

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

COMCAST CABLE COMMUNICATIONS, LLC,
Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,
Patent Owner.

Patent No. 8,223,775

Filing Date: September 30, 2003

Issue Date: July 17, 2012

Title: ARCHITECTURE FOR A FLEXIBLE AND HIGH-PERFORMANCE
GATEWAY CABLE MODEM

Inter Partes Review No.: IPR2024-00446

**PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42.100 *et seq.***

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EXHIBITS

- Ex. 1001: U.S. Patent No. 8,223,775 (“the ’775 Patent”)
- Ex. 1002: Expert Declaration of Dr. Sayfe Kiaei
- Ex. 1003: Curriculum Vitae of Dr. Sayfe Kiaei
- Ex. 1004: Certified Prosecution History of the ’775 Patent
- Ex. 1005: U.S. Pub. No. 2002/0006137 (“Rabenko”)
- Ex. 1006: U.S. Pub. No. 2004/0004974 (“Gaspar”)
- Ex. 1007: U.S. Pub. No. 2002/0091861 (“Kim”)
- Ex. 1008: Harry Newton, *Newton’s Telecom Dictionary*, (CMP Books, 18th ed. Feb. 2002)
- Ex. 1009: U.S. Pub. No. 2004/0125754 (“Johnson”)
- Ex. 1010: U.S. Pub. No. 2002/0065935 (“Koperda”)
- Ex. 1011: 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. 1012: U.S. Pub. No. 2002/0078249 (“Lu”)
- Ex. 1013: U.S. Pub. No. 2002/0012343 (“Holloway”)
- Ex. 1014: Andrew S. Tanenbaum, *Computer Networks*, (4th ed. 2003)
- Ex. 1015: U.S. Pub. No. 2002/0138678 (“Kim ’678”)
- Ex. 1016: U.S. Pub. No. 2004/0019765 (“Klein”)

MANDATORY NOTICES

Real Parties in Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest for this petition are (i) Comcast Corporation, (ii) Comcast Cable Communications, LLC, and (iii) Comcast Cable Communications Management, LLC. These entities are referenced below as “Comcast entity _” or as “Comcast entities __,” where “__” is one of or more of (i)-(iii).

No unnamed entity is funding, controlling, or directing this Petition for *inter partes* review (IPR) of U.S. Patent No. 8,223,775 (“the ’775 Patent”), or otherwise has an opportunity to control or direct this Petition or Petitioner’s participation in any resulting IPR.

Related Matters (37 C.F.R. § 42.8(b)(2))

The ’775 Patent is asserted against Comcast Corp., Comcast Cable Communications, LLC, and Comcast Cable Communications Management, LLC in the Central District of California in *Entropic Communications, LLC v. Comcast Corp. et al.*, No. 2:23-cv-01050 (C.D. Cal.) (“CDCA Litigation”). The earliest date of service on any Comcast entity named in the CDCA Litigation was February 16, 2023.

The ’775 Patent is also being asserted against Cox Communications, Inc., CoxCom LLC, and Cox Communications California, LLC in the Central District of

California in *Entropic Communications, LLC v. Cox Communications, Inc. et al.*, No. 2:23-cv-01049 (C.D. Cal.).

The '775 Patent was previously asserted against Charter Communications, Inc., Spectrum Advanced Services, LLC, and Spectrum Management Holding Company, LLC in *Entropic Communications, LLC. v. Charter Communications, Inc. et al.*, No. 2:22-cv-00125 (E.D. Tex.) which was terminated pursuant to a settlement on December 10, 2023.

No prior petitions for *inter partes* review, post-grant review, or covered business method review have been filed against the '775 Patent.

This is the sole petition for *inter partes* review filed by Petitioner against the '775 Patent.

Lead and Back-Up Counsel (37 C.F.R. § 42.8(b)(3))

Petitioner designates counsel listed below. A power of attorney for counsel is being concurrently filed.

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I. INTRODUCTION

Comcast Cable Communications, LLC (“Petitioner”) petitions for *inter partes* review and cancellation of claims 1-20 of U.S. Patent No. 8,223,775 (“the ’775 Patent”) (Ex. 1001).

II. SUMMARY OF ARGUMENT

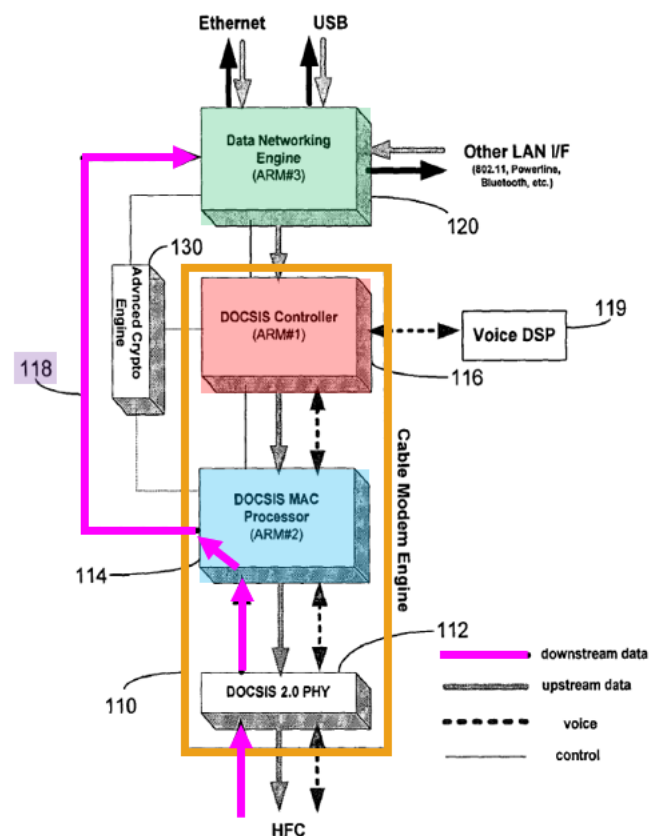
The ’775 Patent generally claims a cable modem system with a cable modem engine functionally partitioned from a data networking engine functionality. Ex. 1001, Abstract. The data networking engine performs home networking functions including interfacing with customer provided equipment. The cable modem engine performs cable modem functions including interfacing with cable media and is configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the data networking engine. The cable modem engine includes a DOCSIS MAC processor and a DOCSIS controller. During prosecution, the Examiner found that the art of record did not disclose a DOCSIS MAC processor configured to process and forward PDU packets directly to the data networking engine, i.e., to bypass the DOCSIS controller. Ex. 1004, p. 158.

However, the ’775 Patent’s claims are rendered obvious by prior art that was not considered by the Examiner as shown herein. As set forth below, claims 1-20 of the ’775 Patent are unpatentable and should be cancelled.

III. OVERVIEW OF THE '775 PATENT

A. Brief Description

The '775 Patent describes a cable modem system 100 that includes a cable modem engine 110 (**orange**) and a data networking engine 120 (**green**). The cable modem engine 110 includes a DOCSIS MAC processor 114 (**blue**) and a DOCSIS controller 116 (**red**). The DOCSIS MAC processor 114 exchanges data and voice data with an external source (not shown) via a DOCSIS PHY layer 112. Ex. 1001, 2:49-3:11, Fig. 1; Ex. 1002, ¶48.



Ex. 1001, Fig. 1 (annotated)

The DOCSIS controller 116 (**red**) implements VoIP functionality (e.g., PacketCable). Ex. 1001, 3:21-48. The DOCSIS MAC processor 114 (**blue**) implements MAC functions and all processing of downstream PDU (protocol data unit) packets (**light purple** arrows). To increase downstream throughput, processed PDU packets are forwarded directly to data networking engine 120 (**green**) along path 118 (**purple**), bypassing DOCSIS controller 116 (**red**). *Id.*, 3:1-20; 1002, ¶49.

B. Prosecution History

The application that led to the '775 Patent, U.S. Application No. 10/675,566, was filed on September 30, 2003, with 15 claims including independent claims 1, 12, and 15. Ex. 1004, pp. 16-19.

All claims were rejected as anticipated by U.S. Published Application 2001/0039600 to Brooks. Ex. 1004, pp. 52-59. In response, Applicant argued that Brooks did not disclose data networking functions performed by a data networking engine being completely partitioned/decoupled from the cable modem functions performed by a cable modem engine. Ex. 1004, pp. 66-71.

In a Final Office Action, the rejection of all claims in view of Brooks was maintained. Ex. 1004, pp. 93-102. Applicant requested an RCE. Ex. 1004, pp. 130-141.

All claims were rejected as either anticipated by U.S. Patent No. 6,944,706 to Schain or unpatentable over Schain and U.S. Published Application 2006/0080650

to Winters. Ex. 1004, pp. 149-160. The Examiner noted that dependent claim 7 contained allowable subject matter: “the DOCSIS MAC processor is 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.” Ex. 1004, p. 158. Applicant amended the claims based on the allowable feature in claim 7. Ex. 1004, pp. 170-179.

The ’775 Patent issued on July 17, 2012. Ex. 1001, cover; *see also* Ex. 1002, ¶¶50-60.

C. Earliest Priority Date for the Claims

The earliest possible priority date for the claims of the ’775 Patent is September 30, 2003. Each reference relied on herein is prior art to that date as explained below.

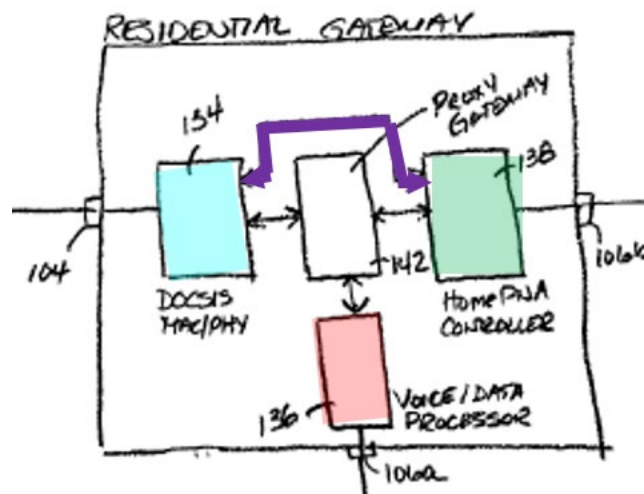
IV. OVERVIEW OF PRIOR ART

A. Rabenko

Rabenko (Ex. 1005) is a U.S. Published Application filed May 8, 2001, and published on January 17, 2002. Ex. 1005, cover, [0001]. Rabenko is prior art under 35 U.S.C. § 102(b). Ex. 1002, ¶61.

Rabenko describes a system with a gateway configured to exchange voice and data packets over a telephone line. Ex. 1005, Abstract, [0004]-[0006]. The gateway includes a DOCSIS MAC/PHY 134 (blue), a proxy gateway 142 and voice/data processor 136 (red), and a HomePNA controller 138 (green). DOCSIS MAC/PHY

134 translates the format for all arriving packets from DOCSIS to an internal format. *Id.*, [0044]. If the packet payload is data, DOCSIS MAC/PHY 134 routes, shown by **purple**, a packet directly to HomePNA controller 138, bypassing both proxy gateway 142 and voice/data processor 136 (like the bypassing of the DOCSIS controller in the '775 Patent). *Id.*, [0045]. HomePNA controller 138, like the data networking engine 120 of the '775 Patent, performs home networking functions. *Id.* If the packet payload is voice, DOCSIS MAC/PHY 134 routes the packet to proxy gateway 142. Proxy gateway 142 and voice/data processor 136 process voice packets. *Id.*, [0044]-[0045], [0074], [0082]-[0087], [0139], Fig. 1b; Ex. 1002, ¶¶62-63.



Ex. 1005, Fig. 1b (excerpted and annotated)

The home networking functions performed by the HomePNA controller 138 are completely partitioned from the cable modem functions performed by the cable modem (**orange**) in the gateway. Ex. 1002, ¶64. Any packet destined for a

HomePNA device connected to HomePNA LAN is sent to HomePNA controller 138 which processes and transmits the packet to a media terminal adapter (MTA) 140. Ex. 1005, [0045], Fig. 1b; Ex. 1002, ¶64. The cable modem is used as described by the CableLabs DOCSIS specification and functions as a proxy for voice over IP. Ex. 1005, [0034]-[0035]. Ex. 1002, ¶63.

B. Gaspar

Gaspar (Ex. 1006) is a U.S. Published Application filed July 2, 2002, which published on January 8, 2004. Ex. 1006, cover. Gaspar is prior art under 35 U.S.C. § 102(e). Ex. 1002, ¶65.

Gaspar describes home telecommunication systems that include a HomePNA controller compliant with the HomePNA specification, and provides background knowledge of well-known features of HomePNA controllers. Ex. 1006, [0001]-[0008]. Gaspar teaches that the MAC 120 of its HomePNA controller “is implemented with a field programmable gate array (FPGA)...[or] with other programmable devices such as a programmable logic device.” Ex. 1006, [0021]. Gaspar’s PHY 122 of the HomePNA controller performs “standard functions,” including “a signal processing function such as a digital signal processor (DSP) function.” Ex. 1006, [0023]; Ex. 1002, ¶¶66-67.

C. Kim

Kim (Ex. 1007) is a U.S. Published Application filed May 31, 2001, which published on July 11, 2002. Ex. 1007, cover. Kim is prior art under 35 U.S.C. § 102(b). Ex. 1002, ¶68.

Kim describes a home-based telecommunications system that includes a residential gateway. Ex. 1007, Abstract, [0001]-[0016]. Kim's residential gateway includes a HomePNA controller. Ex. 1007, [0026], [0032]-[0042], Fig. 3. Kim teaches that its residential gateway is "modular-type" such that the HomePNA controller and an ADSL controller are partitioned and can be independently upgraded. Ex. 1007, [0026]; Ex. 1002, ¶69.

D. Johnson

Johnson (Ex. 1009) is a U.S. Published Application filed August 1, 2003, which published on July 1, 2004. Ex. 1009, cover. Johnson is prior art under 35 U.S.C. § 102(e). Ex. 1002, ¶70.

Johnson describes managing a home network that distributes data such as voice and video. Ex. 1009, Abstract, [0002], [0020], [0048]. Johnson teaches a networking device that includes a networking management capability (as defined in the CableHome Specification) and data interfaces that are also CableHome compliant. Ex. 1009, [0032]-[0035], [0062]-[0067], Figs. 10-13; Ex. 1002, ¶71.

E. Koperda

Koperda (Ex. 1010) is a U.S. Published Application filed February 26, 2001, which published on May 30, 2002. Ex. 1010, cover. Koperda is prior art under 35 U.S.C. § 102(b). Ex. 1002, ¶72.

