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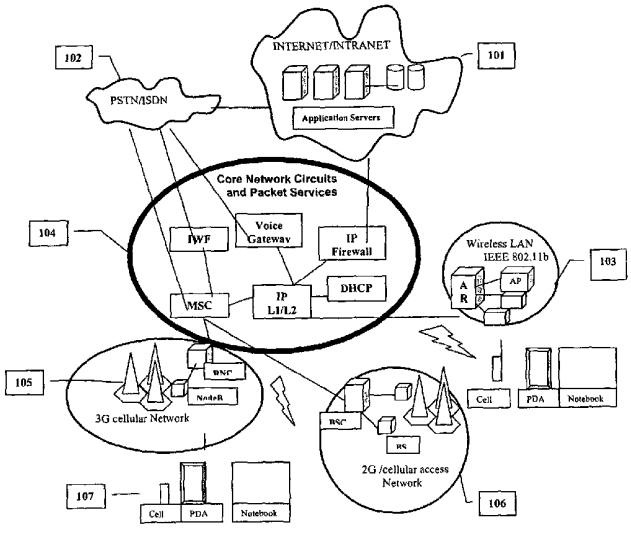
(54) **Title:** AN ARCHITECTURE AND PROTOCOL FOR A WIRELESS COMMUNICATION NETWORK TO PROVIDE SCALABLE WEB SERVICES TO MOBILE ACCESS DEVICES



(57) **Abstract:** A network architecture for small, low-cost, high functionality portable wireless devices which shifts many of the functions performed in typical handheld communication devices to a central Application Server (AS) computer. Communication between the AS and the portable devices is performed using standard Internet Protocol (IP) packets. The AS includes a Client Proxy Server (CPS) which interfaces to applications on the server, and Device Personality Objects (DPOs) that handle the special characteristics of each different types of portable devices. Each portable device has a unique CPS/DPO pair running on the AS that accepts input from the portable devices and provides input to the various applications on the AS and which accepts outputs from the various applications and passes it to the portable devices. Communication from the portable devices to the AS is entirely via IP packets.

WO 02/073372 A2

An Architecture and Protocol for a Wireless Communication Network to provide scalable web services to Mobile Access Devices.

Field of the invention:

The present invention relates to communications and more particularly wireless communication systems.

Background of the invention:

The functionality of cellular telephones and other hand-held communication devices has been increasing rapidly. Internet enabled cellular phones and personal digital assistants (PDAs) that can communicate via the internet are now in widespread use.

A variety of digital communication protocols have been developed. A number of non-compatible communication protocols and air interfaces such as PDC/PHS, TDMA, CDMA, GSM and IEEE 802.11x have each been deployed in the market. However no protocol is ubiquitous. In fact many communication systems incorporate one or more of these protocols to deliver services to their customers.

Third generation wireless protocols that handle voice, video and data are being developed. The third generation protocols are designed to handle voice, video, and data communication over devices such as cellular phones, PDAs and laptop computers.

A typical hand held communication device (e.g. cellular phone or PDA) is relatively complex. Almost all handheld communication devices include a keypad/keyboard and also include a display device (of varying resolution), which may in many cases be a touch-screen. The technical complexities of these handheld devices make them relatively expensive. In order to encourage widespread usage of such communication devices, some network service providers subsidize the cost of these hand-held communication devices.

Additionally because of the difference in the feature sets and processing power available in these communication devices, there is no efficient and low cost method to deliver standard content to all devices. A number of attempts such as the Wireless Application Protocol have been created. WAP requires the execution of a browser on the cellular phone or PDAs. This browser then makes custom requests to the target web applications. The web application also needs to be modified to format the content to match the capabilities of the hand-held device in use. Rewriting and reformatting of content is an impediment to the deployment of a variety of applications to customers. The requirement to execute a browser on the hand-held device generally requires a processor, large memory, a display etc. adding to the cost of the device. It also results in relatively large power consumption leading to relatively short battery life.

The architecture for a typical prior art handheld mobile device is shown in Figure 1. The components of a typical prior art handheld device include a microprocessor 185 and associated RAM and Flash memory 184. The microprocessor 185 executes the resident software and controls the input/output devices. The input/output devices include devices such as microphone/speaker 183, keypad/board 181, display device 182, a codex 186, a radio transceiver 189 and often a DSP 187 for analog signal processing. In view of the number of components and the complexity prior art handheld devices are relatively expensive and they use a relatively large amount of power.

The present invention is directed to a system and method which will accommodate relatively low cost hand held devices that use a relatively small amount of power.

Summary of the present invention:

The present invention provides a system that can accommodate very simple, low cost portable (i.e. hand held) devices that use a very small amount of power. The system includes a central server, that runs a variety of applications and which has a module associated with each portable device. Each portable device communicates with its associated module using wireless communication and the

well known Internet Protocol (IP) that has been developed for the internet. With the present invention the portable device merely sends and receives IP packets. The portable device does not include a browser.

The present invention provides an Internet Protocol based system and method that may be implemented over a heterogeneous wireless communication network. A system operating in accordance with the present invention includes:

1. A set of hardware components that enable radio communication and IP packetization. The system includes a Software Defined Radio (SDR) and Application Specific Device (ASD) modules.
2. Matching software protocol programs: The system includes a Client Proxy Server (CPS) and a Device Personality Object (DPO) program pair that executes at an Application Server (AS). The CPS/DPO program pair abstracts all the device dependencies from the application and uniquely maps the mobile access device to the target application. The CPS/DPO program pair contains all of the information required to map content and translate requests to and from the application and to the accessing mobile device. There is a unique CPS/DPO program pair for each mobile device that is active.

Data is exchanged between the hand-held communication devices and cellular wireless base stations using IP data packets. All devices can use this IP packet transmission protocol to allow for frequency sharing and compatibility with existing internet infrastructure.

The system can include very small, very low power hand-held devices, that do not include a dial/key pad, large data storage or a complex microprocessor based platform and can be low cost and low power devices.

Each hand-held device is logged into the internet via the base station and results in the spawning of a CPS/DPO program pair at the Application Server (AS) where the target application resides. CPS establishes a session for each remote wireless device. A single CPS can have multiple DPOs, each DPO being

a plug-in software object. The DPO is responsible for translating the device requests to the application in use and also for translating the applications responses to the appropriate format required by the requesting mobile device. A very small footprint or "lightweight" software component is embedded in each hand-held device and is responsible for IP packet management.

The Application server is typically a large computer with enormous power. By executing this complex code i.e. the CPS/DPO combination, at the Application Server it is possible to provide rich applications to simple, low-cost mobile or handheld devices. T he cost of complex microprocessor based devices may be dispensed with. This enables the manufacture and deployment of very low-cost wireless hand-held devices for Internet access. The computational capability at the AS is generally capable of handling thousands of such CPS/DPO sessions in parallel enabling a practical way to deploy services.

This method also enables rapid deployment of applications by simply deploying the appropriate DPO for a particular mobile device class at the "head end" of the network i.e. at the AS. This ability to harness the computing power of the Application Server also results in better security, customer experience etc.

Brief Description of the Drawings:

FIG 1 shows the components in a typical prior art hand-held communication device.

FIG 2 is an overall diagram that shows an IP based wireless/mobile network

FIG 3 is a diagram of a typical protocol stack required to implement an IS-95 cdma or a CDMA2000 wireless network.

FIG 4 is a diagram of the hardware components that separate the radio transceiver from the application specific device interface.

