

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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VIVINT SMART HOME, INC.  
NRG ENERGY, INC.  
Petitioner,

MALIKIE INNOVATIONS LIMITED  
Patent Owner,

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U.S. Patent No. 11,119,756  
Issue Date: September 14, 2021  
Title: SYSTEM AND METHOD FOR CONTROLLING UPDATES TO  
INTERNET-THINGS DEVICES

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*Inter Partes* Review No.: IPR2026-00120

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**DECLARATION OF HENRY HOUH, PH.D. IN SUPPORT OF  
PETITION FOR INTER PARTES REVIEW OF  
U.S. PATENT NO. 11,119,756**

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Patent Trial and Appeal Board  
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I, Henry Houh, declare as follows:

**I. INTRODUCTION**

1. I am over the age of eighteen (18) and otherwise competent to make this Declaration.

2. I have been retained by VIVINT SMART HOME, INC. NRG ENERGY, INC. (Petitioners) as an independent, technical expert consultant in this proceeding before the United States Patent and Trademark Office (USPTO). I am being compensated at my rate of \$950 per hour for my services. No part of my compensation is dependent on my opinions or on the outcome of this proceeding. I have no financial interest in any of the parties to this proceeding.

3. This Declaration is in support of the Petition for *inter partes* review involving U.S. Patent 11,119,756 (the “756 Patent” or “the Patent”) (EX-1001), entitled “SYSTEM AND METHOD FOR CONTROLLING UPDATES TO INTERNET-THINGS DEVICES” and listing Edward Snow Willis, David Alan Inglis, Hashim Mohammad Qaderi, Scott Hutchens, Christopher Scott Travers and Conrad Delbert Seaman as the inventors.

4. For the purposes of this *inter partes* review as I discuss later, I have been instructed to assume that the effective filing date of the Claims of

the '756 Patent challenged by the Petitioners in this *inter partes* review is no earlier than August 3, 2018.

5. I understand that, according to USPTO records, the '756 Patent is currently assigned to Malike Innovation Limited. I have been instructed to assume for purposes of this proceeding that Malkie Innovation Limited the patent owner.

6. The '756 Patent is generally directed to the updating of devices over the internet of things. I am familiar with the technology described in the '756 Patent as of the earliest possible priority date of August 3, 2018.

7. In preparing this Declaration, I have reviewed the '756 Patent (EX-1001) and its prosecution history (EX-1002), as well as the patents and documents cited herein, and I have considered these documents in light of the general knowledge in the art as of August 2018. In formulating my opinions, I have relied upon my experience in the relevant art. I have also considered the viewpoint of a person of ordinary skill in the art (“POSITA”) in the relevant field, as of August 2018, who I describe below (§ V.F). For convenience, the materials I considered in arriving at my opinions are listed in Appendix A.

8. I have been asked to provide my technical expertise, analysis, insights and opinions regarding the '756 Patent and relevant references that

form the basis of the arguments set forth in the accompanying Petition for *inter partes* review of the '756 Patent. As described in detail below, I offer the following opinions in this Declaration:

9. A POSITA would have found Claims 1-4, 6-10, 12-17, 19-20 of the '756 Patent to be obvious over Storto alone.

10. A POSITA would have found Claims 5, 11, 18 of the '756 Patent to be obvious over Storto in view of Won and a POSITA would have been motivated to combine the teachings of these references.

11. Unless otherwise indicated, the emphasis in quotations has been added.

## II. QUALIFICATIONS

12. My qualifications for forming the opinions set forth in this declaration are summarized here and explained in more detail in my *curriculum vitae*, which is included as Appendix B. Appendix B also includes a list of my publications and patents.

13. I received a Ph.D. in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology ("MIT") in 1998. I also received a Master of Science degree in Electrical Engineering and Computer Science in 1991, a Bachelor of Science degree in Electrical

Engineering and Computer Science in 1989, and a Bachelor of Science Degree in Physics in 1990, all from MIT.

14. For the last 15 years I have been self-employed as an independent technical consultant which specializes in, among other things, in Web Site Development, Data Networking, Optical Networking, Telecommunications, and Media Streaming. My clients include almost every major law firm in the country.

15. My Career in the area of telecommunications began 1987 when I worked at AT&T Bell Laboratories as part of a five-year dual degree program at MIT. Later, as part of my doctoral research at MIT from 1991-1998, I was a research assistant in the Telemedia Network Systems (TNS) group at the Laboratory for Computer Science. The TNS group built a high-speed gigabit network and created applications that ran over the network. Example applications included ones for remote video capture, processing, and display of video on computer terminals. In addition to working on the design of core network components, designing and building the high speed links, and designing and writing the device drivers for the interface cards, I also set up the group's web server.

16. I defended and submitted my Ph.D. thesis, titled "Designing Networks for Tomorrow's Traffic," in January 1998. As part of my thesis

research, I analyzed local-area and wide-area flows to show a more efficient method for routing packets in a network, based on traffic patterns at the time.

17. From 1997 to 1999, I was a Senior Scientist and Engineer at NBX Corporation, a start-up that made business telephone systems for streaming packetized audio over data networks instead of using traditional telephone lines. NBX was later acquired by 3Com Corporation, and the phone system is still used today by numerous businesses. As part of my work at NBX, I designed the core audio reconstruction algorithms for the telephones, as well as the packet transmission algorithms. I also designed and validated the core packet transport protocol used by the phone system. The protocol was used for all signaling in the phone system. The NBX system was also able to update the software on all the NBX phones, and the protocol I designed also carried all the update data. A web interface to the control system enabled the administrative user to perform these updates. The NBX system also featured a computer interface for initiating phone calls, which could also initiate conference calls. The NBX system also supported TAPI, the Telephony Application Programming Interface, thus allowing other computer programs to integrate with our system telephony features. We obtained U.S. Patent No. 6,697,963, entitled

“Telecommunication method for ensuring on-time delivery of packets containing time-sensitive data,” as a result of part of this work.

18. From 1999-2004, I was employed by Empirix or its predecessor company, Teradyne. Empirix was a leader in test tools for telecommunications protocols and systems, providing functional testing tools as well as load testing tools. From 2000-2001, I conceived and built a test platform for testing Voice-over-IP (VoIP). The first application on this new test platform was a cloud emulator for simulating the effects of transmitting VoIP over a busy network. This system was also able to have its line card network processor software updated remotely through a connection to a web interface on the master control unit.

19. In 2006, as part of my role at BBN Technologies, I helped found PodZinger Inc., now known as RAMP Inc. PodZinger utilized BBN’s speech recognition algorithms to search through the spoken words in audio and video segments. While I was Vice President of Operations and Technology, PodZinger followed its initial prototype with a full streaming audio and video search solution.

20. Furthermore, I have served as expert witness in over 150 patent-related cases where I wrote expert reports and testified in over 100 depositions on topics such as network communications and

telecommunications, including Internet protocols, streaming media, antenna design, and mobile wireless technologies. I have testified in Federal courts, the PTAB, and the ITC on behalf of leading companies such as Amazon, AT&T, Cisco Systems, Google, Microsoft, Comcast, Time Warner Cable, Samsung, Netflix, Disney, and Apple.

21. I have been awarded several United States patents, including the following examples:

U.S. Pat. No.	Title
7,975,296	Automated security threat testing of web pages
7,877,736	Computer language interpretation and optimization for server testing
7,801,910	Method and apparatus for timed tagging of media content
7,590,542	Method of Generating Test Scripts Using a Voice-Capable Markup Language
7,860,999	Distributed computation in network devices
6,967,963	Telecommunication method for ensuring on-time delivery of packets containing time-sensitive data
7,359,993	Method and apparatus for interfacing external resources with a network element

•  
22. Based on my above-described over three decades of experience in network usage and resource allocation and the acceptance of my publications and professional recognition by societies in my field, I believe that I am qualified to be an expert in the field of wireless technology

including the operations of internet of things devices and updating their software.

23. Based on my experience described above, and as indicated in my *curriculum vitae*, I am qualified to provide the following opinions with respect to the patents in this case. Additionally, I am at least a person having ordinary skill in the art, as I have set forth in §V.E below, as of the priority date of the '756 Patent.

### **III. RELEVANT LEGAL STANDARDS**

24. I do not provide any legal opinions in this Declaration. I have been informed and understand that certain legal standards are to be applied by technical experts in forming opinions regarding the meaning and validity of patent claims. I have been asked to provide my opinions regarding whether the claims of the '756 Patent would have been obvious to a person having ordinary skill in the art at the time of the alleged invention, in light of the prior art.

25. Further, I have been informed and understand that a patent claim is not patentable as obvious (a requirement I understand to be governed by a statute, 35 U.S.C. § 103) if the differences between the patent claim and the prior art are such that the claimed subject matter as a whole would have been obvious at the time the claimed invention was made to a

person having ordinary skill in the relevant art. Obviousness, as I have been informed and understand, is based on the scope and content of the prior art, the differences between the prior art and the claim, the level of ordinary skill in the art, and, to the extent that they exist, certain objective indicia of non-obviousness.

26. I understand that objective indicia can be important evidence regarding whether a patent is obvious or nonobvious, if it has an appropriate nexus to the claimed invention, i.e., is a result of the merits of a claimed invention (rather than the result of design needs or market-pressure advertising or similar activities). Such indicia include: commercial success of products covered by the patent claims; a long-felt need for the invention; failed attempts by others to make the invention; copying of the invention by others in the field; unexpected results achieved by the invention as compared to the closest prior art; praise of the invention by the infringer or others in the field; the taking of licenses under the patent by others; expressions of surprise by experts and those skilled in the art at the making of the invention; the patentee proceeded contrary to the accepted wisdom of the prior art, and, the contemporaneous development of the subject matter claimed by others.

27. I have been informed that whether there are any relevant differences between the prior art and the claimed invention is to be analyzed from the view of a person of ordinary skill in the relevant art at the time of the invention. As such, my opinions below as to a person of ordinary skill in the art are as of the time of the invention, even if not expressly stated as such; for example, even if stated in the present tense.

28. In analyzing the relevance of the differences between the claimed invention and the prior art, I have been informed that I must consider the impact, if any, of such differences on the obviousness or non-obviousness of the invention as a whole, not merely some portion of it. The person of ordinary skill faced with a problem is able to apply his or her experience and ability to solve the problem and also look to any available prior art to help solve the problem.

29. I have been informed that a precise teaching in the prior art directed to the subject matter of the claimed invention is not needed. I have been informed that one may take into account the inferences and creative steps that a person of ordinary skill in the art would have employed in reviewing the prior art at the time of the invention. For example, if the claimed invention combined elements known in the prior art and the combination yielded results that were predictable to a person of ordinary

skill in the art at the time of the invention, then this evidence would make it more likely that the claim was obvious. On the other hand, if the combination of known elements yielded unexpected or unpredictable results, or if the prior art teaches away from combining the known elements, then this evidence would make it more likely that the claim that successfully combined those elements was not obvious.

30. I have been informed and understand that there are recognized, exemplary, rationales for combining or modifying references to show obviousness of claimed subject matter. Some of the rationales include the following: combining prior art elements according to known methods to yield predictable results; simple substitution of one known element for another to yield predictable results; use of a known technique to improve a similar device (method or product) in the same way; applying a known technique to a known device (method or product) ready for improvement to yield predictable results; choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and some teaching, suggestion, or motivation in the prior art that would have led

one of ordinary skill to modify the prior art reference or to combine prior art teachings to arrive at the claimed invention.

#### **IV. OVERVIEW**

31. The 756 patent is directed to using a device with a user interface, such as a smartphone, to control a software update for an Internet of Things (IoT) device such as an appliance. The independent claims broadly claim the four steps that are performed in order for the controlling device to manage the software update for a controlled device:

1. Receive state information about the IOT device, such as whether the device is connected.
2. Determine whether the IoT device is ready for the update.
3. Receive an indication from the controlling device to update the IOT device.
4. Send a command to the IoT device to apply the update.

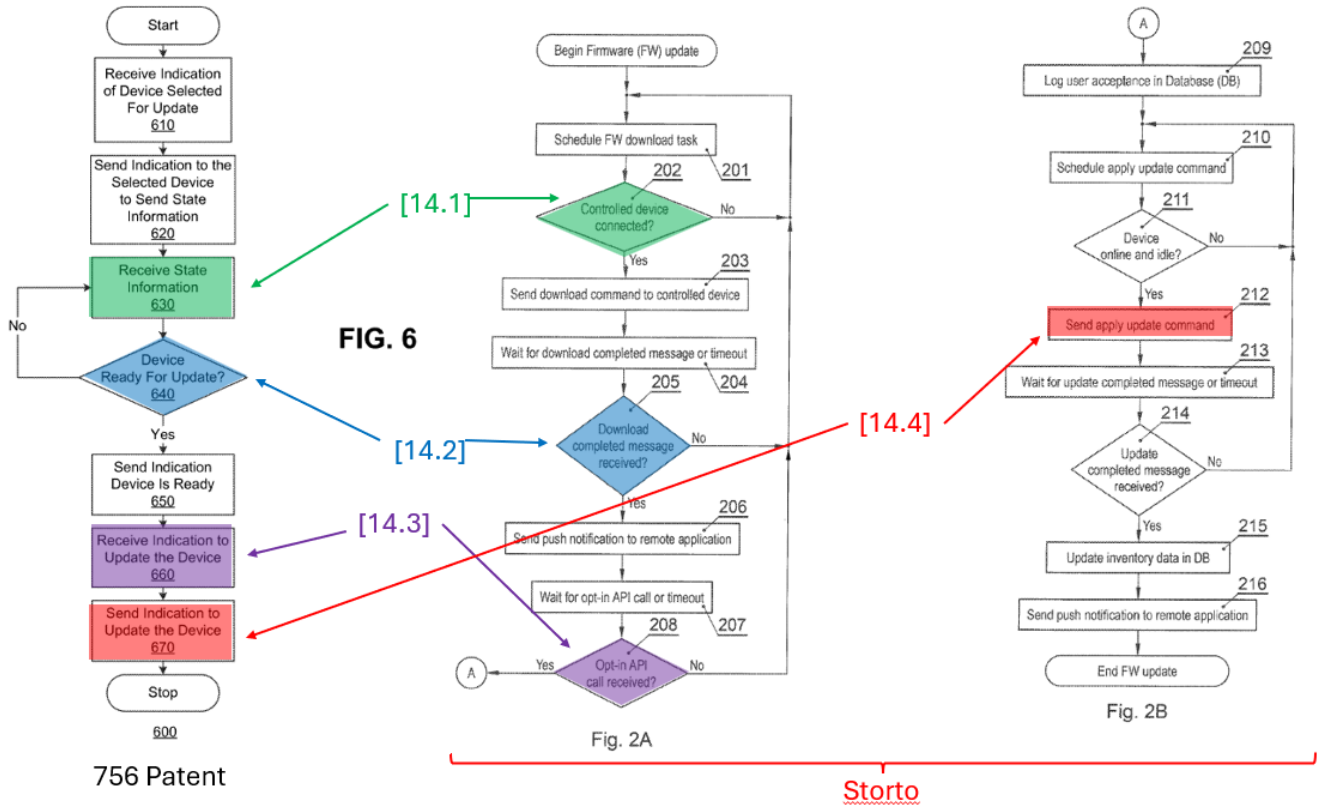
EX-1001 Claims 1,14,20.

32. However, these four steps recited in the independent claims were well-known and had previously been used in the prior art to manage software updates for IoT devices using a smartphone. One such system was disclosed in the Storto reference. For example, using Claim 14 of the '756 Patent as representative, the figures below demonstrate how the four steps

[14.1], [14.2], [14.3] and [14.4] from Claim 1 reads on FIG. 6 of the '756

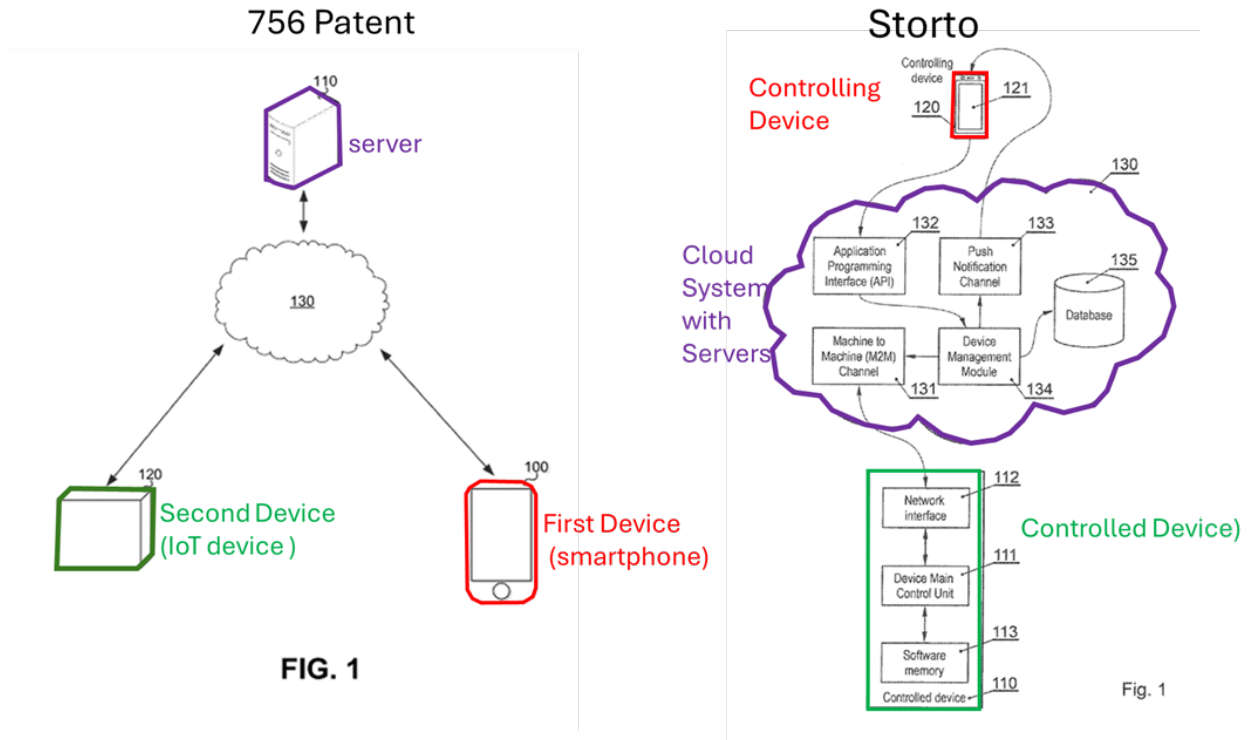
Patent, as well as on FIGs. 2A, 2B and 3 of Storto using a common color for

mapped to each claim limitation recited in Clam 14:



EX-1001 FIG 6; EX-1004 FIGs. 2A &2B.

33. In addition to Storto disclosing the same steps, Storto also discloses a similar architecture for performing those steps. Table 1 and the figures below illustrate the correspondence of the limitations with respect to the '756 Patent and the prior art reference Storto.



EX-1001 FIG. 1; EX-1004 FIG. 1.

Table 1

Limitation	'756 Patent	Storto
<i>computer system with processor/communications subsystem/non-transitory computer readable storage medium</i>	server 110 and network 130 (which includes processor 310, communications subsystem 210 and storage media 330 from FIG. 3).	Network 130 (which includes servers ( <i>processor</i> ) running software modules( <i>storage medium</i> ), M2M channel 131, API 132 and push notification channel 133 ( <i>communication subsystem</i> ))
<i>a device</i>	a second device 120 (IoT device)	controlled device 110 (IoT device)

<i>another device</i>	a first device 100 (smartphone)	controlling device 120 (smartphone)
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34. The dependent claims likewise disclose well-known features used in the prior art to update an IoT device using a smartphone. Thus, the Petition demonstrates that the Challenged Claims are unpatentable over the cited references.