Koperda describes a home-based telecommunications system that includes a residential gateway of modular design that allows for any of a variety of network access technologies, home network technologies, and network services to be implemented in one or more modules. Ex. 1010, Abstract, [0003]-[0007], [0023]-[0025], Table 1; Ex. 1002, ¶73.

F. Lu

Lu (Ex. 1012) is a U.S. Published Application filed December 15, 2000, which published on June 20, 2002. Ex. 1012, cover. Lu is prior art under 35 U.S.C. § 102(b). Ex. 1002, ¶74.

Lu describes a MAC architecture for managing data flow over a network which includes a physical layer and a media access control layer. Ex. 1012, Abstract, [0010]. Lu teaches illustrative implementations of its architecture including a first implementation in a RISC machine. *Id.*, [0124]-[0128], Fig. 23; Ex. 1002, ¶75.

G. Kim '678

Kim '678 (Ex. 1015) is a U.S. Published Application filed January 31, 2001, which published on September 26, 2002. Ex. 1015, cover. Kim '678 is prior art under 35 U.S.C. § 102(b). Ex. 1002, ¶76.

Kim '678 describes that an ARM940-based RISC processor was a commonly known RISC processor. Ex. 1015, [0193]; Ex. 1002, ¶77.

H. Klein

Klein (Ex. 1016) is a U.S. Published Application filed July 23, 2003, which published on January 29, 2004. Ex. 1016, cover. Klein is prior art under 35 U.S.C. § 102(e). Ex. 1002, ¶78.

Klein describes that an ARM9TDMI-based RISC processor was a commonly known RISC processor. Ex. 1016, [0008]; Ex. 1002, ¶79.

V. IDENTIFICATION OF CHALLENGE PURSUANT TO 37 C.F.R. § 42.104(b)

A. Claims for Which Review is Requested and Grounds on Which Challenge Is Based

Petitioner requests review of claims 1–20 on the following grounds.

Ground	References	Basis	Claims Challenged
A	Rabenko	§103	1-7, 10, 12, 14-15, 18-20
B	Rabenko in view of Gaspar	§103	1-7, 10, 12, 14-15, 18-20
C	Rabenko in view of Kim	§103	1-7, 10, 12, 14-15, 18-20
D	Rabenko in view of Gaspar and Kim	§103	1-7, 10, 12, 14-15, 18-20
E-H	Each of Grounds A-D + Lu	§103	1-7, 10, 12, 14-15

I-P	Each of Grounds A-H + Klein and Kim '678	§103	12
Q-X	Each of Grounds A-H + Koperda	§103	8
Y-FF	Each of Grounds Q-X + Johnson	§103	9
GG-NN	Each of Grounds A-H + Johnson	§103	11, 13, 16-17

None of the prior art in the table above was before the examiner during prosecution of the '775 Patent.

B. 314(a) Discretion Does Not Apply

The *Fintiv* factors as set forth in the Director's June 21, 2022, Guidance Memorandum do not warrant discretionary denial.

Factor one appears neutral. Petitioner has filed IPR petitions challenging all eight patents asserted in the District Court in case no. 2:23-cv-01050. If trial is instituted, and the case is not dismissed based on Petitioner's pending motion to dismiss the Second Amended Complaint, then Petitioner expects to request a stay, as decisions in Petitioner's favor would resolve the dispute in its entirety.

Factor two (proximity of trial date) favors institution. Petitioner has filed a motion to dismiss, Patent Owner has filed an Amended Complaint, and Petitioner will renew its Motion to Dismiss in order to seek dismissal of the operative complaint. Further, no trial date has been set.

Factor three favors institution. To date, the investment by the District Court has been limited to considering motions to dismiss on the pleadings.

Factor four strongly favors institution. The petition challenges all claims in the '775 Patent while only claims 18-19 are asserted in the District Court.

Factor five does not warrant denial as Petitioner is a defendant in the District Court case.

Factor six favors institution. Petitioner presents compelling unpatentability challenges that merit institution.

C. 325(d) Discretion Does Not Apply

The Board should not exercise its §325(d) discretion to deny institution. *Advanced Bionics, LLC v. Med-El Elektromedizinische Geräte GMBH*, IPR2019-01469, Paper 6 at 8-9 (PTAB Feb. 13, 2020). First, the grounds raised herein are not the same or substantially the same as the art and arguments raised during prosecution (step one of *Advanced Bionics*). The Examiner did not consider any of the references cited herein. Ex. 1001, cover. Rabenko discloses the limitation the Examiner found missing from the prior art: forwarding of packets directly to a data networking engine by bypassing the DOCSIS controller. Ex. 1004, p. 158. These references are also not cumulative of the references considered during prosecution.

Second, if it is asserted that the art or arguments are similar, the Examiner materially erred by not applying the prior art contained herein.

D. Level of Ordinary Skill

A person of ordinary skill in the art (a “POSITA”) at the time of the alleged invention would have had at least 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. Ex. 1002, ¶¶40-45. Additional education may substitute for professional experience, and significant work experience may substitute for formal education. *Id.*

As set forth in his attached declaration, Safye Kiaei at least meets the level of skill of a POSITA. Ex. 1002, ¶¶1-39.

E. Claim Construction

All claim terms herein should be given their ordinary and customary meaning to a POSITA, consistent with the prosecution history, as they would be given in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b). Petitioner does not contend that the claims include any means-plus-function limitations.

Petitioner notes that in the *Entropic Communications, LLC v. Charter Communications, Inc.* case involving the ’775 Patent, Patent Owner advocated that plain and ordinary meaning applies for all claim terms, and that position was adopted by the Court for all but one term: “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. 1011, pp. 7-25, 61-62. The Court construed this term in claim 18 to mean “wherein 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.” *Id.*, p. 17; *see also* Ex. 1002, ¶¶46-47.

VI. SPECIFIC GROUNDS FOR UNPATENTABILITY

A. Grounds A-P: Claims 1-7, 10, 12, 14-15, and 18-20 are Rendered Obvious

Each of the proposed combinations renders obvious claims 1-7, 10, 12, 14-15, and 18-20¹. Ex. 1002, ¶¶81-258.

Claims 1 and 18 are both independent system claims. Because claim 18 is broader than claim 1, Petitioner addresses claims 18-20 before addressing claims 1-7, 10, 12, and 14-15.

1. Independent Claim 18

a. [18A]: “A cable modem system comprising:”

While the preamble [1A] is not limiting, Rabenko teaches it. As discussed above in Section IV.A, Rabenko discloses a communication system including a

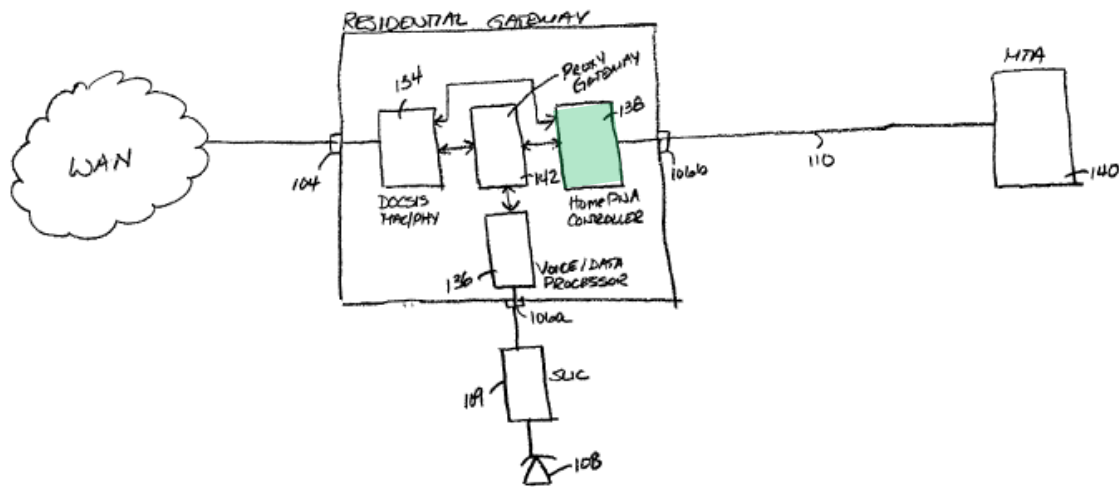
¹ The limitations of the claims appear and are labelled in the Claims Listing Appendix.

gateway with a cable modem (claimed “cable modem system”). Ex. 1005, Abstract, [0034]-[0035], Figs. 1b, 2; Ex. 1002, ¶¶83-84.

Rabenko discloses limitation [18A].

- b. **[18B] “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;”**

Rabenko discloses HomePNA controller 138 (green) that, along with AFE 226, functions as the “data networking engine.” Ex. 1005, Fig. 1b. HomePNA controller 138 can be a fully integrated MAC/PHY device that provides bi-directional communication with (“home networking functions including interfacing with”) multiple devices such as HomePNA phone 126, computer 128, etc., (“customer provided equipment”), operating on a HomePNA LAN. Ex. 1005, [0080]. Rabenko describes that in a downstream direction, DOCSIS MAC/PHY 134 and DOCSIS MAC 212 (collectively hereinafter referred to as “DOCSIS MAC 134/212”) determines whether a packet is voice or data, and if data, the packet is routed to HomePNA controller 138. Ex. 1005, [0045], Fig. 1b; Ex. 1002, ¶¶85-88.



Ex. 1009, Fig. 1b (annotated)

A POSITA would have understood that HomePNA controller's facilitation of bi-directional communications between the WAN and HomePNA phone 126 is a first claimed home networking function of "interfacing with customer provided equipment," and facilitating bidirectional communications between the WAN and computer 128 is a second claimed home networking function of "interfacing with customer provided equipment." Rabenko thus describes multiple home networking functions performed by HomePNA controller 138. Ex. 1005, [0045], Fig. 1a; Ex. 1002, ¶¶87-88.

HomePNA controller 138 is coupled to an analog front end (AFE) 226, connected to port 104. Ex. 1005, [0080], Figs. 1,2. As described regarding Fig. 11, AFE 226 couples HomePNA controller 138 to the HomePNA local area network (LAN). Ex. 1005, [0223], Fig. 11. Rabenko describes that the operation of the AFE

226 is well-known in the art. Ex. 1005, [0226]. Rabenko's HomePNA controller 138 and AFE 226 are the claimed "first circuit."

A POSITA would have understood Rabenko's HomePNA controller 138, which may be "a fully integrated MAC/PHY device," to include a processor (Ex. 1005, [0080]). Indeed, the controller 138, like a processor, comprises the hardware and software necessary to execute its processing functions. Ex. 1005, [0268]. For example, Rabenko describes processing functionality performed by HomePNA controller 138 as including "translat[ing] the data packet to a HomePNA packet" in the downstream direction, and further "convert[ing] the HomePNA packet to a[n] internal format," "determin[ing] whether [the] packet payload contains voice or data," and routing the packets accordingly, in the upstream direction. Ex. 1005, [0045]-[0046]. Thus, Rabenko teaches a HomePNA controller implemented as a processor using software and hardware to perform its various home networking functions. *Id.*

Further, Rabenko's system implements the HomePNA protocol, which "is described in the HomePNA Specification Version 2.0, the contents of which is expressly incorporated herein by reference as though set forth in full." Ex. 1005, [0034]. A POSITA would have understood that a HomePNA controller compliant with this HomePNA Specification Version 2.0 would comprise a processor to execute software to perform the functions specified therein. For example, a

HomePNA controller compliant with this HomePNA Specification Version 2.0 would execute software to perform standardized functions that require a processor, such as digital signal processing functions, QAM/FDQAM modulation functions, and DAC (Digital Analog Conversion) functions. See, e.g., Ex. 1007, [0002], [0042] (collectively teaching that a “HomePNA controller with 10 Mbps HomePNA 2.0 function” “receives HomePNA receiving signal from a home network, and performs ADC (Analog Digital Conversion) function, QAM (Quadrature Amplitude Modulation)/FDQAM (Frequency Diverse QAM) demodulation function, IEEE 802.3 CSMA/CD (Carrier Sense Multiple Access with Collision Detection) MAC (Medium Access Control) function, and PCMCIA signal conversion function”). In this way Rabenko also teaches that the HomePNA controller 138 includes a processor that executes software. Ex. 1002, ¶¶91-95.

Further, it was generally known before the priority date of the '775 Patent that HomePNA controllers included a processor that executes software as shown by Gaspar. Like Rabenko, Gaspar is directed to the design of home telecommunication systems that includes a HomePNA controller compliant with the HomePNA specification. Ex. 1005, Figs. 1a, 1b, 2, [0003], [0031]-[0047]; Ex. 1006, [0001]-[0008]. Gaspar teaches that a HomePNA controller is known to “include[] a physical layer (PHY) and a media access control (MAC)” (again, like Rabenko, which

teaches a HomePNA controller that may be “a fully integrated MAC/PHY device”). Ex. 1006, [0003]; Ex. 1005, [0080].

Gaspar teaches that the MAC 120 of its HomePNA controller “is implemented with a field programmable gate array (FPGA)...[or] with other programmable devices such as a programmable logic device.” Ex. 1006, [0021]. Gaspar’s PHY 122 of the HomePNA controller is “designed with an ASIC” to perform “standard functions,” including “a signal processing function such as a digital signal processor (DSP) function.” Ex. 1006, [0023]. A POSITA would understand that the PHY 122 of Gaspar’s HomePNA controller is at least a digital signal processor. Ex. 1002, ¶¶96-97.

It would have been obvious for a POSITA to implement the HomePNA controller functions of Rabenko using a processor, as taught by the HomePNA controller structure of Gaspar, since the use of a processor would enable Rabenko’s HomePNA to execute the functions specified in the HomePNA Specification. Ex. 1005, [0034], [0268]; Ex. 1006 [0023]. First, a POSITA would have recognized that this combination would be a simple substitution of one known element for another to obtain predictable results. Both Rabenko and Gaspar teach home telecommunication systems that includes HomePNA controller that includes both a MAC and a PHY and that implements functions of the related specification. Ex. 1005, [0003], [0031]-[0047], [0080], Figs. 1a, 1b, 2; Ex. 1006, [0003], [0007],

[0014]. Since Rabenko already provides a HomePNA controller with home networking functionality, a POSITA would have been motivated to apply Gaspar's teaching of constructing the controller using programmable hardware (a processor), including, e.g., ASICs, to help it comply with the HomePNA Specification 2.0. Ex. 1006, [0021]-[0023]; Ex. 1005, [0034]. A POSITA would have sought this combination to ensure that the HomePNA controller included the architecture (*i.e.*, processor(s)) useful for performing the functions set out in the HomePNA Specification Version 2.0. Ex. 1002, ¶98.