FIG 5 shows the minimum set of components that remain in a simplified low-cost hand-held communication device with the present invention.

FIG 6 shows a more general implementation of the present invention to interface multiple types of hand-held or mobile devices e.g. a PDA or a Notebook computer.

FIG 7 is a diagram that shows the Software Hierarchy at the Application Server. It shows the CPS and DPO components that are required to realize present invention

FIG 8 is a diagram that shows the handshake between the mobile device and the target Application Server including the execution of the Client Proxy Server (CPS) program at the Application Server (AS) and ensuing application session.

Fig 9 is a block diagram showing an example of the operations performed.

Detailed Description:

An overall diagram of a preferred embodiment of the present invention is shown in Figure 2. The architecture of the system shown in Figure 2 provides an all IP-wireless/mobile network. The present invention provides a network architecture, an application protocol and devices for small, low-cost, high functionality wireless communications. The present invention shifts many of the functions performed in a typical handheld communication devices to a powerful Application Server (AS) computer 101 via a connection with a wireless Base Station/Controller through a Message Switching Center 104. The hand held device communicate with the AS using IP packets; however, the portable device do not include a browser. The hand held device merely packetizer input and send it to the AS. The AS processes the information, executes the appropriate application program and sends packets back to the hand held device. At the handheld device the data stream from the AS is de-packetized and provided to the user.

The various components of the system shown in Figure 2 will now be described . The main components of the system are a number of application servers101 connected via a conventional internet of intranet network, a group of Core Network circuits and packet services 104, and cellular access networks 105 and 106

The system includes one or more instances of an IEEE802.11b Wireless LAN 103, a 2G cellular access network 106, a 3G cellular access network 105, the core network Circuit and Packet services infrastructure 104, a PSTN/ISDN network 102, an Internet/intranet cloud of Application Servers 101. Also shown are a set of ubiquitous mobile devices e.g a cell phone, a PDA, a Notebook computer 107.

The IEEE 802.11b Wireless LAN 103 provides access points (AP in block 103) and Access Routers (AR in block 103) connectivity to the core services network 104.

The 2G cellular access network 106 has antennas, base stations and base station controllers in place. The cellular devices 107, connect to the Base Station (BS in block 106) and multiple base stations are controlled by a Base Station Controller (BSC in block 106). Multiple BSCs are then connected to the Message Switching Center (MSC in block 104) in the core services network 104

Each of the outer access networks 103,105,106, 102,101 is serviced by a network infrastructure 104, that provides core network circuit and packet switching services such as Message Switching Centers (MSC in block 104), IP Layers 1&2 (IP L1/L2 in block 104), DHCP services (DHCP in block 104), Voice Gateway (Voice Gateway in block 104), IP Firewall (IP Firewall in block 104)

Any of the mobile devices 107, have the ability to connect to any of the wireless access networks 105,103 or 106 to access any resource available on the network including the Application Servers 101. The exact wireless protocol used

make a unique connection i.e. is unique when connecting to the wireless networks 103,105,106 shown .

With the present invention all the heavy-duty computation and data storage is performed by the various blocks in the network from the Base Stations (BS in 106, FIG 2) through the Application Servers 101 shown in FIG 2, A user has access to functions such as e-mail, voice-mail, calendars etc via voice command that are recognized and executed at the appropriate remote Application Server (FIG 2 101)as opposed to on the mobile device. Also no local data storage is required on the mobile device. A user can store their entire contact database at the remote Application Server. This enables the mobile access device to become a simple low-cost, low-power device. It will be clear to those skilled in the art that the mobile device could be any other data/voice device such as a PDA or a Notebook computer. Various types of devices can be connected. Each device has an ASD. A particular bit pattern generated by the ASD indicates the device type or device class. This is used to deploy the appropriate software components in the Application Server.

Figure 7 shows the software environment executing at the Application Servers (FIG 2, 101) resource. In this diagram the Application Server 701, is a powerful computing and data storage resource available to any device connected to the Internet. The diagram shows three native web Applications – Web App1-Stock Quote 702, Web App2-News & Ent. 703 and Web App3 -Telephone Directory 704. Also shown are three ubiquitous mobile access devices - a cell phone 713, a PDA 714 and a notebook computer 715, that are accessing the web applications 702,703,704 at the Application server 701. Each Application Server 701 has a program called the Client Proxy Server 705. The Client Proxy Server 705 is part of the present invention and is responsible for managing the application sessions for each connected mobile access device. It creates logical connection channels for the client device. An important aspect of this invention is the ability of any mobile device to connect to any Internet application and be serviced in a graceful scalable manner. The present invention accomplishes this by implementing a set of programs called Device Personality Objects (DPOs)

that abstract all the device dependencies from the target application. These DPOs can be defined to service various classes of mobile devices. Examples of such classes and the associated mobile access devices are: Voice Only DPO - (telephone) 706, Text DPO – (PDA+ phone) 707, Graphics DPO – (Notebook computers) 708, but not limited to these.

Service or applications requests from the access device are routed to the appropriate DPO 706,707,708, at the Application Server 701. The appropriate DPO 706,707,708 then translates the mobile access device dependencies and creates a payload for the target web application 702,703,704, and sends it to the Client Proxy Server 705. The CPS 705 manages the order of requests and ensures coherency of the message stream.

When the web application 702,703,704 responds to a request, the CPS 705 routes the payload to the correct DPO 706,707,708. The appropriate DPO then translates the payload into a format that is compatible with the target mobile requesting device 713,714,715. If the requestor is a Voice-Only device the Voice Only DPO 706 will translate the application response into a voice or audio stream 710. This stream 710 is easily understood at the Cell Phone 713, which is a voice/audio device.

The value of this approach is that any new set of devices with richer functionality may be supported by simply writing and deploying the required DPO 706,707,708 for that class of devices, at the Application server. These DPOs may also be deployed at various nodes in the networks e.g. at Base Stations if needed by a particular application.

The benefit derived from this architecture is that existing Internet application can be made available to very low cost devices in a useful manner without having to reformat the application or its content for each specific device. It eliminates the need for creation of one-off protocols like Wireless Application Protocol (WAP) for cellular phones. WAP requires the execution of a web browser on the users mobile device. This custom WAP browser makes specially formatted requests to

a WAP customized application that has to manage custom content for each different WAP device. A drawback of this approach is the high minimum capability required of the mobile device. In general in a WAP system the mobile device needs to have a powerful microprocessor, a display, a keypad etc all of which make it a relatively high cost device.

As shown in Fig 4 and Fig 6, the invention embodies a multiple standards compatible Software Defined Radio (SDR) 401 with a universal interface (IP-BUS) 404 for connecting to mobile devices. The invention also includes a Application Specific Device (ASD) 402 component that provides standard interfaces. As shown in Fig 6, the ASD 402 has a USB 2.0, IEEE 1394 bus at one end and the IP-BUS at the other end. Devices such as a notebook or PDA 601 connect to the ASD via the USB 2.0, IEEE 1394 bus as shown in FIG 6. The ASD also contains the logic to support the packetization / de-packetization of IP data packets. The combination of the SDR and ASD is all that is required to implement low cost mobile devices. It is noted that software defined radios are known in the art. For example see: Gang Wu & Mitsuhiko Mizuno , Comm. Research Lab, Japan; Paul J.M. Havinga Univ. of Twente, –"MIRAI Architecture for Heterogeneous Network " IEEE Communication Mag Feb 20002. The content of this reference is hereby incorporated herein by reference.

