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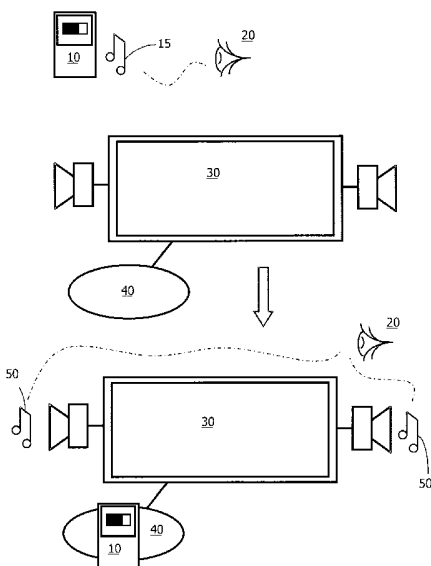
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(54) Title: METHOD DEVICE AND PROGRAM FOR SEAMLESSLY TRANSFERRING THE EXECUTION OF A SOFTWARE APPLICATION FROM A FIRST TO A SECOND DEVICE



(57) Abstract: A method is described of transferring software application execution from a first device (10) to a second device (30) to provide for a seamless transfer of a function (15, 50) provided at the first device (10) to the second device (30). Sais function can comprise hearing to an audio file, watching a film at a TV, visualising a digital item, watching a video, etc. The method involves identifying the first device (10) performing the function (15), software applications executing on the first device (10) to perform the function (15), for instance the plug-in necessary for a data item, data streams being accessed by the first device (10) to provide the function, for instance content streaming downloaded from the internet, and parameters controlling operation of the software applications to provide the function (15), for example when watching a video the current position currently visualised, the format of the video, etc. Execution of the software applications is seamlessly transferred to the second device (30) to enable it to perform the function, i.e. a session mobility soft-handoff is carried out to transfer the execution of said function from a 1st to a 2nd device. After transfer, software execution at the first device (10) is terminated to halt a provision of the function (15) thereat. The invention is relevant to mobile devices, entertain. A method is described of transferring software application execution from a first device (10) to a second device (30) to provide for a seamless transfer of a function (15, 50) provided at the first device (10) to the second device (30) the method involves identifying the first device (10) performing the function (15), software applications executing on

the first device (10) to perform the function (15), data streams being accessed by the first device (10) to provide the function, and parameters controlling operation of the software applications to provided the function (15). Execution of the software applications is seamlessly implemented at the second device (30) to enable it to perform the function. After transfer, software execution at the first device (10) is terminated to halt a provision of the function (15) thereat. The invention is relevant to mobile devices, entertain-ment systems, personal computers, personal data assistants and such like. Moreover, the invention provides for simple user-intuitive seamless transfer of software application execution.



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HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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METHOD, DEVICE AND PROGRAM FOR SEAMLESSLY TRANSFERRING THE EXECUTION OF A SOFTWARE APPLICATION FROM A FIRST TO A SECOND DEVICE

FIELD OF THE INVENTION

The present invention relates to methods of transferring software execution between devices, for example to methods of seamlessly transferring software execution between devices. Moreover, the invention also concerns devices operable according to said
5 methods. Furthermore, the invention also relates to software executable on computing hardware for implementing the methods.

BACKGROUND TO THE INVENTION

Contemporary communication networks provide their users with access to
10 network resources, for example computing resources, data supply resources and data presentation resources. Users are increasingly desirous to migrate spatially within the networks whilst enjoying transfer of their software applications between devices within the networks. Such transfer is especially pertinent when the users are employing devices which are linked in wireless communication with their corresponding networks.

15 In a scientific publication with title "Adaptive Terminal Middleware for Seamless Session Mobility", IEICE Trans. Inf. & Syst., vol. E86-D, no. 11 November 2003, it is disclosed that various network resources, including wireless access services and multimedia devices, are expected by users to be available in ubiquitous computing environments. On account of resource availability changing when a user migrates from one
20 location to another, network functions to monitor availability of resources in use and, if necessary, switch from obsolete resources to new ones are necessary for continuous service provision to the user. The paper further discloses adaptive middleware, namely a form of software or software application, which is operable to execute policy-based dynamic resource selection and host-based session management to ease network administration tasks, and hide
25 session failures and resource changes from software applications and the user. One practical application for the adaptive middleware is a redirection of audio streams from built-in speakers to external speakers, and a handoff between 802.11b standard devices and cellular standard devices which is autonomously performed when a user migrates between regions of a house.