It also would have been obvious for a POSITA to implement the HomePNA controller functions of Rabenko using a processor (as taught in Gaspar) because Rabenko teaches that its HomePNA controller "may be implemented in any number of way [sic] including electronic hardware, computer software, or combinations of both" "depend[ing] upon the particular application and design constraints imposed on the overall system." Ex. 1005, [0268]. Rabenko teaches 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." *Id.* A POSITA, recognizing that Rabenko allows for interchangeability of hardware and software in its HomePNA controller but does not explicitly designate the specific types of hardware and software to be used, would look to specific architectures for HomePNA controllers, such as those taught in

Gaspar, for implementing the hardware and software of Rabenko's HomePNA controller. Ex. 1002, ¶99.

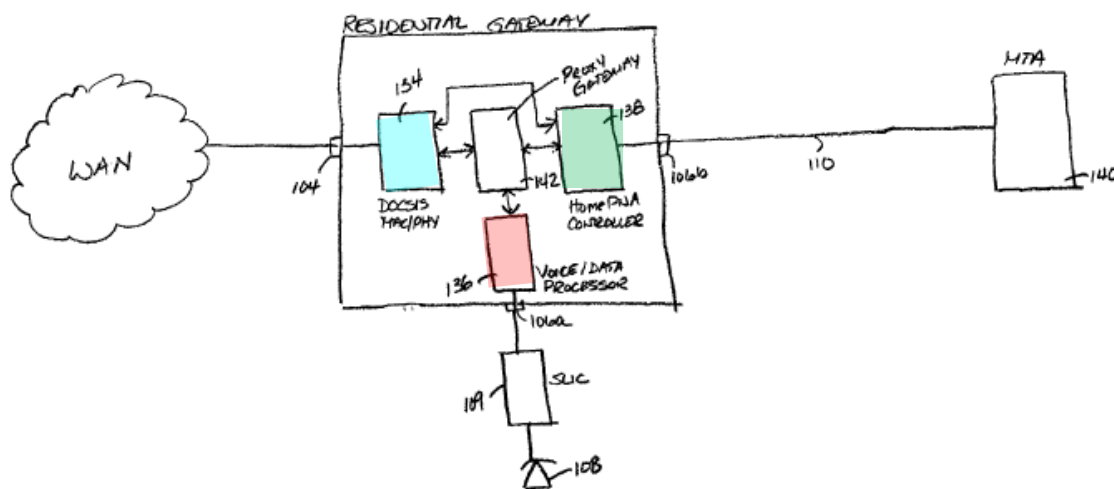
Combining Rabenko and Gaspar would be merely using known techniques (implementing the HomePNA controller functions of Rabenko's HomePNA Version 2.0-compliant controller using a processor of Gaspar) to improve similar devices (the HomePNA controller taught in Rabenko and Gaspar) in the same way (Rabenko's HomePNA controller includes the necessary architecture (*i.e.*, processor(s)) to perform the functions set out in the HomePNA Specification Version 2.0, similar to Gaspar's). Ex. 1002, ¶100; *see also id.* ¶¶101-102.

Additionally, a POSITA would have had the skill to implement a processor-based HomePNA controller in Rabenko's system, as taught by Gaspar, because the POSITA would be familiar with programming processors used for the signal processing and other processing functions required by the HomePNA Version 2.0 specification, leading to an expectation of success. Ex. 1005, [0268]; Ex. 1002, ¶103.

The proposed combinations that include Gaspar also teach limitation [18B]. Ex. 1002, ¶¶85-104.

- c. [18C]: “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”

Rabenko discloses DOCSIS MAC 134/212 (blue), a proxy gateway 142 and voice/data processor 136/213 (red) (collectively, the claimed “cable modem engine”) which are implemented in a second circuit performing cable modem functions according to the CableLabs Data Over Cable Service Interface Specification (DOCSIS). Ex. 1005, [0034].



Ex. 1005, Fig. 1b (annotated)

Specifically, Rabenko discloses,

DOCSIS was developed to ensure that cable modem equipment built by a variety of manufacturers is compatible, as is the case with traditional dial-up modems. The described exemplary embodiment can provide integrated functions for communicating with a cable head (not shown) end via the network port 104. By way of example, a QPSK upstream modulator 202 is configured to transmit data to the cable head end, and a QAM downstream demodulator 200 is configured to receive data from the cable head end, and a QPSK out of band downstream demodulator 206 is configured to receive out of band MPEG-2 encoded messages from the cable head end.

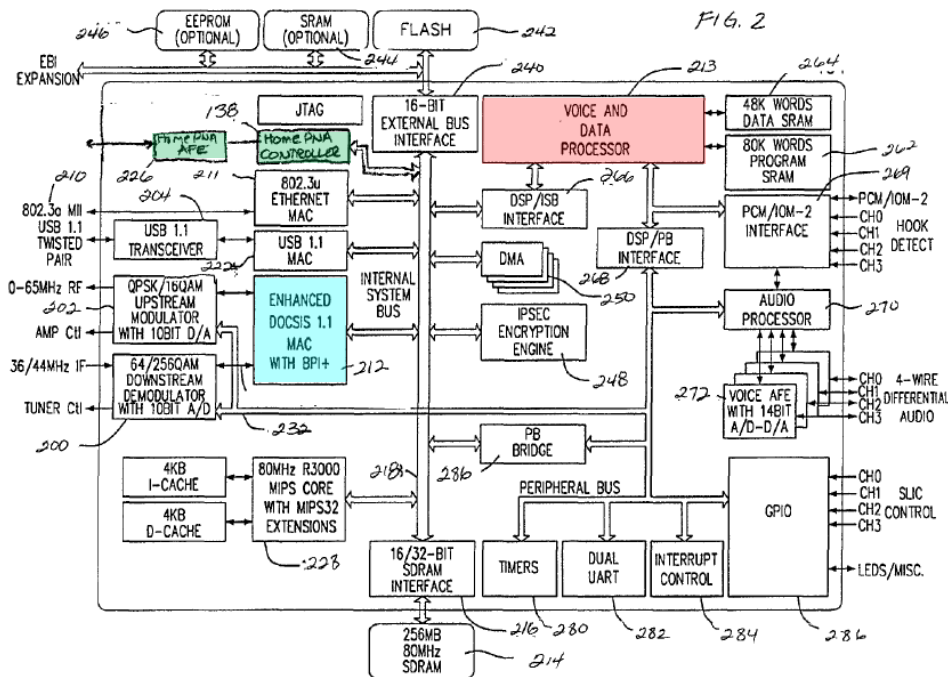
Ex. 1005, [0050].

Rabenko's "integrated functions for communicating with a cable head []end" (Ex. 1005, [0034]) are claimed "cable modem functions" and specifically are cable modem functions for the claimed "interfacing with cable media." *Id.*, [0050]. Network port 104, shown in Fig. 1b below, leads to the cable head end (not shown) in the cloud marked "WAN." *Id.* Rabenko discloses using a DOCSIS network "for delivery of broadband services, such as IP services over the IP network (an HFC network)," which is an example of the claimed "cable media." Ex. 1005, [0033], [0178], [0197]. Patent Owner argued such during prosecution of the '775 Patent. Ex. 1004, p. 137 (arguing that the claimed "the cable modem functions include interfacing with cable media" is supported by the "illustrated interfaces to the HFC or RF external sources" illustrated in FIGS. 1 and 2). Cable modem functions like communicating with a cable head end are functions other than the home networking functions performed by the data networking engine described above in Section VI.A.1.b. *Id.*

Rabenko describes that all packets that arrive to or leave from the residential gateway via the WAN go through DOCSIS MAC 134/212. Ex. 1005, [0044]. DOCSIS MAC 134/212 translates a packet format from DOCSIS to an internal format. *Id.* In the downstream direction, DOCSIS MAC 134/212 determines whether a packet payload is voice or data. *Id.*, [0045]. If the payload is voice and destined for a Plain Old Telephone Service (POTS) telephone 108, the packet is routed to voice and data processor 136/213, illustratively shown in Fig. 1b above. *Id.* Like DOCSIS MAC 134/212, voice and data processor 136 is part of the claimed “second circuit.” Voice and data processor 136 generates an analog voice signal from the decompressed signal and delivers the analog voice signal to the POTS telephone 108 via the Subscriber Line Interface Circuit (SLIC) 109. *Id.* The cable modem functions of generating an analog voice signal from the decompressed signal and delivering the analog voice signal to POTS telephone 108 via SLIC 109 also are “cable modem functions other than the home networking functions performed by the data networking engine.” *See* Section VI.A.1.b.

As described above in Section VI.A.1.b, HomePNA controller 138 can be a fully integrated MAC/PHY device. Ex. 1005, [0080]. 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.

Rabenko's Fig. 2 illustrates an example of the residential gateway 102 in Figs. 1a and 1b. Ex. 1005, [0050]. The claimed "second circuit" includes voice and data processor 213 ("at least one processor") which correlates to the voice/data processor 136 described with respect to Fig. 1b. Ex. 1005, [0057], [0074], [0097]. Rabenko further describes that core 228, a processor that is part of the proxy gateway 142, interfaces with DOCSIS MAC 212, which correlates to DOCSIS MAC/PHY 134 in Fig. 1b. *Id.*



Ex. 1005, Fig. 2 (annotated)

Rabenko describes that core 228,

includes a high performance **CPU** operating at a speed of at least 80 MHz with 32-bit address and data paths. The MIPS core 228 may include two way set associative **instruction** and data **caches** on the order of about 4K bytes each. Further, the MIPS core 228 may provide standard EJTAG support with debug

mode, run control, single step and software breakpoint instruction as well as additional optional EJTAG features.

Ex. 1005, [0057], emphasis added. Cable modem functions implemented by the proxy gateway 142 would be implemented by core 228 using software. *Id.*; Ex. 1002, ¶116. In the downstream direction, proxy gateway 142 determines whether a packet with a voice payload is destined for HomePNA LAN or POTS. Ex. 1005, [0045]. If destined for POTS, proxy gateway routes such a packet to voice and data processor 136. *Id.* Proxy gateway 142 is similarly responsible for voice packet routing in the upstream direction. *Id.*, [0046]. The cable modem functions of determining whether a packet with a voice payload is destined for HomePNA LAN or POTS and routing voice packets in the upstream direction also are “cable modem functions other than the home networking functions performed by the data networking engine.” *See* Section VI.A.1.b.

Rabenko also describes that 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.” Ex. 1005, [0074] (emphasis added). *See, also, Id.*, [0075], [0089]-[0097], [0139].

Finally, Rabenko describes that a POSITA would understand that its components and circuits may be implemented in any of several ways including “software.” Ex. 1005, [0268]. A POSITA would have understood that Rabenko’s

cable modem engine is programmed with software that when implemented by DOCSIS MAC 134/212, core 228, and/or voice and data processor 136/213, causes the cable modem engine to perform the cable modem functions other than the home networking functions performed by the data networking engine, including interfacing with cable media. *Id.*; Ex. 1002, ¶118.

Rabenko discloses limitation [18C]. Ex. 1002, 105-119.

- d. **[18D]: “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,”**

As described above in Sections VI.A.1.b-VI.A.1.c, Rabenko’s DOCSIS MAC/PHY 134, proxy gateway 142, and voice and data processor 136 (“cable modem engine”), and HomePNA controller 138 and AFE 226 (“data networking engine”) are separate, independent components of separate circuits. As taught by Rabenko, a POSITA would have understood that each independent component “may be implemented in any number of way including electronic hardware, computer software, or combinations of both ... depend[ing] upon the particular application and design constraints imposed on the overall system.” Ex. 1005, [0268].

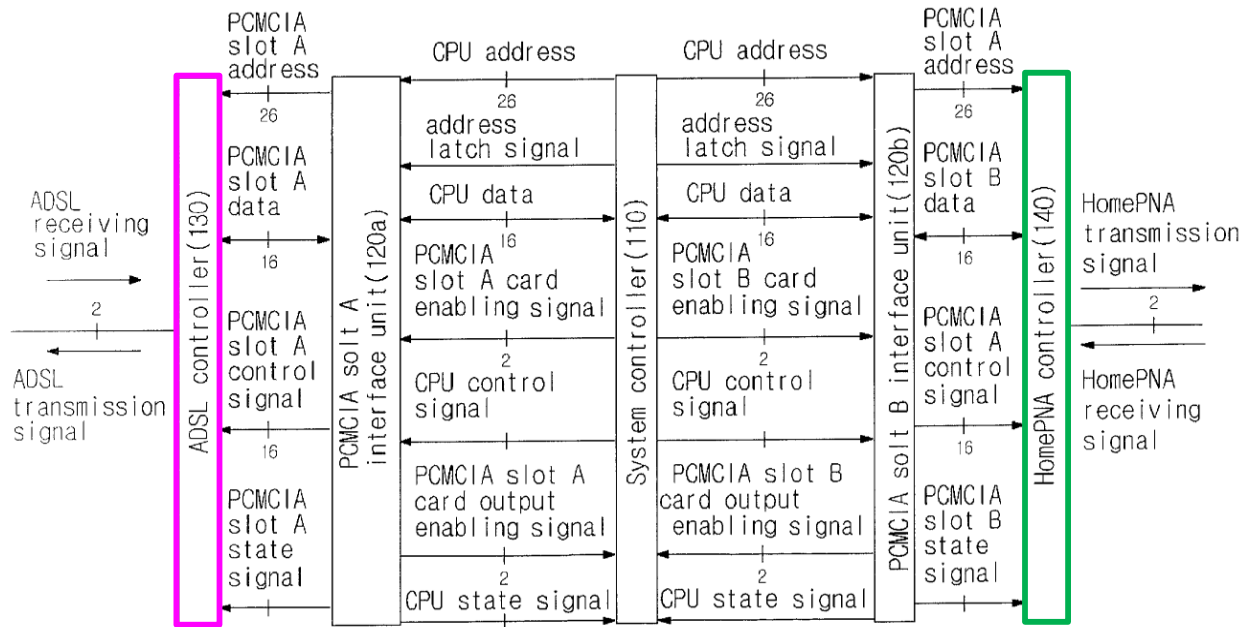
Although Rabenko does not explicitly teach that any of DOCSIS MAC 134/212, proxy gateway 142, or voice/data processor 136/213 is configured to enable upgrades to its software in a manner that is independent of upgrades to the software of the HomePNA controller 138 and AFE 226, Rabenko does teach that

“[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.” *Id.* 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. A POSITA would recognize that these options are equally obvious to try. A POSITA, recognizing these are different, partitioned circuits, would have understood that upgrades to software of any of DOCSIS MAC 134/212, proxy gateway 142, or voice/data processor 136/213 would be independent of upgrades to software of the HomePNA controller 138 and AFE 226. Ex. 1002, ¶¶122-123. Thus, Rabenko renders obvious that “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.*

Moreover, Rabenko teaches that its HomePNA controller complies with the HomePNA protocol, which “is described in the HomePNA Specification Version 2.0, the contents of which is expressly incorporated herein by reference as though set forth in full.” Ex. 1005, [0034]. A POSITA would have understood that a standard-compliant device would have to be frequently updated or replaced to maintain compliance with evolving standards. See, e.g., Ex. 1006, [0005] (“as

protocols change or standards evolve, the HPNA controller must be upgraded.”). 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.

