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McLain

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(54) **OFFLINE VIEWING OF INTERNET CONTENT WITH A MOBILE DEVICE**

(75) Inventor: **Jay F. McLain**, Woodinville, WA (US)

(73) Assignee: **Microsoft Corporation**, Redmond, WA (US)

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(52) **U.S. Cl.** **709/227**; 702/217
(58) **Field of Search** 709/217, 219, 709/246, 224, 227; 704/233; 717/11; 395/200.31

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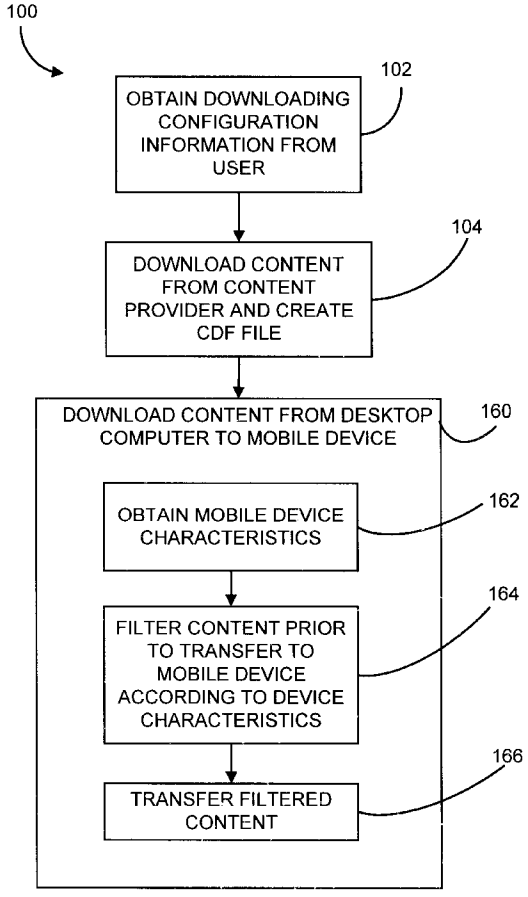
Primary Examiner—David Wiley
(74) *Attorney, Agent, or Firm*—Westman, Champlin & Kelly, P.A.; S. Koehler

(57) **ABSTRACT**

A method and system for transferring offline browsing content information of a wide area network from a host computer to a mobile device includes connecting the mobile device to the host computer and obtaining characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device. The content information is transferred from the host computer to the mobile device as a function of the characteristic information.

31 Claims, 12 Drawing Sheets



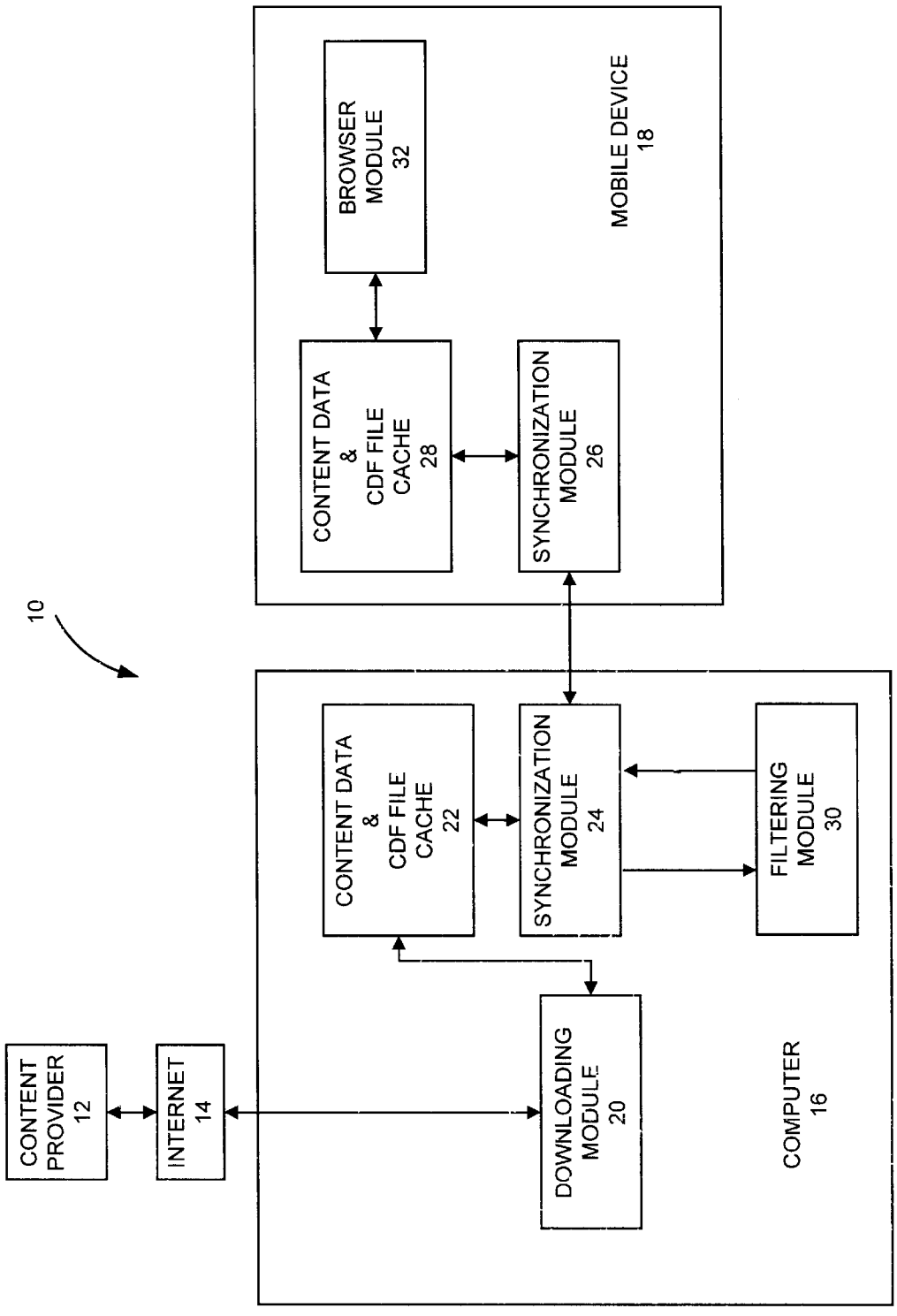

10
CONTENT PROVIDER 12
INTERNET 14
COMPUTER 16
DOWNLOADING MODULE 20
CONTENT DATA & CDF FILE CACHE 22
SYNCHRONIZATION MODULE 24
FILTERING MODULE 30
MOBILE DEVICE 18
BROWSER MODULE 32
CONTENT DATA & CDF FILE CACHE 28
SYNCHRONIZATION MODULE 26

