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# PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

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*Additional inventors are being named on the* 1 *separately numbered sheet attached hereto*

**TITLE OF THE INVENTION** (280 characters maximum)

WIRELESS AUDIO ADAPTER FOR CAR RADIOS

**CORRESPONDENCE ADDRESS**

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**ENCLOSED APPLICATION PARTS** (*check all that apply*)

[X] Specification Pages   Number of Pages 663   ☐ CD(s), Number
☐ Drawings   Number of Sheets ____   ☐ Other (specify)
☐ Application Data Sheet. See 37 CFR 1.76

**METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT**

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check or money order is enclosed to cover the filing fees

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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

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☐ Yes, the name of the U.S. Government agency and the Government contract number are: ________

Respectfully submitted,

SIGNATURE

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**PROVISIONAL APPLICATION COVER SHEET**
Additional Page

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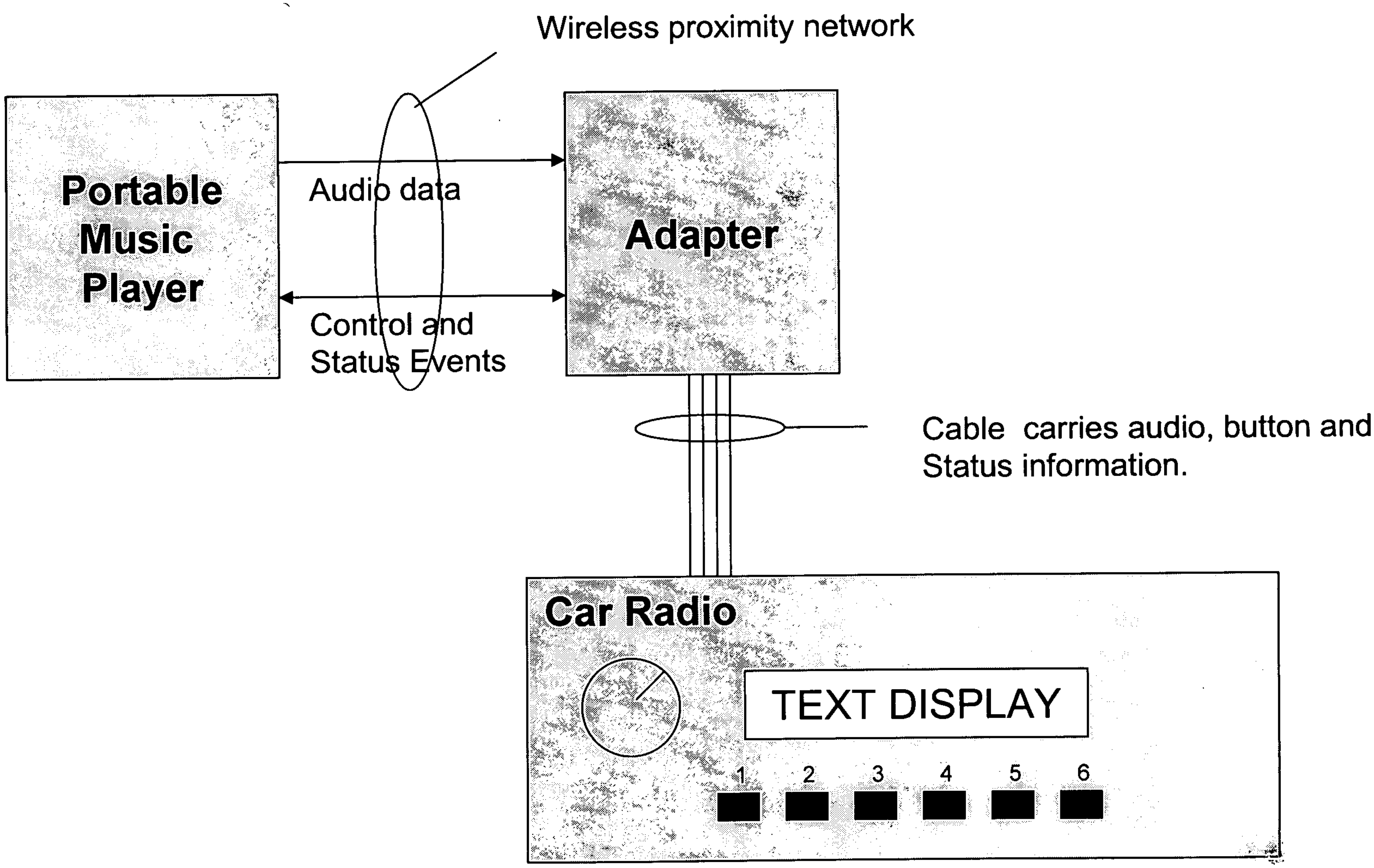
# Wireless audio adapter for car radios



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BACKGROUND INFORMATION

# SYSTEM AND METHOD FOR MANAGING CONTENT BETWEEN DEVICES IN VARIOUS DOMAINS

## FIELD OF THE INVENTION

This invention in general relates to managing content between devices in various domains and, more particularly, to a system and method for delaying or time-slipping broadcast content across different domains.

## BACKGROUND OF THE INVENTION

Digital video recorders and other content storage devices exist that allow a user to store and playback content at later times. Conventional systems, however, are limited in that they deal with storage and playback of the broadcast content in a single domain.

A need exists for a user to seamlessly listen to (or watch) audio (or video) content when moving from one domain (such as a vehicle) to a different domain (such as a home) without missing a portion of that content. For instance, assume that a vehicle operator would like to listen to a talk show or a sporting event that is scheduled for broadcasting one hour before the operator's commute time. It may not be feasible for the vehicle to store the broadcast itself because the vehicle is turned off and the operator does not want to drain the vehicle's battery. Currently, a user cannot delay the playback of the originally broadcast program to a time period when the driver is in the vehicle. The same applies for video, e.g., delay the playing of a regularly scheduled video program on an entertainment system in the vehicle for a time that the occupants may be in the vehicle.

It is, therefore, desirable to provide a system and method to overcome or minimize most, if not all, of the preceding problems especially in the area of managing content in different domains.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a system having client devices in different domains supported by a host system located at a home or at a central service provider;

FIG. 2 is a block diagram of one embodiment of a client device;

FIG. 3 is a perspective view of the inside of a vehicle illustrating one embodiment of a client device in the vehicular domain;

FIG. 4 is a perspective view of the inside of a vehicle illustrating another embodiment of a client device in the vehicular domain;

FIG. 5 is a block diagram of another embodiment of a client device in communication with a separate local wireless communication device;

FIG. 6 is a block diagram of one embodiment of a host system that communicates with different client devices in different domains;

FIG. 7 is a diagram of one embodiment of a database that may reside in a host system to access information and characteristics about a particular client device;

FIG. 8 is a flow diagram of one method for managing broadcast content and providing for the ability of delaying the broadcast content for a later time; and

FIG. 9 is a flow diagram of another method for managing content between a first client device and a second client device.

While the invention is susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

## DETAILED DESCRIPTION

What is described is a system and method for managing content between different client devices in various domains (such as vehicle, home, person, hotspot, workplace, or school). To this end, in one embodiment there is a method for managing content that is scheduled for broadcast during a first time period. The method comprises the steps of: receiving an input from a user on a first device to delay the content to a second time period, the second time period being different from the first time period; determining whether the first device is connected to a first wireless communication system; sending a data message to a host controller if the first device is connected to the first wireless communication system; and obtaining the content scheduled for broadcast during the first time to permit the user to playback the content during the second time period.

The broadcast content may be obtained in a variety of ways. The broadcast content could be obtained by the host controller from a content provider through an Internet connection. The broadcast content may also be obtained by the host controller through a digital satellite communication system that will store the broadcast content during the first time period. Broadcast content may also be obtained from local radio broadcasters over a radio tuner.

Moreover, the step of obtaining the content may further include a determination of whether a broadcast program is stored in whole or in part. If the broadcast program is stored in part, then the host system will store a first segment of the broadcast program and send the first segment of the broadcast program to the first device. The first device will then begin recording the second segment of the broadcast program and connect or overlap the first segment to the second segment of the broadcast program to provide seamless playback to the user.

In one embodiment, the first communication system is a short-range wireless communication system such as a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system. The first device may also include a second transceiver for communication with a second wireless communication system such as a cellular communication network. In a further embodiment, where the first device has a second transceiver, the method may further include the steps of: determining whether the first device is connected to the second wireless communication system and sending the data message over the second wireless communication system if a connection exists. If the first client device is not connected to either the first or second wireless communication system, the first client device may store the data message for later transmission.

In another embodiment, there is a method for managing content between a first client device and a second client device that is scheduled for broadcast during a first time period, where the first client device is in a first domain (such as a vehicle) and the second client device is in a second domain (such as in a home or on the person). The method comprises the steps of: receiving a data message from the first device over a wireless communication system, the data message being received in response to an input from a user on the first device to delay the content to a second time period; obtaining the content scheduled for broadcast during the first time period; and sending the content to the second device over the wireless communication system to permit the user to playback the content on the second device during the second time period. Here, the data message sent to the wireless gateway comprises a plurality of information elements that includes at least a store content instruction. Additionally, the method may further include the steps of determining a content type associated with the second device and formatting the content in the content type associated with the second device before sending the content to the second device.

In a further embodiment, there is a client device in a communication system where the system is capable of managing content that is scheduled for broadcast during a first time period. The client device includes at least a user interface, a first wireless transceiver, a controller, and a memory. The user interface is used to receive an input from a user to access content during a second time period where the second time period is different from the first time period. The first wireless transceiver is capable of wirelessly connecting the client device to a first wireless communication system. The controller, in response to the input from the user, determines whether the client device is connected to the first wireless communication system. If so, the controller generates and sends a data message to a remote host controller over the first communication system. The data message sent to the wireless gateway includes at least a delay content instruction and any additional information as described in more detail below. The memory is used for storing the content that is scheduled for broadcast during the first time period. The content stored in memory is received from the remote host controller in response to the data message sent to the remote host controller. The content may be an entire program broadcast or be a smaller segment of the original program broadcast.

In another embodiment, there is a host system for managing content for a mobile client device that is scheduled for broadcast during a first time period. The mobile client device is selected from one of the domains mentioned above. The host system includes at least a wireless gateway, a database, and a controller. The wireless gateway is configured to receive a data message from the client device that includes a delay content instruction. The data message comprises a plurality of information elements including at least a store content instruction. The database is configured to store information regarding the client device and any other client devices of the user. The controller is connected to the wireless gateway and the database. The controller is capable of identifying the client device from the database and obtaining the content scheduled for broadcast during the first time period. The controller then sends the content to the client device over the wireless communication system to permit the user to playback the content on the client device during the second time period.

Now, turning to the drawings, FIG. 1 illustrates a top-level block diagram of an example use of a communication system 20 for the present invention. Generally, the communication system 20 may include a plurality of client devices 22a, 22b, 22c, 22d that exist in various domains such as the vehicle, home, and person. For instance, a client device 22a in the vehicular domain may be incorporated into a vehicle's head unit and/or entertainment system. A client device 22b, 22c in the home domain may include items such as a personal computer, a home entertainment system, a digital audio recorder, and/or a digital video recorder. A client device 22d in the personal domain may include items such as a portable electronic device such as a personal digital assistant (PDA), a digital music player, and/or a portable phone. Client devices may also exist in other domains such as a hotspot, workplace, or school.

The communication system 20 also includes a central service provider 24 that can communicate with the client devices 22a-d through a combination of wireless and wired links. In one embodiment, the central service provider 24 is connected to a high-speed Internet network 34. The central service provider 24 may assist in managing the distribution and control of content between different client devices 22a-d. The central service provider 24 may further provide additional services or be incorporated into the services of other service providers such as a cellular service provider, a satellite broadcast content provider, a cable television content provider, or a stored Internet content provider. Moreover, some or all of the functions of managing the distribution and control of the content between client devices 22a-d may reside locally with a user in the home domain.

In one embodiment, where the client device 22a-d has a content receiver, the client devices 22a-d may receive broadcast content (audio and/or video) from a satellite content provider 26. This is shown in FIG. 1 through an exemplary satellite content provider and the receipt of a communication link A to the client devices 22a-d. In other embodiments, the client device 22a-d may also have a receiver to receive broadcast content via radio signals from local content broadcasters (not shown). The client device 22a-d may also receive stored content from an Internet content provider 27. The Internet content provider 27 may provide stored broadcast content to users or be part of a cable television provider. If the client device is a portable or mobile unit (such as a client device 22a in the vehicular domain or a client device 22d in the person domain), as explained in more detail below, the client device may receive stored broadcast content from a home gateway 28 or a hot spot gateway 30 through a short-range communication system.

As illustrated in FIG. 1, the client devices 22a-d may wirelessly communicate in the communication system 20 through different communication links (see communication arrows B-E). The wireless communication links B-E may be divided into individual sets (B-C, D-E) for different types of wireless communication protocols. For instance, the client devices 22a-d may include a first wireless transceiver that is capable of establishing a wireless communication link B-C through a short-range wireless communication system or network. In this embodiment, the short-range wireless communication system or network may include a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system. The short-range wireless transceiver in a client device 22a-d may provide direct communication to another client device 22a-d through a home wireless gateway 28 (such as from the client device 22a in the vehicle to the client device 22b, 22c in the home). Alternatively, the short-range wireless transceiver in a client device 22a-d may provide indirect wireless communication to another client device through a hot spot gateway 30 (such as from a client device 22a in the vehicle, through the hot spot gateway 30, to the client device 22b, 22c in the home). The wireless communication links over the short-range communication system can provide for the exchange of data messages as well as the transfer of stored broadcast content to client devices.

Additionally, the client devices 22a-d may include a second wireless transceiver that is capable of establishing a wireless communication link D-E through a second wireless communication system, such as a cellular communication system and network 32. The cellular communication system and network 32 can operate according to a wireless communication protocol such as a Global System for Mobile

Communications (GSM) protocol, a Universal Mobile Telphony System (UMTS) protocol, a Code Division Multiple Access (CDMA) protocol, a Wideband CDMA (WCDMA) protocol, a CDMA2000 protocol, or a Time Division Multiple Access (TDMA) protocol. Here, the cellular system or network 32 is further coupled to the Internet 34 by the cellular service provider 36 or other wired network on route to the central service provider 24, which may ultimately act as the host for data message communications between client devices 22a-d. Alternatively, the cellular system or network 32 is coupled to the Internet 34 or other wired network on route to another client device (such as from the client device 22a in the vehicle, through to the cellular network provider 36, to the client device 22b, 22c in the home). The above described wireless communication protocols are merely representative of existing protocols that could be used in the present invention.

An exemplary client device 22a in a vehicular domain will now be described in further detail with relation to FIGS. 2-4. In one embodiment, a client device 22a in a vehicle may comprise of two main components: a head unit 40 and a Telematics control unit 70. Although shown as separate components for purposes of illustration, one skilled in the art having the benefit of this disclosure will recognize that aspects of the head unit 40 and the Telematics control unit 70, and components thereof, can be combined or swapped. In any event, in the embodiment as shown in FIG. 2, the head unit 40 may include a controller 42, a user interface 44, 46, a content receiver 48, a first wireless transceiver 50, a memory 52.

The user interface includes a user input 44 and a user output 46. The user input 44 may include a keypad or a specific user dedicated set of buttons 54. The user may use the keypad or dedicated buttons to perform particular functions of the present invention, including a request to delay or reschedule content that is scheduled for a first time period. As described in more detail below, the user may request that broadcast content that is originally scheduled for a first time period be delayed to a second time period. The present invention is particular advantageous for users that want to re-schedule and delay an original broadcast to fit the user's personal schedule. For instance, if the user knows that they regularly commute to work at 7:00 am but would like to listen to a broadcast (such as a talk show) that begins at 6:30 am, the user may specify that the broadcast be delayed or otherwise time-slipped by 30 minutes. Alternatively, the broadcast content could be delayed to a later time after receiving further input from the user. In addition to allowing the user to provide a delay request through the user interface in the vehicular client device 22a, the user may also make this selection from another client device 22b-22d (such as a personal computer or another mobile device) that is directed to the vehicular client device 22a. Additionally, a microphone 56 in the client device 22a may also be used to pick up a speaker's voice in the vehicle, and/or possibly to give commands to the head unit 40 if it is equipped with a voice recognition module 58.