Such a feature also would have been obvious in view of Kim. 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].

It would have been obvious for a POSITA to apply Kim's teachings to Rabenko to yield a system wherein Rabenko's HomePNA controller is independently upgradable from other components (as taught in Kim), such as the DOCSIS MAC/PHY, proxy gateway, and voice/data processor, in order to allow the efficient updating of any of Rabenko's partitioned components, resulting in less cost and inconvenience to the user. Ex. 1007, [0002]-[0008]. Incorporating the modular design of Kim would allow the efficient updating of any of Rabenko's partitioned components. A POSITA would have recognized that such a combination would be using known techniques (implementing the individual components of Rabenko by the modular structure of Kim that allows for independent updating) to improve similar devices (processors, including the HomePNA controller taught in Rabenko and Kim) in the same way (Rabenko's components are conveniently and economically updated independently of each other). Ex. 1007, [0005]-[0007]; Ex. 1002, ¶129.

As explained above, both Rabenko and Kim teach home gateways systems that include a HomePNA controller. A POSITA would have understood these controllers would have to be frequently upgraded or replaced. See, e.g., Ex. 1006, [0005]. Kim further states that its HomePNA controller is independently

replaceable. Ex. 1007, [0026]. As a result, there is less cost and inconvenience to the user. Ex. 1007, [0002]-[0008]. Thus, it would have been obvious to a POSITA to use Kim's technique of enabling the independent updating of its partitioned controllers to improve Rabenko in the same way by configuring Rabenko's separate components to be similarly independently updateable. *Id.*

Additionally, a POSITA would have had the skill to implement Rabenko's components to be partitioned and independently upgradable, as taught by Kim. Ex. 1005, [0268]; Ex. 1007, [0005]-[0008]. This combination requires only minor hardware, software, and/or firmware modifications, leading to an expectation of success yielding predictable results: Rabenko's components can be independently upgraded. Ex. 1005, [0268]; Ex. 1002, ¶131.

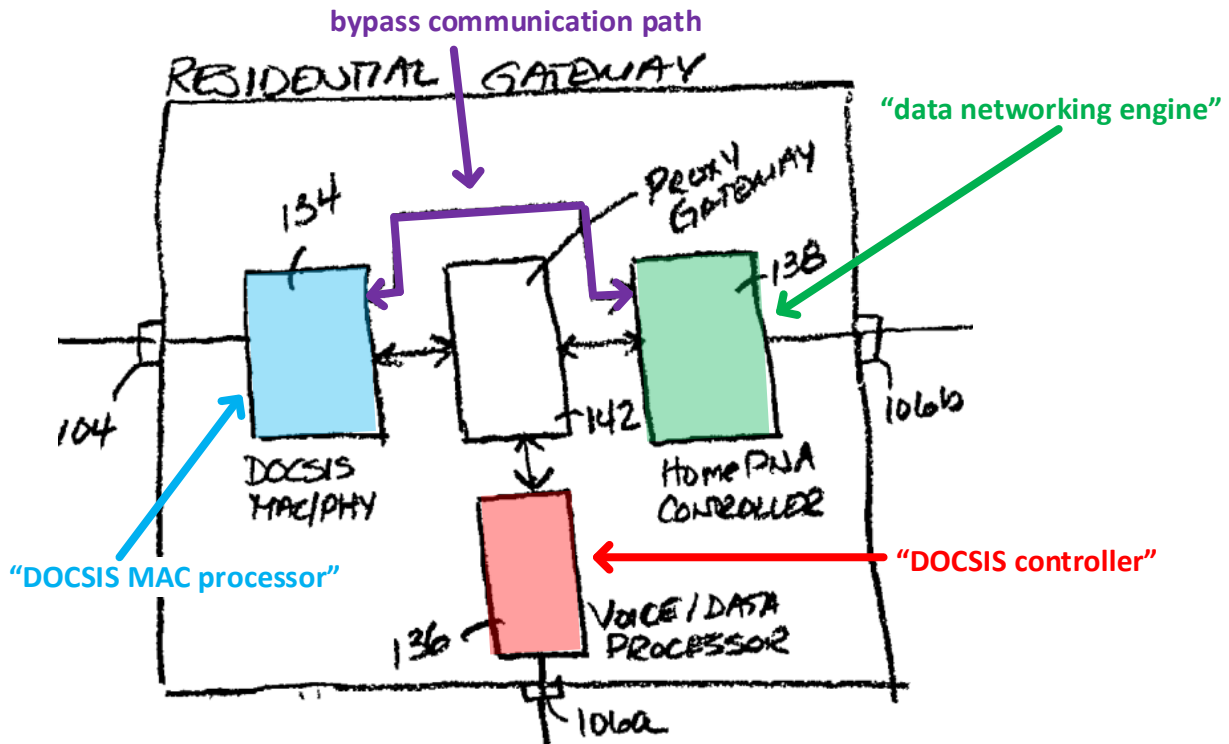
The proposed combinations that include Kim also teach limitation [18D]. Ex. 1002, ¶¶120-133.

e. [18E]: “the cable modem engine including a DOCSIS controller and a DOCSIS MAC processor,”

As discussed above in Section VI.A.1.c, Rabenko's cable modem engine includes voice and data processor 136/213 (“DOCSIS controller”) and DOCSIS MAC 134/212 (“DOCSIS MAC processor”). Ex. 1002, ¶¶134-139. Like 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. Ex. 1005, [0074], [0085], [0087]. Rabenko discloses limitation [18E].

- f. [18F]: “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”

Rabenko discloses that DOCSIS MAC 134/212 (blue) translates the packet format for all arriving packets from DOCSIS to an internal format (“configured to process downstream...packets”), and if a packet is a data packet, routes (“forward the processed packets”) directly to (via the control flow line in purple below) HomePNA controller 138 (green) (part of the claimed “data networking engine”). Ex. 1005, [0044]-[0045], Fig. 1b. Fig. 1b shows that voice/data processor 136/213 (red) (the claimed “DOCSIS controller”) is bypassed (“without the involvement of the DOCSIS controller”) when a packet received by DOCSIS MAC 134/212 is a data packet. *Id.*



Ex. 1005, Fig. 1b (excerpted and annotated)

Rabenko discloses protocol data units (PDUs) in the operation of the gateway control protocol (GCP) logic 530 included within the residential gateway. Specifically, in describing Fig. 5c, Rabenko states, “the GCP logic implements the NCS features of the PacketCable 1.0 specification including protocol transaction management, parsing, verification and formatting of protocol data units (PDUs) and other utility functions.” Ex. 1005, [0108]. A POSITA would have understood that PDUs, as described in Rabenko, are packets.

Finally, the limitation “in order to boost downstream throughput” is an intended result limitation that should not be given any patentable weight since it does not limit the structure of the apparatus. If this limitation limits the structure, the

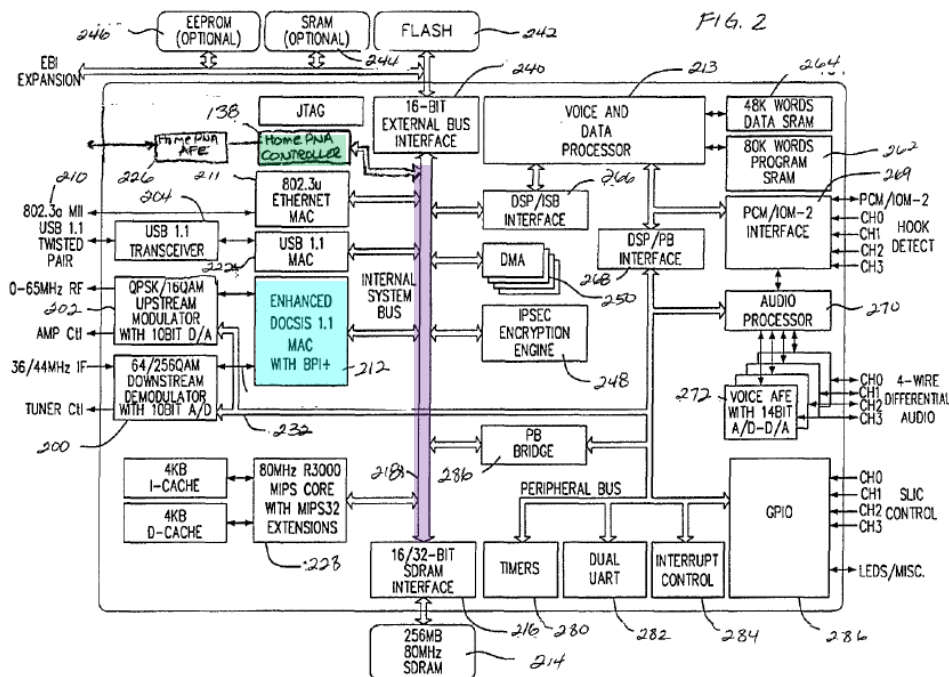
result of “forward[ing] the processed packets directly to the data networking engine without the involvement of the DOCSIS controller” causes the result “in order to boost downstream throughput.” The specification of the ’775 Patent simply states: “[t]o increase downstream throughput, all processing 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.” Ex. 1001, 3:11-16. Similarly, for downstream communications, Rabenko’s DOCSIS MAC 134/212 receives data packets from demodulator 200, shown separate from modulator 202 for upstream, and forwards determined and processed data packets directly to HomePNA controller 139 along bus 218 (shown as the “bypass” line in **purple** above in Fig. 1b). Ex. 1005, [0050], [0052].

A POSITA would have understood that, as a signal passes through a circuit, by bypassing an electrical component, such as Rabenko’s voice/data processor 136 (**red** in Fig. 1b above) (“DOCSIS controller”), downstream throughput is increased or boosted since the signal travels through fewer components to reach its destination, thus avoiding potential bottlenecks. Ex. 1002, ¶146.

Rabenko discloses limitation [18F]. Ex. 1002, ¶¶140-148.

- g. [18G]: “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.”

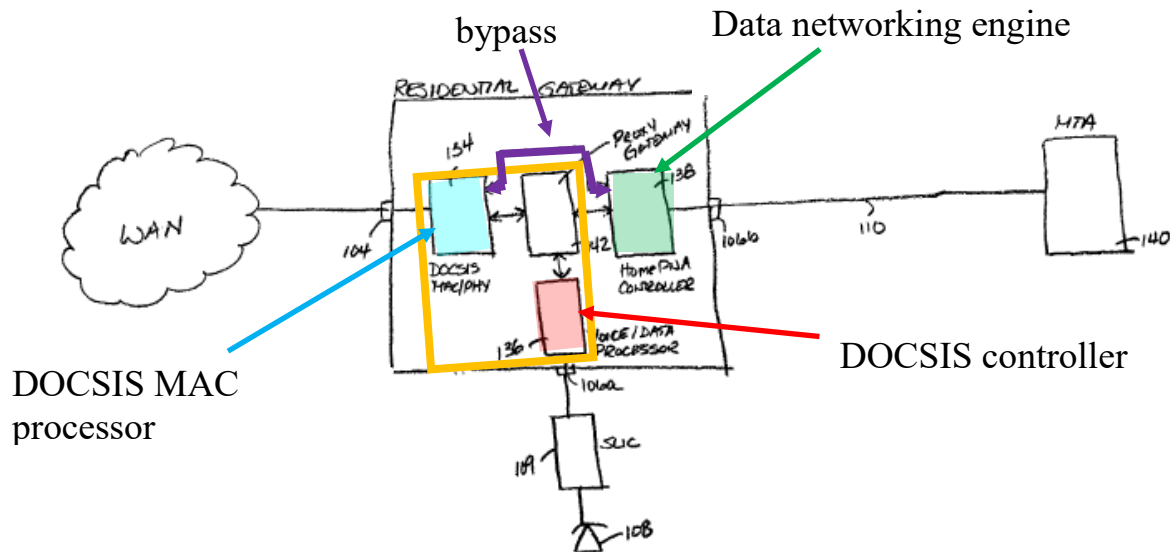
Rabenko discloses an internal system bus 218 (purple) that connects HomePNA controller 138 (green) (“data networking engine”) to DOCSIS MAC 212 (blue) (part of the “cable modem engine”) as described above in Sections VI.A.1.b, VI.A.1.c. Ex. 1005, [0057], [0060], Fig. 2.



Ex. 1005, Fig. 2 (annotated)

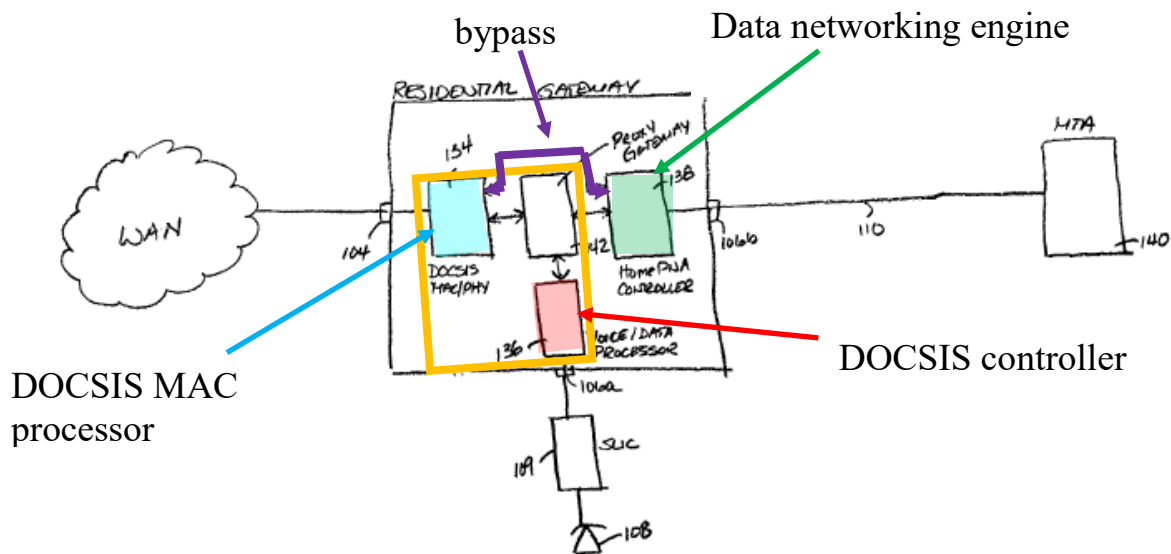
Fig. 1b of Rabenko is a functional block diagram describing the flow of packets in the gateway. Fig. 1b shows completely partitioned functions performed

by the cable modem engine (**orange**) and by HomePNA controller 138 (**green**). Ex. 1005, [0044], Fig. 1b.

