

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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COMCAST CABLE COMMUNICATIONS, LLC,  
Petitioner

v.

ROVI TECHNOLOGIES, CORP.  
Patent Owner

Patent No. 6,725,281  
Filing Date: November 2, 1999  
Original Issue Date: April 20, 2004  
Reexamination Issue Date: October 26, 2012

Title: SYNCHRONIZATION OF CONTROLLED DEVICE STATE USING  
STATE TABLE AND EVENTING IN DATA-DRIVEN REMOTE DEVICE  
CONTROL MODEL

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*Inter Partes* Review No.: Unassigned

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**DECLARATION OF ANDREW LIPPMAN, Ph.D.**

**(Declaration in Support of Petition 2 of 7)**

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**EXHIBITS TO THE DECLARATION**

Exhibit A Curriculum Vitae of Andrew Lippman, Ph.D.

## EXHIBITS TO THE PETITION

- Exhibit-1101: U.S. Patent No. 6,725,281 (“’281 Patent”)
- Exhibit-1102: U.S. Patent No. 6,148,241 (“Ludtke ’241”)
- Exhibit-1103: Reserved
- Exhibit-1104: Reserved
- Exhibit-1105: U.S. Patent No. 6,456,892 (“Dara-Abrams”)
- Exhibit-1106: V. Chikarmane, C. Williamson, R. Bunt, and W. Mackrell, *Multicast Support for Mobile Hosts Using Mobile IP: Design Issues and Proposed Architecture*, *Mobile Networks and Applications* 3 (1998) 365–379 (“Chikarmane”)
- Exhibit-1107: U.S. Patent No. 5,551,701 (“Bouton”)
- Exhibit-1108: U.S. Patent No. 6,020,881 (“Naughton”)
- Exhibit-1109: Reserved
- Exhibit-1110: Reserved
- Exhibit-1111: Reserved
- Exhibit-1112: Expert Declaration of Andrew Lippman, Ph.D.
- Exhibit-1113: November 8, 2002 Non-Final Office Action for the ’281 Patent
- Exhibit-1114: April 22, 2003 Response to Non-Final Office Action for the ’281 Patent
- Exhibit-1115: May 14, 2003 Final Office Action for the ’281 Patent
- Exhibit-1116: October 22, 2003 Response and Request for Reconsideration
- Exhibit-1117: November 21, 2003 Notice of Allowance for the ’281 Patent

- Exhibit-1118: TiVo's request for Reexamination for the '281 Patent
- Exhibit-1119: April 25, 2011 Reexamination Order for the '281 Patent
- Exhibit-1120: August 16, 2011 Reexamination Non-Final Office Action for the '281 Patent
- Exhibit-1121: September 16, 2011 Response to Reexamination Non-Final Office Action for the '281 Patent
- Exhibit-1122: January 28, 2012 Reexamination Non-Final Office Action for the '281 Patent
- Exhibit-1123: February 28, 2012 Response to Reexamination Non-Final Office Action for the '281 Patent
- Exhibit-1124: August 7, 2012 Reexamination Final Office Action for the '281 Patent
- Exhibit-1125: August 29, 2012 Response to Reexamination Final Office Action for the '281 Patent
- Exhibit-1126: Reexamination Certificate for the '281 Patent
- Exhibit-1127: Claim Appendix
- Exhibit-1128: Declaration of Scott Bennett, Ph.D.

I, Andrew B. Lippman, declare that I have personal knowledge of the facts set forth in this Declaration and, if called to testify as a witness, could and would do so competently.

## **I. Introduction**

1. I have been retained as an expert witness on behalf of the Petitioner, Comcast Cable Communications, LLC (“Petitioner” or “Comcast”).

2. I reside in Salem, Massachusetts.

3. I have been asked to provide a declaration regarding remote control of networked devices and related technologies as well as the relevant industry. I have also been asked to render opinions regarding certain matters pertaining to the subject of U.S. Patent No. 6,725,281 (“the ’281 Patent” or Exhibit-1101”). Specifically, this declaration addresses the obviousness of the claims of the ’281 Patent.

4. I understand that this Declaration is being submitted along with the Petitioner’s request for the institution of *Inter Partes* Review of the ’281 Patent by the United States Patent and Trademark Office (“USPTO”).

5. I am being compensated at my usual consulting rate of \$600 per hour for my work on this matter. My compensation is not dependent upon my opinions or testimony or the outcome of this matter.

6. The facts set forth below are known to me personally and I have firsthand knowledge of them. I am a U.S. citizen over eighteen years of age. I am fully competent to testify as to the matters addressed in this Declaration.

## **II. Professional Background and Qualifications**

7. A description of my professional background and qualifications is provided below. I earned my undergraduate degree in Electrical Engineering from MIT in 1971. I also earned a Master of Science degree in Computer Graphics from MIT in 1978 and a Ph.D. in Electrical Engineering from the École Polytechnique Fédérale de Lausanne (Switzerland) in 1995. My thesis was on scalable video, a technique for representing visual data in a fluid and variable networking and processing environment, similar to what we call streaming today. I served on the editorial board of the Image Communication Journal between 1989 and 2003.

8. I am currently a Senior Research Scientist at the Massachusetts Institute of Technology (“MIT”) and Associate Director of the MIT Media Laboratory, an approximately \$50 Million per year research and teaching facility at MIT, which I helped establish in the early 1980s. I direct a special interest group called Ultimate Media, and am co-principal investigator of the Communications Futures Program, which unifies diverse research projects across MIT related to the technology, policy, and economics of communications most generally over the Internet.

9. At MIT, I have supervised over 50 Master's and Ph.D. theses in the Media Arts and Sciences program and have taught courses such as Digital Video and MIT's freshman physics seminars. Through the course of my career, I have directed and served as principal investigator of research projects supported by the defense department (DARPA), the Office of Naval Research (ONR), The National Science Foundation (NSF), and over 50 industrial companies. I have never precisely calculated my net research volume, but it is in excess of \$50 Million.

10. I am named as an inventor on six patents in the area of video and digital processing and have served on the advisory boards for technology companies in fields ranging from video conferencing to music analysis. I have authored or co-authored over 65 published papers in the fields of interactivity, communications, video coding, and television.

11. I have worked generally on video interaction systems since the 1970's. In the early 1970's, I developed font representations that permitted high quality display of text on standard broadcast television receivers. In 1978, I directed a DARPA-funded project called the "Movie-Map" that used computing and optical video and image storage to create and "experiential map" that featured "surrogate travel," the ability to recreate the visual experience of traveling through a real place, a city. This is similar to Google's Street-View and mapping systems. In the 1980's I was principal investigator of Office of Naval Research funded

programs in video and graphics computer systems for interactive learning dedicated to maintenance and repair. I also developed networked video communications systems that included scripting languages for specifying audiovisual content and representing it on various monitoring terminals.

12. I was a member of the Motion Picture Experts Group, an ISO standards committee effort that defined the standards for common distribution of “MP3” music and storage and distribution of “MPEG Video.” I co-wrote the paper defining the requirements for the MPEG-2 standard with Okubo and McCann in 1995. MPEG standards remain the predominant encoding for distribution of digital video to this day. I was also the principal investigator on industry-funded programs addressing digital motion pictures — the “Movies of the Future” program at MIT, and high definition television, “Television of Tomorrow.” At the Media Lab at MIT, I created the “Digital Life” consortium the purpose of which was to explore and develop ideas relevant to an Internet-connected society.

13. In 1991, I created the “Media Bank” program in the Media Lab at MIT the purpose of which was to allow a diverse set of networked devices to access appropriate forms of content for which they had the bandwidth and processing power to display. This entailed maintaining state information about terminal devices at a server and using that to determine the best representation of the audiovisual material to deliver to them. In addition, it included and developed

cryptographic distribution methods that insured secure delivery of information on the network. Related to this work, I also supervised Masters theses on networked distribution of video and coding specifically for diverse uses on the Internet.

14. Also in 1991, I created the Television of Tomorrow program at the MIT Media Lab. This program addressed the digital representation and delivery of video at diverse scales and through diverse networks. This program built on work on scalable representations of images that were standards-independent and interactive. In 1993, I was invited to be a member of Robert Kahn's "Cross Industry Working Group" the goal of which was to develop the ideas for a National Information Infrastructure. At DARPA, Kahn had initiated the research to develop the Arpanet and the Internet. Throughout this period, my students and I worked on distributed interactive systems for consumer use (television, electronic newspapers, learning) including the basic technology of the network and the client-server interactions.

15. A more detailed account of my work experience and qualifications, and a list of my publications, is included in my Curriculum Vitae, which is attached as Exhibit A to this Declaration. Based on my experiences described above, and as indicated in my CV, I am qualified to provide the following opinions with respect to the '281 Patent in this proceeding.

### III. Materials Considered

16. The analysis that I provide in this Declaration is based on my education and experience in the field of electrical engineering, networked devices, and computer software, as well as the documents I have considered, including the '281 Patent (Exhibit-1101) as amended by its Reexamination Certificate (Exhibit-1126), which states on its face that it claims priority to two provisional applications, which were filed on June 11, 1999 and October 18, 1999. I have also reviewed the file wrapper for the '281 Patent, including its reexamination history.

17. Furthermore, I have reviewed various relevant publications from the art at the time of the alleged invention of the '281 Patent to which this Declaration relates. The materials I have reviewed include those listed below:

- Petition for *Inter Partes* Review of U.S. Patent No. 6,725,281 Under 35 U.S.C. §§ 311-319 and 37 C.F.R. §§ 42.100 *et seq.*;
- U.S. Patent No. 6,725,281 B1 to Zintel *et al.* (“the '281 Patent”) (Exhibit-1101 to the Petition);
- File history of the '281 Patent (various exhibits to the Petition);
- Reexamination history of the '281 Patent (various exhibits to the Petition);
- U.S. Patent No. 6,148,241 (“Ludtke '241”) (Exhibit-1102 to the Petition);

- U.S. Patent No. 6,456,892 (“Dara-Abrams”) (Exhibit-1105 to the Petition);
- V. Chikarmane, C. Williamson, R. Bunt, and W. Mackrell, *Multicast Support for Mobile Hosts Using Mobile IP: Design Issues and Proposed Architecture*, *Mobile Networks and Applications* 3 (1998) 365–379 (“Chikarmane”) (Exhibit-1106 to the Petition);
- U.S. Patent No. 5,551,701 (“Bouton”) (Exhibit-1107 to the Petition);
- U.S. Patent No. 6,020,881 (“Naughton”) (Exhibit-1108 to the Petition); and
- Claim Appendix (Exhibit-1127 to the Petition).

#### **IV. Understanding of Applicable Legal Standards**

18. I am not a patent attorney, nor have I independently researched the law on patent validity. Attorneys for the Petitioner have explained certain legal principles to me that I have relied upon in forming my opinions set forth in this report.

##### **A. Person Having Ordinary Skill in the Art**

19. I understand that my assessment of claims of the ’281 Patent must be undertaken from the perspective of what would have been known or understood by a person having ordinary skill in the art, reading the ’281 Patent on its relevant filing date and in light of the specification and file history of the ’281 Patent.

20. For the relevant priority date for the '281 Patent, I have used in my declaration the earliest application date on the face of the patent: June 11, 1999 based on a claim of priority to Provisional Application No. 60/139,137. However, I have not analyzed whether the '281 Patent is entitled to that date for its priority.

21. Counsel has advised me that to determine the appropriate level of one of ordinary skill in the art, the following four factors may be considered: (a) the types of problems encountered by those working in the field and prior art solutions thereto; (b) the sophistication of the technology in question, and the rapidity with which innovations occur in the field; (c) the educational level of active workers in the field; and (d) the educational level of the inventor.

22. With over 40 years of experience in electrical and computer engineering, I am well acquainted with the level of ordinary skill required to implement the subject matter of the '281 Patent. I have direct experience with and am capable of rendering an informed opinion on what the level of ordinary skill in the art was for the relevant field as of June 11, 1999.

23. The relevant technology field for the '281 Patent is networked devices, including synchronization of state tables, graphical user interfaces and remote control of such devices, and associated computer software. Based on this, and the four factors above, it is my opinion that one of ordinary skill in the art would have had at least a bachelor's degree in computer science, electrical

engineering, computer engineering, or similar discipline, and at least two to three years of experience or familiarity in the relevant field, or have had equivalent knowledge and experience.

24. I was of more than this level of ordinary skill in the art as of June 11, 1999.

25. My analysis and opinions regarding the '281 Patent have been based on the perspective of a person of ordinary skill in the art as of June 11, 1999.

26. I understand that the law provides categories of information that constitute prior art that may be used to anticipate or render obvious patent claims, and that this includes printed publications predating the priority date of the subject patent, as well as U.S. patents and published patent applications of another that issued or were filed before the priority date of the subject patent. I also understand that one of ordinary skill in the art is presumed to have knowledge of the relevant prior art.

**B. Anticipation**

27. I understand that to be valid, a patent claim must be “novel,” and is invalid if “anticipated” by a single prior art reference. I further understand a reference anticipates if it discloses each and every element as arranged in the claim, so as to enable a person of ordinary skill in the art to make and use the claimed invention without undue experimentation.

### **C. Obviousness**

28. I understand that a proper analysis of whether an invention is unpatentable for obviousness includes a review of the scope and content of the prior art, the differences between the patent claims and the prior art, and the level of skill in the pertinent art at the time of the invention.

29. I understand that a claim may be considered unpatentable for obviousness if there is a teaching or suggestion to combine prior art references in a manner that yields the claimed invention. I understand that a showing of obviousness requires some articulated reasoning with a rational underpinning to support the combination of the references. I understand that in consideration of the issue it is important to identify whether a reason existed at the time of the invention that would have led one of ordinary skill in the art to combine elements of the references in a way that yields the claimed invention.

30. I understand that various objective or “real world” factors may be indicative of non-obviousness. I understand that such factors include:

- (A) Commercial success of the claimed invention;
- (B) Existence of a long-felt, unresolved need for a solution to the problem solved by the claimed invention;
- (C) Failed attempts to solve the problem solved by the claimed invention;
- (D) Copying of the claimed invention;

- (E) Unexpected results of the claimed invention;
- (F) Praise for the claimed invention by others in the relevant field; and
- (G) Willingness of others to accept a license under the patent because of the merits of the claimed invention.

**D. Broadest Reasonable Interpretation**

31. I understand that, in the present *inter partes* review proceeding, the patent claims are given their broadest reasonable interpretation in light of the specification of the patent at issue. I also understand that claim terms that are not expressly defined in the patent are to be given their plain and ordinary meaning as would have been understood by one of ordinary skill in the art at the time of the invention in view of the patent specification. As explained below, I have followed these directions in forming the opinions set forth in this Declaration.

**V. STATE OF THE ART AND OVERVIEW OF '281 PATENT**

**A. State Of The Art**

32. Networked devices, including remote control of those devices, were well known at the time of the '281 Patent invention. In the mid-1980's, remote control technology advanced to include universal remote controls which can be programmed to operate different types of devices, such as a TV, set-top box ("STB"), VCR player, DVD player, sound system, etc. For example, a VCR player might come with a remote control that can be programmed to work any number of different TV brands and models.

33. Universal remote controls may have buttons that can be used to operate the devices, and may also have a display, such as an LCD display, with a graphical user interface with which a user may control the networked device.

34. Networking technologies and the use of the Internet available at the time of the invention created different ways for devices to interact and share information. As those technologies developed, other devices with user interface capabilities, such as hand-held computers, PDAs, cell phones, etc., were able to interact and share information with other devices in the same way as remote controls.

35. Additionally, synchronization of remote stations to a central device over a network was also commonly known at the time of the invention. Multiple user shared environments were used and each end user had a synchronized real-time view of the shared environment.

#### **B. Overview Of The '281 Patent**

36. The '281 Patent is directed generally to the dynamic synchronization of distributed devices. (Exhibit-1101, 1:13-19.) The '281 Patent teaches remote control of a controlled target device through the use of a data structure (called a state table) that reflects the operational state of the target device. The claimed invention allows a networked target device such as a STB to communicate with a remote control. (*Id.*, 6:48-49, 45:25-47.) The target device has data that defines a

device control user interface and can export the user interface data over a network to the remote control. (*Id.*, 2:32-35.) The user interface on the remote control allows a user to interact with and thereby control the target device. (*Id.*, 6:26-32, 12:65-67.)

37. The '281 Patent teaches that many types of devices can be a target device or a control device. (Exhibit-1101, 6:48-65.) For example, a target device can be any type of device that can respond to discovery requests and accept incoming communications. (*Id.*) A control device can be any type of device that can initiate discovery and communication with a target device and receive events. (*Id.*, 6:26-47.) The '281 Patent teaches that control devices also typically have a user interface through which the target device is controlled. (*Id.*, 12:65-67.) The '281 Patent also teaches that a device can be both a control device and a target device. (*Id.*, 6:44-47, 6:63-65.)

38. In my opinion, one of ordinary skill in the art would have further understood that any device that is able to implement the functionality described in the '281 Patent could function as a target device and/or control device even if that type of device is not specifically identified as a target device and/or control device in the '281 Patent.

39. The '281 Patent teaches that the target device maintains a data structure (called a state table) that represents its operational state, such as the

current electrical, mechanical, or logical state of the target device. (Exhibit-1101, 12:61-62, 8:53-60.) Figure 20 (shown below) depicts an XML schema (or representation) for a data structure that represents an implementation, or an embodiment, of the so-called state table. (*Id.*, Figure 20.)

FIG. 20

```
<?xml version="1.0"?>
<Schema name="upnp_scpdl"
  xmlns="urn:schemas-microsoft-com:xml-data"
  xmlns:dt="urn:schemas-microsoft-com:datatypes">

  <!-- Common Elements and Attributes -->

  <ElementType name="name" content="textOnly" dt:type="string" />

  <!-- Service State Table -->

  <ElementType name="minimum" content="textOnly" dt:type="number" />
  <ElementType name="maximum" content="textOnly" dt:type="number" />
  <ElementType name="step" content="textOnly" dt:type="number" />

  <ElementType name="allowedValueRange" content="eltOnly" model="closed">
    <element type="minimum" />
    <element type="maximum" />
    <element type="step" minOccurs="0" />
  </ElementType>

  <ElementType name="allowedValue" content="textOnly" />

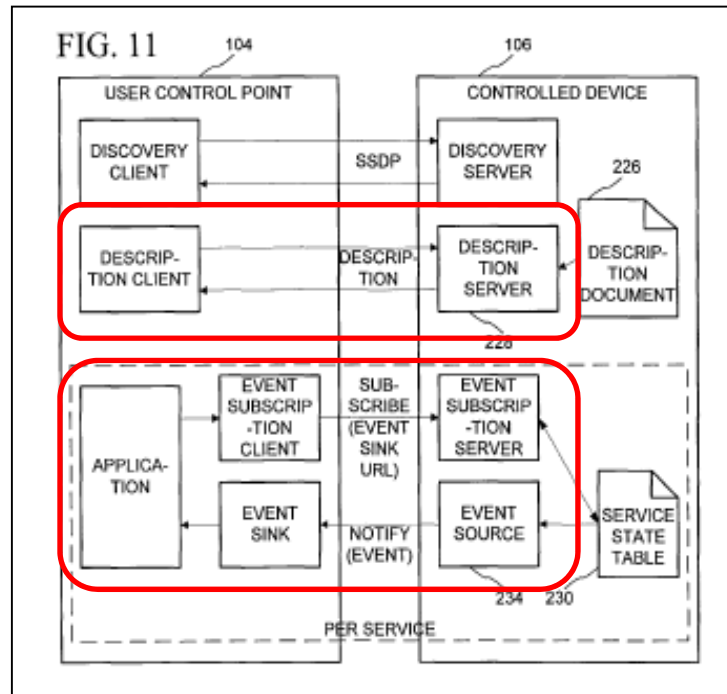
  <ElementType name="allowedValueList" content="eltOnly" model="closed">
    <element type="allowedValue" minOccurs="1" maxOccurs="*" />
  </ElementType>

  <ElementType name="dataType" content="textOnly" dt:type="string" />

  <ElementType name="stateVariable" content="eltOnly" model="closed">
    <element type="name" />
  ...
```

**Exhibit-1101, Figure 20**

40. The “description client” at the remote control device can obtain a copy of the target device’s state table through a request to the “description server” in the target device, and the “event subscription client” subscribes to change notifications to the state table through a request to the “event subscription server” in the target device as indicated by the communications encircled in Figure 11 (below). (*Id.*, 6:27-30, 24:47-49, Figures 11, 13, and 23.) Figure 13 also shows a



**Exhibit-1101, Figure 11 (annotated)**

request to the target device for the copy of the state table information, while Figure 23 shows the subscription request from the remote control to the target device. (*Id.*, Figures 13 and 23.) The target device distributes change notifications to any subscribing device upon a change to the state table, such as those caused by inputs from the remote control. (*Id.*, 6:48-52, 17:2-5, Figure 23.) The subscribing

device(s) (*i.e.*, remote control devices), after receiving the change notifications, can update their copy of the target device state table, and thereby synchronize the table and the interface(s) of the subscribing device(s) with the target device. (*Id.*, 12:61-64, 17:2-5.)

## **VI. PRIOR ART**

41. All claims of the '281 Patent include at least the limitations of (1) the presence of a controller and a controlled device, (2) a state table *maintained in the controlled device* that represents its operational state and the user interface information to portray that state, and (3) a subscription means by which a copy of that state table can be stored in the controller and updated by events occurring at either the controller or the controlled device. (*See generally* Exhibit-1101.) Now I will show that all of these elements were known in the art on or before June 11, 1999.

