/14[d]). The ’775 patent discloses advantages of this “partitioning” of functions. *See* Section VI.A; *see also, e.g.*, Ex. 1001 [’775] 1:27-29 (“Partitioning these functions along with other cable modem functions among different computational agents is an **essential issue** in designing a gateway cable modem.”).

80. As I discussed previously in ¶¶ 54-58, the claimed invention’s “complete[] partition[ing]” of the CME’s cable modem functions from the DNE’s home networking functions helps minimize “latency and jitter of voice packets,” allows for “independent software upgrading and maintenance of these functions,” and allows the system to “support a large number of simultaneous data-application sessions.” Ex. 1001 [’775] 4:10-57.

81. The Petition asserts

Specifically, home networking functions performed by the data networking engine are **completely partitioned** from the cable modem functions performed by the cable modem engine since the home

networking functions ... are performed by HomePNA controller 138 and/or AFE 226 while cable modem functions ... are performed by DOCSIS MAC 134/212, voice and data processor 136/213, and/or core 228 as shown in Figs. 1b and 2. This ***functional partitioning*** of Rabenko matches the description of the '775 patent specification as well.

Pet., 36. It appears that the Petitioner thus asserts Rabenko's purported DNE and CME to be "completely partitioned" simply on the basis that these purported "engines" perform specific functions. Pet., 38. As I discussed in Section VI.A, the groupings Petitioner asserts make up Rabenko's purported DNE and CME appear arbitrary, and I see no indication that Rabenko discloses these groupings as Petitioner claims. As I also previously discussed, the actual teachings of Rabenko do not disclose or even suggest partitioning the purported DNE functions from the purported CME functions, either "completely," as claimed, or "functionally." See ¶ 75 above.

82. Rabenko indicates that at best, from the Petition's perspective, there is an intermixing of data networking and cable modem functions by the voice and data processor 213, contradicting the Petition's placement of voice and data processor 213 in the CME. Rabenko teaches that its voice and data processor supports voice compression and decompression for communications over Rabenko's HomePNA LAN (local area network). Further, the POSITA would have

understood the HomePNA standard. In the world of home telephone wiring, HomePNA was the overwhelmingly dominant home-networking technology. I note that in my own experience, I was involved with a project in which our group designed a HomePNA adapter to work with our DOCSIS-enabled Explorer 4200 set-top box. See ¶ 9 above. There is no reason pointed to in Rabenko to exclude this function from being considered a *data networking* function. Indeed, the Petition must agree with this – it is indisputable that HomePNA was an in-home networking standard based on the use of telephone cabling, and therefore a standard for a LAN. The Petition nevertheless appears to allege the voice and data processor 213 performs *cable modem* functions instead, and is therefore part of the CME.

83. I note that the Petition asserts that Rabenko discloses “complete[] partition[ing]” because Rabenko teaches that “the respective functions are localized in respective processors,” and “performs only home networking functions by the processor in the HomePNA controller 138 ... and only cable modem functions by the DOCSIS MAC 134/212, core 228, and voice/data processor 136/213....” Pet., 38. But there is no indication that the functions of the aforementioned components of the purported DNE and CME are even partitioned from one another, as I discuss later. The Petition further contends:

should it be determined that the claim construction for this term from the case against Charter Communications noted above in Section V.E applies, Rabenko still describes that “the cable modem engine and the data networking engine are not necessarily physically separate but are ***functionally separate such that the cable modem functions are performed only by the cable modem engine and the home networking functions are performed only by the data networking engine***” (Ex. 1011, p. 17) as described above in Sections VI.A.1.b-VI.A.1.c.

Id. It is my opinion that the contentions in the Petition are incorrect. I see no indication in the Petition that Rabenko is shown to disclose that the DNE home networking functions and CME cable modem functions are exclusively handled by different processors, or that the cable modem functions are performed only by the cable modem engine and the home networking functions are performed only by the data networking engine.

84. I understand that the Petition asserts that Rabenko’s voice and data processor forms part of Rabenko’s alleged CME. Pet., 21. However, upon review of Rabenko’s disclosures, I disagree with the Petition, since the voice and data processor appears to perform home networking functions.

85. Rabenko discloses that its voice and data processor supports voice compression and decompression for communications made over the HomePNA LAN. See Ex. 1005 [Rabenko] [0247] (“the voice and data processor 213 ... could

be used to support voice compression and decompression for communications over the HomePNA LAN ...”). The POSITA would understand the HomePNA LAN to self-evidently perform home networking functions. A “LAN” is a local data network. And the Petition appears to agree that the HomePNA LAN performs home networking functions. Pet., 14; *see also* Pet., 5-6 (agreeing that “home networking functions” includes when “[a]ny packet destined for a HomePNA device connected to HomePNA LAN is sent to HomePNA controller 138” in Rabenko). The Petition nowhere explains how Rabenko’s use of its voice and data processor (supposedly in its CME) to provide compression and decompression in support of communications over the data network of its HomePNA LAN (supposedly in its DNE) can be reconciled with the position that Rabenko “completely partition[s]” the “CME” cable modem functions from the “DNE” home networking functions.