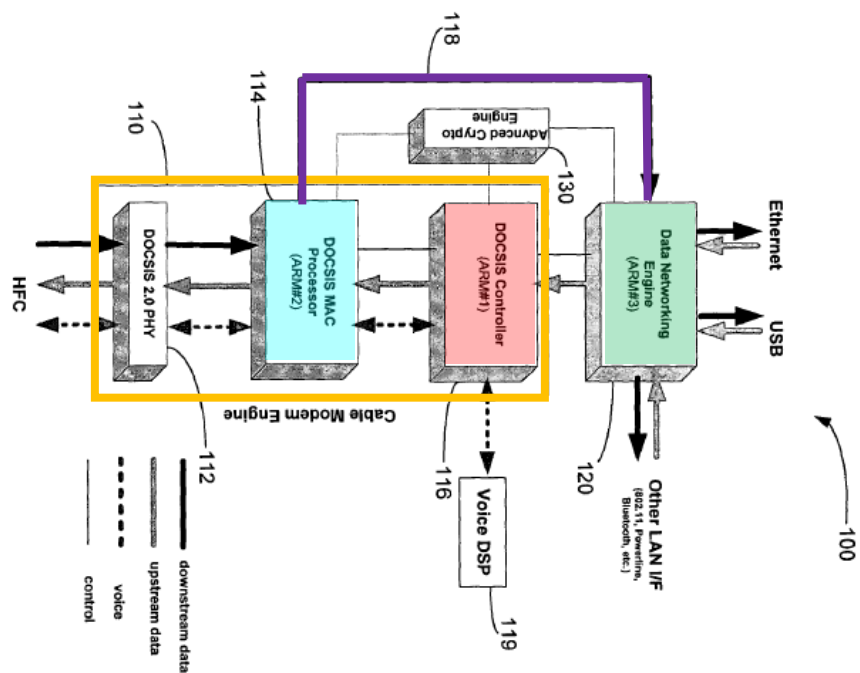


Ex. 1005, Fig. 1b (annotated)

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, described above in Section VI.A.1.b, are performed by HomePNA controller 138 and/or AFE 226 while cable modem functions, described above in Section VI.A.1.c, 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.



Ex. 1005, Fig. 1b (annotated)



Ex. 1001, Fig. 1 (rotated and annotated)

The '775 Patent describes functional partitioning as, “[c]able modem 100 completely partitions data networking functions ... 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.” Ex. 1001, 4:13-19. A POSITA would have understood that the cable modem functions performed by the cable modem engine are completely partitioned from the home networking functions performed by the data networking engine when the respective functions are localized in respective processors. Rabenko performs only home networking functions by the processor in the HomePNA controller 138 described in Section VI.A.1.b and only cable modem functions by the DOCSIS MAC 134/212, core 228, and voice/data processor 136/213 described above in Section VI.A.1.c.

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.

Rabenko discloses limitation [18G]. Ex. 1002, ¶¶149-159.

Accordingly, each of the proposed combinations renders claim 18 obvious.

2. Dependent Claim 19

- a. **“A cable modem system as claimed in claim 18, wherein all DOCSIS functions are localized in the cable modem engine.”**

The claimed “all DOCSIS functions” are the functions performed by the components of the cable modem engine in Rabenko. As described above in Section VI.A.1.c, Rabenko’s DOCSIS MAC 134/212 performs cable modem functions according to the CableLabs DOCSIS. Ex. 1005, [0034], [0044]. Rabenko describes that “[t]he DOCSIS MAC/PHY 134 *translates* the packet format from DOCSIS to an internal format that, at least in some embodiments, is protocol independent.” Ex. 1005, [0044] (emphasis added). Translation of the packet format is one “DOCSIS function” performed by the DOCSIS MAC 134/212 in Rabenko’s cable modem engine.

In addition, Rabenko describes that, “[i]n the downstream direction, the DOCSIS MAC/PHY 134 determines whether the packet payload is voice or data.” Ex. 1005, [0045]. This also is a “DOCSIS function” performed by the DOCSIS MAC 134/212 in Rabenko. Translation of the packet format and determination of whether a packet payload is voice or data are the claimed “all DOCSIS functions.” These functions are both performed by DOCSIS MAC 134/212 and are localized in Rabenko’s cable modem engine.

Like 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. Ex. 1005, [0074], [0085], [0087]. Rabenko’s HomePNA controller 138 performs no DOCSIS functions.

Rabenko discloses the limitations of dependent claim 19. Ex. 1002, ¶¶160-163.

3. Dependent Claim 20

- a. **“The cable modem system as claimed in claim 18 wherein the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications.”**

Rabenko’s DOCSIS MAC 134/212 (“DOCSIS MAC processor”) “provides an interface to the WAN within the residential gateway 102. All packets that arrive to or leave from the residential gateway via the WAN must go through the DOCSIS MAC/PHY 134.” Ex. 1005, [0044]. A POSITA would have understood that packets that “arrive to ... the residential gateway via the WAN” are the claimed downstream communication and that packets that “leave from the residential gateway via the WAN” are the claimed upstream communication. *Id.*, [0045]-[0046]; Ex. 1002, ¶165. In addition, a POSITA would have understood that these packets arrive to and leave from the residential gateway that includes DOCSIS MAC 134/212 in real-time. *Id.*

The “real-time MAC functions” are those described above with respect to the DOCSIS MAC 134/212 in Section VI.A.2. Specifically, the DOCSIS MAC 134/212 performs real-time functions by translating packets from DOCSIS to an internal format in the downstream direction and translating packets from an internal format to DOCSIS in the upstream direction. Ex. 1005, [0044]-[0046].

Rabenko discloses the limitations of dependent claim 20. Ex. 1002, ¶¶164-169.

4. Independent Claim 1

a. [1A]: “A cable modem system comprising:”

As discussed above in Section VI.A.1.a, each of the proposed combinations discloses the preamble. Ex. 1002, ¶170.

b. [1B] “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, wherein the at least one processor is a RISC processor;”

As described above in Section VI.A.1.b, each of proposed combinations teaches [1B]. Ex. 1002, ¶¶171-183.

Compared to [18B], [1B] further recites, “wherein the at least one processor is a RISC processor.” Ex. 1002, ¶171. The ’775 Patent describes that DOCSIS MAC processor 114 may be an ARM9TDMI-based RISC processor. Ex. 1001, 3:16-18.

A POSITA would have understood a RISC processor to be a reduced instruction set controller or reduced instruction set computing processor. Ex. 1012, [0124]; 1002, ¶172. A POSITA further would have understood an ARM9TDMI RISC processor as a 32-bit RISC ARM processor core licensed by ARM Holdings and available starting in 1998. Ex. 1002, ¶172.

As described above in Section VI.A.1.b, Rabenko's HomePNA controller is the claimed "at least one processor" of the data networking engine. Rabenko describes that a POSITA would understand that various components, circuits, and steps, described may be implemented in any of several ways including "electronic hardware, computer software, or combinations of both." Ex. 1005, [0268]. Rabenko continues that "various illustrative components, blocks, modules, circuits, and steps have been described generally in terms of their functionality" and "[w]hether the functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application." *Id.*

A POSITA would have understood that Rabenko's HomePNA controller may be implemented by any of a number of different electronic hardware, computer software, or combinations of both and that the particular choice for a processor to be

a RISC processor would have been an obvious design choice considering “how best to implement the described functionality for each particular application.” *Id.* A POSITA would have looked to commonly-known processors as electronic hardware/software combinations that would have been used to implement the functions of the HomePNA controller 138 based upon cost, quality of service requirements, geographic impairments, reliability, programmability, interchangeability, and/or any of several other factors for a particular use. Ex. 1002, ¶174.

Although Rabenko does not explicitly disclose a RISC processor for HomePNA controller, it would have been an obvious design choice as would have been understood by a POSITA. A POSITA would have known that a RISC processor was a commonly-known type of processor that, when programmed with software, would have implemented the functions of the data networking engine. *Id.*

It was generally known before the priority date of the '775 Patent that a RISC processor was a common processor for components that utilize a media access control (MAC) layer, as shown by Lu. Lu is directed to a MAC architecture for managing data flow over an network which includes a physical layer and a media access control layer. Ex. 1012, Abstract, [0010]. Lu implements operating modules using software, with each module enabling a respective MAC layer. *Id.* Lu's architecture includes MAC implementations of HomePNA 2.0/1.0. *Id.*, [0050]-

[0051], [0057], [0078], [0081]-[0082], [0113], [0129]-[0130]. Lu further provides four illustrative implementations of its architecture, including a first implementation in a single dedicated reduced instruction set controller (RISC) machine. *Id.*, [0124]-[0128], Fig. 23.

It would have been obvious for a POSITA to implement the HomePNA controller functions of Rabenko using a RISC structure as taught by Lu because, when designing Rabenko's HomePNA controller, a POSITA would have looked to incorporate the standard architecture of Lu's RISC as an implementation suitable to applications like Rabenko's that involve MAC functions because "it would be advantageous to provide a new software based or programmable MAC implementation architecture which would speed up MAC implementation development, MAC/PHY and MAC/host integration, enable multiple MAC implementations, and increase MAC portability for different applications and platforms." Ex. 1012, [0009]. Ex. 1002, ¶178.

Combining Rabenko and Lu would be merely using known techniques (implementing the HomePNA controller functions of Rabenko with the RISC processor structure of Lu) to improve similar devices (the HomePNA controller taught in Rabenko) in the same way (Rabenko's HomePNA controller includes the necessary architecture (*i.e.*, RISC processor) to perform its required functionality efficiently and to provide a new software based or programmable MAC

implementation architecture which would speed up MAC implementation development, MAC/PHY and MAC/host integration, enable multiple MAC implementations, and increase MAC portability for different applications and platforms). Ex. 1005, [0268]; Ex. 1012, [0009]; Ex. 1002, ¶¶179-181.

Additionally, a POSITA would have had the skill to implement a RISC processor based HomePNA controller in Rabenko's system, as taught by Lu, by programming a RISC processor with software to comply with HomePNA Version 2.0. Ex. 1002, ¶182. Additionally, a POSITA would have had the skill to implement a RISC processor in Rabenko's system, as taught by Lue, because the POSITA would be familiar with RISC processors and the programming of RISC processors, leading to an expectation of success. Ex. 1005, [0268]; Ex. 1002, ¶182.

The proposed combinations that include Lu also teach [1B]. Ex. 1002, ¶¶171-183.

- c. **[1C]: “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 including a DOCSIS PHY layer, a [first] DOCSIS controller, and a [second] DOCSIS controller² and 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,”**

As described above in Sections VI.A.1.c and VI.A.1.e, each of the proposed combinations teaches [1C]. Ex. 1002, ¶¶184-188. Rabenko’s DOCSIS MAC/PHY 134 is shown in Fig. 2 as DOCSIS MAC 212, downstream demodulator 200, and upstream modulator 202. Downstream demodulator 200 and upstream modulator 202 are the “DOCSIS PHY layer” portions of DOCSIS MAC/PHY 134. Ex. 1005, [0050].

Compared to [18E] reciting “the cable modem engine including a DOCSIS controller and a DOCSIS MAC processor,” [1C] recites, “the cable modem engine including a DOCSIS PHY layer, a [first] DOCSIS controller, and a [second]

² Petitioner does not concede that this limitation (e.g., “the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller”) is definite.

DOCSIS controller.” Ex. 1002, ¶186. Because [1F], *infra*, recites, “without the involvement of the DOCSIS controller” and [1C] recites two DOCSIS controllers, for reference purposes only in this Petition, Petitioner has labeled the first occurrence of DOCSIS controller in [1C] as “a [first] DOCSIS controller” and has labeled the second occurrence of DOCSIS controller in [1C] as “a [second] DOCSIS controller.” Ex. 1002, ¶186. With reference to Section VI.A.1.e, “a [first] DOCSIS controller” is the “DOCSIS controller” in [18E] and “a [second] DOCSIS controller” is the “DOCSIS MAC processor” in [18E]. Ex. 1002, ¶186.

Compared to [18C], [1C] further recites, “the cable modem engine including a DOCSIS PHY layer.” Ex. 1002, ¶186. Rabenko’s DOCSIS MAC/PHY 134 may be an integrated device that includes the claimed “DOCSIS PHY layer” for transmitting to and receiving transmissions from the WAN. Ex. 1005, [0044]-[0047]. Rabenko’s DOCSIS MAC/PHY 134 is shown in Fig. 2 as DOCSIS MAC 212, downstream demodulator 200, and upstream modulator 202. Downstream demodulator 200 and upstream modulator 202 are the claimed “DOCSIS PHY layer” portions of DOCSIS MAC/PHY 134. Ex. 1005, [0050].

- d. **[1D]: “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;”**

As described above in Section VI.A.1.d, each of the proposed combinations teaches [1D]. Ex. 1002, ¶189.

- e. **[1E]: “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;”**

As described above in Section VI.A.1.g, each of the proposed combinations teaches [1E]. Ex. 1002, ¶190.

- f. **[1F]: “wherein the DOCSIS MAC processor is configured to process downstream PDU packets and forward the processed packets directly to the data networking engine without the involvement of the [first] DOCSIS controller in order to boost downstream throughput.”³**

Although no DOCSIS MAC processor is previously recited in claim 1, as described above in Section VI.A.4.c, “the DOCSIS MAC processor,” for this Petition, is the “[second] DOCSIS controller.” Ex. 1002, ¶192.

As described above in Section VI.A.1.f, each of the proposed combinations teaches [1F]. Ex. 1002, ¶¶191-193.

Accordingly, each of the proposed combinations renders claim 1 obvious.

³ Petitioner does not concede that this limitation (e.g., “without the involvement of the [first] DOCSIS controller in order to boost downstream throughput”) is definite.

5. Dependent Claim 2

As described above in Section VI.A.2, each of the proposed combinations teaches claim 2. Ex. 1002, ¶194.