Ultimately, user inputs 44 are processed by the controller 42 in the head unit 40. The controller 42 also executes processes to provide outputs to the occupants in the vehicle through the user output 46, such as through a speaker 60 and/or a display 62. The speakers 60 employed can be the audio (radio) speakers normally present in the vehicle, of which there are typically four or more, although only one is shown for convenience.

The content receiver 48 in the client device 22a is capable of receiving broadcast content (audio and/or video) from a content provider 26. This is shown in FIG. 3 through an exemplary satellite content provider by the receipt of a communication link A to the client device 22a. The user may use the user interface to select one of a plurality of satellite channels that are received by the satellite receiver antenna 64. In other embodiments, as shown in FIG. 4, the client device 22a may also have an antenna 66 and a radio receiver to receive broadcast content via radio signals F from local content broadcasters in the geographic area. This type of broadcast content may be obtained through the content receiver 48 by tuning a radio receiver to a specific radio frequency.

Referring back to FIG. 2, the client device 22a may also obtain stored broadcast content (as well as exchange data messages with a host system or other client devices) through the use of the first wireless transceiver 50. The first wireless transceiver 50 is used for establishing wireless communications B-C over a short-range wireless communication system or network as discussed above. Although shown as part of the head unit 40, the first wireless transceiver 50 could also be included as part of the Telematics control unit 70 or other vehicle control unit. In any event, the short-range wireless transceiver 50 may provide wireless communication to a remote host system 90 (see FIG. 6) over a home gateway 28 or may provide wireless communication to a remote host controller 90 through a hot spot gateway 30.

Additionally, the client device 22a includes a memory 52 for storing broadcast content. In one embodiment, the type of content stored in memory 52 may include content that was scheduled for broadcast during an original broadcast time that the user wishes to playback during a later second time period. The content may be received through the first wireless transceiver 50 from the home gateway 28. For instance, assume that a user of the vehicular client device 22a would like to delay the listening of specific broadcast content that is scheduled during an original first time period. The user may select an input (either on the client device 22a or from another client device 22b-22d) to delay the playback of an original broadcast program content.

A remote host system 90 will obtain the content (in whole or in part) and send the content to the client 22a for storage in memory 52. The content would then be automatically played back to the user at the designated second time period.

In the embodiment where the client device 22a is incorporated into the head unit 40 of a vehicle, the controller 42 may also be configured to communicate via a vehicle bus interface 68 to a vehicle bus 80, which carries communication information and other operational data throughout the vehicle. This connection may be important to allow the controller 42 to utilize a cellular communication transceiver in the Telematics control unit 70 to transmit and receive data messages. In particular, the Telematics control unit 70 is similarly coupled to the vehicle bus 80, via a vehicle bus interface 72, and hence the head unit 40. The Telematics control unit 70 is responsible for sending and receiving voice or data communications to and from the vehicle over a cellular communication network. As such, it comprises a Telematics controller 74 to organize such communications, and a network access device (NAD) that includes a cellular wireless transceiver 76, which may be used as a second wireless transceiver for purposes of the present invention as described further below.

In an alternative embodiment, the client device 22a may be configured to seek out a local wireless communication device to determine whether a data message may be sent over a second wireless communication system. For instance, in FIG. 5, the controller 42 in the client device 22a may determine whether it has access to a second wireless communication network through another wireless communication device 110 that is within proximity of the short-range wireless transceiver 50. Here, the wireless communication device 110, such as a cellular phone, has its own controller 112, a short-range wireless transceiver 114 and a cellular wireless transceiver 116. The short-range wireless transceivers 50 and 114 may communication with each other through a short-range communication protocol. The benefit of this design is that it will allow the controller 42 to utilize a cellular transceiver in the local wireless communication device 110 to transmit and receive data messages, which may be used as a second wireless transceiver for purposes of the present invention as described further below.

In a further embodiment, the wireless communication device 110 in FIG. 5 could serve as a client device itself. For instance, the wireless communication device 110 may include a controller 112, a memory 115, and transceivers 114, 115. In this case, the audio or video from any content stored on the wireless communication device 110 could be sent or transmitted over the short-range wireless transceiver 114 to another system or device, such as the head unit 40 in a vehicle. The transmitted audio or video may then be outputted over the speakers 60 or display 62.

The client device 22a illustrated above can provide a great deal of communicative flexibility within vehicle to manage and control content with other client devices 22b-d owned by a user. For example, assume for purposes of illustration that a driver of the vehicle, using client device 22a, is driving to his/her workplace in the morning and hears an advertisement through their content receiver 48 for a broadcast program such as a talk show or a sporting event that is scheduled for broadcast during the driver's work day (e.g., beginning at 2 pm). However, the driver is unable to listen to the broadcast program during its originally scheduled time period because the driver will be at work. The present invention allows the driver to delay the playback of that originally broadcast program to a later time when the driver will be back inside the vehicle (e.g., the commute home from work at 5:30 pm). The driver can initiate this function by submitting an input that requests the content to start at a second time period such as 5:30 pm or at another time specified by the driver. In response to the user's input, the controller 42 in the client device 22a will send a data message to a remote host controller through either the first wireless transceiver 50 (short-range transceiver) or through the second wireless transceiver 72 (cellular transceiver), depending on the location of the client device 22a. The remote host controller will obtain the originally scheduled broadcast content and then send the content to the client device 22a for subsequent playback to the driver during the driver's designated time period. In one embodiment, the content may be sent to the client device 22a, from the remote host controller, through a hot spot gateway 30 that is located at the driver's workplace.

The example provided above presents a situation where the entire broadcast program is obtained by the home gateway 28 and sent to the client device for later playback. The present invention also solves the problem where the user of the client device 22a only wants to delay or time-slip the content over a relatively short period of time. For instance, in another illustrative example, the driver of a vehicle having a client device 22a may know that a regularly scheduled talk show starts at 6:30 am and would like to listen to the broadcast from the beginning of the talk show. However, the driver knows that they do not start their commute to work until 6:45 am (15 minutes later). In one embodiment, the driver can use a client device (such as a personal computer having a client device 22b) to delay the program by 15 minutes. Here, the driver would submit an input into the client device 22b to request a delay of the broadcast content during a second time period. The home gateway 28 would then obtain a first segment of the content (e.g., the first 15 minutes of the broadcast) and then send the first segment of the content to the vehicular client device 22a. The first segment of the content received by the vehicular client device 22a would then be stored in the memory 52 of the client device 22a. The vehicular client device 22a would then store the second segment of the content (e.g., the remainder of the program) itself through its own content receiver 48. The controller 42 would couple together or overlap the first and second segments of the program to provide seamless playback to the user of the vehicular client device 22a.

In one embodiment, before sending a data message that requests delaying content to a later time, the controller 42 would determine whether the client device 22a in the vehicle is connected to, or capable of sending messages over, a first wireless communication system. This may be done by having the controller 42 determine whether the first wireless transceiver 50 is connected to a wireless gateway 28 in the home or a hot spot gateway 30 mentioned above. If the client device 22a in the vehicle is not connected to, or not capable of sending data messages over, a first wireless communication system, the controller 42 may then make a determination whether the client device 22a in the vehicle is connected to, or capable of sending data message over, a second wireless communication system. The second wireless communication system in FIG. 2 is shown as a cellular wireless transceiver 72 in the Telematics control unit 70 and in FIG. 5 as a cellular wireless transceiver 116 in a portable wireless communication device 110. If the client device 22a is not connected to either the first or second communication system, then the controller 74 may store the data message for later transmission.

The data message may be formatted in a number of ways. In one embodiment, the information in the data message will depend on the type of content being played by the driver of the vehicle. For instance, assume that the content receiver 48 is a digital satellite receiver and that the type of content to be delayed is digital broadcast content. In this case, the data message may include a plurality of information elements or fields that includes at least a delay content instruction and a satellite channel identification. To enhance the functionality of the system, the data message may also include other information elements or fields such as an address (for identifying a host for the driver's content), a client device identification, a user identification, and a date and a time that the user selected the delay content command. This later information may be used to delay content that is not readily storable as well as provide specific information to a user about stored content for later selection.

In another instance, assume that the content receiver 48 is a radio tuner and the type of content to be delayed is analog broadcast content. In this case, the data message may include a plurality of information elements or fields that includes at least a delay content instruction and radio frequency identification. Additionally, to enhance functionality, the data message may also include other information elements or fields such as an address (for identifying a host for the driver's content), a client device identification, a content type identification, a user identification, and a date and a time that the user selected the delay content command.

FIG. 6 shows a block diagram of one embodiment of a remote host system 90 for managing content for purposes of delaying or time-slipping content across domains. In one embodiment, the remote host system includes a wireless gateway 28, a controller 92, and a database 94. Additionally, the system 90 may include other components such as a user inputs 96, user outputs 98, other memory 100, and a content receiver 102. In one embodiment, components of the host system may be included in one of the client devices 22b, such as a home personal computer. However, one skilled in the art having the benefit of this disclosure will recognize that aspects of the host system, and components thereof, can be combined or swapped with other types of devices and systems. For instance, instead of having the remote host system located in the home, the controller 92, database 94, and memory 100 may be located and managed remotely by the central service provider 24.

The wireless gateway 28 may include a wireless transceiver 104 and an Internet interface 106. In one embodiment, the wireless transceiver 104 is capable of wirelessly connecting to the first and second client devices 22a, 22c over a short-range wireless communication system through a system described above. The Internet interface 106 may be used for communicating with a central service provider 24. The connection with the central service provider 24 may also be used to facilitate communications with the first and second client device 22a, 22c, if the client devices are connected to other wireless gateways (such as a hot spot gateway 30) or connected to another wireless communication system (such as a cellular communication system). Moreover, the connection with the central service provider 24 may be used to facilitate access to content providers in addition to, or separate from, the content receiver 102.

In any event, in addition to transferring stored broadcast content to client devices, the wireless gateway 28 is used to receive data messages from the first and second client devices 22a, 22c, including any data messages that have an instruction to delay broadcast content. In one embodiment, as described above, data messages that are received from a client device include a plurality of information elements or fields that include at least a delay content instruction. If the content is broadcast content, the data message may further include information elements or fields that identify the type of client device, identify the content (a specific satellite channel or a radio frequency), and identify the time and date of the delay instruction.

The database 94 is used by the system to store information regarding features and operations of the different client devices 22a-d. The database 94 may also be used to store user preferences and keep track of user stored content. The database 94 may be configurable by the user to facilitate the storage and delay of content for different client devices 22a-d in various domains. For instance, the database 94 may identify the different types of client devices 22a-d, associated with a particular user. Referring to FIG. 7, the database 94 may also include information specific to individual client devices 22a-d such as: the client device identification (122); the client type (124); the domain (126); whether the client device has a short-range transceiver (128); whether the client device has a cellular transceiver (130); the size of memory on the client device (132); whether the client device retains stored content (134); whether the client device has access to Internet content (136); whether the client device has access to satellite content (138); whether the client device has access to RF radio content (140); and whether the client device has access to cable television (142).

Referring back to FIG. 6, the host controller 92 is connected to the wireless gateway 28 and the database 94. The host controller 92 is capable of receiving data messages from a first client device 22a and then using the database 94 to identify other client devices 22b-d associated with a specific user. As mentioned above, the data message will include an instruction to delay content and associated information about the delayed content. In one embodiment, the controller 92 is capable of generating and sending a second set of data messages to other client devices 22b-d after receiving the data message from the first client device 22a.

In another embodiment, the host controller 94 is capable of accessing content from the central service provider 24 in response to receiving the data message (containing the delay instruction) from the first client device 22a. This feature may be beneficial if the other client devices 22b-d do not have their own content receiver or is unable to store their own content at the scheduled time of the original broadcast. Additionally, after accessing content from the central service provider 24, the controller 92 may locally store the content in memory 100 or pass the content onto the other client devices 22c, 22d connected to the host system 90.

FIG. 8 shows a flow diagram illustrating one embodiment of a method for managing content that is scheduled for broadcast during a first time period (e.g., original broadcast time). In one embodiment, the method includes a process block 150 that receives an input from a user on the client device to delay the content. As mentioned above, this input may be an instruction by the user to delay the content (e.g., by pressing a button on a keypad or a dedicated delay button 54). The process then proceeds to decision block 152.

At decision block 152, the client device will make a determination whether the client device is connected to a first wireless communication system. In the context of embodiment described in FIGS. 2 and 3, this may include having the controller 42 determine whether a short-range wireless transceiver 50 is connected to another short-range communication device such as to a home wireless gateway 28 or a hot spot gateway 30. If the client device is connected to the first wireless communication system, then the process proceeds to process block 154.

At process block 154, the client device will generate and transmit a data message over the first communication system to a host system. In one embodiment, as described above, the data message may depend on the type of content being played by the user of the client device. For instance, assume that the type of content to be delayed is broadcast content from a satellite radio provider. In this case, the data message may include a plurality of information elements or fields that includes at least a delay content instruction and a broadcast content identification (such as a satellite channel). To enhance the functionality of the system, the data message may also include other information elements or fields such as an address, a client device identification, a content type identification, a user identification, and a date and a time that the user selected the delay content command.

If the client device is not connected to the first wireless communication system, then the process proceeds to decision block 156. In one embodiment, a determination is then made whether the user is capable of connection through a second wireless communication system. As described above, this may be accomplished by having the controller 42 determine whether a data message may be transmitted via a cellular wireless transceiver 72 in a connected Telematics control unit 70 (see FIG. 2). Alternatively, this may be accomplished by having the controller 42 determine whether a data message may be transmitted via a cellular wireless transceiver 116 in a wirelessly connected communication device 110 (see FIG. 5). Moreover, the decision on whether the user is capable of connecting to a second wireless communication system may include a determination of whether the user has subscribed to preferred services plan of the central service provider 24. If so, the process proceeds to process block 158 and where the client device will generate and send a data message over the second communication system.

If the client device is not connected to the first wireless communication system or the second wireless communication system, then the client device 22a will generate a data message but will store the data message instead of immediately transmitting the data message (block 160). The process will return to decision blocks 152 and156 to wait until the client device is connected to the first or second wireless communication system.

Once the data message is transmitted, at process block 162, the host system 90 will receive the data message from the client device over the first communication system or the second communication system. As mentioned above, the first communication system may be a short-range wireless communication system transmitted directly to a home gateway 28 or to the home gateway 28 through a remote hot spot gateway 30. The second communication system may be a cellular system that transmits the message to the host system 90 through a cellular network. In response, the host system 90 will obtain the content that is being delayed. As explained above, the content may be obtained from a variety of sources depending on the type of content being sought. For instance, the broadcast content can be obtained over an Internet connection 106. The broadcast content can also be obtained from a content receiver 102 such as a digital satellite receiver or a radio tuner. Any obtained content may then be sent to the client device for later playback to the user at the designated time for the delay or time-slip.

In one embodiment, the host system may further make a determination of whether the entire content can be obtained or only a portion of the content. This feature is particularly useful where the delay time is relatively short. For instance, when the original broadcast is still playing during the delay time period. Accordingly, at decision block 164, the host system 90 may determine whether the entire content can be obtained or only a portion of the content. If the entire broadcast can be obtained, then the process continues to block 166.

At process block 166, the host system 90 will obtain the entire broadcast content. In process block 168, the host system 90 will then send or transmit the broadcast content to the client device 22a. The client device 22a may be the same client device that made the delay request or may be a different client device 22b-d of the user. The broadcast content may be sent to the client device 22a through the home wireless gateway 28 or through a hot spot gateway 30, depending on the location of the client device 22a. At process block 170, the client device 22a will then store the broadcast content in its memory 52. The client device 22a will playback the content at the specified second time period (e.g., the delayed time period) in process block 172.