86. As I discussed earlier, there are teachings in Rabenko with respect to functional partitioning of components within Petitioner’s own purported CME, but not partitioning its purported DNE from its purported CME. Meanwhile, components of Rabenko’s purported CME appear to share functionality with the “data networking” of Rabenko’s system. If Rabenko explicitly stated otherwise, or offered evidence upon which to base conclusions about categorization or partitioning, etc., the situation might be different. But Rabenko does not have, and

the Petition, in any event, does not identify statements justifying the liberties it takes with what Rabenko does illustrate.

87. Thus, it is my opinion that the Petition has not shown Rabenko discloses that the CME “cable modem functions” are “completely partitioned” from the DNE “home networking functions.” As I previously noted, the Petition makes no assertion that it would be obvious to modify Rabenko to meet this limitation, and so I do not opine on it at this time.

D. The “Cable Modem Engine Configured To Enable Upgrades To Its Software ... *Independent* of Upgrades To The Software Of The Data Networking Engine” (1[d]/14[c]/18[d], All Claims And Grounds).

88. Each of the independent claims require “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] cls. 1, 14, 18:

Limitations 1[d], 14[c], and 18[d] recite “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.”

89. I note Petitioner concedes that Rabenko does not disclose this limitation, Pet., 26, but asserts that it would be obvious to modify Rabenko to add

independent upgradability of the CME and DNE software in view of Rabenko alone (*id.*), or alternatively in view of Gaspar (*id.*, 26-28) or Kim (*id.*, 28-31).

90. I note that, at the outset, each of Petitioner's arguments appear to rely on the premise that Rabenko discloses a DNE with completely partitioned functions from a CME. As I discussed previously, I do not believe the Petition has shown Rabenko makes any such disclosures. It is further my opinion that Petitioner fails to show a motivation to modify Rabenko or combine it with Gaspar and Kim to meet the limitations at issue. It is also my opinion that there would be no reasonable expectation of success in modifying Rabenko or combining it with either Gaspar or Kim to achieve these limitations.

1. Rabenko Does Not Disclose And/Or Render Obvious Upgradability Of Software, Much Less Independent Upgradability Of Software.

91. I understand that the Petition admits that the required configuration of a cable modem engine to enable upgrades to its software in a manner that is independent of upgrades to the software of a data networking engine is a limitation missing from Rabenko. Pet., 26. Petitioner asserts, first, that Rabenko itself renders obvious adding a configuration of its purported CME to “**enable upgrades** to its software ... **independent of upgrades** to the software of the” purported DNE. Pet., 26-27. This limitation is an important aspect of the claimed inventions. The ’775 patent discloses that the specific, partitioned architecture of the ’775 patent is

expressly described as providing the “highly desirable” advantages of “allow[ing]” the claimed independent software upgradeability claimed, because it is the claimed architecture’s decoupling, and implementation with different processors, of “the data networking and cable modem functions” in this arrangement that make “independent software upgrading and maintenance of these functions . . . feasible.” Ex. 1001 [’775], 1:30-40, 3:58-62, 4:25-40.

92. Petitioner asserts that it would be obvious to modify Rabenko to allow for independent upgradability, relying on Rabenko’s statement that “[s]killed artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application.” Pet., 26-27 (quoting Ex. 1005 [Rabenko] [0268]). As an initial matter, Petitioner does not appear to explain why a reference to hardware and software being interchangeable with one another (as means of implementation) would render obvious, or even has anything to do with software upgradeability, much less upgradeability of software of a cable modem function engine of the gateway cable modem independently of a data networking engine of the gateway cable modem. Nor would it. This generic notion of hardware and interchangeability does not suggest this independent software upgradeability. Swapping out a piece of hardware for software does not imply that the software

itself is upgradeable. And none of this indicates anything about permitting software of a CME to be upgradeable independently of that of a DNE.

93. Petitioner appears to rely on Rabenko’s general disclosure that its teachings “may be implemented in any number of ways including electronic hardware, computer software, or combinations of both ... depend[ing] upon the particular application and design constraints imposed on the overall system” and that “[s]killed artisans recognize the interchangeability of hardware and software,” as noted above. Pet., 26-27 (citing Ex. 1005 [Rabenko] [0268]). But without a specific motivation or explanation as to **how** a POSITA would achieve this modification of Rabenko, it is unconvincing.