6. Dependent Claim 3

- a. **“A cable modem system as claimed in claim 2, wherein VoIP functionality is embedded in the cable modem engine.”**

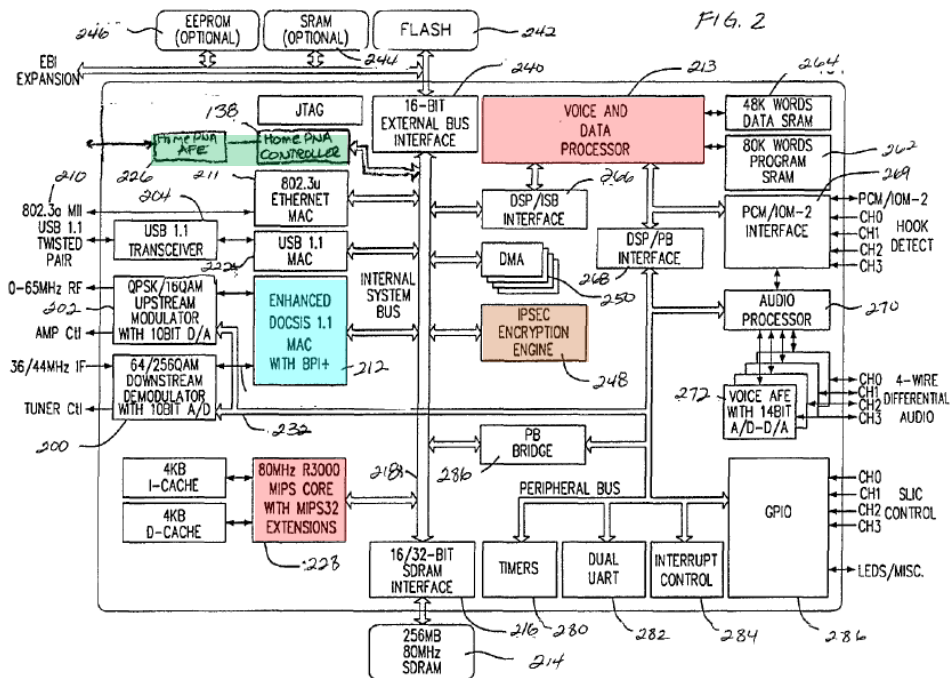
Like the “DOCSIS controller” of the ’775 Patent, Rabenko’s voice and data processor 136/213 is used for processing and transporting voice over packet based networks. Ex. 1005, [0074], [0085], [0087]. Rabenko describes, “[a] voice and data processor 213 is used for processing and transporting *voice over packet based networks* such as ... *WANs such as IP*, ... or any other packet based system.” Ex. 1005, [0074] (emphasis added). Rabenko continues, “[t]he 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.” *Id.* (emphasis added). As described above in Section VI.A.1.e., voice and data processor 213 is part of the claimed “cable modem engine.” Ex. 1002, ¶¶195-197.

Each of the proposed combinations teaches claim 3.

7. Dependent Claim 4

- a. **“A cable modem system as claimed in claim 1, and further comprising an advanced crypto engine configured to perform all crypto functions for both the data networking engine and the cable modem engine, the advanced crypto engine being separate from both the data networking engine and the cable modem engine.”**

The '775 Patent describes an advance crypto engine 130 as providing hardware support for crypto functions, including DES/3DES, AES, and HMAC-MD5/SH-1. Ex. 1001, 4:4-9. Rabenko describes IP security module 248. Ex. 1005, [0064]-[0065]. Like the crypto functions in the '775 Patent, Rabenko's IP security module 248 supports “single DES (CBC and ECB modes) triple DES (CBC and ECB modes) MD-5 and SHA.” *Id.*, [0065]-[0067]. As shown in Fig 2 below, IP security module 248 (**gold**) is separate from both the data networking engine (**green**) and the cable modem engine (**red** and **blue**). Ex. 1002, ¶200. Rabenko's IP security module performs all crypto functions for both its data networking engine and its cable modem engine. Ex. 1002, ¶200.



Ex. 1005, Fig. 2 (annotated)

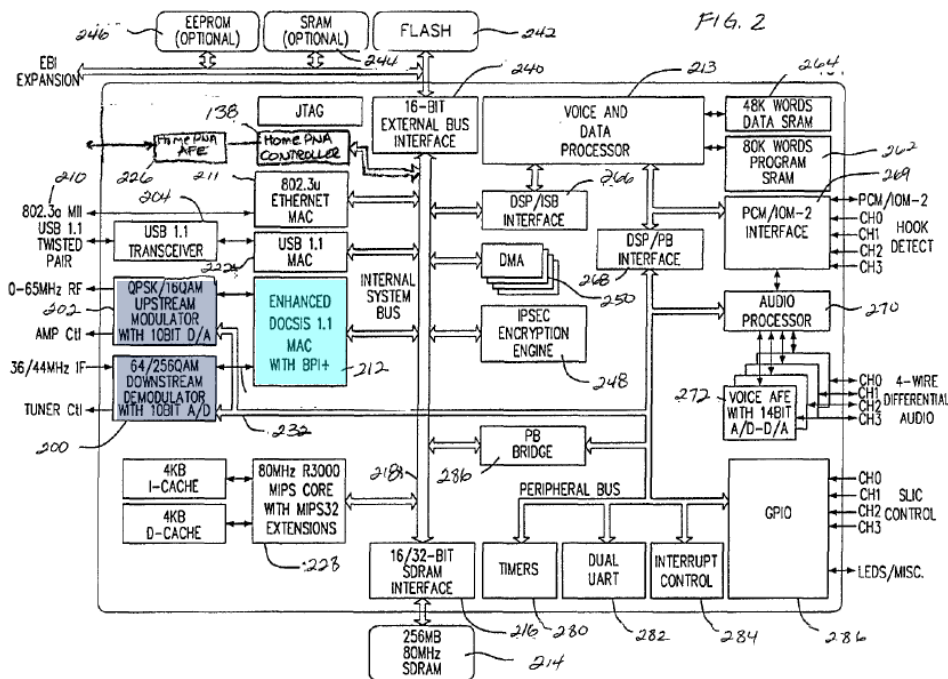
Each of the proposed combinations teaches claim 4. Ex. 1002, ¶¶198-201.

8. Dependent Claim 5

- a. **“A cable modem system as claimed in claim 1, wherein the DOCSIS PHY layer includes a hardware transmitter and receiver.”**

Rabenko’s DOCSIS MAC/PHY 134 is shown in Fig. 2 as DOCSIS MAC 212, downstream demodulator 200, and upstream modulator 202. Downstream demodulator 200 and upstream modulator 202 are the claimed “DOCSIS PHY layer” portions of DOCSIS MAC/PHY 134. Ex. 1005, [0050]. Specifically, Rabenko describes that “a QPSK upstream modulator 202 is configured to transmit data to the cable head end, and a QAM downstream demodulator 200 is configured to receive data from the cable head end” *Id.*

Rabenko describes that a POSITA would understand that various components described may be implemented in any of several ways including “electronic hardware, computer software, or combinations of both.” Ex. 1005, [0268]. Thus, a POSITA would have understood that QPSK upstream modulator 202 (“transmitter”) and QAM downstream demodulator 200 (“receiver”) would obviously be implemented as hardware. Ex. 1002, ¶¶203-204.



Ex. 1005, Fig. 2 (annotated)

Each of the proposed combinations teaches claim 5. Ex. 1002, ¶¶202-205.

9. Dependent Claim 6

- a. “A cable modem system as claimed in claim 1, wherein all VoIP functionality is implemented in the [second] DOCSIS controller.”⁴**

As described in above Section VI.A.6, Rabenko teaches claim 6. Ex. 1002, ¶¶206-208. Specifically, Rabenko’s voice and data processor 213 (claimed “[second] DOCSIS controller”) is used for processing and transporting voice over packet based networks. Ex. 1005, [0074], [0085], [0087].

10. Dependent Claim 7

- a. “A cable modem system as claimed in claim 6, wherein the VoIP functionality is in conformance with the PacketCable specification.”**

Rabenko’s voice and data processor 213 is used for processing and transporting voice over packet based networks. Ex. 1005, [0074], [0085], [0087]. Rabenko describes FIG. 5c as a residential gateway control protocol logic which interfaces with an external control element to terminate and generate call signaling from and to voice and data processor 213 in compliance with the network-based call signaling (NCS) protocol specification. Ex. 1005, [0014]. Specifically, for VoIP, “gateway control protocol (GCP) logic 530 receives and mediates call-signaling

⁴ Petitioner does not concede that this limitation (e.g., “wherein all VoIP functionality is implemented in the DOCSIS controller”) is definite.

information between the DOCSIS network and a PSTN [Public Switched Telephone Network].” Ex. 1005, [0098]. In addition, GCP logic 530 “implements the NCS features of the PacketCable 1.0 specification including protocol transaction management, parsing, verification and formatting of protocol data units (PDUs) and other utility functions.” Ex. 1005, [0108]. Rabenko describes that the VoIP functionality of the voice and data processor 213 is “in conformance with the PacketCable specification.”

Each of the proposed combinations teaches claim 7. Ex. 1002, ¶¶209-211.

11. Dependent Claim 10

**a. [10A]: “A cable modem system as claimed in claim 1, wherein with regard to the cable modem engine:
the DOCSIS PHY layer includes a transmitter and receiver;”**

As described above in Section VI.A.8, each of the proposed combinations teaches [10A]. Ex. 1002, ¶¶212-213.

b. [10B]: “the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications; and”

As described above in Section VI.A.3, each of the proposed combinations teaches [10B]. Ex. 1002, ¶¶214-216.

c. [10C]: “the [second] DOCSIS controller is configured to implement VoIP functionality; and⁵

As described above in Section VI.A.9, each of the proposed combinations teaches [10C]. Ex. 1002, ¶¶217-219.

d. [10D] wherein the data networking engine includes a RISC processor configured to implement a majority of data networking processing and home networking applications decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.”

As described above in Section VI.A.4.b, each of the proposed combinations teaches that the at least one processor of the data networking engine is a RISC processor. Ex. 1002, ¶¶220-221. Also, as described above in Section VI.A.4.c, functions performed by the cable modem engine of Rabenko, including interfacing with cable media, are separate from and “other than the home networking functions performed by the data networking engine.” *See* Section VI.A.4.e. Ex. 1002, ¶221.

Rabenko describes two personal computers 128 and 130 connected to the HomePNA LAN 110, where personal computer 128 is described as Net Meeting and personal computer 130 is described as Netscape. Ex. 1005, [0042]. “These describe two possible *applications* that are supported by personal computers connected to

⁵ Petitioner does not concede that this limitation (e.g., “the DOCSIS controller is configured to implement VoIP functionality”) is definite.

networks, in this case an HomePNA LAN. Those skilled in the art will appreciate that any computer ***application*** can be substituted or added.” *Id.* (emphasis added). Rabenko describes home networking applications and data networking processing managed by the HomePNA controller 138. Ex. 1002, ¶222. As described above in Section VI.A.4.b, home networking functions, including bidirectional communications between the WAN and computer 128 is a home networking function already described as completely partitioned from the cable modem functions performed by the cable modem engine as described above in Section VI.A.4.e. Accordingly, Rabenko teaches that “a majority of data networking processing and home networking applications” are “decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.” Ex. 1002, ¶¶220-225.

Each of the proposed combinations teaches [10D].

12. Dependent Claim 12

- a. “A cable modem system as claimed in claim 11, wherein the DOCSIS MAC processor is an ARM9TDMI-based RISC processor, and wherein the DOCSIS controller is an ARM940-based RISC processor.”**

Although none of Rabenko, Gaspar, Kim, or Lu specifically recite an ARM9TDMI-based or an ARM940-based RISC processor, a POSITA would have found it obvious to implement the functions of the DOCSIS MAC processor and

DOCSIS controller using commonly-known and available processors, selected based upon cost, quality of service requirements, geographic impairments, reliability, programmability, interchangeability, and/or any of several other factors for a particular use. Ex. 1002, ¶227.

A POSITA would have understood a RISC processor to be a reduced instruction set controller or reduced instruction set computing/computer processor. Ex. 1012, [0124]; Ex. 1002, ¶228.

As described above in Section VI.A.1.c, Rabenko's DOCSIS MAC 134/212 is the claimed "DOCSIS MAC processor" and voice/data processor 136/213 is the claimed "DOCSIS controller" of the cable modem engine. Rabenko describes that a POSITA would understand that various components, circuits, and steps, described may be implemented in any of several ways including "electronic hardware, computer software, or combinations of both." Ex. 1005, [0268]. Rabenko continues that "various illustrative components, blocks, modules, circuits, and steps have been described generally in terms of their functionality" and "[w]hether the functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. Skilled artisans recognize the interchangeability of hardware and software under these circumstances, and how best to implement the described functionality for each particular application." *Id.*

Thus, a POSITA would have understood that Rabenko's DOCSIS MAC 134/212 and voice/data processor 136/213 may be implemented by any of several electronic hardware, computer software, or combinations of both and that the particular choice for a processor to be a RISC processor, or a specific commercially-available RISC processor, would have been an obvious design choice considering "how best to implement the described functionality for each particular application." *Id.*

Although Rabenko does not explicitly disclose a ARM9TDMI-based RISC processor for DOCSIS MAC 134/212 or an ARM940-based RISC processor for voice/data processor 136/213, these would have been an obvious design choice as would have been understood by a POSITA. A POSITA would have known that a RISC processor was a commonly-known type of processor that, when programmed, would have implemented the functions of the data networking engine and a POSITA would have looked to existing RISC processors such as those claimed based upon the particular design choice of the system. A POSITA also would have known that it would have been obvious to try such known types of RISC processors to implement the Rabenko HomePNA controller and voice and data controller knowing it would lead to predictable results of hardware and software combinations suited to implement the functions of Rabenko's controllers recognizing "how best to

implement the described functionality for each particular application.” Ex. 1005, [0268]; see., e.g., Ex. 1015, [0076]; Ex. 1016, [0024]; Ex. 1002, ¶231.

It was generally known before the priority date of the ’775 Patent that an ARM9TDMI-based RISC processor was a commonly known processor for accommodating digital logic processing functions, such as in Rabenko’s DOCSIS MAC, in products that demand the highest levels of performance with small size, low cost, and low power consumption, as shown by Klein. Ex. 1016, [0008]. Klein is directed to a new silicon-based architecture and construction where the architecture satisfies conflicting imperatives—high computing performance at low size, cost and power consumption—demanded by shrinking portable, wireless and internet-connected devices. *Id.*, [0009]. Klein’s architecture utilized a RISC microcontroller for performing logic functions, specifying the ARM9TDMi from ARM, Ltd., among others, that may be used. *Id.*, [0024]. Similarly, it was generally known before the priority date of the ’775 Patent that an ARM940-based RISC processor was a commonly known processor for offering high probability that a functional block having bus ownership can perform its operation compared to conventional exclusive bus arbitration schemes as shown by Kim ’678. Ex. 1015, [0193]. Kim ’678 is directed to systems having a system bus, an external bus, and a bus arbiter with programmable priorities for both buses, software, and methods for assigning such priorities. *Id.*, [0002]. Kim ’678’s architecture utilized a

RISC CPU for performing functions, specifying the ARM940T by ARM Co., among others, that may be used. *Id.*, [0076].