In practice, it is found that such autonomous transfer does not function as reliably as intended with a result that such transfer is often not performed in a seamless manner. Despite attempts having been made to improve transfer of software execution and data streams, difficulties continue to be encountered by users.

5

SUMMARY OF THE INVENTION

An object of the present invention is to provide an improved method of transferring software execution between devices.

According to a first aspect of the invention, there is provided a method of
10 transferring software application execution from a first device to at least one second device to provide for a seamless transfer of a function provided at said first device to said at least one second device, said method comprising steps of:

- (a) identifying the first device performing said function, one or more software applications executing on the first device to perform said function, one or more data streams
15 being accessed by the first device to provide said function, and one or more parameters controlling operation of said one or more software applications to provide said function;
- (b) identifying said at least one second device to which seamless transfer of said function is to be made;
- (c) when not already provided at said at least one second device, loading said one
20 or more software applications into the second device;
- (d) copying said one or more parameters from the first device to said at least one second device;
- (e) seamlessly commencing execution of said one or more software applications at said at least one second device controlled by said copied one or more parameters to access
25 said one or more data streams to enable the at least one second device to perform said function; and
- (f) terminating software execution of said one or more software applications at the first device to halt a provision of said function at the first device.

The invention is of advantage in that more reliable seamless transfer of
30 software execution between devices is capable of being achieved.

Optionally, in the method, said one or more data streams are present at both the first device and said at least one second device. Provision of the one or more data streams at the first device and the at least second device is of benefit in that synchronization

of data streams for the first and second devices is not required, thereby potentially expediting software execution transfer.

Optionally, in the method, said one or more data streams are present at the first device wherein, after seamless transfer of said function from said first device to said at least one second device, said at least one second device is operable to access said one or more data streams from the first device. Continuation of sourcing of the one or more data streams from the first device after seamless transfer is of benefit in that the seamless transfer can occur promptly without a need to copy over data objects corresponding to the one or more data streams.

Optionally, in the method, the one or more data streams are provided from a source other than said first device and said at least one second device. More optionally, said one or more data streams are provided from a communication network such as the Internet.

Optionally, in the method, transfer of software application execution is executed in response to said first device being brought into mutually close spatial proximity to said at least one second device. Such transfer in response to relative proximity of the first and second devices provides the user with an intuitive approach to invoke seamless transfer of software application execution.

Optionally, in the method, transfer of software application execution is executed in response to a user manipulating graphical symbols presented to the user, said graphical symbols being representative of said one or more software applications under execution. Manipulation of such graphical symbols provides the user with a simple and intuitive manner of selectively identifying software applications to be seamlessly transferred.

Optionally, in the method, said first device and said at least one second device are operable to indicate to a user when seamless transfer is achieved by way of at least one of an audio confirmation and a visual confirmation to the user. Such indication provides the user with an easily interpreted and intuitive feedback regarding seamless transfer of software applications between the first and second devices.

Optionally, in the method, the first device and said at least one second device are mutually coupled via a wireless network. The wireless network can, for example, be beneficially implemented as contemporary Wifi or Bluetooth.

Optionally, in the method, the first device and the at least one second device comprise at least one of: mobile telephones, cell phones, entertainment systems, personal computers (PCs), personal data assistants (PDAs), intelligent headphones, digital cameras, televisions. Other implementations of the present invention are also possible.

According to a second aspect of the invention, there is provided a device operable to provide for seamless software application therefrom or thereto, said device being operable according to a method according to the first aspect of the invention.

Optionally, the device is implemented as at least one of: a mobile device, an
5 entertainment system.

According to a third aspect of the invention, there is provided software executable on computing hardware for implementing a method according to the first aspect of the invention.

It will be appreciated that features of the invention are susceptible to being
10 combined in any combination without departing from the scope of the invention.