FIG. 1

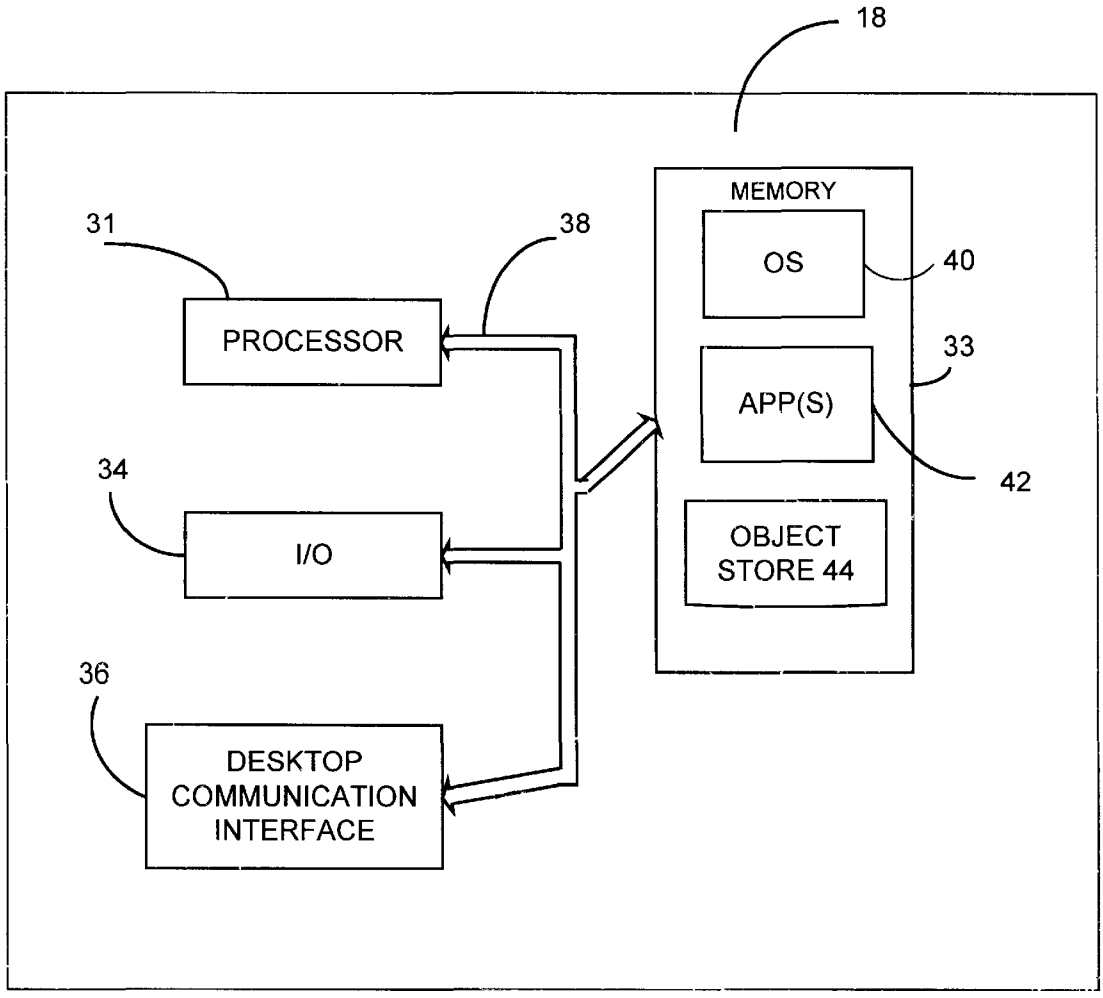

18
MEMORY
31
38
OS
40
PROCESSOR
33
APP(S)
34
42
I/O
OBJECT
STORE 44
36
DESKTOP
COMMUNICATION
INTERFACE

FIG.2

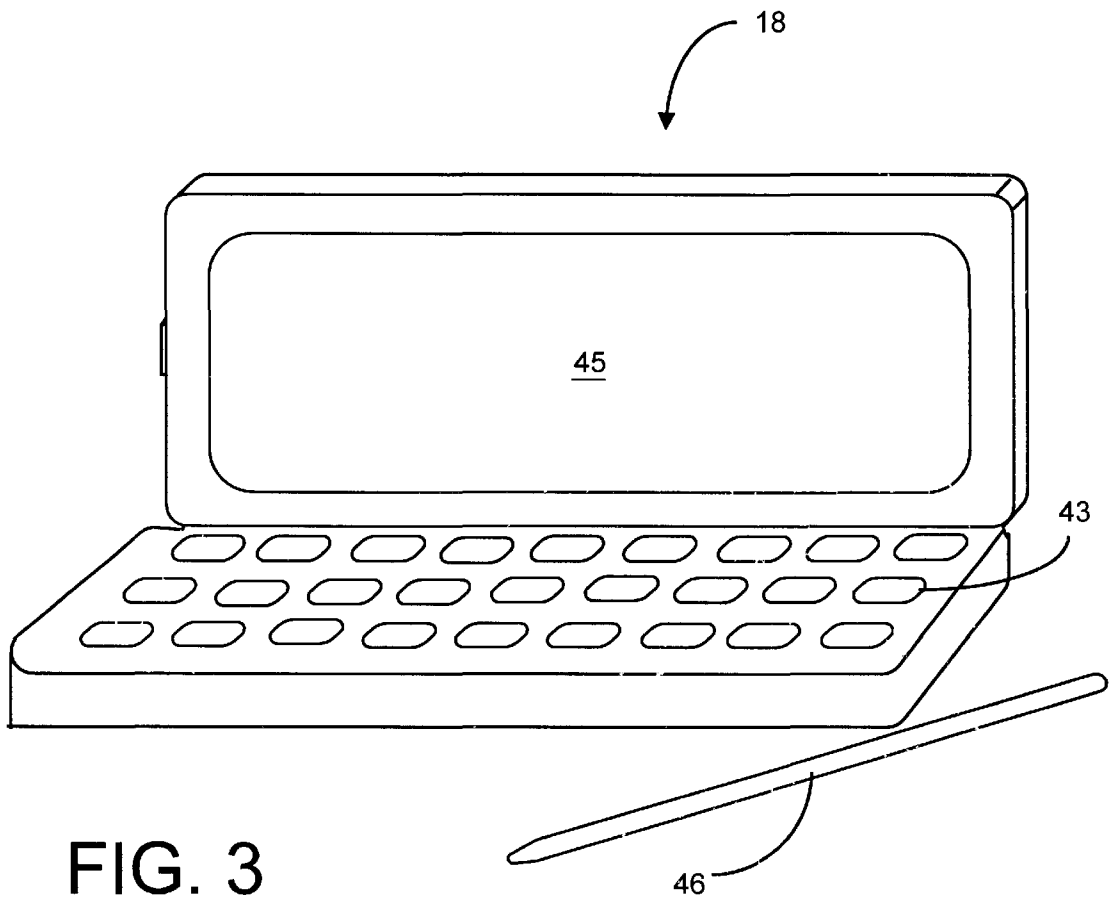


FIG. 3

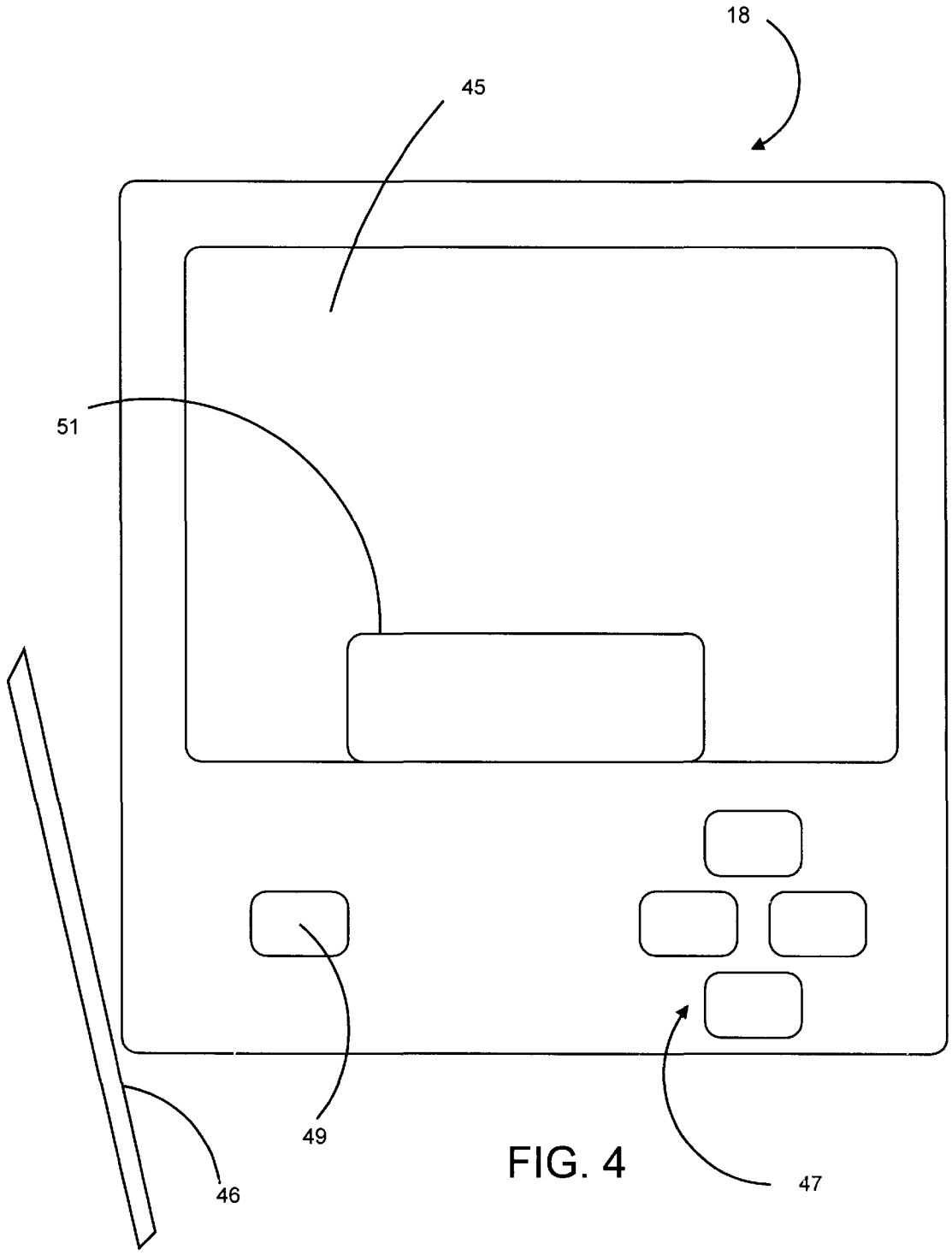
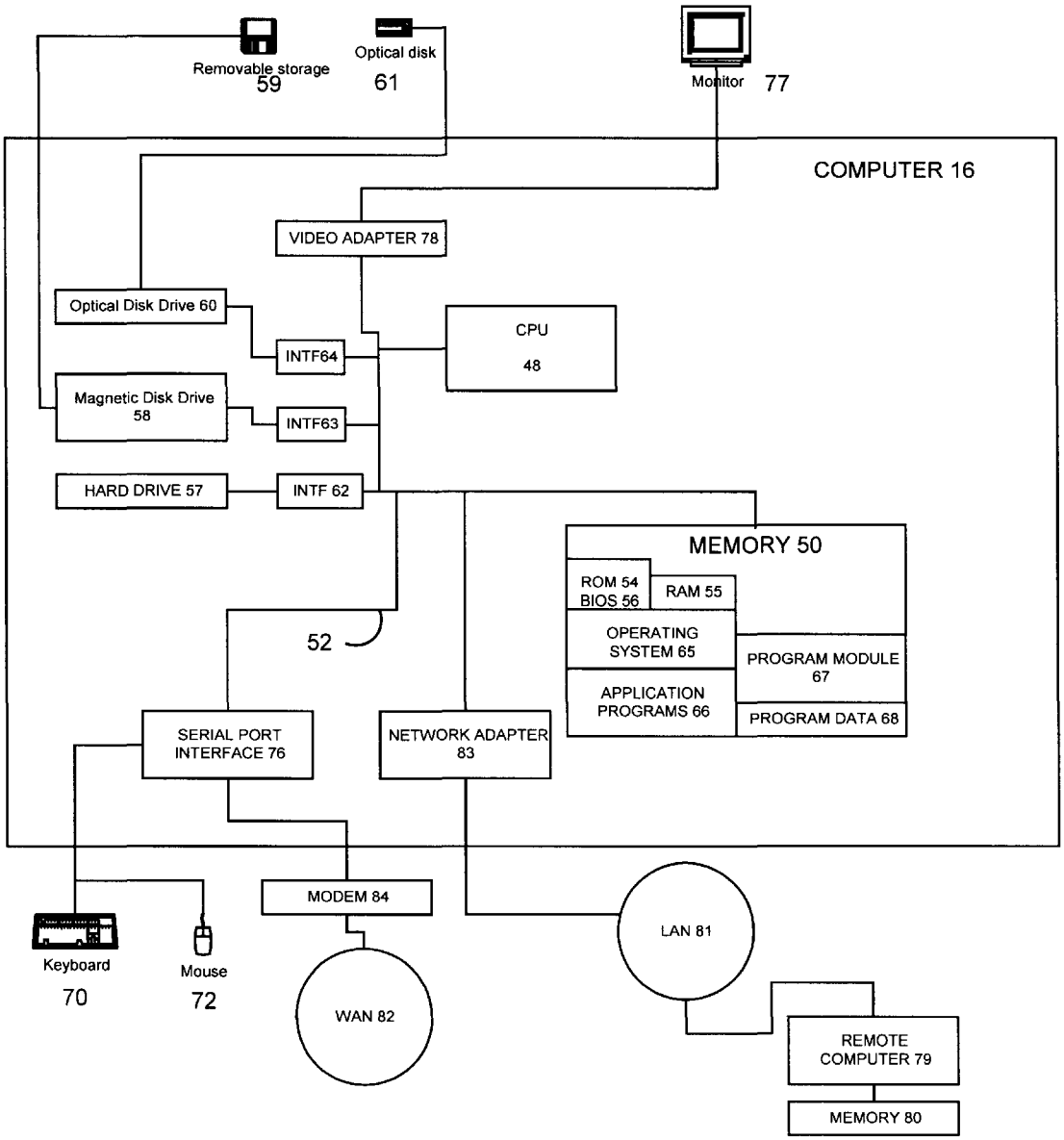


FIG. 4

FIG. 5


Removable storage
59
Optical disk
61
Monitor
77
COMPUTER 16
VIDEO ADAPTER 78
Optical Disk Drive 60
INTF64
CPU
48
Magnetic Disk Drive
58
INTF63
HARD DRIVE 57
INTF 62
MEMORY 50
ROM 54
BIOS 56
RAM 55
OPERATING
SYSTEM 65
PROGRAM MODULE
67
APPLICATION
PROGRAMS 66
PROGRAM DATA 68
52
SERIAL PORT
INTERFACE 76
NETWORK ADAPTER
83
MODEM 84
LAN 81
Keyboard
70
Mouse
72
WAN 82
REMOTE
COMPUTER 79
MEMORY 80