It would have been obvious for a POSITA to implement the DOCSIS MAC functions of Rabenko using an ARM9TDMI-based RISC processor as taught by Klein and the DOCSIS controller functions of Rabenko using an ARM940-based RISC processor as taught by Kim '678 because, when designing Rabenko's DOCSIS MAC and DOCSIS controller, a POSITA would have looked to incorporate the standard architecture of Klein's and Kim '678's RISC processor as an implementation suitable to applications like Rabenko's because it "satisfies conflicting imperatives—high computing performance at low size, cost and power consumption—demanded by shrinking portable, wireless and internet-connected devices," like Rabenko's devices. Ex. 1016, [0008]. Ex. 1002, ¶233.

Combining Rabenko and Klein and Kim '678 would be merely using known techniques (implementing the DOCSIS MAC and DOCSIS controller functions of Rabenko with the ARM9TDMI-based and ARM940-based RISC processors of Klein and Kim '678) to improve similar devices (the processors in Klein and Kim '678 within the DOCSIS MAC and DOCSIS controller processors taught in Rabenko) in the same way (Rabenko's DOCSIS MAC and DOCSIS controller includes the necessary architecture (*i.e.*, ARM9TDMI-based and ARM940-based RISC processors) to perform its required functionality efficiently and to satisfy

conflicting imperatives—high computing performance at low size, cost and power consumption—demanded by shrinking portable, wireless and internet-connected devices. Ex. 1005, [0268]; Ex. 1016, [0008]; Ex. 1002, ¶¶234-235.

Additionally, a POSITA would have had the skill to implement the RISC processors based DOCSIS MAC and DOCSIS controller in Rabenko's system, as taught by Klein and Kim '678, by programming an ARM9TDMI-based RISC processor with software to comply with the functions of Rabenko's DOCSIS MAC and by programming an ARM940-based RISC processor with software to comply with the functions of Rabenko's DOCSIS controller. Ex. 1002, ¶236. Additionally, a POSITA would have had the skill to implement these RISC processors in Rabenko's system, as taught by Klein and Kim '678, because the POSITA would be familiar with RISC processors and the programming of RISC processors, leading to an expectation of success. Ex. 1005, [0268]; Ex. 1002, ¶236.

Each of the proposed combinations teaches claim 12. Ex. 1002, ¶¶226-237.

13. Independent Claim 14

a. [14A]: “A method of cable modem operation comprising:”

As discussed above in Section VI.A.4.a, each of the proposed combinations teaches the preamble. Ex. 1002, ¶¶238-239.

- b. **[14B]: “executing, via at least one processor of a first circuit that implements a data networking engine, first software that causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;”**

As described above in Section VI.A.4.b, each of the proposed combinations teaches [14B]. Ex. 1002, ¶¶240-242.

- c. **[14C]: “executing, via one or more processors of a second circuit that implements a cable modem engine programmed with second software, the second software to cause 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, 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, wherein the second circuit is separate from the first circuit, and wherein the cable modem engine includes a DOCSIS PHY layer, a [first] DOCSIS controller and a [second] DOCSIS controller;”⁶**

As described above in Sections VI.A.4.c and VI.A.4.d, each of the proposed combinations teaches [14C]. Ex. 1002, ¶¶243-246.

⁶ Petitioner does not concede that this limitation (e.g., “the cable modem engine including a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller”) is definite.

- d. **[14D]: “connecting, via a data bus, 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;”**

As described above in Section VI.A.4.e, each of the proposed combinations teaches [14D]. Ex. 1002, ¶¶247-248.

- e. **[14E]: “processing, via the DOCSIS MAC processor, downstream PDU packets and forwarding the processed packets directly to the data networking engine without the involvement of the [first] DOCSIS controller in order to boost downstream throughput.”⁷**

As described above in Section VI.A.4.f, each of the proposed combinations teaches [14E]. Ex. 1002, ¶¶249-250.

14. Dependent Claim 15

- a. **[15A]: “A method of cable modem operation as claimed in claim 14, further comprising:**

providing a flexible and partitioned cable modem gateway comprising:”

As described above in Section VI.A.4.e, each of the proposed combinations teaches [15A]. The ’775 Patent recites “[t]he architecture of the gateway cable modem should be flexible enough to allow independent software development and

⁷ Petitioner does not concede that this limitation (e.g., “without the involvement of the DOCSIS controller in order to boost downstream throughput”) is definite.

field-upgrade of gateway value-added services and basic DOCSIS cable modem services.” Ex. 1001, 1:30-33. Thus, the ability to upgrade software for different processors makes a cable modem flexible. Ex. 1002, ¶252. As described above in Sections VI.A.4.d-VI.A.4.e, each of the proposed combinations teaches [15A]. Ex. 1002, ¶¶251-253.

b. [15B]: “providing data and home networking functionality in the data networking engine;”

As described above in Section VI.A.4.b, each of the proposed combinations teaches [15B]. Ex. 1002, ¶254.

c. [15C]: “providing DOCSIS and VoIP functionality in the cable modem engine; and”

As described above in Section VI.A.6, each of the proposed combinations teaches [15C]. Ex. 1002, ¶¶255-256.

d. [15D]: “partitioning the data networking engine from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.”

As described above in Section VI.A.11.d, each of the proposed combinations teaches [15D]. Ex. 1002, ¶¶257-258.

B. Grounds Q-X: Grounds A-H in view of Koperda render obvious Claim 8

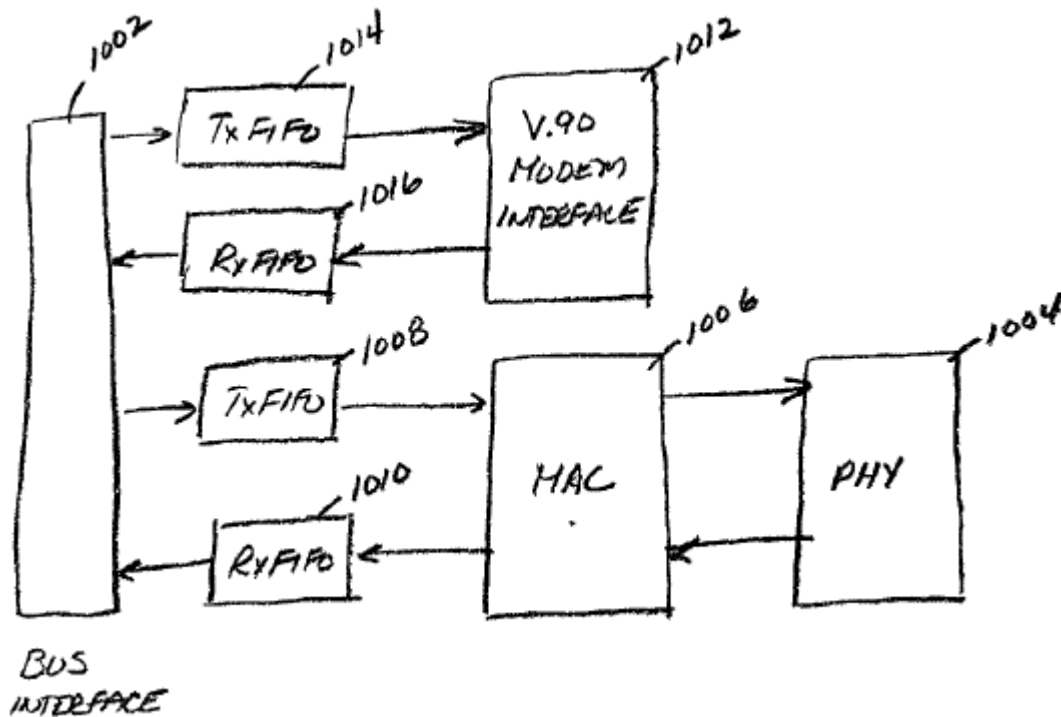
Each of the proposed combinations that includes Koperda renders obvious claim 8. Ex. 1002, ¶¶259-269.

1. Dependent Claim 8

- a. **“A cable modem system as claimed in claim 1, wherein the data networking engine is configured to perform all data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN, and home networking applications.”**

As noted above in Section VI.A.1.b, Rabenko's HomePNA controller performs all data networking processing for the devices attached to the HomePNA LAN 110. Ex. 1005, Figs. 1a, 1b. Rabenko also describes two personal computers 128 and 130 connected to the HomePNA LAN 110, where personal computer 128 is described as Net Meeting and personal computer 130 is described as Netscape. Ex. 1005, [0042]. “These describe two possible *applications* that are supported by personal computers connected to networks, in this case an HomePNA LAN. Those skilled in the art will appreciate that any computer *application* can be substituted or added.” *Id.* (emphasis added). Rabenko thus also describes home networking applications being performed or managed by the HomePNA controller 138. Ex. 1002, ¶261.

FIG. 10 of Rabenko is a system block diagram of an exemplary HomePNA controller. Ex. 1005, [0024], Fig. 10. “Referring to FIG. 10, the exemplary HomePNA controller 138 (see FIG. 1a) can be a fully integrated MAC/PHY that transmits and receives data over the HomePNA LAN.” *Id.*, [0217].



Ex. 1005, Fig. 10

Although Rabenko does not explicitly teach “data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN,” Koperda does.

Like Rabenko, Koperda is directed to a home-based telecommunications system that includes a residential gateway that may be configured to perform any of several functions. Ex. 1010, Abstract, [0003]-[0007], [0023]-[0024]. Koperda’s residential gateway is a modular design that allows for any of a variety of network access technologies, home network technologies, and network services to be implemented in one or more modules. Ex. 1010, [0023]-[0025]. Koperda provides

a non-exhaustive list “of the network technologies categories that could be provided by modules in the gateway system.” *Id.*, [0025], Table 1.

TABLE 1

Network interfaces	Home interfaces	Wireless modules	Misc. modules
DOCSIS	Ethernet	IEEE 802.11a	power
ADSL	HomePNA	IEEE 802.11b	Security
ADSLite	Bluetooth	HomeRF	Firewall/Router
T1	Homepower	HiperLAN II	VPN
T3	2-Line POTs	900 MHz cordless phone	Standby power
SDSL	4-Line POTs	2.4 GHz cordless phone	NAT/DHCP
ISDN	Security Panel Monitoring		Softswitch PBX functions
V.90 (56K) modem	Utility Monitoring		
HDTV Tuner	Multi-port Ethernet Hub		
VDSL	Cordless Telephony		
FDDI	Camcorder Video (HAVI - IEEE 1394)		

Ex. 1010, Table 1 (annotated)

As shown by Table 1 above, Koperda teaches that for a DOCSIS network, as taught in Rabenko, that utilizes a HomePNA interface, as taught in Rabenko, data networking processing including “Firewall/Router,” “VPN,” and “NAT” may be implemented by the HomePNA controller. *Id.* Koperda also teaches that many functions shown in Table 1 may be in a single module. *Id.*, [0043]. It would have been obvious to apply Koperda’s teachings to Rabenko to yield a system wherein the HomePNA controller is configured to perform advanced multi-port bridging routing with network address translation functions, firewall functions, and virtual private network functions.

It would have been obvious to a POSITA to combine a module comprising the VPN, NAT, firewall, and routing functions, as taught in Koperda, in the HomePNA controller of Rabenko because the modular design of Koperda has low initial costs and scales well as additional networks are added. Ex. 1010, [0023]. The combination would further have been obvious because Koperda states that such functions may be combined into a single “Home interface[]” (e.g., Rabenko’s HomePNA controller) and because the data networking engine, which is controlling all of the communications with the local home devices, would be the logical location to have these functionalities in order to provide such functionalities to the local home devices on the HomeLAN. Ex. 1010, [0005], [0043], Table 1. Ex. 1002, ¶¶265-266.

A POSITA would have recognized that such a combination would be using known techniques (implementing multiple HomePNA controller functions of Rabenko so as to include the functionality of the module in the HomePNA controller of Koperda) to improve similar devices (the HomePNA controller taught in Rabenko) in the same way (Rabenko’s HomePNA controller includes the various new functionalities). Ex. 1010, [0005], [0043]; Ex. 1005, [0268]; Ex. 1002, ¶267. As explained above, both Rabenko and Koperda teach home gateways systems that include a HomePNA controller. It would have been obvious to a POSITA to use

Koperda's technique of enabling multiple functions in a single HomePNA controller module to improve Rabenko's HomePNA controller. *Id.*

Additionally, a POSITA would have had the skill to implement the HomePNA controller in Rabenko's system as a single module type architecture, as taught by Koperda, to allow for such functionalities to the local home devices on the HomeLAN. Ex. 1005, [0268]; Ex. 1010, [0005], [0043]. As taught by both Rabenko and Koperda, this combination requires only minor hardware, software, and/or firmware modifications, leading to an expectation of success in yielding predictable results: ensuring that Rabenko's HomePNA controller implements VPN, NAT, firewall, and advanced multi-port bridging routing functions. Ex. 1005, [0268]; Ex. 1010, [0043]; Ex. 1002, ¶268.

Each of the proposed combinations that includes Koperda teaches claim 8. Ex. 1002, ¶¶260-269.

C. Grounds Y-FF: Grounds Q-X in view of Johnson render obvious Claim 9

Each of the proposed combinations that includes Johnson renders obvious claim 9. Ex. 1002, ¶¶271-278.

1. Dependent Claim 9

- a. **“A cable modem system as claimed in claim 8, wherein the data networking engine comprises the entire embedded portal services functionality of the CableHome specification.”**

As described above in Section VI.A.1.b and VI.A.4.b, Rabenko’s HomePNA controller 138 and AFE 226 functions as the claimed “data networking engine.” As described, HomePNA controller 138 can be a fully integrated MAC/PHY device that provides bi-directional communication with multiple devices such as HomePNA phone 126, computer 128, television 132, etc., operating on HomePNA LAN 110. Ex. 1005, [0033]-[0034], [0042]-[0043], [0045], [0080]. Specifically, Rabenko describes television 132 for displaying “television programming *streamed from the external IP network* or spooled from memory systems of an attached video server.” Ex. 1005, [0043] (emphasis added).

Rabenko also describes a DOCSIS network used for delivery of broadband services, such as IP services over the IP network (an HFC network), to the network port 104. Ex. 1005, [0033]. “In the exemplary residential gateway, a cable modem is used as described by the CableLabs DOCSIS specification except that the telephony and services delivered to the subscriber port 106*b* are not limited to Ethernet, but rather can support any physical media and protocol compatible with the specific in home LAN.” Ex. 1005, [0034]. A POSITA would have understood

that Rabenko describes a cable modem that complies with the CableLabs DOCSIS specification except for not being limited to Ethernet. Ex. 1002, ¶273.