Referring back to decision block 164, if it is determined that only a portion of the content can be obtained by the host system 90, the process will then proceed to block 174 where the host system 90 will obtain a first segment of the broadcast content. At process block 176, the host system 90 will then send the first segment of the broadcast content to the client device 22a (or another designated client device 22b-d). Again, the first segment of the broadcast content may be sent to the client device 22a through the home wireless gateway 28 or through a hot spot gateway 30, depending on the location of the client device 22a. In process block 178, the client device 22a will store the first segment of the broadcast content that it received from the host system 90 and then begin recording the second segment of the broadcast content. At process block 180, the controller 42 of the client device 22a will then connect the stored first segment and the recording second segment to provide seamless playback to the user of the client device 22a. The client device 22a will playback the content at the specified second time period (e.g., the delayed time period) in process block 182, beginning with the start of the first segment.

FIG. 9 shows a flow diagram illustrating a further embodiment of a method for managing content that is scheduled for broadcast during a first time period (e.g., original broadcast time). This method is similar to the one described with relation to FIG. 8, but provides for the exchange of information between different client devices in different domains. In one embodiment, the method includes a process block 250 that receives an input from a user on a first device to delay the content. As mentioned above, this input may be an instruction by the user to delay the content (e.g., by pressing a button on a keypad or a dedicated delay button 54). The process then proceeds to decision block 252.

At decision block 252, the first device will make a determination whether the first device is connected to a first wireless communication system. In the context of embodiment described in FIGS. 2 and 3, this may include having the controller 42 determine whether a short-range wireless transceiver 50 is connected to another short-range communication device such as to a home wireless gateway 28 or a hot spot gateway 30. If the first device is connected to the first wireless communication system, then the process proceeds to process block 254.

At process block 254, the first device will generate and transmit a data message over the first communication system to the host system 90. In one embodiment, as described above, the data message may depend on the type of content being played by the user of the first device. For instance, assume that the type of content to be delayed is digital broadcast satellite content. In this case, the data message may include a plurality of information elements or fields that includes at least a delay content instruction and a broadcast content identification (such as a satellite channel). To enhance the functionality of the system, the data message may also include other information elements or fields such as an address, a client device identification, a content type identification, a user identification, and a date and a time that the user selected the delay content command.

If the first device is not connected to the first wireless communication system, then the process proceeds to decision block 256. In one embodiment, a determination is then made whether the user is capable of connection through a second wireless communication system. As described above, this may be accomplished by having the controller 42 determine whether a data message may be transmitted via a cellular wireless transceiver 72 in a connected Telematics control unit 70 (see FIG. 2). Alternatively, this may be accomplished by having the controller 42 determine whether a data message may be transmitted via a cellular wireless transceiver 116 in a wirelessly connected communication device 110 (see FIG. 5). Moreover, the decision on whether the user is capable of connecting to a second wireless communication system may include a determination of whether the user has subscribed to preferred services plan of the central service provider 24. If so, the process proceeds to process block 258 and where the first device will generate and send a data message over the second communication system.

If the first device is not connected to the first wireless communication system or the second wireless communication system, then the first device 22a will generate a data message but will store the data message instead of immediately transmitting the data message (block 260). The process will return to decision blocks 252 and 256 to wait until the first device is connected to the first or second wireless communication system.

Once the data message is transmitted, at process block 262, the host system 90 will receive the data message from the first device over the first communication system or the second communication system. As mentioned above, the first communication system may be a short-range wireless communication system transmitted directly to a home gateway 28 or to the home gateway 28 through a remote hot spot gateway 30. The second communication system may be a cellular system that transmits the message to the host system 90 through a cellular network.

In response, the host system 90 will generate and send a second data message to other second devices. As explained below, the second data message may be a modified data message that is addressed directly to the second devices associated with the user of the first device and based on the features and capabilities of the second device.

For instance, at decision block 264, the host system 90 may determine from the database 94 whether the second device 22c has access to the content that the user desires to be stored. If the second device has direct access to the same content, then at process block 266, the second device will receive a data message from the host system 90. The data message may include a plurality of information elements or fields that includes at least a delay content instruction and other instructional information. For instance, if the second device has a satellite receiver, the data message may also include a satellite channel and the time period for the original broadcast of the content. To enhance the functionality of the system, the data message may also include other information elements or fields such a first device identification, a user identification, and a date and a time that the user selected for the delay time period.

In response to the data message from the host system, the second device will then begin to record (or otherwise obtain) the broadcast content based on the information contained in the data message. In decision block 268, in one embodiment, the second device will wait until the second time period arrives (e.g., the delay time period) to playback the original broadcast content (block 270).

Alternatively, in process block 272, if the second device 22c does not have access to the same content or the second device 22c cannot obtain the broadcast content itself, then the host system 90 may record the content or access the content from a content service provider. The ability to access content from a content service provider can provide significant benefits to the user. For instance, if the data message originally sent to the host system is late (e.g., if the data message with the delay instruction was not sent immediately), the host system 90 may connect to a service provider to download the requested content. At process block 274, once the content is accessed by the host system 90, the host system 90 will transmit or send the accessed content to the second device. Here, the host system 90 may further use its database 94 of client devices to check memory constraints, user output abilities, and other characteristics of the second client device 22c. Depending on those characteristics or attributes, the host system 90 may format the content for playback on the second device 22c. The process then proceeds to decision block 276 and process block 270 where the second device resumes playback of the content at the specified delayed time period.

What has been described is a communication system in a vehicle that includes the capability of managing and controlling content between different devices in different domains. The system and method allow a user to delay the listening (or watching) of audio (or video) content to fit a user's personal schedule. The above description of the present invention is intended to be exemplary only and is not intended to limit the scope of any patent issuing from this application. The present invention is intended to be limited only by the scope and spirit of the following claims.

What is claimed is:

1. A method for managing content that is scheduled for broadcast during a first time period, the method comprising the steps of:

receiving an input from a user on a first device to delay the content to a second time period, the second time period being different from the first time period;

determining whether the first device is connected to a first wireless communication system;

sending a data message to a host controller if the first device is connected to the first wireless communication system, the data message comprising a plurality of information elements including at least a delay content instruction; and

obtaining the content scheduled for broadcast during the first time period to permit the user to playback the content during the second time period;

wherein the first device being in a domain selected from a group consisting of at least the home, vehicle, and person.

2. The method in claim 1, wherein the step of obtaining the content includes the host controller obtaining the content through an Internet connection from a content provider.

3. The method in claim 1, wherein the step of obtaining the content includes the host controller obtaining the content through a digital satellite communication system.

4. The method in claim 3, wherein the plurality of information elements of the data message also includes at least a satellite channel identification.

5. The method in claim 1, wherein the step of obtaining the content includes the host controller obtaining the content through a radio tuner.

6. The method in claim 5, wherein the plurality of information elements of the data message also includes at least a radio frequency identification.

7. The method in claim 1, wherein the content is a broadcast program and the step of obtaining the content includes the step of determining whether to obtain the entire broadcast program or a portion of the broadcast program.

8. The method in claim 7, wherein the host controller obtains a first segment of the broadcast program if it is determined to obtain a portion of the broadcast program and sends the first segment of the broadcast program to the first device.

9. The method in claim 8, wherein the first device stores a second segment of the broadcast program and connects the first segment of the broadcast program to the second segment of the broadcast program.

10. The method in claim 9, wherein the first device begins to automatically play the broadcast program to the user at a beginning of the first segment during the second time period.

11. The method in claim 1 further comprising the step of storing the data message in the first device if it is determined that the data message is not connected to the first wireless communication system, the data message being sent to the host controller when it is determined that the first device is connected to the first wireless communication system.

12. The method in claim 1, wherein the first wireless communication system is selected from a group consisting of a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system.

13. The method in claim 12, wherein the first device has a first transceiver to communicate with the first wireless communication system and a second transceiver to communicate with a second wireless communication system.

14. The method in claim 13, wherein the second wireless communication system is a cellular communication system.

15. The method in claim 14 further comprising the steps of:

determining whether the first device is connected to the second wireless communication system if it is determined that the first device is not connected to the first wireless communication system;

sending the data message to the host controller if the first device is connected to the second wireless communication system.

16. The method in claim 15 further comprising the step of storing the data message in the first device if it is determined that the data message is not connected to the second wireless communication system, the data message being sent to the host controller when it is determined that the first device is connected to the first wireless communication system or the second wireless communication system.

17. The method in claim 13 further comprising the steps of:

determining whether the user of the first device has subscribed to a preferred service plan; and

connecting to the second wireless communication system if it is determined that the user of the first device has subscribed to the preferred service plan.

18. The method in claim 1 further comprising the step of sending the obtained content to the first device to permit the user to playback the content during a second time period on the first device.

19. The method in claim 18 further comprising the steps of determining in the host controller a content type associated with the first device and formatting the content according to the content type associated with the first device before the step of sending the obtained content to the first device.

20. The method in claim 1 further comprising the step of sending the obtained content to a second device to permit the user to playback the content during a second time period on the second device, the first device being in a domain that is different than the second device.

21. The method in claim 20 further comprising the steps of determining in the host controller a content type associated with the second device and formatting the content according to the content type associated with the second device before the step of sending the obtained content to the second device.

22. The method in claim 20 further comprising the step of sending at least a portion of the obtained content from the second device to a third device to permit the user to playback the content during the second time period on the third device.

23. The method in claim 1 further comprising the step of sending the obtained content to a plurality of client devices to permit the user to playback the content during a second time period on at least one of the client devices.

24. The method in claim 1, wherein the first device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

25. A method for managing content for a first device that is scheduled for broadcast during a first time period, the first device being in a first domain that is selected from a group consisting of at least the home, vehicle, and person, the method comprising the steps of:

receiving a data message from the first device over a wireless communication system, the data message being received in response to an input from a user on the first device to delay the content to a second time period, the second time period being different from the first time period;

obtaining the content scheduled for broadcast during the first time period; and

sending the content to the first device over the wireless communication system to permit the user to playback the content on the first device during the second time period;

wherein the data message comprises a plurality of information elements including at least a delay content instruction.

26. The method in claim 25, wherein the step of obtaining the content includes obtaining the content through an Internet connection from a content provider.

27. The method in claim 25, wherein the step of obtaining the content includes obtaining the content through a digital satellite communication system.

28. The method in claim 27, wherein the plurality of information elements of the data message also includes at least a satellite channel identification.

29. The method in claim 25, wherein the step of obtaining the content includes obtaining the content through a radio tuner.

30. The method in claim 29, wherein the plurality of information elements of the data message includes at least a radio frequency identification.

31. The method in claim 25, wherein the content is a broadcast program and the step of obtaining the content includes the step of determining whether to obtain the entire broadcast program or a portion of the broadcast program.

32. The method in claim 31, wherein the step of obtaining the content includes obtaining a first segment of the broadcast program if it is determined to obtain a portion of the broadcast program.

33. The method in claim 25, wherein the wireless communication system is selected from a group consisting of a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system.

34. The method in claim 25, wherein the wireless communication system is a cellular communication system.

35. The method in claim 25 further comprising the steps of determining a content type associated with the first device and formatting the content in the content type associated with the first device before sending the content to the first device.

36. The method in claim 25, wherein the first device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

37. The method in claim 23 further comprising the step of sending the content from the first device to a second device to permit the user to playback the content on the second device.

38. The method in claim 23 further comprising the step of sending the content to a plurality of client devices to permit the user to playback the content on at least one of the client devices.

39. A method for managing content between a first device and a second device that is scheduled for broadcast during a first time period, the first device being in a first domain and the second device being in a second domain, the first domain and the second domain selected from a group consisting of at least the home, vehicle, and person, the method comprising the steps of:

receiving a data message from the first device over a wireless communication system, the data message being received in response to an input from a user on the first device to delay the content to a second time period, the second time period being different from the first time period;

obtaining the content scheduled for broadcast during the first time period; and

sending the content to the second device over the wireless communication system to permit the user to playback the content on the second device during the second time period.

40. The method in claim 39, wherein the step of obtaining the content includes obtaining the content through an Internet connection from a content provider.

41. The method in claim 39, wherein the step of obtaining the content includes obtaining the content through a digital satellite communication system.

42. The method in claim 41, wherein the plurality of information elements of the data message also includes at least a satellite channel identification.

43. The method in claim 39, wherein the step of obtaining the content includes obtaining the content through a radio tuner.

44. The method in claim 43, wherein the plurality of information elements of the data message also includes at least a radio frequency identification.

45. The method in claim 39, wherein the step of obtaining the content includes the step of determining whether the second device has access to the content.

46. The method in claim 45, wherein the step of obtaining the content includes the step of storing the content in a host system and sending the content to the second device if the second device does not have access to the content.

47. The method in claim 45, wherein the step of obtaining the content includes the step of generating and sending a second data message to the second device instructing the store the content if the second device has access to the content.

48. The method in claim 39, wherein the wireless communication system is selected from a group consisting of a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system.

49. The method in claim 39, wherein the wireless communication system is a cellular communication system.

50. The method in claim 39 further comprising the steps of determining a content type associated with the second device and formatting the content in the content type associated with the second device before sending the content to the second device.

51. The method in claim 39, wherein the first device and the second device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

52. A client device in a communication system, the communication system being capable of managing content that is scheduled for broadcast during a first time period between the client device and other client devices, the client device and other client devices being in different domains, the domains selected from a group consisting of at least the home, vehicle, and person, the client device comprising:

a user interface for receiving an input from a user to delay content to a second time period, the second time period being different from the first time period;

a first wireless transceiver that is capable of wirelessly connecting the client device to a first wireless communication system;

a controller, responsive to the input from the user to access the content during a second time period, for determining whether the client device is connected to the first wireless communication system and sending a data message to a remote host controller if the client device is connected to the first wireless communication system; and

a memory for storing the content that is scheduled for broadcast during the first time period to permit the user to playback the content during the second time period, the content stored in the memory received from the remote host controller in response to the data message sent to the remote host controller;

wherein the data message sent to the remote host controller comprises a plurality of information elements including at least a delay content instruction.

53. The client device in claim 52, wherein the first wireless communication system is selected from a group consisting of a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system.

54. The client device in claim 53 further comprising a second transceiver to communicate with a second wireless communication system.

55. The client device in claim 54, wherein the second wireless communication system is a cellular communication system.

56. The client device in claim 54, wherein the controller further determines whether the client device is connected to the second wireless communication system if it is determined that the client device is not connected to the first wireless communication system and sends the data message to the remote host controller if the client device is connected to the second wireless communication system.

57. The client device in claim 56, wherein the controller further stores the data message in the client device if it is determined that the data message is not connected to the second wireless communication system, the data message being sent to the remote host controller when it is determined that the client device is connected to the first wireless communication system or the second wireless communication system.

58. The client device in claim 52, wherein the client device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

59. A host system for managing content for a mobile client device that is scheduled for broadcast during a first time period, the mobile client device being in a domain selected from a group consisting of at least the home, vehicle, and person, the host system comprising:

a wireless gateway for receiving a data message over a wireless communication system from the client device, the data message being received in response to an input from a user on the client device to delay the content to a second time period, the data message comprising a plurality of information elements including at least a delay content instruction;

a database for storing information regarding the client device; and

a controller connected to the wireless gateway, the controller capable of identifying the client device from the database and obtaining the content scheduled for broadcast during the first time period;

wherein the controller sends the content to the client device over the wireless communication system to permit the user to playback the content on the client device during the second time period.

60. The host system in claim 59, wherein the controller obtains the content through an Internet connection from a content provider.

61. The host system in claim 59, wherein the controller obtains the content through a digital satellite communication system.

62. The host system in claim 61, wherein the information elements of the data message further including at least a satellite channel identification.

63. The host system in claim 59, wherein the step of obtaining the content includes obtaining the content through a radio tuner.

64. The host system in claim 63, wherein information elements of the data message further including at least a radio frequency identification.

65. The host system in claim 59, wherein the wireless communication system is selected from a group consisting of a Bluetooth™ communication system, an IEEE 802.11 communication system, an IEEE 802.16 communication system, an IEEE 802.20 communication system, a Wireless Universal Serial Bus (WUSB) system, or a Dedicated Short-Range Communications (DSRC) system.

66. The host system in claim 59, wherein the wireless communication system is a cellular communication system.

67. The host system in claim 59 wherein the controller is further capable of determining a content type associated with the client device and formatting the content in the content type associated with the client device before sending the content to the client device.