## V. BACKGROUND

### A. Overview of the '756 Patent

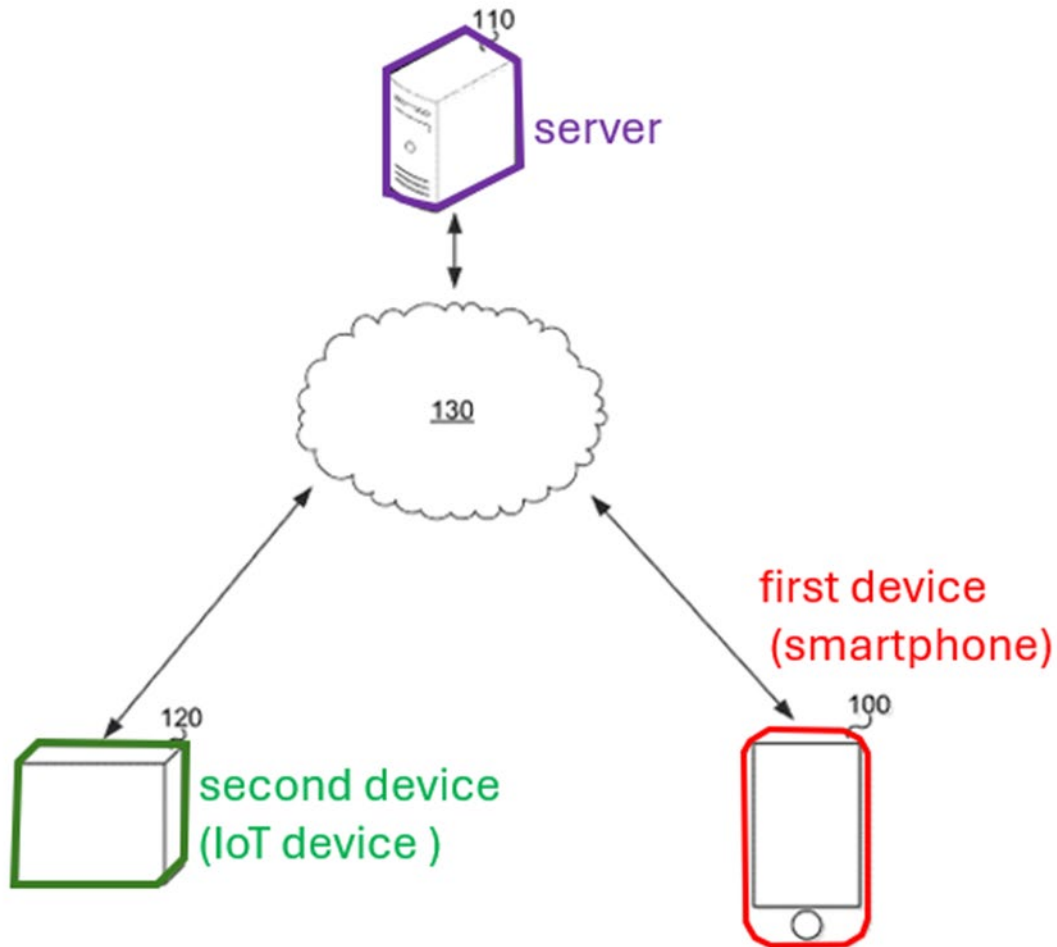
35. The '765 Patent is directed to providing software updates to many conventional devices such as, for example, cars, washing machines, refrigerators, that have been enhanced with the addition of embedded computing devices. The '765 Patent describes that one problem in the prior art for providing software updates was it required bringing updated software to a device by way of portable media which was cumbersome. For example, an update would be written to a USB thumb drive using a desktop or laptop computer and then the USB thumb drive would be physically brought to the device to perform the update. The '765 Patent also identified that as Internet-of-Things (IoT) devices continue to become more common, the need to visit and operate/interact with each such device in order to periodically update it became increasingly cumbersome. It also identified

that in some cases, specialized hardware or the services of a specialized technician were required. EX-1001 1:17-39.

36. The '756 Patent identified that because IoT devices are connected to the internet they could be updated online, and could do so remotely using another device. The '756 Patent explained that this was beneficial since some IoT devices did not have a rich user interface. The '756 Patent also described that because update of a device may make it unusable for its intended purpose when the update is being applied to the device, it was beneficial to be able to schedule when updates are applied. EX-1001 3:1-30.

37. FIG 1. illustrates one embodiment of remote updating an IoT device using a smartphone:

# 756 Patent



**FIG. 1**

EX-1001 FIG. 1.

38. As illustrated, a first device 100, a switchboard server 110, and a second device 120 are in communication via a network 50 130. Each of the first device 100, the switchboard server 110, and the second device 120 may

be in geographically disparate locations. The first device 100 is or includes a computing device, such as a smartphone, a personal computer, a laptop computer, a tablet computer, etc. EX-1001 3:52-4:7.

39. The second device 120 includes a computing device, and may be an IoT (Internet of Things) device such, for example, a vehicle, an appliance such as, for example, a washing machine or a refrigerator, a smart device, a connected device, etc. The switchboard server 110 communicates with the first device 100 and the second device 120 to facilitate initiation and control update of the second device 120 as directed by the first device 100. EX-1001 4:23-44.

40. FIG. 6 illustrates a flow chart for one embodiment of the switchboard server initiating an update to the second device:

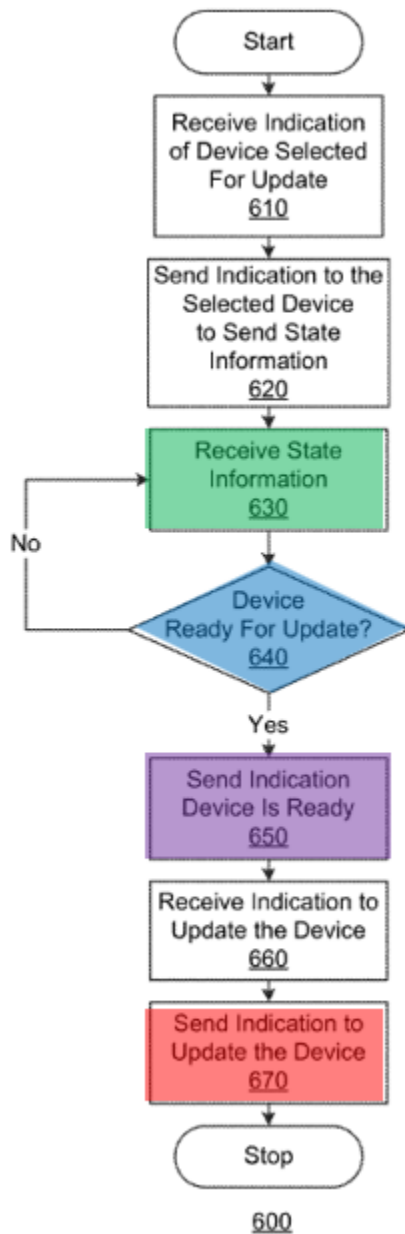


FIG. 6

EX-1001 FIG. 6.

41. At the operation 610, the switchboard server 110 receives an indication of a device selected for update. For example, it may be that the first device 100 may select from amongst a variety of devices for which it may initiate an update. As such, the switchboard server 110 may receive a

message from the first device indicating that the second device is selected for an update. EX-1001 12:16-26.

42. At step 620, the switchboard server 110 sends an indication to the selected second device that it should send state information to the switchboard server 110. EX-1001 12:27-31.

43. At step 630, the switchboard server 110 processes an indication of state information received from the selected device. EX-1001 12:35-37. For example, the indication of state information may be whether the update has been downloaded to the second device. EX-1001 10:20-22.

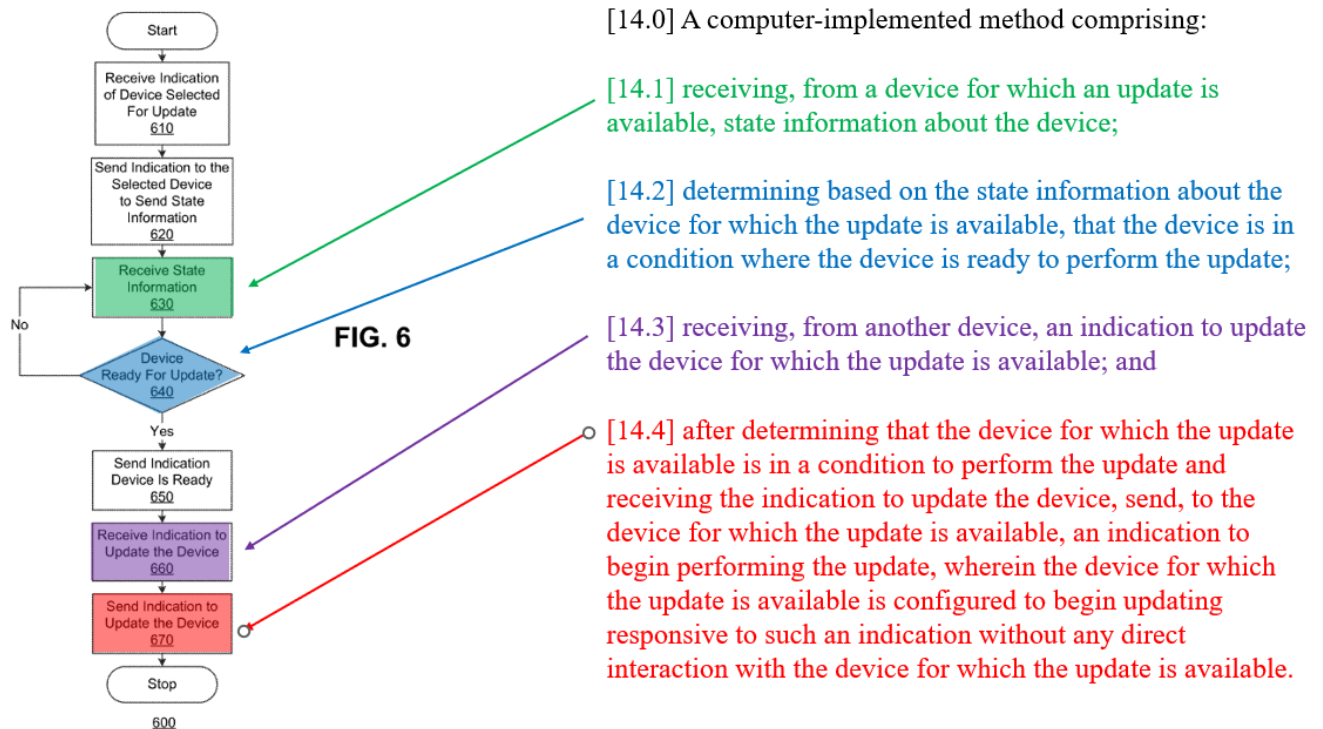
44. At step 640, it is determined whether the selected device is ready for update. For example, determining that the second device 120 is ready to perform an update may include determining that the any pending update has been downloaded. EX-1001 10:22-25. If it is determined that the selected device is ready for update, control flow proceeds to step 650. Alternatively, if it is determined that the selected device is not ready, control flow returns to operation 630 to receive and process further state information. EX-1001 12:46-51.

45. At step 650, the switchboard server 110 sends an indication that the selected device is ready to the first device. EX-1001 12:53-60.

46. At step 660, once a determination that the second device should be updated is made, the first device may send an indication to the switchboard server 110. EX-100112:67-13:2.

47. At step 670, the switchboard server 110 sends an indication to the second device that it is to begin updating itself. EX-1001 13:6-8.

48. The '756 Patent issued with 20 Claims, with Claims 1, 14 and 20 being independent. Claim 14 is representative and is a computer-implemented method claim that reads on some of the method steps of the embodiment illustrated in FIG. 6, as shown below with color coding mapping the recited claim steps to FIG. 6:



EX-1001 FIG. 6; Claim 14.

49. Independent Claim 1 is a corresponding computer system claim, and independent Claim 20 is a corresponding computer readable medium claim, both reciting limitations corresponding to the four method steps recited in Claim 14.

**B. Prosecution History of the '756 Patent**

50. I understand the '756 Patent was filed on July 6, 2020, as Application Ser. No. 16/921,461 as a continuation application claiming priority to the filing date of August 3, 2018 of U.S. Pat. No. 10,719,309 ("Parent Patent"). EX-1001 (21-22).

51. I also understand prior to the first Office Action, the applicant for the '756 Patent filed a terminal disclaimer disclaiming the terminal portion of the '756 Patent which would extend beyond the expiration date of the Parent Patent. The '756 Patent received a first Office Action allowance.

52. I understand during the prosecution of the Parent Patent, the examiner rejected all independent claims as obvious over Bae (US 2007/0192462) in view of US Shim (2013/0311611). In response, the applicant amended all independent claims. The amendment dependent Claim 15 is representative:

15.(Currently amended) A computer-implemented method comprising:

receiving, at a server from a first device, an indication [[of ]]that a second device for which an update is available was selected, at the first device, for update;

sending, by the server to the second device, an indication signaling the second device to send state information about the second device to the server;

receiving, by the server from the second device, the state information about the second device;

determining, by the server based on the received the state information about the second device, that the second device is in a condition where the second device is ready to perform [[an]] the update;

sending, by the server to the first device, an indication that the second device is ready to perform the update;

receiving, by the server from the first device, an indication to update the second device; and sending, by the server to the second device, an indication to begin performing the update, wherein the second device is configured to begin updating responsive to such an indication without any direct interaction with the second device.

EX-1002 199-200.

53. I further understand that the applicant argued that the prior art did not disclose the step of determining that the second device is ready to perform an update:

By contrast, claim 15 previously recited “determining, by the server based on the received the state information about the second device, that the second device is ready to perform an update;”. As such, the determination being made is not as to whether an update is available for the second device, but rather whether the second device is ready to perform (*i.e.*, apply) some available update—see, *e.g.*, paragraphs [0051]–[0056] and [0072]. Respectfully, this is not disclosed by Bae. That is to say, Bae does not disclose or suggest a server determining based on received state information about a second device that that second device is in a condition where it is ready to perform some update.

This distinction between the subject-matter of claim 15 and Bae is even clearer when amended claim 15 is considered. Claim 15 has been amended to further clarify that the availability of the update is known to the server based on an indication received from the first device—“receiving, at a server from a first device, an indication that a second device for which an update is available was selected, at the first device, for update”—and that what is being determined by the server based on the state information is that the second device is in a condition where the second device is ready to perform that update—“determining, by the server based on the received state information about the second device, that the second device is in a condition where the second device is ready to perform the update” (emphasis added). As explained above, none of this is disclosed by Bae.

EX-1002 203.

54. In addition I understand, in response, the examiner allowed the claims and in the notice of allowance stated that the prior art of record do not disclose the recited claimed limitations from the independent claims.

### **C. Priority Date of the Challenged Claims**

55. I understand the application that issued as the ’756 Patent was filed July 6, 2020 as Application Serial No. 16/921,461 and claims priority to non-provisional application 16/054,004, now Patent No. 10,719,309 filed on August 3, 2018 and I have been instructed to assume that the earliest priority date is August 3, 2018.

**D. Claim Construction**

56. I have been informed to give each claim term in the Challenged Claims its plain and ordinary meaning in this proceeding. It is my opinion that no specific construction of any claim term is required because the prior art I have relied upon meets each of the claim terms under any reasonable construction. .

**E. Level of Ordinary Skill in the Art**

57. A Person of Ordinary Skill in the Art (“POSITA”) in August 2018 would have been someone knowledgeable and familiar with networks, in particular, wireless communications and the connectivity of Iot devices over those networks. A POSITA would have gained knowledge of these concepts through a mixture of training and work experience, such as by having at least a bachelor’s degree in electrical engineering, computer science , or related field, and at least two to three years of training or additional work experience in the area of wireless communications, or a related field. Additional hands-on and design experience could compensate for less formal education, and vice versa. The knowledge and skill of a POSITA is further reflected in the prior art references themselves, as well as the State of the Art, discussed below.

**F. State of the Art**

58. This section describes the state of the art as of the Priority Date of August 2018. This section, and the expert testimony and documentary evidence cited, provide additional factual support for the general knowledge, common understanding and skill of a POSITA at the Priority Date. This section provides additional factual support and motivation to modify and combine the teachings in the references, and further demonstrates why doing so would involve a reasonable expectation of success.

**1. It was known to use smartphone to manage downloads to devices that did not have a user interface**

59. By August 2018 it was known to provide software updates to connected devices without a display, like appliances, by using a controlling device that receives user consent prior to upgrading the software on the connected device. Once such system is shown below:

Exemplary System 100

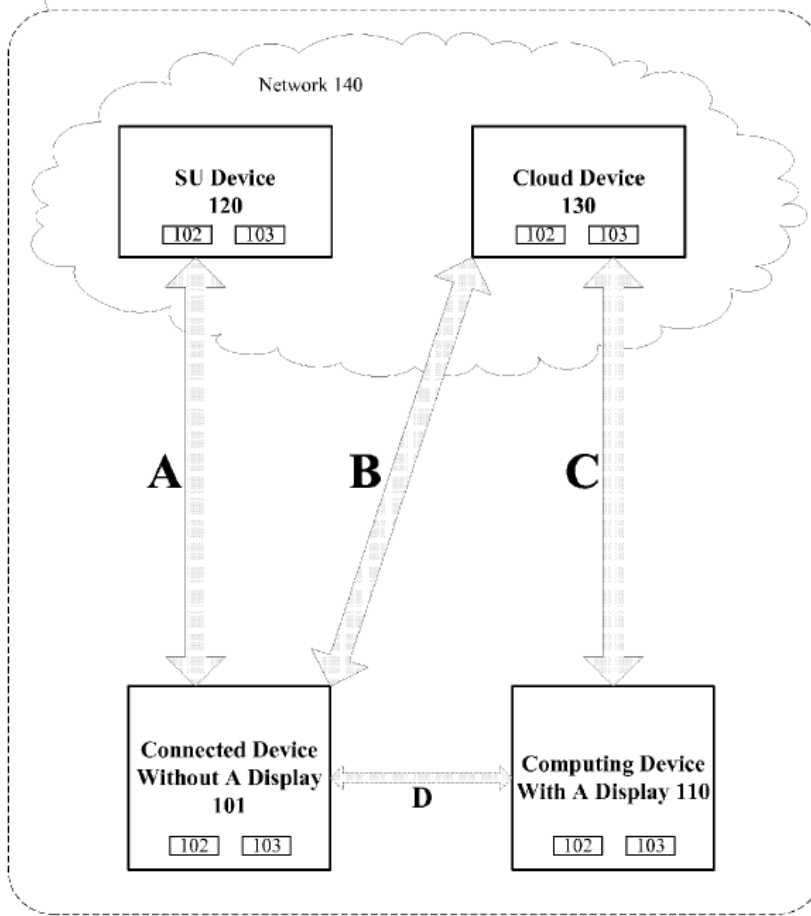


Figure 1A

EX-1006 FIG. 1A.

60. FIG. 1A illustrates an exemplary system 100 having a connected device without a display 101 that communicates with a computing device 110 to manage the installation of software on the connected device 101. EX-1006 [0011]. The connected device 101 was without a display, including network routers, network switches, phones, remotes, printers, monitoring equipment, near field communication transmitters and readers,

appliances, home appliances, refrigerators, etc. EX-1006 [0028]. The computing device 110 was any hardware that included a central processing unit 102, a memory 103 and a display, including, desktops, notebooks, laptops, phones, tablets, computer workstations, next generation portable devices, handheld computers, or some other computing system and/or device. EX-1006 [0029]-[0030]. Software Update (“SU) device 120 and a cloud device 130 were servers that communicated with the connected and computing devices 101, 110 through network 140 in support of managing software updates. EX-1006 [0012].

61. In operation, the SU device 120 informed the connected device 101 that a software package was available to download, and in turn the connected device 101 downloaded the software package (see Arrow A). The connected device 101 further required an installation consent from a user or third party before installation of the software package. EX-1006 [0013].

62. To acquire installation consent, the connected device 101 sent a software update available indication to the cloud device 130 (see Arrow B), which forwarded the software update available indication to the computing device 110 (see Arrow C). The computing device provided a software update available notification to and received an input indicating installation consent from the user. EX-1006 [0014].

63. In response to the input, the computing device 110 sent a response indication based on the input to the cloud device 130 (see Arrow C). The cloud device 130 forwarded the response indication to the connected device 101 (see Arrow B). Based on the response indication, e.g., accept, defer, or reject, the connected device 101 performed particular operation. For, example, when the input was an acceptance of the software package, the response indication triggers an installation of the software package by the connected device 101. EX-1006 [0015].

**2. It was known to download a software update and apply it to a controlled in response to an update command from a smartphone**

64. It was known to let the user of a controlling device know that a software update was available for a controlled device. Upon receipt of a user “install now” input on the controlling device, software was downloaded and installed on the controlled device. EX-1007 [0075]. Thus, a smartphone could issue a single command to download the update and apply it to the controlled device.

**3. It was known to check the state of a device prior to updating the software**

65. In order to successfully update software in a device, it was known to first check the state of the device to ensure it is an appropriate time to update the device. For example, one prior art system automatically and

remotely updates the software in electronic controls units (ECUs) found in vehicles. From time to time the vehicle manufacturer would issue software updates to provide enhancements or corrections or other changes to software and data stored in the various ECUs. The updates were installed by reflashing the ECU flash memories. EX-1007 [0005]. A processor monitored the ECU and the vehicle state and to execute the update only while the ECU is in a predetermined ECU state and the vehicle is in the predetermined state, and the updates can be completed in a predetermined period of time. EX-1007 [0248].

## **VI. IDENTIFICATION OF CHALLENGES**

### **A. Challenged Claims**

66. Claims 1-20, (the “Challenged Claims”) of the ’756 Patent are unpatentable under 35 U.S.C. § in view of following grounds:

<b>Grounds</b>	<b>Claims</b>	<b>Basis</b>	<b>References</b>
Ground 1	1-4, 6-10, 12-17, 19-20	103	Storto
Ground 2	5, 11, 18	103	Storto in view of Won

### **B. Prior Art**

67. I have been informed that U.S. Patent Publication No. 2017/0351503 (“Storto”) (EX-1004) and, U.S. Patent Publication No.

2017/0351503 (“Won”) (EX-1005) qualify as prior art under §102 for purposes of this IPR.

## **VII. IDENTIFICATION OF HOW CLAIMS ARE UNPATENTABLE**

### **A. Ground 1: Claims 1-4, 6-10, 12-17, 19-20 Are Obvious Over Storto**

#### **1. The Storto Reference**

68. Storto is generally directed software upgrades appliances with embeded computing devices. Storto explains that there is an increasing number of network-connected devices of various types, including in an Internet of Things (IoT) infrastructure. Storto explains that a networking device typically comprises a set of hardware elements, including a software-controlled processor. The basic operation of the device is controlled by a so-called firmware, i.e., software that provides control, monitoring and data manipulation of engineered products and systems. In order to keep the device up to date with the latest technology developments, the firmware may need to be updated, e.g., to allow communication according to new standards. EX-1004 [0002].