94. The Petition asserts that Rabenko may be modified to upgrade the software of its purported DNE and CME independent from one another. Pet., 26-27 (“A POSITA would have understood that it would have been obvious to try because, when faced with implementing the upgradability of Rabenko’s data networking engine and cable modem engine, there are only a few finite options: to configure them to be updated together or separately.”). However, this assertion assumes that Rabenko indicates to the POSITA that its software is upgradeable in the first place.

95. The Petition ignores that the components that supposedly make up the claimed CME in Rabenko include “embedded” software, which as of the time of

Rabenko and of the ‘775 Patent was generally not upgradable, let alone independently upgradeable. Rabenko discloses that the voice and data processor and the proxy gateway of the purported CME use “embedded software.” Ex. 1005 [Rabenko] [0074] (“The **voice and data processor 213** may be implemented with a variety of technologies including, by way of example, **embedded communications software** that enables transmission of voice over packet based networks.”), [0097] (“In the described **exemplary embodiment**, the **proxy gateway function** is implemented with **embedded software** at the applications layer.”). Indeed, the Petition itself concedes that Rabenko’s voice and data processor as being implemented with “embedded communications software.” Pet., 25 (emphasis omitted).

96. I note that Rabenko discloses that its voice and data processor and proxy gateway, components of the purported CME, are implemented via “embedded” software.

97. As was well-known at the time, upgrading “embedded” software (at least without changing the hardware that is used) generally was impossible or at least difficult, depending on details of the system in question. For instance, “key features of embedded systems” may include the following:

For their **lifetime**, they **perform the same duty**. For example, an MP3 player will only play MP3s.

...

Users are **unable to change or update embedded systems**. They must have good dependability and stability ratings. The user shouldn't have any problems using them for extended periods.

Ex. 2005 [IoT] 2-3.

98. Such “embedded” software is generally rigid and fixed, incapable of being upgraded without replacing or modifying the accompanying hardware. *Id.*, 2 (“An embedded system is an integration of programmable software and hardware that may have **fixed capabilities**.”), 4 (“Because embedded systems are sometimes related to certain hardware platforms, **upgrading the system without changing the hardware can be difficult**.”); Ex. 2004 [Monarch] 6 (“Once an embedded system is developed [y]ou are **not able to alter, enhance or upgrade**.”).

99. In short, there was a clear reason Rabenko does not state that these components have software that can be upgraded: Rabenko expressly describes them as having embedded software, and such software generally could not be upgraded. Thus, the POSITA would not be taught that Rabenko's voice and data processor and proxy gateway, components of the purported CME, would be software-upgradable at all. Nor is any reason provided why the POSITA would have been motivated to modify Rabenko to make these components upgradable, even assuming that was possible.

100. Furthermore, for Rabenko to have this software upgradeable feature would have seemingly required a facility for accessing (today, presumably downloading), verifying, extracting, and installing the upgraded software. At the time the POSITA would have understood these facilities to use (and therefore require) another processor and other software, or possibly special hardware or a specialized software “bootloader.” Such upgrades generally interrupt normal operation of the software in question while they occur and require careful design and testing.

101. None of these aspects of software or upgradeability are discussed or noticeably acknowledged by the Petition. Thus, no reason is shown why a POSITA would be motivated to modify Rabenko to allow for the claimed independent upgradability, or how that could be done with a reasonable likelihood of success.

102. For the cable modem to be upgradeable in its software would presumably requires a facility for accessing (today, presumably downloading), verifying, extracting, and installing the upgraded software. As the POSITA would have known, these facilities would predictably require some other processor and software, or else, possibly special hardware, particularly if it were not feasible to make the software in the CME upgradeable in an on the fly manner.

103. Further, as I discussed earlier, Rabenko teaches functionality of the purported DNE and CME components are intermixed. I see no explanation for why the POSITA would find it obvious to embark on modifying these components to be independently upgradeable or even have a reasonable expectation of success in doing so, when there is no reason given that the POSITA would know how functionally intermixed components would be amenable to independent software upgrades. Thus, it is my opinion that the Petition does not explain why the POSITA would be motivated to modify Rabenko to allow for the claimed independent upgradability, nor is there any explanation how that could be done with a reasonable likelihood of success.

104. I understand Petitioner's assertion that it would be obvious to modify Rabenko hinges on what is known as an "obvious to try" argument, which requires that there only be a "few finite options" in order to be considered obvious.

105. I understand that the Petition asserts that it would be obvious to modify Rabenko because "[a] POSITA would have understood that [independent upgradability] would have been obvious to try because, when faced with implementing the upgradability of Rabenko's data networking engine and cable modem engine, there are only a few finite options: to configure them to be updated together or separately." Pet., 26-27.