68. The method in claim 59, wherein the client device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

69. A method for managing content for a first device that is scheduled for broadcast during a first time period, the first device being in a first domain that is selected from a group consisting of at least the home, vehicle, and person, the method comprising the steps of:

receiving a data message from a user, the data message being received in response to an input from the user to delay the content to a second time period, the second time period being different from the first time period;

obtaining the content scheduled for broadcast during the first time period; and

sending the content to the first device over a wireless communication system to permit the user to playback the content on the first device during the second time period;

wherein the data message comprises a plurality of information elements including at least a delay content instruction.

70. The method in claim 69, wherein the step of obtaining the content includes obtaining the content through an Internet connection from a content provider.

71. The method in claim 69, wherein the step of obtaining the content includes obtaining the content through a digital satellite communication system.

72. The method in claim 71, wherein the plurality of information elements of the data message also includes at least a satellite channel identification.

73. The method in claim 69, wherein the step of obtaining the content includes obtaining the content through a radio tuner.

74. The method in claim 73, wherein the plurality of information elements of the data message includes at least a radio frequency identification.

75. The method in claim 69, wherein the content is a broadcast program and the step of obtaining the content includes the step of determining whether to obtain the entire broadcast program or a portion of the broadcast program.

76. The method in claim 69 further comprising the steps of determining a content type associated with the first device and formatting the content in the content type associated with the first device before sending the content to the first device.

77. The method in claim 69, wherein the first domain is the vehicle domain and the data message is generated by a personal computer in a second domain, the second domain being different from the first domain.

78. The method in claim 69 further comprising the step of sending the content to a plurality of client devices to permit the user to playback the content on at least one of the client devices.

79. A method for managing content for a first device that is scheduled for broadcast during a first time period, the first device being in a first domain that is selected from a group consisting of at least the home, vehicle, and person, the method comprising the steps of:

receiving a first data message from a user, the first data message being received in response to an input from the user to delay the content to a second time period, the second time period being different from the first time period;

using a database to obtain information about the first device;

generating a second data message that comprises a plurality of information elements including at least a delay content instruction; and

sending the second data message to the first device over a wireless communication system to permit the user to playback the content on the first device during the second time period.

80. The method in claim 79, wherein the plurality of information elements of the second data message also includes at least a satellite channel identification.

81. The method in claim 79, wherein the plurality of information elements of the second data message also includes at least a radio frequency identification.

82. The method in claim 79 further comprising the steps of determining a content type associated with the first device and the plurality of information elements of the second data message also includes at least information associated with the content type.

83. The method in claim 79, wherein the first domain is the vehicle domain and the first data message is generated by a personal computer in a second domain, the second domain being different from the first domain.

84. The method in claim 79 further comprising the step of sending the second data message to a plurality of client devices to permit the user to playback the content on at least one of the client devices.

## ABSTRACT

A system and method for managing content between different client devices in various domains (such as vehicle, home, and person). The system and method include receiving an input from a user on the first client device to delay the content. After receiving the input, the first client device determines whether the first client device is connected to a wireless communication system. If the first client device is connected to the wireless communication system, the first client device sends a data message to a host system. In one embodiment, the host system will then obtain the content (in whole or in part) after receiving the data message to permit the user to resume playback of the content on the first client device or another client device.

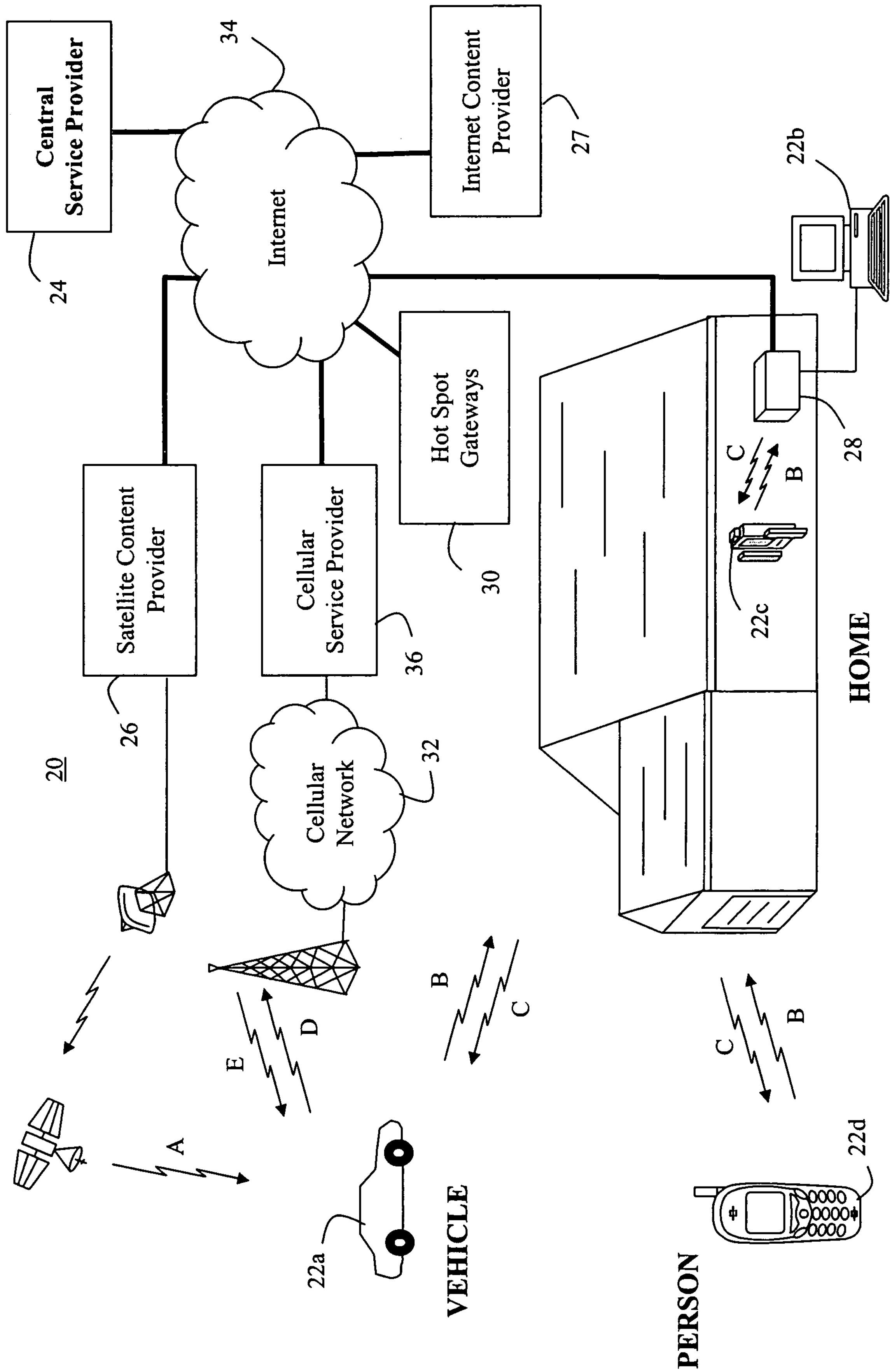

20
Central Service Provider
24
Internet
34
Internet Content Provider
27
Satellite Content Provider
26
Cellular Service Provider
36
Hot Spot Gateways
30
Cellular Network
32
22b
28
C
B
22c
HOME
A
E
D
B
C
22a
VEHICLE
C
B
22d
PERSON

FIG. 1

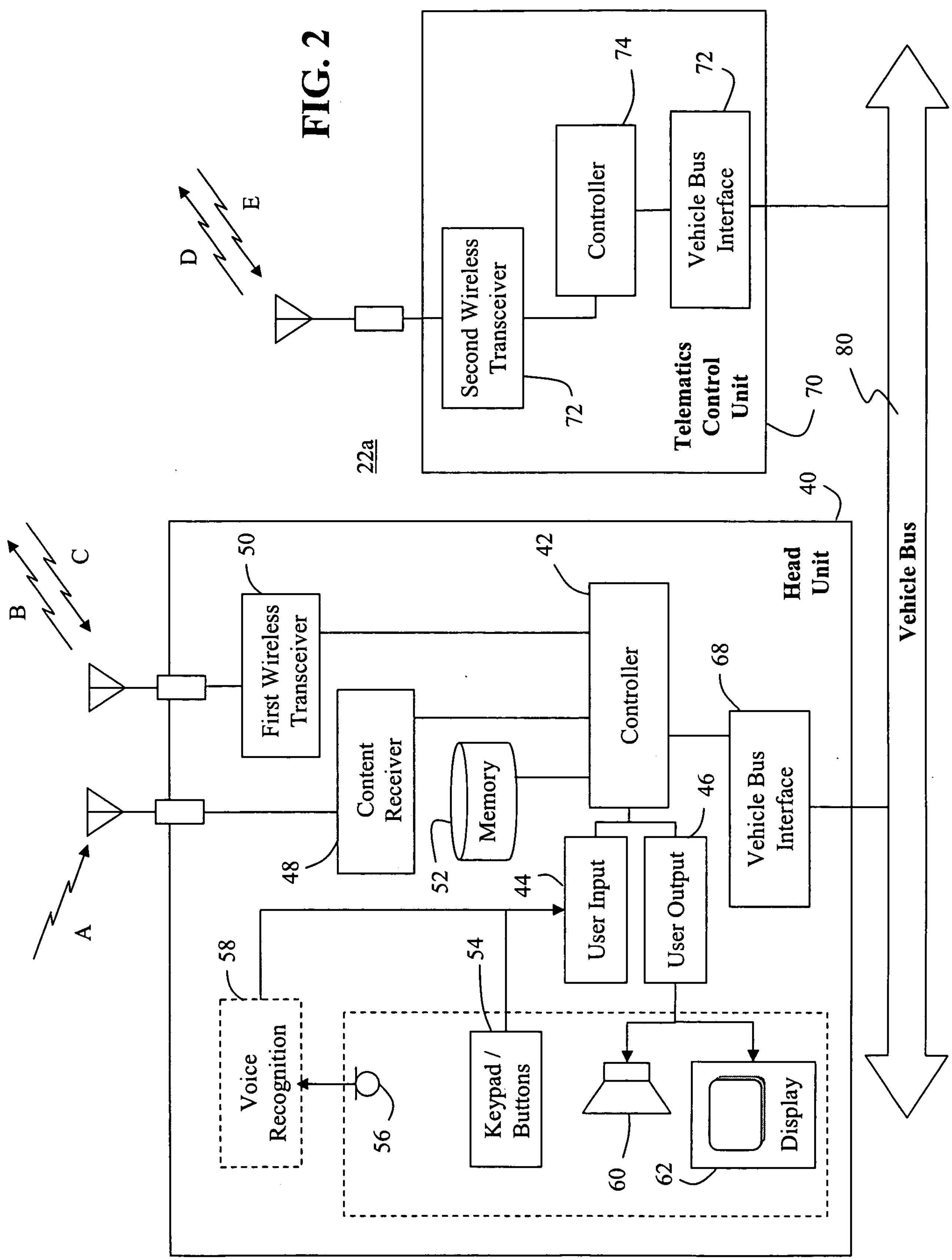

A
B
C
D
E
22a
First Wireless Transceiver
50
Content Receiver
48
Memory
52
Controller
42
User Input
44
User Output
46
Vehicle Bus Interface
68
Voice Recognition
58
Keypad / Buttons
54
56
60
62
Display
Head Unit
40
Second Wireless Transceiver
72
Controller
74
Vehicle Bus Interface
72
Telematics Control Unit
70
80
Vehicle Bus