69. Storto explains that firmware update methods are generally known and provides a known technique for remotely updating software on an electronic device connected to a network. The electronic devices have a non-volatile rewritable storage unit divided into at least two partitions, one

of which will contain core firmware and the other of which will contain auxiliary software. When an update was received at the device, the updated core firmware was written to overwrite the partition in the rewritable storage unit that contained the auxiliary software. When this was completed and verified, the previous version of the core firmware stored in the storage unit was disabled from execution by the device. Next, the updated auxiliary software was written to overwrite the old version of the core firmware. When this write was complete, the device determines a suitable time for it to be rebooted to execute the updated software. EX-1004 [0003].

70. Storto explained that the prior art updating techniques were not fully automated but generally required some type of user input through a user interface. For example, Storto explained that in many cases it was necessary to obtain user approval before applying a new firmware version in a device, due to operational or regulatory constraints. This process was known as an opt-in firmware update. Sophisticated devices, such as smartphones, having their own user interface, may simply run a firmware update application that asks the user for approval via the user interface of that device. EX-1004 [0004].

71. Storto identified that one problem associated with the prior art updating technique is that there is a large group of devices, such as

appliances with embedded computing devices, which do not have their own user interface or have an interface that is very limited, e.g., comprises only 7 - segment display and buttons or knobs. For example, the embedded computing devices may include devices that have limited man-machine user interfaces or do not have any man-machine user interface at all such as a washing machine, a microwave, a dishwasher, a movement sensor, a temperature sensor, a window opening sensor, a camera, a microphone, a motor, a driver, a loudspeaker. EX-1004 [0006], [0027].

72. As a solution to this problem, Storto proposed a method and system a remote management system with a push notification provided to a controlling device with a user-friendly interface like a smartphone, to control a software update on a controlled device, such as an appliance with limited user interface. EX-1004 [0028].

73. FIG . 1 illustrates an example of a system for installing software (such as firmware) on a controlled device 110 .

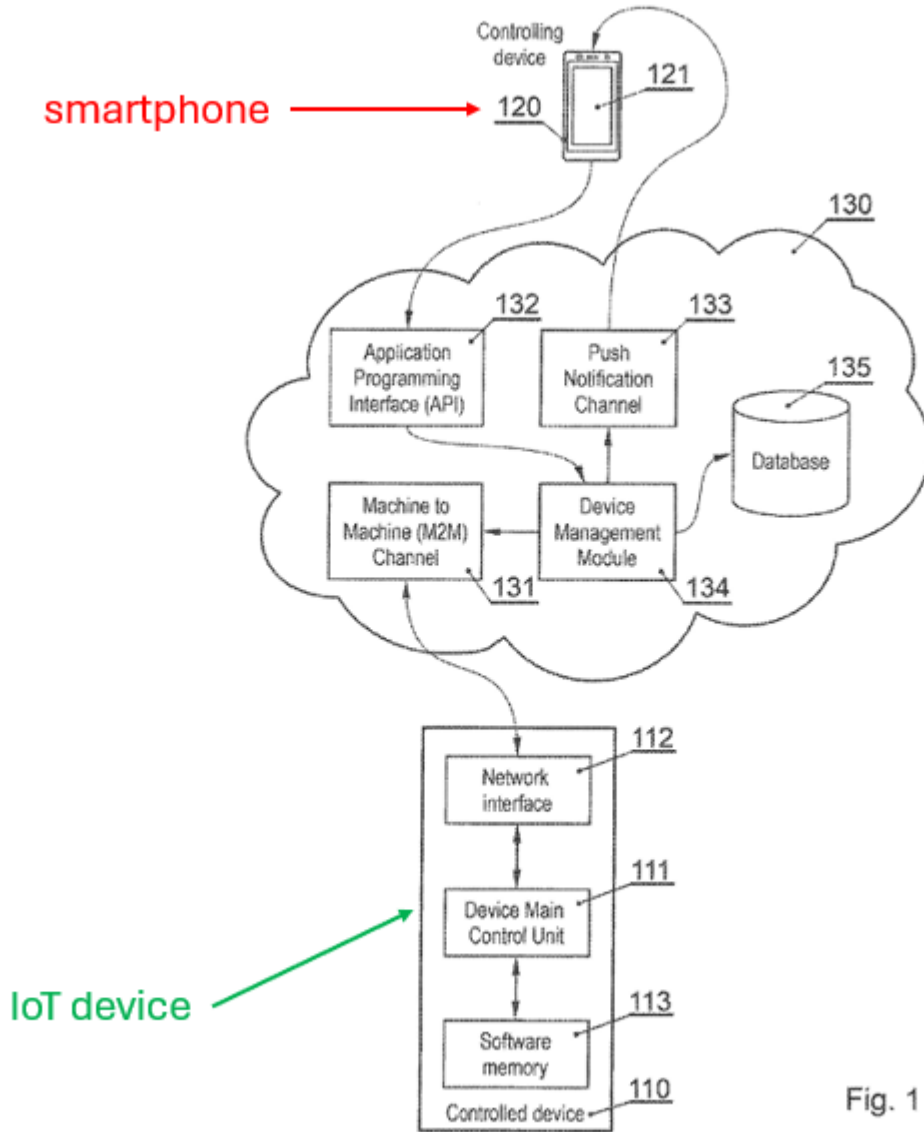


Fig. 1

74. The controlled device comprises a software memory 113, wherein the software that can be updated is stored, and a processor 111 that is controlled by the software stored in the memory 113. The controlled device 110 may communicate with other devices via a network interface 112. The network interface 112 allows connecting the controlled device 110 to a network 130, wherein a cloud system may operate including various

modules. The cloud system is operable by one or more servers. The modules may communicate with the controlled device 110 via a machine to machine (M2M) channel 131. The cloud system also includes a device management module 134 with its associated database 135, an application programming interface (API) 132 and a push notification channel 133 towards an application 121 running on a controlling device 120. EX-1004 [0031]-[0032].

75. FIGS . 2A and 2B present a flowchart for software upgrade with user opt- in. The color coding corresponds to the same claim limitation steps that are identified above for FIG. 6 of the '756 Patent for Claim 14:

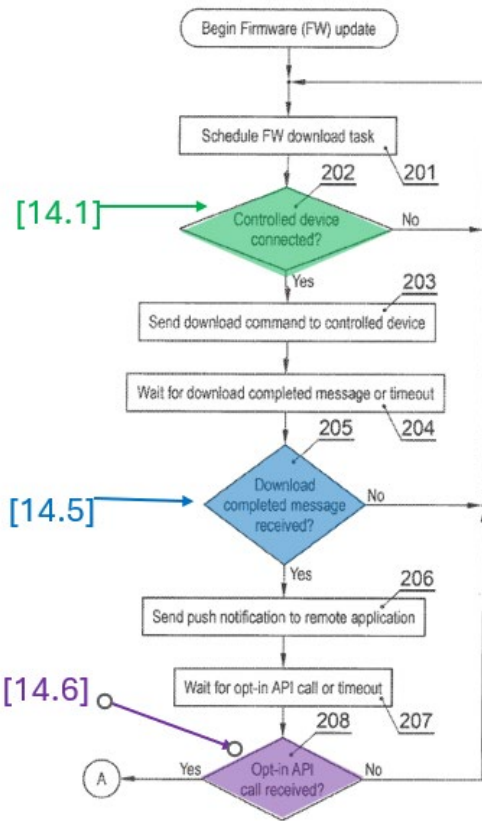


Fig. 2A

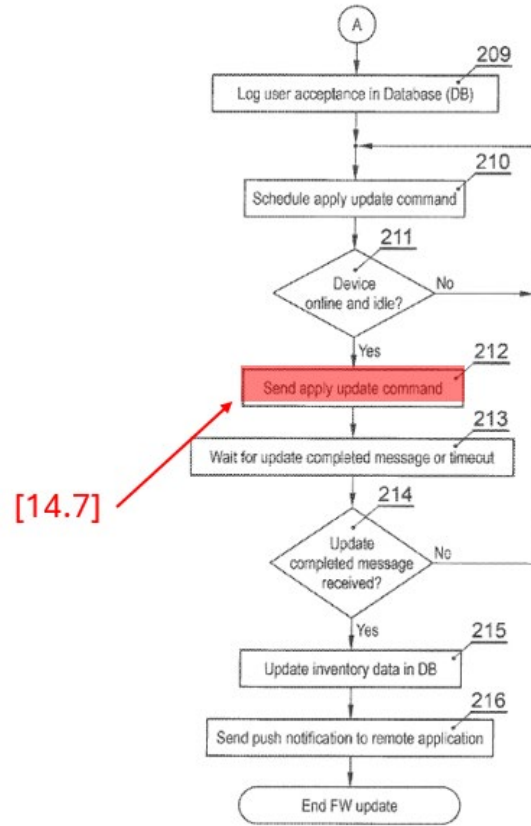


Fig. 2B

76. In step 201, the device management module 134 schedules a software (e.g. firmware - FW) download task. In step 202 the device management module 134 checks the connection state of the controlled device. In step 203, if the controlled device 110 is connected, a download command is sent to the controlled device 110. In step 204, device management module 134 waits until a download completed message is received from the controlled device 110. In step 205, if the download completed message is not received before a timeout occurs, then the task is rescheduled for execution. EX-1004 [0036].

77. In step 206, once the download complete message is received, the cloud system 130 sends a push notification to the remote controlling device. In step 207, cloud system waits for reception of a dedicated opt-in API message from the remote device. The remote controlling device 120 requests the owner of the controlled device 110 to accept the software upgrade for the controlled device 110 and upon acceptance (i.e., receiving an acceptance message), notifies the cloud system 130 via an opt-in API call. In step 208, once the opt-in API call is received, in step 209 the cloud system 130 logs user acceptance message and associated metadata ( such as a timestamp and a remote application ID ) in the cloud system database 135. In step 210, the system schedules an apply update task to the target controlled device 110. In step 211, as part of processing the apply update task, the device management module 134 checks the connection and functionality state of the controlled device 110. In step 212, if the controlled device is connected, and in an idle state (e.g., an operating cycle is not running), an apply update command is sent to the controlled device 110 (i.e., the device is instructed to install the software file). In step 213, the device management module 134 waits until an update completed message is received from the controlled device 110. In step 214, if an update completed

message (i.e., a message confirming software installation) is not received before a timeout occurs, then the task is rescheduled for execution.

78. In step 215, once the update completed message is received the system 130 updates the inventory data in the cloud system database 135. In step 216, the system 130 sends push notification to the remote device to inform the owner of the controlled device 110 of the update completion.

EX-1004 [0037].

**2. Detailed Application of Storto to Claims 1-4, 6-10, 12-17, 19-20**

79. Independent Claim 14 is a computer implemented method that recites the four method steps discussed above, and thus this Petition first addresses Claim 14. Independent Claim 1 is a corresponding computer system claim, and independent Claim 20 is a corresponding computer readable medium claim, both reciting limitations corresponding to the four method steps recited in Claim 14, and both will be discussed below with reference to the analysis of Claim 14.

**Claim 14**

*[14.0] A computer-implemented method comprising:*

80. Storto discloses a method for installing software on a controlled device. EX-1004 [0001] The method is implemented by cloud system network (purple).

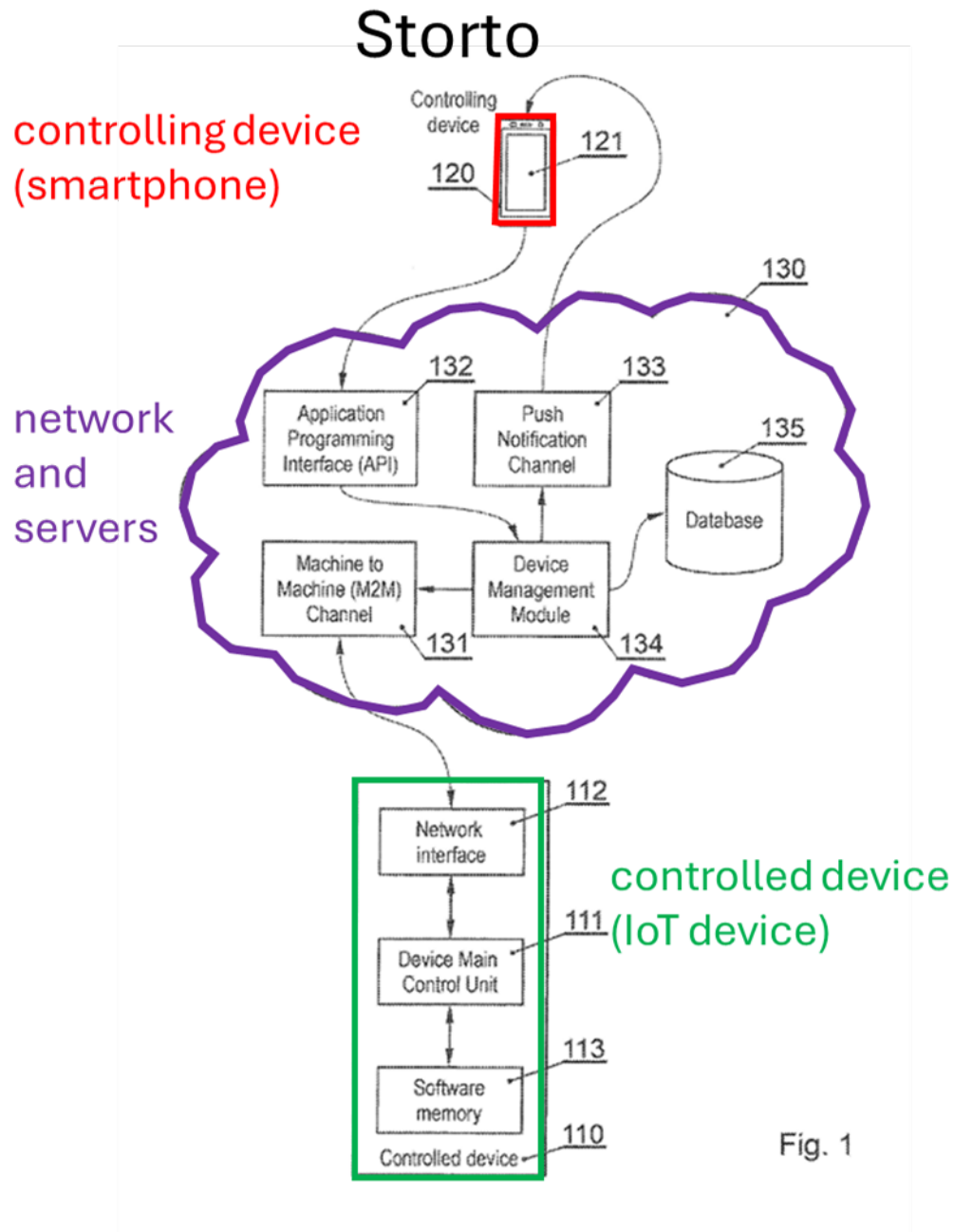


Fig. 1

EX-1004 FIG.1.

81. The cloud system includes one or more servers running software modules that manage the installation of software on the controlled device [*a computer implemented method*] EX-1004 [0031]. For example, FIGs. 2A and 2B illustrate a flowchart describing the instructions execute by modules in the cloud system to perform a software upgrade with user opt-in. EX-1004 [0020].

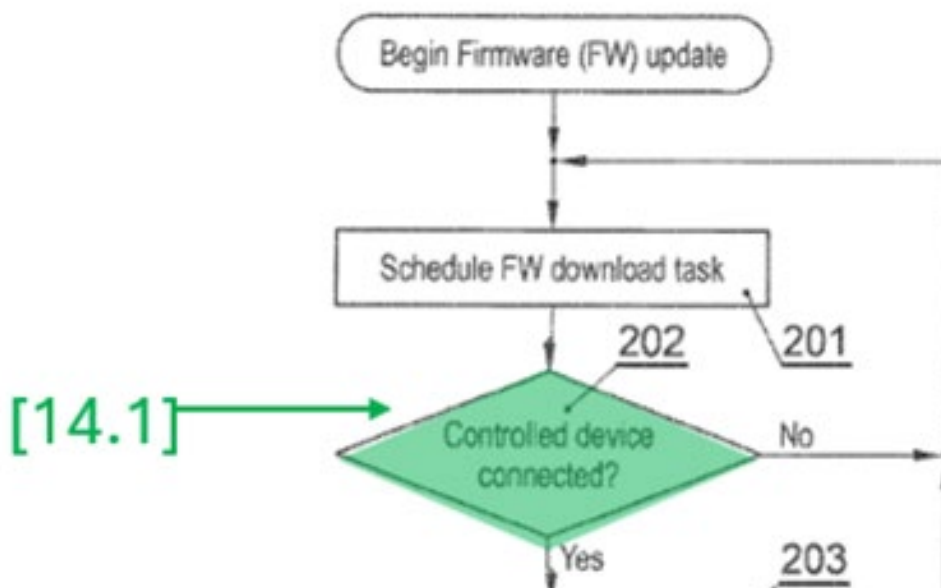
82. Storto discloses that an IoT controlled device communicates with the cloud service and cloud service communicates with a controlling device (smartphone) via channels. EX-1004 [0053]. The modules in the cloud service may communicate with the controlled device 110 via a machine to machine ( M2M ) channel 131. The cloud system also includes a device management module 134 with its associated database 135, an Application Programming Interface (API) 132 and a push notification channel 133 towards an application 121 running on a controlling device 120. EX-1004 [0031].

83. Storto discloses two examples of this limitation.

### **EXAMPLE 1**

84. Storto discloses receiving the connection status [*state information about the device for which an update is available*] from the controlled device [*device*].

85. FIG 2A illustrates that in step 201, the device management module 134 schedules a software (e.g. firmware—FW) download task for a controlled device. When processing such task in step 202, the device management module 134 checks the connection state of the controlled device 110 [*receiving, from the device for which an update is available, state information about the device*](green). EX-1004 [0035-0036]. The device management module communicates with the controlled device 110 via a machine to machine ( M2M ) channel 131. EX-1004 [0031]. In this example, the *state information* is the connection state of the device.



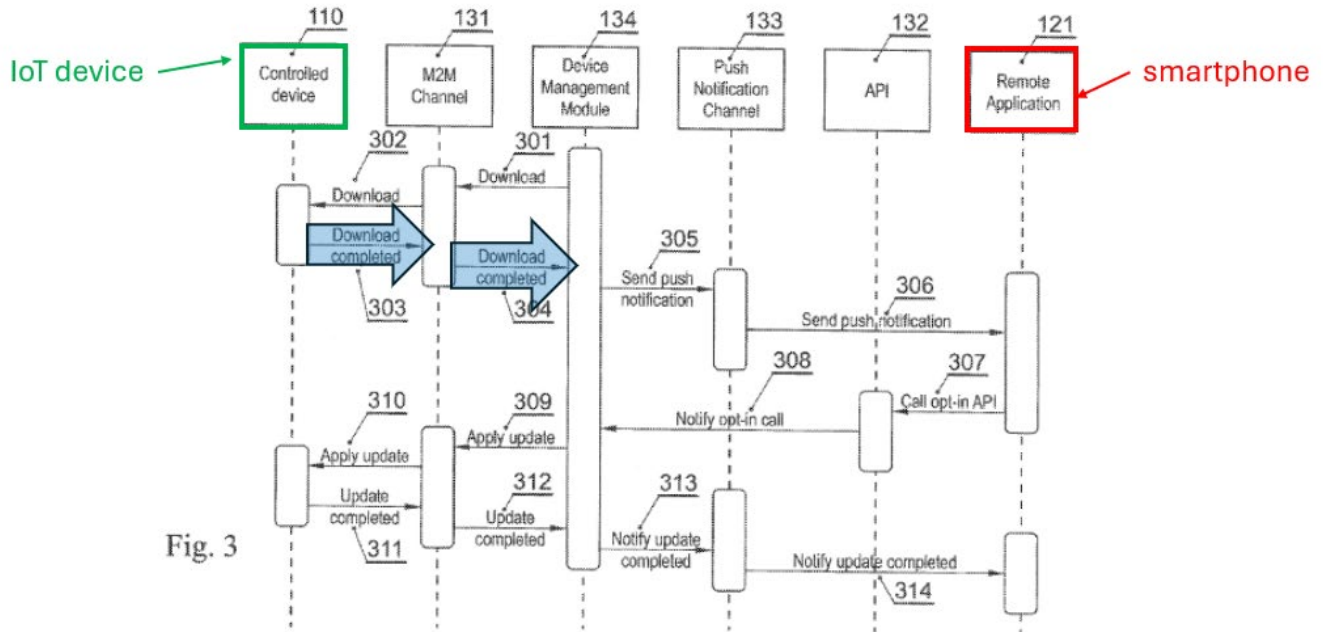
EX-1004 FIG. 2A.

**EXAMPLE 2**

86. Storto also discloses the device management module 134 receives a “download complete” 303/304 message [*state information about the device for which an update is available*] from the controlled device [*device*] via the M2M channel 131;

The device management module 134 sends a download command 301 to the M2M channel 131, which delivers it as a message 302 to the controlled device 110. Once the controlled device 110 has completed the download, it sends back a download completed message 303 to the M2M channel 131, which delivers it to the device management module 134 .

EX-1004 [0043].



EX-1004 FIG. 3.

87. In the above example, the *state information* received is a download complete message.

88. Storto's disclosure is consistent with the disclosure of the '756 Patent that confirms state information may include the download completed message:

It may be that the state information provided by the second device 120 (e.g. in messages 530) includes a status of any such download.

EX-1001` 10:20-22.