### **A. U.S. Patent 6,148,241 (“Ludtke ’241”)**

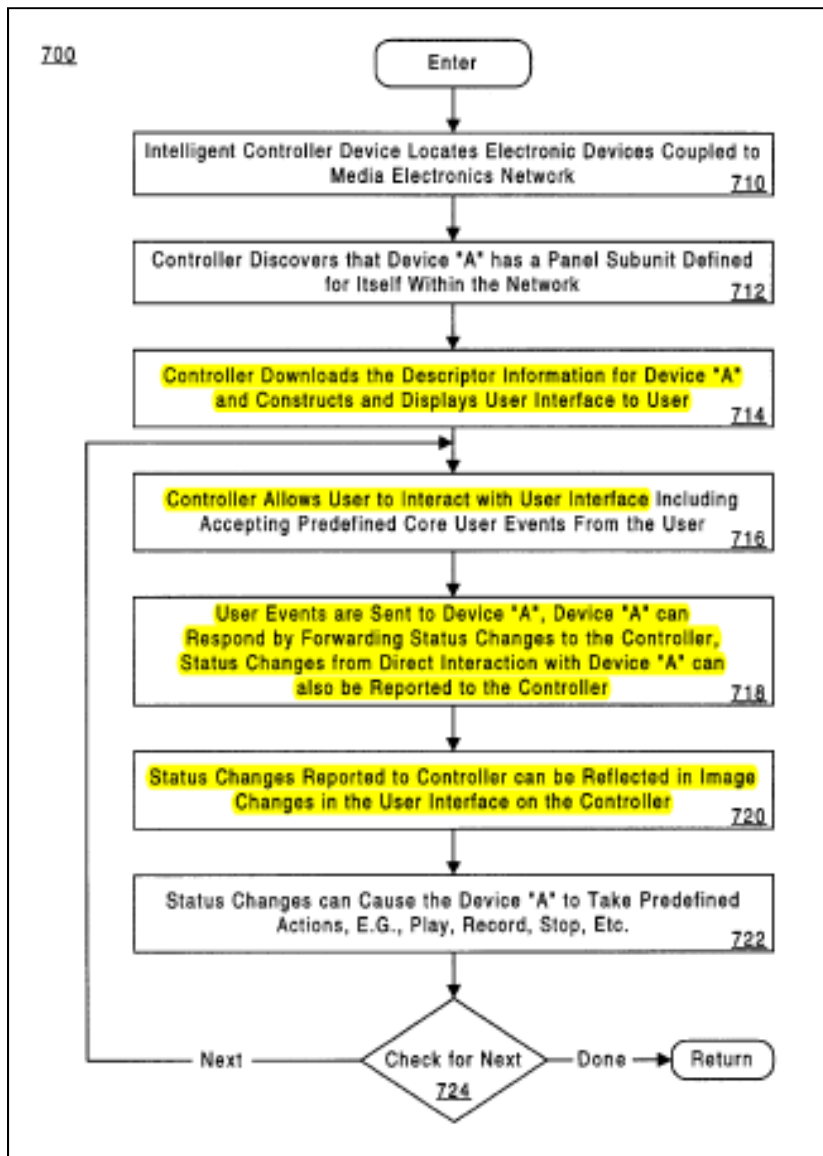
42. Ludtke '241 was filed on July 1, 1998 and issued on November 14, 2000. (Exhibit-1102.) I am advised that Ludtke '241 is prior art to the '281 Patent under 35 U.S.C. §102(e).

43. Ludtke '241 teaches a system for “providing user interfaces for networked electronic devices including remote devices” where “target” devices maintain a description of their interface. (Exhibit-1102, 1:10-12, 2:36-38.) An

“intelligent controller” can use that information to display a representation of that user control and allow a user to operate the target device via the intelligent controller as if he or she were operating a panel on the target device itself. (*Id.*, 2:42-44.) The current status of the target device is maintained in that target device and updated in the controller. (*Id.*, 3:17-21.) The controller can subscribe to the target for updates to its status via event-driven notifications. (*Id.*, 3:24-27, 3:66-4:4.)

44. The target device has a panel subunit which is a collection of data structures that describes the physical controls of the target device as well as the current operational state of the target device. (*Id.*, 9:8-10, 10:26-28, 15:17-39, Figures 5-8.) Figures 5 and 6 illustrate the organizational nature of the data structures. (*Id.*, Figure 5.) Figures 7A & 7B illustrate the physical description of the target controls and data to implement controls on the intelligent controller. (*Id.*, Figures 7A and 7B.) Figure 8 illustrates the current operational status for each of the controls in the data structure. (*Id.*, Figure 8.)

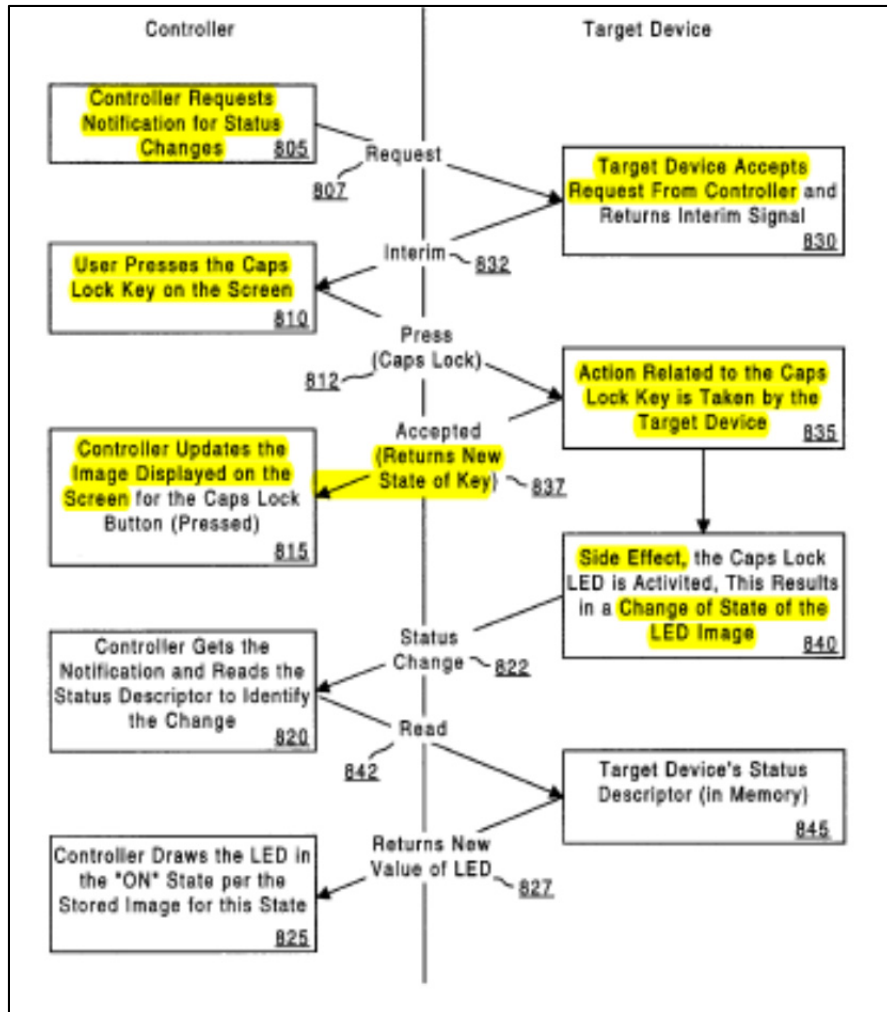
45. The intelligent controller, upon locating a target device on the network, obtains a copy of the target device panel subunit information, including operational state data, and generates a user interface for the user. (Exhibit-1102, 16:10-37, Figure 9 (step 714).) The user may then interact with the target device through the intelligent controller. (*Id.*, 16:38-64, Figure 9 (steps 716, 718).)



**Exhibit-1102, Figure 9 (annotated)**

46. The intelligent controller can post a notification request to the target device, so that any time there is a change in the status of the target device, a notification will be sent to the intelligent controller. (*Id.*, 15:40-43, 17:10-15, Figure 9 (step 718), 18:47-49, 18:61-63, Figure 12 (steps 805, 807, and 837).) The controller will then update its graphical display to reflect the change in status. (*Id.*,

17:18-22, Figure 9 (steps 718, 720), 18:47-49, 18:61-63, Figure 12 (highlighted portions).)



**Exhibit-1102, Figure 12 (annotated)**

47. Ludtke '241 states that the “intelligent controller is not burdened with keeping state tables.” (Exhibit-1102, 17:30-40.) For clarity, this portion of Ludtke '241 means that the intelligent controller does not maintain a separate state transition table for the target devices where the intelligent controller would have to know the operational details of the target devices internal operation. (See *e.g., Id.*,

9:60 (Table 1).) That is to say, the user interface is an abstraction of the command at a user level that the target will implement in its own way; the controller need not know what that is or maintain state associated with it. That is abstracted away to the target. The controller *does* maintain the state of the interface (and thereby the operational state of the target device) and via that interface the target reports its state.

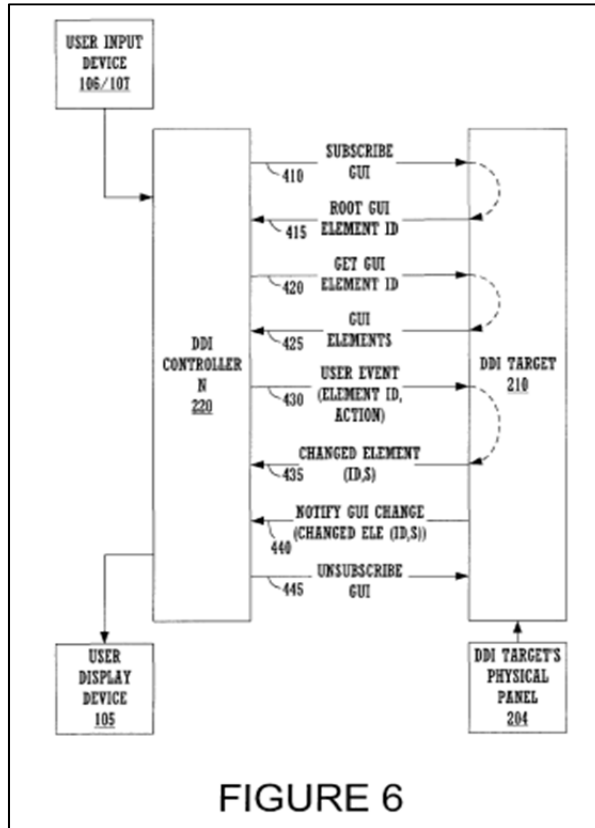
**B. U.S. Patent No. 6,456,892 (“Dara-Abrams”)**

48. Dara-Abrams was filed October 30, 1998 and issued on September 24, 2002. (Exhibit-1105.) I am advised that Dara-Abrams is prior art under 35 U.S.C. §102(e).

49. Dara-Abrams teaches a data-driven interface (“DDI”) between devices to allow a universal controller. (Exhibit-1105, Abstract.) A DDI controller discovers target devices. (*Id.*, 4:52-56.) The target devices store graphical user interface (“GUI”) elements in a data structure which define the target device’s physical controls and maintain the current state of the target device. (*Id.*, 4:35-39, 5:3-10, 5:24-28, 6:65-7:5, 11:65-12:1.) The DDI controller is configured to display controls of a target device, where the displayed controls permit a user to control the target device “as if [the] user had directly physically manipulated the control on the target device.” (Exhibit-1105, 4:39-46.)

50. The target device sends the data structure containing the description of its physical appearance including control and display information to the controller. (*Id.*, 6:61-7:6.) Using this description information, the controller can display target device controls to the user, which trigger actions on the target device. (*Id.*, 7:1-6.)

51. In addition, the controller can subscribe to notifications of changes in the GUI description by sending a `SubscribeGui` message to the target device. (*Id.*, 13:57-59, 14:17-22, Figure 6 (step 410).) Upon receipt, the target device records which element sent the message to use for future change notification messages. (*Id.*, 13:59-62.) The target device keeps the controller informed of its status by sending `NotifyGuiChange` messages to the controller, which then displays the current status of the target device to the user. (*Id.*, 5:24-26, 13:14-20, 13:25-34, 14:17-26, Figure 6 (step 440).)



**Exhibit-1105, Figure 6**

52. Dara-Abrams states that the DDI controller “does not need to have any knowledge at all about what is happening within the DDI target device” and that the “state transition logic ... is all contained within the DDI target device.” (Exhibit-1105, 7:39-47.) For clarity, this portion of Dara-Abrams means that the DDI controller does not maintain a separate state transition table for the target devices where the DDI controller would have to know the meaning of the target device’s internal operation. (See *e.g., Id.*, 12:50 (Table 1).) That is to say, the user interface is an abstraction of the command at a user level that the target will implement in its own way; the controller need not know what that is or maintain

state associated with it. That is abstracted away to the target. The DDI controller *does* maintain the state of the interface (and thereby the operational state of the target device) and via that interface the target reports its state.

**C. Multicast Support for Mobile Hosts Using Mobile IP: Design Issues and Proposed Architecture (“Chikarmane”)**

53. Chikarmane is non-patent literature that was published in the Mobile Networks and Applications Journal, Volume 3, Issue 4 (1998), relevant portions of which are attached to the Petition as Exhibit-1106. I am advised that Chikarmane is prior art under at least 35 U.S.C. § 102(a).

54. Chikarmane teaches an architecture for providing multicast to groups with dynamic membership in a TCP/IP internetwork with mobile hosts. (Exhibit-1106, p. 4.) In mobile IP and IP multicast, agents manage mobile host registrations by maintaining a list of all currently registered mobile hosts that are visiting the network served by the agent. (*Id.*, p. 5.) A lifetime of the registration is negotiated during the registration. (*Id.*) If the mobile host does not re-register prior to expiration of the registration’s lifetime, the agent assumes that the mobile host has moved to another network. (*Id.*)

**D. U.S. Patent No. 5,551,701 (“Bouton”)**

55. Bouton was filed January 5, 1994, and issued on September 3, 1996. (Exhibit-1107.) I am advised that Bouton is prior art under 35 U.S.C. §102(b).

56. Bouton teaches a video game controller that is reconfigurable to match the user's video game of choice. (Exhibit-1107, 3:11-13.) The video game system (*e.g.*, a personal computer) can provide keycodes to the video game controller to reconfigure the video game controller. (*Id.*, Abstract, 3:34-53.)

**E. U.S. Patent No. 6,020,881 (“Naughton”)**

57. Naughton was filed February 18, 1997, issued February 1, 2000. (Exhibit-1108.) I am advised that Naughton is prior art under 35 U.S.C. §102(e).

58. Naughton teaches an apparatus that provides a graphical user interface for controlling remote devices. (Exhibit-1108, 1:10-16.) For instance, a hand-held display device 170 may control remote devices such as a thermostat 150, video cassette recorder 39, and stereo system 152. (*Id.*, 7:14-21.) The remote devices provide information about themselves to the hand-held display device 170, which may be used by the hand-held display device 170 to render a graphical user interface. (*Id.*, 7:28-37.) A user can interact with the graphical user interface to control the remote device. (*Id.*, 26:58-27:7.) In response, the remote device provides the hand-held display device 170 return values and feedback resulting from the user's commands. (*Id.*, 27:8-16.)

**VII. CLAIM CONSTRUCTION**

59. I have been instructed that an unexpired claim subject to inter partes review “shall be given its broadest reasonable construction in light of the

specification of the patent in which it appears.” 37 C.F.R. § 42.100(b). The challenged claims of the ’281 Patent include terms addressed below. The broadest reasonable constructions of these terms in light of the specification are, in my opinion, the meanings provided below.

**A. “*a controlled computing device*”**

60. The ’281 Patent describes a controlled computing device as able to respond to incoming communications from controllers, and send status updates to the controller. (Exhibit-1101, 6:49-62.) Examples of controlled computing devices include VCR, DVD player or recorder, computer, smartphone, etc. (*Id.*) Accordingly, in my opinion, the broadest reasonable construction of a controlled computing device in light of the specification is a device that responds to commands of another device.

**B. “*a state table...representing an operational state of the controlled computing device*”**

61. The ’281 Patent teaches that the invention can, in at least one embodiment, conform to the Universal PlugNPlay (“UPnP”) standard. (Exhibit-1101, 3:37-41.) The ’281 Patent describes a device state table (DST) 230 as a service state table (SST). (*Id.*, 28:41-43, Figure 3 (230).) SST is defined as a table of rows having values that represents the current electrical, mechanical, and/or logical state of a controlled device. (*Id.*, 8:53-56, 16:12-18.) Figure 20 illustrates an XML data structure that represents an embodiment of the SST. (*Id.*, 3:26-28,

Figure 20.) The '281 Patent describes that while, in one embodiment, the SST may include five items, “the state table alternatively can contain fewer ... items.” (*Id.*, 16:14-16.) Although the specification often discusses the invention in the context of UPnP, the specification also refers to UPnP as “one described implementation.” (*Id.*, 4:7-11.) Therefore, for purposes of this proceeding, in my opinion, the broadest reasonable interpretation of this term is a data structure regarding the current state of a device.

**C. “a user controller device”/“control point computing device”**

62. The '281 Patent uses both “user controller device” and “control point computing device” to refer to a User Control Point, which is a device that initiates communication with and receives incoming communications (*e.g.*, Events) from a controlled device and displays a user interface to control the controlled device over a network. (Exhibit-1101, 6:27-41.) The User Control Point may act as a universal remote by aggregating control of multiple controlled devices. (*Id.*, 6:37-41.) Examples of a User Control Point include personal computers, digital televisions, set-top boxes, hand-held computers, smart mobile phones, and the like. (*Id.*, 6:41-44.) In my opinion, the broadest reasonable interpretation in light of the specification is a device that presents a user interface to interact with another device resulting in a change in the other device’s operational state.

**D. “a user control point module”**

63. The '281 Patent describes a “user control point module” as a module or set of modules that enable communication with a controlled device and contain a rehydrator module that “translates between native operating system APIs [application programming interfaces] and SCPs [service control protocols] and events.” (Exhibit-1101, 6:26-27, 11:1-3.) A subscribe request informs the controlled device of the user control point’s desire to receive future events and, in response, the controlled device may notify the user control points upon changes to the state table. (*Id.*, 11:14-21.) The '281 Patent defines a “module” as “[a] component of a device, software program, or system that implements some ‘functionality’, which can be embodied as software, hardware, firmware, electronic circuitry, or etc.” (*Id.*, 6:22-25.) Accordingly, in my opinion, the broadest reasonable interpretation of a user control point module in the user controller device operating to obtain a copy of the state table of the user controlled device and subscribe to change notifications of the state table is a component (or set of components) in the user controller device that requests the operational state from the controlled device and causes the controlled device to send operational state updates to the user controller device.

**E. “an eventing model”**

64. The specification of the '281 Patent describes an event source module that runs in a controlled device that sends notifications to subscribing user control points whenever the state table changes. (Exhibit-1101, 11:19-21, 11:40-42.) The '281 Patent teaches maintaining synchronization of changes in the state table between interested user control points and the controlled device. (*Id.*, 17:1-5, 9:22-28, 12:33-36.) The '281 Patent does not define event source module or eventing model, but “eventing” is generally referred to as “the ability for a device to initiate a connection at any time to one or more devices that have expressed a desire to receive events from the source device” and an event is a message from a controlled device. (*Id.*, 12:32-39, 9:22-28.) Accordingly, in my opinion, the broadest reasonable interpretation of this limitation is a software module in the controlled computing device that distributes operational state updates of the controlled computing device to a subscribing user controller device for presentation in the user interface.

**F. “embedded computing device”**

65. The '281 Patent teaches that an embedded computing device can be any type of device having “electronics to control operational functions ... and in which computing and networking capabilities are embedded” including televisions,

cell phones, audio video recorders, CD players, set top boxes, etc. (Exhibit-1101, 45:29-47.)

**G. “a peer networking state eventing and control protocol method for effecting state-concurrent multi-master control of a controlled computing device by a plurality of control point computing devices communicating on a data communications network”**

66. The '281 Patent teaches a data communications network that allows for multiple control point computing devices 104, 105 in a peer-to-peer networking environment to control the same controlled computing device 106. (Exhibit-1101, 12:47-50, Figure 2 (104, 105, 106).) In my opinion, one of ordinary skill in the art would have understood this to be “multi-master” control of the controlled computing device. All of the control point computing devices receive the same state events, both the initial copy of the state table and the change notifications, from the controlled computing device. (*Id.*, 12:58-60.) Thus, the state information is synchronized between the controlled computing devices. (*Id.*, 12:61-64.) Accordingly, in my opinion, the broadest reasonable interpretation of this limitation is a method for enabling multiple control point computing devices to control the same controlled computing device and receive the same state events over a data communications network in a peer to peer networking environment.

## **VIII. SPECIFIC GROUNDS FOR UNPATENTABILITY**

67. It is my opinion that claims 34, 48-69, 73, and 75 of the '281 Patent are unpatentable under the grounds set forth below.

<b>Ground(s)</b>	<b>'281 Patent Claims</b>	<b>Basis for Unpatentability</b>
<b>1</b>	<b>48-54, 56, 58-64, 67-69, 73, and 75</b>	<b>Obvious over Ludtke '241</b>
<b>2</b>	<b>55</b>	<b>Obvious over Ludtke '241 in view of Dara-Abrams</b>
<b>3</b>	<b>34, 57</b>	<b>Obvious over Ludtke '241 in view of Chikarmane</b>
<b>4</b>	<b>65</b>	<b>Obvious over Ludtke '241 in view of Bouton</b>
<b>5</b>	<b>66</b>	<b>Obvious over Ludtke '241 in view of Naughton</b>

**A. Ground 1: Claims 48-54, 56, 58-64, 67-69, 73, and 75 are Obvious Over Ludtke '241**

68. As explained below, in my opinion, claims 48-54, 56, 58-64, 67-69, 73, and 75 are obvious over Ludtke '241 in view of the knowledge of one having ordinary skill in the art, and thus are unpatentable under 35 U.S.C. §103.

**1. Claim 48 (Exhibit-1127, pp. 27-30.)**

***a. Peer Networking Limitation (Preamble)<sup>1</sup>***

69. With reference to the interpretation I discuss in Paragraph 66, Ludtke '241 teaches this limitation. Specifically, Ludtke '241 teaches networked consumer electronic devices, in a home entertainment system such as TVs, STBs, VCRs, and PCs, within a peer-to-peer environment. (Exhibit-1102, 1:8-11, Figure

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<sup>1</sup> For ease of reference, I use Claim Limitation Designations provided to me in the Claim Appendix (Exhibit-1127) to refer to claim language that is repeated throughout the claims.

1, 2:44-48, 6:34-37.) Ludtke '241 also teaches that there can be multiple intelligent controller devices for the same controlled computing device. (*Id.*, 7:21-23.) Ludtke '241 teaches a controlled target device, which can be any type of electronic device, and which responds to an intelligent controller. (*Id.*, 8:36-37, 2:44-48.)

***b. State Table Limitation (Preamble)***

70. Ludtke '241 teaches a panel subunit which is a collection of data structures that describes the physical controls of a target device such as VCR 12 with various controls such as LCD panel 214 and play button 250 (Figures 3A & 3B). (Exhibit-1102, 9:8-10.) Figure 5 (below) shows the overall structure of the panel subunit 314 for VCR 12. Figures 7A and 7B show the specific details for two different control objects – object 382 which represents LCD panel 214 and object 384 which represents play button 250. The data structure for the control objects include type (numerals 440/460), image for the control object for the user interface (numerals 442/462), presentation data for the user interface (numerals 444/446/448/464/466/468), object identifiers (numerals 456/476), valid values, and ranges (numerals 450/470) among others. (*Id.*, 11:15-38 (Figure 5), 13:16-14:24 (Figure 7A), 14:25-55 (Figure 7B).)