FIG. 2

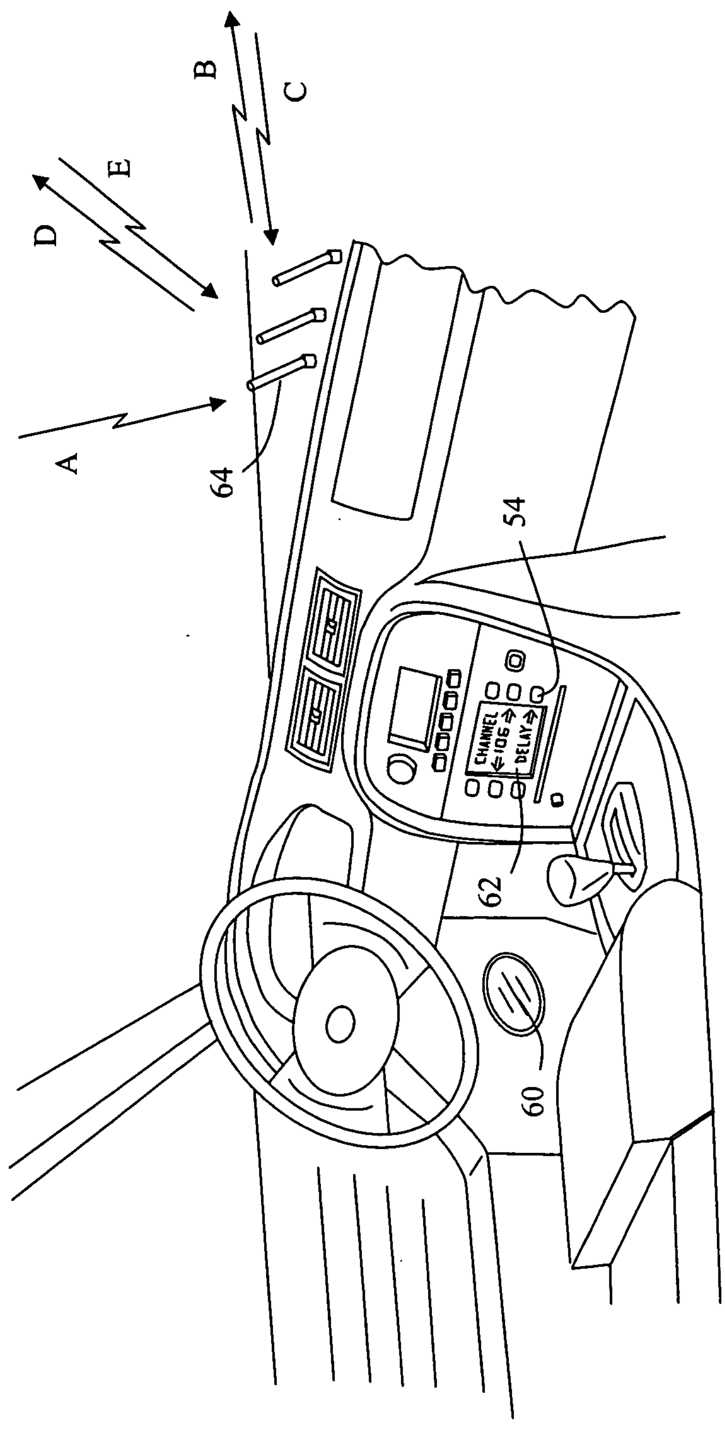



FIG. 3

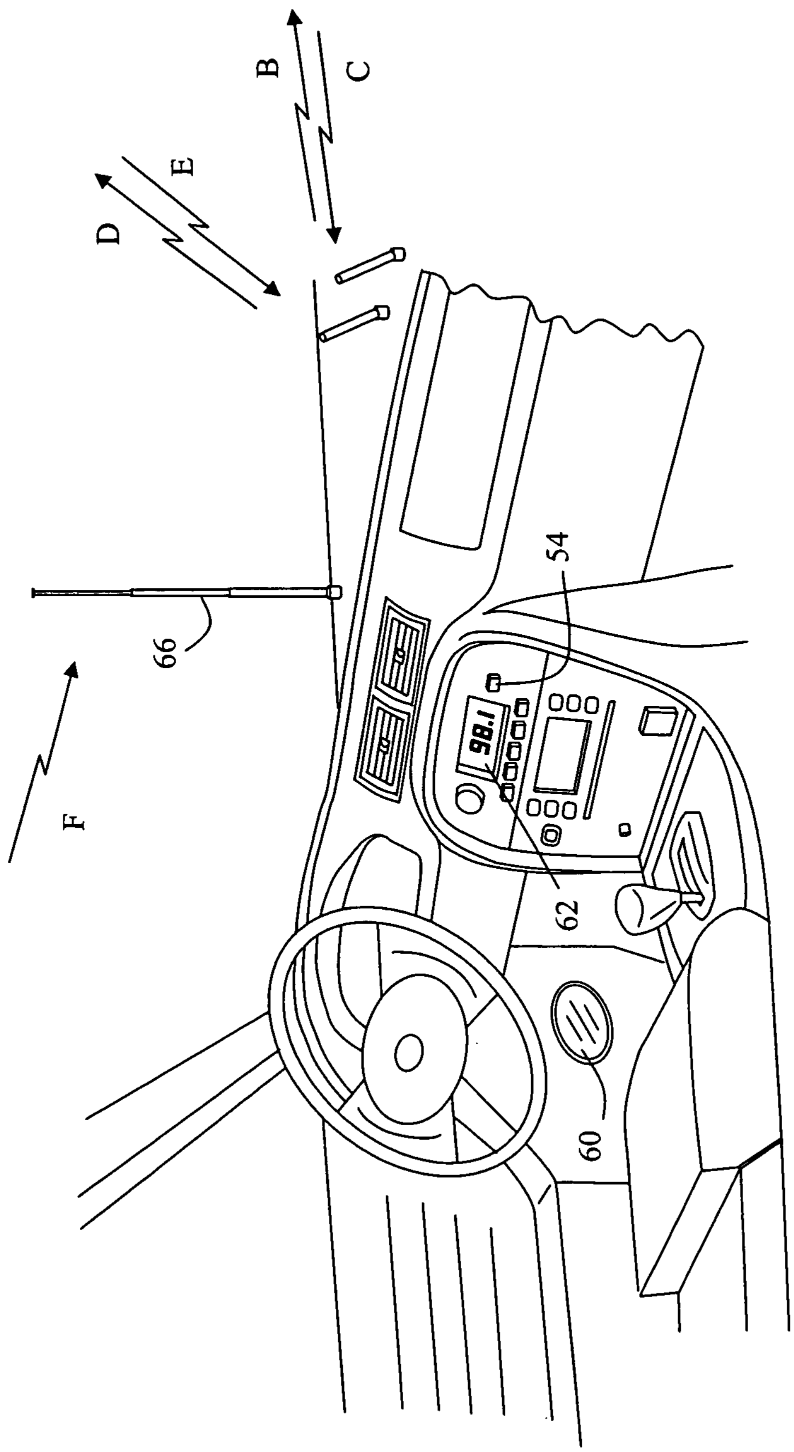



FIG. 4

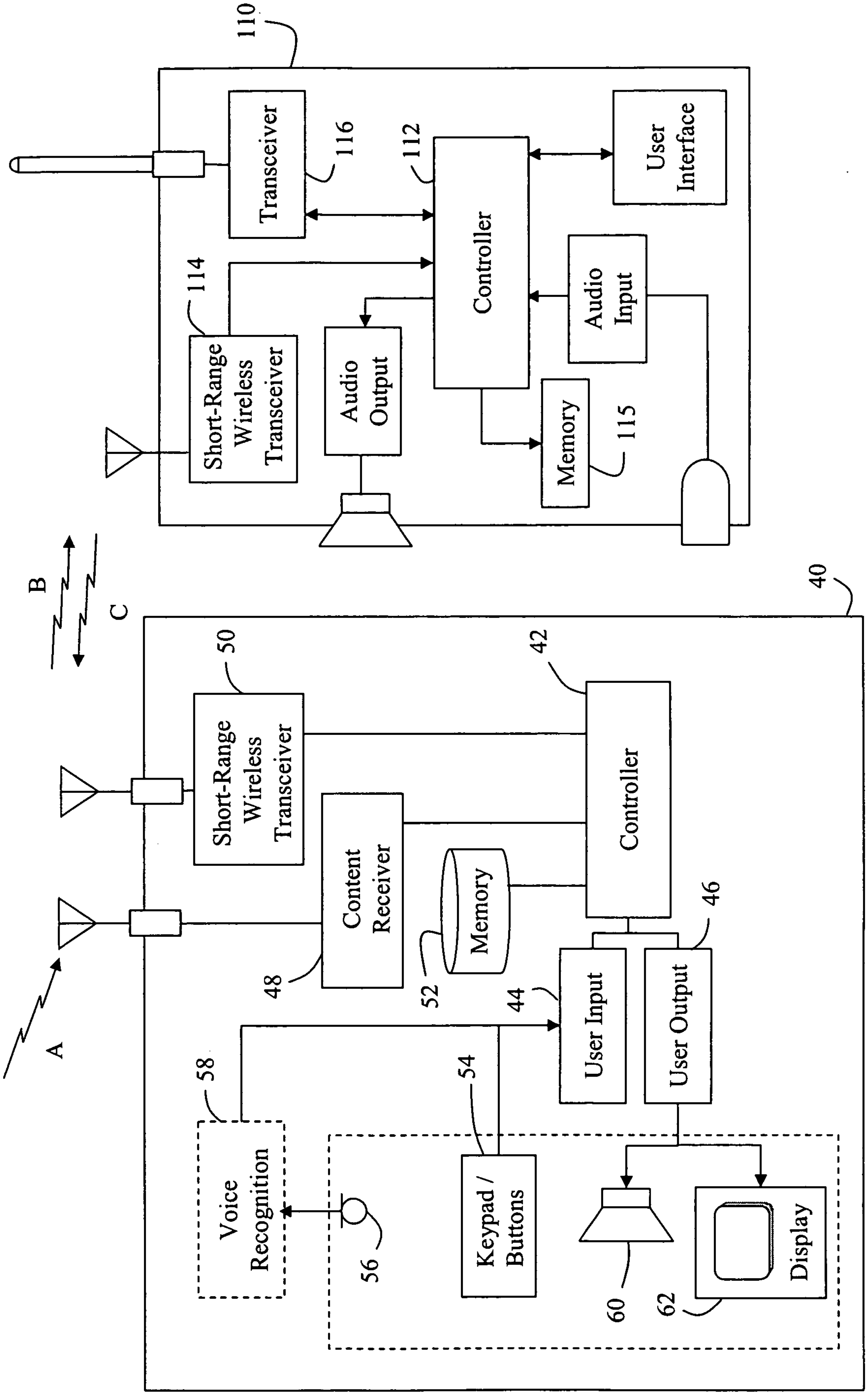

110
Transceiver
116
112
Controller
User Interface
114
Short-Range Wireless Transceiver
Audio Output
Audio Input
Memory
115
B
C
40
50
42
Short-Range Wireless Transceiver
Content Receiver
Controller
Memory
46
48
52
44
User Input
User Output
A
58
54
Voice Recognition
Keypad / Buttons
56
60
62
Display

FIG. 5

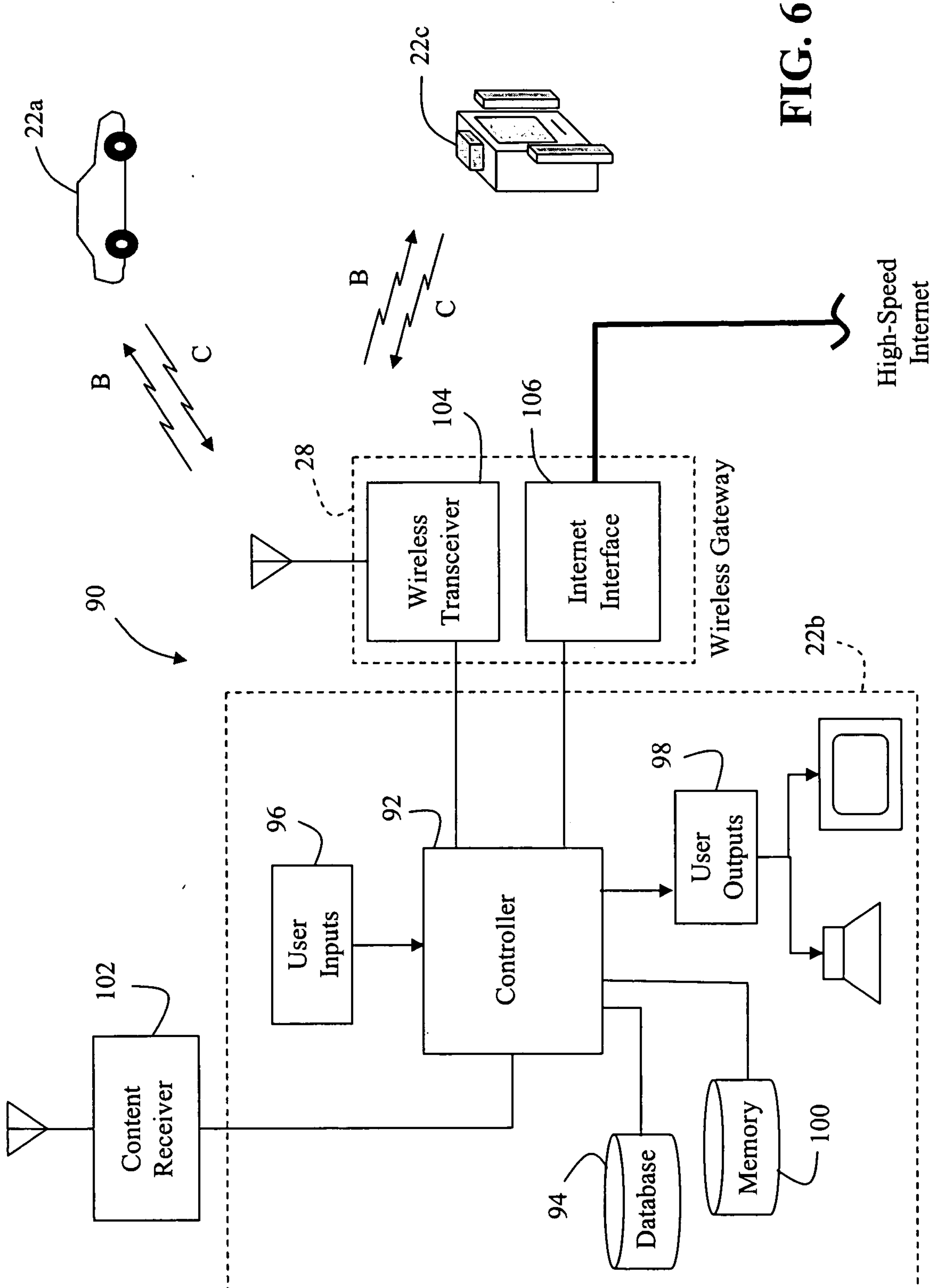

22a
22c
B
C
B
C
90
28
104
106
Wireless Transceiver
Internet Interface
Wireless Gateway
High-Speed Internet
22b
102
Content Receiver
96
User Inputs
92
Controller
98
User Outputs
94
Database
Memory
100

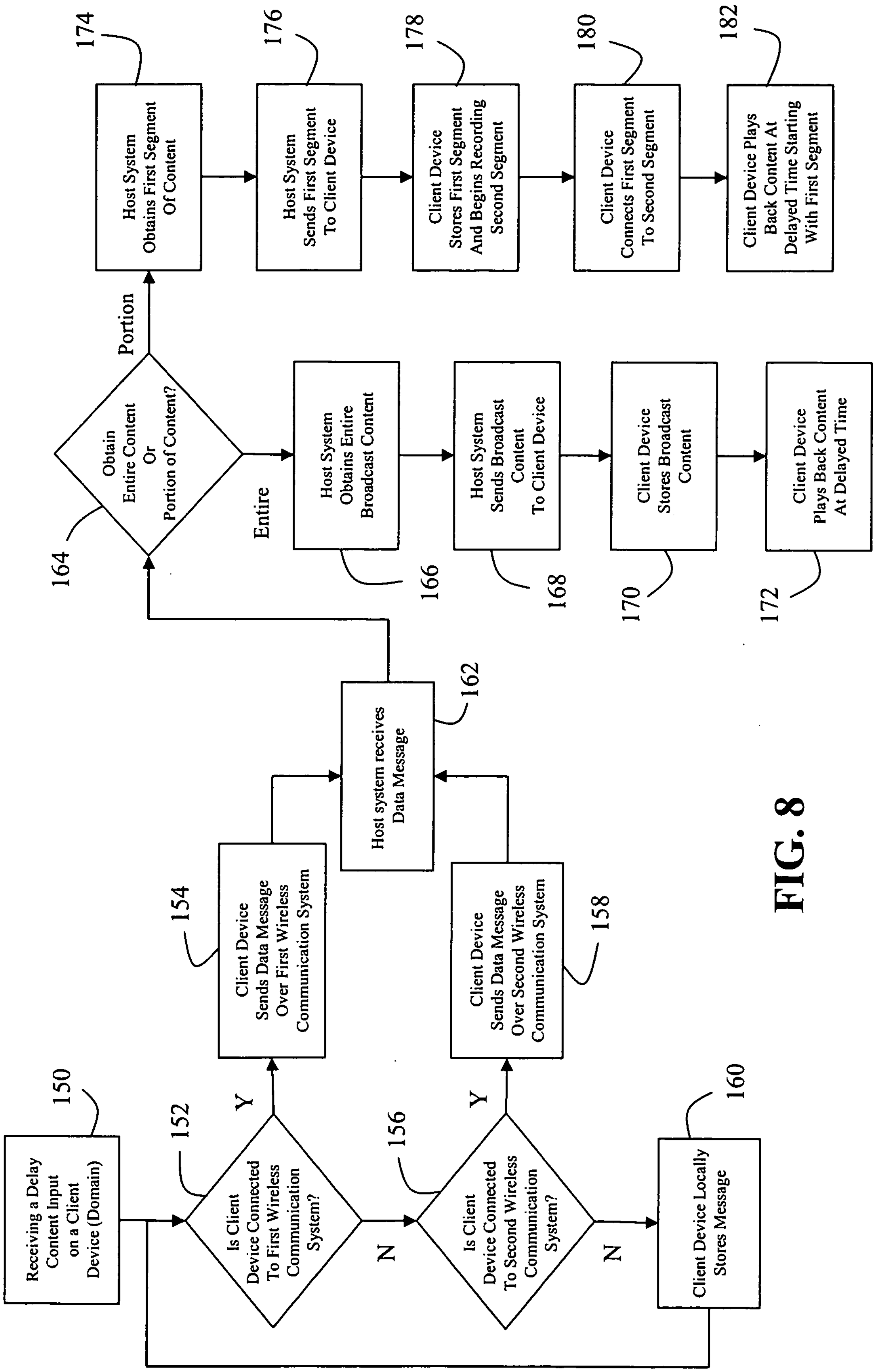
FIG. 6

94

**USER 1**

| Device ID (122) | Client Type (124) | Domain (126) | Short-Range Transceiver (128) | Cellular Transceiver (130) | Memory Size (132) | Stored Content (134) | Internet Content (136) | Satellite Content (138) | RF Radio Content (140) | Cable TV Content (142) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D1 | Head-Unit | Vehicle | Y | Y | XXX | Y | N | Y | Y | N | ••• |
| D2 | PC | Home | Y | N | XXX | Y | Y | Y | N | N | ••• |
| D3 | Audio Recorder | Home | Y | N | XXX | Y | N | N | N | N | |
| D4 | Video Recorder | Home | Y | N | XXX | Y | N | Y | N | N | |
| D5 | Cell Phone | Person | Y | Y | XXX | Y | N | N | N | N | |
| D6 | MP3 Player | Person | Y | N | XXX | Y | N | N | N | N | |
| D7 | PDA | Person | Y | Y | XXX | Y | Y | N | N | N | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |

FIG. 7



Receiving a Delay Content Input on a Client Device (Domain)
150
Is Client Device Connected To First Wireless Communication System?
152
Y
N
Client Device Sends Data Message Over First Wireless Communication System
154
Is Client Device Connected To Second Wireless Communication System?
156
Y
N
Client Device Sends Data Message Over Second Wireless Communication System
158
Client Device Locally Stores Message
160
Host system receives Data Message
162
Obtain Entire Content Or Portion of Content?
164
Entire
Portion
Host System Obtains Entire Broadcast Content
166
Host System Sends Broadcast Content To Client Device
168
Client Device Stores Broadcast Content
170
Client Device Plays Back Content At Delayed Time
172
Host System Obtains First Segment Of Content
174
Host System Sends First Segment To Client Device
176
Client Device Stores First Segment And Begins Recording Second Segment
178
Client Device Connects First Segment To Second Segment
180
Client Device Plays Back Content At Delayed Time Starting With First Segment
182