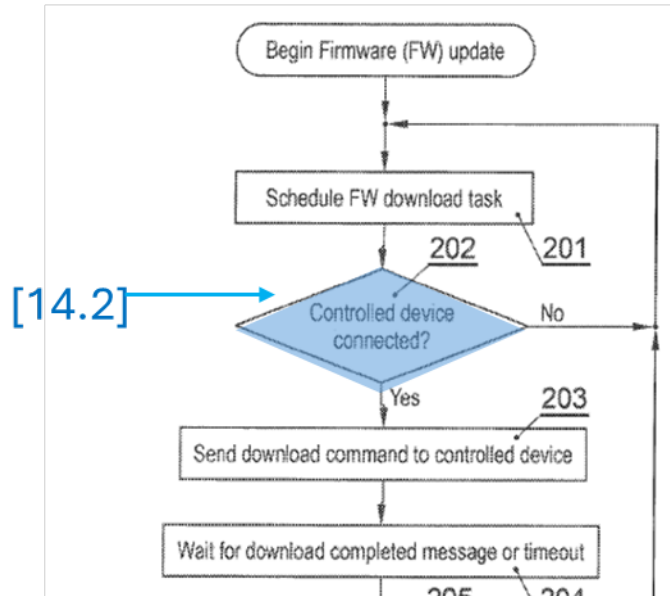
89. Thus, Storto discloses this limitation.

***[14.2] determining, based on the state information about the device for which the update is available, that the device is in a condition where the device is ready to perform the update;***

90. Storto discloses this limitation using the two examples of limitation [14.1]. Storto discloses determining that the controlled device is ready to perform the update [*is in a condition where the device is ready to perform the update*] based on its connection state and/or download status of the controlled device [*state information about the device for which the update is available.*]

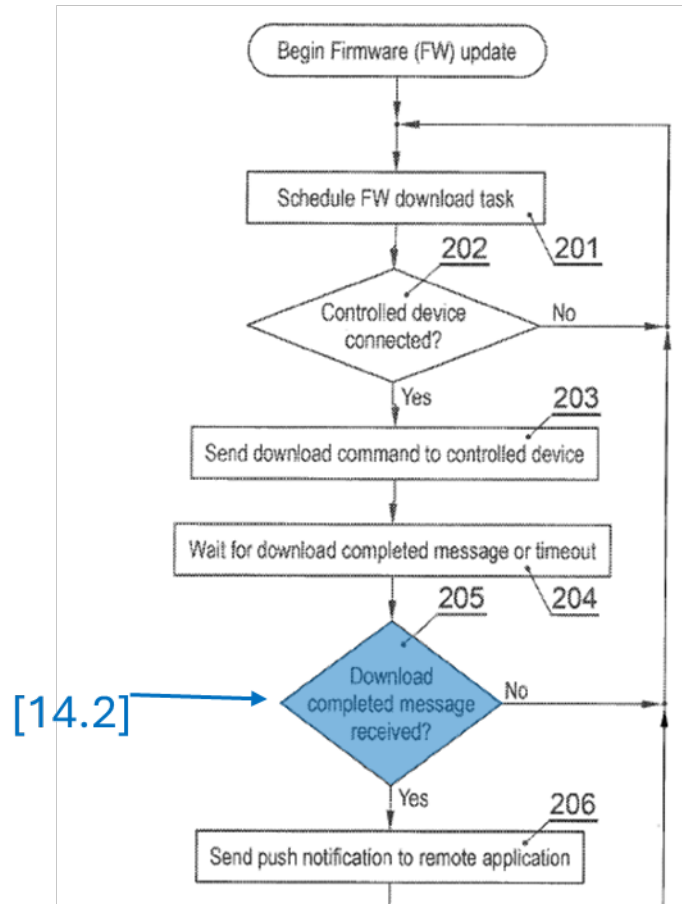
91. With references to FIG. 2A, Storto discloses that in step 201, the device management module 134 schedules a software (e.g. firmware—FW) download task [*update*]. EX-1004 FIG. 2A.

92. When processing such task in step 202 the device management module 134 checks the connection state of the controlled device 110 [*determine, based on the state information about the device for which the update is available*], and if the controlled device is connected, the controlled device is ready to receive the download in step 203 [*that the device is in a condition where the device is ready to perform the update*].



EX-1004 FIG. 2A.

93. With respect to Example 2, a download command is sent to the controlled device 110 in step 203 and device management module 134 waits until a download completed message is received from the controlled device 110 in step 204. In step 205 if download message complete is received, *the device is in a condition where the device is ready to perform the update* (blue). If the download completed message is not received before a timeout occurs, then the task is rescheduled for execution. EX-1005 [0036].



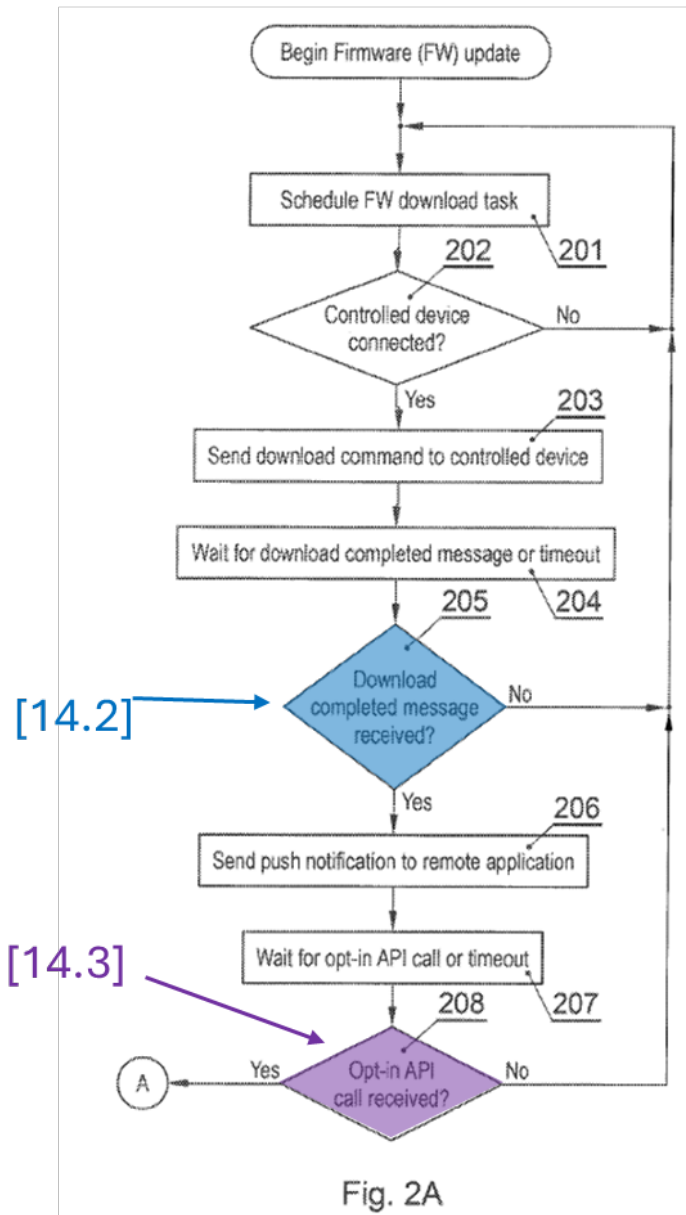
EX-1004 FIG. 2A.

94. Thus, Storto determines based on the connection state of the controlled device and/or the download completed message that the controlled device is ready to perform the update.

***[14.3] receiving, from another device, an indication to update the device for which the update is available; and***

95. Storto discloses this limitation by receiving an opt-in API call *[indication to update the device for which the update is available]* from the controlling device *[another device]*.

96. With reference to FIG 2A, once the download complete message is received, in step 206, the cloud system 130 sends a push notification to a remote application 121 registered for the controlled device 110 [*device*] and waits for reception of a dedicated opt-in API call [*indication to update*] from the remote application 121 on the controlling device 120 [*another device*] in step 207 [*receive, from another device, an indication to update the device for which the update is available*](purple).



EX-1004 Fig. 2A.

97. Specifically, the remote application 121 requests the owner of the controlled device 110 to accept the software upgrade for the controlled device 110 and upon acceptance (i.e. receiving an acceptance message), notifies the cloud system 130 via an opt-in API call. In step 208, when the

opt-in call is received it is *an indication to update the device for which the update is available* (purple). In the case that the opt-in API call is not received before a timeout occurs, the cloud system 130 issues a new push notification to the remote application 121 and waits again. EX-1005 [0037].

98. Turning to FIG 3, the API Call (purple) [*indication*] is received via the API 132.

The remote application 121 requests a user acceptance of software upgrade for the controlled device 110 and executes an opt-in API call 307 to notify the user acceptance. The API 132, upon receipt of the incoming opt-in call, notifies the device management module 134 via a message 308.

EX-1004 [0045-46].

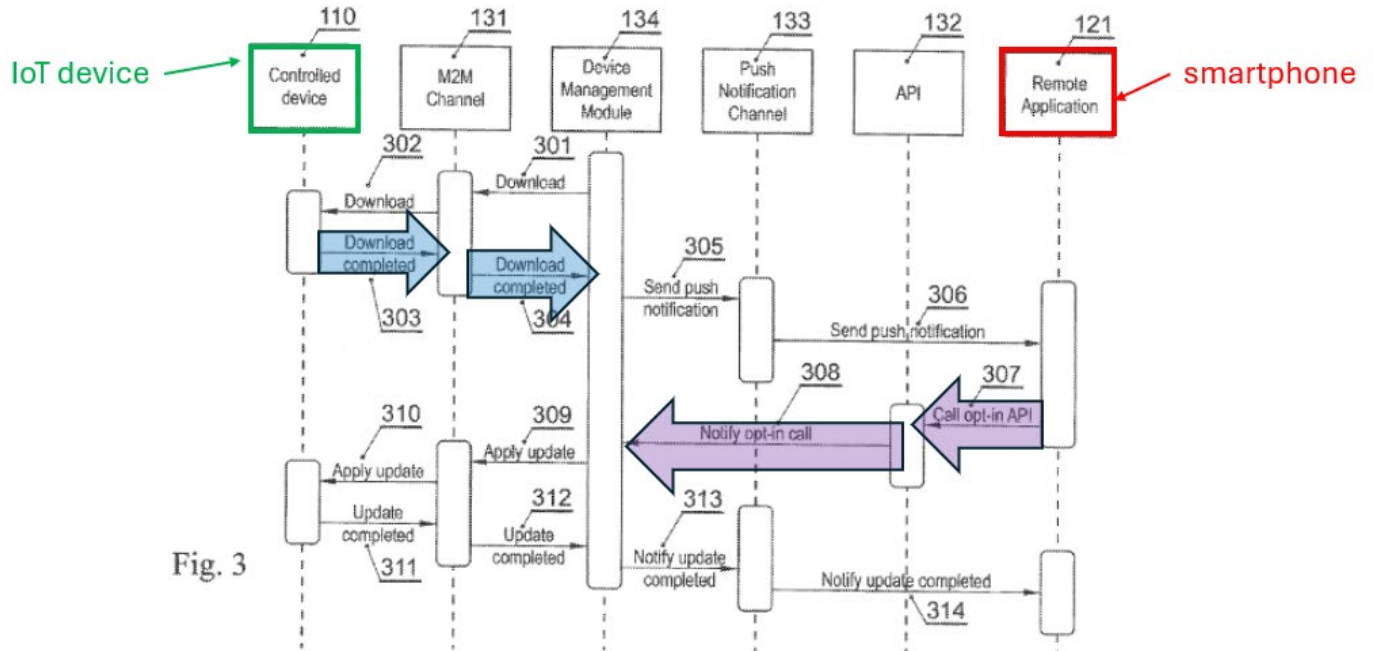


Fig. 3

EX-1004 FIG. 3.

99. Thus, Storto discloses this limitation in that the opt-in API call is received from the controlling device via the API of the cloud system providing an indication to update the controlled device.

*[14.4] after determining that the device for which the update is available is in a condition to perform the update and receiving the indication to update the device, send, to the device for which the update is available, an indication to begin performing the update, wherein the device for which the update is available is configured to begin updating responsive to such an indication without any direct interaction with the device for which the update is available.*

100. Storto discloses this limitation. Specifically with reference to FIGs. 2A and 2B, the flow diagram shows that limitation [14.4] [send, to the

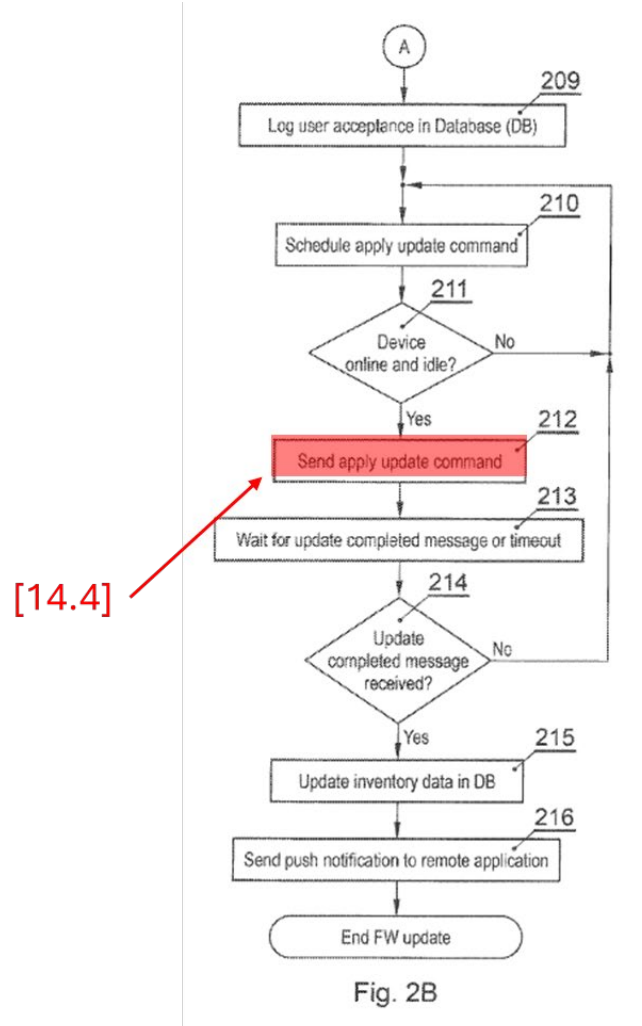
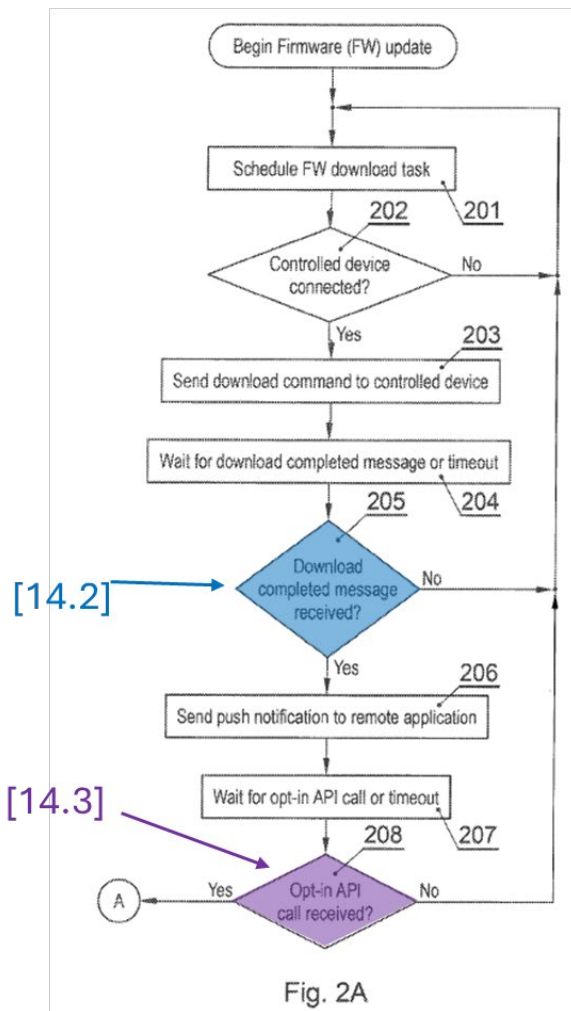
device for which the update is available using the communications

subsystem, an indication to begin performing the update](red) is performed

after limitations [14.2] [determining that the device for which the update is

available is in a condition to perform the update](blue) and [14.3][receiving

the indication to update the device](purple):



[14.2]

[14.3]

[14.4]

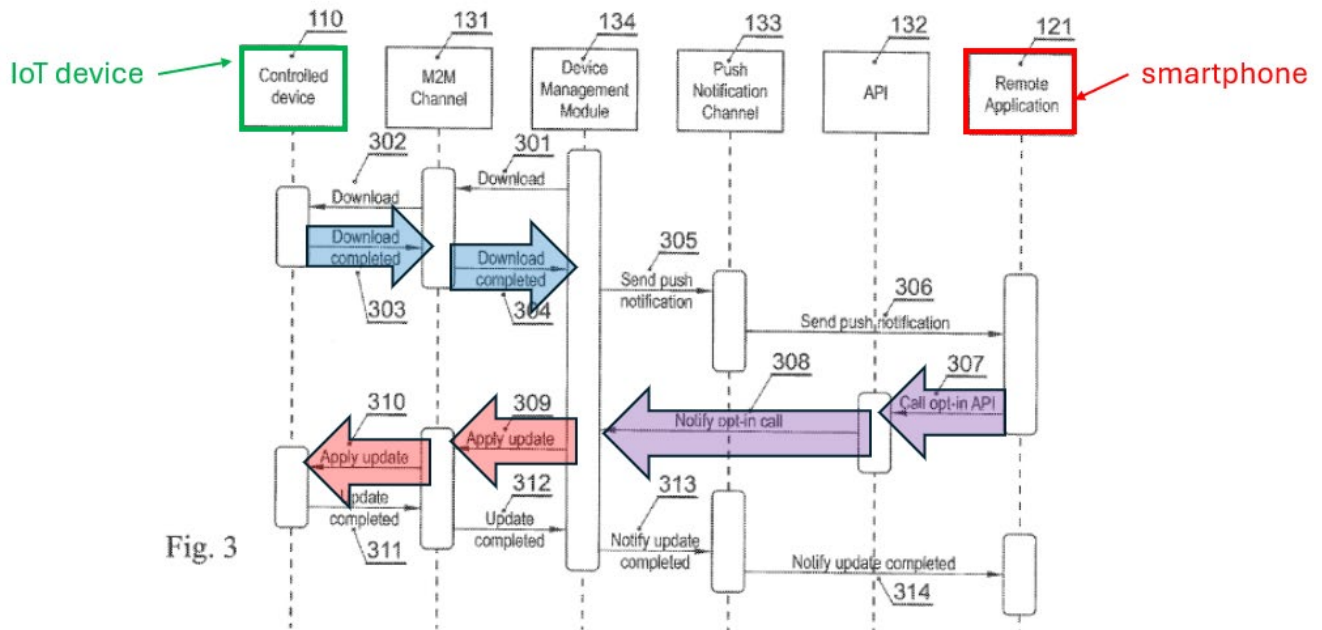
EX-1004 FIGs. 2A and 2B.

101. Storto further discloses that after the opt-in API call [*indication to update*] is received, in step 209 the cloud system 130 logs user acceptance message and associated metadata (such as a timestamp and a remote application ID) in the cloud system database 135 for auditing purposes. Then, in step 210, the system schedules (*i.e.*, determines the time at which the update task shall be performed) an apply update task to the target controlled device 110. When processing the apply update task in step 211, the device management module 134 checks the connection and functionality state of the controlled device 110 and if the controlled device 110 is connected, an apply update command is sent to the controlled device 110 (*i.e.*, the device is instructed to install the software file) in step 212 [*send, to the device for which the update is available, an indication to begin performing the update*]. In step 213, the device management module 134 waits until an update completed message is received from the controlled device 110. EX-1004 [0038].

102. As further illustrated below referring to FIG. 3, the device management module 134 sends an “apply update” 309/310 (red)[*indication to begin*] via the M2M channel, to the controlled device [*device*]:

The device management module 134 then sends to the M2M channel 131 an apply update command 309, which is delivered as a message 310 to the controlled device 110. Once the controlled device 110 has completed the software upgrade, it sends an update completed message 311 to M2M channel 131, which delivers it to the device management module 134 as a message 312.

EX-1004 [0047,48].



EX-1004 FIG. 3.

103. Storto further describes that the controlled device does not have its own user interface, and thus a controlling device with a user friendly interface like a smartphone is used to control a software update on a controlled device, such as an appliance with limited user interface [wherein the device for which the update is available is configured to begin updating

*responsive to such an indication without any direct interaction with the device for which the update is available*]. EX-1004 [0027][0028].

104. Storto's disclosure that the update is performed *without any direct interaction with the device for which the update is available* is consistent with the disclosure in the '756 Patent that the update is done without the user interacting with any physical interface elements on the updated device:

More particularly, update of the second device 120 is initiated by way of the first device 100, no direction interaction with the second device 120 such by way of any physical interface elements (*e.g.*, buttons, keys, display mounted on the second device 120, etc.) is required to update the second device 120. In other words, as further described below, after update of the second device 120 is initiated as a consequence of an indication sent from the first device 100 to the switchboard server 110, update of the second device 120 will be performed without any direct interaction with the second device 120 (*e.g.* interaction controls provided on/by the second device 120, etc.). Put differently, the second device 120 is configured to begin performing the update responsive to a corresponding indication without any interaction requiring an operator to attend the second device 120. For example, the update will be triggered without an operator providing any input to the second device 120 by way of a control panel, button, and/or user interface, etc. thereof.