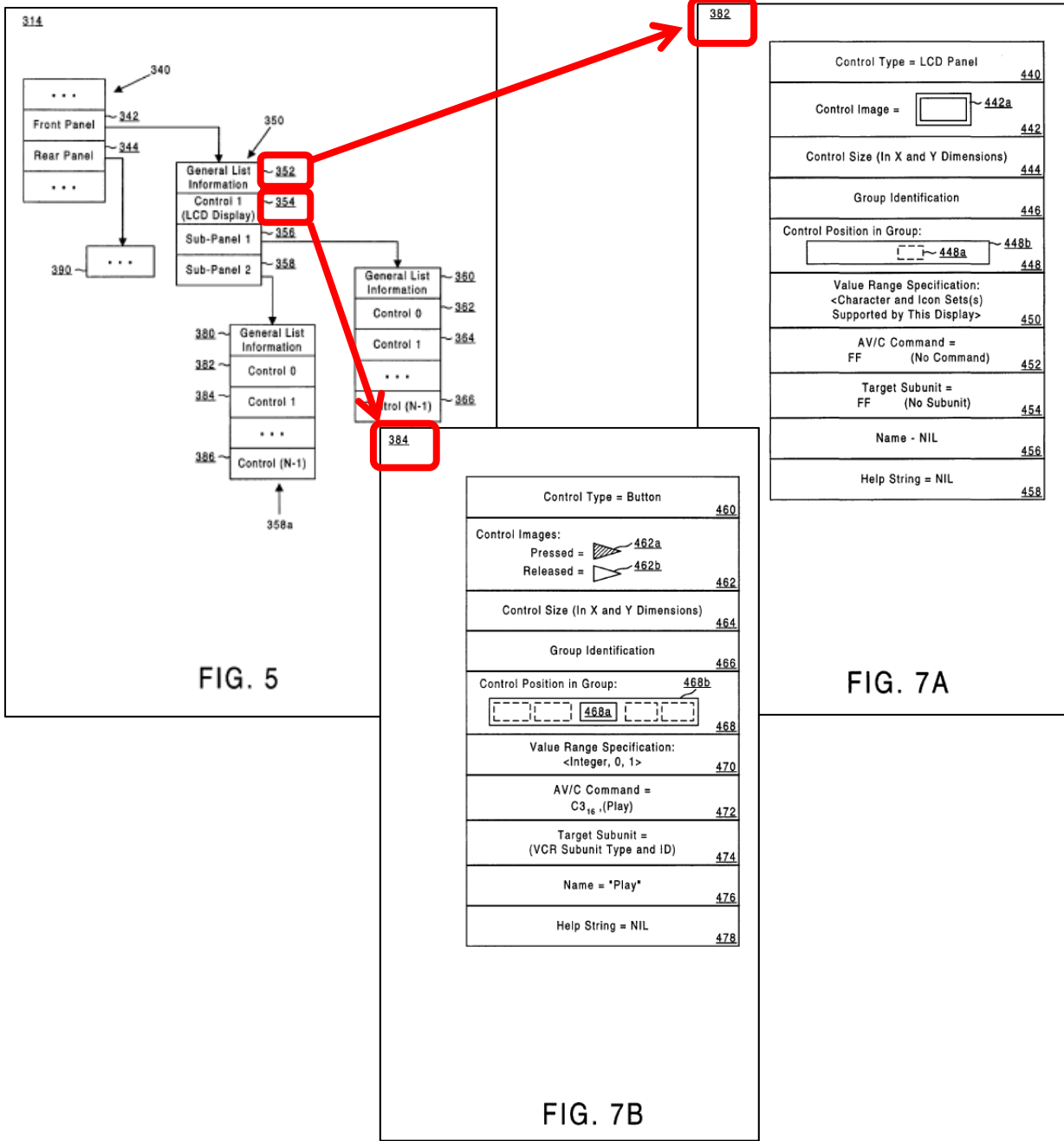
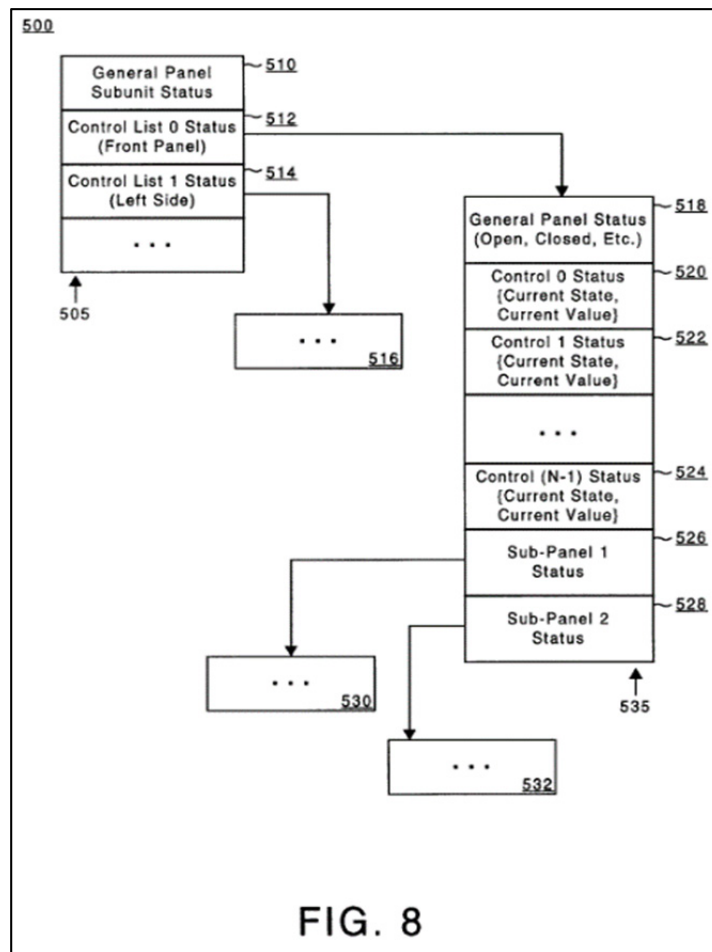


Exhibit-1102, Figures 5, 7A & 7B (annotated)

71. The panel subunit also includes a dynamic status descriptor data structure that is maintained by the target device and represents the current status of each control object of the target device (e.g., VCR 12) that is described in the panel subunit. (Exhibit-1102, 10:39-41, 15:17-26, Figure 8.) Figure 8 is a representation of the status descriptor data structure and shows the current state or value for every control object defined in the panel subunits shown in Figures 5-7. (*Id.*, 15:26-39, 15:50-16:9.) For example, status information may include that LCD Panel 214 is displaying certain text or that play button 250 is currently pressed. (*Id.*, 15:36-39.)



**Exhibit-1102, Figure 8**

72. As I discuss in Paragraph 61, the SST in Figure 20 of the '281 Patent is an XML data structure rather than a "table," meaning it is not itself a series of rows with column values. Because the '281 Patent teaches the use of XML to represent the operational state of the target device, one of ordinary skill in the art would have understood that there is more than one way to construct the claimed state table. With reference to the interpretation I discuss in Paragraph 61, in my opinion, the Ludtke '241 panel subunit status descriptor data structures, as shown in the Figures above, are data structures regarding the current state of the target device. Therefore, in my opinion, one of ordinary skill in the art at the time of the invention would have understood that the panel subunit status descriptor data structures of Ludtke '241 meet this limitation.

73. It is further my opinion that one of ordinary skill in the art at the time of the alleged invention would have understood that the table shows the state of the target device. State data is persistently stored information representing a condition of the target device. In my opinion, the format of the representation of the state data is a matter of programming style or engineering choice rather than an inventive distinction. Therefore, in my opinion, one of ordinary skill in the art at the time of the alleged invention would have understood that the design of the state table/XML schema (*e.g.*, how many rows or columns) is a matter of design choice to organize the status information for ease of use. The system taught in both the

'281 Patent and Ludtke '241 would work the same using any variety of data formats. In my opinion, one of ordinary skill in the art would also have understood that any data structure format would have worked in the same way as a table with rows and column values with no unexpected results. Therefore, in my opinion, one of ordinary skill in the art would have found it obvious to use any data structure format that maintains the same operational state information of the controlled device, such as the status descriptor data structure found in Ludtke '241.

***c. Control Point Computing Device Limitation (Preamble)***

74. Ludtke '241 teaches that an intelligent controller can be any device in a network that has input and display capabilities. (Exhibit-1102, 7:18-21.) The intelligent controller in Ludtke '241 provides a user interface for interacting with a target device, such as pressing play button 250. (*Id.*, 7:25-32.) For example, referring to Figure 12, when a user presses a caps lock key (step 810), a message (812) is sent to the target device and the proper action is taken at the target device (step 835). (*Id.*, 18:44-19:13, Figure 12.) When the target device executes the action, it will then update its operational state that is represented in the panel subunit status descriptor data structure. (*Id.*)

75. Additionally, regarding “and communicating with the controlled computing device via a device control protocol,” I note that for a control point computing device to communicate with and to effect remote control of the

controlled computing device, there must be a device control protocol shared by both devices, such as AV/C command and control protocol taught by Ludtke '241. (Exhibit-1102, 5:4-13.) In my opinion, one of ordinary skill in the art would have understood that for two devices to communicate with each other they would need to share a communication protocol.

***d. User Control Point Module Limitation (D) (Preamble)***

76. The language of this limitation, taken literally, does not match the invention that is described in the '281 Patent specification. This portion of the preamble recites that the user control point module in the control point computing device obtains a copy of the state table of the control point computing device.

77. I understand that Claim 48 was introduced in the reexamination proceeding with this error. In my opinion, reviewing the claim as a whole in conjunction with the reexamination history, one of ordinary skill in the art would have understood this portion of the claim to mean obtaining a copy of the state table of the controlled computing device rather than the control point computing device.

78. Based on this understanding and using the broadest reasonable interpretation that I discuss in Paragraph 63, in my opinion, the intelligent controller of Ludtke '241 meets this limitation. Ludtke '241 teaches that the intelligent controller downloads the target device panel subunit descriptor

information which includes the current status descriptor table for the target device. (Exhibit-1102, 16:22-26, Figure 9 (step 714).)

79. Additionally, the intelligent controller can post a notification request to the target device to receive any changes to the status descriptor information. This describes a subscription to change notifications, as shown in Figure 12 (step 805). (*Id.*, 10:41-51, 18:47-49, Figure 12.)

*e. Event Source Module Limitation (D) (Preamble)*

80. This limitation refers to a module in the controlled computing device that distributes change notifications to a subscribing user controller device upon a change to the operational state of the controlled computing device. The change notification serves to synchronize the user interface at the user controller device with the operational state of the controlled device.

81. Using the broadest reasonable interpretation of “eventing model” that I discuss in Paragraph 64, the target device of Ludtke ’241 meets this limitation. Ludtke ’241 teaches that the target device sends a notification to the intelligent controller when any change to the device (such as pressing the caps lock key discussed above) results in a change to the status descriptor data structure. (Exhibit-1102, 10:46-51, 17:10-15, 19:2-5, Figure 12.) As shown in Figure 12, after the target device takes the action indicated by the intelligent controller (step 835), it sends status message 837 to the intelligent controller indicating the change.

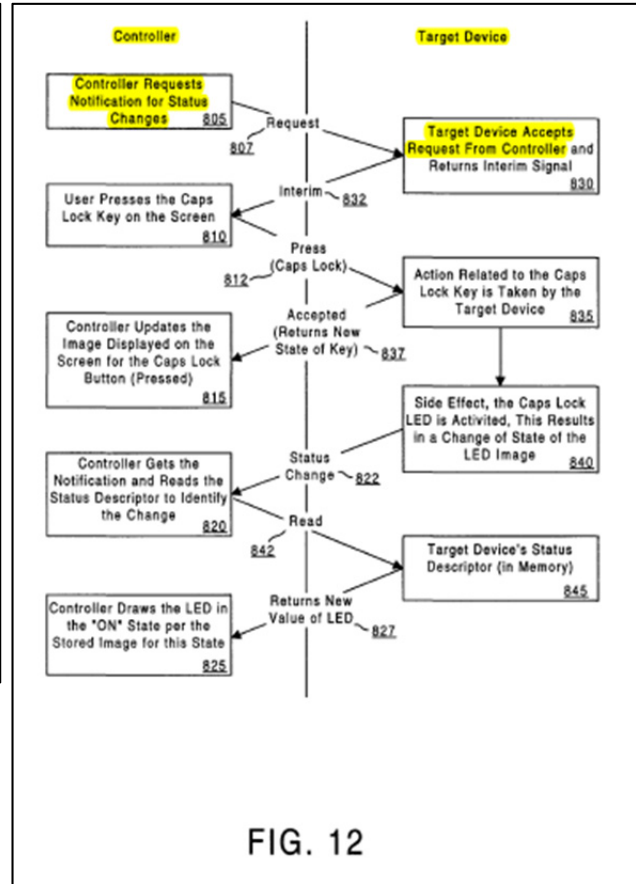
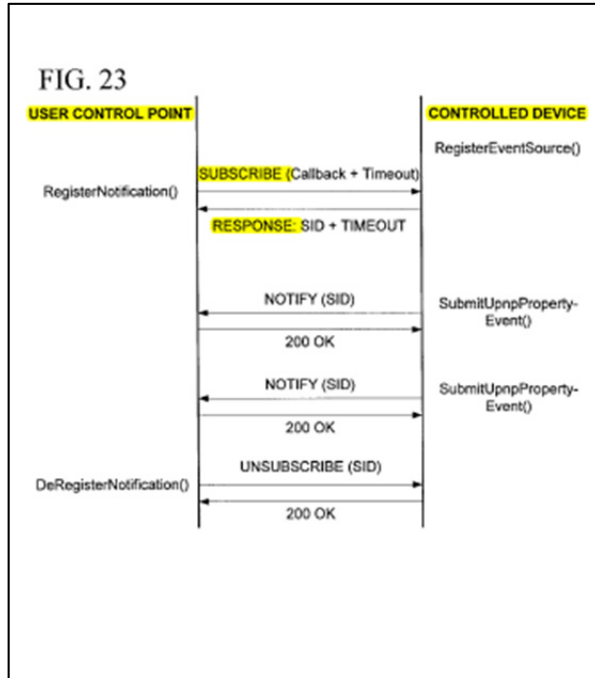
(*Id.*) Upon receipt of the notification, the intelligent controller updates its graphical display; this is indicated by the change notification to synchronize the display with the changed state information as shown in step 815. (*Id.*, 10:49-51.)

***f. Receiving Subscription Limitation***

82. Ludtke '241 also teaches that there can be multiple intelligent controller devices for the same controlled computing device. (*Id.*, 7:21-23.) Ludtke '241 further teaches that the intelligent controllers send subscription requests for change of state to the target device. (*Id.*, 18:47-49.)

***g. Registering Subscription Limitation***

83. Ludtke '241 teaches that in response to a subscription request from an intelligent controller, the target device accepts the request and generates an interim signal acknowledging the request. (Exhibit-1102, 18:50-52, Figure 12.) This request and acknowledgement is analogous to the actions in the '281 Patent as shown in annotated Figure 23 (below left) and Ludtke '241, Figure 12 (below right).



**Exhibit-1101, Figure 23 (annotated) and Exhibit-1102, Figure 12 (annotated)**

84. As seen in Figure 23 (above), the '281 Patent teaches a SUBSCRIBE message sent from the user control point device to the controlled device after which a RESPONSE message is sent by the controlled device in return. Similarly, as shown in Figure 12 above, Ludtke '241 teaches a notification request message (807) sent from the controller to the target device after which an interim response message (832) is sent by the target device in return.

85. In my opinion, one of ordinary skill in the art would have understood that the response message from the controlled/target device according to Ludtke '241 indicates that the subscription request has been received and registered with the controlled/target device.

***h. Communicating Events Limitation***

86. Ludtke '241 teaches that the target device communicates state events to the subscribing intelligent controllers. (Exhibit-1102, 10:41-46, 16:22-26, 18:47-49.)

***i. Receiving Control Command Limitation***

87. Ludtke '241 teaches that the intelligent controller can detect any events entered by a user through the intelligent controller and forward the event to the target device such as those events that would affect the state of the target device (*e.g.*, pushing the play button). (Exhibit-1102, 16:65-17:8.)

***j. Performing Operation Limitation***

88. Ludtke '241 teaches that the target device interprets and performs commands sent from the intelligent controller. (Exhibit-1102, 16:67-17:1.)

***k. Maintain Concurrent Storage Limitation***

89. Ludtke '241 teaches that the target device sends change notifications to all subscribing intelligent controllers upon a change in the state of the target device, thereby allowing the intelligent controllers to maintain the state information at the same time. (Exhibit-1102, 17:12-15.)

***l.* “storing presentation data defining a presentation of the user perceptible device control interface”**

90. Ludtke '241 teaches that the status descriptor data structures maintained by the target device describe the physical controls of the target device as well as the current state of operation. (Exhibit-1102, 9:8-14.) In particular, the data structures “describe the look, shape, grouping and location for each user input element and each information display element for the user interface.” (*Id.*, 16:30-33.) For example, Figures 7A and 7B reproduced above in Paragraph 70, include the image that may be shown for a control object (442, 462), the size of that image (444, 464), the position of the image within a group (448, 468) and text related to the image (456, 476). (*Id.*, Figures 7A, 7B.) The intelligent controller implements a user interface for the target device based on the status descriptor data structures. (*Id.*, 10:49-51.) Therefore, in my opinion, one of ordinary skill in the art would have understood that the data structures maintained by the target device have data that define the presentation of the controller user interface.

***m.* “transferring the presentation data defining the presentation of the user perceptible device control interface to a control point computing device” (hereinafter “*Transfer Data Limitation*”)**

91. Ludtke '241 teaches that the target device transfers the status descriptor data for the display to the intelligent controller. (Exhibit-1102, 16:22-26.) The data includes the “look, shape, grouping and location for each user input

element and each information display element for the user interface.” (*Id.*, 16:31-33, Figures 7A, 7B.)

## **2. Claims 49 and 67**

92. Claims 49 and 67 both depend from claim 48. (Exhibit-1127, pp. 30, 34.) Both claims add the limitation that the control point computing device is a mobile phone, which are met by Ludtke '241. (*Id.*) Ludtke '241 teaches the use of a cell phone as an intelligent controller. (Exhibit-1102, 7:25-28.)

## **3. Claims 50 and 68**

93. Claims 50 and 68 both depend from claim 48. (Exhibit-1127, pp. 30, 34.) Both claims add the limitation that the control point computing device is a set-top box, which are met by Ludtke '241. (*Id.*) Claim 50 uses the term “control point device” rather than “control point computing device.” In my opinion, one of ordinary skill in the art at the time of the alleged invention would have understood these terms to be interchangeable. Ludtke '241 teaches the use of a set-top box as an intelligent controller. (Exhibit-1102, 2:39-40, 2:50-53.)

## **4. Claims 51 and 69**

94. Claims 51 and 69 both depend from claim 48. (Exhibit-1127, pp. 30, 34.) Both claims add the limitation that the control point computing device is a hand-held computer, which are met by Ludtke '241. (*Id.*) Ludtke '241 teaches the use of a hand-held computer as an intelligent controller. (Exhibit-1102, 7:25-28.)

## 5. Claim 52

95. Claim 52 depends from claim 48 and adds the limitation that the state table represents a “current electrical state of the controlled computing device” (Exhibit-1127, p. 31), which is met by Ludtke '241. Ludtke '241 teaches the target device maintains the electrical state of the target device, such as a power on key (Figure 10 (560)), LED (Figure 10 (554, 556, 558)), or a hybrid key with an LED (Figure 10 (550)). (Exhibit-1102, 17:56-18:6, Figure 10.)

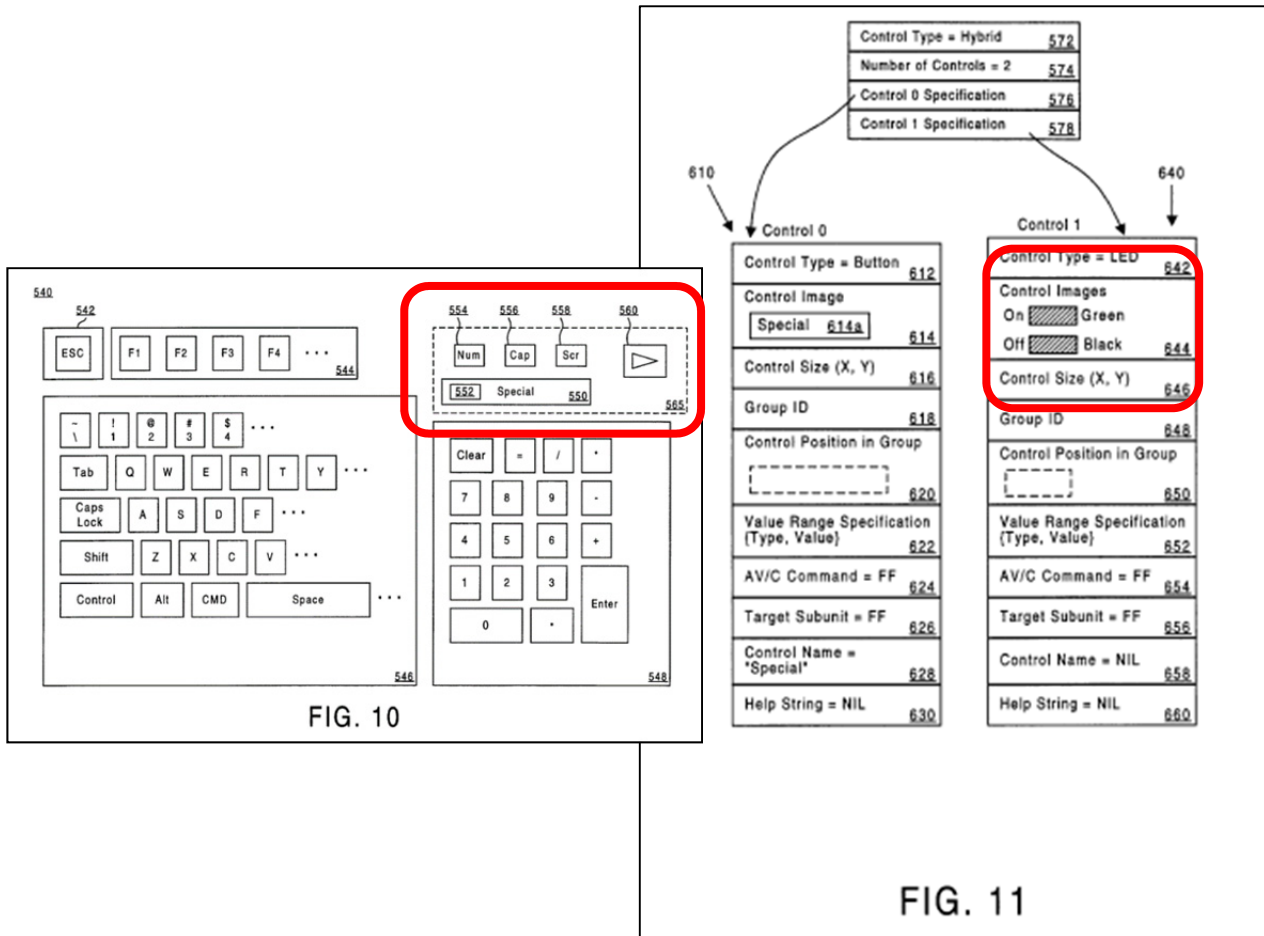


Exhibit-1102, Figures 10 and 11 (annotated)

96. Figure 11 shows the status descriptor structure for hybrid key 550 which includes entry 644 to reflect the state information as to whether the LED is on or off. (*Id.*, Figure 11, 18:7-43.)