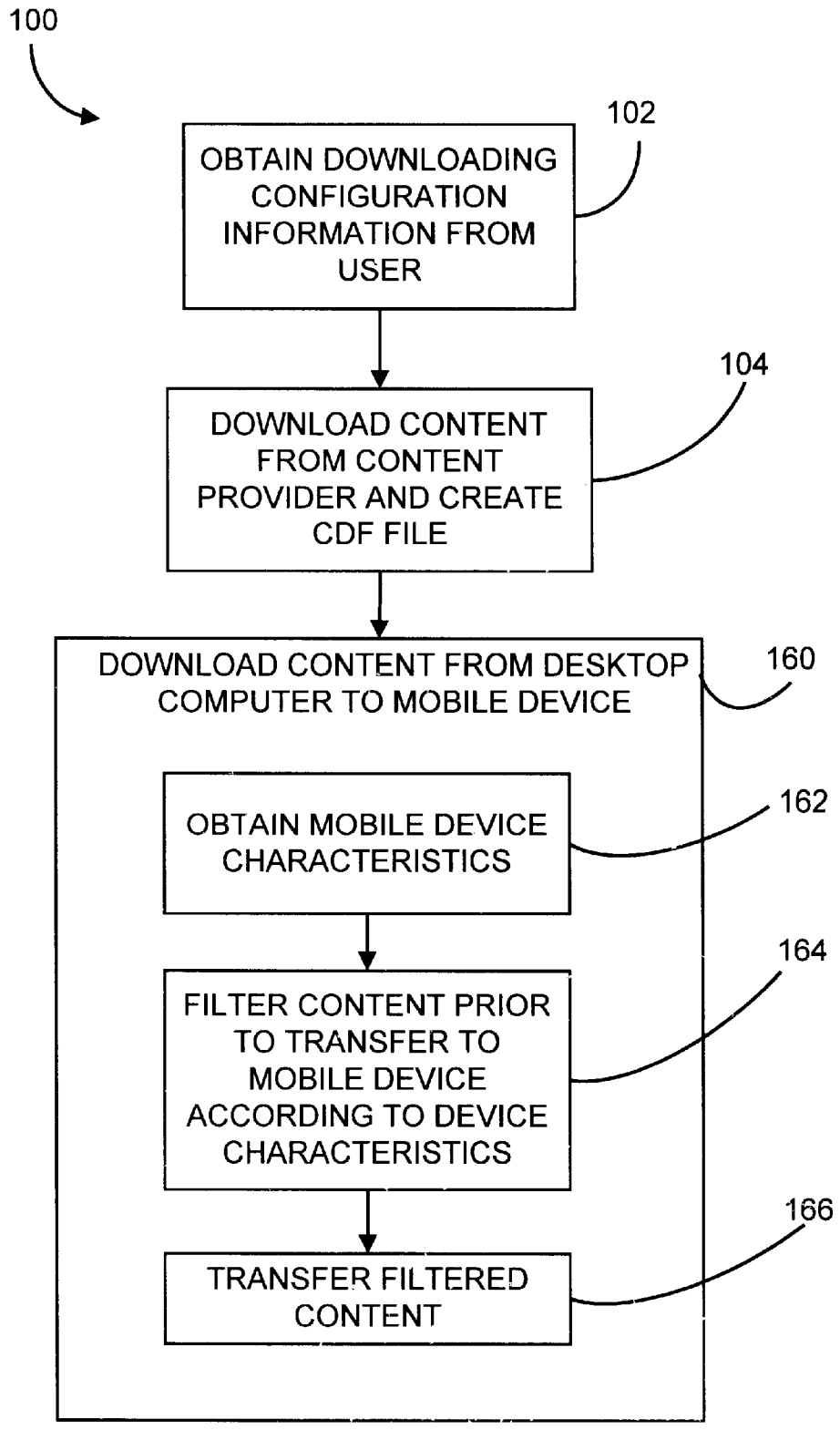

100
102
OBTAIN DOWNLOADING CONFIGURATION INFORMATION FROM USER
104
DOWNLOAD CONTENT FROM CONTENT PROVIDER AND CREATE CDF FILE
160
DOWNLOAD CONTENT FROM DESKTOP COMPUTER TO MOBILE DEVICE
162
OBTAIN MOBILE DEVICE CHARACTERISTICS
164
FILTER CONTENT PRIOR TO TRANSFER TO MOBILE DEVICE ACCORDING TO DEVICE CHARACTERISTICS
166
TRANSFER FILTERED CONTENT

FIG. 6

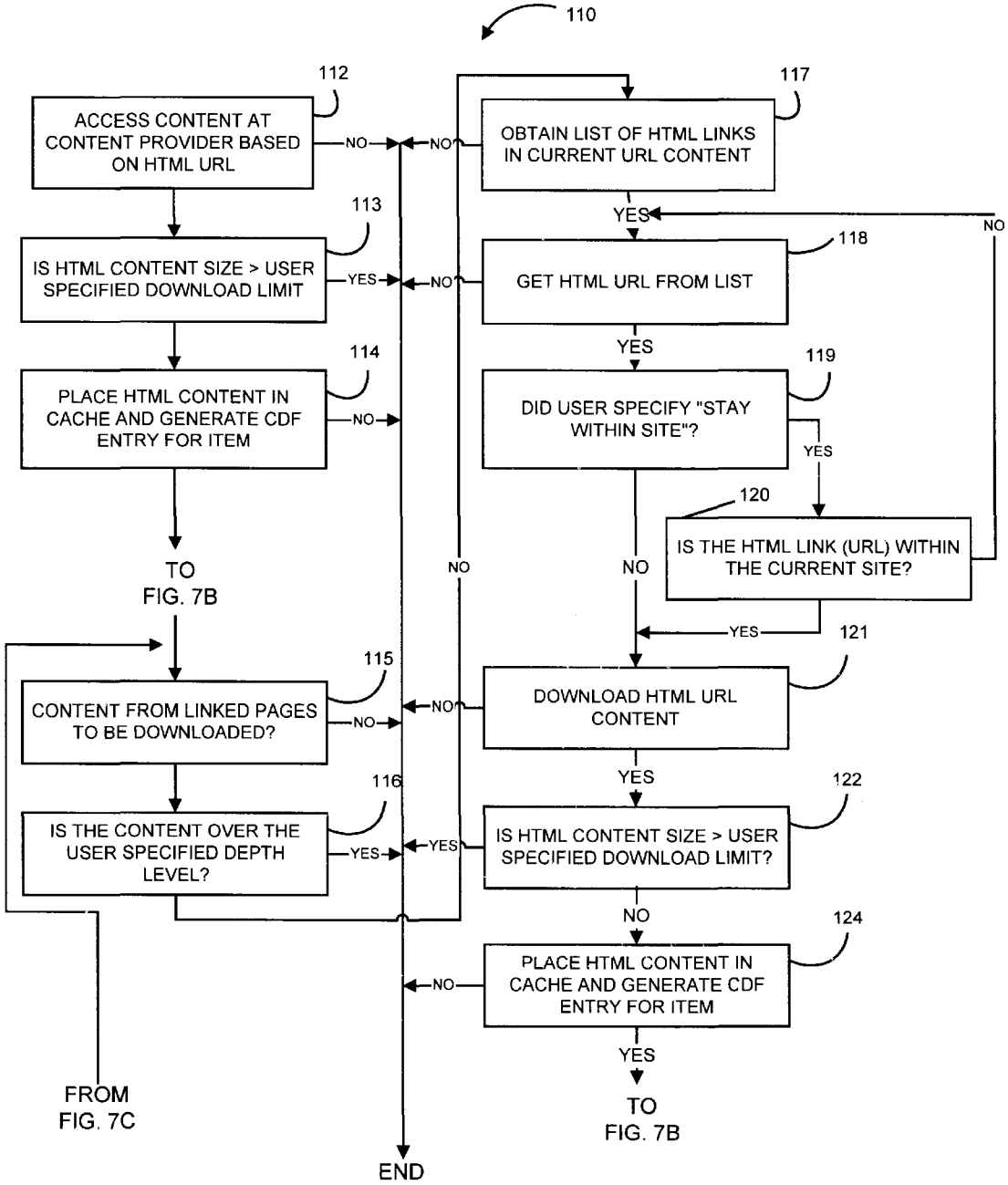

110
112
ACCESS CONTENT AT CONTENT PROVIDER BASED ON HTML URL
NO
113
IS HTML CONTENT SIZE > USER SPECIFIED DOWNLOAD LIMIT
YES
114
PLACE HTML CONTENT IN CACHE AND GENERATE CDF ENTRY FOR ITEM
NO
TO FIG. 7B
115
CONTENT FROM LINKED PAGES TO BE DOWNLOADED?
NO
116
IS THE CONTENT OVER THE USER SPECIFIED DEPTH LEVEL?
YES
FROM FIG. 7C
END
117
OBTAIN LIST OF HTML LINKS IN CURRENT URL CONTENT
NO
YES
118
GET HTML URL FROM LIST
NO
YES
119
DID USER SPECIFY "STAY WITHIN SITE"?
YES
NO
120
IS THE HTML LINK (URL) WITHIN THE CURRENT SITE?
NO
YES
121
DOWNLOAD HTML URL CONTENT
YES
122
IS HTML CONTENT SIZE > USER SPECIFIED DOWNLOAD LIMIT?
YES
NO
124
PLACE HTML CONTENT IN CACHE AND GENERATE CDF ENTRY FOR ITEM
NO
YES
TO FIG. 7B

FIG. 7A

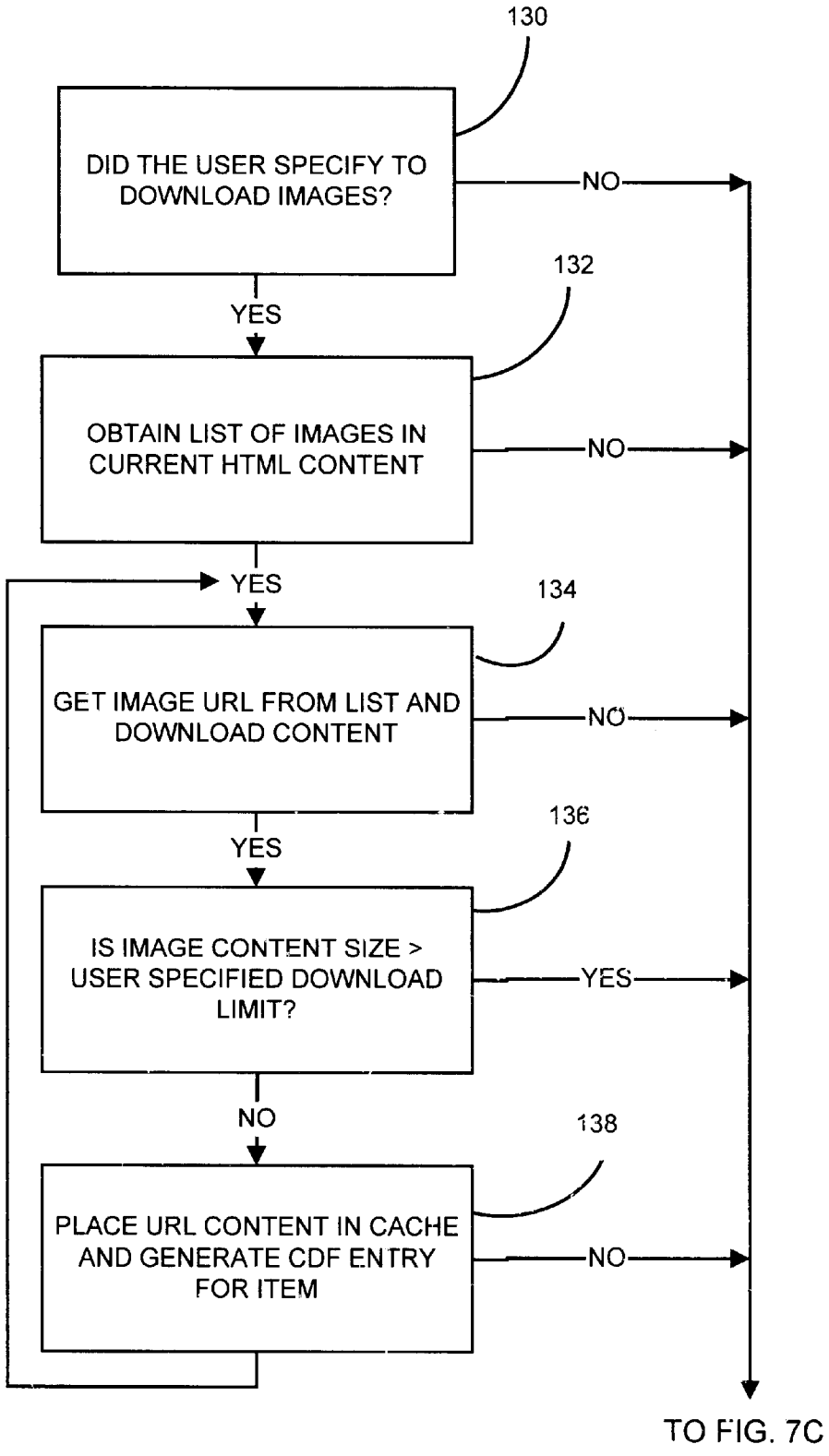

130
DID THE USER SPECIFY TO DOWNLOAD IMAGES?
NO
YES
132
OBTAIN LIST OF IMAGES IN CURRENT HTML CONTENT
NO
YES
134
GET IMAGE URL FROM LIST AND DOWNLOAD CONTENT
NO
YES
136
IS IMAGE CONTENT SIZE > USER SPECIFIED DOWNLOAD LIMIT?
YES
NO
138
PLACE URL CONTENT IN CACHE AND GENERATE CDF ENTRY FOR ITEM
NO
TO FIG. 7C