106. I disagree, however, that there are only the two finite options presented by the Petition as to how a POSITA would modify Rabenko. This is because Petitioner's argument seems to rely on its previous assertion that the POSITA would understand that the Petition's arbitrary grouping of Rabenko's components would even create a CME and DNE, and that this putative CME and DNE would be "separate and independent." Pet., 26-27. As I have discussed at ¶¶ 68-70, 82-85, this is not the case. Rather than the two options presented by the Petition, which are groupings created based on the benefit of hindsight by looking at the disclosures and innovations of the '775 patent, the possible combinations of Rabenko's components, which are shown in its Figure 2, could be grouped together in innumerable ways. Thus, I disagree that a POSITA would have found modifying Rabenko as simple or obvious as the Petition asserts.

107. It is my opinion that, given the embedded nature of Rabenko's components, and the number of possible combinations that a POSITA could feasibly make from Rabenko's myriad components, it would not be obvious to a POSITA to modify Rabenko's asserted DNE and CME to allow for upgradability, much less independent upgradability.

2. Adding Gaspar Does Not Meet This Limitation.

108. I understand that the Petition alternatively asserts that it would be obvious to modify Rabenko by combining it with Gaspar's teachings in order to

satisfy the limitation at issue. Petitioner asserts that Gaspar teaches upgrading the HomePNA controller of its system, and that applying this teaching to Rabenko would be obvious because Rabenko's HomePNA controller "would have to be frequently updated or replaced," and thus the addition of Gaspar would allow independent upgradability of Rabenko's purported CME and DNE. Pet., 27. I note that there is no disclosure in Gaspar of a DNE or CME, nor does the Petition rely on it for such. Specifically, Petitioner asserts that:

A POSITA would have known that such frequent upgrades could be "costly and time-consuming" and thus, when designing a system that includes a HomePNA controller, a POSITA would have recognized the need to "enable convenient modifications" of the controller. Ex. 1006, [0005]-[0006]. Thus, a POSITA would have found it obvious that the partitioned components in Rabenko (DOCSIS MAC/PHY, proxy gateway, voice/data processor on the one hand, and HomePNA controller and AFE 226 on the other) be independently modifiable. Ex. 1006, [0014] (teaching that components of a **HomePNA controller** should be partitioned so that each component can be independently debugged or upgraded). Ex. 1002, ¶125.

Pet., 27-28.

109. Petitioner appears to use Gaspar to provide a "motivation to modify" Rabenko to enable upgradability of the **HomePNA controller**, a component of the DNE. See Pet., 27-28. Even if, *arguendo*, Gaspar's teachings were applied to Rabenko, this does not even address the issue that, as discussed above, several of

Rabenko's **CME** components are embedded and do not provide for upgradability. Gaspar only discusses upgrading its "HPNA controller" of, supposedly, the DNE, not the CME (though neither appears in Gaspar, nor, as I have explained, in Rabenko), and there is no indication that its teachings could be applied to a CME in combination with Rabenko.

110. It is my opinion that the addition of Gaspar does not explain *why* a POSITA would be motivated or able to modify Rabenko such that the embedded software of the purported CME is independently upgradable.

111. Even assuming it were "obvious" in the abstract to desire to modify Rabenko's components to become independently upgradable, that is not sufficient to achieve the invention disclosed in the '775 patent.

112. A "desire" to do something does not furnish a way to do it. Such a way is lacking here, even or perhaps especially with the addition of Gaspar.

113. As discussed, Gaspar does not teach altering embedded components (*e.g.*, voice and data processor or proxy gateway) such that they are upgradable, much less teaching that components be configured to be independently upgradable from other components in a system. Gaspar solely concerns, at the very most and generously assuming the Petition's premises are correct, partitioning the DNE's HomePNA controller itself "[b]y partitioning the MAC and PHY circuits" and independently upgrading those portions of it. Ex. 1006 [Gaspar] [0014].

114. I once again note that, even if Gaspar's teachings were obvious to apply to Rabenko, it is unlikely that the limitation requiring upgradability would be met. The claims require that the **software of the CME** be independently upgradable from the software of the DNE. Gaspar only discloses upgrading its HomePNA controller. The Petition itself asserts that the HomePNA controller is only one part of the purported DNE, and Gaspar is not shown to disclose any other component as upgradable.