EX-1001 8:64-9:15.

**Claim 15**

***[15.0] The method of claim 14, further comprising:***

105. Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.0].

***[15.1] receiving, from the device for which the update is available, one or more indications as to a status of the performing of the update; and***

106. Storto discloses this limitation. Storto discloses that in step 213, the device management module 134 waits until an update completed message is received from the controlled device 110 [*receiving, from the device for which the update is available, one or more indications as to a status of the performing of the update*]. In step 214, if an update completed message (*i.e.*, a message confirming software installation) is not received before a timeout occurs then the task is rescheduled for execution. EX-1004 [0038].

107. As further illustrated below referring to FIG. 3, the controlled device 110 sends an “update completed” 311/312 (yellow)[*one or more indications as to a status of the performing of the update*] via the M2M channel, to the device management module 134:

Once the controlled device 110 has completed the software upgrade, it sends an update completed message 311 to M2M channel 131, which delivers it to the device management module 134 as a message 312.

EX-1004 [0048].

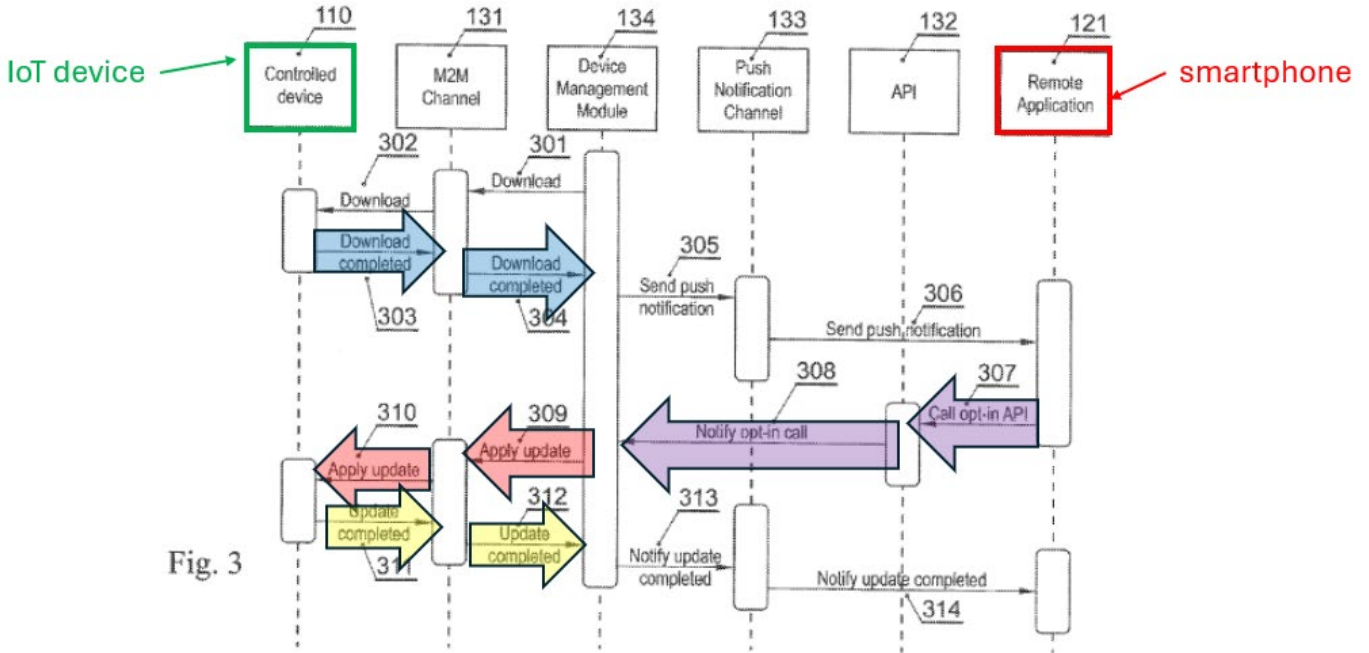


Fig. 3

EX-1004 FIG. 3.

***[15.2] sending, to the another device, information about the performing of the update based on the one or more indications.***

108. Storto discloses this limitation. Storto discloses that in step 215, once the update completed message is received, the system 130 updates the inventory data in the cloud system database 135. Then, in step 216, the system 130 sends push notification to the remote application 121 to inform the owner of the controlled device 110 of the update completion [*sending, to the another device, information about the performing of the update based on*

*the one or more indications]* and terminates execution for this controlled device 110. EX-1004 [0039].

109. As further illustrated below referring to FIG. 3, the device management module 134 sends a “notify update completed” 313/314 (orange)[*information about the performing of the update based on the one or more indications]* via the push notification channel 133 and API 132, to the remote application on the controlling device:

The device management module 134 can optionally issue a push notification 313 to inform the controlled device owner that the software upgrade process is completed. In case such push notification is used, it is delivered to the remote application 121 by the push notification channel 133 as a message 314 .

EX-1004 [0049].

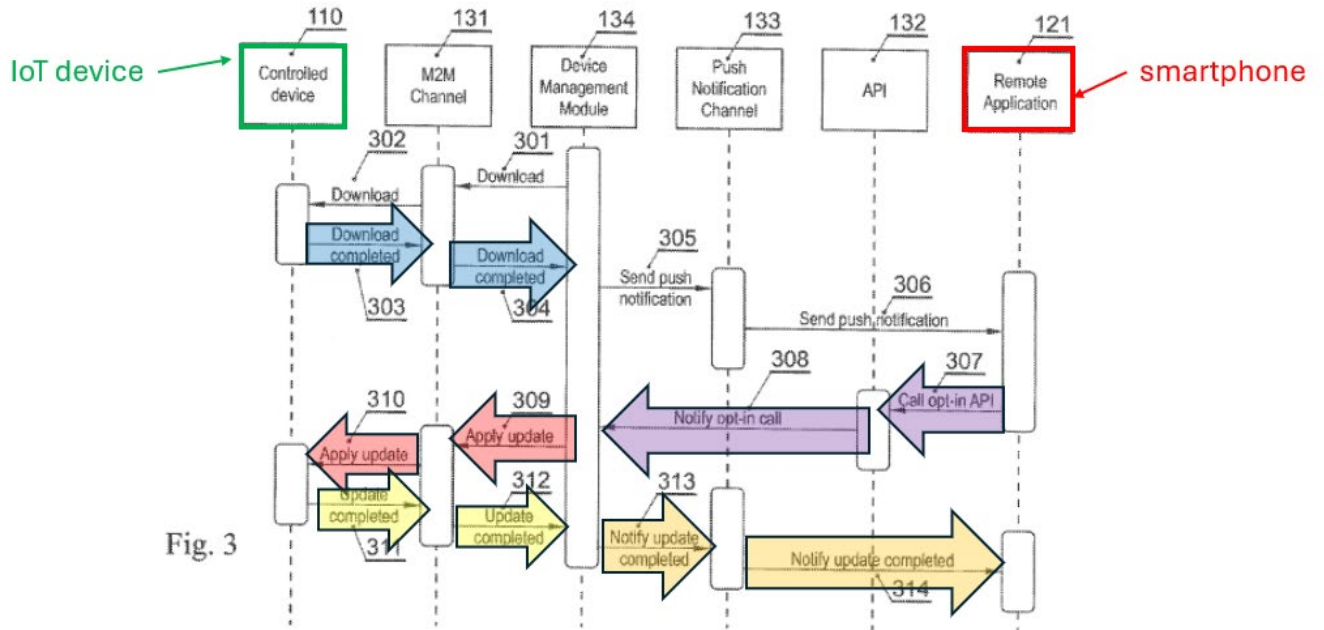


Fig. 3

EX-1004 FIG. 3.

**Claim 16**

***[16] The method of claim 14, wherein the state information about the device for which the update is available indicates whether the device is ready to perform the update.***

110. Storto discloses this limitation. Storto discloses that in step 204, the device management module receives state information in the form of a download completed message from the controlled device 110 *indicates whether the device is ready to perform the update.* EX-1004 [0036].

**Claim 17**

***[17] The method of claim 14, wherein the state information about the device for which the update is available indicates whether the device for which the update is available has downloaded the update.***

111. Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.2].

**Claim 19**

*[19] The method of claim 14, wherein the another device is configured to provide a user interface, responsive to the indication that the device for which the update is available is ready to perform the update, for initiating the update of the device for which the update is available and wherein the another device is configured to send the indication to update the device for which the update is available responsive to initiation of the update via the user interface.*

112. Storto discloses this limitation. Storto discloses that recited *another device* is the controlling device and that the remote application 121 is operated by the remote controlling device 120 and offers a convenient man-machine user interface [*user interface*] for that application (for example, a smartphone or a tablet device offering a touch-sensitive graphical user interface) [*wherein the another device is configured to provide a user interface*]. EX-1004 [0037].

113. Storto further discloses that the user interface of the controlling device receives the push notification in step 206 that the controlled device is ready for updating [*responsive to the indication that the device for which the update is available is ready to perform the update*], requests the owner of the controlled device 110 to accept the software upgrade for the controlled

device 110 [*initiating the update of the device for which the update is available*] and upon acceptance (i.e. receiving an acceptance message), notifies the cloud system 130 via an opt-in API call [*configured to send the indication to update the device for which the update is available responsive to initiation of the update via the user interface*]. EX-1004 [0037].

**Claim 1**

***[1.0] A computer system comprising:***

***a processor;***

***a communications subsystem; and***

***a non-transitory computer-readable storage medium storing instructions that when executed by the processor adapt the computer system to:***

114. Storto discloses this claim limitation. As illustrated in FIG. 1, Storto discloses a network and servers (**purple**) for installing software on a controlled device (**green**). EX-1004 [0001].

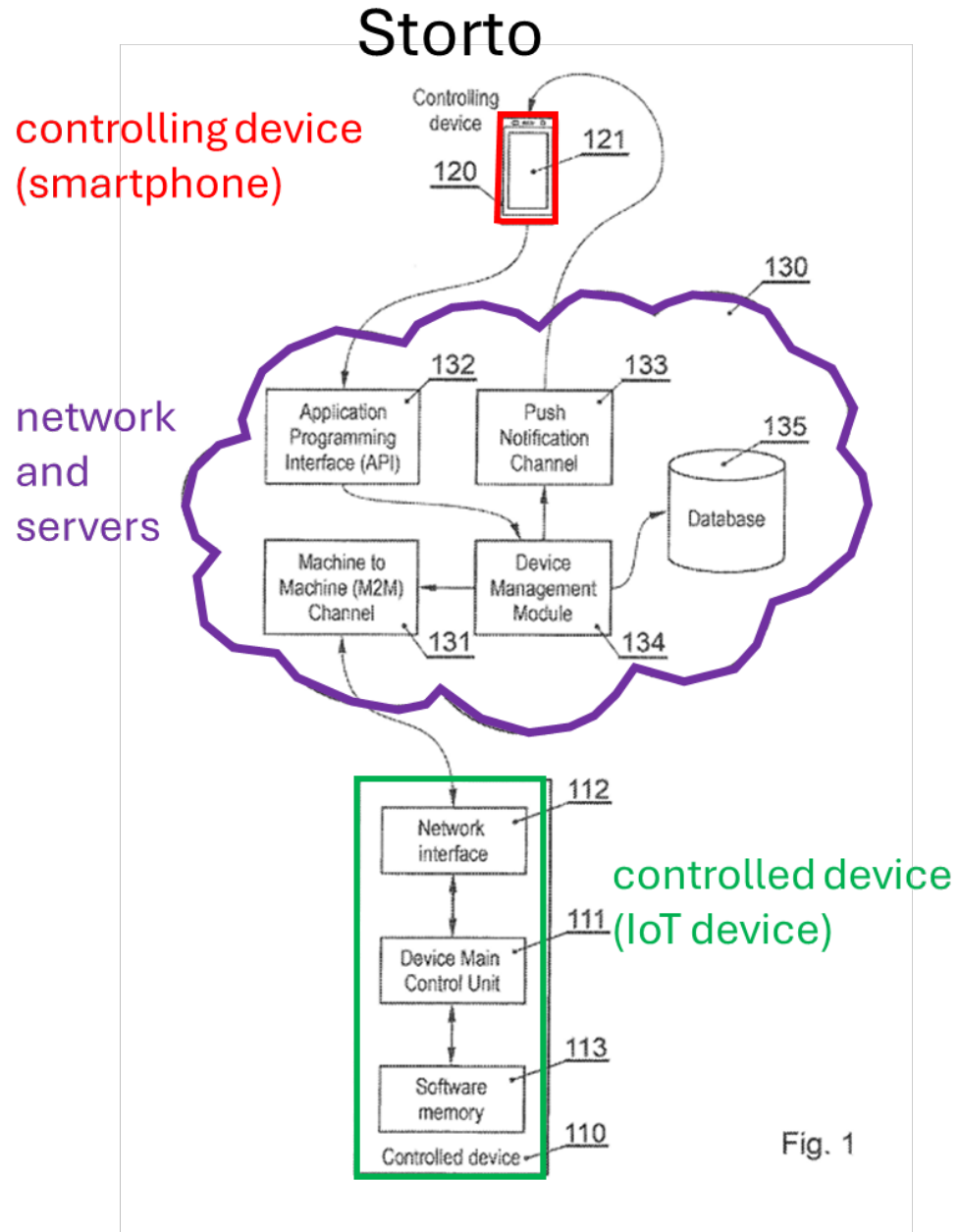


Fig. 1

EX-1004 FIG.1.

115. The cloud system includes one or more servers [a processor] running software modules [a non transitory computer readable storage medium storing instructions that when executed by the processor adapt the computer system to] that manage the installation of software on the

controlled device. EX-1004 [0031]. For example, FIGs. 2A and 2B illustrate a flowchart describing the instructions executed by modules in the cloud system to perform a software upgrade with user opt-in. EX-1004 [0020].

Storto discloses that an IoT controlled devices communicates with the cloud service and cloud service communicates with a controlling device (smartphone) via channels [*communications subsystem*]. EX-1004 [0053]. The modules in the cloud service may communicate with the controlled device 110 via a machine to machine ( M2M ) channel 131. The cloud system also includes a device management module 134 with its associated database 135, an application programming interface ( API ) 132 and a push notification channel 133 towards an application 121 running on a controlling device 120 (red). EX-1004 [0031]

***[1.1] receive, from a device for which an update is available, using the communications subsystem, state information about the device;***

116. Storto discloses several examples of this limitation as discussed above with respect to limitation [14.1]

### **EXAMPLE 1**

117. Storto discloses receiving the connection status [*state information about the device for which an update is available*] from the

controlled device [*device*], via the M2M channel 131 [*communications subsystem*], for the same reasons as discussed above with respect to limitation [14.1].

## **EXAMPLE 2**

118. Storto also discloses the device management module 134 receives a “download complete” 303/304 message [*state information about the device for which an update is available*] from the controlled device [*device*] via the M2M channel 131 [*communications subsystem*]; for the same reasons as discussed above with respect to limitation [14.1]

119. Thus Storto discloses this limitation.

***[1.2] determine, by the processor based on the state information about the device for which the update is available, that the device is in a condition where the device is ready to perform the update;***

120. Storto discloses this limitation for the same reasons as described above with respect to limitation [14.2].

***[1.3] receive, from another device using the communications subsystem, an indication to update the device for which the update is available; and***

121. Storto discloses this limitation for the same reasons as described above with respect to limitation [14.3], where the API call [*indication to update*] is received via the API 132 [*communications subsystem*].

***[1.4] after determining that the device for which the update is available is in a condition to perform the update and receiving the indication to update the device, send, to the device for which the update is available using the communications subsystem, an indication to begin performing the update, wherein the device for which the update is available is configured to begin updating responsive to such an indication without any direct interaction with the device for which the update is available.***

122. Storto discloses this limitation for the same reasons as discussed above with respect to limitation [14.4]. Where the indication to begin performing the update is via the M2M Channel 131 [*communications subsystem*].

## **Claim 2**

***[2.0] The computer system of claim 1, wherein the instructions, when executed by the processor, further adapt the computer system to:***

123. Storto discloses this limitation for the same reasons as discussed with respect to limitation [1.0].

***[2.1] receive, from the device for which the update is available, one or more indications as to a status of the performing of the update; and***

***Storto discloses this limitation for the same reasons as described above with respect to limitation [15.1][2.2] send, to the another device, information about the performing of the update based on the one or more indications.***

**Storto discloses this limitation for the same reasons as described above with respect to limitation [15.2]. Claim 3**

*[3] The computer system of claim 1, wherein the state information about the device for which the update is available indicates whether the device is ready to perform the update.*

124. Storto discloses this limitation for the same reasons as described above with respect to Claim 16.

**Claim 4**

*[4] The computer system of claim 1, wherein the state information about the device for which the update is available indicates whether the device for which the update is available has downloaded the update.*

125. Storto discloses this limitation for the same reasons as discussed with respect to Claim 16.

**Claim 6**

*[6] The computer system of claim 1, wherein the computer system communicates with each of the device for which the update is available and the another device via a network, wherein the device for which the update is available and the another device cannot communicate directly with each other via the network.*

126. Storto discloses this limitation. Specifically, Storto discloses an example where the cloud system can use Message Queuing Telemetry Transport (MQTT) as the M2M channel for communication with the controlled device, and a smartphone as a controlling device using a Representational State Transfer ( REST ) API over Hypertext Transfer

Protocol In Secure ( HTTPS ) and a smartphone system - specific push notification channel. Storto provides another example where the cloud system uses Constrained Application Protocol (COAP) as the M2M channel for communication with controlled device, and a tablet as the controlling device using a REST API over HTTPS and email as the push notification channel. EX-1004 [0032]-[0033]. A POSA understood that these protocols used by the controlled device, and controlling device are incompatible and thus there the controlled device and control device cannot communicate directly with each other via the network.

### **Claim 7**

*[7] The computer system of claim 1, wherein the another device is configured to provide a user interface, responsive to the indication that the device for which the update is available is ready to perform the update, for initiating the update of the device for which the update is available and wherein the another device is configured to send the indication to update the device for which the update is available responsive to initiation of the update via the user interface.*

127. Storto discloses this limitation for the same reasons as described above with respect to Claim 19.

### **Claim 8**

*[8] The computer system of claim 1, wherein the device for which the update is available is a component of a further device and wherein determining that the device for which the update is*

*available is ready to perform the update comprises determining that the further device is not in use.*

128. Storto discloses this limitation. Storto discloses that the controlled device [device] can be a sensor or actuator [wherein the device for which the update is available is a component of a further device]. EX-1004 [0027]. Storto further discloses checking the functionality state of the controlled device which includes if an operating cycle is running and thus the device is not available for an update[determining that the further device is not in use]:

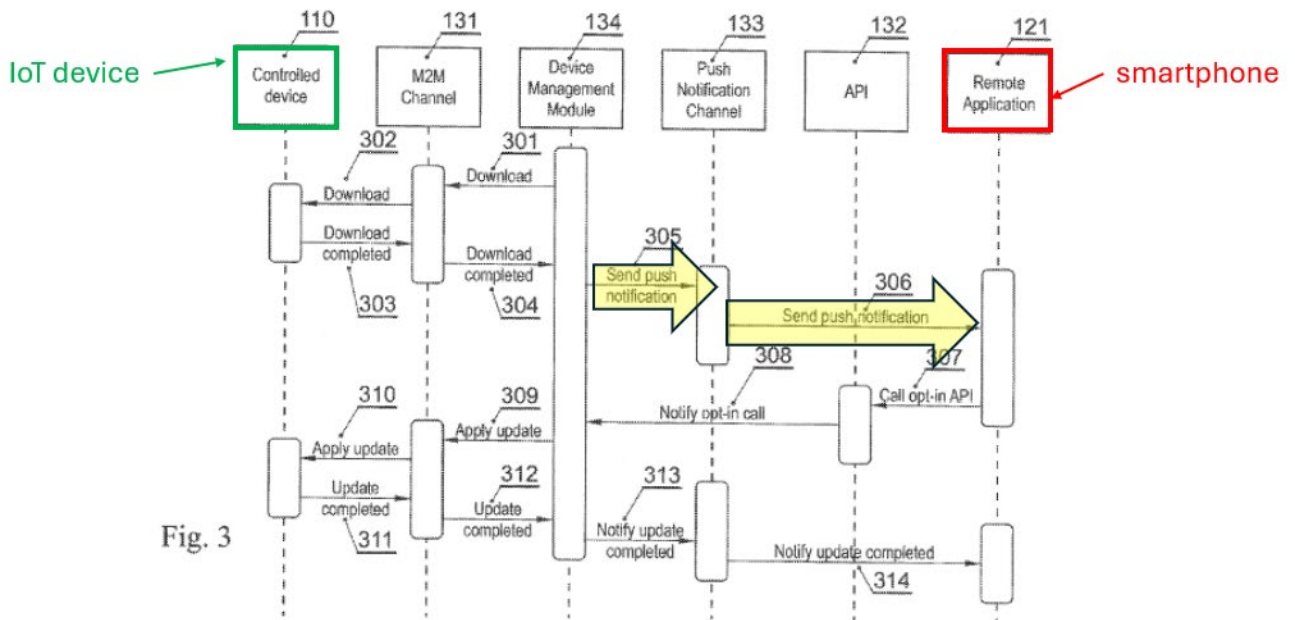
When processing the apply update task in step 211, the device management module 134 checks the connection and functionality state of the controlled device 110 and reschedules the task if the controlled device is not connected , or if it is connected but not in an idle state (e. g., an operating cycle is running )

EX-1004 [0038]

### **Claim 9**

***[9] The computer system of claim 1, wherein the instructions when executed by the processor further adapt the computer system to send, to the another device using the communications subsystem, a notification that the update is available for the device for which the update is available.***

129. Storto discloses this limitation. Storto discloses that a push notification (yellow) 305/306 [notification that the update is available] is send to the remote application on the controlling device [another device] via push notification channel 133 [communication subsystem] to inform the end user of the availability of a new software [a notification that the update is available for the device for which the update is available] and request user approval to apply it. EX-1004 [0029].