DESCRIPTION OF THE DIAGRAMS

Embodiments of the invention will now be described, by way of example only, with reference to the following diagrams wherein:

15 Figure 1 is an implementation of the present invention for providing for seamless software execution transfer from a first mobile device to an entertainment system; and

Figure 2 is an illustration of seamless transfer of software applications achieved by way of user-manipulation of presented graphical symbols.

20

DESCRIPTION OF EMBODIMENTS OF THE INVENTION

The present invention is concerned with methods of transferring software-execution activities from one device to another. The devices are, for example, mutually connected via a wireless digital network such as contemporary Wifi or Bluetooth.

25 Conventionally, a user often has to stop a given software execution activity on a first device and then proceed through menus or browse software applications on a second device to start up execution of the given software application on the second device. Within in-home and office telephone networks, a principle of call forwarding from a first telephone to a second telephone is well known; when executing such call transfer, a user calls the second telephone
30 to which the call is to be transferred and, upon acceptance at the second telephone, the call is transferred to the second telephone.

The inventors have developed methods of transferring software execution from one stationary device to another stationary device in home environments. Conceptually, the inventors utilize a principle of using a form of token to transfer software execution from

one device to another device such that transfer of the token is operable to terminate software execution in the device which has notionally given up the token. A benefit provided by the present invention is that it is capable of reducing the number of user interaction steps with devices necessary to stop, transfer and resume software execution.

5 The present invention utilizes following features in embodiments thereof:

(a) physical gesture interaction is employed to transfer a software execution activity from a first device to a second device;

(b) a software execution activity is stopped at the first device and continued seamlessly and immediately at the second device at a same execution point and with similar
10 execution settings;

(c) in a situation wherein software execution has terminated at the first device, the first device is permitted to proceed automatically to a stand-by mode or to a switched-off mode;

(d) a network is established between the devices in an implicit manner, for
15 example initiated by a physical gesture interaction; and

(e) the devices provide for a display to users of a list of executing software applications of one or more of the devices, so that user can precisely select a software application which is to be transferred.

 The aforementioned physical gesture interaction is, for example, enabled by
20 proximity sensing which is enabled in each of the devices. Such proximity sensing can be implemented by way of mutual near-field communication or by using simple radio frequency identification device (RFID) tags and readers. Thus, software application execution can be transferred by placing a mobile device in local proximity to another device.

 In Figure 1, there is illustrated transfer of software application execution in an
25 embodiment of the present invention. A mobile device 10 executes one or more software applications which render the device 10 operable to replay music 15 to its associated user 20. The user 20 proceeds to place the device 10 near an home entertainment system 30 which is provided with an associated connectivity hot-spot zone 40, for example the zone 40 being implemented as a tag reader or near field communicator (NFC). In response to placement of
30 the device 10 on the hot-spot zone 40, the one or more software applications executing in the device 10 halt whilst seamlessly one or more corresponding software applications commence execution on the home entertainment system 30 so that the user 20 merely perceives the replay of music simultaneously ceasing on the device 10 and transferring to corresponding replay of music 50, namely sound reproduction, from the entertainment system 30 at a similar

point in a music play-list. On account of software execution being halted on the device 10, the device 10 is able to switch to its stand-by mode, for example to conserve battery power thereat. Software execution on the entertainment system 30 enables the user 20 to gain access to a potentially wider range of options on account of the entertainment system 30 being provided with a wider range of executable software applications and sound replaying hardware in comparison to the device 10; for example, the device 10 is operable to replay sound in stereo whereas the entertainment system 30 is provided with more than two sound channels for providing cinema-type sound rendition, for example surround sound rendition. The entertainment system 30 is capable, for example, of presenting a video clip to the user 20 to accompany corresponding sound reproduction 50 thereat.

There are potentially numerous different embodiments of the invention which, for example, can conveniently be sub-divided into at least five categories:

Category 1: Embodiments of the invention can relate to mobile entertainment devices wherein, if the user 20 places a first device executing software applications spatially near another second such device, for example placing the device 10 near the entertainment system 30, software execution is halted on the first device and seamlessly transferred to the second device. Software application execution activities will continue on the second device with a status corresponding to software application execution activities on the first device.