115. Petitioner argues that adding Gaspar to Rabenko renders it obvious to add upgradable CME software independent of the DNE software because Rabenko's HomePNA supposedly "would have to be frequently updated or replaced" and Gaspar's supposed DNE HomePNA controller has components "independently modifiable" from CME components. Pet., 27-28. But neither Gaspar nor Rabenko discloses that, and there is no showing that Gaspar in combination with Rabenko yields these things. Gaspar's cited disclosure of "partitioning the MAC and PHY circuits" in its "HPNA controller" so "the controller circuit can be debugged or upgraded by modifying the MA circuit, leaving the PHY circuit intact," Ex. 1006 [Gaspar], [0014] (cited at Pet., 28), is at most a teaching about upgrading different parts of one component of the DNE independently, not upgrading the software of the CME independently from that of the DNE as claimed. Contrary to the Petition's argument (Pet., 28), the first

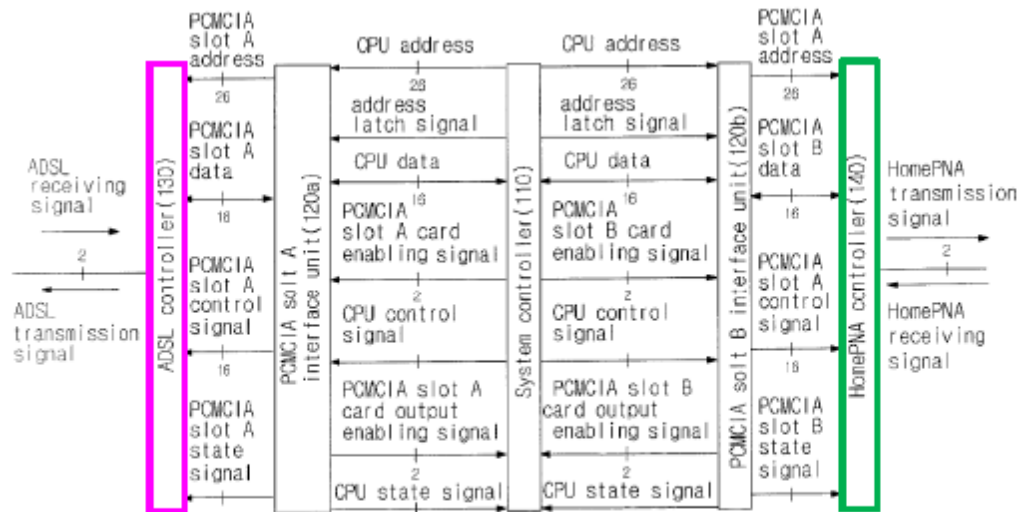
disclosure of making the software of the CME independently upgradeable from that of the DNE, as far as I am aware, is in the '775 patent. *See* Ex. 1001 ['775], *e.g.*, 1:30-40.

116. Thus, there is no indication that the addition of Gaspar would even allow other components of Rabenko's purported DNE to become independently upgradable, much less the software of components of the purported CME, which the Petition does not assert even exist in Gaspar. Thus, it is my opinion that Gaspar cannot offer either a motivation or a reasonable expectation of success for modifying Rabenko to configure its purported CME to meet the claims.

3. Adding Kim Does Not Meet This Limitation.

117. I understand that the Petition next asserts that it would be obvious to modify Rabenko in view of Gaspar and Kim to achieve the limitation requiring CME software be independently upgradable from DNE software. Petitioner asserts:

Like Rabenko, Kim is directed to a home-based telecommunications system that includes a residential gateway. Ex. 1007, Abstract, [0001]-[0016]. Kim's residential gateway includes a HomePNA controller (like Rabenko) (green below) and an ADSL controller (pink below). Ex. 1007, [0026], [0032]-[0042], Fig. 3.



Ex. 1007, Fig. 3 (annotated)

Kim teaches that its residential gateway is “modular-type” such that the HomePNA controller and the ADSL controller are partitioned and can be independently upgraded:

Further, even when improving the performance of HomePNA controller or ADSL controller, the modular-type home gateway system maintains the system controller of the home gateway and replaces either the HomePNA controller or the ADSL controller, thereby improving the whole performance of the home gateway. The ADSL controller and the homePNA are embedded in the modular-type home gateway system.

Ex. 1007, [0026]. Kim’s use of modular controllers beneficially provides “a small-sized and economical structure,” that results in less cost and inconvenience when updating the controllers. Ex. 1007, [0007]; *see also*, Ex. 1007, [0002]-[0006], [0008].

Pet., 28-30. It is my opinion that the Petitioner is incorrect, as Kim’s “modular” (and hence allegedly easily *replaceable*) HomePNA controller and ADSL controller would not render it obvious to add independent upgradeability of the combination’s alleged CME software as claimed. This is because Kim concerns *replacing* modular pieces of *hardware*, not *upgrading software*. In other words, Kim, if anything, teaches away from the invention, and in the process illustrates why the POSITA would not obviously try the claimed upgradable software. It does not appear to me that the Petition ever addresses this distinction.