An example of a specific portable device constructed in accordance with the present invention is shown in Figure 5. The device includes an Application specific Device (ASD) 501 and a SDR 502. The radio transceiver SDR 502 is programmable to use standard wireless signaling methods e.g. IS-95 cdma or CDMA 2000, or IEEE 802.11b DSSS mechanisms, to communicate to the nearest base station or access point. The radio may be programmed to adapt to the available air interface. The SDR 502 includes a conventional Radio Bus Interface and a conventional Radio Air Interface

With the present invention the handheld/mobile device need not include a keyboard or a display. For instance in the case of a voice/telephony only

application, the input and output from the handheld device is audio data in the form of IP packets.

Figure 5 illustrates an ASD that include a coder 501A to digitize the audio, a packetizer 501B and a radio control processor block 501C to program the SDR to the appropriate mode. The entire device is controlled by a Control logic processor 501P that performs a conventional control program stored in Flash memory 501M.

With the present invention all the heavy-duty computation and data storage is performed by the various blocks in the network from the Base Station through the Application Servers shown in FIG 2. A user has access to functions such as e-mail, voice-mail, calendars etc via voice command that are recognized and executed at the appropriate remote Application Server as opposed to on the mobile device. Also no local data storage is required on the mobile device. A user can store their entire contact database at the remote Application Server. This enables the mobile access device to become a simple low-cost, low-power device. It will be clear to those skilled in the art that the mobile device could be any other data/voice device such as a PDA or a Notebook computer. Various types of devices can be connected . A particular bit pattern generated by the ASD indicates the device type or device class. This is used to deploy the appropriate software components in the Application Server.

An important aspect of this invention is the ability of any mobile device to connect to any Internet application and be serviced in a graceful scalable manner. This is accomplished by implementing a set of programs called Device Personality Objects (DPOs) that abstract all the device dependencies from the target application. These DPOs can be defined to service various classes of mobile devices. Examples of classes of devices are. "Voice Only - telephone" , "Text Only - pager", "Voice and Data –PDA+ phone", "Graphics & Audio – Notebook " devices , but not limited to these. The value of this approach is that any new set of devices with richer functionality may be supported by simply writing and deploying the required DPO program for that class of devices, at the

Application server. These DPOs may also be deployed at various nodes in the networks e.g. at Base Stations if needed by a particular application.

The great benefit derived from this architecture is that existing Internet application can be made available to very low cost devices in a useful manner without having to reformat the application or its content for each specific device. It eliminates the need for creation of one-off protocols like Wireless Application Protocol (WAP) for cellular phones . WAP requires the execution of a web browser on the users mobile device. This custom browser makes specially formatted requests to a WAP customized application that has to manage custom content for each different WAP device. A drawback of this approach is the high minimum capability required of the mobile device. It needs to have a powerful microprocessor, a display, a keypad etc all of which make it a much higher cost device.

The present invention takes advantage of the existing and robust IP packet data network and enables unique applications such as "Voice Based Multi-party Instant Messaging" which would not be feasible using current point-to-point methodology required by existing wireless communication systems.

The present invention allows mobile devices to communicate with the nearest wireless base station or wireless access point. The local connection is established using DHCP protocol. Also the Mobile IP standard is utilized to maintain a pair of IP addresses per mobile device i.e. a "home IP address" and a " "care-of IP address." These support IP based mobility of the device when needed

Since these connections are based on an IP data packet protocol, it enables all such devices within a cell to multiplex the air interface and use the bandwidth more efficiently. It is also enables all the devices within that cell to message each other using standard IP messaging applications such as Instant Messaging in an efficient manner with the base station acting as a router. If the DPOs are

deployed on a Base Station, it will enable heterogeneous devices to communicate in a localized network thereby improving latency and performance.

The application architecture is an overlay on top of TCP/IP and abstracts the existing Link and Physical layer infrastructure available. This structure may be IS-95 cdma or CDMA2000 or IEEE802.3.11a or the proposed IEEE802.3.11g standard. This method uses digital data for both voice (VoIP) and data transmission.

The value that this application protocol provides is that it enables existing IP based web applications to support multiple end-user devices in a scalable device specific manner without re-writing the application.

Hence a very simple " voice only" telephony device may be used to access voice and data services. This simple device has no keyboard or display and can therefore be very low cost. In its most basic form it is simply a voice driven mobile access device.

The steps performed during the operation of the invention are illustrated in Figure 8

Example 1. A voice/telephony application using VoIP.

A user has a minimal mobile incorporating an ASD (Application Specific Device) and a Software Defined Radio transceiver (SDR) connected to a headset with the custom controller (see Fig 5). This user can avail of web applications in the following manner: (as shown in Fig 8).

Step 1. The user turns on the radio.

Step 2. The radio establishes contact with the nearest base station (BSC) using the appropriate air interface (RF protocol) and requests a network connection.

Step3. The base station queries the device for its "Device Type".

Step4 The device identifies itself as a " voice only" class mobile IP device. The Base Station passes the request to the base station controller BSC.

Step 5 The base station (BSC) proceeds to issue a DHCP address to the device and also informs the Message Switching Center (MSC) about the device and its associated DHCP generated "care of IP address".

Step 6. The MSC performs the authorization, creates the IP address pair "home IP " and "care of " required to map the mobile device into its routing tables. It then connects with the Application server and invokes the appropriate Client Server Proxy CPS/DPO program pair for the specific device (In this case a "voice only" device). It then sends an acknowledgement to the MSC. The MSC then updates its internal mapping and routing tables and returns a valid DHCP address to the terminal mobile device. This completes a TCP/IP link.

Step7. The Application executing on the AS then queries the "voice only" device via the appropriate Client Proxy Server/ DPO program that in this case would support voice recognition and synthesis as its user interface..

Step 8. The user says " I want to make a call". This is packetized and transmitted to the AS where the CPS voice recognition module translates this voice request into application commands.

Step 9. The application asks "Whom should I call?" This is sent back as a digital audio stream and is decoded at the "voice only" device into analog audio so that the user can understand it.

Step 10. The user may then either provide name e.g. "call Bill Smith" or a number "925-555-1212".

Step 11. A phone call is thus placed and a voice (Voice over IP or VoIP) connection established

Example 2. A data access application using a "voice only" device

The same steps outlined in the previous example would be executed to establish a TCP/IP based link with the specific application URL.

In this case because the device type is known to be a "voice only" device it will not accept any graphical input. The application interface now gets routed through a voice module on the AS that does the conversion of voice to text and data to voice. Clearly graphics cannot be supported on this type of device. However most data based applications such as e-mail, SMS, news delivery, stock quotes etc. can be easily supported. Thus, the application gracefully scales the features available to a specific mobile access device. The user is only exposed to the features that his mobile device can support.

Example 3. Access using a PDA type device that can support graphics.

The same steps as before would be followed to establish the TCP/IP link. In this case however, the CPS/DPO program pair knows that the mobile device has graphics capability and therefore present data in a format supported by the specific device. A device of this sort would be capable of supporting voice as well as data.