EX-1004 FIG. 3.

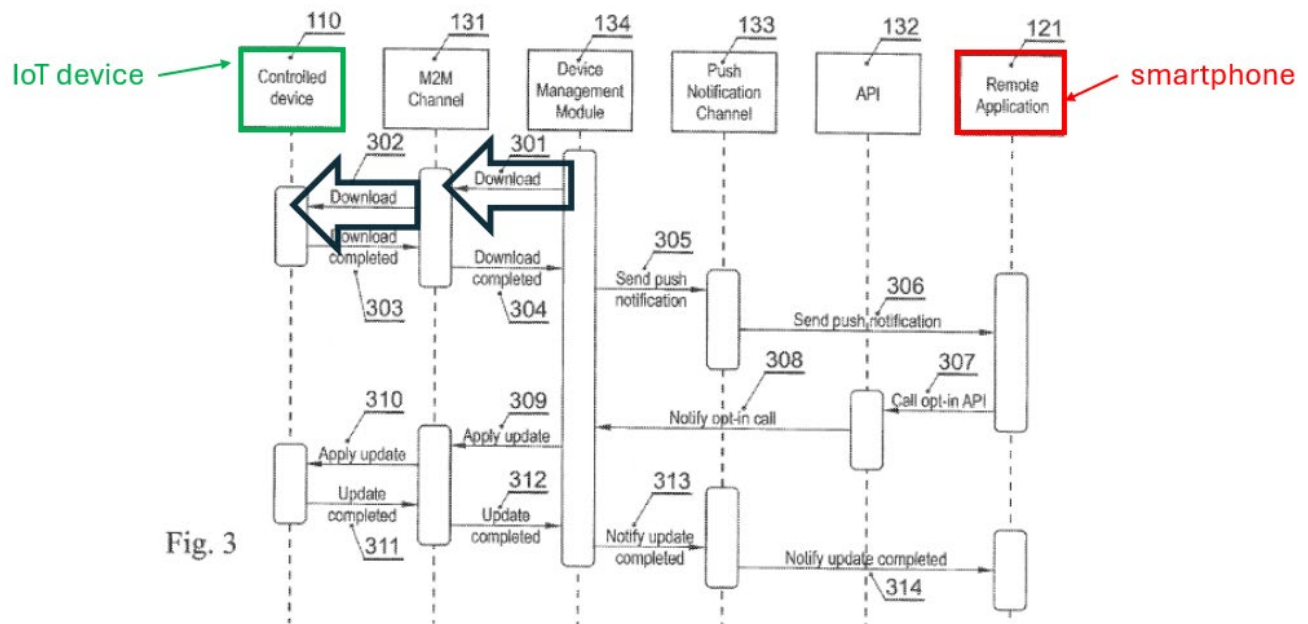
**Claim 10**

***[10] The computer system of claim 9, wherein the instructions when executed by the processor further adapt the computer system to send an indication to the device for which the update is available using the communications subsystem to notify that the update is available.***

130. Storto discloses this limitation for the same reasons as described with respect to limitation [1.1] If the controlled device 110 is connected, a download command [indication... that the update is available] is sent by the device management module 134 on the servers [processor] to the controlled device 110 [device] using the M2M channel 131 [communications subsystem].

The device management module 134 sends a download command 301 to the M2M channel 131, which delivers it as a message 302 to the controlled device 110.

EX-1004 [0043].



EX-1004 FIG. 3.

**Claim 12**

***[12] The computer system of claim 1, wherein the another device is a smartphone.***

131. Storto discloses that the controlling device can be a smartphone. EX-1004 [0032].

**Claim 13**

***[13] The computer system of claim 1, wherein the device for which the update is available is included in an Internet-of-Things connected device.***

132. Storto discloses that the controlled device can be an IoT controlled device. EX-1004 [0053].

**Claim 20**

***[20.0] A non-transitory computer-readable storage medium storing instructions that when executed by a processor of a computer system adapt the computer system to:***

133. ]. Claim 20 is a computer-readable storage medium claim for storing the instructions of the computer system recited in Claim 1, and thus Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.0].

***[20.1] receive, from a device for which an update is available, state information about the device;***

134. Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.1].

*[20.2] determine, based on the state information about the device for which the update is available, that the device is in a condition where the device is ready to perform the update;*

135. Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.2].

*[20.3] receive, from another device, an indication to update the device for which the update is available; and*

136. Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.3].

*[20.4] after determining that the device for which the update is available is in a condition to perform the update and receiving the indication to update the device, send, to the device, an indication to begin performing the update, wherein the device for which the update is available is configured to begin updating responsive to such an indication without any direct interaction with the device for which the update is available.*

137. Storto discloses this limitation for the same reasons as discussed with respect to limitation [14.4].

**B. Ground 2: Claims 5, 11 and 18 are Obvious Over Storto in View of Won**

**1. The Won Reference**

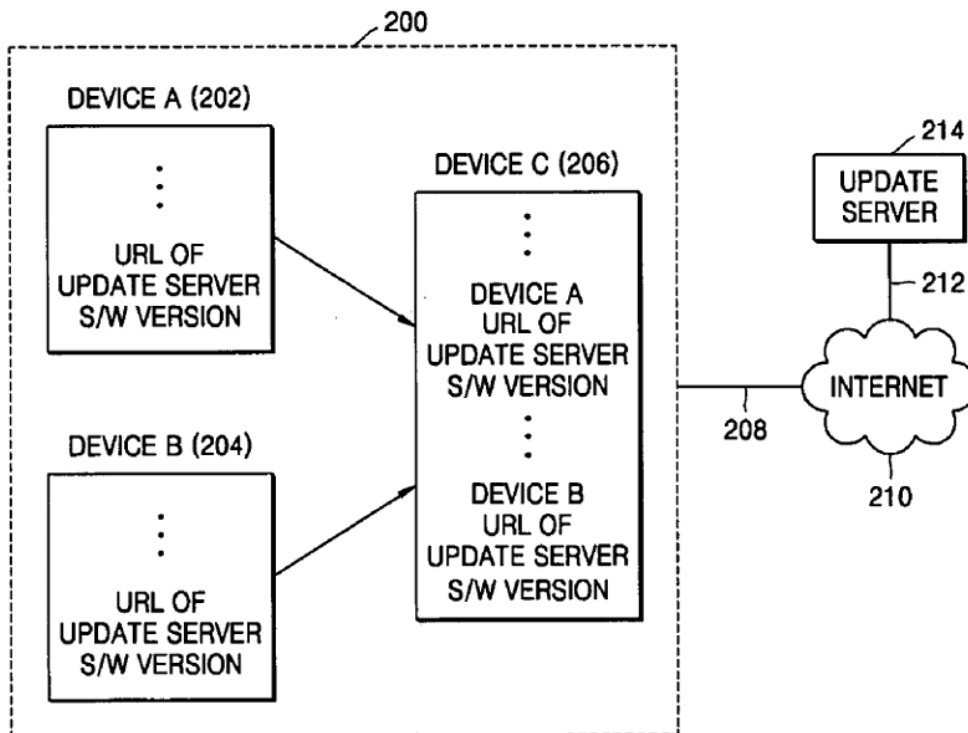
138. Won is directed to a method and apparatus for updating the software of a device that is a controlled device linked to a control device over a network. A control device obtains information regarding updating of the software of a controlled device, determines whether updating is available

using the information, and allows the controlled device to update its software, thereby easily updating the software of device. EX-1005 Abstract.

139. The controlled device that needs to be updated may be a personal computer, a printer, a refrigerator, a washing machine, a microwave oven, or an audio/video (A/V) appliance. EX-1005 [0005].

140. FIG. 2 illustrates one architecture for updating the software of a device A202 and a device B 204, using a control device C206.

FIG. 2

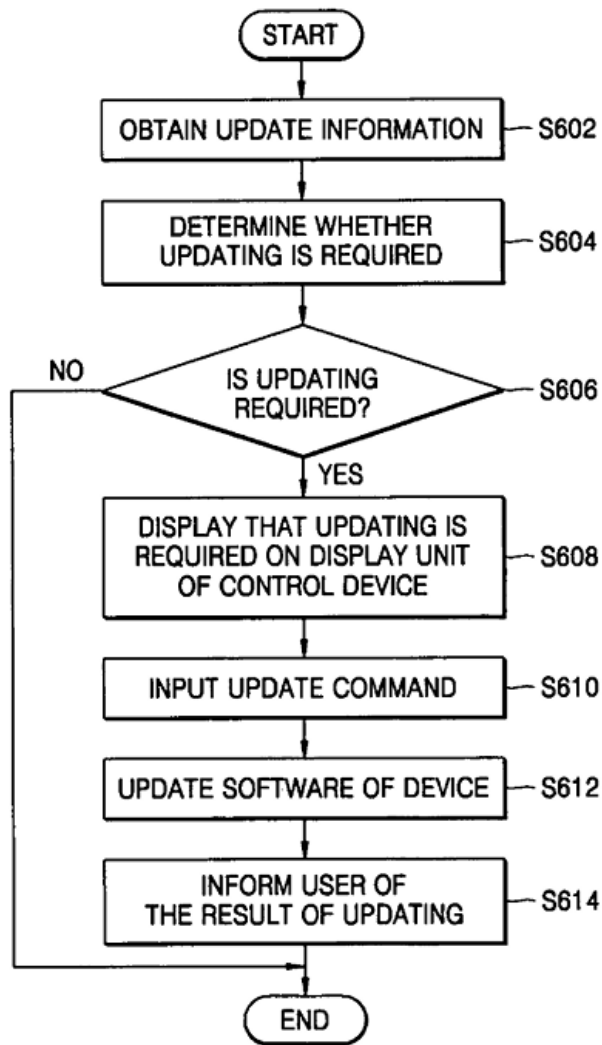


EX-1005 FIG. 2.

141. The device C 206 controls updating of the software and contains update information of the device A 202 and the device B 204. The device C 206 inquires of the update server 214 about whether updating of the software of the device A202 and the device B 204 is required, based on the update information. When updating the software of the device A 202 or the device B 204 is required, the device C 206 informs a user of the result of inquiry via a display unit and performs a process of updating the software of the corresponding device in response to a user's request. The process includes downloading files required for updating, transmitting the downloaded files to the device A 202, and controlling the updating of the software. EX-1005 [0045].

142. In operation, the device C 206 periodically or non-periodically informs the user of whether updating of the software of the device A 202 and the device B 204 is required, thereby avoiding a user having to check whether updating is required. Accordingly, it is possible to improve a user's convenience by using a display unit connected to the control device C206 to further update the software of a device to which the display unit cannot be connected, such as controlled device A202 or B204. EX-1005 [0046].

143. FIG. 6 illustrates a flowchart illustrating a method of updating the software of a device according to one embodiment:



EX-1005 FIG. 6.

144. In step S602, a control device obtains update information regarding the device over a network. Next, in step S604 the control device reads the update information of the device and inquires of an update server about whether updating of the software of the device is required. In step S606, when it is determined that updating of the software is required (S606),

the control device informs a user of the result of determination via a display unit in step S608. In step S610, the user determines whether updating the software is required via the display unit of the control device, and inputs an updating command to the control device via an input device. In step S612, upon receiving the updating command, the control device updates the software while communicating with the device. Specifically, the control device downloads files required for updating from the update server and provides the files to the device. Then, the device updates its software using the files and informs the control device of the result of updating. Next in step S614, the control device informs the user of the result of updating via the display unit. EX-1005 [0063]-[0068].

**2. Detailed Application of Storto in View of Won to Claims 5, 11 and 18**

**Claim 5**

*[5] The computer system of claim 1, wherein the device for which the update is available is configured to download the update responsive to the indication to begin performing the update.*

145. Storto in combination with Won discloses this limitation.

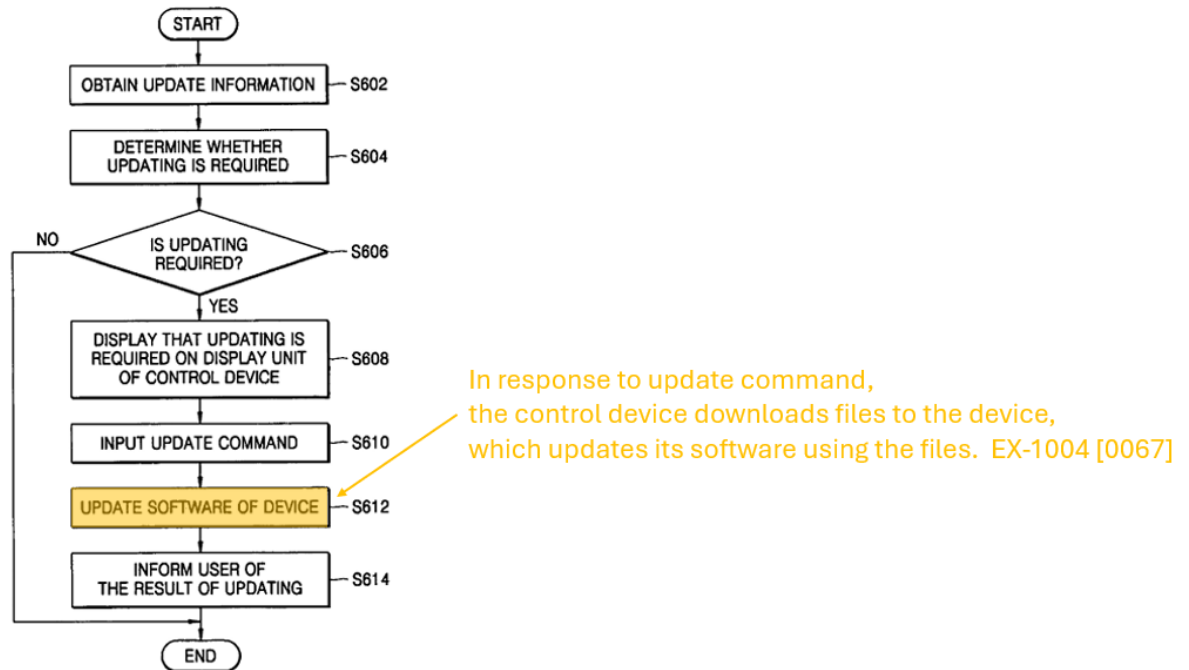
Storto discloses that once it is determined that the controlled device is connected, a software update can be automatically downloaded to the device to be update without requiring user permission. EX-1004 [0036]. This is consistent with the disclosure in the '756 Patent of an embodiment of

automatically downloading the software update without first seeking user permission. The '756 Patent also discloses an embodiment in which the software update is not automatically downloaded, and instead, is only downloaded once the controlling device gives the command to update the controlled device. EX-1001 10:16-25. However, the '756 Patent does not provide any explanation as to any benefits provided by one embodiment over the other, and thus the choice as to whether to automatically download the update to the controlled device prior to updating the device is a design choice. For example, as discussed in the State of the Art section it was known to let the user of a controlling device know that a software update was available for a controlled device. Upon receipt of a user "install now" input on the controlling device, software was downloaded and installed on the controlled device. EX-1006 [0075]. Thus, a POSITA understood it was simply a design choice as to whether to automatically download a software update to a controlled device, or download the software update in response to an update command from a user.

146. Although Storto does not expressly disclose downloading the software update in response to an indication to begin performing the update, Won does disclose such a method and it would be obvious to modify the teachings of Storto to download the software update in response to a user

command to perform the update. For example, Won discloses one such method of providing an update by downloading and installing an update in response to a user command as illustrated in FIG. 6:

FIG. 6



EX-1005 FIG. 6.

147. Specifically, in step S610, the user determines whether updating the software is required via the display unit of the control device, and inputs an updating command to the control device via an input device. In step S612, upon receiving the updating command, the control device downloads files required for updating from the update server and provides the files to the device [wherein the device for which the update is available is configured to download the update responsive to the indication to begin

*performing the update*]. Then, the device updates its software using the files and informs the control device of the result of updating. Next in step S614, the control device informs the user of the result of updating via the display unit. EX-1005 [0067, 0068].

Upon receiving the updating command, the control device updates the Software while communicating with the device (S612). Specifically, the control device downloads files required for updating from the update server and provides the files to the device. Then, the device updates its software using the files and informs the control device of the result of updating.

EX-1005 [0067].

Next, the control device informs the user of the result of updating via the display unit (S614).

EX-1005 [0068]

148. Won is directed to the same solution as Storto—using a controlling device to update software on a controlled device that does not have a user interface. EX-1004 [0027]; EX-1005 [0046]. A POSITA would be motivated to modify the teaching of Storto to include Won’s teaching of downloading the software update in response to a user commend to perform the update because it simplifies the update process. In addition, the modification would entail nothing more than a simple programmatic change

to Storto's method by elimination of a separate download command, and notification that the download is complete.

149. Thus, Storto as modified by Won discloses this limitation.

**Claim 11**

*[11] The computer system of claim 10 wherein the device for which the update is available is configured to download the update responsive to the indication that the update is available.*

150. Storto discloses this limitation for the same reasons as discussed with respect to Claim 5.

**Claim 18**

*[18] The method of claim 14, wherein the device for which the update is available is configured to download the update responsive to the indication to begin performing the update.*

151. Storto discloses this limitation for the same reasons as discussed with respect to Claim 5.

## CONCLUSION AND DECLARATION

My findings and opinions set forth in this Declaration are based on my work and examination to date. I may continue my examinations in view of additional documents or other factual evidence over the course of this proceeding that may necessitate supplementing and/or refining my opinions. I reserve the right to add to, alter, or delete my opinions and my Declaration upon discovery of additional information. I reserve the right to make such changes as necessary.

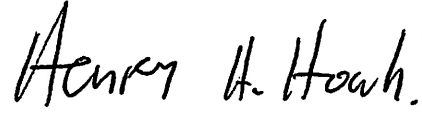
In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will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

I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001, of Title 18 of the United States Code.

[SIGNATURE ON FOLLOWING PAGE]

Date: November 14, 2025

By:

A handwritten signature in black ink that reads "Henry H. Houh." The signature is written in a cursive style with a distinct loop at the end of the last name.

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Henry Houh Ph.D

**APPENDIX A-MATERIALS RELIED UPON**

<b><i>Exhibit #</i></b>	<b><i>Description</i></b>
<b>1001</b>	U.S. Patent No. 11,119,756 (“the ’756 Patent”)
<b>1002</b>	Prosecution History of the ’756 Patent (“File History”)
<b>1004</b>	U.S. Pat. Pub. No. 2017/0351503 A1 (“Storto”)
<b>1005</b>	U.S. Pat. Pub. No. 2006/0031828 A1 (“Won”)
<b>1006</b>	U.S. Pat. Pub. No. 2015/0178061 A1 (“Wang”)
<b>1007</b>	U.S. Pat. Pub. No. 2016/0371077 A1 (“Moeller”)

## APPENDIX B – Curriculum vitae

# Henry H. Houh

henry.houh@gmail.com  
cell: 781-325-8273

## Education

### Massachusetts Institute of Technology, Cambridge, MA

- PhD in Electrical Engineering and Computer Science, February 1998. “Designing Networks for Tomorrow's Traffic,” thesis supervised by Professor David Tennenhouse and Professor John Guttag. GPA 4.7/5.0
- Master of Science in Electrical Engineering and Computer Science, February 1991. “Demonstration of a laser repetition rate multiplier,” thesis. GPA 4.5/5.0
- Bachelor of Science in Electrical Engineering and Computer Science, June 1989. “Boundary element analysis of arbitrarily shaped dielectric structures,” thesis. GPA 4.7/5.0
- Bachelor of Science in Physics, February 1990. GPA 4.7/5.0

### MITx, Cambridge, MA

- 2020 – 2021: Completed four courses in the Statistics and Data Science MicroMasters program, a sequence of MIT-offered graduate-level courses in statistics and machine learning.

## Experience

### Houh Consulting Inc. / Independent Consultant

- 2009 - present: Technical consultant specializing in Social Networking, Web 2.0, Web Site Development, Data Networking, Optical Networking, Telecommunications, Media Streaming and Voice Over IP. Clients include: Akin Gump Strauss Hauer & Feld LLP, Arnold & Porter Kaye Scholer LLP, BBN, Baker Botts LLP, Barnes & Thornburg LLP, BBN Technologies, Beus Gilbert McGroder PLLC, Bracewell LLP, Christensen O'Connor Johnson Kindness PLLC, Cooley LLP, Covington & Burling LLP, Cozen O'Connor P.C., DLA Piper, Davis Polk & Wardwell LLP, Desmarais LLP, Duane Morris LLP, Erise IP, P.A., Faegre Baker Daniels LLP, Finnegan, Henderson, Farabow, Garrett & Dunner, LLP, Fish & Richardson P.C., Goldman Ismail Tomaselli Brennan & Baum LLP, Haynes and Boone, LLP, Kaye Scholer, Kellogg Huber Hanson Todd Evans & Figel PLLC, Kirkland & Ellis LLP, Klarquist Sparkman, LLP, McCarthy Tetrault LLP,

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McGuireWoods LLP, Morgan, Lewis & Bockius LLP, Munger Tolles & Olson LLP, Orrick, Herrington & Sutcliffe LLP, O'Melveny & Myers LLP, Orrick, Herrington & Sutcliffe LLP, Paul Hastings LLP, Paul, Weiss, Rifkind, Wharton & Garrison LLP, Perkins Coie LLP, Quinn Emanuel Urquhart & Sullivan, LLP, Sidley Austin LLP, Smith Baluch LLP, Sterne, Kessler, Goldstein & Fox PLLC, Troutman Sanders LLP, Venable LLP, Weil, Gotshal & Manges LLP, Wiley Rein LLP, Wilmer Cutler Pickering Hale and Dorr LLP, and Winston & Strawn LLP.