A POSITA would have understood that CableLabs refers to Cable Television Laboratories, Inc., a consortium of cable television system operators established in 1988. Ex. 1008, p. 4. A POSITA further would have understood that, at the time of the priority date of the '775 Patent, current projects of CableLabs included PacketCable and CableHome, a “trademarked term of CableLabs for a project to develop interface specifications to extend high quality cable-based (i.e., cable TV-based) services to network devices within a residence.” *Id.* Rabenko’s CableLabs DOCSIS compliance was a commonly known initiative for cable modems at the priority date of the '775 Patent. Ex. 1002, ¶274. Given that Rabenko’s cable modem was CableLabs DOCSIS compliant, a POSITA would have been motivated to implement one or more other CableLabs specifications, such as CableHome as taught by Johnson, for functionalities of Rabenko’s gateway to ensure uniformity, interactivity, and operability in a CableLabs DOCSIS network. Ex. 1002, ¶274.

Like Rabenko, Johnson is directed to designing and managing a home network that distributes data such as voice and video. Ex. 1009, Abstract, [0002], [0020], [0048]. Johnson teaches a networking device that includes a networking management capability (as defined in the CableHome Specification) and data interfaces that are also CableHome compliant. Ex. 1009, [0032]-[0035], [0062]-

[0067], Figs. 10-13. Johnson recognizes that as more users gain access to high speed Internet access or digital television, “users will desire to transmit video or other timing critical data over their home networks.” Ex. 1009, [0004]. Johnson’s system allows for “distributing broadcast quality video (or similar timing critical data) in the home over a network that is also carrying IP traffic,” a feature absent in prior systems which transmitted video in MPEG formats and thus were often incompatible with IP networks “due to the timing considerations inherent in high quality video.” Ex. 1009, Abstract, [0004].

A POSITA would have been motivated to incorporate CableHome specification functionality of Johnson into Rabenko to allow for the integration of IP traffic with non-IP video traffic to ensure that video data transmitted in MPEG format, which is not necessarily compatible with IP networks due to the timing considerations inherent in high quality video, will work in Rabenko’s traffic system. Ex. 1002, ¶276. A POSITA would have been motivated because Rabenko’s HomePNA controller provides bi-directional communication with television 132, which displays “television programming *streamed from the external IP network.*” Ex. 1005, [0043] (emphasis added). When implementing Rabenko’s system, a POSITA would have looked to Johnson for similar networks and specific specification compliances implemented by Johnson in order to allow for the integration of non-IP video into its system.

A POSITA would have recognized that such a combination would be using known techniques (Johnson's implementation of CableHome-compliant networking devices) to improve a similar device (Rabenko's HomePNA controller within a residential gateway) in the same way (by ensuring that Rabenko's HomePNA controller, which handles transmissions to television 132 on the Home LAN 110, is compliant with CableLabs' CableHome specification as taught by Johnson to allow for the integration of IP traffic with non-IP video traffic).

Thus, each of the proposed combinations teaches claim 9. Ex. 1002, ¶¶271-278.

D. Grounds GG-NN: Grounds A-H in view of Johnson render obvious Claims 11, 13, and 16-17

Each of the proposed combinations that includes Johnson renders obvious claims 11, 13, and 16-17. Ex. 1002, ¶¶279-301.

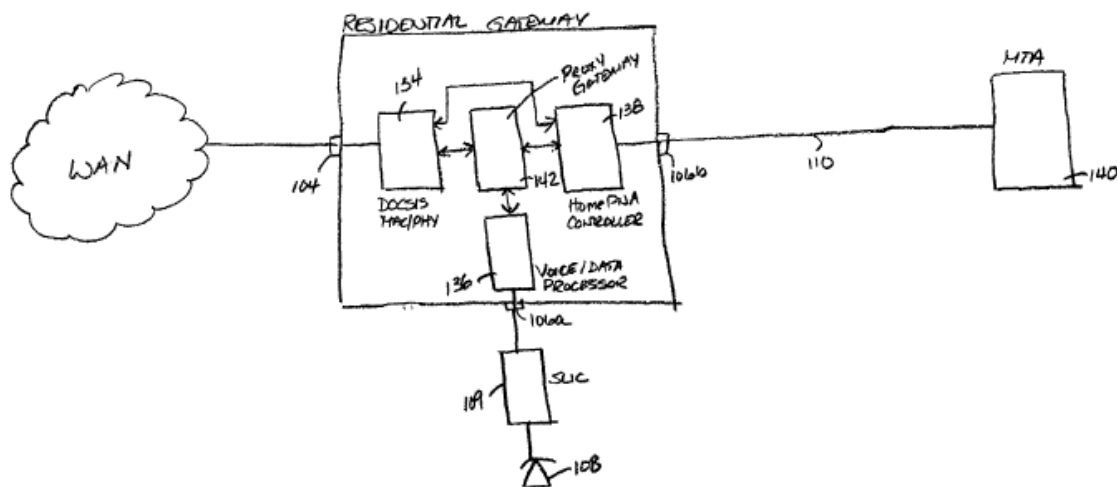
1. Dependent Claim 11

As described above in Sections VI.A.1.e, VI.A.7, and VI.C.1, each of the proposed combinations teaches claim 11. Ex. 1002, ¶¶280-282.

2. Dependent Claim 13

- a. [13A]: “A cable modem system as claimed in claim 1, wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver and”

Rabenko describes that in a downstream direction, DOCSIS MAC 134/212 of a residential gateway determines whether a packet is voice or data, and if data, the packet is routed to HomePNA controller 138. Ex. 1005, [0045], Fig. 1b.



Ex. 1005, Fig. 1b (annotated)

Rabenko discloses that, “[a]n exemplary embodiment of the residential gateway [shown in Fig. 1b] is shown schematically in FIG. 2.” Ex. 1005, [0050]. While describing Fig. 2, Rabenko describes “a universal serial bus transceiver 204 can provide transparent bi-directional IP traffic between devices operating on a USB such as for example a PC (personal computer) workstation, server printer or other similar devices (not shown). Additionally, an IEEE 802.3

compliant media independent interface (MII) 210 in conjunction with an Ethernet MAC 211 can also provide bi-directional data exchange between devices such as, for example a number of PCs and/or Ethernet phones (not shown).” Ex. 1005, [0051]. A POSITA would have understood these to be home networking functions implemented by the USB transceiver 204/USB MAC 222 and the Ethernet MAC 211 that also include a USB driver and an Ethernet driver, respectively. Ex. 1002, ¶286. In addition, a POSITA would have understood that in a downstream direction, if a packet is data it is routed to HomePNA controller 138, which uses transceiver 204 to provide transparent bi-directional IP traffic between devices operating on a USB and Ethernet MAC 211 to provide bi-directional data exchange between devices via MII 210. Ex. 1005, [0045], [0051], Fig. 1b. Each of the proposed combinations teaches [13A]. Ex. 1002, ¶¶283-287.

b. [13B]: “the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification,”

As described above in Section VI.C, each of the proposed combinations teaches [13B]. Ex. 1002, ¶¶288-290.

c. [13C]: “wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, and”

As described above in Sections VI.A.9-VI.A.10, each of the proposed combinations teaches [13C]. Ex. 1002, ¶¶291-293.

- d. [13D]: “wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.”**

The '775 Patent describes that because “[t]he data networking engine is partitioned from the cable modem engine,” “the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.” Ex. 1001, 2:24-27. As described above in Section VI.A.11.d, Rabenko teaches partitioning HomePNA controller 138 (“data networking engine”) from DOCSIS MAC 134/212, proxy gateway 142, and voice/data processor 136 (“cable modem engine”) so the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality. A POSITA would have understood that Rabenko teaches CableHome functionality provided by the data networking engine is completely decoupled from PacketCable and DOCSIS functionality provided by the cable modem engine. Ex. 1002, ¶¶294-297.

3. Dependent Claim 16

As described above in Section VI.D.2, each of the proposed combinations teaches claim 16. Ex. 1002, ¶¶298-299.

4. Dependent Claim 17

As described above in Sections VI.D.2, each of the proposed combinations teaches claim 17. Ex. 1002, ¶¶300-301.

VII. GROUNDS FOR STANDING & FEE PAYMENT

Petitioner hereby certifies that the '775 Patent is available for, and Petitioner is not barred or estopped from requesting, *inter partes* review challenging claims 1-20.

Pursuant to 37 C.F.R. § 42.103, the undersigned authorizes the charge of any required fees to Deposit Account No. 19-0733.

VIII. CONCLUSION

Inter partes review should be instituted and claims 1-20 canceled.

Dated: February 15, 2024

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CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Inter Partes Review totals 13,992, which is less than the 14,000 allowed under 37 CFR § 42.24(a)(1)(i). This total includes 13,963 words as counted by the Word Count feature of Microsoft Word and 29 words used in annotations.

Pursuant to 37 C.F.R. § 42.24(a)(1), this count does not include the table of contents, the table of authorities, mandatory notices under § 42.8, the certificate of service, this certification of word count, the claims listing appendix, or appendix of exhibits.

BANNER & WITCOFF, LTD

Dated: February 15, 2024

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.105, I hereby certify that I caused a true and correct copy of this Petition for *Inter Partes* Review in connection with U.S. Patent No. 8,223,775 and supporting evidence to be served via FedEx Priority Overnight on February 15, 2024, on the following:

McAndrews, Held & Malloy, Ltd
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Suite 3400
Chicago, IL 60661

Dated: February 15, 2024

By: /Frederic M. Meeker/

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CLAIM LISTING APPENDIX

U.S. Pat. No. 8,223,775

Designation	Claim Language
Claim 1	
[1A]	1. A cable modem system comprising:
[1B]	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, wherein the at least one processor is a RISC processor;
[1C]	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 including a DOCSIS PHY layer, a DOCSIS controller, and a DOCSIS controller and 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,
[1D]	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; and
[1E]	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;
[1F]	wherein the DOCSIS MAC processor is 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.
Claim 2	
2	2. A cable modem system as claimed in claim 1, wherein all DOCSIS functions are localized in the cable modem engine.

Designation	Claim Language
Claim 3	
3	3. A cable modem system as claimed in claim 2, wherein VoIP functionality is embedded in the cable modem engine.
Claim 4	
4	4. A cable modem system as claimed in claim 1, and further comprising an advanced crypto engine configured to perform all crypto functions for both the data networking engine and the cable modem engine, the advanced crypto engine being separate from both the data networking engine and the cable modem engine.
Claim 5	
5	5. A cable modem system as claimed in claim 1, wherein the DOCSIS PHY layer includes a hardware transmitter and receiver.
Claim 6	
6	6. A cable modem system as claimed in claim 1, wherein all VoIP functionality is implemented in the DOCSIS controller.
Claim 7	
7	7. A cable modem system as claimed in claim 6, wherein the VoIP functionality is in conformance with the PacketCable specification.
Claim 8	
8	8. A cable modem system as claimed in claim 1, wherein the data networking engine is configured to perform all data networking processing including advanced multi-port bridging routing with NAT/firewall and VPN, and home networking applications.
Claim 9	
9	9. A cable modem system as claimed in claim 8, wherein the data networking engine comprises the entire embedded portal services functionality of the CableHome specification.
Claim 10	
[10A]	10. A cable modem system as claimed in claim 1, wherein with regard to the cable modem engine: the DOCSIS PHY layer includes a transmitter and receiver;
[10B]	the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications; and

Designation	Claim Language
[10C]	the DOCSIS controller is configured to implement VoIP functionality; and
[10D]	wherein the data networking engine includes a RISC processor configured to implement a majority of data networking processing and home networking applications decoupled from the implementation of the MAC functions and the VoIP functionality of the cable modem engine.
Claim 11	
11	11. A cable modem system as claimed in claim 10, wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, wherein the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification, and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 12	
12	12. A cable modem system as claimed in claim 11, wherein the DOCSIS MAC processor is an ARM9TDMI-based RISC processor, and wherein the DOCSIS controller is an ARM940-based RISC processor.
Claim 13	
[13A]	13. A cable modem system as claimed in claim 1, wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver and
[13B]	the data networking engine is configured to provide the embedded portal services functionality of the CableHome specification,
[13C]	wherein the DOCSIS controller is configured to provide VoIP functionality in accordance with the PacketCable specification, and
[13D]	wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.

Designation	Claim Language
Claim 14	
[14A]	14. A method of cable modem operation comprising:
[14B]	executing, via at least one processor of a first circuit that implements a data networking engine, first software that causes the data networking engine to perform home networking functions including interfacing with customer provided equipment, wherein the at least one processor is a RISC processor;
[14C]	executing, via one or more processors of a second circuit that implements a cable modem engine programmed with second software, the second software to cause 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, 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, wherein the second circuit is separate from the first circuit, and wherein the cable modem engine includes a DOCSIS PHY layer, a DOCSIS controller and a DOCSIS controller;
[14D]	connecting, via a data bus, 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;
[14E]	processing, via the DOCSIS MAC processor, downstream PDU packets and forwarding the processed packets directly to the data networking engine without the involvement of the DOCSIS controller in order to boost downstream throughput.
Claim 15	
[15A]	15. A method of cable modem operation as claimed in claim 14, further comprising: providing a flexible and partitioned cable modem gateway comprising:
[15B]	providing data and home networking functionality in the data networking engine;
[15C]	providing DOCSIS and VoIP functionality in the cable modem engine; and

Designation	Claim Language
[15D]	partitioning the data networking engine from the cable modem engine so that the data and home networking functionality is completely decoupled from the DOCSIS and VoIP functionality.
Claim 16	
16	16. A method as claimed in claim 14, further comprising: providing VoIP functionality in accordance with the PacketCable specification in the DOCSIS controller; and providing the embedded portal services functionality of the CableHome specification in the data networking engine; wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 17	
17	17. A method as claimed in claim 14, further comprising: providing the embedded portal services functionality of the CableHome specification in the data networking engine; and providing VoIP functionality in accordance with the PacketCable specification in the DOCSIS controller; wherein the data networking engine includes consumer provided equipment drivers including a USB driver and an Ethernet driver; and wherein the CableHome functionality provided by the data networking engine is completely decoupled from the PacketCable and DOCSIS functionality provided by the cable modem engine.
Claim 18	
[18A]	18. A cable modem system comprising:
[18B]	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;
[18C]	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

Designation	Claim Language
	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
[18D]	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,
[18E]	the cable modem engine including a DOCSIS controller and a DOCSIS MAC processor,
[18F]	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
[18G]	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.
Claim 19	
19	19. A cable modem system as claimed in claim 18, wherein all DOCSIS functions are localized in the cable modem engine.
Claim 20	
20	20. The cable modem system as claimed in claim 18 wherein the DOCSIS MAC processor is configured to implement real-time MAC functions for both upstream and downstream communications.