#### **6. Claim 53**

97. Claim 53 depends from claim 48 and adds the limitation that the state table represents a current mechanical state of the controlled computing device (Exhibit-1127, p. 31), which is met by Ludtke '241. Ludtke '241 teaches the target device maintains a current mechanical, or physical, state of the target device such as whether a key has been pressed. (Exhibit-1102, 16:38-64.)

#### **7. Claim 54**

98. Claim 54 depends from claim 48 and adds the limitation that the state table represents a current logical state of the controlled computing device (Exhibit-1127, p. 31), which is met by Ludtke '241. The '281 Patent teaches that a logical entity is when one device emulates the behaviors of another device. (Exhibit-1101, 7:45-48.) Ludtke '241 teaches the target device maintains a current logical state, such as logical controls and the appearance of a logical control panel that can be used to control a black box that has no physical controls. (Exhibit-1102, 5:49-55.) For example, the virtual keyboard shown in Figure 10 (on the intelligent controller) can be used to control a device that has no physical controls. (Exhibit-1102, 17:44-55, Figure 10.)

## **8. Claim 56**

99. Claim 56 depends from claim 48 and adds the limitation that the controlled computing device can send a copy of the state table to the user controller device in response to receiving a subscribe message (Exhibit-1127, p. 32), which is met by Ludtke '241. As I discuss above in Paragraph 63, a subscribe message informs the controlled device of the desire to receive events. (Exhibit-1101, 11:14-18.) Ludtke '241 teaches that the target device sends a copy of the descriptor information for the target device to the intelligent controller in response to a message from the intelligent controller. (Exhibit-1102, 16:22-26, Figure 9.) In my opinion, one of ordinary skill in the art would have understood that any message that elicits a response from a device can be a subscribe message in accordance with the teachings of the '281 Patent.

## **9. Claim 58**

100. Claim 58 depend from claim 48 and adds the limitation that the controlled computing device is a cell phone (Exhibit-1127, p. 32), which is met by Ludtke '241. Ludtke '241 teaches that a target device can be any electronic device with its own panel subunit. (Exhibit-1102, 8:36-37.) Ludtke '241 teaches that cell phones are one example of an electronic device. (*Id.*, 7:25-27.) Therefore, in my opinion, one of ordinary skill in the art at the time of the invention would have understood that a cell phone could be the controlled computing device.

101. It is further my opinion that it would have been obvious to a person of ordinary skill in the art at the time of the alleged invention in view of Ludtke '241 to use the cell phone as a controlled computing device. The '281 Patent teaches that a device can be both a target and a controller. (Exhibit- 1001, 6:44-46, 6:63-65.) Likewise, Ludtke '241 teaches that devices such as a STB can be both a target and a controller. (Exhibit-1102, 2:44-53, 19:25-38.) Additionally, although Ludtke '241 describes a cell phone as an example of an intelligent controller, it also falls within Ludtke '241's description of a target device.

**10. Claim 59**

102. Claim 59 depends from claim 48 and adds the limitation that the controlled computing device is an audio and video recorder (Exhibit-1127, p. 33), which is met by Ludtke '241. Ludtke '241 teaches that the target device can be a VCR which records audio and video. (Exhibit-1102, 2:44-48, 8:34-35.)

**11. Claim 60**

103. Claim 60 depends from claim 48 and adds the limitation that controlled computing device is an audio or video playback device (Exhibit-1127, p. 33), which is met by Ludtke '241. Ludtke '241 teaches that the target device can be a VCR which plays back audio and video. (Exhibit-1102, 2:44-48, 8:34-35.)

**12. Claim 61**

104. Claim 61 depends from claim 48 and adds the limitation that the controlled computing device is a set-top box (hereinafter "*STB Limitation*")

(Exhibit-1127, p. 33), which is met by Ludtke '241. Ludtke '241 teaches that the target device can be a set-top box. (Exhibit-1102, 2:44-48; 19:25-38.)

### **13. Claim 62**

105. Claim 62 depends from claim 61 and adds the limitation that the state table represents a tuner channel selection (hereinafter "*Tuner Limitation*") (Exhibit-1127, p. 33), which is met by Ludtke '241. Ludtke '241 teaches that status descriptor fields contain state information for channel selection buttons. (Exhibit-1102, 12:29-37.) Although Ludtke '241 does not explicitly teach the storing of the tuner channel selection, one of ordinary skill in the art would have understood the current tuner channel selection to inherently be stored in the status descriptor table since channel selection buttons control the tuner of the device. As noted above, the controlled computing devices can include VCRs and televisions; the current channel for these devices is typically shown on the front panel of the device and, as such, would be incorporated into the status descriptor data structure for the device.

106. It is further my opinion that it would have been obvious to one of ordinary skill in the art at the time of the alleged invention in view of Ludtke '241 to represent the current tuner channel selection in the status descriptor table. As noted above, the controlled computing devices can include VCRs and televisions, the current channel for these devices is typically shown on the front panel of the

device and, as such, would be incorporated into the status descriptor data structure for the device. (*Id.*)

#### **14. Claim 63**

107. Claim 63 depends from claim 61 and adds the limitation that the state table represents an audio decoding format (hereinafter “*Audio Limitation*”) (Exhibit-1127, p. 33), which is met by Ludtke ’241. Ludtke ’241 teaches that target devices such as set-top boxes contain MPEG2 (audio/video) decoders and the status descriptor fields of the target device are used to define objects that represent the MPEG2 decoder and allow the user to interface with the MPEG2 decoder. (Exhibit-1102, 19:28-39.)

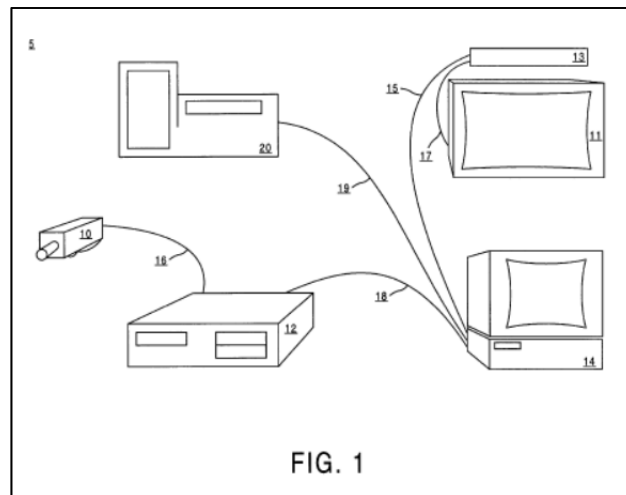
#### **15. Claim 64**

108. Claim 64 depends from claim 61 and adds the limitation that the state table represents a video decoding format of the set-top box (hereinafter “*Video Limitation*”) (Exhibit-1127, p. 33), which is met by Ludtke ’241. Ludtke ’241 teaches that target devices such as set-top boxes contain MPEG2 (audio/video) decoders and the status descriptor fields of the target device are used to define objects that represent the MPEG2 decoder and allow the user to interface with the MPEG2 decoder. (Exhibit-1102, 19:28-39.)

**16. Claim 73 (Exhibit-1127, pp. 35-36.)**

***a. Distributed Computing Network Limitation (A)  
(Preamble)***

109. Ludtke '241 teaches distributed networked consumer electronic devices, in a home entertainment system such as TVs, set-top boxes ("STB"), VCRs, and personal computers ("PC") to distribute communications between two or more devices. (Exhibit-1102, 1:8-11, Figure 1, 2:16-19, 2:44-48.) In my opinion, one of ordinary skill in the art would have understood the network taught by Ludtke '241 (such as shown in Figure 1) to be a distributed computing network because Ludtke '241 teaches the distribution of operations among different devices.



**Exhibit-1102, Figure 1**

***b. Controlled Computing Device Limitation***

110. Ludtke '241 teaches a controlled target device, which can be any type of electronic device, and which responds to another device, *e.g.*, intelligent controller. (Exhibit-1102, 2:44-48, 8:36-37.)

***c. State Table Limitation***

111. Ludtke '241 teaches a panel subunit which is a collection of data structures that describes the physical controls of a target device such as VCR 12 with various controls such as LCD panel 214 and play button 250 (Figures 3A & 3B). (Exhibit-1102, 9:8-10.) Figure 5 (below) shows the overall structure of the panel subunit 314 for VCR 12. Figures 7A and 7B show the specific details for two different control objects – object 382 which represents LCD panel 214 and object 384 which represents play button 250. The data structure for the control objects include type (numerals 440/460), image for the control object for the user interface (numerals 442/462), presentation data for the user interface (numerals 444/446/448/464/466/468), object identifiers (numerals 456/476), valid values, and ranges (numerals 450/470) among others. (*Id.*, 11:15-38 (Figure 5), 13:16-14:24 (Figure 7A), 14:25-55 (Figure 7B).)

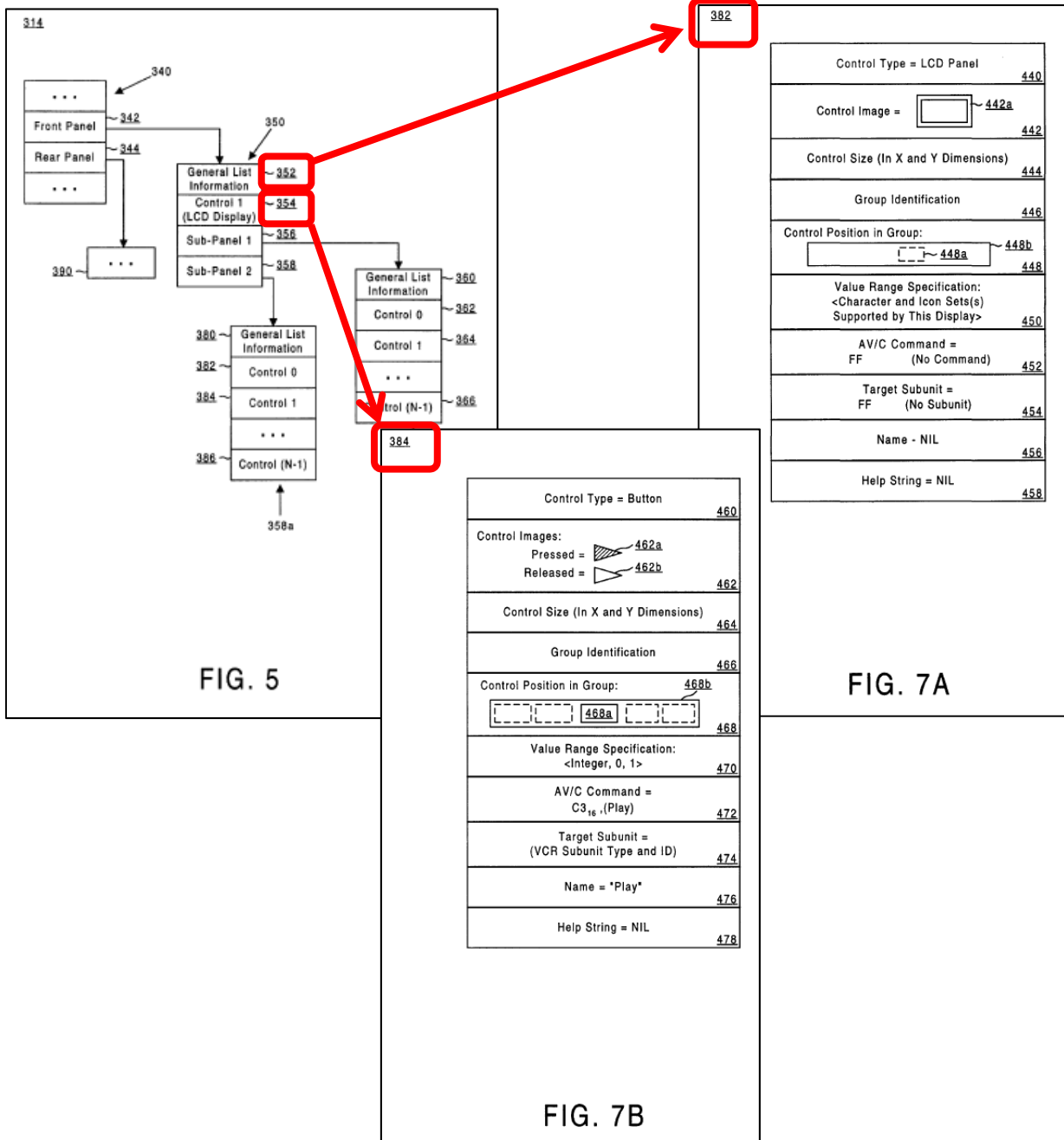


Exhibit-1102, Figures 5, 7A & 7B (annotated)

112. The panel subunit also includes a dynamic status descriptor data structure that is maintained by the target device and represents the current status of each control object of the target device (e.g., VCR 12) that is described in the panel subunit. (Exhibit-1102, 10:39-41, 15:17-26, Figure 8.) Figure 8 is a representation of the status descriptor data structure and shows the current state or value for every control object defined in the panel subunits shown in Figures 5-7. (*Id.*, 15:26-39, 15:50-16:9.) For example, status information may include that LCD Panel 214 is displaying certain text or that play button 250 is currently pressed. (*Id.*, 15:36-39.)

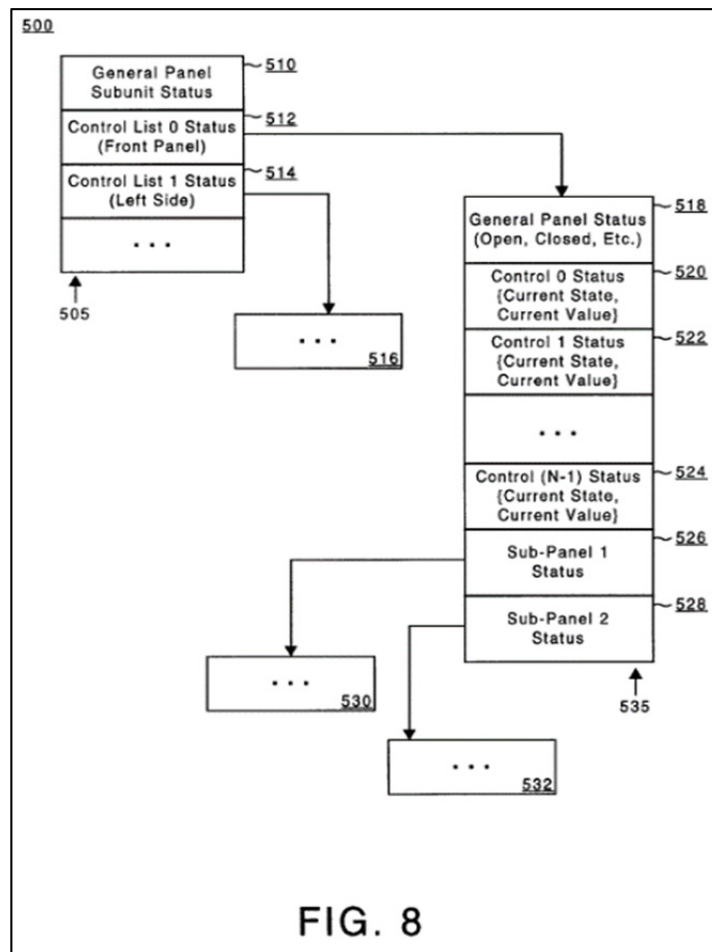


Exhibit-1102, Figure 8

113. As I discuss in Paragraph 61, the SST in Figure 20 of the '281 Patent is an XML data structure rather than a "table," meaning it is not itself a series of rows with column values. Because the '281 Patent teaches the use of XML to represent the operational state of the target device, one of ordinary skill in the art would have understood that there is more than one way to construct the claimed state table. With reference to the interpretation I discuss in Paragraph 61, in my opinion, the Ludtke '241 panel subunit status descriptor data structures, as shown in the Figures above, are data structures regarding the current state of the target device. Therefore, in my opinion, one of ordinary skill in the art at the time of the invention would have understood that the panel subunit status descriptor data structures of Ludtke '241 meet this limitation.

114. It is further my opinion that one of ordinary skill in the art at the time of the alleged invention would have understood that the table shows the state of the target device. State data is persistently stored information representing a condition of the target device. In my opinion, the format of the representation of the state data is a matter of programming style or engineering choice rather than an inventive distinction. Therefore, in my opinion, one of ordinary skill in the art at the time of the alleged invention would have understood that the design of the state table/XML schema (*e.g.*, how many rows or columns) is a matter of design choice to organize the status information for ease of use. The system taught in both the

'281 Patent and Ludtke '241 would work the same using any variety of data formats. In my opinion, one of ordinary skill in the art would also have understood that any data structure format would have worked in the same way as a table with rows and column values with no unexpected results. Therefore, in my opinion, one of ordinary skill in the art would have found it obvious to use any data structure format that maintains the same operational state information of the controlled device, such as the status descriptor data structure found in Ludtke '241.

***d. User Controller Device Limitation (A)***

115. Ludtke '241 teaches that an intelligent controller can be any device in a network that has input and display capabilities. (Exhibit-1102, 7:18-21.) The intelligent controller in Ludtke '241 provides a user interface for interacting with a target device, such as pressing play button 250. (*Id.*, 7:25-32.) For example, referring to Figure 12, when a user presses a caps lock key (step 810), a message (812) is sent to the target device and the proper action is taken at the target device (step 835). (*Id.*, 18:44-19:13, Figure 12.) When the target device executes the action, it will then update its operational state that is represented in the panel subunit status descriptor data structure. (*Id.*)

***e. User Control Point Module Limitation (A)***

116. Based on the broadest reasonable interpretation that I discuss in Paragraph 63, the intelligent controller of Ludtke '241 meets this limitation.

Ludtke '241 teaches that the intelligent controller downloads the target device panel subunit descriptor information which includes the current status descriptor table for the target device. (Exhibit-1102, 16:22-26, Figure 9 (step 714).)

117. Additionally, the intelligent controller can post a notification request to the target device to receive any changes to the status descriptor information. This describes a subscription to change notifications, as shown in Figure 12 (step 805). (*Id.*, 10:41-51, 18:47-49, Figure 12.)

***f. Event Source Module Limitation (A)***

118. This limitation refers to a module in the controlled computing device that distributes change notifications to a subscribing user controller device upon a change to the operational state of the controlled computing device. The change notification serves to synchronize the user interface at the user controller device with the operational state of the controlled device.

119. Using the broadest reasonable interpretation of “eventing model” that I discuss above in Paragraph 64, the target device of Ludtke '241 meets this limitation. Ludtke '241 teaches that the target device sends a notification to the intelligent controller when any change to the device (such as pressing the caps lock key discussed above) results in a change to the status descriptor data structure. (Exhibit-1102, 10:46-51, 17:10-15, 19:2-5, Figure 12.) As shown in Figure 12, after the target device takes the action indicated by the intelligent controller (step

835), it sends status message 837 to the intelligent controller indicating the change.

(*Id.*) Upon receipt of the notification, the intelligent controller updates its graphical display; this is indicated by the change notification to synchronize the display with the changed state information as shown in step 815. (*Id.*, 10:49-51.)

***g. Tuner/Audio/Video Limitation***

120. It is my understanding that this limitation only requires that the state table represent (1) a tuner channel selection, (2) an audio decoding format, or (3) a video decoding format. The claim does not require all three to be present in the state table. Therefore, if any one of these are present in the prior art, then the prior art teaches this limitation. In any event, one of ordinary skill in the art would have understood that Ludtke '241 teaches all three limitations.

121. Ludtke '241 teaches that status descriptor fields for the target device contain state information for channel selection buttons. (*Id.*, 12:29-37.) Although Ludtke '241 does not explicitly teach the storing of the tuner channel selection, one of ordinary skill in the art would have understood the current tuner channel selection to be stored in the status descriptor table. As noted above, the controlled computing devices can include VCRs and televisions; the current channel for these devices is typically shown on the front panel of the device and, as such, would be incorporated into the status descriptor data structure for the device.

122. Ludtke '241 further teaches that target devices such as set-top boxes contain MPEG2 decoders and the status descriptor fields of the target device are used to define virtual objects that represent the MPEG2 decoder and allow the user to interface with the MPEG2 decoder. (*Id.*, 19:28-39.) In my opinion, one of ordinary skill in the art would have understood that MPEG2 is a format for audio and video transmissions and an MPEG2 decoder would therefore have audio and video decoding formats. Because the descriptor fields of the target device allow a user to interact with the MPEG2 decoder, the fields must inherently identify the audio and video decoding format of the decoder.

**17. Claim 75 (Exhibit-1127, pp. 37-39.)**

***a. Peer Networking Limitation (Preamble)***

123. With reference to the interpretation I discuss above in Paragraph 66, Ludtke '241 teaches this limitation. Specifically, Ludtke '241 teaches networked consumer electronic devices, in a home entertainment system such as TVs, STBs, VCRs, and PCs, within a peer-to-peer environment. (Exhibit-1102, 1:8-11, Figure 1, 2:44-48, 6:34-37.) Ludtke '241 also teaches that there can be multiple intelligent controller devices for the same controlled computing device. (*Id.*, 7:21-23.) Ludtke '241 teaches a controlled target device, which can be any type of electronic device, and which responds to an intelligent controller. (*Id.*, 8:36-37, 2:44-48.)

***b. State Table Limitation (Preamble)***

124. Ludtke '241 teaches a panel subunit which is a collection of data structures that describes the physical controls of a target device such as VCR 12 with various controls such as LCD panel 214 and play button 250 (Figures 3A & 3B). (Exhibit-1102, 9:8-10.) Figure 5 (below) shows the overall structure of the panel subunit 314 for VCR 12. Figures 7A and 7B show the specific details for two different control objects – object 382 which represents LCD panel 214 and object 384 which represents play button 250. The data structure for the control objects include type (numerals 440/460), image for the control object for the user interface (numerals 442/462), presentation data for the user interface (numerals 444/446/448/464/466/468), object identifiers (numerals 456/476), valid values, and ranges (numerals 450/470) among others. (*Id.*, 11:15-38 (Figure 5), 13:16-14:24 (Figure 7A), 14:25-55 (Figure 7B).)