FIG. 7B

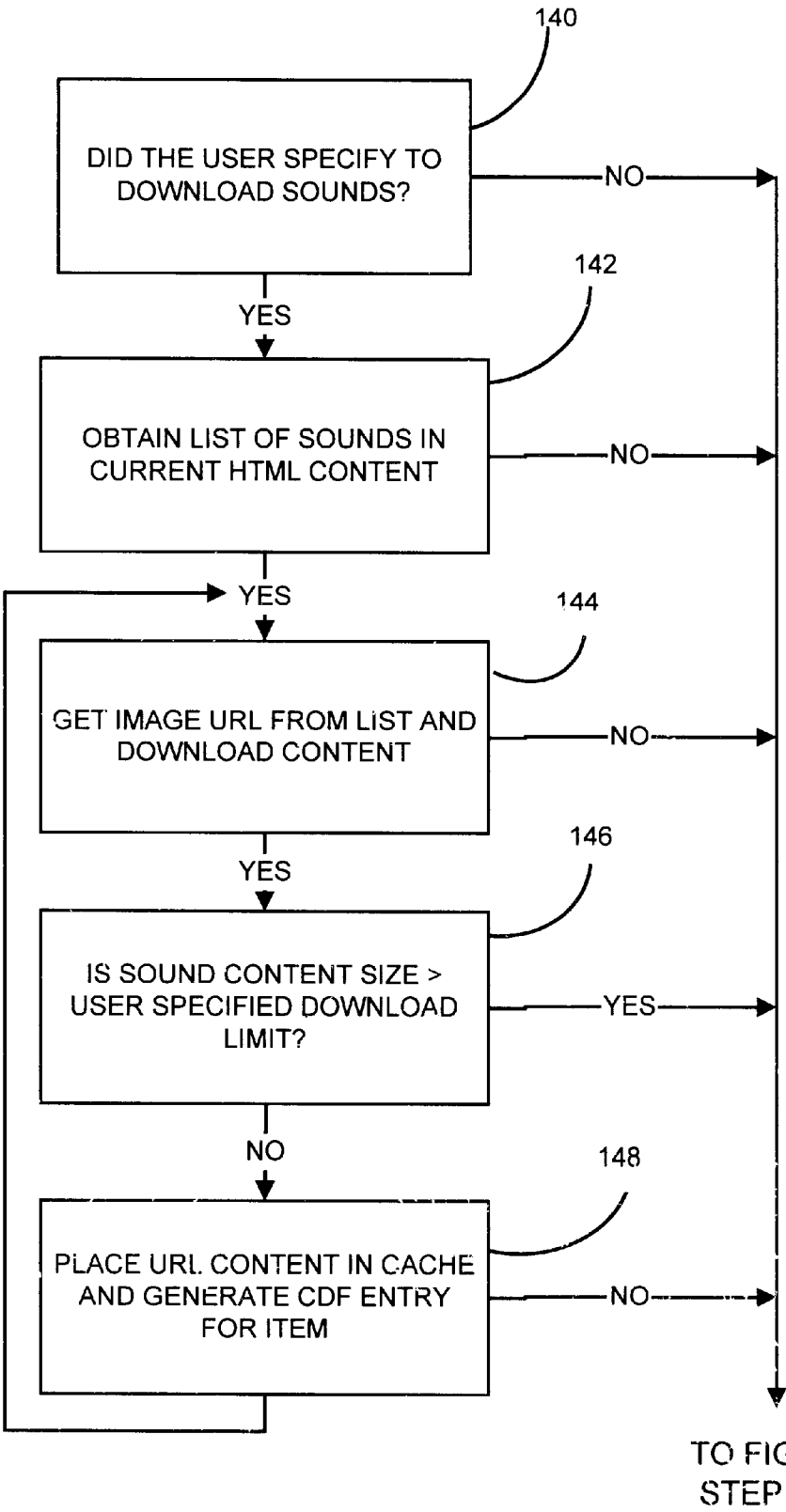

140
DID THE USER SPECIFY TO DOWNLOAD SOUNDS?
NO
YES
142
OBTAIN LIST OF SOUNDS IN CURRENT HTML CONTENT
NO
YES
144
GET IMAGE URL FROM LIST AND DOWNLOAD CONTENT
NO
YES
146
IS SOUND CONTENT SIZE > USER SPECIFIED DOWNLOAD LIMIT?
YES
NO
148
PLACE URL CONTENT IN CACHE AND GENERATE CDF ENTRY FOR ITEM
NO
TO FIG. 7A
STEP 115

FIG. 7C

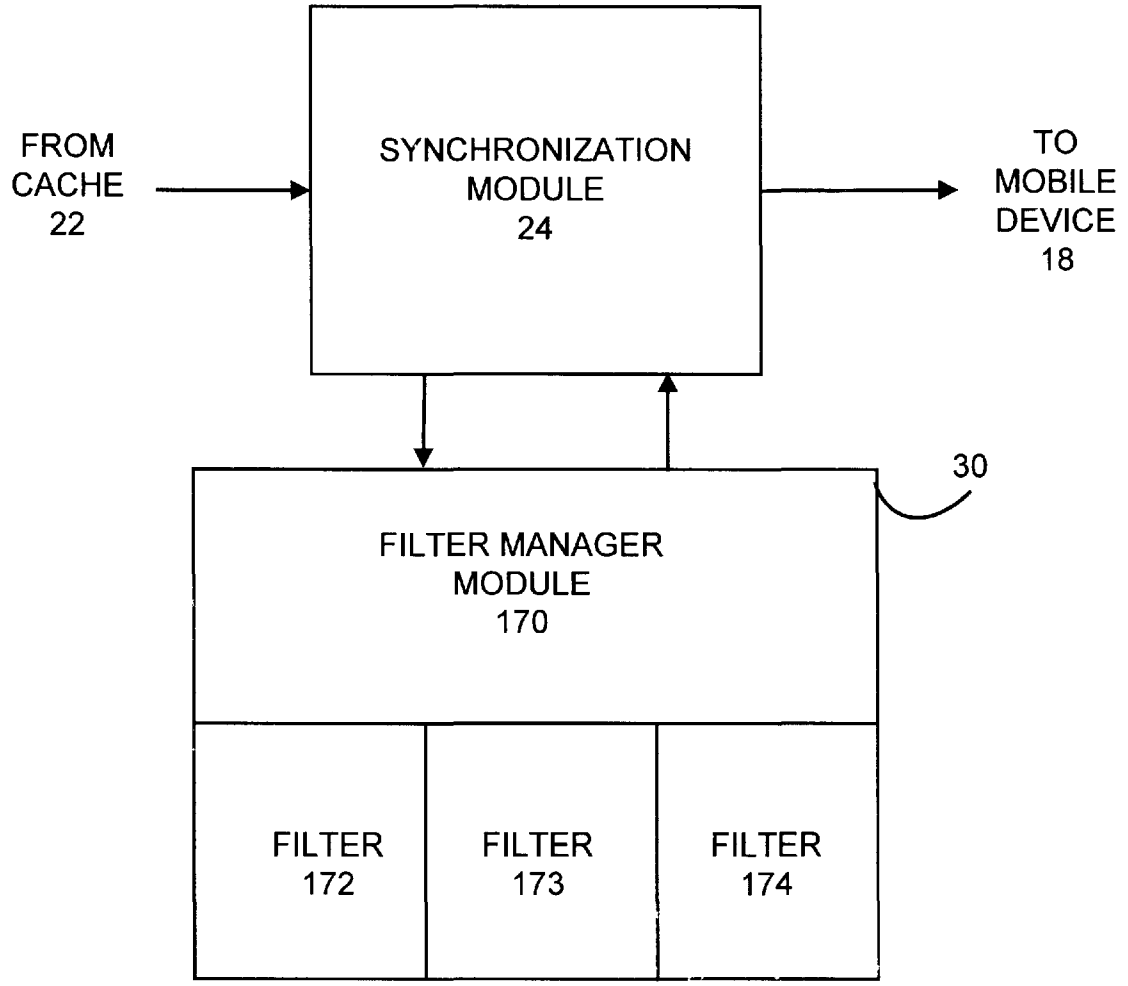

FROM
CACHE
22
SYNCHRONIZATION
MODULE
24
TO
MOBILE
DEVICE
18
30
FILTER MANAGER
MODULE
170
FILTER
172
FILTER
173
FILTER
174