### **BlocksCAD Inc. (H3XL spin-out)**

- 2014 – 2025: Founder and member of Board of Directors. BlocksCAD is a visual Computer-Aided Design (CAD) program, designed to teach children mathematics and geometric visualization. BlocksCAD is being used in U.S. schools and worldwide in maker spaces, with 350,000+ users. BlocksCAD was selected to be part of the LearnLaunch 2017 Boost Accelerator, the MIT Play Labs 2018 Summer Accelerator, and the MassChallenge 2018 Boston Cohort. Recipient of DARPA DSO grant in 2014, and SBIR grant from the USDA in 2019. BlocksCAD was acquired by zSpace in 2025.

### **H3XL Inc. d/b/a Einstein's Workshop (formerly Lexington Robotics)**

- 2009 - 2022: Founder and President. Started a science, technology, engineering and math enrichment program and creative/maker space, in 7,000 square feet of space. Serve 2,000+ kids and families annually. As of end of 2022, have delivered an estimated 250,000 student-instruction-hours of STEM courses. Principle Investigator for 2-year DARPA grant to improve 3D Computer Aided Design tool developed in-house for the purposes of teaching 8 year olds and up 3D CAD.

### **Eons**

- 2008 - 2009: Chief Technology Officer. Created product that Eons acquired from BBN Technologies. Integrated BBN product with Eons social networking platform and significantly increased the Eons group creation rate. Helped evaluate advertisement platform offerings and rolled out the "Boom Network" advertising network. Eons raised \$32 million from General Catalyst Partners, Charles River Ventures, Sequoia Capital, and Intel Capital.

### **BBN Technologies**

- 2007 - 2008: Delta Division, Vice President of Technology. Grew "Boomerang" counter-sniper project engineering team and significantly de-risked \$10 million worth of product deliveries. Identified sales team leading to \$10 million dollars of new sales within 6 months and \$100+ million in additional orders in the following two years. Boomerang was a significant asset leading to the acquisition of BBN by Raytheon in 2009. Created new business plan and grew team; launched new fully-featured social networking web site in 5 months. Served as lead expert witness in patent infringement lawsuit, resulting in

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\$58 million jury award to client; verdict for patents I testified on were upheld on appeal which resulted in a \$120 million settlement.

- 2004 - 2007: Delta Division, Director of Technology, responsible for commercializing IP and creating new businesses. Hired and grew division's initial engineering team. Wrote three business plans, two of which were funded. For call center business plan, acted as general manager, hiring and managing engineering team, inside sales team, and identifying and recruiting a new general manager. Identified and recruited other key employees to Delta Division, including senior members of team leading to successful internal sales growth and spin-outs of projects. Contracted by BBN to BBN spin-out PodZinger as VP of Operations and Technology. Additional areas studied include mesh networking, network security, satellite communications, and semantic web.

### **PodZinger Inc. (BBN spin-out, also known as EveryZing and now RAMP)**

- 2006: Vice President of Operations and Technology. Significantly upgraded capability of consumer-facing search site and redeployed web site from company to co-location facility. Identified key portions of infrastructure for upgrading and cost reduction. Helped write business plan, evaluating advertisement models of revenue. Hired in operations replacement and phased back to BBN.

### **Commonwealth Capital**

- 2004: Entrepreneur-in-residence (informally), performed technical due diligence on business plans, brainstormed ideas for new businesses with venture partner. With venture partner, left for portfolio company BBN to form core of commercialization team.

### **Empirix, Inc./Teradyne, Inc.**

- 2001 - 2004: Chief Technologist, Engineering Manager, Web Application Test Group. Researched potential new product areas; developed product plan and prototype. Responsible for three new and existing products. Managed off-shore development team. Chief architect for all web testing products. Re-architected core testing product, helped write javascript interpreter. Provided technical vision for core product.
- 2000 - 2001: Chief Technologist, Communication Infrastructure Test Group. Responsible for incorporating new technology internally, tracking new technologies, technical evaluation of partnerships and potential acquisitions. Helped develop division strategy. Developed plans which formed core capabilities for successful new products introduced in 2004-5.
- 2000 - 2001: Engineering Manager, Communications Infrastructure Test Group. Execution of new product plan developed in prior role. Grew team from four existing engineers to team of over 30 on immediate team and over 40 on project. Delivered new platform in one year. Platform and derivatives accounted for large portion of booked products for the division within 2 years and is currently (2008) a key portion of new product offerings.
- 2000: Empirix was formed as a spin-out of Teradyne in January 2000. Reported to CEO in carve-out of Empirix from Teradyne.

## Petition for *Inter Partes* Review of U. S. Patent No. 11,119,756

- 1999: (Teradyne) Director of Business Development, Software Test Units. Reported directly to Chairman of the Board/Founder and then to general manager of software test unit (6 divisions of Teradyne). Evaluated and researched acquisition and partnership candidates. Internally assessed technology position in market and gaps in product lines. Worked with senior division staff to develop new product strategies. Attended internal Teradyne divisional board meetings. Chairman served as my mentor.

### **3Com Corporation/NBX Corporation**

- 1999: Software Engineer 5. Continued work after 3Com acquisition of NBX. Built cross-division relationships for new products and research directions. NBX was acquired by 3Com in March 1999.
- 1997 - 1999: (NBX) Senior Scientist and Engineer. Work in IP Telephony. Architected next-generation product. Protocol design and validation for core protocol now used tens of millions of times daily. Led team in integration of IP protocols into current product. Designed audio reconstruction algorithms. Developed applications for bug analysis and diagnosis of system problems. Implementation of network simulator. Work on collaborative projects with external partners. Worked to identify gaps in product. Representative at numerous trade shows. Innovated novel methods of using product.

### **MIT Department of Electrical Engineering and Computer Science, Cambridge, MA**

- 1991 - 1998: Research assistant, Telemedia Network Systems Group. Design, development, and implementation of Gigabit ATM network for distributed multimedia system. Studied host interface design issues. ATM network simulation.
- Spring 1989, Fall 1990, Spring 1995: Teaching assistant, Computation Structures digital systems course. (Spring 1995 Head TA)
- 1988 - 1989: Head laboratory teaching assistant for Computation Structures. Responsibilities included writing and revising lab assignments, and maintaining the lab.
- 1987: Laboratory teaching assistant for Computation Structures.
- 1987: Design, construction, and programming of 16-bit computer.

### **Agora Technology Group, Incorporated**

- 1994 - 1996: Founder and CEO. Conceived and oversaw development of targeted advertising-supported Web sites. Responsible for company's vision and direction. Attended the first two WWW Conferences, presenting a workshop and paper at the first, and appearing on the "Commercialization and Economics of the Web" panel and chairing the "Where Commercial Services and the Web Are Headed" panel at the second. Sold company intact; is currently an operating stand-alone company.

### **AT&T Bell Laboratories, Holmdel, NJ**

- 1989 - 1990: Implementation of cascadable all-optical fiber logic gate. Modelocking of all-fiber erbium laser. Construction of modelocked laser repetition rate booster. Strong optics laboratory and fiber optic experience.

## Petition for *Inter Partes* Review of U. S. Patent No. 11,119,756

- Summer 1988, 1987: Research in integrated optics. Analysis of rectangular waveguides using microwave modeling. Fabrication of integrated optical components.

## Honors

- MIT Alumni Association Great Dome Award, 2010, Baker 60<sup>th</sup> Anniversary Reunion Co-Chair (highest group award given by MIT Alumni Association)
- MIT Alumni Association Presidential Citation Award (now known as Great Dome), 2008, Member of MIT Chairman's Salon committee
- MIT Alumni Association Bronze Beaver Award, 2007 (highest individual award given by MIT Alumni Association)
- MIT Alumni Association Volunteer Honor Roll, February 2004
- MIT Alumni Association Lobdell Award, 1999
- Boston Museum of Science Gold Pin for 1000 hours of Volunteer Service, April 1999
- MIT Alumni Association Presidential Citation Award (now known as Great Dome), 1997, Member of Alumni Online Communications Committee

## Patents and Patent Publications

- U.S. Patent #9,697,231, H. Houh, J. Stern, R. Spina, M. Meter, "Methods and apparatus for providing virtual media channels based on media search," July 4, 2017.
- U.S. Patent #9,697,230, H. Houh, J. Stern, "Methods and apparatus for dynamic presentation of advertising, factual, and informational content using enhanced metadata in search-driven media applications," July 4, 2017. See also WO2007056485.
- U.S. Patent #7,975,296, L. Apfelbaum, H. Houh, T. Mayberry and G. Friedman, "Automated security threat testing of web pages," July 5, 2011. See also US20030159063, WO2003067405.
- U.S. Patent #7,877,736, H. Houh and J. N. Stern, "Computer language interpretation and optimization for server testing," January 25, 2011. See also US20050138104, WO2005043300.
- U.S. Patent #7,801,910, H. Houh and J. N. Stern, "Method and apparatus for timed tagging of media content," September 21, 2010. See also US20070112837, US20090222442, WO2007056535.
- U.S. Patent #7,590,542, D. C. Williams, W. C. Hand, H. Houh, A. R. Seeley, "Method of Generating Test Scripts Using a Voice-Capable Markup Language," September 15, 2009. See also EP1530869, US20030212561, WO2003096663.
- U.S. Patent #6,967,963, H. H. Houh, P. Anderson, C. Gadda, "Telecommunication method for ensuring on-time delivery of packets containing time-sensitive data," November 22, 2005. See also EP1060400, WO2000033092, CA2318774.
- U.S. Patent #5,144,375, M. C. Gabriel, H. H. Houh, N. A. Whitaker, "Sagnac Optical Logic Gate," September 1, 1992. Also issued as European Patent # EP0456422, July 23, 1997, German Patent #DE69126913, August 28, 1997
- U.S. Patent Application Publication No. 20020015387, "Voice Traffic Packet Capture and Analysis Tool for a Data Network" (Abandoned in 2007)

## Petition for *Inter Partes* Review of U. S. Patent No. 11,119,756

- U.S. Patent Application Publication No. 20020016708, “Method and Apparatus for Utilizing a Network Processor as Part of a Test System” (Abandoned in 2007)
- U.S. Patent Application Publication No. 20020016937, “Method and Apparatus for Utilizing a Network Processor as Part of a Test System.” (Abandoned in 2007) See also WO2002011413.
- U.S. Patent Application Publication No. 20070106646, “User-directed navigation of multimedia search results” (Abandoned in 2009)
- U.S. Patent Application Publication No. 20070106660, “Method and apparatus for using confidence scores of enhanced metadata in search-driven media applications” (Abandoned in 2009)
- U.S. Patent Application Publication No. 20070106685, “Method and apparatus for updating speech recognition databases and reindexing audio and video content using the same” (Abandoned in 2015)
- U.S. Patent Application Publication No. 20070118873, “Methods and apparatus for merging media content” (Abandoned in 2015)
- U.S. Patent Application Publication No. 20090222442, “User-directed navigation of multimedia search results” (Abandoned in 2016)
- U.S. Patent Application 11/395,732, “Search snippet creation for audio and video data” (Abandoned in 2009)
- U.S. Patent Application 11/774,931, “Methods and apparatus for managing a social networking web site”
- U.S. Patent Application 11/774,947, “Methods and apparatus for organizing media files”
- U.S. Patent Application 11/774,956, “Methods and apparatus for managing an online event”
- U.S. Provisional Patent Application 61/086,909, “Measuring and ranking relationship activity”
- U.S. Provisional Patent Application 61/086,914, “Detecting media object commonality”
- U.S. Provisional Patent Application 61/086,904, “Message categorization based on message characteristics”
- U.S. Provisional Patent Application 61/086,905, “Photo tagging to request action”

## **Trials, Testimony and Depositions**

- Case No. 1:06CV682 (CMH/BRP), Verizon vs. Vonage, U.S. District Court for the Eastern District of Virginia, filed expert report, was deposed and testified at trial.
- Case No. 1:08CV157 (CMH/TRJ), Verizon vs. Cox, U.S. District Court for the Eastern District of Virginia, was deposed and testified at trial.
- Case No. 5:09-cv-476, Two-Way Media vs. AT&T, U.S. District Court for the Western District of Texas, filed expert report, testified at trial.
- Case No. 2:10-cv-248 (RAJ/FBS), ActiveVideo Networks vs. Verizon, U.S. District Court for the Eastern District of Virginia, filed expert report and was deposed as an expert witness.
- Case No. 1:11-cv-00880-TSE-JFA, Bear Creek Technologies, Inc. vs. Verizon Services Corp., et al, U.S. District Court for the Eastern District of Virginia, was deposed as an expert witness.

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- Case No. 3:10-CV-298-BBC, AlmondNet, Inc. vs. Microsoft Corp., U.S. District Court for the Western District of Wisconsin, filed expert report.
- Case No. 6:10-cv-00597, Guardian Media Technologies, Ltd. Vs. AT&T Operations, Inc. et al., U.S. District Court for the Eastern District of Texas, Tyler Division, filed expert report.
- Case No. ESCV2010-02282C, The Octopus Solution LLC v. Gary Brown et al., Essex, MA Superior Court, testified at trial.
- Investigation No. 337-TA-882, In the matter of Certain digital media devices, including televisions, Blu-ray disc players, home theater systems, tablets and mobile phones, components thereof and associated software, U.S. International Trade Commission, filed expert reports, was deposed and testified at hearing.
- Investigation No. 337-TA-995, In the matter of Certain communications or computing devices, and components thereof, U.S. International Trade Commission, filed expert reports, and was deposed.
- Case No. 8:12-cv-122-LES-TDT, Prism Technologies LLC v. AT&T Mobility LLC, U.S. District Court for the District of Nebraska, filed expert report, was deposed and testified at trial.
- Case No. 11-2684 (JWL), Sprint Communications Co., L.P., v. Comcast Cable Communications, LLC, et al., U.S. District Court for the District of Kansas, filed expert report and was deposed.
- Case No. 11-2686 (JWL), Sprint Communications Co., L.P., v. Time Warner Cable, Inc., et al., LLC, et al., U.S. District Court for the District of Kansas, filed expert report, was deposed, and testified at trial.
- Case No. 12-487 (SLR), Cox Communications, Inc., et al., v. Sprint Communications Company L.P., et al., U.S. District Court for the District of Delaware, filed expert report and was deposed.
- Case IPR 2014-00039, Microsoft Corporation v. B.E. Technology LLC, U.S. Patent No. 6,628,314. Submitted declaration and cross-examined in deposition.
- Case IPR 2014-00086, Apple, Inc. v. Evolutionary Intelligence, LLC, U.S. Patent No. 7,010,536. Submitted declaration and cross-examined in deposition.
- Case No. 6:11-CV-421, Stragent, LLC v. Intel Corporation, U.S. District Court for the Eastern District of Texas, Tyler Division, deposed and testified at trial as a fact witness.
- IPR2014-01366, IPR2014-01367, IPR2014-01368, Samsung et al. v. Straight Path, submitted IPR declarations and was deposed.
- IPR2015-1006, IPR2015-1007, Cisco v. Straight Path, submitted IPR declarations.
- IPR2014-01457, IPR2014-01459, Microsoft v. Biscotti, submitted IPR declaration and was deposed.
- IPR2016-00302, Apple v. Nonend, submitted IPR declaration.
- IPR2014-00812, Yelp and Twitter v. Evolutionary Intelligence, submitted IPR declaration.
- IPR2015-00307, Cisco v. AIP, submitted IPR declaration.
- Microsoft v. Acacia, submitted IPR declaration.
- IPR2015-00342, AT&T Mobility LLC and Cellco Partnership d/b/a Verizon Wireless v. Solocron, submitted IPR declaration.
- Mediatube v. Bell Canada, Canadian Federal Court, submitted expert report and testified at trial.

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- CBM2016-00036, Google v. At Home Bondholder's Liquidating Trust, submitted CBM declaration.
- IPR2016-01198, IPR2016-01201, Apple, Inc. v. VoIP-Pal.com, Inc., submitted IPR declaration and was deposed.
- Case No. 3:14-cv-2824-VC, Trend Micro Incorporated v. Rpost Holdings, Inc., et al, submitted expert report and was deposed
- Akamai v. Limelight Networks, IPR2016-01631, IPR2016-01711, IPR2017-00249, IPR2017-00349, submitted IPR declarations and was deposed
- Hyperlync Technologies v. Verizon Sourcing, No. 650151/2015 New York Supreme Court, submitted declaration and was deposed
- Cascades Streaming Technologies v. Big Ten Networks, submitted expert reports and was deposed
- Klaustech, Inc. v. Google LLC., Case No. 4:10-CV-05899-JSW (N.D. Cal.), submitted expert report and was deposed
- Cisco v. Uniloc, IPR2017-00198, IPR2017-00058, submitted IPR declarations and was deposed.
- Cisco v. Uniloc, IPR2017-00597, submitted IPR declaration and was deposed
- Twitter v. Youtoo Technologies, LLC, IPR2017-01133, IPR2017-01131, submitted IPR declarations and was deposed
- Taser International Inc. (now Axon Enterprise, Inc.) v. Digital Ally Inc., IPR2017-00375, submitted IPR declaration and was deposed
- Taser International Inc. (now Axon Enterprise, Inc.) v. Digital Ally Inc., IPR2017-00376, IPR2017-00515, IPR2017-00775, submitted IPR declarations
- HTC Corporation v. IPA Technologies, IPR2018-00306, IPR2018-00307, submitted IPR declaration
- Hulu v. Soundview, IPR2018-00864, IPR2018-01023, submitted IPR declarations and was deposed
- XpertUniverse v. Cisco, 3:17-cv-3848, U.S. District Court for Northern District of California, submitted declaration in support of claim construction and was deposed
- Improved Search v. Microsoft, C.A. No. 16-cv-650-JFB-SRF (Del.), submitted declaration in support of claim construction
- Apple v. Uniloc, IPR2018-00361, IPR2018-00394, IPR2018-00395, IPR2019-00700, IPR2019-00701, IPR2019-01667, submitted IPR declarations
- LG Electronics v. Uniloc, submitted IPR declaration
- SRC Labs and Saint Regis Mohawk Tribe v. Microsoft, 2:18-cv-00321-JLR, U.S. District Court for Western District of Washington at Seattle, submitted declaration in support of claim construction and was deposed
- Verizon Wireless v. Barkan Wireless IP Holdings LP, submitted IPR declarations
- Verizon Wireless and Samsung Electronics America Inc. v. Barkan Wireless IP Holdings LP, IPR2019-199, IPR2019-200, IPR2019-234, IPR2019-631, IPR2019-632, submitted IPR declarations
- Samsung Electronics America Inc. v. Barkan Wireless IP Holdings LP, IPR2019-100, submitted IPR declaration
- Cisco Systems Inc. v. Meetrix IP LLC, IPR2019-539, IPR2019-540, IPR2019-541, IPR2019-542, IPR2019-543, IPR2019-544, submitted IPR declarations

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- GMG Products LLC v. Traeger Pellet Grills LLC, PGR2019-24, PGR2019-34, PGR2019-35, PGR2019-36, submitted PGR declaration and was deposed
- Uniloc 2017 LLC v. Google LLC, 2:18-cv-00502-JRG-RSP, U.S. District Court for the Eastern District of Texas, Marshall Division, submitted declaration in support of claim construction
- Microsoft Corporation v. Uniloc 2017 LLC, IPR2020-00102, IPR2020-00103, submitted IPR declarations
- Microsoft Corporation and HP Inc. v. Synkcloud Technologies, LLC, IPR2020-00316, IPR2020-01031, IPR2020-01032, IPR2020-01269, IPR2020-01270, IPR2020-01271, submitted IPR declarations
- Seven Networks, LLC v. Apple Inc, 2:19-cv-115-JRG, U.S. District Court for the Eastern District of Texas, Marshall Division, submitted declaration in support of claim construction
- Unified Patents Inc. v. Ortiz & Associates Consulting, LLC, IPR2019-00743, submitted IPR declaration
- Uniloc 2017 LLC v. Apple Inc., 3:19-cv-01905-JD, U.S. District Court for the Northern District of California, San Francisco Division, submitted declaration in support of claim construction and was deposed
- ClearPlay Inc. v. Dish Network LLC et al.; 2:14-cv-00191, U.S. District Court for the District of Utah, Central Division, submitted expert report and re-examination declarations, was deposed, and testified at trial
- AMC Networks, Inc. et al v. Sound View Innovations, LLC, IPR2020-00482, submitted IPR declaration
- Case No. 1:17-cv-01734-RGA, Sprint Communications Co., L.P., v. Charter Communications, Inc., et al., U.S. District Court for the District of Delaware, filed expert report and was deposed.
- CommScope Technologies LLC et al. v. Barkan Wireless IP Holdings LP et al., IPR2020-00827, IPR2020-00829, IPR2020-00831, IPR2020-00833, IPR2020-00835, IPR2020-00838, submitted IPR declarations
- Cisco Systems Inc. v. Monarch Networking Solutions LLC, IPR2020-01226, submitted IPR declaration
- CoolTV Network.com v. Blackboard, Inc., Facebook, Inc., International Business Machines Corporation, Kaltura, Inc., Limelight Networks, Inc., Microsoft Corporation, Ooyala, Inc., Snap, Inc., and Trapelo Corp., submitted declaration in support of claim construction and was deposed
- Facebook, Inc. v. Onstream Media Corporation, IPR2020-01507, IPR2020-01508, IPR2020-01525, IPR2020-01527, IPR2020-01528, submitted IPR declarations
- Hisense Co LTD. v. Maxell, LTD, IPR2020-01598, IPR2020-01600, submitted IPR declarations
- Microsoft Corp. v. O'Brien, IPR2021-00015, submitted IPR declaration and was deposed
- Sable Networks Inc. v. Cisco Systems, Inc., WA:20-CV-00288-ADA, U.S. District Court for the Western District of Texas, Waco Division, submitted declaration in support of claim construction
- Peloton Interactive, Inc. v. Icon Health and Fitness Inc et al., IPR2021-00342, submitted IPR declaration