An example of the protocol stack required to support an IS-95 cdma or CDMA 2000 wireless IP network is shown in Figure 3. Figure 3 illustrates the Upper Layer
OSI 3-7, the Link layer)SI and the Physical Layer OSI 1. The abbreviations used in Figure 3 are as follows:

LAC – Link Access Control
MAC – Medium Access Control
OSI – Open Systems interconnect
PPP – Point-to-Point Protocol
QoS – Quality of Service
RLP – Radio Link Protocol
TCP – Transmission Control Protocol
UDP – User Datagram Protocol

Such software stacks are well known. For example see a book by Vijay K. Garg – " IS-95 Cellular/PCS Systems Implementation; Prentice Hall PTR"; 2000. The above book is hereby incorporated herein by reference.

Fig. 9 is a block diagram illustrating an example of how a mobile device accesses the target application for service. That is, Fig 9 is a representation of the connecting blocks data flow between the Application and the mobile device in use. The example illustrated in Fig 9 involves a mobile access device in the form of a cell phone 905. The cell phone 905 connects to the wireless IP network and all the associated network infrastructure 904 and finally to the application server and the specific CPS/DPO program pair 902,903 associated with this particular mobile device 905. The DPO 903, on the one side, connects to the TCP/IP layer at the Application Server and on the other it connects to the CPS 902 executing on that server.

The CPS 902 interfaces with the target application program 901 and its associated data. The user connects to the network and selects the desired application following the steps shown in Fig. 8. The mobile device in this example is a voice-only cell phone 907 that is designed in accordance with the present invention..

The users voice commands are digitized by the mobile device, packetized and transmitted through the network infrastructure 904 onto the device's DPO 903 as IP-packets via the paths 906 and 907. The physical path 906 is an abstraction of the network infrastructure that is involved in delivering the IP-packets to the

target application server. The path 907 represents the TCP /IP buffers queues. The DPO 903 extracts a packet from the buffer 907 and parses the incoming mobile device packet. It extracts all device dependent information and spawns any necessary programs required to support the mobile device e.g. a voice recognition /voice synthesis program 910 to provide a voice-only user interface. The DPO 903 then maps the IP-packet payload data into a device-independent payload that it sends to the CPS 902 for session and presentation layer control through a buffer mechanism 908 The CPS 902 parses this incoming packet and decides upon which application 901 it must invoke. It then formats the payload data into a format e.g. a series of XML commands that the application 901 accepts and responds to and sends them to the application via a buffer mechanism represented by 909.

The application 901 will respond to the XML commands with the appropriate response via the buffer mechanism 909. The CSP902 will then process and translate the payload for processing by the DPO 903. The DPO 903 will process the payload and pass it thru any special program e. the voice recognition /voice synthesis module 910 for device specific processing. In this example the application data is converted from text to voice. by the voice recognition/synthesis module 910. The output of this module 910 may then is then a compressed bit stream. This bit stream is buffered and packetized into IP packets and sent back to the mobile device 905. The ASD in the mobile device extracts the payload from the IP-packet and transform extracted the digital bit stream into an audio signal. This process is repeated as many times as required during a user session.

While the invention has been shown and described with respect to preferred embodiments thereof, those skilled in the art will understand that various other changes in form and detail may be made without departing from the spirit and scope of the invention. The scope of the invention is limited only by the appended claims.

I claim:

1) A system including a plurality of portable devices each having at least one input/output device and a central server,
said server including at least one Client Proxy Server (CPS) and a Device Personality Object (DPO) for each portable device, whereby there is a CPS/DPO program pair for each portable device,
a packetizer/de-packetizer at each portable device for generating Internet Protocol (IP) packets from input to said portable device and for generating output from IP packets provided to said portable device,
a communication network for transmitting IP packets between each portable devices and the associated CPS/DPO pair,
said central server including at least one application program,
each CPS/DPO pair providing an interface between the associated hand held device and said application program,
whereby said hand held devices merely serve as input output devices, transmitting and receiving IP packets to and from the associated CPS/DPO pair, and all computation and data storage relative to said application is done at said central server.

2) A system which includes a plurality of portable devices, said portable devices having device characteristics and at least one input/output device,
each of said portable devices including a packetizer/de-packetizer for packetizing and de-packetizing input to said hand portable devices into IP packets,
a central application server which includes at lease one application program and a CPS (Client Proxy Server) for each of said plurality of hand held devices,
a communication network for transmitting IP (Internet Protocol) packets from said portable devices to said server, whereby input to said handheld device is packetized and transmitted to the associated CPS, and data from said CPS is packetized and transmitted to the associated portable device,

said CPS being adapted to abstract device dependencies from said application program and to uniquely map between the device characteristics of said portable devices and said application program.

3) A system including,
a plurality of portable devices,
a central server,
a radio communication network for transmitting standard Internet Protocol (IP) packets between providing radio communication between said portable devices and said central server,
a plurality of applications on said central server,
a Client Proxy Server (CPS)program on said central server which interfaces input and output messages from said portable devices to said applications,
whereby said portable devices serve as input output devices, communicating with said central server using IP packets and all computations and data storage relative to said applications is done at said central server, and
whereby said portable devices can be very simple low cost devices that use little power.

4) The system recited in claim 1 where each of said portable devices includes a Software defined Radio (SDR) which transmits IP packets to said AS.

5) The system recited in claim 2 where each of said portable devices includes a Software defined Radio (SDR) which transmits IP packets to said AS.

6) The system recited in claim 3 where each of said portable devices includes a Software defined Radio (SDR) which transmits IP packets to said AS.

7) The system recited in claim 1 where each of said portable devices includes an Application Specific Device Module (ASD) that identifies the particular device to the AS.

8) The system recited in claim 2 where each of said portable devices includes an Application Specific Device Module (ASD) that identifies the particular device to the AS.

9) The system recited in claim 3 where each of said portable devices includes an Application Specific Device Module (ASD) that identifies the particular device to the AS.

10) A method of connecting a plurality of portable devices to an application program located at a central server, each of said portable device having input and output capability, said central server including at least one application program, said portable devices not including a browser,
each portable device generating Internet Protocol (IP) packets containing the input received by the associated portable device,
transmitting said IP packets to said AS,
de-packetizing said packets at said AS and using the input received by the associated portable device to exercise said application program and to generate output,
packetizing said output into IP packets and transmitting the IP packets containg said output to the associated portable device,
de-packetizing said output at the portable device and presenting said output to a user,
whereby said portable devices communicate with said application program at said central server using IP packets.