FIG. 8

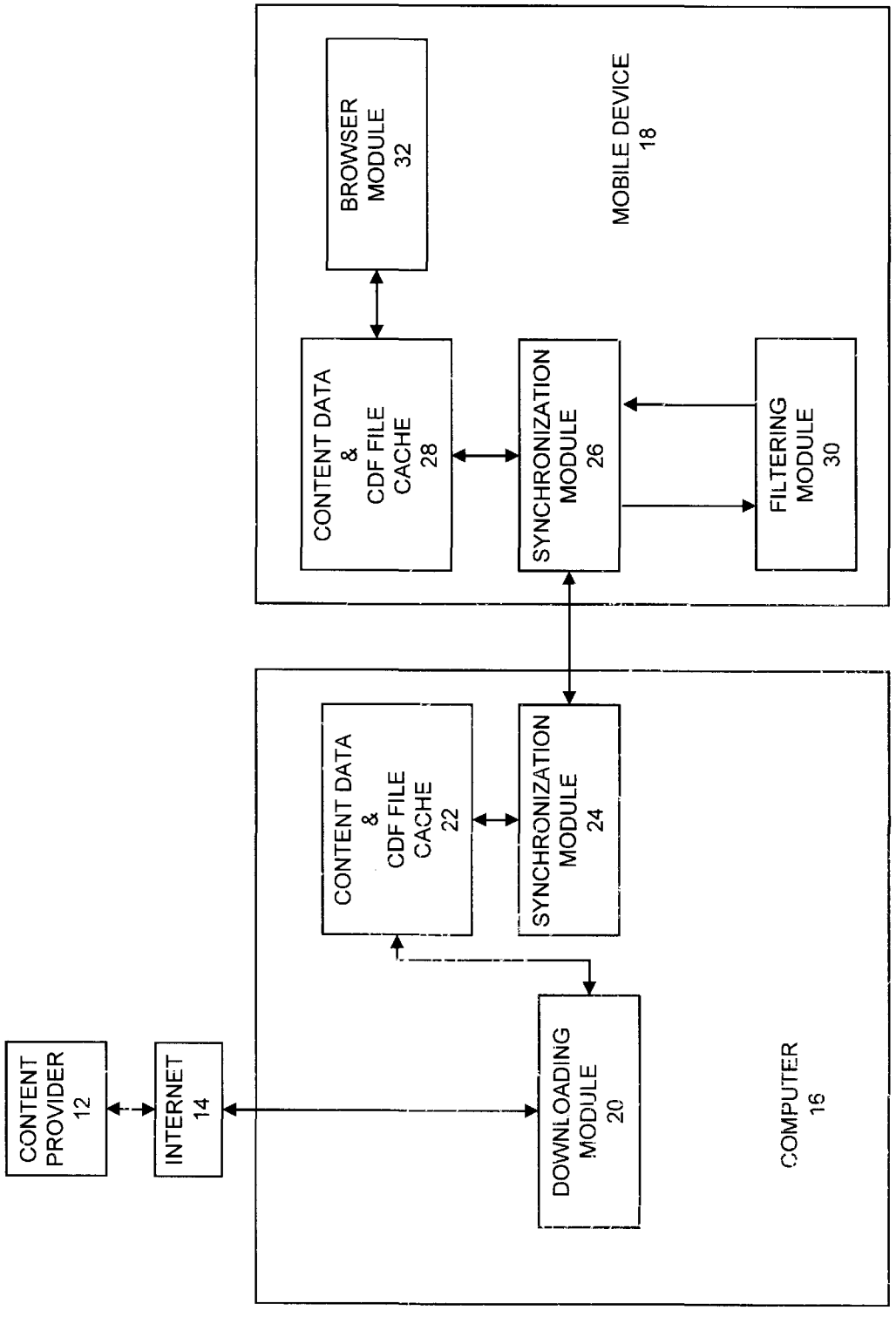

CONTENT PROVIDER 12
INTERNET 14
DOWNLOADING MODULE 20
COMPUTER 16
CONTENT DATA & CDF FILE CACHE 22
SYNCHRONIZATION MODULE 24
MOBILE DEVICE 18
BROWSER MODULE 32
CONTENT DATA & CDF FILE CACHE 28
SYNCHRONIZATION MODULE 26
FILTERING MODULE 30

FIG. 9

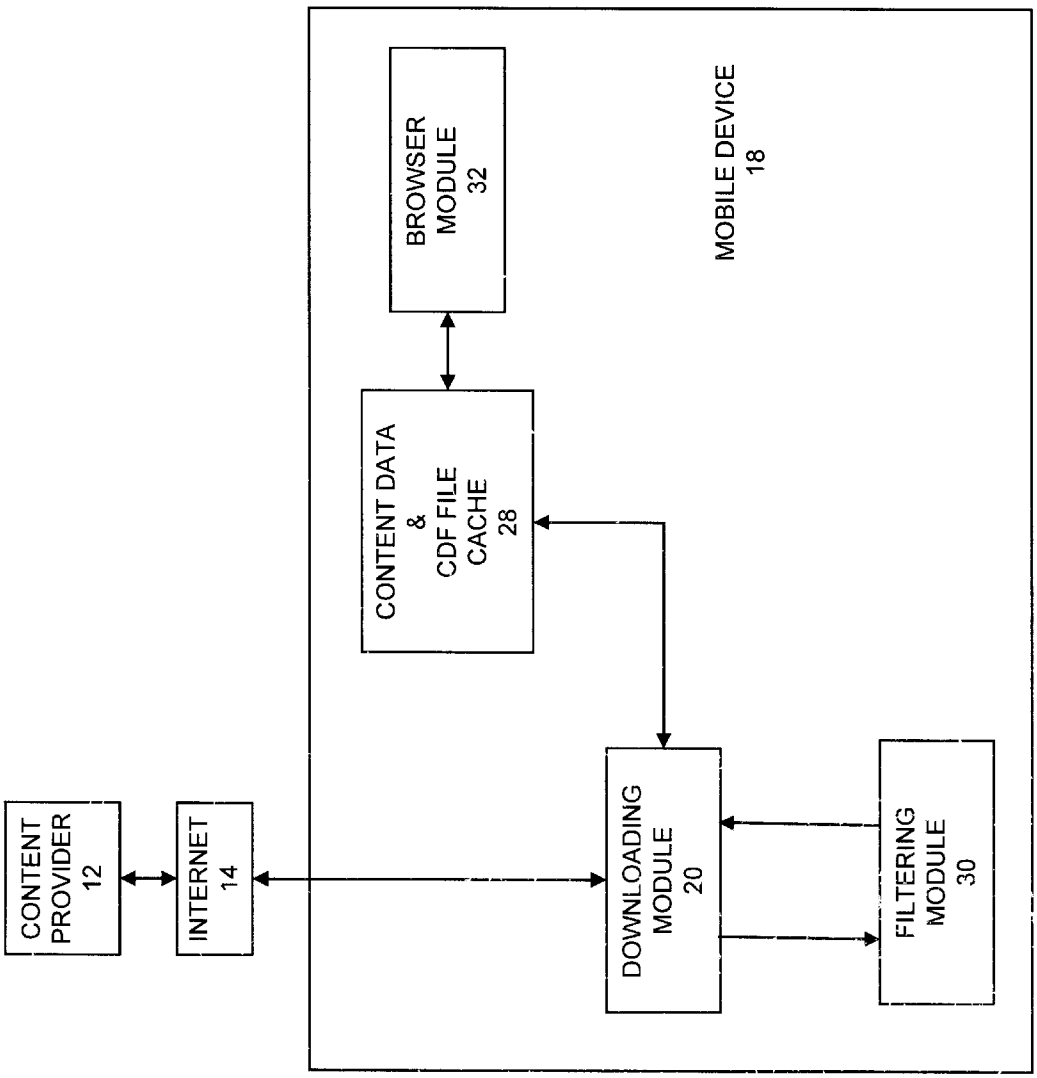

CONTENT PROVIDER 12
INTERNET 14
MOBILE DEVICE 18
BROWSER MODULE 32
CONTENT DATA & CDF FILE CACHE 28
DOWNLOADING MODULE 20
FILTERING MODULE 30

FIG. 10

OFFLINE VIEWING OF INTERNET CONTENT WITH A MOBILE DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to personal mobile computing devices commonly known as mobile devices. More particularly, the present invention relates to a system and method for offline viewing of content from a wide area network, such as content from the Internet, with the mobile device.

Mobile devices are small electronic computing devices often referred to as personal digital assistants. Many such mobile devices are hand-held devices, or palm-size devices, which comfortably fit within the hand. One commercially available mobile device is sold under the trade name Hand-Held PC (or H/PC) having software provided by Microsoft Corporation of Redmond, Washington.

Generally, the mobile device includes a processor, random access memory (RAM) , and an input device such as a keyboard and a display. The keyboard can be integrated with the display, such as where the keyboard is incorporated as a touch sensitive display. A communication interface is optionally provided and is commonly used to communicate with a desktop computer. A replaceable or rechargeable battery powers the mobile device. Optionally, the mobile device can receive power from an external power source that overrides or recharges the built-in battery.

Commonly, the mobile device is used in conjunction with a desktop computer. For example, the user of the mobile device may also have access to, and use, a desktop computer at work or at home, or both. The user typically runs the same types of applications on both the desktop computer and on the mobile device. Thus, it is quite advantageous for the mobile device to be designed to be coupled to the desktop computer to exchange information with, and share information with, the desktop computer.

Another technique for providing information to such mobile devices is through a wireless transmission link. Such information can include electronic mail or pager information including news, weather; sports, traffic and local event information.

In addition to the above-mentioned uses of the mobile device, there is also a desire to use the mobile device for "offline" browsing of Internet content. U.S. patent application Ser. No. 09/107,666 filed Jun. 30, 1998, entitled "SYSTEM FOR DELIVERING DATA CONTENT OVER A LOW BIT RATE TRANSMISSION CHANNEL" and U.S. patent application Ser. No. 09/107,941. filed Jun. 30, 1998, entitled "CHANNEL DEFINITION ARCHITECTURE EXTENSION" describe a system and method wherein Web or Internet content is rendered on a mobile device using a channel definition format, (CDF) file, a set of script files and a set of data files. Briefly, navigation of the content on the mobile device is performed using the CDF file, which includes references to the script files and the data files. When a particular page of content is to be displayed, a script file is accessed and is used to operate upon the data file in order to render the desired information. This architecture allows wireless updates of data files, because, typically, only the data files will change with time. However, if desired, the CDF file and the script files can also be updated wirelessly. Likewise, each of these files can be updated through synchronization of the mobile device with the desktop computer.

Although the above-described system allows wireless updates for Internet content, the content provider must adapt

to this architecture and make available to the mobile device user separate script files and data files. In many cases, this requires the content provider to maintain two different types of Internet sites, one for browsers that expect to receive HTML (hypertext markup language) pages for rendering information, and a second site using the above-described architecture.

Another technique for "offline" browsing with a desktop computer involves traversing or "crawling" through a particular Internet site and storing the information locally. If the information is stored as pages, simple transfer of this information to the mobile device would not be efficient since the mobile device typically has limited memory resources and the information may contain portions that cannot be used or are unsuitable for the mobile device. Thus, memory may be wasted in storing irrelevant information.

There is an ongoing need to provide efficient offline browsing of content, particularly, when performed on a mobile device. The downloading of information for offline browsing should allow access to existing Internet sites without requiring the content provider to maintain separate Internet sites.

SUMMARY OF THE INVENTION

A method and system for transferring offline browsing content information of a wide area network from a host computer to a mobile device includes connecting the mobile device to the host computer and obtaining characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device. The content information is transferred from the host computer to the mobile device as a function of the characteristic information.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a simplified block diagram illustrating one embodiment of a mobile device in a system in accordance with the present invention.

FIG. **2** is a more detailed block diagram of one embodiment of a mobile device shown in FIG. **1**.

FIG. **3** is a simplified pictorial illustration of one embodiment of the mobile device shown in FIG. **2**.

FIG. **4** is a simplified pictorial illustration of another embodiment of the mobile device shown in FIG. **2**.

FIG. **5** is a block diagram of one embodiment of a desktop computer in accordance with one aspect of the present invention.

FIG. **6** is a flow diagram illustrating a method for downloading content from a content provider.

FIGS. **7**A, **7**B and **7**C are a flow diagram illustrating detailed aspects of the method of FIG. **6**.

FIG. **8** is a block diagram of a filtering module.

FIG. **9** is a simplified block diagram illustrating another embodiment of a mobile device in a system in accordance with the present invention.