FIG. 8

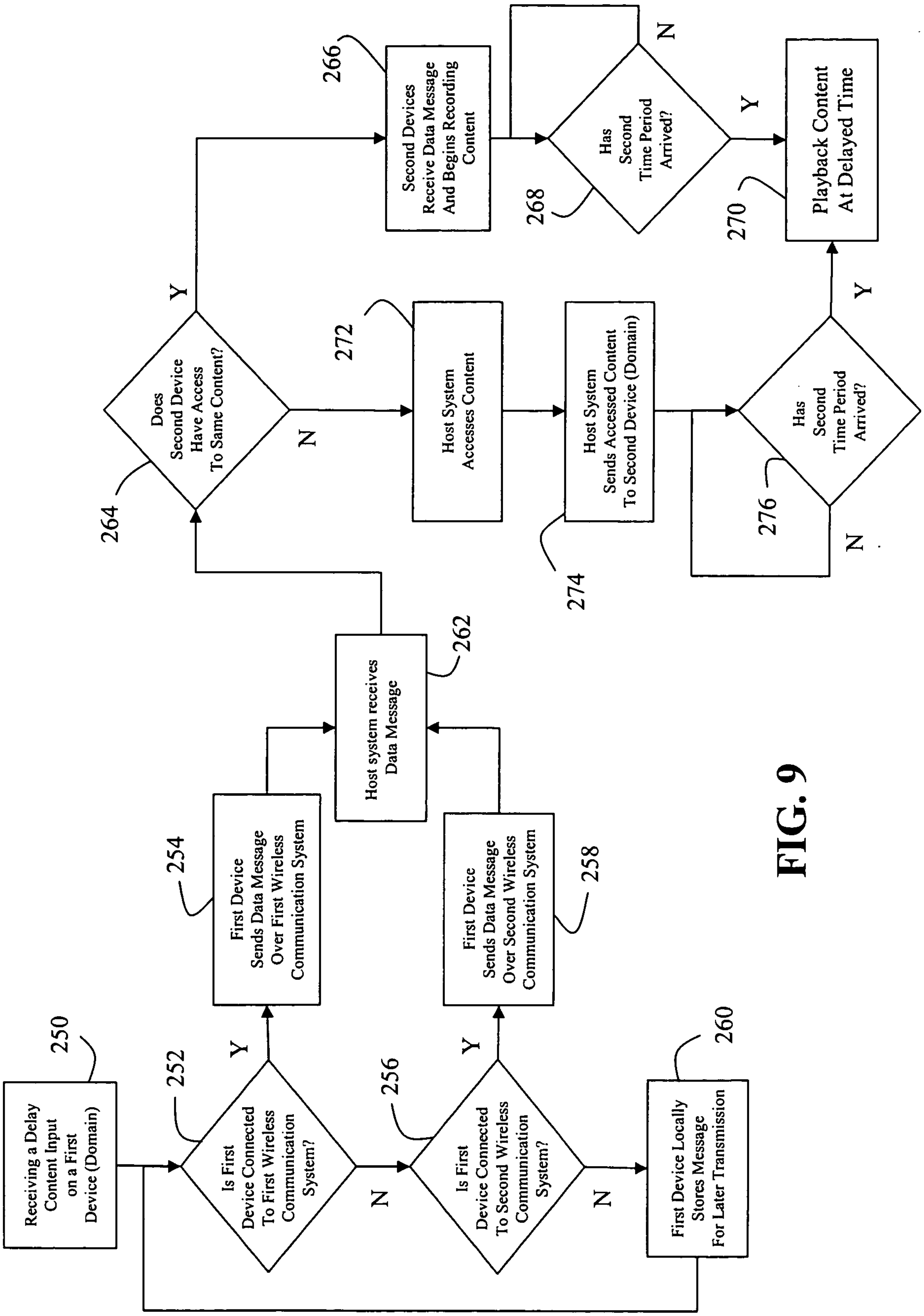

Receiving a Delay Content Input on a First Device (Domain)
250
Is First Device Connected To First Wireless Communication System?
252
Y
N
First Device Sends Data Message Over First Wireless Communication System
254
Is First Device Connected To Second Wireless Communication System?
256
Y
N
First Device Sends Data Message Over Second Wireless Communication System
258
First Device Locally Stores Message For Later Transmission
260
Host system receives Data Message
262
Does Second Device Have Access To Same Content?
264
Y
N
Second Devices Receive Data Message And Begins Recording Content
266
Has Second Time Period Arrived?
268
N
Y
Playback Content At Delayed Time
270
Host System Accesses Content
272
Host System Sends Accessed Content To Second Device (Domain)
274
Has Second Time Period Arrived?
276
Y
N

FIG. 9

# SYSTEM AND METHOD FOR MANAGING CONTENT BETWEEN DEVICES IN VARIOUS DOMAINS

## FIELD OF THE INVENTION

This invention in general relates to managing content between devices in various domains and, more particularly, to a system and method for pausing content in one device and resuming playback of the content in another device that may be in a different domain.

## BACKGROUND OF THE INVENTION

Digital video recorders exist that allow a user to pause and store video content and playback the video content at a later time. Conventional systems, however, are limited in that they only deal with storing video content and playing back the content in a single domain.

A need exists for a user to seamlessly listen to (or watch) audio (or video) content when moving from one domain (such as a vehicle) to a different domain (such as a home) without missing a portion of that content. For instance, assume that a user is driving in their vehicle and listening to an audio broadcast content such as a talk show or a sporting event. When the user arrives at their home and parks the vehicle, the user may wish to continue listening to the broadcast content at a later time and, preferably, in a different domain (such as their home). Currently, the user cannot pause the broadcast content in the vehicle and resume the broadcast content at the exact spot later in their home. The same applies for video, e.g., pause a digital video recorder at home and resume playing the video content on an entertainment system in the vehicle.

It is, therefore, desirable to provide a system and method to overcome or minimize most, if not all, of the preceding problems especially in the area of managing content in different domains.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a system having client devices in different domains supported by a server at a central service provider;

FIG. 2 is a block diagram of one embodiment of a client device;

FIG. 3 is a perspective view of the inside of a vehicle illustrating one embodiment of a client device in the vehicular domain;

FIG. 4 is a perspective view of the inside of a vehicle illustrating another embodiment of a client device in the vehicular domain;

FIG. 5 is a block diagram of another embodiment of a client device in communication with a separate local wireless communication device;

FIG. 6 is a block diagram of one embodiment of a communication system that communicates with different client devices in different domains;

FIG. 7 is a diagram of one embodiment of a database that may reside in a host system to access information and characteristics about a particular client device;

FIG. 8 is a flow diagram of one method for managing content between a first client device and a second client device; and

FIG. 9 is a flow diagram of another method for managing content between a first client device and a second client device.

While the invention is susceptible to various modifications and alternative forms, specific embodiments have been shown by way of example in the drawings and will be described in detail herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

## DETAILED DESCRIPTION

What is described is a system and method for managing content between different client devices in various domains (such as vehicle, home, person, hotspot, workplace, or school). To this end, in one embodiment there is a method for managing content between a first client device and a second client device. The method comprises the steps of: receiving an input from a user on the first client device to pause the content, determining whether the first client device is connected to a first wireless communication system, sending a data message to the second client device if the first client device is connected to the first wireless communication system; and storing the content in the second client device after receiving the data message to permit the user to resume playback of the content on the second client device.

The content may be a variety of types including broadcast content and stored content. Broadcast content may include digital content such as from a digital satellite communication system. Broadcast content may also include analog or digital content from local radio broadcasters over a radio tuner. The content may also be stored content in that a user may have the system store and manage personal content and content that is accessible from Internet content providers.

In one embodiment, the first communication system is a short-range wireless communication system such as a Bluetooth™ communication system or an IEEE 802.11 communication system. The first device may also include a second transceiver for communication with a second wireless communication system such as a cellular communication network. In a further embodiment, where the first device has a second transceiver, the method may further include the steps of: determining whether the first device is connected to the second wireless communication system and sending the data message over the second wireless communication system if a connection exists. If the first client device is not connected to either the first or second wireless communication system, the first client device may store the data message for later transmission.

In another embodiment, there is a method for managing content between a first client device and a second client device, where the first client device is in a first domain (such as a vehicle) and the second client device is in a second domain (such as in a home or on the person). The method comprises the steps of: receiving an input from a user on the first device to pause the content; determining whether the first device is connected to a first wireless communication system; and sending a data message to a wireless gateway if the first device is connected to the first wireless communication system. Here, the data message sent to the wireless gateway comprises a plurality of information elements that includes at least a pause content instruction. If the content is broadcast content, the information elements in the data message may further include a content identification (such as a satellite channel identification or a radio frequency identification). The information elements may also include a host address, a content type identification, a user identification, and a date and a time that the user selected the pause content command. If the content is stored content, the information elements in the data message may further include a content identification and a pause location identification as well as other information to enhance user functionality.

In a further embodiment, there is a client device in a communication system where the system is capable of managing content between the client device and other client devices in various domains. The client device includes at least a user interface, a first wireless transceiver, and a controller. The user interface is used to receive an input from a user to pause the content. The first wireless transceiver is capable of wireless connecting the client device to a first wireless communication system. The controller, in response to the input from the user to pause the content, determines whether the client device is connected to the first wireless communication system. If so, the controller generates and sends a data message to a wireless gateway over the first communication system. The data message sent to the wireless gateway includes at least a pause content instruction and any additional information as described briefly above and in more detail below.

In another embodiment, there is a communication system for managing content between a first client device and a second client device. The communication system includes at least a wireless gateway, a database, and a controller. The wireless gateway is configured to receive a first data message from the first client device. The data message comprises a plurality of information elements including at least a pause content instruction. The database is configured to store information regarding the first client device and the second client device. The controller is connected to the wireless gateway and the database. The controller is capable of identifying the second device from the database and sending a second data message (or the content itself) to the second client device in response to receiving the first data message from the first client device.

Now, turning to the drawings, FIG. 1 illustrates a top-level block diagram of an example use of a communication system 20 for the present invention. Generally, the communication system 20 may include a plurality of client devices 22a, 22b, 22c, 22d that exist in various domains such as the vehicle, home, and person. For instance, a client device 22a in the vehicular domain may be incorporated into a vehicle's head unit and/or entertainment system. A client device 22b, 22c in the home domain may include a personal computer, a home entertainment system, a digital audio recorder, and/or a digital video recorder. A client device 22d in the personal domain may include a portable electronic device such as a personal digital assistant (PDA), a digital music player, and/or a portable phone. Client devices may also exist in other domains such as a hotspot, workplace, or school.

The communication system 20 also includes a central service provider 24 that can communicate with the client devices 22a-d through a combination of wireless and wired links. In one embodiment, the central service provider 24 is connected to a high-speed Internet network 34. The central service provider 24 may assist in managing the distribution and control of content between different client devices 22a-d. The central service provider 24 may further provide additional services or be incorporated into the services of other service providers such as a cellular service provider, a satellite broadcast content provider, a cable television content provider, or a stored Internet content provider. Moreover, some or all of the functions of managing the distribution and control of the content between client devices 22a-d may reside locally with a user in the home domain.

In one embodiment, where the client device 22a-d has a content receiver, the client devices 22a-d may receive broadcast content (audio and/or video) from a satellite content provider 26. This is shown in FIG. 1 through an exemplary satellite content provider and the receipt of a communication link A to the client devices 22a-d. In other embodiments, the client device 22a-d may also have a receiver to receive broadcast content via radio signals from local content broadcasters (not shown). The client device 22a-d may also receive stored content from an Internet content provider 27. The Internet content provider 27 may provide stored music or video content to users or be part of a cable television provider. If the client device is a portable or mobile unit (such as a client device 22a in the vehicular domain or a client device 22d in the person domain), as explained in more detail below, the client device may receive stored content from a home gateway 28 or a hot spot gateway 30 through a short-range communication system.

As illustrated in FIG. 1, the client devices 22a-d may wirelessly communicate in the communication system 20 through different communication links (see communication arrows B-E). The wireless communication links B-E may be divided into individual sets (B-C, D-E) for different types of wireless communication protocols. For instance, the client devices 22a-d may include a first wireless transceiver that is capable of establishing a wireless communication link B-C through a short-range wireless communication system or network. In this embodiment, the short-range wireless communication system or network may include a Bluetooth™ communication system or an IEEE 802.11 communication system. The short-range wireless transceiver in a client device 22a-d may provide direct communication to another client device 22a-d through a home wireless gateway 28 (such as from the client device 22a in the vehicle to the client device 22b, 22c in the home). Alternatively, the short-range wireless transceiver in a client device 22a-d may provide indirect wireless communication to another client device through a hot spot gateway 30 (such as from a client device 22a in the vehicle, through the hot spot gateway 30, to the client device 22b, 22c in the home). The wireless communication links over the short-range communication system can provide for the exchange of data messages as well as the transfer of stored content to client devices.

Additionally, the client devices 22a-d may include a second wireless transceiver that is capable of establishing a wireless communication link D-E through a second wireless communication system, such as a cellular communication system and network 32. The cellular communication system and network 32 can operate according to a wireless communication protocol such as a Global System for Mobile Communications (GSM) protocol, a Code Division Multiple Access (CDMA) protocol, or a Time Division Multiple Access (TDMA) protocol. Here, the cellular system or network 32 is further coupled to the Internet 34 by the cellular service provider 36 or other wired network on route to the central service provider 24, which may ultimately act as the host for data message communications between client devices 22a-d. Alternatively, the cellular system or network 32 is coupled to the Internet 34 or other wired network on route to another client device (such as from the client device 22a in the vehicle, through to the cellular network provider 36, to the client device 22b, 22c in the home). The above described wireless communication protocols are merely representative of existing protocols that could be used in the present invention.

An exemplary client device 22a in a vehicular domain will now be described in further detail with relation to FIGS. 2-4. In one embodiment, a client device 22a in a vehicle may comprise of two main components: a head unit 40 and a Telematics control unit 70. Although shown as separate components for purposes of illustration, one skilled in the art having the benefit of this disclosure will recognize that aspects of the head unit 40 and the Telematics control unit 70, and components thereof, can be combined or swapped. In any event, in the embodiment as shown in FIG. 2, the head unit 40 may include a controller 42, a user interface 44, 46, a content receiver 48, a first wireless transceiver 50, a memory 52.

The user interface includes a user input 44 and a user output 46. The user input 44 may include a keypad or a specific user dedicated set of buttons 54. The user may use the keypad or dedicated buttons to perform particular functions of the present invention, including a request to pause content or a request to resume playback of content. Additionally, a microphone 56 may also be used to pick up a speaker's voice in the vehicle, and/or possibly to give commands to the head unit 40 if it is equipped with a voice recognition module 58.

Ultimately, user inputs 44 are processed by the controller 42 in the head unit 40. The controller 42 also executes processes to provide outputs to the occupants in the vehicle through the user output 46, such as through a speaker 60 and/or a display 62. The speakers 60 employed can be the audio (radio) speakers normally present in the vehicle, of which there are typically four or more, although only one is shown for convenience.

The content receiver 48 in the client device 22a is capable of receiving broadcast content (audio and/or video) from a content provider 26. This is shown in FIG. 3 through an exemplary satellite content provider by the receipt of a communication link A to the client device 22a. The user may use the user interface to select one of a plurality of satellite channels that are received by the satellite receiver antenna 64. In other embodiments, as shown in FIG. 4, the client device 22a may also have an antenna 66 and a radio receiver to receive broadcast content via radio signals F from local content broadcasters in the geographic area. This type of broadcast content may be obtained through the content receiver 48 by tuning a radio receiver to a specific radio frequency.