118. In Kim’s system, a HomePNA controller or an ADSL controller—both modular pieces of hardware—may allegedly be replaced independently. Ex. 1007 [Kim] [0026]. Thus, there is no indication that a POSITA would be motivated to apply Kim to Rabenko. After all, the POSITA armed with Kim has an alternative to performing software upgrades *at all*. With swappable hardware modules (including associated firmware/embedded software, which apparently is how Kim works as the new modules are plug-and-play), the ability to update software itself can be dispensed, since a module can be replaced rather than upgraded given Kim’s disclosures. Ex. 1007 [Kim] [0026].

119. I otherwise see nothing in the combination of references which teaches upgradability of CME software, as Rabenko’s embedded software is not shown to be upgradable at all. Section VI.C.1. Gaspar is not cited on this point, and

in Kim, the “upgrades” are to a HomePNA controller (which the Petition includes in the DNE), with no indication of allowing “upgrades” to anything that might plausibly be related to the CME. Ex. 1007 [Kim] [0026]. In short, the claim requires enabling upgrades of software associated with a CME, while Kim concerns, if anything, replacing modular hardware associated with a DNE. Pet., 28-30.

120. The Petition relies on Kim’s disclosure of a “modular-type home gateway system” and the phrase “improving the performance of HomePNA controller or ADSL controller.” Pet., 29-30. I note, however, that Kim states its “modular-type” HomePNA controller and ADSL controller are “detachably connected” to the system and can be “replaced.” Ex. 1007 [Kim] [0001], [0014]; *id.*, Abstract. Thus, it is apparent that Kim actually refers to ***replacing hardware*** rather than ***upgrading software***.

121. 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. 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 in Kim, 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 adds disadvantages.

122. Thus, it is my opinion that adding Kim’s teachings to Rabenko and Gaspar would not result in satisfying the limitation requiring independent upgradability of software which the claims require.

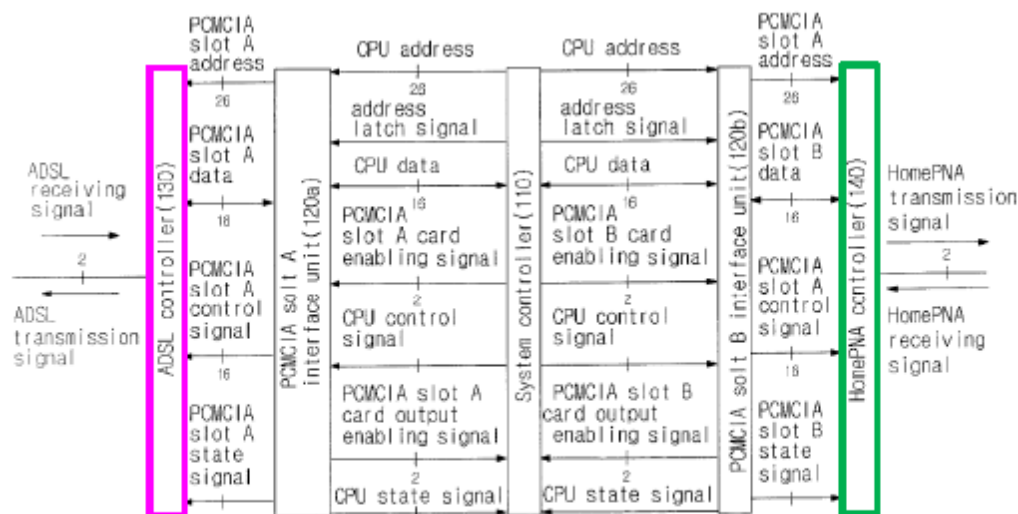
123. There is further no indication that, even if replacing hardware was considered to be the same as upgrading software, Kim’s teachings **could** be obviously and successfully applied to Rabenko to achieve the claimed limitation, as it would require much more than the “minor ... modifications” to Rabenko that the Petition asserts would be needed.

124. Petitioner asserts a POSITA would be successful in modifying Rabenko to use Kim’s teachings such that “Rabenko’s component [would] be partitioned and independently upgradable,” and that the modification would only “require[] ... minor hardware, software, and/or firmware modifications.” Pet., 30-31. But applying Kim’s teachings to Rabenko as the proposed combination would do would require much more than “minor” (as the Petition terms them, Pet., 30-31) modifications.

125. Only two components of Kim’s system are “modular,” and only one of those components, the HomePNA controller, is a common component shared between Kim and Rabenko’s disclosures. Pet., 30; *compare* Ex. 1005 [Rabenko] Fig. 2 (illustrating DOCSIS MAC/PHY, voice/data processor, **HomePNA controller**, proxy gateway, AFE) *with* Ex. 1007 [Kim] [0026] (“The modular-type home gateway system has a small-sized and economical structure by making the **HomePNA controller and the ADSL controller** as a modular type controller having a PCMCIA interface”).