FIG. **10** is a simplified block diagram illustrating a mobile device directly connectable to a content source provider.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** illustrates a system **10** in which the present invention is illustratively implemented. System **10** includes content provider **12**, host computer **16** (for example, a desktop computer) and mobile device **18**. Content provider

12 provides any suitable type of data from a database or other data source. For example, content. provider 12 is discussed hereinafter as a provider of Internet world wide web content that is connected to and transmitted through a wide area network, herein, Internet 14. Typically, the content is provided in .standard formats, such as HTML, JPEG, GIF or WAV data files. Content provider 12 organizes the data files of content as a "Web site" as is commonly known in the art. A user can access content of content provider 12 using a browser operated on the desktop computer 16. A suitable browser includes Internet Explorer 4.0 by the Microsoft Corporation of Redmond, Wash. The browser receives the content which can include text graphics, audio or video as is known in the art. The content provider 12 provides content in the form of "pages" that are typically viewable on a monitor of the desktop computer 16. The pages can be stored in memory devices of the content provider 12 in a static hierarchical structure, or any or all of the pages can be dynamically created and transferred to the desktop computer 16 upon request by the user. Dynamic creation of pages allows easy updating of information stored at content provider 12 since static pages do not have to be rewritten. Some Web sites of content providers 12 include a channel definition format (CDF) file that, when downloaded to a user, provides a local index or hierarchical structure of the content available from content provider 12. The Channel Definition Format is an application of the Extensible Markup Language (XML) The Channel Definition Format is an open specification that permits a content provider to offer frequently updated collections of information, or channels, from any server for delivery to compatible receiver programs (browsers) on desktop computer or other information appliances.

Although the Channel Definition Format is used by some content providers, many content providers do not organize content in this manner. One aspect of the present invention, as will be described below, includes generating a CDF file based on the content of the content provider 12 and using this information to download content to the mobile device 18 for offline browsing.

Referring to FIG. 1, a content downloading module located on the desktop computer 16 accesses the content provider 12 and obtains pages of content information that, in turn, is stored in cache 22. In a preferred embodiment, the user can specify preferences or download options for the content download process. For instance, images and sound clips found during the download process can or cannot be made available for offline browsing. In addition, the amount of data (bytes) downloaded or the levels of the Web site that should be downloaded can be limited.

Downloading module 20 stores the CDF file, if available, or alternatively generates a CDF file for the site of the content provider. The CDF file is also stored in cache 22. The content and CDF file stored in cache 22 is transferred from the desktop computer 16 to mobile device 18 through synchronization modules 24 and 26. The content and CDF file is stored locally on mobile device 18 in cache 28. A second aspect of the present invention includes a content filter module 30, located on desktop computer 16, that operates upon the content data from cache 22, and filters or transforms the content as a function of characteristics of the type of mobile device 18. This minimizes content data stored in cache 28 where memory or storage capabilities are typically limited. A browser module 32 is provided on mobile device 18 to access the CDF file in cache 28 to render content during offline browsing.

As described above, desktop computer 16 includes synchronization module 24. Briefly, synchronization module 24 is configured to interact with synchronization module 26 on mobile device 18 such that data which are the subject of synchronization can be synchronized from desktop computer 16 to mobile device 18, or vice versa. Once synchronized, both files (those on desktop computer 16 and mobile device 18) contain up to date information.

In order to accomplish synchronization, synchronization modules 24 and 26 run on both mobile device 18 and desktop computer 16. The synchronization components communicate with one another through well defined interfaces to manage communication and synchronization.

FIG. 2 is a more detailed block diagram of mobile device 18. Mobile device 18 preferably includes processor 31, memory 33, input/output (I/O) components 34 and desktop communication interface 36. In a preferred embodiment, these components of mobile device 18 are coupled for communication with one another over a suitable bus 38.

Memory 33 is preferably implemented as non-volatile electronic memory such as random access memory (RAM) with a battery back-up module (not shown) such that information stored in memory 33 is not lost when the general power to mobile device 18 is shut down. A portion of memory 33 is preferably allocated as addressable memory for program execution, while another portion of memory 33 is preferably used for storage, such as to simulate storage on a disc drive.

Memory 33 includes operating system 40, an application program 42 (such as a personal information manager or PIM) as well as an object store 44. During operation, operating system 40 is preferably executed by processor 31 from memory 33. Operating system 40, in one preferred embodiment, is a WINDOWS CE brand operating,system commercially available from Microsoft Corporation. The operating system 40 is preferably designed for mobile devices, and implements database features which can be utilized by application programs through a set of exposed application programming interfaces (APIs) and methods. The objects in an object store 44 are preferably maintained by application programs and operating system 40, at least partially in response to calls to the exposed application programming interfaces and methods.

I/O components 34, in one preferred embodiment, are provided to facilitate input and output operations from a user of mobile device 18. I/O, components 34 are described in greater detail with respect to FIGS. 3 and 4.

Desktop communication interface 36 is provided as any suitable communication interface, such as a serial connection, a network interface, an infrared link or a modem connection. Interface 36 is used to communicate with desktop computer 16. Thus, interface 36 preferably includes synchronization module 26 for communicating with desktop computer 16.

FIG. 3 is a simplified pictorial illustration of one preferred embodiment of a mobile device 18 which can be used in accordance with the present invention. Mobile device 18, as illustrated in FIG. 3, can be a desktop assistant sold under the designation H/PC having software provided by the Microsoft Corporation. In one preferred embodiment, mobile device 18 includes a miniaturized keyboard 43, display 45 and stylus 46. In the embodiment shown in FIG. 3, display 45 is a liquid crystal display (LCD) which uses a contact sensitive display screen in conjunction with stylus 46. Stylus 46 is used to press or contact the display 45 at designated coordinates to accomplish certain user input functions. Miniaturized keyboard 43 is preferably implemented as a miniaturized alpha-numeric keyboard, with any

suitable and desired function keys which are also provided for accomplishing certain user input functions.

FIG. **4** is another simplified pictorial illustration of the mobile device **18** in accordance with another preferred embodiment of the present invention. Mobile device **18**, as illustrated in FIG. **4**, includes some items which are similar to those described with respect to FIG. **3**, and are similarly numbered. For instance, mobile device **18**, as shown in FIG. **4**, also includes touch sensitive screen **45** which can be used, in conjunction with stylus **46**, to accomplish certain user input functions. It should be noted that the display **45** for the mobile device as shown in FIGS. **3** and **4** can be the same size as one another, or different sizes from one another, but would typically be much smaller than a conventional display used with a desktop computer. For example, display **45** shown in FIGS. **3** and **4** may be defined by a matrix of only 240×320 coordinates, or 16×160 coordinates, or any other suitable size.

The mobile device **18** shown in FIG. **4** also includes a number of user input keys or buttons (such as scroll buttons **47**) which allow the user to scroll through menu options or other display options which are displayed on display **45**, or which allow the user to change applications, without contacting display **45**. In addition, the mobile device **18** also shown in FIG. **4** also preferably includes a power button **49** which can be used to turn on and off the general power to the mobile device **18**.

It should also be noted that, in the embodiment illustrated in FIG. **4**, mobile device **18** includes a handwriting area **51**. Handwriting area **51** can be used in conjunction with. stylus **46** such that the user can write messages which are stored in memory **33** for later use by the mobile device **18**. In one illustrative embodiment, the handwritten messages are simply stored in handwritten form and can be recalled by the user and displayed on the display screen **45** such that the user can review the handwritten messages entered into the mobile device **18**. In another preferred embodiment, mobile device **18** is provided with a character recognition module such that the user can enter alpha-numeric information into mobile device **18** by writing that alpha-numeric information on area **51** with stylus **46**. In that instance, character recognition module in the mobile device **18** recognizes the alpha-numeric characters and converts the characters into computer recognizable alpha-numeric characters which can be used by the application programs **42** in mobile device **18**.

FIG. **5** and the related discussion are intended to provide a brief, general description of a suitable desktop computer **16** in which portions of the invention may be implemented. Although not required, the invention. will be described, at least in part, in the general context of computer-executable instructions, such as program modules, being executed by a desktop computer **16** or mobile device **18**. Generally, program modules include routine programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types. Moreover those skilled in the art will appreciate that desktop computer **16** may be implemented with other computer system configurations, including multiprocessor systems, microprocessor-based or programmable consumer electronics network PCs, minicomputers, mainframe computers, and the like. The invention may also be practiced in distributed computing environments where tasks are performed by remote processing devices that are linked through a communications network. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

With reference to FIG. **5**, an exemplary system for implementing desktop computer **16** includes a general purpose computing device in the form of a conventional personal computer, including processing unit **48**, a system memory **50**, and a system bus **52** that couples various system components including the system memory **50** to the processing unit **48**. The system bus **52** may be any of several types of bus structures including a memory bus or memory controller, a peripheral bus, and a local bus using any of a variety of bus architectures. The system memory **50** includes read only memory (ROM) **54** and random access memory (RAM) **55**. A basic input/output system (BIOS) **56**, containing the basic routine that helps to transfer information between elements within the desktop computer **16**, such as during start-up, is stored in ROM **54**. The desktop computer **16** further includes a hard disk drive **57** for reading from and writing to a hard disk (not shown) a magnetic disk drive **58** for reading from or writing to removable magnetic disk **59**, and an optical disk drive **60** for reading from or writing to a removable optical disk **61** such as a CD ROM or other optical media. The hard disk drive **57**, magnetic disk drive **58**, and optical disk drive **60** are connected to the system bus **52** by a hard disk drive interface **62**, magnetic disk drive interface **63**, and an optical drive interface **64**, respectively. The drives and the associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, program modules and other data for the desktop computer **16**.

Although the exemplary environment described herein employs a hard disk, a removable magnetic disk **59** and a removable optical disk **61**, it should be appreciated by those skilled in the art that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks (DVDs) , Bernoulli cartridges, random access memories (RAMs), read only memory (ROM), and the like, may also be used in the exemplary operating environment.

A number of program modules may be stored on the hard disk, removable magnetic disk **59**, removable optical disk **61**, ROM **54** or RAM **55**, including an operating system **65**, one or more application programs **66** (e.g. downloading module **20**), other program modules **67** (which may include synchronization module **24**), and program data **68**. A user may enter commands and information into the desktop computer **16** through input devices such as a keyboard **70**, pointing device **72**. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like. These and other input devices are often connected to the processing unit **48** through a serial port interface **76** that is coupled to the system bus **52**, but may be connected by other interfaces, such as a sound card, a parallel port, game port or a universal serial bus (USB) . A monitor **77** or other type of display device is also connected to the system bus **52** via an interface, such as a video adapter **78**. In addition to the monitor **77**, desktop computers may typically include other peripheral output devices such as speaker and printers.

The desktop computer **16** may operate in a networked environment using logic connections to one or more remote computers (other than mobile device **18**), such as a remote computer **79**. The remote computer **79** may be another personal computer, a server, a router, a network PC, a peer device or other network node, and typically includes many or all of the elements described above relative to desktop computer **16**, although only a memory storage device **80** has been illustrated in FIG. **4**. The logic connections depicted in FIG. **4**. include a local area network (LAN) **81** and a wide area network (WAN) **82**. Such networking environments are commonplace in offices, enterprise-wide computer network intranets and the Internet.

When used in a LAN networking environment, the desktop computer **16** is connected to the local area network **81** through a network interface or adapter **83**. When used in a WAN networking environment, the desktop computer **16** typically include sa modem **84** or other means for establishing communications over the wide area network **82**, such as the Internet. The modem **84**, which may be internal or external, is connected to the system bus **52** via the serial port interface **76**. In a network environment, program modules depicted relative to desktop computer **16**, or portions thereof, may be stored in the remote memory storage devices. It will be appreciated that the network connections shown are exemplary and other means of establishing a communications link between the computers may be used.