Referring back to FIG. 2, the client device 22a may also obtain stored content (as well as exchange data messages with a host system or other client devices) through the use of the first wireless transceiver 50. The first wireless transceiver 50 is used for establishing wireless communications B-C over a short-range wireless communication system or network. For instance, as mentioned above, the short-range wireless communication system or network may include a Bluetooth™ communication system or an IEEE 802.11 communication system. Although shown as part of the head unit 40, the first wireless transceiver 50 could also be included as part of the Telematics control unit 70 or other vehicle control unit. In any event, the short-range wireless transceiver 50 may provide wireless communication to another client device 22b-d over a home gateway 28 (such as a data message from the client device 22a in the vehicle to the client device 22b, 22c in the home) or may provide wireless communication to another client device or content provider through a hot spot gateway 30 (such as a data message from the client device 22a in the vehicle, through the hot spot gateway 30, to the client device 22b, 22c in the home; or such as obtaining stored content from the internet content provider 27, through the hot spot gateway 30, to the client device 22a).

Additionally, the client device 22a includes a memory 52 for storing content. The memory 52 is controlled by the controller 42 and is responsive to user inputs 44 and to certain data messages that may be received by the controller 42 from other client devices 22b-d. For instance, assume that a user of the vehicular client device 22a is listening to broadcast content on a specific satellite channel over the content receiver 48. The user may desire to pause the broadcast content while the user talks to another occupant in the vehicle. The user may then select an input on the keypad or other dedicated button 54 to pause the content. The system may also be configured to automatically generate a pause command upon the initiation of a user action such as the changing of a channel, selecting a mute button on the entertainment system, or turning off the entertainment system or vehicle.

In response to that input (generated directly or indirectly by the user), the controller 42 would use the memory 52 to begin storing the broadcast content on the specific satellite channel to enable the user to play back the content at a later time. Additionally, the memory 52 may be used for storing specific programs of the broadcast content that a user desires to playback at a time that is different from the original broadcast time. For example, as explained below, the controller 42 in the vehicular client device 22a may receive data messages from another client device 22b-d in a different domain (i.e. home or person). That data message may include an instruction to start the recording of a program of the broadcast content (in whole or in part) on a specific satellite channel. Moreover, the memory 52 may be used to download specific content from an Internet content provider 27 through a home gateway 28 or a hot spot gateway 30.

In the embodiment where the client device 22a is incorporated into the head unit 40 of a vehicle, the controller 42 may also be configured to communicate via a vehicle bus interface 68 to a vehicle bus 80, which carries communication information and other operational data throughout the vehicle. This connection may be important to allow the controller 42 to utilize a cellular communication transceiver in the Telematics control unit 70 to transmit and receive data messages. In particular, the Telematics control unit 70 is similarly coupled to the vehicle bus 80, via a vehicle bus interface 72, and hence the head unit 40. The Telematics control unit 70 is responsible for sending and receiving voice or data communications to and from the vehicle over a cellular communication network. As such, it comprises a Telematics controller 74 to organize such communications, and a network access device (NAD) that includes a cellular wireless transceiver 76, which may be used as a second wireless transceiver for purposes of the present invention as described further below.

In an alternative embodiment, the client device 22a may be configured to seek out a local wireless communication device to determine whether a data message may be sent over a second wireless communication system. For instance, in FIG. 5, the controller 42 in the client device 22a may determine whether it has access to a second wireless communication network through another wireless communication device 110 that is within proximity of the short-range wireless transceiver 50. Here, the wireless communication device 110, such as a cellular phone, has its own controller 112, a short-range wireless transceiver 114 and a cellular wireless transceiver 116. The short-range wireless transceivers 50 and 114 may communication with each other through a short-range communication protocol such as is set forth in the Bluetooth™ communication system and an IEEE 802.11 communication system. The benefit of this design is that it will allow the controller 42 to utilize a cellular transceiver in the local wireless communication device 110 to transmit and receive data messages, which may be used as a second wireless transceiver for purposes of the present invention as described further below.

The client device 22a illustrated above can provide a great deal of communicative flexibility within vehicle to manage and control content with other client devices 22b-d owned by a user. For example, assume for purposes of illustration that a driver of the vehicle, using client device 22a, is listening to a program of audio broadcast content such as a talk show or a sporting event on the content receiver 48. When the driver arrives at their home, the driver may select an input on the keypad or other dedicated button 54 to pause the playback of the content.

Additionally, as mentioned above, the system may also be configured to automatically generate a pause command input upon the initiation of a user action such as the changing of a channel, selecting a mute button on the entertainment system, or turning off the entertainment system or vehicle. In either event, in response to that input, the controller 42 would use the memory 52 to begin storing the broadcast content from the content receiver 48. This would permit the driver to playback the stored content at a later time in the vehicle. Additionally, in response to that input, the controller 42 would generate a data message for transmission to other client devices 22b-d.

In one embodiment, before sending a data message, the controller 42 would determine whether the client device 22a in the vehicle is connected to, or capable of sending messages over, a first wireless communication system. This may be done by having the controller 42 determine whether the first wireless transceiver 50 is connected to a wireless gateway 28 in the home or a hot spot gateway 30 mentioned above. If the client device 22a in the vehicle is not connected to, or not capable of sending data messages over, a first wireless communication system, the controller 42 may then make a determination whether the client device 22a in the vehicle is connected to, or capable of sending data message over, a second wireless communication system. The second wireless communication system in FIG. 2 is shown as a cellular wireless transceiver 72 in the Telematics control unit 70 and in FIG. 5 as a cellular wireless transceiver 116 in a portable wireless communication device 110. If the client device 22a is not connected to either the first or second communication system, then the controller 74 may store the data message for later transmission.

The data message may be formatted in a number of ways. In one embodiment, the information in the data message will depend on the type of content being played by the driver of the vehicle. For instance, assume that the content receiver 48 is a digital satellite receiver and that the type of content to be paused is broadcast content. In this case, the data message may include a plurality of information elements or fields that includes at least a pause content instruction and a satellite channel identification. To enhance the functionality of the system, the data message may also include other information elements or fields such as an address (for identifying a host for the driver's content), a client device identification, a user identification, and a date and a time that the user selected the pause content command. This later information may be used to access content that is not readily storable as well as provide specific information to a user about stored content for later selection.

In another instance, assume that the content receiver 48 is a radio tuner and the type of content to be paused is broadcast content. In this case, the data message may include a plurality of information elements or fields that includes at least a pause content instruction and a radio frequency identification. Additionally, to enhance functionality, the data message may also include other information elements or fields such as an address (for identifying a host for the driver's content), a client device identification, a content type identification, a user identification, and a date and a time that the user selected the pause content command.

In a further instance, assume that the client device 22a contains stored content and the user was listening to a specific song of the stored content or a previously stored broadcast program. In this case, the data message may include a plurality of information elements or fields that includes at least a pause content instruction, a content identification, and a pause location identification. Other information elements or fields that may be included, for enhancing functionality, include an address (for identifying a host for the driver's content), a client device identification, a user identification, and a date and a time that the user selected the pause content command.

FIG. 6 shows a block diagram of one embodiment of a host system 90 for managing content between a first client device (such a client device 22a in a vehicle) and a second client device (such as a client device 22c in the home). In one embodiment, the host system includes a wireless gateway 28, a controller 92, and a database 94. Additionally, the system 90 may include other components such as a user inputs 96, user outputs 98, other memory 100, and a content receiver 102. In one embodiment, components of the host system may be included in one of the client devices 22b, such as a home personal computer. However, one skilled in the art having the benefit of this disclosure will recognize that aspects of the host system, and components thereof, can be combined or swapped with other types of devices and systems. For instance, instead of having the host system located in the home, the controller 92, database 94, and memory 100 may be located and managed remotely by the central service provider 24.

The wireless gateway 28 may include a wireless transceiver 104 and an Internet interface 106. In one embodiment, the wireless transceiver 104 is capable of wirelessly connecting to the first and second client devices 22a, 22c over a short-range wireless communication system such as a Bluetooth™ communication system and an IEEE 802.11 communication system. The Internet interface 106 may be used for communicating with a central service provider 24. The connection with the central service provider 24 may also be used to facilitate communications with the first and second client device 22a, 22c, if the client devices are connected to other wireless gateways (such as a hot spot gateway 30) or connected to another wireless communication system (such as a cellular communication system). Moreover, the connection with the central service provider 24 may be used to facilitate access to content providers in addition to, or separate from, the content receiver 102.

In any event, in addition to transferring stored content to client devices, the wireless gateway 28 is used to receive data messages from the first and second client devices 22a, 22c, including any data messages that have an instruction to pause broadcast content or stored content. In one embodiment, as described above, data messages that are received from a client device include a plurality of information elements or fields that include at least a pause content instruction. If the content is broadcast content, the data message may further include information elements or fields that identify the type of client device, identify the content (a specific satellite channel or a radio frequency), and identify the time and date of the pause instruction. If the content is stored content, the data message may further include information elements or fields that identify the type of client device, identify the content (a specific artist, album, song, or stored broadcast program), and identify the location of the pause instruction.

The database 94 is used by the system to store information regarding features and operations of the different client devices 22a-d. The database 94 may also be used to store user preferences and keep track of user stored content. The database 94 may be configurable by the user to facilitate the storage and playback of content between different client devices 22a-d in various domains. For instance, the database 94 may identify the different types of client devices 22a-d, associated with a particular user. Referring to FIG. 7, the database 94 may also include information specific to individual client devices 22a-d such as: the client device identification (122); the client type (124); the domain (126); whether the client device has a short-range transceiver (128); whether the client device has a cellular transceiver (130); the size of memory on the client device (132); whether the client device retains stored content (134); whether the client device has access to Internet content (136); whether the client device has access to satellite content (138); whether the client device has access to RF radio content (140); and whether the client device has access to cable television (142).

Referring back to FIG. 6, the controller 92 is connected to the wireless gateway 28 and the database 94. The controller 92 is capable of receiving data messages from a first client device 22a and then using the database 94 to identify other client devices 22b-d associated with a specific user. As mentioned above, the data message will include an instruction to pause content and associated information about the paused content. In one embodiment, the controller 92 is capable of generating and sending a second set of data messages to other client devices 22b-d after receiving the data message from the first client device 22a. This may be beneficial if the other client devices 22b-d have their own content receiver and memory.

In another embodiment, the controller 94 is capable of accessing content from the central service provider 24 in response to receiving the data message (containing the pause instruction) from the first client device 22a. This feature may be beneficial if the other client devices 22b-d do not have their own content receiver. Additionally, after accessing content from the central service provider 24, the controller 92 may locally store the content in memory 100 or pass the content onto the other client devices 22c, 22d connected to the host system 90.

FIG. 8 shows a flow diagram illustrating one embodiment of a method for managing content between a first client device and a second client device. For purposes of illustration, the first client device will be in a first domain and the second client device will be in a second domain. In one embodiment, the method includes a process block 150 that receives an input from a user on the first device to pause the content. As mentioned above, this input may be a direct instruction by the user to pause the content (e.g., by pressing a button on a keypad or a dedicated pause button 54) or the input may be a result of some action taken by the user (e.g., changing a channel, selecting a mute button on the entertainment system, or turning off the entertainment system or vehicle). Moreover, the content may include either broadcast content or stored content. The process then proceeds to decision block 152.

At decision block 152, the first device will make a determination whether the first device is connected to a first wireless communication system. In the context of embodiment described in FIGS. 2 and 3, this may include having the controller 42 determine whether a short-range wireless transceiver 50 is connected to another short-range communication device such as to a home wireless gateway 28 or a hot spot gateway 30. If the first device is connected to the first wireless communication system, then the process proceeds to process block 154.

At process block 154, the first device will generate and transmit a data message over the first communication system to the second device. In one embodiment, as described above, the data message may depend on the type of content being played by the user of the first device. For instance, assume that the type of content to be paused is broadcast content. In this case, the data message may include a plurality of information elements or fields that includes at least a pause content instruction and a broadcast content identification (such as a satellite channel or a radio frequency). To enhance the functionality of the system, the data message may also include other information elements or fields such as an address, a client device identification, a content type identification, a user identification, and a date and a time that the user selected the pause content command.

In another instance, assume that the first device contains stored content and the user was listening to a specific song of the stored content or a previously stored broadcast program. In this case, the data message may include a plurality of information elements or fields that includes at least a pause content instruction, a content identification, and a pause location identification. Other information elements or fields that may be included, for enhancing functionality, include an address, a client device identification, a user identification, and a date and a time that the user selected the pause content command.

In any event, if the first device is not connected to the first wireless communication system, then the process proceeds to decision block 156. In one embodiment, a determination is then made whether the user is capable of connection through a second wireless communication system. As described above, this may be accomplished by having the controller 42 determine whether a data message may be transmitted via a cellular wireless transceiver 72 in a connected Telematics control unit 70 (see FIG. 2). Alternatively, this may be accomplished by having the controller 42 determine whether a data message may be transmitted via a cellular wireless transceiver 116 in a wirelessly connected communication device 110 (see FIG. 5). Moreover, the decision on whether the user is capable of connecting to a second wireless communication system may include a determination of whether the user has subscribed to preferred services plan of the central service provider 24. If so, the process proceeds to process block 158 and where the first device will generate and send a data message over the second communication system.

If the first device is not connected to the first wireless communication system or the second wireless communication system, then the first device 22a will generate a data message but will store the data message instead of immediately transmitting the data message (block 160). In this case, it is preferred that the information in the data message include a paused location for the content such as a date and a time or a record and a track. The process will return to decision blocks 152 and156 to wait until the first communication device is connected to the first or second wireless communication system.

Once the data message is transmitted, at process block 162, the host system 90 will receive the data message from the first device over the first communication system or the second communication system. As mentioned above, the first communication system may be a short-range wireless communication system transmitted directly to a home gateway 28 or to the home gateway 28 through a remote hot spot gateway 30. The second communication system may be a cellular system that transmits the message to the host system 90 through a cellular network. In response, the host system 90 will generate and send a second data message to other second devices. As explained below, the second data message may be a modified data message that is addressed directly to the second devices associated with the user of the first device and based on the features and capabilities of the second device.

For instance, at decision block 164, the host system 90 may determine from the database 94 whether the second device 22c has access to the content that the user desires to be stored. If the second device has direct access to the same content, then at process block 166, the second device will receive a data message from the host system 90. In response to the data message from the host system, the second device will then begin to record the content based on the information contained in the data message. As illustrated in decision block 168, in one embodiment, the second device will continue to store the content on a particular satellite channel or a radio frequency until the second device receives an input from the user to resume playback of the content on the second device. Alternatively, the second device may be configured to store the content for a predetermined period of time after receiving the pause instruction (such as 2 hours) or may be configured to store the content until a particular program on the broadcast content is completed.

Alternatively, in process block 170, if the second device 22c does not have access to the same content, then the host system may record the content itself or access the content from a content service provider. The ability to access content from a content service provider can provide significant benefits to the user. For instance, if the data message originally sent to the host system is late (e.g., if the data message with the paused instruction was not sent immediately), the host system 90 may connect to a service provider to download the requested content. As illustrated in decision block 172, in one embodiment, the host system 90 will continue to store the content or access the content until the second device receives an input from the user to resume playback of the content on the second device. At process block 174, once the user desires to playback the content, the host system 90 will transmit the stored or accessed content to the second device. The process then proceeds to block 176 where the second device resumes playback of the content.

FIG. 9 shows a flow diagram illustrating a further embodiment of a method for managing content between a first client device and a second client device. This method is similar to the one described with relation to FIG. 8, but adds additional steps 180, 182, and 184. In particular, if it is determined that the second device does not have access to the same content (decision block 164), the host system 90 will then access the content from another source (block 180). For instance, the host system 90 could obtain any paused content from the Internet content provider 27 shown in FIG. 1. In process block 182, the host system 90 will then transfer the accessed content to the second device 22c. The transferred content should also include a data message that identifies the content and paused location of the content. Then, in decision block 184, the second device will wait until the user has selected to resume the content on the second device 22c. At that point, the process proceeds to block 176 where the second device resumes playback of the content.