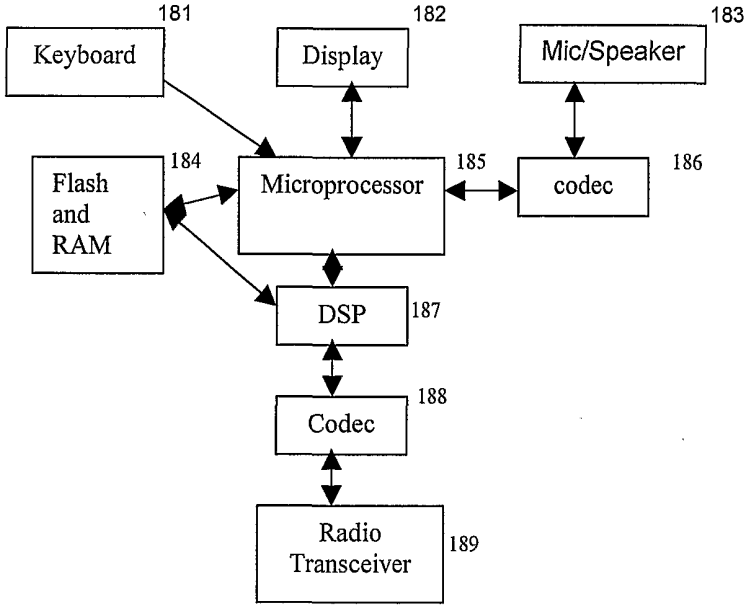


FIG 1
Prior Art

Figure 2

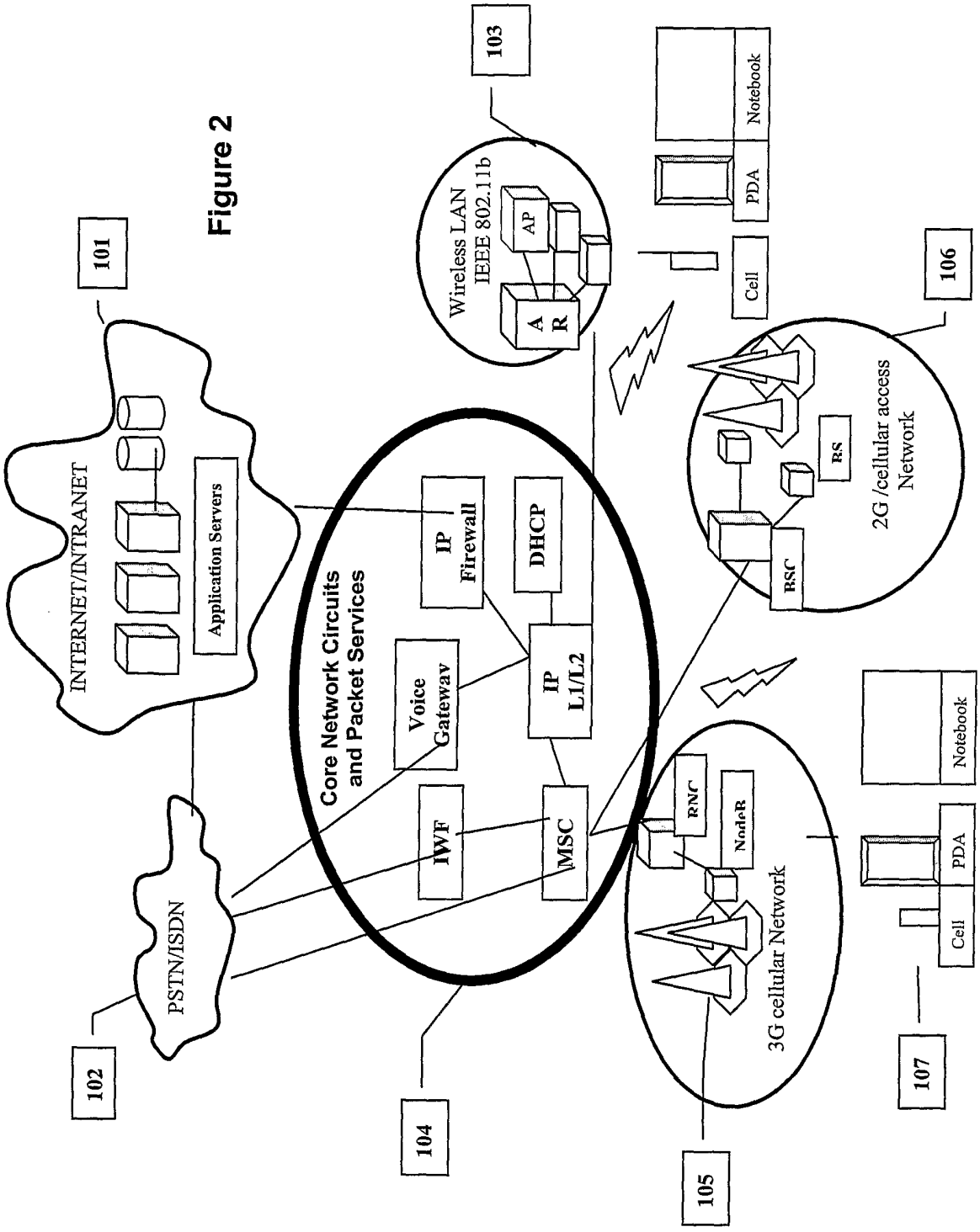

101
INTERNET/INTRANET
Application Servers
PSTN/ISDN
102
Core Network Circuits and Packet Services
IP Firewall
DHCP
Voice Gatewav
IP L1/L2
IWF
MSC
104
103
Wireless LAN IEEE 802.11b
AP
A R
Notebook
PDA
Cell
106
2G /cellular access Network
RS
BSC
105
3G cellular Network
RNC
NodeB
107

FIG 3.