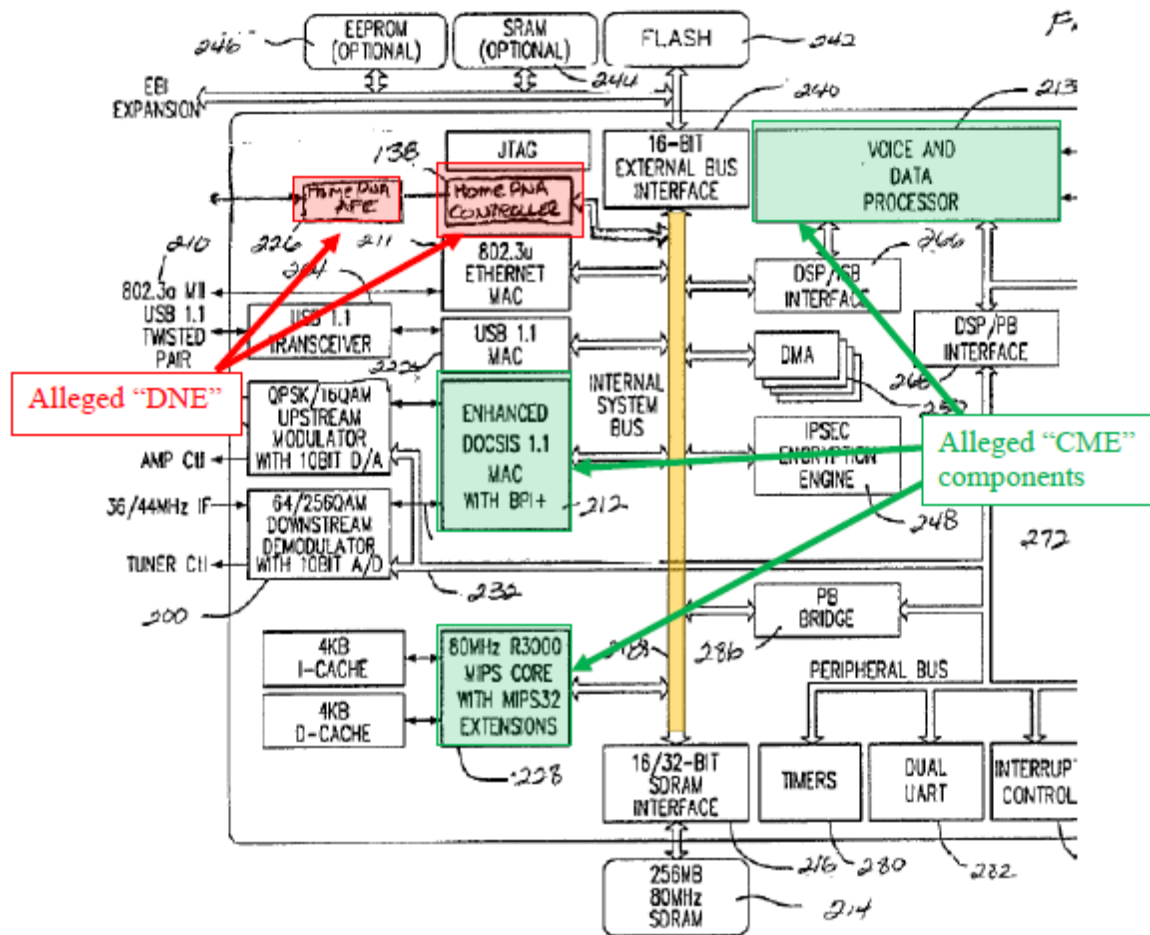
126. Petitioner does not offer any explanation as to why modifications of Rabenko would be “minor” in view of Kim, because it cannot: such a modification would not be “minor.”

127. Kim’s hardware is arranged such that the modular components of Kim’s system are located on the outer edges of the system to allow for easy replacement, shown in Petitioner’s annotated Fig. 3 below:



Ex. 1007, Fig. 3 (annotated)

Pet., 29. Kim’s Figure 3 shows that only the marked components, the ADSL controller “connected to an outdoor telephone line” (Ex. 1007 [Kim] [0012]) and HomePNA controller “connected to a prior home telephone line” (*id.*, [0011]) are modular. None of the other components in Kim’s home gateway system may be so replaced. Meanwhile, recall that the components the Petition calls the CME are scattered:



Ex. 1005 [Rabenko] Fig. 2 (annotated); *id.*, [0009]. For the modular swapping of Kim to be applied to Rabenko, the POSITA would not only be faced with serious implementation challenges, but with significant unclear choices before even undertaking the effort. The Petition seems to argue that the POSITA would know to place DNE components (red) on one circuit board, and place the CME components on another, but what about all the remaining components? Which of those would be located where? And how would these assemblies connect? Kim is

the effort of its authors to invent a hardware arrangement permitting modular replacement. Rabenko's hardware is not arranged for that at all, and it would be far more than obvious, routine activity for a POSITA to decide what Rabenko components to place where (and then go about making it work).