Desktop computer **16** runs operating system **65** that is typically stored in no-volatile memory **54** and executes on the processor **48**. One suitable operating system is a "WINDOWS" brand operating system sold by Microsoft Corporation, such as "WINDOWS 95" or "WINDOWS NT", operating systems, other derivative versions of Windows brand operating systems, or another suitable operating system. Other suitable operating systems include systems such as the "MACINTOSH OS" sold from Apple Corporation, and the "OS/2 PRESENTATION MANAGER" sold by International Business Machines (IBM) of Armonk, N.Y. Application programs are preferably stored in program module **67**, in volatile memory or non-volatile memory, or can be loaded into any of the components shown in FIG. **5** from a floppy diskette **59**, CDROM disk **61**, downloaded from a network via network adapter **83**, or loaded using another suitable mechanism.

FIG. **6** illustrates a method **100** for obtaining and downloading content from the content provider **12** through the desktop computer **16** and to mobile device **18**. Each of the steps illustrated in FIG. **6** and in the flow diagram of FIG. **7** are implemented using the downloading module **20**, synchronizing modules **24** and **26** and filter module **30**, described above. At step **102**, a user desiring to download content to mobile device **18** for offline browsing preferably provides downloading user preferences that are used to access the desired content from content provider **12** and to limit the amount of content that is transferred to desktop computer **16**, which is subsequently transferred to mobile device **18**. The user preferences include the URL or similar address pointer used to access content provider **12** and specify content contained therein. The user preferences also act as a filter to limit the amount of content that is downloaded from content provider **12**. Limitations can be expressed using a number of different parameters. For instance, the user can impose a limit as to the total quantity of content that is to be downloaded from content provider **12**. Generally, the quantity is expressed in bytes; however, other units representing a quantity of digital data can also be used. If desired, the user can also limit how many levels of content organized in a hierarchical manner will be downloaded from content provider **12**. Typically, hierarchical content stored at content provider **12** is accessed through "links", which allow the user to navigate up, down or directly to other portions of the hierarchical structure. In addition, content provider **12** may include links to "external" sites of content, which may be under the control of content provider **12** or be accessed through Internet **14** at other remote content providers. In one embodiment, the user preferences indicate whether or not to access and download content from the external sites.

In a further embodiment, the user preferences can include user selections regarding the type of information that will be downloaded from content provider **12**. For instance, content at content provider **12** can include text data, image or graphical data and/or sound or audio data. It may be desirable for the user to limit which types of data that are downloaded to desktop computer **16** and subsequently transferred to mobile device **18** because of memory availability in cache **28** and/or the existence or non-existence of other hardware on mobile device **18** such as whether or not sound support exists. By indicating the types of data to be downloaded at step **102**, the user can avoid unnecessary transfer of data to mobile device **18**, and minimize the time necessary to complete downloading of content to desktop computer **16**. From step **102**, program flow continues to step **104** whereat downloading module **20** accesses content provider **12** and downloads content therefrom in accordance with the user preferences as well as creates a CDF file. The content and CDF file are stored in cache **22**.

FIGS. **7**A, **7**B and **7**C together illustrate an exemplary method **110** for downloading content from content provider **12** based on user preferences. At step **112**, downloading module **20** accesses content at content provider **12** in accordance with the first or topmost specified URL or other address pointer and downloads the first page of content. If the HTML content does not exceed the user specified download limit at step **113**, operational flow continues to step **114** whereat the HTML content is placed in cache **22** and CDF format topmost channel tags are placed in the CDF file. Referring to Table 1 below the topmost tags are indicated at "A".

TABLE 1

```
    <?XML version="1.0"?>
A   <CHANNEL HREF="http://home.microsoft.com/" ID="GM434790"
        BASE="http://home.microsoft.com/">
      <SELF HREF="http://home.microsoft.com/GM434790.cdf"/>
      <USAGE VALUE="MobileChannel"/>
      <ABSTRACT>This Mobile Channel was created for offline use!</ABSTRACT>
      <CHANSCPIPT VALUE="P434790"/>
      <ITEM HREF="http://home.microsoft.com/" ID="P434790."><USAGE
          VALUE="None"/></ITEM>
      <TITLE>Microsoft Internet Start</TITLE>
      <ITEM HREF="http://homeadvisor.msn.com/ie/financing/highlights.asp"
          ID="P806324">
        <TITLE>Financing Highlights - Microsoft HomeAdvisor</TITLE>
      </ITEM>
D   <CHANNEL HREF="personalizing/personalizing.asp" ID="C388888">
      <CHANSCRIPT VALUE="P388888"/>
      <ITEM HREF="personalizing/personalizing.asp" ID="P388888"><USAGE
          VALUE="None"/></ITEM>
```

TABLE 1-continued

```
            <TITLE>Personalize your Start page</TITLE>
            <ITEM HREF="personalizing/Header.asp" ID="P408086">
              <TITLE>Personalize Your Start page - Header</TITLE>
            </ITEM>
            <ITEM HREF="personalizing/Categories.asp#" ID="P470294"><USAGE
                VALUE="None"/></ITEM>
D         </CHANNEL>
            <ITEM HREF="exploring/exploring.asp" ID="P291536"><USAGE
B               VALUE="None"/></ITEM>
B         <ITEM HREF="hmchelp/help.asp" ID="P500560"><USAGE VALUE="None"/></ITEM>
            <ITEM HREF="isapi/bin/redir.dll?target=http://business.msn.com&Cbiz&"
                ID="P871609"><USAGE VALUE="None"/></ITEM>
          .
          .
          .
            <ITEM HREF="isapi/bin/redir.dll?target=http://www.ca.msn.com&INTLCA&"
C               ID="P83646"><USAGE VALUE="None"/></ITEM>
            <ITEM HREF="isapi/bin/redir.dll?target=http://start.fr.msn.com&INTLFR&"
C               ID="P339813 "><USAGE VALUE="None"/></ITEM>
        </CHANNEL>
A
```

Operational flow then continues to step **130** in FIG. **7**B to determine if image content is to be downloaded. At step **130**, the user preferences are examined, and if images are to be downloaded, a list of image content URLs in the current HTML content is obtained at step **132**. In steps **134**, **136** and **138**, the images from the list of image content URLs are sequentially downloaded wherein the individual size of the image and/or the total amount of image content so far stored is compared with the user preferences, and if not exceeded, is stored in cache **22**. For each image, a CDF format URL entry is provided in the CDF file. In Table 1, images are indicated at "B" for the topmost channel.

Operational flow then continues to step **140** in FIG. **7**C to determine if sound or audio content (for example, audio clips) is to be downloaded. Steps **140**, **142**, **144**, **146** and **148** are similar to steps **130**, **132**, **134**, **136** and **138**, discussed above. At step **140**, the user preferences are examined, and if audio content is to be downloaded, a list of audio content URLs in the current HTML content is obtained at step **142**. In steps **144**, **146** and **148**, the audio clips from the list of audio content URLs are sequentially downloaded wherein the individual size of the audio clip and/or the total amount of audio content so far stored is compared with the user preferences, and if not exceeded is stored in cache **22**. For each audio clip, a CDF format entry is provided in the CDF file. In Table 1, audio clips are indicated at "C" for the topmost channel.

Referring back to FIG. **7**A, operational flow then continues to step **115** whereat the user preferences are examined to determine if content from linked pages should be downloaded. Assuming this is the case, the user preferences are then examined to determine if the next level of linked pages will exceed the user preferences at step **116**. If such is not the case, operational flow continues to step **117** whereat the list of HTML links is obtained for the current URL content. The first HTML URL link in the list is then obtained at step **118**. At step **119**, the user preferences are examined to determine if the user desired to stay within the current site, or allow links to external sites. At step **120**, if the user preferences indicate that the user desired to stay within the current site, the HTML link obtained at step **118** is compared with the current HTML URL. If the comparison realizes that the HTML link from step **118** is not within the site, the operational flow returns to step **118** and the next HTML URL is obtained. However, if the HTML URL from step **118** is within the site, or the user preferences indicate that "external" sites will also be accessed and downloaded, operational flow continues to step **121**. At step **121**, the HTML content for the URL from step **118** is downloaded. At step **122**, the total HTML content size (with the newly downloaded content) is compared with the user preferences, and if not exceeded, operational flow continues to step **124** whereat the HTML content for the HTML URL from step **118** is stored in cache **22** and CDF channel tags are placed, in the CDF file as indicated at "D" in Table 1.

From step **124**, operational flow continues to steps **130–138** of FIG. **7**B and steps **140–148** of FIG. **7**C to download image and audio content, as described above. After downloading the image and audio content, if desired, operational flow returns to step **118** where the next HTML URL for the next link is obtained. Each link from the list HTML links is processed as described above in order that each level of the site is downloaded before further, lower levels are obtained. Once a complete level of the site has been processed, operational flow returns to step **115** to determine if further levels should be processed.

At this point, it should be noted that the CDF file stored in cache **22** can include further entries. For, instance, "Title" and "Abstract" tags and entries can be inserted as illustrated in Table 1. If the mobile device browser **32** (FIG. **1**) also operates pursuant to script files, it may be necessary to also include a "Channelscript" tag and reference in order that a blank script is file is implemented during offline browsing. Use of script files is described in detail in U.S. patent application Ser. No. 09/107,666 filed Jun. 30, 1998, entitled "SYSTEM FOR DELIVERING DATA CONTENT OVER A LOW BIT RATE TRANSMISSION CHANNEL" and U.S. patent application Ser. No. 09/107,941 filed Jun. 30, 1998, entitled "CHANNEL DEFINITION ARCHITECTURE EXTENSION", the contents of which are hereby incorporated by reference.

Referring back to FIG. **6**, downloading of content and the CDF file stored in cache **22** of desktop computer **16** to cache **28** of mobile device **18** occurs at step **160**. In a preferred embodiment, downloading content from desktop computer **16** to mobile device **18** includes, at step **162**, obtaining characteristic information about mobile device **18**, such as video display capabilities, audio display capabilities,

browser **32** capabilities, or other information related to the hardware or software on mobile device **18** that is implemented during offline browsing. Typically, characteristics of mobile device **18** include the type and model of mobile device **18** as well as the type, model or version level of hardware and software components of mobile device **18**. Such information is commonly maintained by operating system **40** (FIG. **2**) and can be accessed and transferred to desktop computer **16** using well-known API calls.

At step **166**, content from cache **22** of desktop computer **16** is transferred to cache **28** of mobile device **18** using synchronization modules **24** and **26**. However, as will be described below, content data is filtered or transformed by filter module **30** in accordance with characteristics or capabilities of mobile device **18** as obtained from seep **162**. Filtering of content data prior to transfer and storage in cache **28** is particularly advantageous dale to the limited memory resources commonly found in mobile devices. For instance, if mobile device **18** cannot support or render a particular form of content downloaded from content provider **12**, filtering module **30** can omit this information prior to transfer to mobile device **18**. In another example, mobile device **18** can have limited or no ability to display colors. Accordingly, filtering module **30** can replace or omit information related to colors, and thereby, convert the content to be displayed in a format which is more suitable for the mobile device **18**, such as a gray-scale format. Typically, images displayed in color require considerably more bytes than that necessary to display the same image using a gray-scale format. By converting the image data to the gray-scale format prior to storage in cache **28**, considerable storage savings can be realized.