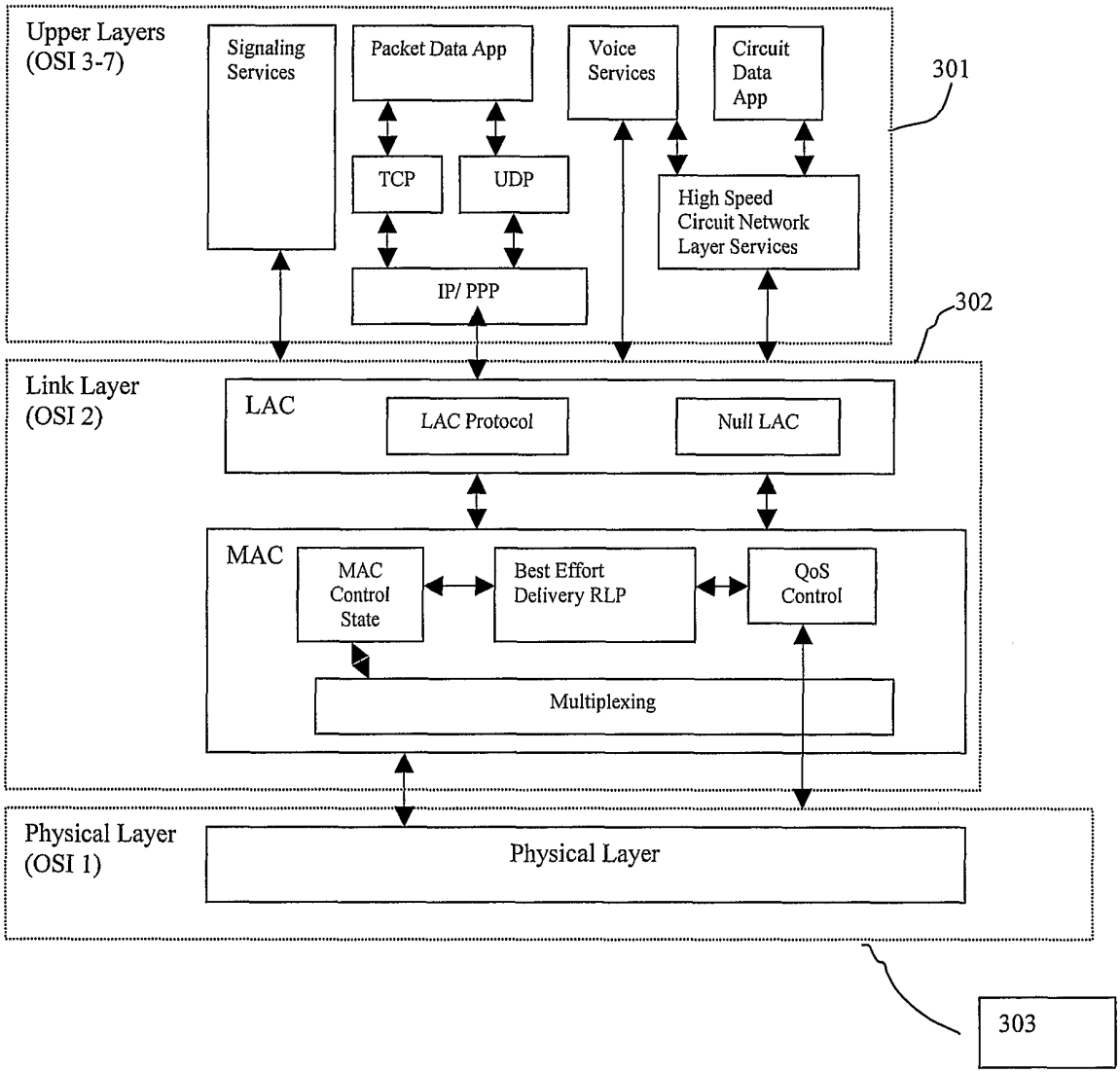

Upper Layers
(OSI 3-7)
Signaling Services
Packet Data App
Voice Services
Circuit Data App
301
TCP
UDP
High Speed Circuit Network Layer Services
IP/ PPP
302
Link Layer
(OSI 2)
LAC
LAC Protocol
Null LAC
MAC
MAC Control State
Best Effort Delivery RLP
QoS Control
Multiplexing
Physical Layer
(OSI 1)
Physical Layer
303

FIG 4

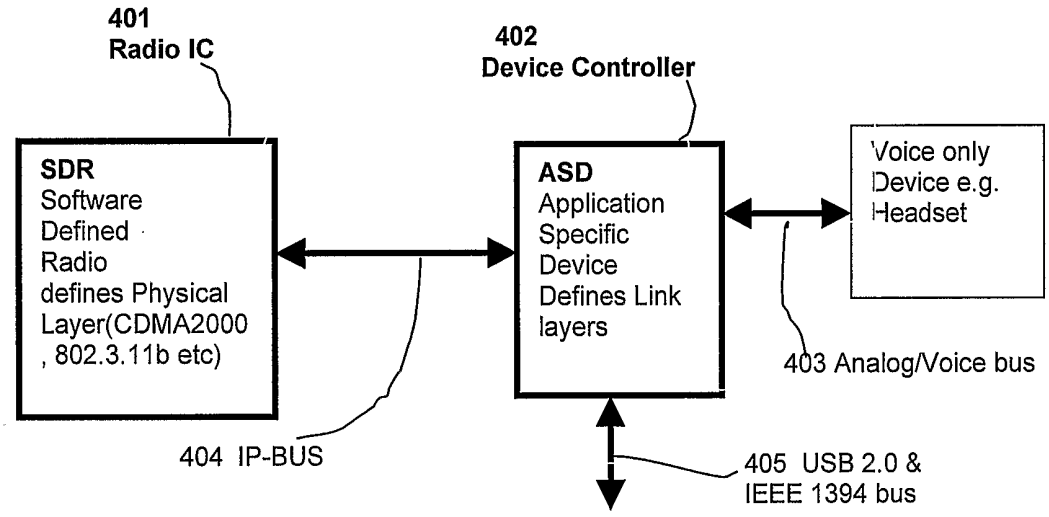

401
Radio IC
402
Device Controller
SDR
Software
Defined
Radio
defines Physical
Layer(CDMA2000
, 802.3.11b etc)
ASD
Application
Specific
Device
Defines Link
layers
Voice only
Device e.g.
Headset
403 Analog/Voice bus
404 IP-BUS
405 USB 2.0 &
IEEE 1394 bus

Figure 5

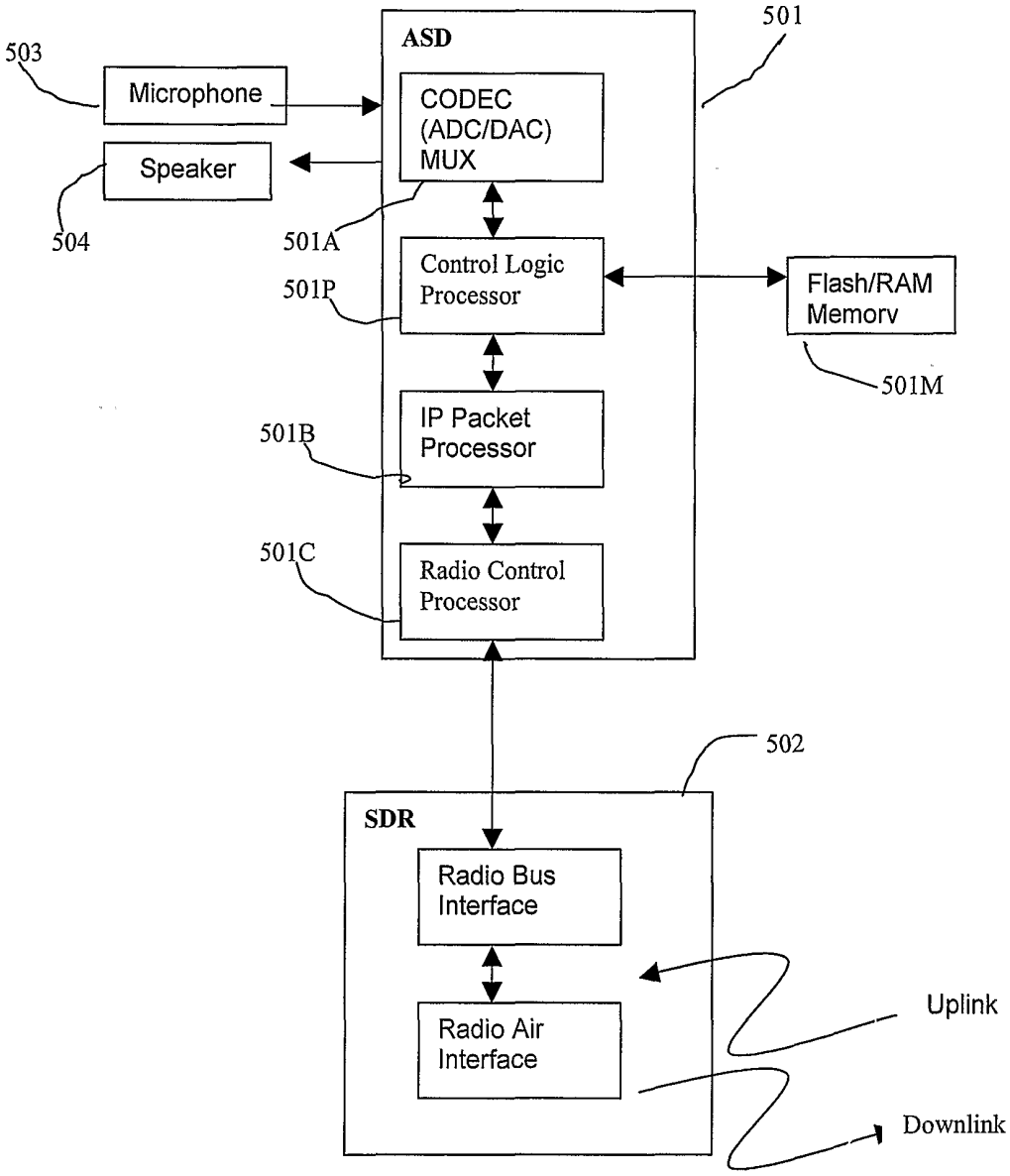
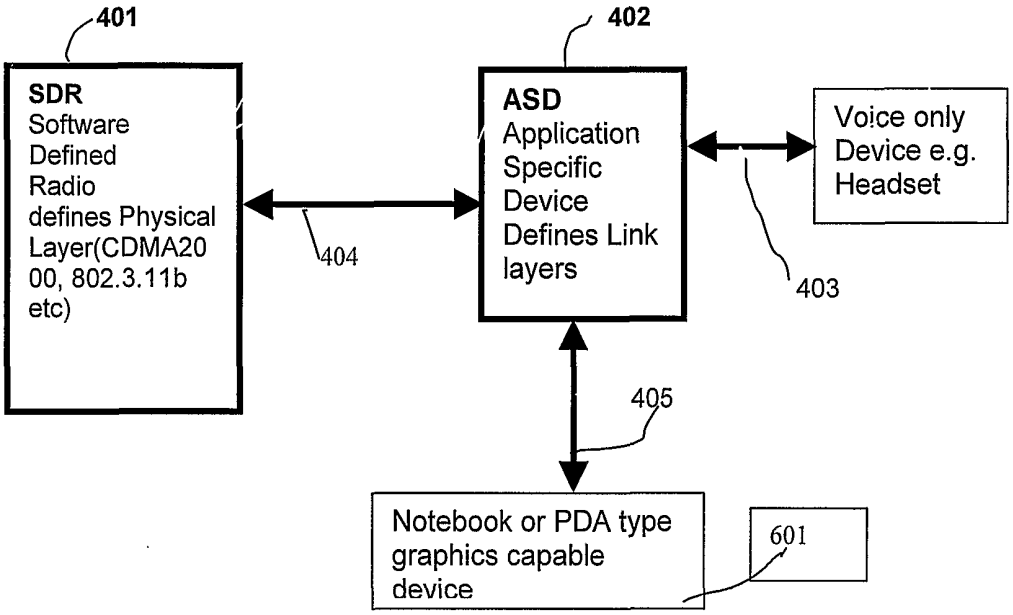