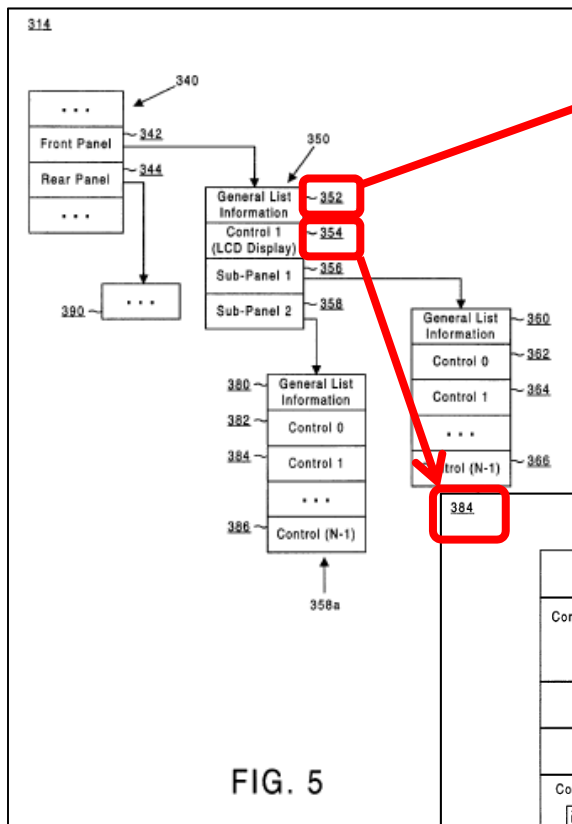


FIG. 5


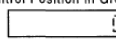
Control Type = LCD Panel	440
Control Image = 	442
Control Size (In X and Y Dimensions)	444
Group Identification	446
Control Position in Group: 	448b
Value Range Specification: <Character and Icon Sets(s) Supported by This Display>	450
AV/C Command = FF (No Command)	452
Target Subunit = FF (No Subunit)	454
Name = NIL	456
Help String = NIL	458

FIG. 7A



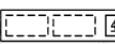
Control Type = Button	460
Control Images: Pressed =  462a Released =  462b	462
Control Size (In X and Y Dimensions)	464
Group Identification	466
Control Position in Group: 	468b
Value Range Specification: <Integer, 0, 1>	470
AV/C Command = C3 <sub>16</sub> (Play)	472
Target Subunit = (VCR Subunit Type and ID)	474
Name = "Play"	476
Help String = NIL	478

FIG. 7B

Exhibit-1102, Figures 5, 7A & 7B (annotated)

125. The panel subunit also includes a dynamic status descriptor data structure that is maintained by the target device and represents the current status of each control object of the target device (*e.g.*, VCR 12) that is described in the panel subunit. (Exhibit-1102, 10:39-41, 15:17-26, Figure 8.) Figure 8 is a representation of the status descriptor data structure and shows the current state or value for every control object defined in the panel subunits shown in Figures 5-7. (*Id.*, 15:26-39, 15:50-16:9.) For example, status information may include that LCD Panel 214 is displaying certain text or that play button 250 is currently pressed. (*Id.*, 15:36-39.)

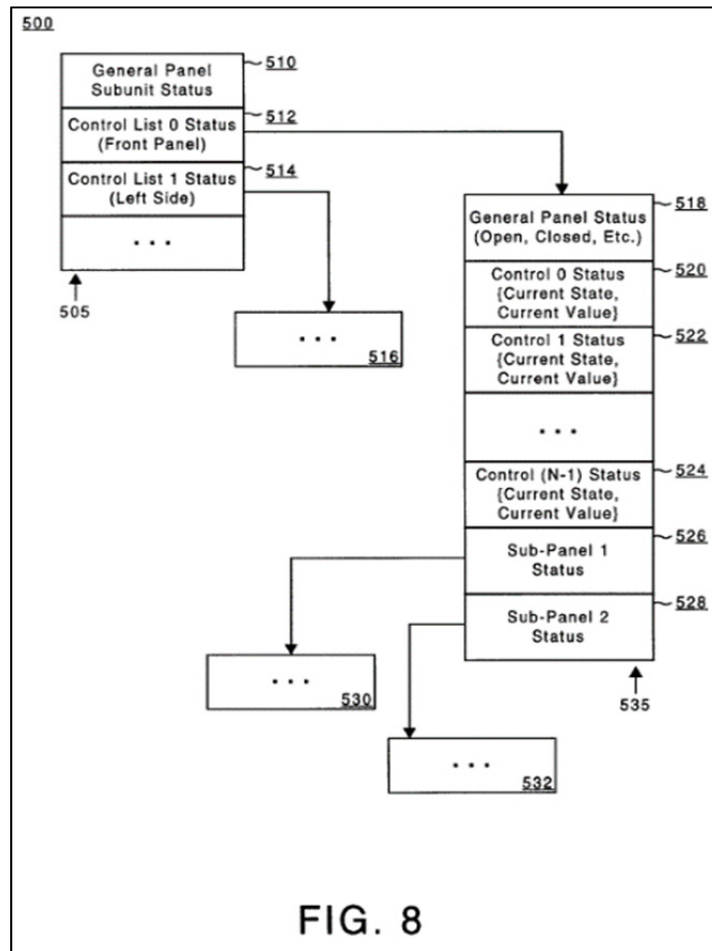


Exhibit-1102, Figure 8

126. As I discuss in Paragraph 61, the SST in Figure 20 of the '281 Patent is an XML data structure rather than a "table," meaning it is not itself a series of rows with column values. Because the '281 Patent teaches the use of XML to represent the operational state of the target device, one of ordinary skill in the art would have understood that there is more than one way to construct the claimed state table. With reference to the interpretation I discuss in Paragraph 61, in my opinion, the Ludtke '241 panel subunit status descriptor data structures, as shown in the Figures above, are data structures regarding the current state of the target device. Therefore, in my opinion, one of ordinary skill in the art at the time of the invention would have understood that the panel subunit status descriptor data structures of Ludtke '241 meet this limitation.

127. It is further my opinion that one of ordinary skill in the art at the time of the alleged invention would have understood that the table shows the state of the target device. State data is persistently stored information representing a condition of the target device. In my opinion, the format of the representation of the state data is a matter of programming style or engineering choice rather than an inventive distinction. Therefore, in my opinion, one of ordinary skill in the art at the time of the alleged invention would have understood that the design of the state table/XML schema (*e.g.*, how many rows or columns) is a matter of design choice to organize the status information for ease of use. The system taught in both the

'281 Patent and Ludtke '241 would work the same using any variety of data formats. In my opinion, one of ordinary skill in the art would also have understood that any data structure format would have worked in the same way as a table with rows and column values with no unexpected results. Therefore, in my opinion, one of ordinary skill in the art would have found it obvious to use any data structure format that maintains the same operational state information of the controlled device, such as the status descriptor data structure found in Ludtke '241.

***c. Control Point Computing Device Limitation (Preamble)***

128. Ludtke '241 teaches that an intelligent controller can be any device in a network that has input and display capabilities. (Exhibit-1102, 7:18-21.) The intelligent controller in Ludtke '241 provides a user interface for interacting with a target device, such as pressing play button 250. (*Id.*, 7:25-32.) For example, referring to Figure 12, when a user presses a caps lock key (step 810), a message (812) is sent to the target device and the proper action is taken at the target device (step 835). (*Id.*, 18:44-19:13, Figure 12.) When the target device executes the action, it will then update its operational state that is represented in the panel subunit status descriptor data structure. (*Id.*)

129. Additionally, regarding “and communicating with the controlled computing device via a device control protocol,” I note that for a control point computing device to communicate with and to effect remote control of the

controlled computing device, there must be a device control protocol shared by both devices, such as AV/C command and control protocol taught by Ludtke '241. (Exhibit-1102, 5:4-13.) In my opinion, one of ordinary skill in the art would have understood that for two devices to communicate with each other they would need to share a communication protocol.

***d. User Control Point Module Limitation (D) (Preamble)***

130. Similar to claim 48, the language of this limitation, taken literally, does not match the invention that is described in the '281 Patent specification. This portion of the preamble recites that the user control point module in the control point computing device obtains a copy of the state table of the control point computing device.

131. I understand that Claim 75 was introduced in the reexamination proceeding with this error. Nevertheless, like claim 48, in my opinion, reviewing the claim as a whole in conjunction with the reexamination history, one of ordinary skill in the art would have understood this portion of the claim to mean obtaining a copy of the state table of the controlled computing device rather than the control point computing device.

132. Based on this understanding and using the broadest reasonable interpretation that I discuss in Paragraph 63, in my opinion, the intelligent controller of Ludtke '241 meets this limitation. Ludtke '241 teaches that the

intelligent controller downloads the target device panel subunit descriptor information which includes the current status descriptor table for the target device. (Exhibit-1102, 16:22-26, Figure 9 (step 714).)

133. Additionally, the intelligent controller can post a notification request to the target device to receive any changes to the status descriptor information. This describes a subscription to change notifications, as shown in Figure 12 (step 805). (*Id.*, 10:41-51, 18:47-49, Figure 12.)

***e. Event Source Module Limitation (D) (Preamble)***

134. This limitation refers to a module in the controlled computing device that distributes change notifications to a subscribing user controller device upon a change to the operational state of the controlled computing device. The change notification serves to synchronize the user interface at the user controller device with the operational state of the controlled device.

135. Using the broadest reasonable interpretation of “eventing model” that I discuss in Paragraph 64, the target device of Ludtke ’241 meets this limitation. Ludtke ’241 teaches that the target device sends a notification to the intelligent controller when any change to the device (such as pressing the caps lock key discussed above) results in a change to the status descriptor data structure. (Exhibit-1102, 10:46-51, 17:10-15, 19:2-5, Figure 12.) As shown in Figure 12, after the target device takes the action indicated by the intelligent controller (step

835), it sends status message 837 to the intelligent controller indicating the change.

(*Id.*) Upon receipt of the notification, the intelligent controller updates its graphical display; this is indicated by the change notification to synchronize the display with the changed state information as shown in step 815. (*Id.*, 10:49-51.)

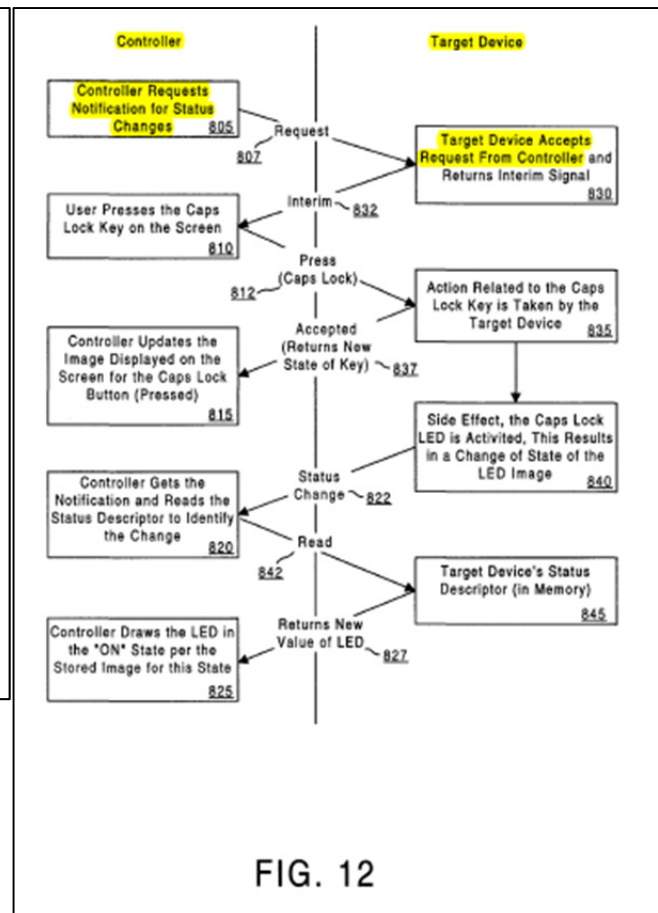
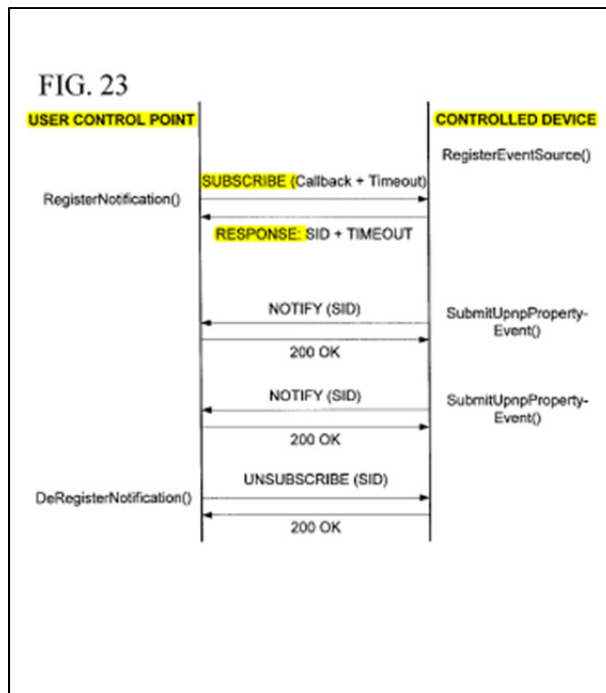
***f. Receiving Subscription Limitation***

136. Ludtke '241 teaches that there can be multiple intelligent controller devices for the same controlled computing device. (Exhibit-1102, 7:21-23.)

Ludtke '241 further teaches that the intelligent controllers send subscription requests for change of state to the target device. (*Id.*, 18:47-49.)

***g. Registering Subscription Limitation***

137. Ludtke '241 teaches that in response to a subscription request from an intelligent controller, the target device accepts the request and generates an interim signal acknowledging the request. (Exhibit-1102, 18:50-52, Figure 12.) This request and acknowledgement is analogous to the actions in the '281 Patent as shown in annotated Figure 23 (below left) and Ludtke '241, Figure 12 (below right).



**Exhibit-1101, Figure 23 (annotated) and Exhibit-1102, Figure 12 (annotated)**

138. As seen in Figure 23 (above), the '281 Patent teaches a SUBSCRIBE message sent from the user control point device to the controlled device after which a RESPONSE message is sent by the controlled device in return. Similarly, as shown in Figure 12 above, Ludtke '241 teaches a notification request message (807) sent from the controller to the target device after which an interim response message (832) is sent by the target device in return.

139. In my opinion, one of ordinary skill in the art would have understood that the response message from the controlled/target device according to Ludtke '241 indicates that the subscription request has been received and registered with the controlled/target device.

***h. Communicating Events Limitation***

140. Ludtke '241 teaches that the target device communicates state events to the subscribing intelligent controllers. (Exhibit-1102, 10:41-46, 16:22-26, 18:47-49.)

***i. Receiving Control Command Limitation***

141. Ludtke '241 teaches that the intelligent controller can detect any events entered by a user through the intelligent controller and forward the event to the target device such as those events that would affect the state of the target device (*e.g.*, pushing the play button). (Exhibit-1102, 16:65-17:8.)

***j. Performing Operation Limitation***

142. Ludtke '241 teaches that the target device interprets and performs commands sent from the intelligent controller. (Exhibit-1102, 16:67-17:1.)

***k. Maintain Concurrent Storage Limitation***

143. Ludtke '241 teaches that the target device sends change notifications to all subscribing intelligent controllers upon a change in the state of the target device, thereby allowing the intelligent controllers to maintain the state information at the same time. (Exhibit-1102, 17:12-15.)

***I. Tuner/Audio/Video Limitation***

144. It is my understanding that this limitation only requires that the state table represent (1) a tuner channel selection, (2) an audio decoding format, or (3) a video decoding format. The claim does not require all three to be present in the state table. Therefore, if any one of these are present in the prior art, then the prior art teaches this limitation. In any event, one of ordinary skill in the art would have understood that Ludtke '241 teaches all three limitations.

145. Ludtke '241 teaches that status descriptor fields for the target device contain state information for channel selection buttons. (*Id.*, 12:29-37.) Although Ludtke '241 does not explicitly teach the storing of the tuner channel selection, one of ordinary skill in the art would have understood the current tuner channel selection to be stored in the status descriptor table. As noted above, the controlled computing devices can include VCRs and televisions; the current channel for these devices is typically shown on the front panel of the device and, as such, would be incorporated into the status descriptor data structure for the device.

146. Ludtke '241 further teaches that target devices such as set-top boxes contain MPEG2 decoders and the status descriptor fields of the target device are used to define virtual objects that represent the MPEG2 decoder and allow the user to interface with the MPEG2 decoder. (*Id.*, 19:28-39.) In my opinion, one of ordinary skill in the art would have understood that MPEG2 is a format for audio

and video transmissions and an MPEG2 decoder would therefore have audio and video decoding formats. Because the descriptor fields of the target device allow a user to interact with the MPEG2 decoder, the fields must inherently identify the audio and video decoding format of the decoder.

**B. Ground 2: Claim 55 is Unpatentable Over Ludtke '241 in view of Dara-Abrams**

147. As explained below, in my opinion, claim 55 is obvious over Ludtke '241 in view of Dara-Abrams, and thus is unpatentable under 35 U.S.C. §103.

148. Claim 55 depends from claim 48 and adds the limitation that the user control point module can unsubscribe to change notifications of the state table (Exhibit-1127, pp. 31-32), which is met by Ludtke '241 and Dara-Abrams. Claim 55 also adds that the unsubscribe requests be received from a plurality of control devices. (*Id.*) Ludtke '241 teaches that the intelligent controller sends a subscribe request for change notifications to the target device and allows for multiple intelligent controllers, but does not teach an unsubscribe request. (Exhibit-1102, 18:47-49, 7:21-23.) Dara-Abrams teaches a controller that subscribes to change notifications to the target device and then also sends an unsubscribe message to the target device. (Exhibit-1105, 13:57-62, 14:42-44.)

149. In my opinion, one of ordinary skill in the art at the time of the alleged invention would have found it obvious to modify the Ludtke '241 system to include the unsubscribing limitation described by Dara-Abrams to allow the

intelligent controller to stop receiving status updates which would advantageously save memory space and maximize network bandwidth usage efficiency.

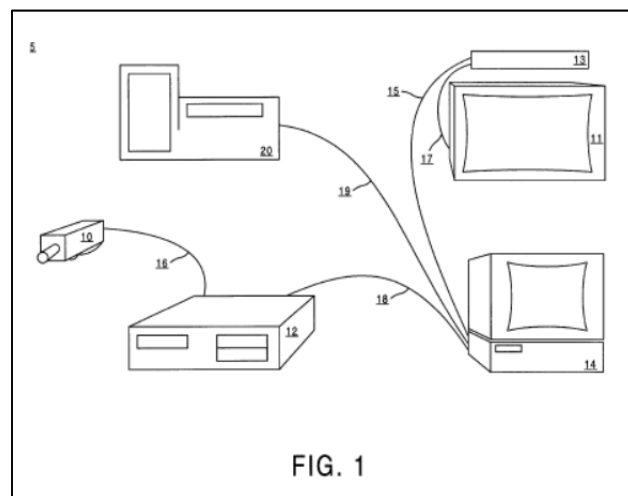
**C. Ground 3: Claims 34 and 57 are Unpatentable over Ludtke '241 in view of Chikarmane**

150. As explained below, in my opinion, claims 34 and 57 are obvious over Ludtke '241 in view of Chikarmane, and thus are unpatentable under 35 U.S.C. §103.

**1. Claim 34 (Exhibit-1127, pp. 23-24.)**

***a. Distributed Computing Network Limitation (A) (Preamble)***

151. Ludtke '241 teaches distributed networked consumer electronic devices, in a home entertainment system such as TVs, set-top boxes ("STB"), VCRs, and personal computers ("PC") to distribute communications between two or more devices. (Exhibit-1102, 1:8-11, Figure 1 (below), 2:16-19, 2:44-48.) In my opinion, one of ordinary skill in the art would have understood the network



**Exhibit-1102, Figure 1**

taught by Ludtke '241 (such as shown in Figure 1) to be a distributed computing network because Ludtke '241 teaches the distribution of operations among different devices.

***b. Controlled Computing Device Limitation***

152. Ludtke '241 teaches a controlled target device, which can be any type of electronic device, and which responds to another device, *e.g.*, intelligent controller. (Exhibit-1102, 2:44-48, 8:36-37.)

***c. State Table Limitation***

153. Ludtke '241 teaches a panel subunit which is a collection of data structures that describes the physical controls of a target device such as VCR 12 with various controls such as LCD panel 214 and play button 250 (Figures 3A & 3B). (Exhibit-1102, 9:8-10.) Figure 5 (below) shows the overall structure of the panel subunit 314 for VCR 12. Figures 7A and 7B show the specific details for two different control objects – object 382 which represents LCD panel 214 and object 384 which represents play button 250. The data structure for the control objects include type (numerals 440/460), image for the control object for the user interface (numerals 442/462), presentation data for the user interface (numerals 444/446/448/464/466/468), object identifiers (numerals 456/476), valid values, and ranges (numerals 450/470) among others. (*Id.*, 11:15-38 (Figure 5), 13:16-14:24 (Figure 7A), 14:25-55 (Figure 7B).)