FIG. **8** illustrates synchronization module **28** and filter module **30** in greater detail. In the embodiment illustrated, filtering module **30** includes a filter manager module **170** and separate content-type filtering modules **172**, **173** and **174**. Filtering module **30** is an open architecture wherein each of the content-type filtering modules **172–174** can be written separately and registered with filter manager module **170**. Generally, filter manager module **170** controls content data transfer to and from synchronizing module **28**, while filtering or conversion of content data is performed by content-type filtering modules **172–174**. Although illustrated wherein three filtering modules **172–174** are present, it should be understood that any number of filtering modules can operate with filter manager module **170**. Generally, content-type filtering modules **172–174** are "registered" with filter manager module **170** wherein filter manager module **170** maintains a list of available content-type filtering modules **172–174** and the type of data each filtering module **172–174** operates upon. In this manner, the filter manager module **170** can operate the desired content-type filtering module **172–174** upon ascertaining the type of content to be transferred. It should be noted that filtering modules **172–174** need not be limited to one type of content data, such as "WAV" data, "HTML" data, "BMP" data, etc., but can be written to perform filtering or conversion for multiple types of content data.

In an exemplary, method of operation, synchronization module **24** first determines which content in cache **28** is out of date or simply not stored in cache **28**. The synchronization module **24** passes this information to filter manager module **170**. Filter manager module **170** accesses cache **22** in order to determine the content type of content to be transferred to mobile device **18**. The type of content can be ascertained by using known APIs, wherein the type of content is defined by known data protocol standards. One such standard includes Multipurpose Internet Mail Extensions (MIME) that defines a format of messages used on the Internet. After determining the content type to be transferred, the filter manager module **170** ascertains which, if any, content-type filtering modules **172–174** have been registered to filter or convert the specific type of content data. In one embodiment, filtering modules **172–174** comprise streaming filters that allow filtering to be performed asynchronously so that content data can be filtered or converted under separate operating threads to allow other actions to be performed by desktop computer **16** during transfer of content data from desktop computer **16** to mobile device **18**. In the embodiment illustrated, filter manager module **170** opens a stream using the URL from the stored CDF file in cache **22**. A stream handle is then obtained indicating what portion of cache **22** contains the desired content. A stream handle is similar to a file handle commonly used in operating systems. Filter manager module **170** then passes the stream handle to one of the filtering modules **172–174** that will filter or convert the content data. As content data is converted, it is passed back to filter manager module **170**, which in turn, passes it to synchronization module **24** for transmission to and storage in cache **28**.

In one exemplary embodiment, the above-described information is passed between filter manager module **170** and filters **172–174** using APIs. In addition to standard ("Read"), ("Seek"), and ("Write") interface APIs, additional APIs include:

SetFilterStream([in] IStream * pStreamIn, [in] BSTR bstrURL, [in] BSTR bstrContentType)

Where,

pStreamIn—Raw stream to be filtered

bstrURL—URL of the resource pointed to by pStreamIn

bstrContentType—MIME content type as detected by the Filter Manager

SetFilterStream sets the stream, to be filtered. This API also defines the source of the stream, and its content type (for filters which may handle more than one content type).

SetFilterParam([in] UINT uFilterParam, [in] DWORD dwFilterValue)

Where,

uFilterParam—Filter specific configuration parameter

dwFilterValue—Filter specific configuration value

SetFilterParam sets filter specific parameters. For instance, this API can be used to provide bits-per-pixel for image filters, or information about the destination device HTML levels support for HTML filters.

If desired, another API can be provided to allow a filter to display a user interface for setting filter specific configuration information not otherwise set via the SetFilterParam API. Such an API can take the form:

Customize ([in] OLE-HANDLE hwndparent)

Where,

hwndParent—Parent window for configuration dialog box.

FIGS. **9** and **10** illustrate other embodiments of the present invention. The embodiment of FIG. **9** is substantially similar to the embodiment of FIG. **1** discussed above; however, in this embodiment, filtering module **30** resides on mobile device **18** rather than on computer **16**. The system of FIG. **9** operates substantially similar to the system of FIG. **1** wherein steps **102**, **104** and **160** of FIG. **6** are performed. However, in this embodiment, the filtering of content is performed on mobile device **18**, thus content data in cache **22** is transferred from synchronization module **24** to syn-

chronization module **26** whereat content data is filtered prior to storage in cache **28**.

The embodiments of FIGS. **1** and **9** demonstrate that the filter module **30** can operate on both the computer **16** and the mobile device **18**. It should be noted that, if desired, filter modules can be present on both the computer **16** and the mobile device **18** wherein the filter modules operate on different types of content information.

In the embodiment of FIG. **10**, downloading module **20** resides on mobile device **18** in addition to filtering module **30**. In this embodiment, mobile device **18** can access content at content provider **12** without the need for content to be first downloaded to computer **16** and subsequently transferred to mobile device **18** using synchronizing modules **24** and **26**. In this embodiment, downloading module **20** operates with filtering module **30** in order to filter or transform content from content provider **12** prior to storage in cache **28**. Downloading module **20** accesses content provider **12** and downloads content according to the user preferences. Based on the type of content data downloaded, filtering module **30** filters or transforms the content data according to characteristics or capabilities of mobile device **18**.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

What is claimed is:

1. A method for transferring selected content information organized in a hierarchical structure of a wide area network for offline browsing from a host computer to a mobile device, the method comprising:

connecting the mobile device to the host computer to form a communication link;

selecting a portion of the hierarchical structure to be transferred to the mobile device, the portion comprising multiple levels of the hierarchical structure;

obtaining content information corresponding to the portion by traversing through the portion of the hierarchical structure;

obtaining characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device; and

transferring the content information from the host computer to memory on the mobile device as a function of the characteristic information via the communications link.

2. The method of claim **1** wherein the step of transferring comprises transforming the content information prior to transmitting the content information to the mobile device.

3. The method of claim **1** wherein the step of transferring comprises transforming the content information on the mobile device prior to storage in the memory.

4. The method of claim **1** and further comprising detecting a type of the content information to be transferred.

5. The method of claim **4** and further comprising:

storing content-type filtering modules on the host computer;

selecting a content-type filtering module as a function of the type of the content information to be transferred; and

wherein the step of transferring includes passing the content information to be transferred through the selected content-type filtering module, the content-type filtering module operating upon the content information.

6. The method of claim **5** and further comprising passing an address pointer to the selected content-type filtering module indicating a location of the content information to be transferred.

7. The method of claim **5** and further comprising passing a filter parameter to the selected content-type filtering module indicative of the characteristic information.

8. The method of claim **1** and further comprising:

connecting to a content provider through the wide area network, the content provider having the content information;

obtaining user preferences of the content information to be obtained from the content provider; and

transferring the content information from the content provider to the host computer as a function of the user preferences.

9. The method of claim **8** wherein the user preferences include indications of the type of content information to be obtained.

10. The method of claim **9** wherein the user preferences include indications as to where the content information is to be obtained.

11. A computer readable medium including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

selecting a portion of a hierarchical structure of content information to be transferred to a mobile device, the portion comprising multiple levels of the hierarchical structure;

downloading content information corresponding to the portion from a wide area network to a host computer by traversing through the portion of the hierarchical structure;

obtaining characteristic information of a mobile device connectable to the host computer, the characteristic information pertaining to at least one of hardware and software capabilities of the mobile device; and

transferring the content information from the host computer to memory on the mobile device via a communications link as a function of the characteristic information.

12. The computer readable medium of claim **11** wherein the step of transferring comprises transforming the content information prior to transmitting the content information to the mobile device.

13. The computer readable medium of claim **11** wherein the step of transferring comprises transforming the content information on the mobile device prior to storage in memory.

14. The computer readable medium of claim **11** including instructions readable by a computer which, when implemented, cause the computer to handle information by performing a step comprising:

detecting a type of the content information to be transferred.

15. The computer readable medium of claim **14** including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

selecting a content-type filtering module as a function of the type of the content information to be downloaded; and

wherein the step of transferring includes passing the content information to be downloaded through the

selected content-type filtering module, the content-type filtering module operating upon the content information.

16. The computer readable medium of claim **15** including instructions readable by a computer which, when implemented, cause the computer to handle information by performing a step comprising:

passing an address pointer to the selected content-type filtering module indicating a location of the content information to be downloaded.

17. The computer readable medium of claim **11** including instructions readable by a computer which, when implemented, cause the computer to handle information by performing a step comprising:

passing a filter parameter to the selected content-type filtering module indicative of the characteristic information.

18. The computer readable medium of claim **11** including instructions readable by a computer which, when implemented, cause the computer to handle information by performing steps comprising:

connecting to a content provider through a wide area network, the content provider having the content information;

obtaining user preferences of the content information to be obtained from the content provider; and

transferring the content information from the content provider to the host computer as a function of the user preferences.

19. A system for viewing content information organized in a hierarchical structure of a wide area network offline, the system comprising:

a selection module for selecting a portion of the hierarchical structure to be transmitted, the portion comprising multiple levels of the hierarchical structure;

a host computer comprising:

a first module for downloading content information corresponding to the portion by traversing through the selected portion of the hierarchical structure; and

a second module for transmitting the content information via a communications link;

a mobile device comprising:

a third module for receiving the content information from the second module; and

a fourth module for selectively viewing the content information; and

wherein at least one of the host computer and the mobile device includes a fifth module for operating on the content information as a function of characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device.

20. The system of claim **19** wherein the fifth module comprises:

a plurality of content-type filtering modules for operating on a selected type of content information; and

a managing module for selecting a content-type filtering module as a function of the type of the content information to be downloaded.

21. The system of claim **20** wherein the content-type filtering modules comprise streaming filters.

22. A mobile device for viewing content information organized in a hierarchical structure of a wide area network, the mobile device comprising:

a selection module for selecting a portion of the hierarchical structure, the portion comprising multiple levels of the hierarchical structure;

a first module for downloading content information corresponding to the selected portion from a content provider via a communications link by traversing through the selected portion of the hierarchical structure;

a second module for selectively viewing content information; and

a third module for operating on the content information as a function of characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device.

23. The mobile device of claim **22** wherein the third module comprises:

a plurality of content-type filtering modules for operating on a selected type of content information; and

a managing module for selecting a content-type filtering module as a function of the type of the content information.

24. The system of claim **23** wherein the content-type filtering modules comprise streaming filters.

25. A method for obtaining offline browsing content information organized in a hierarchical structure of a content provider for use on a mobile device, the method comprising:

selecting a portion of the hierarchical structure to be transferred to the mobile device, the portion comprising multiple levels of the hierarchical structure;

obtaining content information corresponding to the selected portion by traversing through the selected portion of the hierarchical structure;

obtaining characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device; and

transferring the portion via a communications link to memory on the mobile device as a function of the characteristic information.

26. The method of claim **25** and further comprising detecting a type of the content information.

27. The method of claim **26** and further comprising:

selecting a content-type filtering module as a function of the type of the content information to be transferred; and

wherein the step of transferring includes passing the content information to be transferred through the selected content-type filtering module, the content-type filtering module operating upon the content information.

28. A method for obtaining offline browsing content information organized in a hierarchical structure of a content provider for use on a mobile device, the method comprising:

obtaining user preferences of content information to be downloaded from a content provider;

connecting to the content provider via a communications link;

downloading content information from the content provider as a function of the user preferences;

generating a file having tags associated with the content information downloaded and comprising multiple levels of the hierarchical structure; and

storing the content information and the file in memory of the mobile device.

29. The method of claim **28** wherein the step of downloading comprises downloading content information to a host computer, and the method further comprises transferring the content information to the mobile device.

30. The method of claim 28 and further comprising:

obtaining characteristic information of the mobile device pertaining to at least one of hardware and software capabilities of the mobile device; and

transferring the content information to memory on the mobile device as a function of the characteristic information.

31. The method of claim 28 wherein the content information is organized in a hierarchical structure, wherein the file relates to the hierarchical structure of the content information and wherein downloading the content information includes traversing through the hierarchical structure of the content information.

* * * * *