ASD
501
503
Microphone
CODEC
(ADC/DAC)
MUX
Speaker
504
501A
Control Logic
Processor
501P
Flash/RAM
Memory
501M
IP Packet
Processor
501B
Radio Control
Processor
501C
502
SDR
Radio Bus
Interface
Radio Air
Interface
Uplink
Downlink

Figure 6


401
SDR
Software
Defined
Radio
defines Physical
Layer(CDMA20
00, 802.3.11b
etc)
404
402
ASD
Application
Specific
Device
Defines Link
layers
Voice only
Device e.g.
Headset
403
405
Notebook or PDA type
graphics capable
device
601

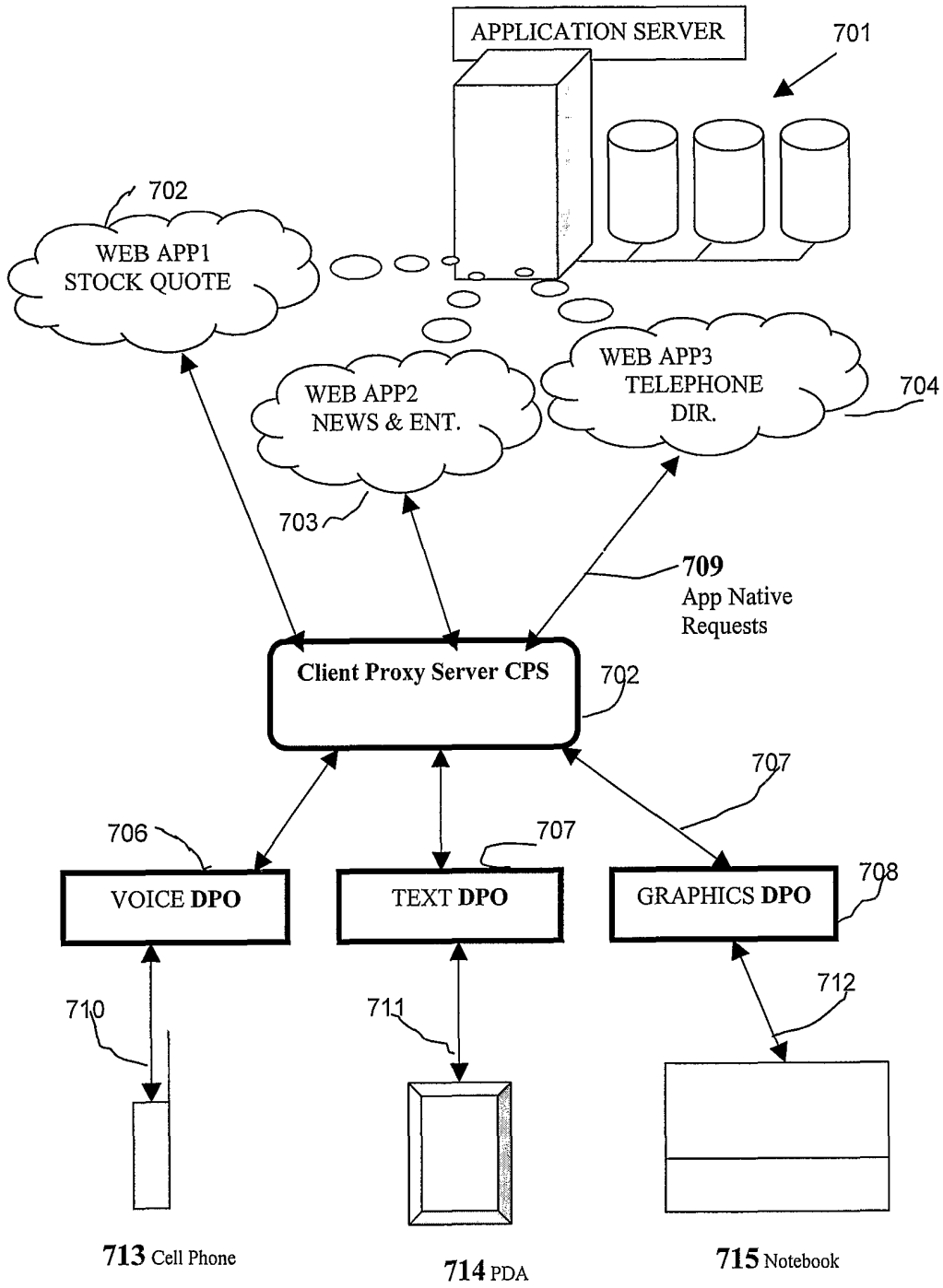

APPLICATION SERVER
701
702
WEB APP1
STOCK QUOTE
WEB APP2
NEWS & ENT.
WEB APP3
TELEPHONE
DIR.
704
703
709
App Native
Requests
Client Proxy Server CPS
702
707
706
707
708
VOICE DPO
TEXT DPO
GRAPHICS DPO
712
710
711
713 Cell Phone
714 PDA
715 Notebook

Figure 7.