Category 2: Embodiments of the invention can relate to mobile telephones, namely cell-phones. For example, if the user 20 places a mobile telephone near the entertainment system 30, a telephone call presently being supported by the mobile telephone is seamlessly transferred to the entertainment system 30, after which the mobile phone will switch to its stand-by mode to conserve battery power. Such seamless transfer of software application from the mobile telephone to the entertainment system 30 enables the user 20 to continue a telephone conversation via, for example, a video-phone provided as a facility on the entertainment system 30. A similar transfer of software application from one device to another is also feasible for car-kit systems for mobile telephones, namely cell-phones, for example to seamlessly transfer an active call or a navigation application.

Category 3: Embodiments of the invention can relate to smart docking stations, for example pertinent to products which are designed to work with docking stations of personal computers (PCs) or other entertainment devices. As a practical example of an embodiment, the user 20 is able to browse pictures in the user's 20 digital camera, presentation of such pictures being seamlessly transferred from the camera to a wide-format

screen of an apparatus including a docking station in response to placing the camera in a vicinity of the docking station.

Category 4: Embodiments of the invention can relate to content streaming. For example, a wireless headphone can be provided with on-board software application execution facilities which render the headphone operable such that placing the headphone
5 near to a source of sound, for example a television (TV), an audioset or a personal computer (PC) operable to execute software applications for providing a source of sound, results in seamless transfer of reproduction of the sound to the headphone.

Category 5: Embodiments of the invention can relate to mobile computing
10 devices, for example personal data assistants (PDAs), lap-top computers and such like. First and second such mobile computing devices can be placed mutually in close spatial proximity whilst operating, such mutual placement causing a pop-up window to appear on at least a screen of the first mobile computing device indicative of software application presently executing on the second mobile computing device. The user 20 is able to drag a symbol
15 representative of a presently executing software application on the screen from a region representing the first device to another region on the screen representing the second device, thereby seamlessly transferring execution of a thereby selected software application from the first device to the second device. Execution of the software application resumes seamlessly in the second device with a same status as execution on the first device, for example with
20 regard to execution parameters and setting specified for the software application to be transferred. Data content that is associated with the software application selected by the user 20 to be transferred is copied with the software application in running memory, or it will continue to be streamed from the first device to the second device when execution of the software application is seamless transferred from the first device to the second device. If
25 required, a physical gesture can be sufficient for transferring the software application from the first device to the second device. An illustration of such software application transfer between two mobile devices is provided in Figure 2. In Figure 2 the first and second devices are denoted by 100, 110 respectively disposed in mutually close spatial proximity 115. Each of the devices 100, 110 is provided with a corresponding display screen 120, 130
30 respectively. The screens 120, 130 are provided, for example by way of suitable driver software for presenting images on the screens 120, 130, with regions 140, 150 representative of the devices 110, 100 respectively. Symbols 160 included in the regions 140, 150 are representative of executing software applications in the devices 100, 110. The user 20 is

capable of dragging the symbols 160 for selectively seamlessly transferring software application execution between the devices 100, 110.

Although seamless transfer of software application execution from one device to another is described in embodiments of the invention in the foregoing, more detailed
5 implementation of seamless software application transfer will now be provided.

To ensure a seamless hand-over of software application execution providing rendition of a media content stream, a source device is identified in a local wireless network before actual seamless hand-over occurs. The wireless network is conveniently implemented as Wifi or Bluetooth although other implementations are feasible. This local network
10 conventionally has a communication range of a few hundred meters. A receiving device to which seamless transfer is to be implemented is able to anticipate a hand-over of a rendition of a current media data stream by arranging for the source device notifying the receiving device that there is a media content stream currently playing. The receiving device proceeds to load all necessary software components, for example software applications and associated
15 parameter data, for example media player software applications and corresponding codecs implemented as executable software applications, to ensure that hand-over from the source device to the receiving device can subsequently seamlessly.