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- Hulu, LLC v. SITO Mobile R&D IP, LLC et al., CBM2020-00028, IPR2020-00158, IPR2020-00206 , IPR2020-00219 , IPR2020-00265 , IPR2020-00298 , IPR2020-00304 , IPR2020-00308 , submitted CMB and IPR declarations and was deposed
- Twitter, Inc. and Google LLC v. B.E. Technology, LLC, IPR2021-00482, IPR2021-00483, IPR2021-00484, IPR2021-00485, submitted IPR declarations
- MG Freesites LTD v. ScorpCast, LLC, IPR2021-00511, submitted IPR declaration
- Avionte, LLC v. Sandeep Acharya, Samar Basnet, and Aqore LLC, Arbitration, Hon. Jeffrey Keyes (Ret.)
- Microsoft Corporation v. WSOU Investments, LLC d/b/a Brazos Licensing and Development, IPR2021-00751, submitted IPR declaration
- SAP America, Inc. v. Express Mobile, Inc., IPR2021-01144, IPR2021-01145, IPR2021-01146, submitted IPR declarations
- StratosAudio Inc. v. Hyundai Motor America, 6:20-cv-01125-ADA, U.S. District Court for the Western District of Texas, Waco Division, submitted claim construction declaration and was deposed Peloton Interactive, Inc. v. Ifit Health and Fitness Inc, IPR2022-00029, IPR2022-00030, submitted IPR declarations and was deposed
- Investigation No. 337-TA-1263, In the matter of Certain televisions, remote controls, and components thereof, U.S. International Trade Commission, filed expert reports, was deposed, and testified at hearing
- Alexander Stross v. Netease, Inc., et al., U.S. District Court (Central District of California), Case 2:20-cv-00861-AB(JC), filed expert reports, and was deposed
- Ralph Ledergerber v. Netease, Inc., et al., U.S. District Court (Central District of California), Case 2:20-cv-00862-AB(JC), filed expert reports and was deposed
- John Walmsley v. Netease, Inc., et al., U.S. District Court (Central District of California), Case 2:20-cv-00863-AB(JC), filed expert reports and was deposed
- Bernhard Kuhmstedt v. Netease, Inc., et al., U.S. District Court (Central District of California), Case 2:20-cv-02044-AB(JC), filed expert reports and was deposed
- Netflix, Inc. v. CA, Inc., IPR2021-01319, submitted IPR declaration and was deposed
- F45 Training Pty Ltd. v. Body Fit Training USA Inc., C.A. No. 20-1194 (LPS) (D. Del.), filed expert report
- Apple v. Fintiv, IPR2022-00976, IPR2022-01149, IPR2022-01150, IPR2023-00399, submitted IPR declarations and was deposed
- Estech Systems, Inc. v. Howard Midstream Energy Partners d/b/a Howard Energy Partners, C.A. No. 6:20-cv-777-ADA (Western District of Texas, Waco Division), filed expert reports and was deposed
- Echelon Fitness Multimedia, LLC. v. Peloton Interactive, Inc., IPR2020-01187, submitted IPR declaration and was deposed
- VIZIO. V. Maxell Ltd., IPR2022-01458, submitted IPR declaration
- Maxell, Ltd. et el. v. VIZIO, Inc., Case No. 2-21-cv-06758 (C.D. Cal.). filed declaration and was deposed
- Microsoft Corporation v. SurfCast, Inc., submitted IPR declarations
- The Walt Disney Company et al. v. WAG Acquisition LLC, IPR2022-01227, IPR2022-01228, IPR2022-01346, submitted IPR declarations and was deposed
- Rakuten Rewards et al. v. IBM, submitted IPR declarations and was deposed
- Fubotv Media Inc. v. SITO Mobile R&D IP, LLC et al., submitted IPR declarations
- Unified Patents, LLC v. Noblewood IP LLC, IPR2022-01111, submitted IPR declaration

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- Unified Patents, LLC. v. Pedersen, Peter Henrik, IPR2023-00029, submitted IPR declaration
- Ericsson Inc v. Dali Wireless Inc., submitted IPR declarations
- Universal Electronics, Inc. et al. v. Roku, Inc., IPR2022-00818, submitted declarations and was deposed
- Google LLC. v. Wildseed Mobile LLC et al., IPR2023-00244, IPR2023-00245, IPR2023-00246, IPR2023-00247, IPR2023-00248, submitted declarations
- Lululemon Athletica Canada Inc. et al. v. Nike, Inc., IPR2023-00180, IPR2023-00424, submitted declarations
- Zoho Corporation, et al. v. Meetrix IP, LLC, IPR2023-00371, IPR2023-00377, IPR2023-00379, IPR2023-00380, IPR2023-00382, submitted declarations
- WSOU Investments, LLC d/b/a/ Brazos Licensing and Development v. Google LLC, 6:20-cv-572, U.S. District Court for the Western District of Texas, Waco Division, submitted reports and was deposed
- Google LLC v. Safecast Limited LLC, IPR2023-00652, submitted declaration
- Investigation No. 337-TA-1338, In the matter of Certain smart televisions, U.S. International Trade Commission, filed reports and was deposed
- Cisco Systems, Inc. v. Orckit IP LLC, IPR2023-00714, submitted declaration
- SupplyPro, Inc. v. Sandvik Machining Solutions AB, et al., AAA Case No. 01-22-000-7897. submitted declaration
- TrackThings LLC v. NETGEAR, Inc., Case No. 22-00981-RGA-JLH, U.S. District Court for the District of Delaware, submitted declaration
- Correct Transmission, LLC v. Nokia of America Corporation, Case No. 2:22-CV-00343-JRG-RSP, U.S. District Court for the Eastern District of Texas, Marshall Division, submitted export reports, was deposed, and testified at trial
- Walt Disney Parks & Resorts US Inc. v. Agile Journeys LLC; IPR2024-00029, submitted declaration
- Aylo Freesites Ltd v. Dish Technologies LLC; IPR2024-00043, IPR2024-00044, IPR2024-00045, IPR2024-00046, IPR2024-00047, IPR2024-00048, IPR2024-00146, IPR2024-00147; submitted declarations and was deposed
- Arm Inc. et al. v. Icpillar LLC; IPR2024-00476, IPR2024-00566; Retained by Arm; submitted declarations
- Microsoft Corp et al. v. Litl LLC, IPR2024-00454, IPR2024-00455, IPR2024-00456, IPR2024-00457, IPR2024-00458; submitted declarations
- Cisco Systems Inc et al. v. InfoExpress Inc, IPR2024-00539, IPR2024-00540, IPR2024-00677, IPR2024-00678; submitted declarations and was deposed
- Vizio Inc v. Multimedia Technologies Pte Ltd; IPR2024-00722, IPR2024-00723; Retained by Vizio; submitted declarations and was deposed
- Sap America Inc v. Isix IP LLC; IPR2024-00615; Retained by SAP; submitted declarations
- Cisco Systems Inc et al. v. Portsmouth Network Corp; IPR2024-00505, IPR2024-00506; submitted declarations and was deposed
- Aylo Freesites Ltd v. Dish Technologies LLC; IPR2024-00512, IPR2024-00513, IPR2024-00514, IPR2024-00515, IPR2024-00516, IPR2024-00517, IPR2024-00518,

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IPR2024-00519, IPR2024-00940, IPR2024-00941; submitted declarations and was deposed

- Aylo Freesites Ltd v. WellcomeMat LLC; IPR2024-00710, IPR2024-01101; submitted declarations and was deposed
- Verizon Corporate Service Group et al. v. Headwater Partners I LLC; IPR2024-00809, IPR2024-00945; Retained by Verizon; Technology: Mobile device management; Submitted declarations
- Microchip Technology Inc v. Aptiv Technologies Ltd et al.; IPR2024-00228; Retained by Aptiv; Technology: Universal Serial Bus; submitted declaration and was deposed
- Vusion Group SA v. Hanshow Technology Co Ltd; IPR2024-00963; Retained by VusionGroup; Technology: Video analysis; submitted declaration
- Maxell, Ltd. v. TCL Electronic Holdings Ltd. et al.; Case No. 5:23-cv-00108-RWS-JBB; U.S. District Court for the Eastern District of Texas, Texarkana Division; Retained by TCL; submitted declaration and was deposed
- Cerence Operating Company v. Samsung Electronics Co., LTD. et al., Case No. 2:23-cv-00482-JRG-RSP, U.S. District Court for the Eastern District of Texas, Marshall Division, submitted expert report on claim construction and was deposed
- MasterClass and FuboTV v. Dish Technologies LLC; IPR2024-00917, IPR2024-00918, IPR2024-00919; submitted declarations and was deposed
- Microsoft Corp v. Dialect LLC; IPR2025-00655, IPR2025-00656, IPR2025-00657, IPR2025-00658, IPR2025-00659; submitted declarations
- Topia Technology, Inc. v. Box, Inc., Case No. 3:23-cv-00063-JSC, U.S. District Court for the Northern District of California, submitted expert report and was deposed
- Google LLC v. Cellular South Inc.; IPR2025-00875, IPR2025-00876, IPR2025-00877; submitted declarations
- Carvana LLC v. International Business Machines Corp.; IPR2025-00564; submitted declaration

## Publications

- “IP switching: server driven flow classification,” H. H. Houh, *Proceedings of the Washington University Workshop on Integration of IP and ATM*, November 1996.
- “Aurora at MIT,” D. D. Clark, H. H. Houh, and D. L. Tennenhouse, Editors, *MIT Laboratory for Computer Science Technical Report 673*, December 1995.
- “ViewStation Applications: Implications for Network Traffic,” C. J. Lindblad, D. Wetherall, W. Stasior, J. F. Adam, H. H. Houh, M. Ismert, D. Bacher, B. Phillips, and D. L. Tennenhouse, *IEEE Journal of Selected Areas in Communications*, 1995.
- “The VuNet Desk Area Network: Architecture, Implementation, and Experience,” H. H. Houh, J. F. Adam, M. Ismert, C. J. Lindblad, and D. L. Tennenhouse, *IEEE Journal of Selected Areas in Communications*, 13 (4), May, 1995.
- “Reducing the Complexity of ATM Host Interfaces,” H. H. Houh and D. L. Tennenhouse, Hot Interconnects II Symposium Proceedings, Stanford, August 11-12, 1994.
- “Media-intensive data communications in a ‘desk-area’ network,” J. F. Adam, H. H. Houh, M. Ismert, and D. L. Tennenhouse, *IEEE Communications*, August 1994.

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- “ViewStation Applications: Intelligent Video Processing Over A Broadband Local Area Network,” C. J. Lindblad, D. J. Wetherall, W. Stasior, B. Phillips, D. Bacher, J. Adam, H. Houh, M. Ismert, and D. L. Tennenhouse, Proceedings of the 1994 USENIX Symposium on High-Speed Networking, Oakland, CA, August 1994.
- “The Media Gateway: Live Video on the World Wide Web,” H. H. Houh, C. J. Lindblad, J. Soo, D. L. Tennenhouse, and D. J. Wetherall, Workshop at the 1994 World Wide Web Conference, Geneva, Switzerland, May 1994.
- “Active Pages: Intelligent Nodes on the World Wide Web ,” H. H. Houh, C. J. Lindblad, and D. J. Wetherall, Proceedings of the 1994 World Wide Web Conference, Geneva, Switzerland, May 1994.
- “Wavelength Division vs. Code Division Access Methods for Optical Networks,” H. H. Houh, Area Exam Paper, May 1993.
- “Experience with the VuNet: A Network Architecture for a Distributed Multimedia System,” J. F. Adam, H. H. Houh, D. L. Tennenhouse, Proceedings of the 18th Conference on Local Computer Networks, pp. 70-76, September 1993
- “The VudBoard: A Simple DMA Interface,” H. H. Houh, Proceedings of the 4th Gigabit Minijam, January 1994.
- “A Software-Oriented Approach to the Design of Media Processing Environments,” D. L. Tennenhouse, J. Adam, D. Carver, H. Houh, M. Ismert, C. Lindblad, W. Stasior, D. Weatherall, D. Bacher, and T. Chang., submitted to the International Conference on Multimedia Computing and Systems, May 1994.
- “A Network Architecture for Distributed Multimedia Systems,” J. F. Adam, H. H. Houh, M. Ismert, and D. L. Tennenhouse, submitted to the International Conference on Multimedia Computing and Systems, May 1994.
- “The Viewstation Collected Papers,” D. L. Tennenhouse, J. Adam, C. Compton, A. Duda, D. Gifford, H. Houh, M. Ismert, C. Lindblad, W. Stasior, R. Weiss, D. Wetherall, D. Bacher, D. Carver, and T. Chang, MIT Laboratory for Computer Science Technical Report, MIT/LCS/TR-590, November 1993.
- “The Viewstation Collected Papers II,” W. F. Stasior, D. L. Tennenhouse, J. F. Adam, D. R. Bacher, H. H. Houh, M. Ismert, C. J. Lindblad, B. M. Phillips, D. J. Wetherall, MIT Laboratory for Computer Science Technical Report, MIT/LCS/TR-696, April 1996.
- “A System's Perspective of the Sagnac Fiber Logic Gates and Their Possible Applications,” A. Huang, N. Whitaker, C. Gabriel, H. Avramopoulos, P. M. W. French, H. H. Houh, and I. Chuang, Applied Optics, September 10, 1994
- “Complete Switching in a Three-Terminal Sagnac Switch,” H. Avramopoulos, P. M. W. French, M. C. Gabriel, H. H. Houh, N. A. Whitaker, T. Morse, IEEE Phot. Tech. Lett. **3** (3), 235
- “Complete Switching in a Three-Terminal Sagnac Switch,” H. Avramopoulos, P. M. W. French, M. C. Gabriel, H. H. Houh, N. A. Whitaker, IEEE/LEOS Annual Meeting, Paper PDP-13, November 1990
- “All-optical phase-locked oscillator,” N. A. Whitaker, Jr., H. H. Houh, H. Avramopoulos, T. F. Morse, IEEE/LEOS Annual Meeting, Paper ELT2.4/MOO3, November 1990
- “Passive modelocking of an all-fiber erbium laser,” H. Avramopoulos, H. H. Houh, N. A. Whitaker, M. C. Gabriel, T. F. Morse, IEEE/LEOS Conference on Optical Amplifiers and their Applications, Paper PDP-8, August 1990

- “Transverse modes, waveguide dispersion, and 30ps recovery in submicron GaAs/AlAs microresonators,” J. L. Jewell, S. L. McCall, A. Scherer, H. H. Houh, N. A. Whitaker, A. C. Gossard, and J. H. English, *Appl. Phys. Lett.* **55** (1), July 3, 1989

## Leadership, Activities and Interests

- Leadership
  - Reading Symphony Orchestra
    - Board of Directors (Treasurer), 2022 – present
  - Discovery Museum (Acton, MA)
    - Board of Directors, 2023 – present
    - Board of Directors, Development Committee, 2023 – present
    - Science and Technology Advisory Council, 2012 – present
    - The Discover Museum received the 2024 National Medal for Museum and Library Service, the nation’s highest honor given to museums and libraries that make significant and exceptional contributions to their communities.
  - Tau Beta Pi National Engineering Honor Society
    - Executive Councilor and Secretary, 2024 – 2026
    - Advisor, MA B Chapter at MIT, 2003 – present
    - District Director (National Officer), Tau Beta Pi, New England Area, 1991 – 2003
    - President, MA B Chapter at MIT, Fall 1988 – Spring 1989
    - Laureate award, 1989
  - MIT Alumni Association Board of Directors
    - MIT Annual Giving Board, 3 year term, 2024 – 2027
    - National Selection Committee, 3 year term, 2020 – 2023
    - K-12 STEM Initiatives Co-chair, 2013 – 2017
    - Awards Committee Chair, 2012 – 2014
    - Awards Committee, 3 year term, 2011 – 2014
    - Vice President, 2 year term, 2004 – 2006
    - Alumni Ad-Hoc Committee, Chair, 2005-2006
    - Board Member, 2 year term, 1997 – 1999
  - MIT Club of Boston
    - Board of Directors, 2006 – 2011
    - K-12 Initiatives Chair, 2009 – 2012
    - VP of Communications, MIT Club of Boston, 2003 – 2006
    - Past-President, MIT Club of Boston, 2002 – 2003
    - President, MIT Club of Boston, 2001 – 2002
    - President-Elect, MIT Club of Boston, 2000 – 2001
    - VP of Programs, MIT Club of Boston, 1999 – 2000
    - Activities Super-Chair, MIT Club of Boston, 1998 – 1999
  - MIT Enterprise Forum of Cambridge, Inc.
    - Past Chair, 2009 – 2011
    - In-NOW-vation Co-chair, 2010
    - Chair, 2007 – 2009
    - Vice Chair, 2005 – 2007

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- Executive Board Member, 2002 – 2011
- Winter Workshop Co-Chair, February 2007 – conceived idea for conference, which sold-out and produced largest attendance numbers in recent memory
- Spring Workshop Co-Chair, Spring 2004
- Membership Committee Chair, Fall 2003 - 2006
- 25th Anniversary Dinner Chair, Fall 2003
- As Membership Chair and Board Member, started Special Interest Groups in 2004; a SIG won the MIT Presidential Citation award, the MIT Alumni Association's highest award for organizations, in 2006
- Estabrook Elementary School PTA
  - Advisory committee to the superintendent on PCB issue, 2010-2011
  - 4<sup>th</sup> Grade after-school science program co-organizer, 2010-2012
  - 4<sup>th</sup> and 5<sup>th</sup> Grade before-school Math Olympiad co-organizer, 2009-2013
  - 5<sup>th</sup> Grade BBQ and Yearbook Committee, 2011, 2013
  - Family Math Night volunteer, 2008-2012
- MIT Class of 1989
  - Class Agent, 2024 – present
  - 35-year Reunion Gift Committee, Co-chair, 2024
  - Secretary, five consecutive 5 year terms, 1989 – 2014
  - 30-year Reunion Committee, 2019
  - 25-year Reunion Committee, 2014
  - 20-year Reunion Committee and Gift Committee, 2009
  - 15-year Reunion Committee and Gift Committee, 2004
  - 10-year Reunion Committee and Gift Committee, 1999
  - 5-year Reunion Committee, 1994
  - Interim Treasurer, 1993 – 1994
  - Instituted annual senior class career fair, now raising over \$100,000 annually for senior class activities, Fall 1988
- Strong, consistent record of leadership dating to high school
- Acting
  - ‘21’ (Sony Pictures), credited as “Chinatown Dealer,” 2007, Kevin Spacey's movie about the MIT Blackjack Team inspired by “Bringing Down the House” by Ben Mezrich, opened nationwide on March 28, 2008. 21 was the number one movie in US for two weeks and number one globally for one week. 21 also topped the DVD sales, Blu-ray sales and DVD rental charts.
  - Spring Lake Theater Company, first New York-area off-broadway production of “A Chorus Line,” played role of Mark, Summer 1990
- Former member of the MIT Blackjack team
- Producer for 10,000 Maniacs’ 2013 album “Music from the Motion Picture”
- Executive Producer for 10,000 Maniacs’ 2015 album “Twice Told Tales”
- Producer for 10,000 Maniacs’ 2016 DVD “10,000 Maniacs Live”
- Executive Producer for OK Go’s 2025 album “And The Adjacent Possible”
- 2024-25 production of “Romeo & Juliet” at the Circle in the Square Theater, nominated for 2025 Tony for Best Revival of a Play, Investor

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- Violist, violinist, cellist, harpist, guitarist, singer, actor: played in many amateur/semi-professional groups including Firebird Pops Orchestra, Boston Civic Symphony Orchestra, Reading Symphony Orchestra, MIT Summer Philharmonic Orchestra, Carlisle Chamber Orchestra, Horizon Ensemble, Rivers Symphony Orchestra, Opera51 Orchestra, American Music Abroad Summer 2025 Tour, Freisinger Chamber Orchestra, Merrimack Valley Philharmonic, Longwood Symphony, MIT Symphony, and Somerville Community Chorus
- Violist, “Coming Home” album by Karen Phillips, 2014
- Google Scholar citations: 2224, h-index: 22, i10-index: 27 (since 2019: 539/12/12)
- Erdos-Bacon number of 7
- Erdos-Bacon-Sabbath number of 11