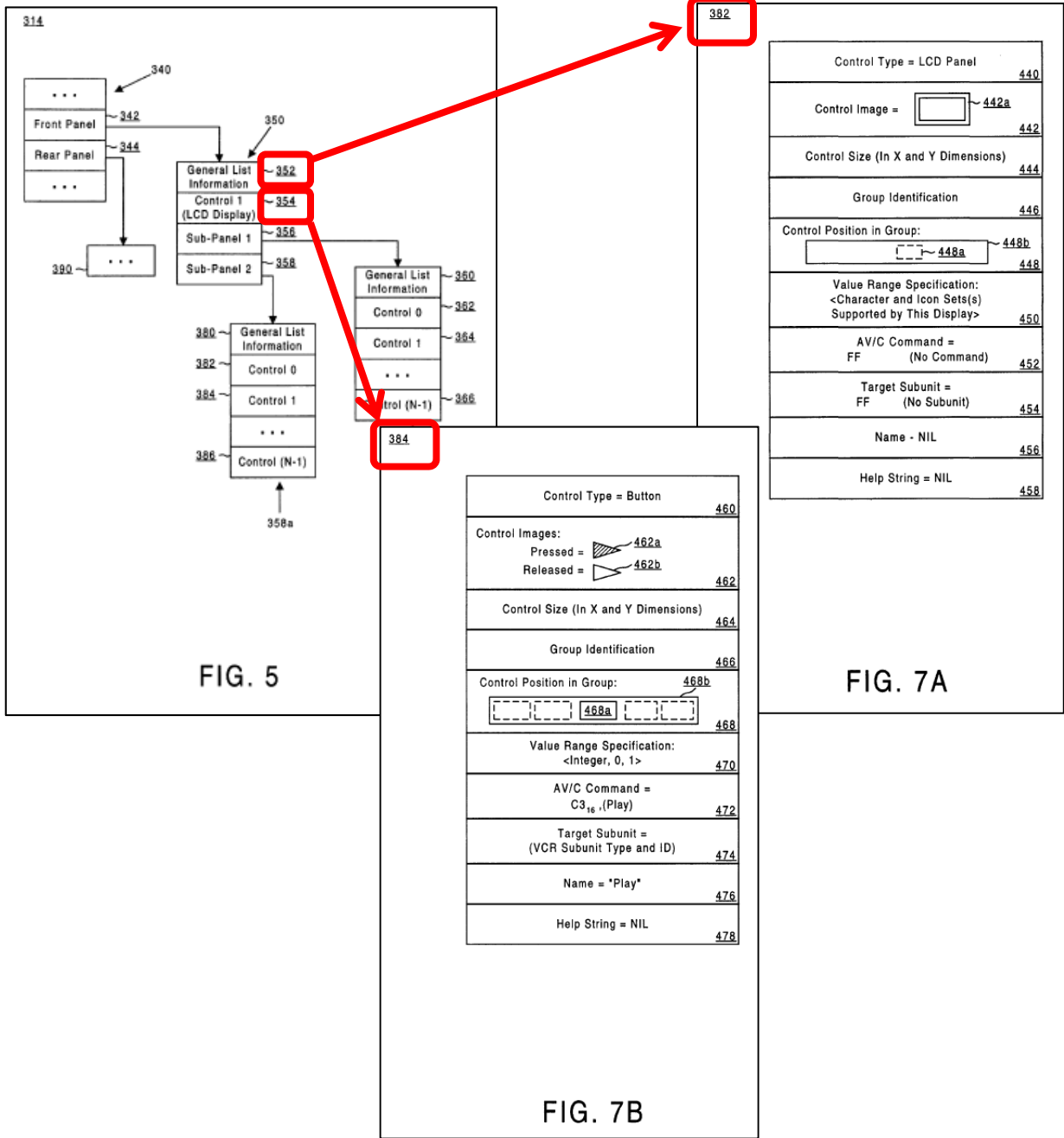


Exhibit-1102, Figures 5, 7A, 7B (annotated)

154. The panel subunit also includes a dynamic status descriptor data structure that is maintained by the target device and represents the current status of each control object of the target device (e.g., VCR 12) that is described in the panel subunit. (Exhibit-1102, 10:39-41, 15:17-26, Figure 8.) Figure 8 is a representation of the status descriptor data structure and shows the current state or value for every control object defined in the panel subunits shown in Figures 5-7. (*Id.*, 15:26-39, 15:50-16:9.) For example, status information may include that LCD Panel 214 is displaying certain text or that play button 250 is currently pressed. (*Id.*, 15:36-39.)

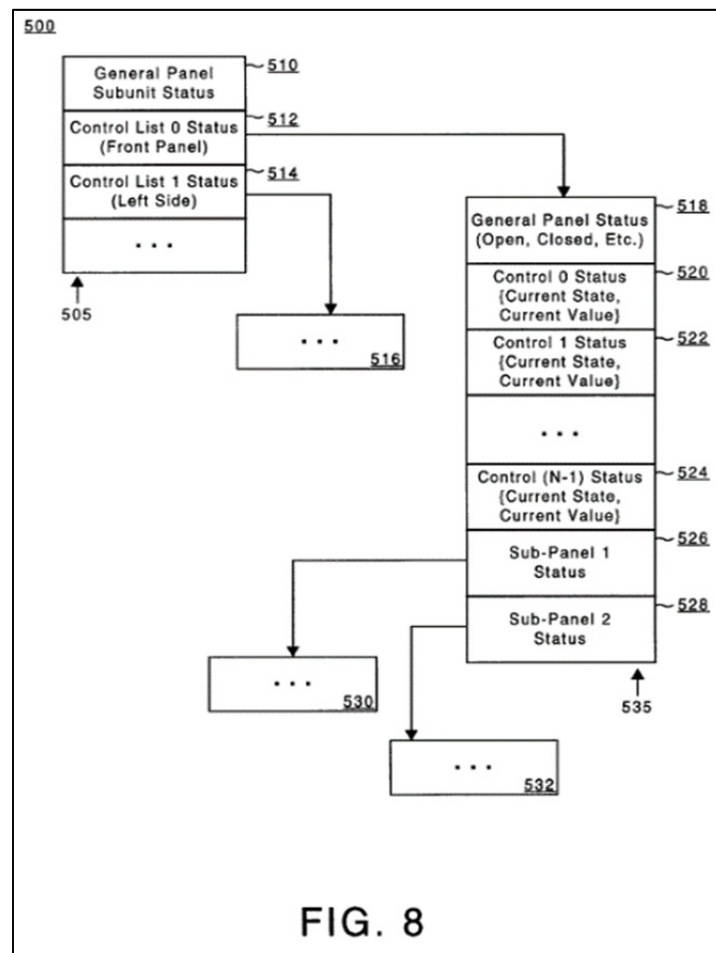


Exhibit-1102, Figure 8

155. As I discuss in Paragraph 61, the SST in Figure 20 of the '281 Patent is an XML data structure rather than a "table," meaning it is not itself a series of rows with column values. Because the '281 Patent teaches the use of XML to represent the operational state of the target device, one of ordinary skill in the art would have understood that there is more than one way to construct the claimed state table. With reference to the interpretation I discuss in Paragraph 61, in my opinion, the Ludtke '241 panel subunit status descriptor data structures, as shown in the Figures above, are data structures regarding the current state of the target device. Therefore, in my opinion, one of ordinary skill in the art at the time of the alleged invention would have understood that the panel subunit status descriptor data structures of Ludtke '241 meet this limitation.

156. It is further my opinion that one of ordinary skill in the art at the time of the alleged invention would have understood that the table shows the state of the target device. State data is persistently stored information representing a condition of the target device. In my opinion, the format of the representation of the state data is a matter of programming style or engineering choice rather than an inventive distinction. Therefore, in my opinion, one of ordinary skill in the art at the time of the alleged invention would have understood that the design of the state table/XML schema (*e.g.*, how many rows or columns) is a matter of design choice to organize the status information for ease of use. The system taught in both the

'281 Patent and Ludtke '241 would work the same using any variety of data formats. In my opinion, one of ordinary skill in the art would also have understood that any data structure format would have worked in the same way as a table with rows and column values with no unexpected results. Therefore, in my opinion, one of ordinary skill in the art would have found it obvious to use any data structure format that maintains the same operational state information of the controlled device, such as the status descriptor data structure found in Ludtke '241.

***d. User Controller Device Limitation (A)***

157. Ludtke '241 teaches that an intelligent controller can be any device in a network that has input and display capabilities. (Exhibit-1102, 7:18-21.) The intelligent controller in Ludtke '241 provides a user interface for interacting with a target device, such as pressing play button 250. (*Id.*, 7:25-32.) For example, referring to Figure 12, when a user presses a caps lock key (step 810), a message (812) is sent to the target device and the proper action is taken at the target device (step 835). (*Id.*, 18:44-19:13, Figure 12.) When the target device executes the action, it will then update its operational state that is represented in the panel subunit status descriptor data structure. (*Id.*)

***e. User Control Point Module Limitation (A)***

158. Based on the broadest reasonable interpretation that I discuss in Paragraph 63, the intelligent controller of Ludtke '241 meets this limitation.

Ludtke '241 teaches that the intelligent controller downloads the target device panel subunit descriptor information which includes the current status descriptor table for the target device. (Exhibit-1102, 16:22-26, Figure 9 (step 714).)

159. Additionally, the intelligent controller can post a notification request to the target device to receive any changes to the status descriptor information. This describes a subscription to change notifications, as shown in Figure 12 (step 805). (*Id.*, 10:41-51, 18:47-49, Figure 12.)

***f. Event Source Module Limitation (A)***

160. This limitation refers to a module in the controlled computing device that distributes change notifications to a subscribing user controller device upon a change to the operational state of the controlled computing device. The change notification serves to synchronize the user interface at the user controller device with the operational state of the controlled device.

161. Using the broadest reasonable interpretation of “eventing model” that I discuss in Paragraph 64, the target device of Ludtke '241 meets this limitation. Ludtke '241 teaches that the target device sends a notification to the intelligent controller when any change to the device (such as pressing the caps lock key discussed above) results in a change to the status descriptor data structure. (Exhibit-1102, 10:46-51, 17:10-15, 19:2-5, Figure 12.) As shown in Figure 12, after the target device takes the action indicated by the intelligent controller (step

835), it sends status message 837 to the intelligent controller indicating the change.

(*Id.*) Upon receipt of the notification, the intelligent controller updates its graphical display; this is indicated by the change notification to synchronize the display with the changed state information as shown in step 815. (*Id.*, 10:49-51.)

***g.* “wherein the user control point module is configured to subscribe to change notifications of the state table by sending to the controlled computing device a subscribe message specifying timeout duration and wherein the controlled computing device is configured to remove the subscription of the user control point module in response to determining that a resubscribe message has not been received from the user control point module for at least the specified timeout duration” (hereinafter “*Timeout Duration Limitation*”)**

162. Ludtke '241 teaches providing an intelligent controller device with a user interface to control a networked target device where the controller device subscribes to change notifications to the target device, but does not teach the use of timeout duration. (Exhibit-1102, Abstract.) Chikarmane teaches using timeout periods to determine whether to maintain registration of a mobile device. (Exhibit-1106, p. 5.) The mobile device, upon registration, negotiates a “lifetime” and includes a timestamp which is used for determining timeouts for registrations. (*Id.*) The mobile device must reregister before the timeout period has expired to avoid interruption of service. (*Id.*) If the reregistration is not received, then it may

be assumed that the mobile device has moved on to another network and no more messages will be sent (*Id.*)

163. At the time of the alleged invention, one having ordinary skill in the art would have found it obvious to use the timeout registration management of Chikarmane in the Ludtke '241 system to determine when to stop providing status updates to the intelligent controller in the event, for example, the intelligent controller moved on to control another target device without first notifying the previous target device, thus meeting the claim limitation. In this manner, the target device does not continue to generate and send unnecessary updates, thereby increasing available network bandwidth while also decreasing resources (*e.g.*, processing power and memory usage) of the target device.

## **2. Claim 57**

164. Claim 57 depends from claim 48 and recites:

receiving, from a first user control point module, a subscribe message specifying a timeout duration; and removing the subscription of the first user control point module in response to determining that a re-subscribe message has not been received from the first user control point module for at least the specified timeout duration

(Exhibit-1127, p. 32), which is met by Ludtke '241 and Chikarmane. Ludtke '241 teaches providing an intelligent controller device with a user interface to control a

networked target device where the controller device subscribes to change notifications to the target device, but does not teach the use of timeout duration. (Exhibit-1102, Abstract.) Chikarmane teaches using timeout periods to determine whether to maintain registration of a mobile device. (Exhibit-1106, p. 5.) The mobile device, upon registration, negotiates a “lifetime” and includes a timestamp which is used for determining timeouts for registrations. (*Id.*) The mobile device must reregister before the timeout period has expired to avoid interruption of service. (*Id.*) If the reregistration is not received, then it may be assumed that the mobile device has moved on to another network and no more messages will be sent (*Id.*)

165. At the time of the alleged invention, one having ordinary skill in the art would have found it obvious to use the timeout registration management of Chikarmane in the Ludtke '241 system to determine when to stop providing status updates to the intelligent controller in the event, for example, the intelligent controller moved on to control another target device without first notifying the previous target device, thus meeting the claim limitation. In this manner, the target device does not continue to generate and send unnecessary updates, thereby increasing available network bandwidth while also decreasing resources (*e.g.*, processing power and memory usage) of the target device.

**D. Ground 4: Claim 65 is Unpatentable over Ludtke '241 in view of Bouton**

166. As explained below, in my opinion, claim 65 is obvious over Ludtke '241 in view of Bouton, and thus is unpatentable under 35 U.S.C. §103.

167. Claim 65 depends from claim 48 and adds that the controlled computing device is a game console (hereinafter "*Game Console Limitation*") (Exhibit-1127, p. 34), which is met by Ludtke '241 and Bouton. Ludtke '241 teaches a controlled target device, but does not teach a game console. (Exhibit-1102, 2:44-48, 8:36-37.) Bouton teaches a video game/simulator system in a PC with a joystick controller and a throttle controller. (Exhibit-1107, Abstract.) "The throttle and joystick controller inputs are reconfigurable to work with different video game/simulator programs by downloading a new set of keycodes from the personal computer via the keyboard port to a microcontroller and nonvolatile memory in the throttle controller." (*Id.*)

168. In my opinion, one of ordinary skill in the art at the time of the alleged invention would have found it obvious for the controlled device in Ludtke '241 to be a gaming device as described in Bouton since gaming devices were commonly used with TVs, thus meeting the claim limitation. Additionally, Ludtke '241 and Bouton are both directed to providing control description information to a remote controller device.

**E. Ground 5: Claim 66 is Unpatentable over Ludtke '241 in view of Naughton**

169. As explained below, in my opinion, claim 66 is obvious over Ludtke '241 in view of Naughton, and thus is unpatentable under 35 U.S.C. §103.

170. Claim 66 depends from claim 48 and adds the limitation that the controlled computing device is an environment control device (hereinafter “*Environment Control Device Limitation*”) (Exhibit-1127, p. 34), which is met by Ludtke '241 and Naughton. Ludtke '241 teaches a controlled target device, but does not teach environment control devices. (Exhibit-1102, 2:44-48, 8:36-37.) Naughton teaches that a controlled computing device may be a thermostat (an environment control device). (Exhibit-1108, 7:17-19.) In my opinion, one of ordinary skill in the art at the time of the alleged invention would have found it obvious that the Ludtke '241 controlled target device could be the Naughton controlled thermostat because both references teach graphical user interfaces for the remote control of target devices commonly found within the home such as a VCR or personal computer, thus meeting the claim limitation. Additionally, both references teach that the target devices provide user interface data to the remote control and that the target devices provide updated information to the remote control upon changes to the target device.

All of the statements made in this declaration of my own knowledge are true. All statements made based on information and belief are believed to be true. Further, these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code.

Date: 16 March, 2017

Signature: \_\_\_\_\_

A handwritten signature in black ink, appearing to read 'A. Lippman', written over a horizontal line.

Andrew Lippman

# **Exhibit A**

**Andrew B. Lippman**  
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**Senior Research Scientist**  
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**Education**

École Polytechnique Fédérale de Lausanne (EPFL), Switzerland,  
PhD, Electrical Engineering, 1995

MIT, Master of Science, Computer Graphics, 1978

MIT, Bachelor of Science, Electrical Engineering, 1971

**Massachusetts Institute of Technology  
(MIT, a teaching and research university)**

Media Laboratory, Associate Director, 2008-present

Media Laboratory, Associate Director, 1987-2000

Massachusetts Institute of Technology, Senior Research Scientist, 2000-present

Media Laboratory, Graduate Officer, Media Arts and Sciences, 2002-2007

Massachusetts Institute of Technology, Principal Research Scientist, 1995-2000

Media Laboratory, Associate Director and Lecturer, 1987-2000

Media Laboratory, NEC Career Development Professor of Computers and Communications,  
1985-1986

Architecture Machine Group, Associate Professor, 1983-1987

Architecture Machine Group, Assistant Professor, 1980-83

Architecture Machine Group, Research Associate, 1977-80

Architecture Machine Group, Research Assistant, 1976-77

Architecture Machine Group, Technical Instructor, 1975-76

Architecture Machine Group, Technical Assistant, 1971-75

**Other Professional Experience**

EMC Technology Advisory Board, 2013-present

Diamond Management & Technology Consultants (PwC since 2010) Fellow, 1999-present

Nortel Visiting Fellow, 2007-2008

École Polytechnique Fédérale de Lausanne, Switzerland,  
Visiting Professor of Electrical Engineering, 1995

**Publications**

"8K Time into Space: Web-based Interactive Storyboard with Playback for Hundreds of Videos," H. Ohmata and A. Lippman, 2016 IEEE International Symposium on Multimedia (ISM 2016), to be published December 2016.

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"*The Coming Settop Shootout*", Lippman, A.B., Testimony paper given before the Subcommittee on Telecommunications and Finance on February 1, 1994.

"*MPEG-2 Requirements, Profiles and Performance Verification*", Okubo, S., McCann, K., Lippman, A.B., Proceedings of HDTV '93 international workshop, Ottawa, October 1993.

*"Structured Sound and Pictures"*, Lippman, A.B., IEEE/Academica Sineca Seminar on Multimedia Distributed Systems, Taipei, Taiwan, April 1993.

*"Generalized Predictive Coding of Movies"*, Lippman, A.B., Kermode, R., PCS '93 Proceedings, March 1993.

*"Scalable Open-Architecture Television"*, Bove, V.M., Lippman A.B., SMPTE Journal, January 1992.

*"Feature Sets for Interactive Images"*, Lippman, A.B., CACM, Vol. 34, No. 4, April 1991.

*"HDTV Sparks a Digital Revolution"*, invited paper for BYTE Magazine, December 1990, Vol. 15, No. 13.

*"Optimization of Subband Vector Quantization for Moving Images"*, Senoo, T., Girod, B., Lippman, A.B., invited paper for SMPTE "Sound and Vision '90", Sydney, Australia, July 4, 1990.

*"High-Definition Systems in the 1990s: Open Architecture & Computational Video"*, Lippman, A.B., Bove, V.M., Bender, W., Liu, L., Watlington, J., HDTV World Review, 1990, Vol. 1, No. 3.

*"Open Architecture Television Receivers and Extensible/Intercompatible Digital Video Representations"*, Bove, V.M, Lippman, A.B., invited paper for IEEE ISCAS '90, New Orleans, May 1-3, 1990.

*"Fifth Generation Television"*, invited paper for Optical News, January 1990, Vol. 1, No. 1.

*"A Compatible High-Definition Television System Using the Noise-Margin Method of Hiding Enhancement Information"*, Schreiber W.F., Adelson E.H., Lippman A.B., Rongshu, Gong, Monta P., Popat A., Sallic H., Shen P., Tom A., Zangi K., Netravali A.N., SMPTE Journal, Vol. 98, No. 12, December 1989.

*"Robust Bandwidth-Efficient HDTV Transmission Formats"*, Schreiber, W.F, Butera, W, Chalom, E, Monta, P, Popat, A, Lim, J, Lippman A.B, Netravali, A.N, Staelin, D.H. SMPTE Conference, Los Angeles, CA, October 21, 1989.

*"Automatic 3-D Scene Modeling from Range & Motion"*, Girod, B, Bove, V.M, Lippman, A.B., invited paper for the 2nd International Workshop on 64 kbit/s Coding of Moving Video, Hannover, W. Germany, September 1989.

*"Coding Image Sequences for Interactive Retrieval"*, Lippman, A.B., Butera, W., Communications of the ACM, Vol. 32, No. 7, July 1989.

*"Reliable EDTV/HDTV Transmission in Low-Quality Analog Channels"*, Schreiber, W.F, Lippman, A.B, SMPTE Journal, Vol. 98, No. 7, July 1989.

*"Open Architecture Television"*, Lippman, A.B., OSA invited paper for Applied Vision, 1989 Technical Digest Series, Vol. 16, San Francisco, CA, July 1989.

*"A Compatible High-Definition Television System Using The Noise-Margin Method of Hiding Enhancement Information"*, Schreiber, W.F., Adelson, E.H., Lippman, A.B, Girod, B., Monta, P., Popat, A., Sallic, H., Shen, P., Tom, A., Zangi, K., Netravali, A., SMPTE, San Francisco, CA, 1989.

*"Single-Channel Backward Compatible EDTV Systems"*, Lippman, A.B., Netravali, A.N., Adelson, E.H., Neuman, W.R., Schreiber, W.F. SMPTE Journal, Vol. 98, No. 1, January 1989.

*"Channel-Compatible 6-MHz HDTV Distribution Systems"*, Schreiber, W.F., Lippman, A.B., Netravali, A.N., Adelson, E.H., Staelin, D.H., SMPTE Journal, Vol. 98, No. 1, January 1989.

*"Single-Channel HDTV systems"*, Schreiber, W.F., Lippman, A.B., SPIE Symposium "Visual Communications and Image Processing '88", Cambridge, MA, November 9, 1988.

*"Asymmetric Coding of Motion Pictures Sequences"*, Picture Coding Symposium, Torino, Italy, September 12-14, 1988.

*"Bandwidth-Efficient Advanced Television Systems"*, Schreiber, W.F., Lippman, A.B., NAB Conference, Las Vegas, NV, April 11, 1988.

*"Single-Channel HDTV Systems, Compatible and Noncompatible"*, Schreiber, W.F., Lippman A.B., HDTV Workshop, L'Aquila, Italy, March 1988.

*"High Definition Television"*, NCGA '88 Conference Proceedings, Tutorials Vol. II, March 20-24, 1988.

*"News and Movies in the 50 Megabit Living Room"*, Lippman, A.B., Bender, W., IEEE/IECE.J Global Telecommunications Conference, Tokyo, Japan, November 15-17, 1987.

*"Computing with Television: Paperback Movies"*, Metropolitan Chapter of the Human Factors Society, Proceedings of the 1986 Annual Symposium "Images, Information & Interfaces - Directions for the 1990's".

*"Unrecordable Video"*, Lippman, A.B., Hoque, T., IEEE Transactions on Broadcasting, Vol. BC-33, No. 3, September 1987.

*"Electronic Publishing"*, MIT Media Lab, Cambridge, MA, January 1986.

*"Color Word Processing"*, Lippman, A.B., Bender, W., Solomon G., Saito, M., IEEE Computer Graphics and Applications, Vol. 5, No. 6, June 1985.

*"Optical Publishing"*, Computer Society International Conference (COMPCON), San Francisco, CA, February 1985.

*"Imaging and Interactivity"*, invited paper for the 15th Joint Conference on Image Technology, Tokyo, Japan, November 26, 1984.

*"Transmission of Presence"*, International Conference of Progetts Milano, Milan, Italy, June 15, 1984.

*"Optical Data Storage & Electronic Publishing"*, invited paper for the Optical Society of America, Monterey, CA, April 18, 1984.

*"Non-Committal Computer Systems"*, IEEE Conference, Frontiers in Education, September 1983.

*"Personal Computers as Intelligent Partners"*, Proceedings of IEEE Trends and Applications Conference, May 1983.

*"Current and Proposed Research at MIT on Videodisc Training"*, invited paper for the US Dept. of Commerce, National Bureau of Standards, December 13, 1982.