The aforesaid media content can be played from several sources, for example:

- (a) from the receiving device, wherein the media content is duplicated at both the
20 source device and the receiving device;
- (b) from the source device, wherein the media content is streamed as background data flow to the receiving device after seamless transfer has occurred from the source device to the receiving device; and
- (c) from a source external to the source and receiving device, for example from
25 the Internet, wherein a stream of data provided to the receiving device is temporally synchronized with a corresponding stream of data provided to the source device.

When the media content is data content subject to digital rights management (DRM), digital rights keys are beneficially sent to the receiving device to unlock a playback function provided at the receiving device.

30 It will be appreciated that embodiments of the invention described in the foregoing are susceptible to being modified without departing from the scope of the invention as defined by the accompanying claims.

Optionally, hand-over can be implemented during a running session, for example during a video call executing via a mobile telephone, for example a cell-phone.

Seamless hand-over during a running session is achieved by forwarding all session parameters when the session is handed-over. Appropriate software components, for example executable software applications, can be anticipated and loaded into memory in preparation for seamless transfer.

Optionally, feedback to the user 20 providing an indication of when seamless transfer has been successfully achieved can be achieved by way of at least one of audio feedback and visual feedback. For example, when seamless transfer between two devices has been implemented pursuant to the present invention, both devices can illuminate, for example by way of energized blue light emitting diodes (LEDs), to indicate successful seamless exchange. If seamless transfer cannot be executed immediately in response to user demand, for example for technical reasons associated with software application execution, one or more of the devices is operable to present display icons to the user 20 that content is being transferred.

Optionally, in addition to supporting seamless software application transfer from one device to another, the devices can be operable to only transfer a presentation of media content temporarily whilst the devices are maintained in spatially close proximity, namely hand-over is only executed temporarily and reversibly whilst the devices are in close mutual spatial proximity.

Administration of seamless transfer of software applications as described in the foregoing to provide the user 20 with seamless function transfer from one device to another is implemented or supervised either by additional digital hardware or additional software applications, or mixture of additional hardware and software.

In the accompanying claims, numerals and other symbols included within brackets are included to assist understanding of the claims and are not intended to limit the scope of the claims in any way.

Expressions such as "comprise", "include", "incorporate", "contain", "is" and "have" are to be construed in a non-exclusive manner when interpreting the description and its associated claims, namely construed to allow for other items or components which are not explicitly defined also to be present. Reference to the singular is also to be construed to be a reference to the plural and vice versa.

CLAIMS:

1. A method of transferring software application execution from a first device to at least one second device to provide for a seamless transfer of a function provided at said first device to said at least one second device, said method comprising steps of:
 - (a) identifying the first device performing said function, one or more software applications executing on the first device to perform said function, one or more data streams being accessed by the first device to provide said function, and one or more parameters controlling operation of said one or more software applications to provide said function;
 - (b) identifying said at least one second device to which seamless transfer of said function is to be made;
 - 10 (c) when not already provided at said at least one second device, loading said one or more software applications into the second device;
 - (d) copying said one or more parameters from the first device to said at least one second device;
 - (e) seamlessly commencing execution of said one or more software applications
 - 15 at said at least one second device controlled by said copied one or more parameters to access said one or more data streams to enable the at least one second device to perform said function; and
 - (f) terminating software execution of said one or more software applications at the first device to halt a provision of said function at the first device.
- 20 2. A method as claimed in claim 1, wherein said one or more data streams are present at both the first device and said at least one second device.
3. A method as claimed in claim 1, wherein said one or more data streams are
- 25 present at the first device wherein, after seamless transfer of said function from said first device to said at least one second device, said at least one second device is operable to access said one or more data streams from the first device.

4. A method as claimed in claim 1, wherein said one or more data streams are provided from a source other than said first device and said at least one second device.

5. A method as claimed in claim 4, wherein said one or more data streams are provided from a communication network such as the Internet.

6. A method as claimed in claim 1, wherein transfer of software application execution is executed in response to said first device being brought into mutually close spatial proximity to said at least one second device.

10

7. A method as claimed in claim 1, wherein transfer of software application execution is executed in response to a user manipulating graphical symbols presented to the user, said graphical symbols being representative of said one or more software applications under execution.