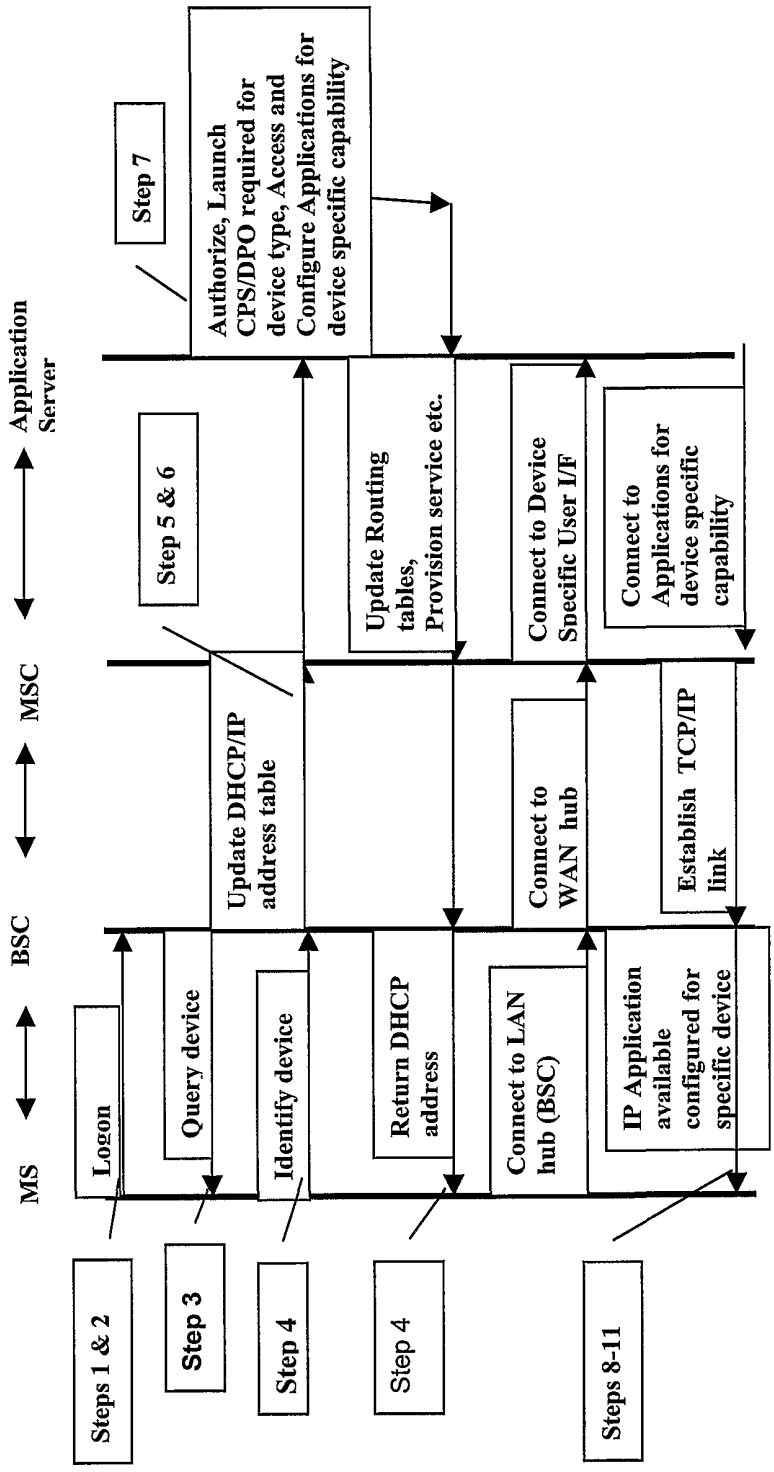
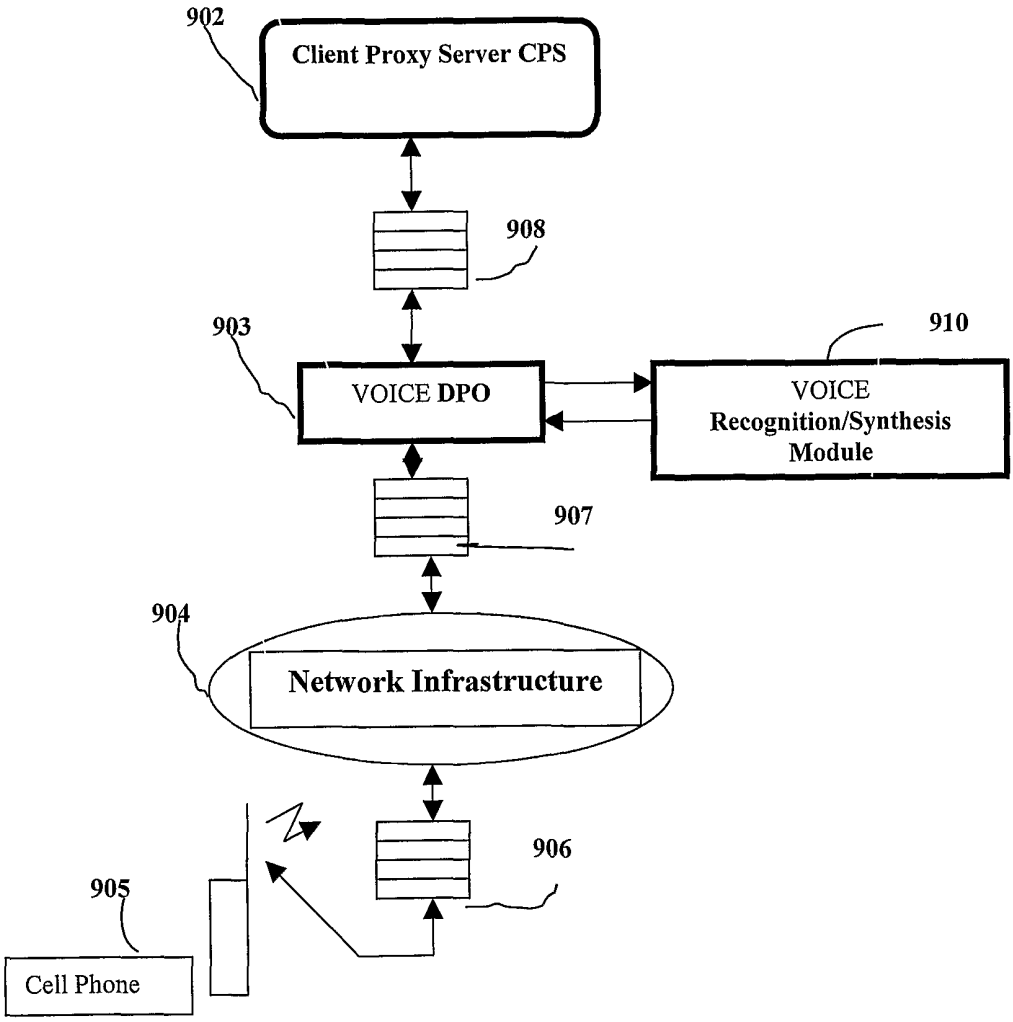

MS
BSC
MSC
Application Server
Logon
Query device
Identify device
Return DHCP address
Connect to LAN hub (BSC)
IP Application available configured for specific device
Update DHCP/IP address table
Connect to WAN hub
Establish TCP/IP link
Update Routing tables, Provision service etc.
Connect to Device Specific User I/F
Connect to Applications for device specific capability
Authorize, Launch CPS/DPO required for device type, Access and Configure Applications for device specific capability
Steps 1 & 2
Step 3
Step 4
Step 4
Step 5 & 6
Step 7
Steps 8-11

Figure 8

Figure 9


902
Client Proxy Server CPS
908
903
910
VOICE DPO
VOICE
Recognition/Synthesis
Module
907
904
Network Infrastructure
906
905
Cell Phone