*"Video Instrument Control"*, Instrument Society of America (ISA), International Conference and Exhibit, Philadelphia, PA, October 1982.

*"Graphics and Bandwidth Compression in Video Conferencing"*, with Peggy Weil, SIGGRAPH 1982, Boston, MA, July 26, 1982.

*"Emerging Computer Media: On Image Interaction"*, SPIE Proceedings for the 1st International Conference on Picture Archiving and Communication Systems, January 1982.

*"Computational Video"*, Proceedings for the 7th Canadian Man-Computer Communications Conference, June 1981.

*"A Flat Parallax-Free Interactive Graphic Station"*, Journal of the Society for Information Display, Vol. 21, No. 1, 1981.

*"Semantic Bandwidth Compression: Speechmaker"*, paper for the Picture Coding Symposium, June 1981.

*"And Seeing through your Hand"*, Proceedings of the SID, Vol. 22/21 MIT, Cambridge, MA, 1981.

*"Future Interactive Graphics: Personal Video"*, Backer, D., Lippman A.B., NCGA Conference Proceedings, 1981.

*"Video at the Learning Interface"*, Proceedings for the Society for Applied Learning Technology Symposium on Learning Technology for the 80's, February 1981.

*"Movie-Maps: An Application of the Optical Videodisc to Computer Graphics"*, Proceedings for SIGGRAPH '80, Washington, July 14-18, 1980.

*"High Quality Graphic Display on Standard Television"*, The Journal of the Society for Information Display.

### **MIT Research Programs**

Ultimate Media Program	Principal Investigator, unincorporated research venture with Cisco, Comcast, DirectTV, et al.
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NSF Grant CNS-0434816 (2004-2007)	Three-year grant from National Science Foundation NeTS for research on Viral Radio
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Communications Futures Program (2003-Present)	Principal Investigator of cross-MIT research venture along with David Reed, Media Lab; Charles Fine, MIT Sloan School of Management; and David Clark, MIT Computer Science and Artificial Intelligence Laboratory
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Digital Life Consortium (1997-Present)	Director of Media Laboratory consortium of sponsors Bertelsmann, Brightstar Corporation, Cisco Systems, France Telecom, Google, News Corporation, Nortel Networks, NTT Comware, Panasonic Technologies Company, Philip Morris USA, Qualcomm Incorporated, Rodale, Inc., and Stan Winston Studio, Inc.
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TV of Tomorrow Program (1991-1996)	Principal Investigator, unincorporated venture between Bertelsmann, Bell-Northern Research, Deutsche Telekom, Hughes Aircraft Company, Eastman
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Kodak Company, Intel Corporation, Philips International, Sony Corporation, Televisa, Toppan Printing Company and Viacom International

MediaBank  
(1994-1998)

Principal Investigator, funded by National Computer Board, Singapore

Movies of the Future Program  
(1985-1991)

Principal Investigator, unincorporated venture between Paramount, Warner Brothers and Viacom, International, later others

Synthetic Teleportation  
(1985-1987)

DARPA

### **Patents**

*Video Codes for Encoding/Decoding Streaming Data*, US Patent No 9,189,827

*Solar Micro-Mining*, US Provisional Patent, filed 6/2/2016

*Methods and Apparatus for Encoded Textures*, US Patent No 9056422

*Video Codes for Encoding/Decoding Streaming Data*, US Patent No 9189827

*A Quasi-Passive Wakeup Function to Reduce Power Consumption of Electronic Devices*, US Patent No 7864051

*Realistic Audio Communication in a Three-Dimensional Computer-Generated Virtual Environment*, US Patent Application 12/344,542, filed 12/28/2008

*Method for Automatic Signal Routing In Ad Hoc Networks*, US Patent pending, filed 11/19/02

*Tag Interrogation With Observable Response Signal*, US Patent No. 7,109,865, filed 9/26/02

*Video Image Compositing Techniques*, US Patent Number: 5,262,856, filed 11/16/93

*Receiver-Compatible Enhanced Definition Television System*, US Patent No. 5,010,405, filed 4/23/91

*Video Graphic Arthroscopy System*, US Patent No. 5,005,559, filed 4/9/91

*Extended Definition Television Systems*, US Patent No. 5,003,377, filed 3/26/91

*Multiscale Coding of Images*, US Patent No. 4,987,480, filed 1/22/91

*Unrecordable Video Signals*, US Patent No. 4,673,981, filed 6/16/87

### **Other**

FCC Filing NPRM 14-28 "In the Matter of Promoting the Open Internet," 2014

Advisory board, Applause, 2014

Customer Board, Nokia Siemens Networks (now Nokia Networks), 2013-present

Technical Advisory Board, EMC, 2013-present

Director, Beonten, 2012-2013

Advisory Panel, Terrarium, 2012-2014

Advisory Board, Echonest, 2008-2014

Advisory Board, Damaka, Inc., 2006-2010

Advisory Board, MiND (Media Independence), 2006-2008

Science Advisor, Public Radio International's *PRI at Night*, 2006

Investor/advisor, Ember, 2001-2012

Board Member, Wave Systems, c2000 – c2003

Chairman, Presto Technologies, 1998-2000

Member of Advisory Board to Board of Directors, MaMaMedia, Inc., 1997-2003

Member of Scientific Advisory Board, Centre for User Oriented IT Design,  
Stockholm, Sweden, 1997-2004

Member of Technical Advisory Board, VTEL (Austin), 1992-2000

Member of International Steering Committee, International Workshop on Coding Techniques for  
Very Low Bit-rate Video, 1995

Member of the Science Council of the Cross Industry Working Team (XIWT), Corporation for  
National Research Initiatives (CNRI), 1993-present

Founding Member of the Editorial Board for Multimedia Systems Journal, 1992

Member of the International Organizing Committee for the Picture Coding Symposium, 1989-  
1993

Chairman, International Organizing Committee, Picture Coding Symposium, 1990

Member of Strategic Advisory Council of the Research and Demonstration Center on Remote  
Medical Consultation Via High-Definition Television, Texas Children's Hospital, 1990-91

Member of Editorial Board of Image Communication Journal, 1989-2003

Member of the Steering Committee for International Workshop on Advanced Techniques for  
Transmission of Video at 64 kbit/s or less, Hannover, West Germany, 1988-90

Board Member of Technology Broadcasting Corporation (WMBR), 1983-1989

FCC Advisory Committee Member of Advanced Television Service, 1989-90

Member of the US CCIR Study Group 11 (Television), 1990

Member of Editorial Board of ACM TOIS (Transactions on Information Systems), 1989-1990

Chairman of the Board of Advisors, Medical Simulation Foundation, 1987-1988

Medical Simulation Foundation: Principal Investigator for "The Video-Graphic Arthroscope"  
Project, 1987-88

Graduate Student Council (GSC) Teaching Award for the Architecture Department, 1986

1983 Nebraska Interactive Videodisc Award for Best Technical Achievement, Lincoln, NE,  
September 15, 1983

MIT Committee member of the Computing Environment, 1983-84

Member of Project Athena Technical Committee, 1983-84

Review Board, NSF, Applications of Interactive Videodisc to Science Education, 1977-1979, 1981

Member of the School Committee, City of Salem, MA. 1987-1993

**Memberships**

ACM; IEEE; IEEE Computer Society

**Theses Supervised**

Nadav Aharony	<i>Virtual Private Milieus: Sharing Our Digital Aura through Social and Physical Proximity</i> , MS, September 2008
Matthew Antone	<i>Synthesis of Navigable 3-D Environments from Human-Augmented Image Data</i> , ME EECS, September 1996
Barry Arons	<i>The Audio-Graphical Interface to a Personal Integrated Telecommunications System</i> , MS, September 1984
Derek Atkins	<i>Access and Access Control</i> , MS, June 1995
Dave Backer	<i>Structure and Interactivity in Media: A Prototype for the Electronic Book</i> , PhD, April 1988
Alex Benenson	<i>VideoLogo: Synthetic Movies in a Learning Environment</i> , MS, June 1990
Matthew Blackshaw	<i>The broadcast marketplace : Designing a more efficient local marketplace for goods and services</i> , MS June 2012
Aggelos Bletsas	<i>IntelligentAntenna Sharing in Cooperative Diversity Wireless Networks</i> , PhD, August 2005
Aggelos Bletsas	<i>Time Keeping in Myriad Networks: Theories, Solutions, and Applications</i> , MS, June 2001
Katherine Blocher	<i>Affective Social Quest (ASQ) Teaching Emotion Recognition with Interactive Media and Wireless Expressive Toys</i> , MS, June 1998
Guillaume Boissiere	<i>Personalized Multicast</i> , SM MAS, June 1988
V. Michael Bove	<i>Synthetic Movies Derived from Multi-Dimensional Image Sensors</i> , PhD, June 1989
V. Michael Bove	<i>Personalcasting: Interactive Local Augmentation of Television Programming</i> , MS, September 1985
V. Michael Bove	<i>A Flexible Integrated Framestore System</i> , BS, May 1983
Eric Brown	<i>Optical Publishing</i> , MS, February 1983
William Butera	<i>Multiscale Coding of Images</i> , MS, July 1988

Mark Callahan	<i>A 3-D Display Head-set for Personalized Computing</i> , MS, June 1983
Ken Carson	<i>A Color Spatial Display Based on a Raster Framebuffer and Varifocal Mirror</i> , MS, September 1984
William Capolongo	<i>Color Spatial Animation Using a Varifocal Mirror Display</i> , BS, May 1985
Sailabala Challapalli	<i>Modeling the Temporal Components of Video Structure</i> , MS, May 2001
Xiang Chen	<i>Adaptive Bit Allocation for Spatiotemporal Subband Coding Using Vector Quantization</i> , MS, June 1990
Pascal Chesnais	<i>A Graphic/Photographic Arthroscopy Simulator</i> , MS, February 1988
Constantine Christakos	<i>Taking Advantage of Distributed Multicast Video to Deliver and Manipulate Television</i> , MA June 2000
Constantine Christakos	<i>Distributed-in/Distributed-out Sensor Networks: A New Framework to Analyze Distributed Phenomena</i> , PhD, June 2006
Lawrence N. Claman	<i>A Two Channel Spatio-Temporal Encoder</i> , BS, May 1988
James Cooley	<i>A Day in the Life of the RF Spectrum</i> , MS, September 2005
Vivian Chan Diep	<i>Me.TV: A Visual Programming Language and Interface for Dynamic Media Programming</i> , MS, June 2015
Judith Donath	<i>Inhabiting the Virtual City: The Design of Social Environments for Electronic Communities</i> , PhD MAS, June 1996
Judith Donath	<i>The Electronic Newsstand: Design of an Intelligent Interface to a Variety of News Sources in Several Media</i> , MS, September 1986
Chen-Koung Dong	<i>Measurement of Printer Parameters for Model-Based Halftoning</i> , MS, May 1992
Daniel Dreilinger	<i>Scale Free Information Retrieval</i> , EECS, Meng, June 1998
Steve Gano	<i>Forms for Electronic Books</i> , MS, June 1983
William Gardner	<i>Machine-Aided Visualization of Molecular Vibration</i> , BS, June 1982
David Gauthier	<i>Distributed, Mobile and Pervasive Systems Design</i> , MS, September 2009
Carol Ginsberg	<i>Human Body Motion as Input to an Animated Graphical Display</i> , MS, June 1983

Jeffrey Halbig	<i>Construction and Analysis of a Wireless Antenna-Sharing Scheme</i> , June 2004
Walid Hamdy	<i>Hardware Implementation of Dynamic Video on Personal Computers</i> , BS, May 1986
Michael J. Hawley	<i>Structure out of Sound</i> , PhD, (Committee) September 1993
Robert Michael Hemsley	<i>Flow: A Framework for Reality-Based Interfaces</i> , MS, February 2014
Mohamed Atef Hendawi	<i>Multimedia Capture of Events to Support Passive Virtual Attendance</i> , MS, June 1995
Henry N. Holtzman	<i>Three-Dimensional Representations of Video using Knowledge Based Estimation</i> , MS, September 1991
Leonard Hourvitz	<i>Stills from Movies: Personal Photography and the Personal Computer</i> , MS, August 1984
Giridharan Iyengar	<i>Video Retrieval for Reuse</i> , PhD MAS, June 1998
Giridharan Iyengar	<i>Information Theoretic Measures for Encoding Video</i> , MS, September 1995
Frank Kao	<i>Parallel Processing Interfaces to Television</i> , MS, June 1995
Karrie Karahalios	<i>Salient Movies</i> , MEng, June 1995
Karrie Karahalios	<i>Merging Static and Dynamic Visual Media Along an Event Timeline</i> , SM MAS, February 1998
Jeffrey Keast	<i>The Design and Application of a Personal Printer/Scanner System</i> , MS, June 1985
Roger Kermode	<i>Smart Network Caches: Content and Application Mediated Delivery of Multimedia Over the Internet</i> , PhD MAS, March 1998
Roger Kermode	<i>Building the Big Picture: Enhanced Coding from Resolution</i> , MS, June 1994
Boris Kizelshteyn	<i>REACH: The Local Social Favor Exchange</i> , MS, February 2012
Inna Lobel Koyrakh	<i>Increasing the Bandwidth of Social Navigation during the Prototyping Process</i> , MS, February 2011
Shyam Krishnamoorthy	<i>Minerva: A Smart Video Assistant for the Kitchen</i> , MS, June 2001
Amir Lazarovich	<i>Invisible Ink: Blockchain for Data Privacy</i> , MS, June 2015

Gene S. Lee	<i>Progressive Transmission of Digitally Compressed Color Images</i> , BS, June 1989
Kwan Hong Lee	<i>The Influences of the Just-in-time Social Cloud on Real World Decisions</i> , PhD, February 2012
Sung Hyuck Lee	<i>XCast: A Personalized and Groupwise Broadcasting System for Social Event Networking</i> , MS, September 2008
Fulu Li	<i>Community Storage</i> , PhD, June 2009
Fulu Li	<i>Cooperative Multicast in Wireless Networks</i> , MS, June 2005
Inna Lobel Koyrakh	<i>Increasing the Bandwidth of Social Navigation during the Prototyping Process</i> , MS, February 2011
Julia Ma	<i>Interest networks : understanding the influence of interesting people in an organization</i> , MS, June 2012
Bruce McHenry	<i>Multi-Modal Communication in the Computer Medium</i> , BS, June 1984
Patrick Campbell McLean	<i>Structured Video Coding</i> , MS, June 1991
Christopher Metcalfe	<i>Media Jacket: An Integrated Clothing Based Personal Communications System</i> , MS, June 1999
Iliia Mirkin	<i>Reliable Real-time Stream Distribution Using an Internet Multicast Overlay</i> , February 2006
Robert Charles Mollitor	<i>Image Sequence Compression via Code Encyclopedias</i> , BS, May 1988
Paul Thomas Monaghan	<i>Codebook Replenishment of Vector Quantized Movies by use of a Megatable</i> , BS, May 1989
Casey R. Muller	<i>Design and Performance of a Viral Network</i> , MS, June 2003
Savannah Niles	<i>Glyph: Lightweight and Evocative Looping Images in the News</i> , MS, June 2015
Eugene N. Opsasnick	<i>Color Correction for the Eikonix Digitizing Scanner</i> , BS, May 1988
Durga Pandey	<i>UniPlug: A Framework For Ad-hoc Invention Sharing Over A Campus Network</i> , MS, September 2007
Peter Pathe	<i>A Virtual Vocabulary Speech Recognizer</i> , MS, June 1983
Manuela Pereira	<i>Video Coding in a Broadcast Environment</i> , MS, September 1993
Travis Rich	<i>Encoding Data into Physical Objects with Digitally Fabricated Textures</i> , MS, June 2013

Steven L. Rohall	<i>A Graphical Interface for Cooperative Problem Solving</i> , MS, May 1988
Pasquale Romano	<i>Vector Quantization for Spatiotemporal Sub-band Coding</i> , MS, February 1990
James B. Salem	<i>Computers in the Audio Domain; creating an audio news system</i> , BS, June 1984
Gitta Salomon	<i>Design and Implementation of an Electronic Special Interest Magazine</i> , MS, June 1986
Dan Sawada	<i>Recast: An Interactive Platform for Personal Media Curation and Distribution</i> , MS, June 2014
Robert Schaeffer	<i>Audio Augmentation of Video Disc Training Systems</i> , BS/SM, May 1983
Dawei Shen	<i>Co-channel Digital Signal Separation: Application and Practice</i> , MS, February 2008
Dawei Shen	<i>Design of Currency, Markets, and Economy for Knowledge</i> , PhD, September 2012
Shen Shen	<i>Design, Implementation, and Evaluation of a Social Learning Network for Chess</i> , MS, June 2014
Jeremy Silber	<i>A Cooperative Communication Protocol for Wireless Ad-Hoc Networks</i> , ME, June 2002
Abha Singh	<i>Variable Resolution Video</i> , MS, June 1991
Scott T. Smith	<i>Scalable Distributed Resource Location</i> , ME EECS, May 1998
Marc Spehlmann	<i>A Speech Peripheral for an IBM Personal Computer</i> , MS
Jonathan Speiser	<i>WorldLens: Exploring World Events Through Media</i> , MS June 2014
Joseph B. Stampleman	<i>Multiscale Codebooks</i> , BS, May 1989
Joseph B. Stampleman	<i>Scalable Video Compression</i> , MS, June 1992
Dang Van Tran	<i>Multimedia Applications and Network Management Support in Video DialTone ATM Network</i> , MS/BS, May 1994
Edison Thomaz	<i>Developing Distributed Contextualized Communication Services</i> , MS, September 2002
Eyal Toledano	<i>Opportunistic, Collaborative and Synchronized, Proximal Device Ecology</i> , MS, September 2013

Tri D. Tran	<i>Low Delay MPEG2 Video Encoding</i> , BS /MEng EECS, June 1997
Nuno Vasconcelos	<i>A Bayesian Framework for Content Characterization, Summarization, Indexing, and Retrieval</i> , PhD, MAS, November 1997
Nuno Vasconcelos	<i>Library-based Image Coding using Vector Quantization of the Prediction Space</i> , MS, September 1993
Dimitrios Vyzovitis	<i>An Active Protocol Architecture for Collaborative Media Distribution</i> , MS, June 2002
Anders Richard Wallgren	<i>Movies on the Workstation</i> , BS, May 1989
John A Watlington	<i>Synthetic Movies</i> , MS, September 1989
John A. Watlington	<i>A Decoder for Vector Coded Color Motion Picture Sequences</i> , BS, May 1987
Grace Woo	<i>Demonstration and Evaluation of Co-channel DBPSK Source Separation</i> , MS, June 2007
Grace Woo	<i>VRCodes : embedding unobtrusive data for new devices in visible light</i> , PhD, June 2012
Steven Yelick	<i>The Authoring of Optical Videodiscs with Digital Data</i> , MS, June 1982
Steven Yelick	<i>Anamorphic Image Processing</i> , BS, June 1980
Polychronis Ypodimatopoulos	<i>Cerebro: Forming Parallel Internets and Enabling Ultra-Local Economies</i> , MS, September 2008
Polychronis Ypodimatopoulos	<i>An Open Application Framework For Social Discovery</i> , PhD, (June 2012, proposed)
Hector Yuen	<i>An Ad-Hoc Wireless Communication System</i> , MS, August 2006

**Panels and Presentations**

Future Media panel, National Institute of Standards and Technology (NIST), Named Data Networking Workshop, Gaithersburg, MD, June 2016

Keynote Speaker, Comms Vision, Gleneagles, Scotland, November 2015

Keynote Speaker, Collaboration & Mobility Summit, San Francisco, CA, September 2015

Speaker, Outdoor Advertising Association of America, San Diego, CA, May 2015

Speaker, MIT Information and Communication Technologies Conference, Cambridge, MA, April 2015

Keynote Speaker, RDV Media: Transformation, Montreal, Canada, September 2014

Speaker, 61st Cannes Lions International Festival of Creativity, Cannes, France, June, 2014

Keynote Speaker, Ernst & Young Global Media & Entertainment Industry Meeting, Orlando, Florida, December, 2012

Keynote Speaker, AT&T Technical Leaders Forum, Orlando, Florida, November, 2012

Keynote Speaker, AT&T Technical Leaders Forum, San Juan, Puerto Rico, February, 2012

Panel Speaker, PWC Global Communications Forum, London, June, 2011

Keynote Speaker, Fidelity Executive Forum, Orlando, May 2011

Keynote Speaker, AT&T Technical Leaders Forum, Los Angeles, November 2010

Keynote Speaker, HSM World Marketing & Sales Forum, Lisbon, November 2009

Keynote Speaker, 16<sup>th</sup> CLSA Investors' Forum, Hong Kong, September 2009

Keynote Speaker, HSM World Marketing & Sales Forum, Mexico City, July 2009

Keynote Speaker, Gartner Wireless and Mobile Summit, Chicago, February 2009

Keynote Speaker, TelephonyLIVE, Chicago, September, 2008

Keynote Speaker, The Future of Computing, Dell Mexico, Monterey, Mexico, September, 2008

Keynote Speaker, Product Development & Management Association's International Conference, Orlando, September, 2008

Keynote Speaker, Wainhouse Research, Cambridge, MA, July 2008

Keynote Speaker, Gartner Group Future of Technology, Orlando, June 2008

Keynote Speaker, HSM World Marketing & Sales Forum, São Paulo, Brazil, June 2008

Keynote Speaker, Photo Marketing Association International, Las Vegas, February 2008

Speaker, eg07, Los Angeles, December 2007

Speaker, Gartner Networking Summit, Nashville, December 2007

Keynote Speaker, SSPA Services Leadership Conference, New Orleans, October 2007

Keynote Speaker, SonyBMG Music Entertainment Worldwide Information Technology Conference, Miami, April 2007

Panelist, NSF Cognitive Ratio and Cooperative Communication, Washington, DC, April 2007

Keynote Speaker, IEEE/CTIA Portable'07 Conference, Orlando, March 2007

Panelist, The New New Media, Realscreen Summit, Washington, DC, January 2007

Keynote Speaker, World Science Forum, New York, NY, November 2006

Keynote Speaker, Playback Mobile Forum, Toronto, Canada, May 2006

Keynote Speaker, Media Summit/Digital Hollywood, New York NY, February 2006

Panelist, Telecoms Transitions, Lisbon, Portugal, June 2005

Keynote Speaker, IT MIDIA, Sao Paulo, Brazil, June 2005

Speaker, IDG Communications Meeting, Cadiz, Spain, May 2004

Speaker, Samsung Tech Fair 2003, Seoul, Korea, July 2003

Workshop Co-Director: United Nations: The Wireless Internet Opportunity for Developing Nations, New York, June 2003

Keynote speaker, Worldcom Customer Summit, Orlando, FL, February 2003

Keynote speaker, Nextel Indirect Conference, Las Vegas, January 2003

Presentation before Congressional Internet Caucus, Washington, DC, July 2002

*"Not Your Victorian Internet,"* speaker, MIT On the Road, The Association of Alumni and Alumnae of MIT, West Palm Beach, FL, January 2001.