15

8. A method as claimed in claim 1, wherein said first device and said at least one second device are operable to indicate to a user when seamless transfer is achieved by way of at least one of an audio confirmation and a visual confirmation to the user.

20 9. A method as claimed in claim 1, wherein the first device and said at least one second device are mutually coupled via a wireless network.

10. A method as claimed in claim 1, wherein said first device and said at least one second device comprise at least one of: mobile telephones, cell phones, entertainment systems, personal computers (PCs), personal data assistants (PDAs), intelligent headphones, digital cameras, televisions.

25

11. A device operable to provide for seamless software application therefrom or thereto, said device being operable according to a method as claimed in claim 1.

30

12. A device as claimed in claim 11 implemented as at least one of: a mobile device, an entertainment system.

13. Software executable on computing hardware for implementing a method as claimed in claim 1.

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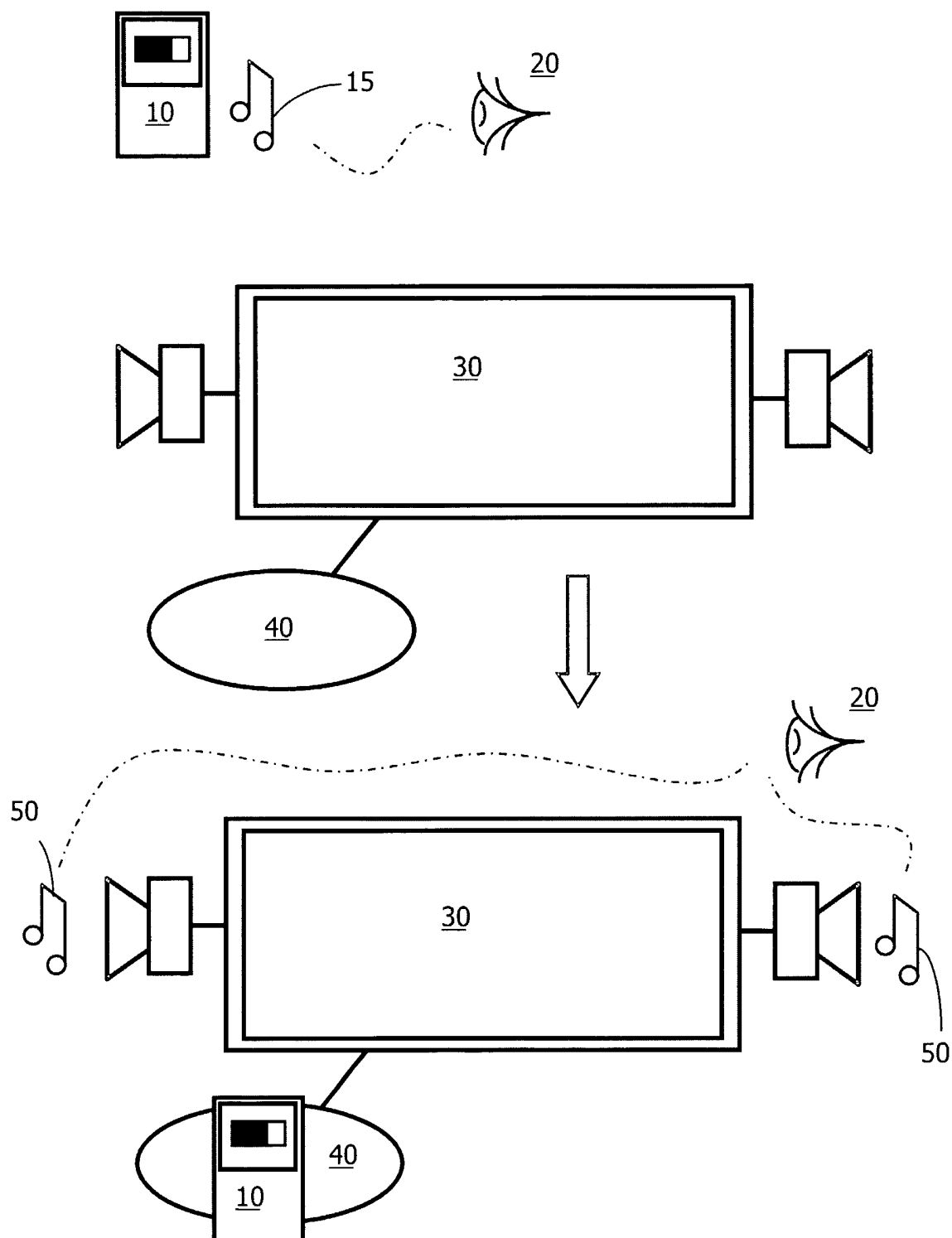