128. Thus, given the differences between Kim's and Rabenko's components, the Petition does not show a reasonable expectation of success in modifying the combination's embedded software to be independently upgradable as claimed. Any "independent" upgradability, further, would not yield advantages to Rabenko's system.

129. Even if Rabenko's system could be modified to enable upgrades to the CME software in a manner independent of the DNE's software, the modification would not be expected to bring the advantages that this limitation provides in the claimed invention. As I discussed previously at ¶¶ 56, 91, the independent upgradability is an important aspect of the claimed invention which is possible and desired because the "data networking and cable modem functions are decoupled," allowing the implementation of the PacketCable E-MTA "with ***minimum impact on the cable modem.***" Ex. 1001 [775] 4:25-40. But, as I again previously discussed at ¶¶ 82-86, in Rabenko there is overlap in functions between the purported DNE and purported CME, so any upgrades to one engine, which may make it inoperable, would not have a "minimum impact on the cable modem."

Instead, any upgrade would be prone to affecting the cable modem's functionality as a whole. Furthermore, Rabenko's embedded CME components are not designed to be upgradable and, as I discussed earlier, their embedded nature actually provides benefits to Rabenko's system. See ¶¶ 95-98.

130. Thus, in my opinion the POSITA is not shown to have had a reasonable expectation of success in achieving the claimed invention with the addition of Kim's teachings to Rabenko.

131. In my opinion, for at least these reasons, Petitioner and Mr. Kiaei fail to demonstrate that a POSITA would have been motivated or able to combine Rabenko with Gaspar and Kim with a reasonable likelihood of success.

VII. CONCLUSION

132. 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.

133. 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 1-7, 10, 12, 14-15, 18-20 are not obvious over Rabenko;
- Claims 1-7, 10, 12, 14-15, 18-20 are not obvious over Rabenko in view of Gaspar;
- Claims 1-7, 10, 12, 14-15, 18-20 are not obvious over Rabenko in view of Kim;
- Claims 1-7, 10, 12, 14-15, 18-20 are not obvious over Rabenko in view of Gaspar and further in view of Kim;
- Claims 1-7, 10, 12, 14-15 are not obvious over each of Grounds A-D, above, further in view of Lu;
- Claim 12 are not obvious over each of Grounds A-H, above, further in view of Klein and further in view of Kim '678;
- Claim 8 are not obvious over each of Grounds A-H, above, further in view of Koperda;
- Claim 9 are not obvious over each of Grounds Q-X, above, further in view of Johnson;
- Claims 11, 13, 16-17 are not obvious over each of Grounds A-H, above, further in view of Johnson.

134. I understand that my opinions discussed above support a legal conclusion that claims 1-20 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 10, 2024



Samuel H. Russ, Ph.D.

EXHIBIT A

Curriculum Vitae of Dr. Samuel H. Russ

Personal

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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)
2. Samuel Russ, Bret Webb, Jonathan Holifield and Justin Walker (2011). "PILS: Low-Cost Water-Level Monitoring, Environmental Monitoring", Dr. E.O. Ekundayo, Ph.D., (Ed.), pp. 137-156, ISBN: 978-953-307-724-6, InTech, (Peer-reviewed)

Journal and Magazine Articles

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.
6. Samuel H. Russ and Salim Alsharif, "Packet Loss Behavior of HomePlug AV Traffic at Video Bit Rates", *IEEE Transactions on Consumer Electronics*, Vol. 57, No. 2, May 2011, pp. 823-826.
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.
9. Samuel H. Russ, and Ramesh Nallur, "A Framework for Calculating Fundamental DVR

- Performance Limits”, *IEEE Transactions on Consumer Electronics*, Vol. 55, No. 1, Feb. 2009, pp. 132-138.
10. Ioana Banicescu, Sheikh Ghafoor, Vijay Velusamy, Samuel H. Russ, Mark Bilderback, “Experiences from integrating algorithmic and systemic load balancing strategies”, *Concurrency and Computation: Practice and Experience*, Volume 13, Number 2, pp. 121-139 (2001).
 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).
 15. S.H. Russ and C.O. Alford, “Coupled Noise and Its Effects on Modern Packaging Technology”, *IEEE Transactions on Components, Hybrids, and Manufacturing Technology*, Volume 13, Number 4, December 1990, pp. 1074-1082.

U.S. Patents

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