*"Digital Extremism,"* speaker, The Leadership Center, Atlanta, GA, November 2000

*"Digital Entertainment,"* speaker, Minnesota TEKNE Awards, Minneapolis, MN, November 2000

*"Digital Life: Clearing the Cobwebs from the Net,"* speaker, New York State Annual Meeting, Lake Placid, NY, June 2000

*"The Future is Now,"* keynote speaker, South Dakota Governor's Economic Development Conference, Pierre, SD, April 2000

*"Always On,"* keynote speaker, Canadian Music Week conference, Toronto, March 2000

*"Accessible Computers for All,"* speaker, INET'2000, Sao Paulo, Brazil, July 2000

*"Taking the Lead – Issues of the Future,"* keynote speaker, Canadian Associate of Broadcasters, Montreal, Canada, November 1999.

*"The New Technology Changing the World,"* keynote speaker, Mgate New-Biz Forum, Athens, Greece, January 1999.

*"The Developing Relation Between Digital Broadcasting and the Internet,"* workshop speaker, Conference on the Hong Kong TV Broadcasting Industry: Towards the 21<sup>st</sup> Century, Hong Kong, November 1998

*"Transparent Technology,"* Keynote speaker, CUE Telecon XVII, Anaheim, CA, October 1998.

*"The New World for Technology,"* invited speaker, Federation of European Direct Marketing, Brussels, Belgium, April 1998.

*"Future of TV Networks,"* invited panelist, Aspen Comedy Festival, Aspen, CO, March 1998.

"*The Future of Media Technology*," invited speaker, Fischer, Justus Communicacao Total, Sao Paulo, Brazil, January 1998.

"*The New Multimedia Environment*," invited panelist, United Nations World Television Forum, New York, NY, November 1997.

TED6, Technology, Entertainment & Design, invited speaker, New York, NY, September 1997.

"*The Future of Technology*," Technology Forum, California State University, Hayward, CA, May 1997.

"*The Future of the Newspaper in the Digital Age*," International Seminar on the Future of the Daily Newspaper, Belo Horizonte, Brazil, April 1997.

"*How Future Communications Impact You*," Meetings & Exhibitions Technology Conference, Rosemont, IL, April 1997.

"*Digital Life: Media & Community in a Connected World*," ECON Zukunftstag, Dusseldorf, Germany, April 1997.

"*The Future of Technology*," Technology Forum, California State University, Hayward, CA, May 1997.

"*QoS & Mobile Multimedia*," Nomadic 97, panel member, Santa Clara, CA, August 1997.

"*Nomadcity, Wearability & The Technologies of Community*," Arthur Andersen High Tech Advanced Industry Seminar, keynote speaker, San Jose, CA, September 1997.

Speaker, TED6, Technology, Entertainment & Design, New York, NY, September 1997..

"*The New Multimedia Environment*," invited panelist, United Nations World Television Forum, New York, NY, November 1997.

"*The Impact of Future Communications on the Printing Industry*," keynote speaker at Tech Alert 96 Conference, Graphics Arts Technical Foundation, Pittsburgh, PA, January 1996

"*Internet Entertainment*," Singapore Digital Media Consortium Symposium, speaker, Singapore, February 1996.

"*How Future Communications Impacts You*," First Swiss Telecom Symposium, speaker, Lugano, Switzerland, May 1996.

"*Telecommunications, Telematics & Social Change*," ARTIS Seminar, speaker, Firenze, Italy, June 1996.

"*The Future of Television*," Medientage Munchen '96, speaker, Munich, Germany.

"*The Future of Video Coding: What Will Be New*," International Symposium on Circuits & Systems, panel member, Atlanta, May 1996.

"*Emerging Architecture*," invited panel participant at NII 2000 Forum of the Computer Science and Telecommunications Board, Washington, DC, May 23, 1995.

"*Multimedia Revolutions: past, present and future*," speaker at Management Circle Conference on Datenautobahn und Multimedia, Frankfurt, Germany, June 19-21, 1994.

*"Coding Content instead of Pixels"*, keynote speaker at the VLBV 94 conference, Colchester, Essex, UK, April 6-8, 1994.

*"Technology Day Panel"*, invited panel participant at the 1994 MTV Networks Management Retreat, San Juan, PR, February 8, 1994.

*"Selling Value in the New Media 90s"*, Guest Speaker at Advanstar Communications 1994 International Sales Meeting, Cleveland, OH, January 14, 1994.

*"The 5 Year Prospective for Digital Television"*, Panel Moderator, IEEE Digital Video Workshop, Cambridge, MA, October 1993.

*"Television of Tomorrow"*, Interactive Panel session at the World Economic Forum Industrial Summit, MIT/Harvard, Cambridge, MA, September 10, 1993.

*"Life After HDTV"*, panel speaker at session on "MIT in the 21st Century", Enterprise '93 Conference, Boston, MA, June 17, 1993.

*"Digital Television"*, invited speaker at Advanced Seminar on "Desktop Video Communications: The Final Step in the Merger of Computers and Video", sponsored by Applied Business teleCommunications, Atlanta, GA, May 3, 1993.

*"Jumping Into the Frame: Past Interaction, Into Participation"*, invited speaker for AECT 1993 National Convention, New Orleans, LA, January 14, 1993.

*"Telecommunications Future"*, panel speaker at the PLI Telecommunications Policy and Regulation Conference, Washington DC, December 3, 1992.

*Television of Tomorrow: HDTV or Video home computer? "*, seminar speaker at the Association Descartes Conference on "Images, Screens, Networks", Paris, France, November 27, 1992.

*"Variable Resolution Video on Demand"*, panel speaker at the EIA Digital Video Workshop, Boston, MA, October 1, 1992.

*"The Communication Revolution Now: The Atlantic Connection"*, panel speaker at the 41st Annual IPI General Assembly, Budapest, Hungary, May 19, 1992.

*"Workstations of the Future: A User's Perspective"*, presenter for the IEEE Satellite Videoconference, April 30, 1992.

*"Television of Tomorrow/How Now PTV"*, presentation and panel speaker at Pacific Mountain Network Conference "Making the Most of Multichannel", La Jolla, CA, April 14, 1992.

*Television of Tomorrow"*, speaker at the 22nd T&M Seminar "The Digital Challenge: Future Tools for Film & TV Makers", Stockholm, Sweden, February 20, 1992.

*"The Potential of All-digital High Definition Television Systems"*, panel speaker at the Financial Times Cable Television and Satellite Broadcasting Conference, London, UK, February 19, 1992.

*"How Technology will Reshape Communication"*, and *"Consumers — Taking Command of their Media Flow"*, speaker at the World Communication Summit, Crans-Montana, Switzerland, October 6, 1991.

*"Advanced Television Systems: Anything but HDTV"*, invited banquet speaker at IEEE Multidimensional Signal Processing Conference, Lake Placid, NY, September 24, 1991.

*"Inventing the Future at MIT's Media Lab"*, presentation to the CCIA Board of Director's meeting, Boston, MA, September 12, 1991.

*"Movies of the Future"*, speaker at the CRAI Multimedia Systems: From Technologies to Applications, Capri, Italy, June 2-7, 1991.

*"Television of Tomorrow: Signals with a Sense of Themselves"*, keynote speaker, 36th Annual IEEE International Computer Conference, COMPCON '91, San Francisco, CA, February 27, 1991.

*"Digital Television"*, banquet speaker at the 1991 SPIE Symposium on Electronic Imaging: Science and Technology, San Jose, PR, February 26, 1991.

*"The Future Path for Broadband"*, plenary session speaker at the 1990 ComForum Conference "Broadband: Converging on the Future", Orlando, FL, December 10-14, 1990.

*"Digital Video Terminals"*, speaker and round table participant, EIA/IEEE 2nd International Workshop on Digital Video Communications, Cambridge, MA, November 27, 1990.

*"Computing with Feeling: Directions for the Human Interface to Personal Computing in the Coming Years"*, invited speaker at SOFTWORLD '90 Conference, Chiba, Tokyo, Japan, August 3, 1990.

*"Perspectives on Media Technology"*, guest speaker at the James Martin World Seminar, (TTI), Cambridge, MA, May 2, 1990.

*"Information Technology Seminars"*, a series of talks presented at the Institute of Systems Science, National University of Singapore, Singapore, April 23-27, 1990

*"HDTV Update: Current Status, Issues and Trends"*, NCGA '90 Tutorial speaker, Anaheim, CA, March 19, 1990.

*"Electronic Document Delivery"*, keynote speaker at the first Bellcore/BCC Conference on Electronic Document Delivery, New Brunswick, NJ, March 12, 1990.

*"Communications and Information in the Next Millenium"*, keynote speaker at the 1990 HIMSS Conference, New Orleans, LA, February 20, 1990.

*"Focusing on the Future of the Media"*, keynote speaker at the Digital Photography Conference, Washington DC, February 8-10, 1990.

*"Communications in the Year 2001"*, keynote speaker at the Dallas Communications Council conference "Communications: The Economic Wave of the Future", Dallas, TX, October 16, 1989.

*"Movies of the Future: Computing in your Television, and Television in your Computers"*, CCISP Seminar Series, University of Pennsylvania, Philadelphia, PA, October 11, 1989.

*"Video Technologies of the Future"*, panelist at National Communications Forum, Chicago, IL, October 3, 1989.

*"Inventing the Future"*, keynote speaker, "Interchange '89 Conference organised by Monsanto, St. Louis, MS, September 21, 1989.

*"Advances in Media Technology: The Innovations at MIT's Media Laboratory"*, pre-conference workshop at HCI International '89 Conference, Boston, MA, September 18, 1989.

*"HDTV and the Future of Home Communications"*, speaker at SEMI conference "HDTV: The Impact of New Age Electronics", San Francisco, CA, June 29, 1989.

*"Information in the Next Millenium"*, speaker at the International Thomson Professional Publishing Conference, Boston, MA, June 28, 1989.

*"Media Technology"*, keynote address, IEEE International Workshop on Microelectronics and Photonics in Communications, New Seabury, MA, June 7, 1989.

*"The Face of Communications in the Year 2001"*, keynote address, Video 9 Conference and Exhibition, Quinnipiac College, CT, May 25, 1989.

*"Open Architecture Television"*, speaker at University of North Carolina/IBM Technical Symposium, Chapel Hill, NC, May 17, 1989.

*"Movies of the Future"*, speaker at the Image and Sound Film Festival, Den Haag, The Netherlands, April 27-28, 1989.

*"The Way We Like It: Concurrent, Redundant and Plural"*, speaker at OCRI MultiMedia '89 Conference, Ottawa, Canada, April 21, 1989.

*"Human Interfaces for Multimedia Systems"*, speaker at Open Software Foundation University Symposium, Cambridge, MA, April 18, 1989.

*"The Face of Communications in the Year 2001"*, keynote speaker for "Advanced Communications Technologies in Pennsylvania and the Public Interest" seminar, sponsored by PPTN, Hershey, PA, April 6, 1989.

*"The Future of Television"*, invited speaker, 99th meeting of the National Council of the Arts, Washington DC, February 3, 1989.

*"Opportunities in Communications: The Technology View"*, speaker for the San Diego Communications Council Conference on Technology, November 15, 1988, San Diego, CA.

*"Computing and Communications in the Year 2001"*, speaker for Hewlett Packard Seminar, Cupertino, CA, November 15, 1988.

*"The Future: Home Communications"*, speaker for Intel Technology Seminar, Sedona, AZ, November 2, 1988.

*"The Future: Home Communications"*, speaker for Ameritech Presidents Conference, Pheonix AZ, November 2, 1988.

*"The Face of Communications in the Year 2001"*, speaker for Ameritech Corporate Strategy Conference, Chicago, IL, October 26, 1988.

*"Media Technology"*, Chairman of SIGGRAPH panel, Atlanta, GA, August 4, 1988.

*"The 135 Mb Living Room"*, speaker for ITS Seventh International Conference, MIT Cambridge, MA, June 29, 1988.

*"HDTV...The Systems Under Development"*, panelist at NAB Broadcast Engineering Conference, Las Vegas, NV, April 10, 1988.

*"News and Movies in the 135 Megabit Living Room"*, speaker for Bellcore/MIT Conference  
*"Towards a Universal Broadband Infrastructure for the US"*, Salt Lake City, UT, April 7, 1988.

*"HDTV: Benefits, Costs and Issues"*, Tutorial Instructor, NCGA '88, Anaheim, CA, March 21, 1988.

*"The Future Impact of HDTV Standards and Digital Television Technologies on Computer Graphics"*, Technical Speaker for NCGA '88, Anaheim, CA, March 2, 1988.

*"Adaptive Vector Quantization of Moving Images"*, speaker at seminar in "Visual Communications", Columbia University, New York, NY, November 13, 1987.

*"New Publishing Technologies: The Day after Tomorrow"*, speaker at the American Association of University Presses' Northeastern Regional meeting, Cambridge, MA, October 18, 1987.

*"Electronic Futures: Technology Directions for Publishing"*, speaker at the Corporate Electronic Publishing Systems Conference, Boston, MA, October 28, 1987.

*"Where Do User Interfaces Come From?"*, panelist at SIGGRAPH Conference, Anaheim, CA, July 1987.

*"Digital Television: An Overview"*, IEEE International Symposium on Circuits and Systems, speaker, Philadelphia, PA, May 4, 1987.

*"Interactive 3-D Imaging for Remote Presence and Simulation"*, speaker at The Institute for Graphic Communication Conference "Real-Time Stereoscopic Video Display System", Bedford, MA, March 24, 1987.

*"Computing with Television"*, invited speaker for Images, Information, & Interfaces: Directions for the 1990s, New York Telephone, New York, NY, November 19, 1986

Workshop on Interactive 3-D Graphics, University of North Carolina, Chapel Hill NC, October 1986.

*"Advanced Television Concepts"*, ICCE panelist for Consumer Electronics Conference, Chicago, IL, June 5, 1986.

*"Unproven Guidelines for the Human Interface"*, invited Tutorial at Eurographics, Nice, France, September 1985.

*"The Advanced Television Research Program at MIT"*, HDTV Conference, invitational conference of young researchers in television, Rennes, France, September 1985.

*"Computer Graphics & the Media Technology"* Invited Speech for Texas A&M Symposium, April 1985.

*"Optical Videodiscs and Electronic Publishing"*, speaker for Continuing Education Institute, Los Angeles, June 1984.

*"Optical Storage in the House"*, presentation for Technical Opportunity Conference, San Francisco, CA, December 1983.

*"Exploring the Future"*, invited speaker for the American Press Institute, Reston, VA, November 1983.

*"Interactive Three-Dimensional Computer Graphics"*, speaker for the Institute for Graphic Communication Conference on 3-D Display Techniques Andover, MA, November 1983.

*"The Human Interface to Personal Computers"*, Federal Computer Conference, Washington, DC, September 1983.

*"Audio-visual Communications: Tomorrow's World"*, speaker for the International Institute of Communications Conference, Aruba, Spain, September 1983.

*"Artists Interfacing with Technology"*, panelist for SIGGRAPH Conference, Detroit, MI, July 1983.

*"Media Technology - Past, Present, Future"*, speaker for the Biological Photographic Association, Dallas, TX, July 1983.

Computer & Communications Industry Association Conference, presentation, Calsbad, CA, November 5, 1982.

*"Computer Graphics and the Man/Machine Interface"*, speaker for the First Annual Pacific Northwest Computer Graphics Conference, Eugene, OR, October 1982.

*"A Conversational Model for the Human Interface to Graphics"*, speaker for the NCGA, Anaheim, CA, June 1982.

*"Computational Video"*, invited speaker for the Whitney Symposium on Science and Technology, Rochester, NY, May 1982.

*"Picture Archiving & Communications Systems for Medical Imaging"*, speaker for the First International Conference and Workshop on Picture Archiving and Communication Systems for Medical Applications Paper, Newport Beach, CA, January 17, 1982.

Advanced Research in Computer Graphics Conference, NCGA, speaker, June 1981.

*"NTSC Compatible Text and Graphics"*, speaker for the IEEE 21st Annual Chicago Spring Conference on Consumer Electronics, June 1981.

*"Computational Video: Television as a Human Interface"*, Canadian Man-Machine Society, June 1981.

*"Video at the Learning Interface"*, Society for Applied Learning Technology Symposium, February 1981.

*"Introduction to Dataland"*, speaker for the Association of Educational Communication and Technology Convention, April 1980.

*"Computers in Everyday Life"*, Session Chairman of Technical Committee, International Federation of Information Processing (IFIP) 8th World Congress, 1980.

*"Personalized Movies, Society for Applied Learning Technology"*, speaker for Third International Congress, January 1980.

*"The Case for TV Compatibility in Computer-Aided Design"*, speaker for the Detroit Engineering Society, April 1979.

*"Videodiscs in Cataloging"*, speaker for the Art Libraries Society of North America (ARLIS) Conference, March 1979.

*"Interactive Computing"*, panelist for SIGGRAPH Conference, 1976.

**Law Cases (Complete; none omitted for confidentiality or other reason)**

IPR of 6,725,281 and 9,172,987 by Banner and Witcoff, Oct, 2016

IPR, Connex, obo Apple et al, Cooley LLP, August, 2016. No report or deposition.

FastVDO LLC v. AT&T Mobility LLC et al., 2:15-cv-921 (E.D. Tex.), obo Morrison and Foerster representing Apple, Mar-June 2016, IPR declaration filed.

OpenTV v Apple, IPR 2015-0131, obo O'Melveny & Myers, representing Apple. Feb-Mar, 2016, no report or deposition, deferred.

PMC v. Amazon, Civil Action No. 1:13-cv- 1608-RGA, obo Knobbe, Martens, Olson & Bear, L.L.P./ Amazon, Oct 2014 – open. On hiatus

OpenTV v. Apple, Civil Action 14-cv-1622, obo O'Melveny & Myers/ Apple. June, 2014 – open

OpenTV v. Netflix, Civil Action 1:12-cv-01733-GMS, obo Durie Tangri/ Netflix. March, 2014 – November, 2014

Varghese v Amazon, inc. et al, No.12-2-39303-6 (King County Superior Court, KL Gates, on behalf of Amazon, December 2013 – December, 2014, settled

EON Corp IP Holdings v FLO TV et al, C.A. No 10-812 (RGA), on behalf of Sprint Spectrum LP and Simplicity, Morris Nichols, Arsht and Tunnell, LLP, and on behalf of USCellular, Sidney Austin LLP, July, 2013 – October, 2013, Deposition 4 Oct, 2013

Bose Corporation v SDI, Inc, IPR2013-00465, declaration, Foley, Lardner (Boston) on behalf of SGI, June 2013-Mar 2014, deposition, 10 March, 2014

TiVo, Inc., v Cisco Systems et al, No 2:12-cv-00311-JRG, on behalf of Cisco et al, April 2013 – June 2013, case settled

Jongerius Panoramic Technologies v Google and Apple, Norther District of California, 4:12-cv-03797, Greenberg Traurig on behalf of Google, and Ropes and Gray obo Apple, 2013 – 2014, patent invalidated

Rovi v Amazon et al, CIV-1:11-cv-00003, US dist court, Delaware. Boies Schiller on behalf of Amazon. 2012 Case dropped.

Rovi v Vizio, ITC 337-TA-820 and ITC-TA-845, Akin Gump, on behalf of Vizio. Both actions dropped. 2012.

Patent Harbor, LLC v. The Walt Disney Co. & Buena Vista Home Entertainment, Eastern District, Texas, 6:10-cv-00607-LED, Rothwell Figg, on behalf of Disney, 2011 – June, 2012

Reexamination of U.S. Patent Nos. 7,467,218 and 7,890,648, U.S. Patent and Trademark Office, Civ. No. 10-SS-533(W.D. Tex), Kenyon & Kenyon LLP, August 2011 – present, on behalf of Sony Electronics and Sony Entertainment America

Bose Corporation v SGI, Inc et al. D. Mass. Case No. 09-cv-11439-WGY. Foley, Lardner (Boston) on behalf of SGI, et al, Deposition January, 2012

S3G V Apple Computer, Finnegan Henderson et al, Washington, Finnegan, on behalf of plaintiff S3G, ITC 337-TA-724, testified in ITC April 2011

LG v. Vizio, ITC case 337-TA-687, Jones Day, on behalf of Vizo, testified in ITC June 2010

DIRECTV, Inc. v. Gemstar TV-Guide Interactive, Inc. (Commercial Arbitration). Jones Day, on behalf of DirecTV, testified December 2009

MPT and Sony v. Vizio, Jones Day, 2009, in US Patents 6,778,182, 6,111,614, and 5,434,626, no case number. Hired by Jones Day on behalf of Vizio

Superguide v. DirecTV, Jones Day, 2008 -2009, in re US Patent 5,068,734 (Beery). Hired by Jones Day on behalf of DirecTV

Beery – DirecTV, Jones Day, hired by Jones Day, 2008

Guardian v. Toshiba America Consumer Products, Knobbe Martens, 2008 –2009, hired on behalf of Toshiba America

Microsoft '682, Fish and Richardson, on behalf of Microsoft, 2007

United States of America v. American Society of Composers, Authors and Publishers (for determination of reasonable license fees,) arbitration, White Case, 2007, on behalf of ASCAP

Digital Choice of Texas v. Sichuan Changhong Electric Co, Mayer Brown Rowe & Maw, 2006, on behalf of SCE, deposed September, 2006

Acacia v. New Destiny Internet Group et al, Jones Day, 2005 to present, hired on behalf of several of the defendants, deposed August 2005.

Kyocera v. Nokia, Jones Day, September 2005, on behalf of Nokia

Antal Media Corporation v. Apple Computer et al, Weil Gotschal and Manges, 2004 hired on behalf of Microsoft and Real Networks.

Hewlett Packard v. Intergraph, Civil Action 03-2517 (MJJ). McDermott, Will and Emery, November 2003 on behalf of Intergraph

Collaboration Properties v. Polycom, USAOP-23M40533. Kecker and Van Ness, 2003 - 2004, Deposed December 2003 on behalf of Polycom

Gemstar, MDL-1274-WBH, Morrison and Foerster, Banner and Witcoff, September 2002-April 2003, Deposed February 2003, multi-client litigation

Electronic Industries Alliance and Consumer Electronics Association – Technical Consulting, Dickstein, Shapiro, Morin & Oshinsky, April 2002.

Certain Set-top Boxes, 337-TA-454 (Vogel). Kirkland and Ellis, July-December 2001, Deposed October 2001

Pegasus Development v. DirecTV, et al, CA 00-1020 (GMS). Jones, Day, 2001, Idle for >12 months