FIG.1

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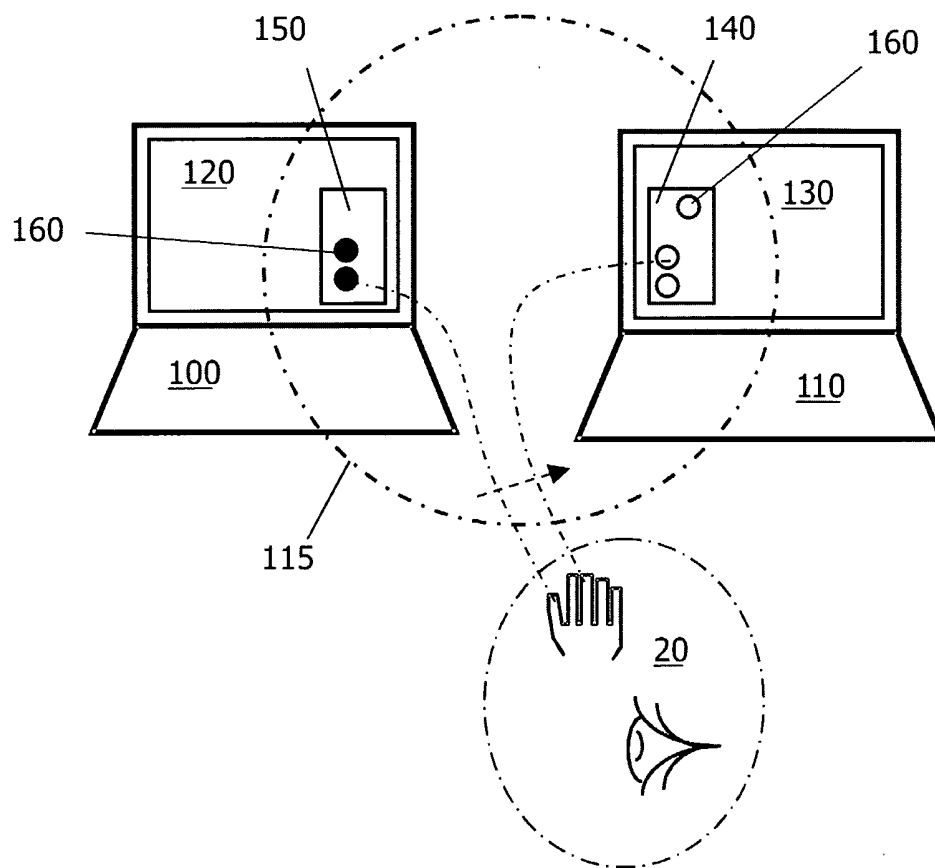


FIG.2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB2005/051432

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L29/08 H04L12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L H04M H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 03/032173 A (UNIVERSITY OF WOLLONGONG; RUSKIN, PAUL, ADAM; BURNETT, IAN, SHAW) 17 April 2003 (2003-04-17) abstract page 1, line 9 - page 4, line 20 page 5, line 3 - page 9, line 19 figures 1,2	1-13
Y	----- OHTA K ET AL: "Adaptive terminal middleware for session mobility" MULTIMEDIA SIGNAL PROCESSING, 2002 IEEE WORKSHOP ON 9-11 DEC. 2002, PISCATAWAY, NJ, USA, IEEE, 19 May 2003 (2003-05-19), pages 394-399, XP010642403 ISBN: 0-7803-7713-3 cited in the application paragraphs 2-3 ----- -/--	1-13



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

7 July 2005

Date of mailing of the international search report

20/07/2005

Name and mailing address of the ISA

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Moreno-Solana, S-F

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB2005/051432

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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