What has been described is a communication system in a vehicle that includes the capability of managing and controlling content between different devices in different domains. The system and method allow a user to seamlessly listen (or watch) audio (or video) content when moving from one domain (such as a vehicle) to a different domain (such as home) without missing a portion of that content. The above description of the present invention is intended to be exemplary only and is not intended to limit the scope of any patent issuing from this application. The present invention is intended to be limited only by the scope and spirit of the following claims.

What is claimed is:

1. A method for managing content between a first device and a second device, the method comprising the steps of:

receiving an input from a user on the first device to pause the content;

determining whether the first device is connected to a first wireless communication system;

sending a data message to the second device if the first device is connected to the first wireless communication system; and

storing the content in the second device after receiving the data message to permit the user to resume playback of the content on the second device;

wherein the first device being in a first domain and the second device being in a second domain, the first domain and the second domain selected from a group consisting of at least the home, vehicle, and person.

2. The method in claim 1, wherein the first device and the second device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

3. The method in claim 1, wherein the content is broadcast content and received by a digital satellite communication system.

4. The method in claim 3, wherein the data message comprises a plurality of information elements including at least a pause content instruction and a satellite channel identification.

5. The method in claim 1, wherein the content is broadcast content received by a radio tuner.

6. The method in claim 5, wherein the data message comprises a plurality of information elements including at least a pause content instruction and a radio frequency identification.

7. The method in claim 1, wherein the content is stored content received by a content provider through a wireless gateway.

8. The method in claim 1, wherein the content is video and the first device is a digital video recorder and the second device is a vehicular video entertainment system.

9. The method in claim 1, wherein the content is video and the first device is a digital video recorder and the second device is a portable digital video recorder.

10. The method in claim 1 further comprising the step of storing the data message in the first device if it is determined that the data message is not connected to the first wireless communication system.

11. The method in claim 1, wherein the first wireless communication system is at least one of a Bluetooth™ communication system and an IEEE 802.11 communication system.

12. The method in claim 11, wherein the first device has a first transceiver to communicate with the first wireless communication system and a second transceiver to communicate with a second wireless communication system.

13. The method in claim 12, wherein the second wireless communication system is a cellular communication system.

14. The method in claim 13 further comprising the steps of:

determining whether the first device is connected to the second wireless communication system if it is determined that the first device is not connected to the first wireless communication system;

sending the data message to the second device if the first device is connected to the second wireless communication system.

15. The method in claim 14 further comprising the step of storing the data message in the first device if it is determined that the data message is not connected to the second wireless communication system.

16. The method in claim 12 further comprising the steps of:

determining whether the user of the first device has subscribed to a preferred service plan; and

connecting to the second wireless communication system if it is determined that the user of the first device has subscribed to the preferred service plan.

17. The method in claim 1 further comprising the step of determining whether the content is broadcast content or stored content prior to sending the data message to the second device.

18. The method in claim 17 wherein, if it is determined that the content is broadcast content, the data message comprising a plurality of information elements including at least a pause content instruction and a satellite channel identification.

19. The method in claim 17 wherein, if it is determined that the content is stored content, the data message comprising a plurality of information elements including at least a pause content instruction, a content identification, and a pause location identification.

20. A method for managing content between a first device and a second device, the first device being in a first domain and the second device being in a second domain, the first domain and the second domain selected from a group consisting of at least the home, vehicle, and person, the method comprising the steps of:

receiving an input from a user on the first device to pause the content;

determining whether the first device is connected to a first wireless communication system; and

sending a data message to a wireless gateway if the first device is connected to the first wireless communication system;

wherein the data message sent to the wireless gateway comprises a plurality of information elements including at least a pause content instruction.

21. The method in claim 20, wherein the first device and the second device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

22. The method in claim 20, wherein the content is broadcast content and received by a digital satellite communication system.

23. The method in claim 22, wherein the information elements in the data message sent to the wireless gateway further comprises a satellite channel identification.

24. The method in claim 20, wherein the content is broadcast content received by a radio tuner.

25. The method in claim 24, wherein the information elements in the data message sent to the wireless gateway further comprises a radio frequency identification.

26. The method in claim 20, wherein the content is stored content received by a content provider through a wireless gateway.

27. The method in claim 20, wherein the content is video and the first device is a digital video recorder and the second device is a vehicular video entertainment system.

28. The method in claim 20, wherein the content is video and the first device is a digital video recorder and the second device is a portable digital video recorder.

29. The method in claim 20 further comprising the step of storing the data message in the first device if it is determined that the data message is not connected to the first wireless communication system.

30. The method in claim 20, wherein the first wireless communication system is at least one of a Bluetooth™ communication system and an IEEE 802.11 communication system.

31. The method in claim 30, wherein the first device has a first transceiver to communicate with the first wireless communication system and a second transceiver to communicate with a second wireless communication system.

32. The method in claim 31, wherein the second wireless communication system is cellular communication system.

33. The method in claim 20 further comprising the steps of:

receiving the data message in a host system, the host system connected to the wireless gateway;

determining in the host system whether the second device has access to the content;

sending a second data message to the second device if it is determined that the second device has access to the content.

34. The method in claim 20 further comprising the steps of:

receiving the data message in a host system, the host system connected to the wireless gateway;

accessing the content from a central service provider in response to receiving the data message in the host system.

35. The method in claim 34 further comprising the step of sending the content accessed from the central service provider to the second device in response to a playback instruction by the user.

36. A client device in a communication system, the communication system being capable of managing content between the client device and other client devices, the client device and other client devices being in other domains, the domains selected from a group consisting of at least the home, vehicle, and person, the client device comprising:

a user interface for receiving an input from a user to pause the content;

a first wireless transceiver that is capable of wirelessly connecting the client device to a first wireless communication system;

a controller, responsive to the input from the user to pause the content, for determining whether the client device is connected to the first wireless communication system and sending a data message to a wireless gateway if the client device is connected to the first wireless communication system;

wherein the data message sent to the wireless gateway comprises a plurality of information elements including at least a pause content instruction.

37. The client device in claim 36, wherein the client device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

38. The client device in claim 36, wherein the client device further comprises a satellite radio receiver, the content being broadcast content received from the satellite radio receiver.

39. The client device in claim 38, wherein the plurality of information elements of the data message further includes at least a satellite channel identification.

40. The client device in claim 36, wherein the client device further comprises a radio tuner, the content being broadcast content received from the radio tuner.

41. The client device in claim 40, wherein the plurality of information elements of the data message further includes at least a radio frequency identification.

42. The client device in claim 36, wherein the content is stored content received by a content provider through a wireless gateway.

43. The client device in claim 36, wherein the content is video and the client device is a home digital video recorder.

44. The client device in claim 36, wherein the first wireless communication system is at least one of a Bluetooth™ communication system and an IEEE 802.11 communication system.

45. The client device in claim 44, wherein the client device further comprises a second wireless transceiver that is capable of wireless connecting the client device to a cellular wireless communication system.

46. The client device in claim 45, wherein the controller sends the data message through the second wireless transceiver if the client device is not connected to the first wireless communication system.

47. The client device in claim 36, wherein the controller further determines whether the user of the client device has subscribed to a preferred service plan and sends the data message through the second wireless transceiver if the client device has subscribed to the preferred service plan.

48. The client device in claim 36, wherein the controller further determines whether the content is broadcast content or stored content prior to sending the data message to the wireless gateway.

49. The client device in claim 48, wherein the plurality of information elements of the data message further includes at least a satellite channel identification if it is determined that the content is broadcast content.

50. The client device in claim 48, wherein the plurality of information elements of the data message further includes at least a content identification and a pause location identification if it is determined that the content is stored content.

51. The client device in claim 36, wherein the wireless gateway is in the home domain and connected to a host system, the host system having a database that contains information about the other client devices associated with the user.

52. A communication system for managing content between a first device and a second device, the communication system comprising:

a wireless gateway for receiving a first data message from the first device, the first data message comprising a plurality of information elements including at least a pause content instruction;

a database for storing information regarding the first device and the second device; and

a controller connected to the wireless gateway, the controller capable of identifying the second device from the database and sending a second data message to the second device in response to receiving the first data message from the first device;

wherein the first device being in a first domain and the second device being in a second domain, the first domain and the second domain selected from a group consisting of at least the home, vehicle, and person.

53. The communication system in claim 52, wherein the first device and the second device is selected from a group consisting of a vehicular entertainment system, a home entertainment system, and a portable electronic device.

54. The communication system in claim 52, wherein the content is broadcast content and received by a digital satellite communication system.

55. The communication system in claim 54, wherein the plurality of information elements of the first data message further includes at least a satellite channel identification.

56. The communication system in claim 52, wherein the content is broadcast content received by a radio tuner.

57. The communication system in claim 56, wherein the plurality of information elements of the first data message further includes at least a radio frequency identification.

58. The communication system in claim 52, wherein the content is stored content received by a content provider through a wireless gateway.

59. The communication system in claim 52, wherein the content is video and the first device is a digital video recorder and the second device is a vehicular entertainment system.

60. The communication system in claim 52, wherein the wireless gateway includes a wireless transceiver that is capable of wirelessly connecting to the first device and the second device over a wireless communication system, the wireless communication system being at least one of a Bluetooth™ communication system and an IEEE 802.11 communication system.

61. The communication system in claim 52 further comprising of an Internet interface for communicating with a central service provider.

62. The communication system in claim 61, wherein the controller is further capable of accessing the content from the central service provider in response to receiving the first data message.

63. The communication system in claim 62 further comprising a memory for storing content accessed from the central service provider.

64. The communication system in claim 61, wherein the wireless gateway is capable of receiving a playback data message from the second device, the second data message comprising a plurality of information elements including at least a playback instruction.

65. The communication system in claim 64, wherein the controller is further capable of transferring content to the second device that was accessed from the central service provider in response to receiving the playback data message.

66. The communication system in claim 52 further comprising a memory for storing content, wherein the controller stores content in response to receiving the first data message from the first device.

67. The communication system in claim 66, wherein the wireless gateway is capable of receiving a playback data message from the second device, the second data message comprising a plurality of information elements including at least a playback instruction.

68. The communication system in claim 67, wherein the controller is further capable of transferring content to the second device that was stored in memory in response to receiving the playback data message.

69. The communication system in claim 52, wherein the first device includes a satellite radio receiver and the second device includes a satellite radio receiver.

70. The communication system in claim 69, wherein the controller is further capable of identifying whether the second device has access to the same content as the first device and, if so, the second data message sent to the second device comprising a plurality of information elements including at least a pause content instruction, a satellite channel identification, and a store content instruction.

71. The communication system in claim 70, wherein, if the second device does not have access to the same content as the first device, the controller is capable of accessing the content from an Internet content provider and transfers the content to the second client device.

72. The communication system in claim 52, wherein the first device includes a radio tuner and the second device includes a radio tuner.

73. The communication system in claim 72, wherein the controller is further capable of identifying whether the second device has access to the same content as the first device and, if so, the second data message sent to the second device comprising a plurality of information elements including at least a pause content instruction, a radio frequency identification, and a store content instruction.

74. The communication system in claim 73, wherein, if the second device does not have access to the same content as the first device, the controller is capable of accessing the content from an Internet content provider and transfers the content to the second client device.

75. The communication system in claim 52, wherein the first device is an audio entertainment system and the second device is a digital video recorder.

76. The communication system in claim 75, wherein the controller is further capable of identifying that the second device is a digital video recorder and, if so, the second data message sent to the second device comprising a plurality of information elements including at least a pause content instruction, a channel identification, and a store content instruction.

**ABSTRACT**

A system and method for managing content between different client devices in various domains (such as vehicle, home, and person). The system and method include receiving an input from a user on the first client device to pause the content. After receiving the input, the first client device determines whether the first client device is connected to a wireless communication system. If the first client device is connected to the wireless communication system, the first client device sends a data message to the second client device through a host system. In one embodiment, the second client device will then store the content in the second client device after receiving the data message to permit the user to resume playback of the content on the second client device. In another embodiment, the host system will store the content itself or access the content from a content provider and transfer the content directly to the second device with a data message that indicates the paused location of the content.

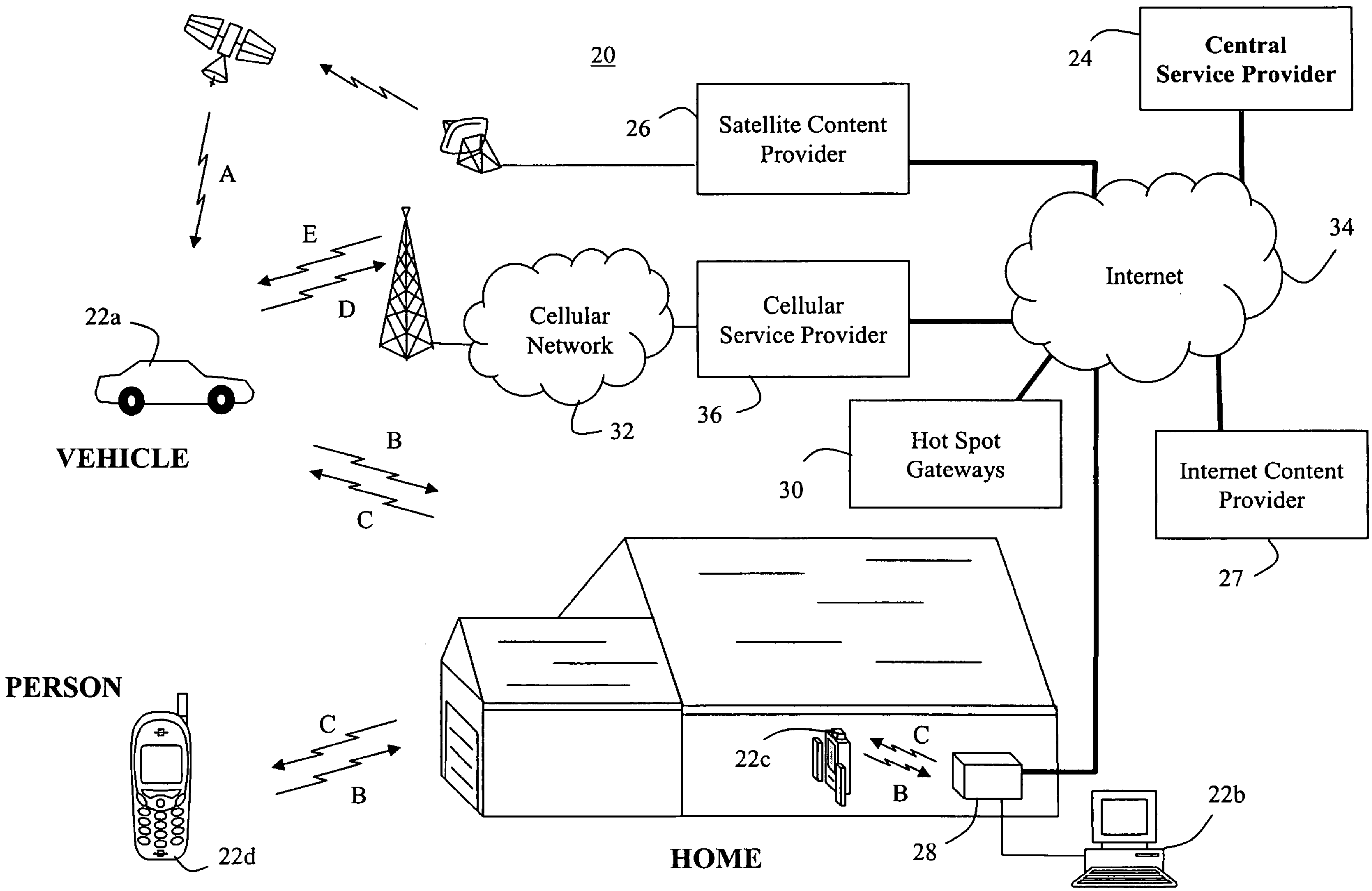

20
Central
Service Provider
24
Satellite Content
Provider
26
Internet
34
Cellular
Network
32
Cellular
Service Provider
36
Hot Spot
Gateways
30
Internet Content
Provider
27
A
E
D
B
C
22a
VEHICLE
PERSON
22d
HOME
22c
28
22b

FIG. 1

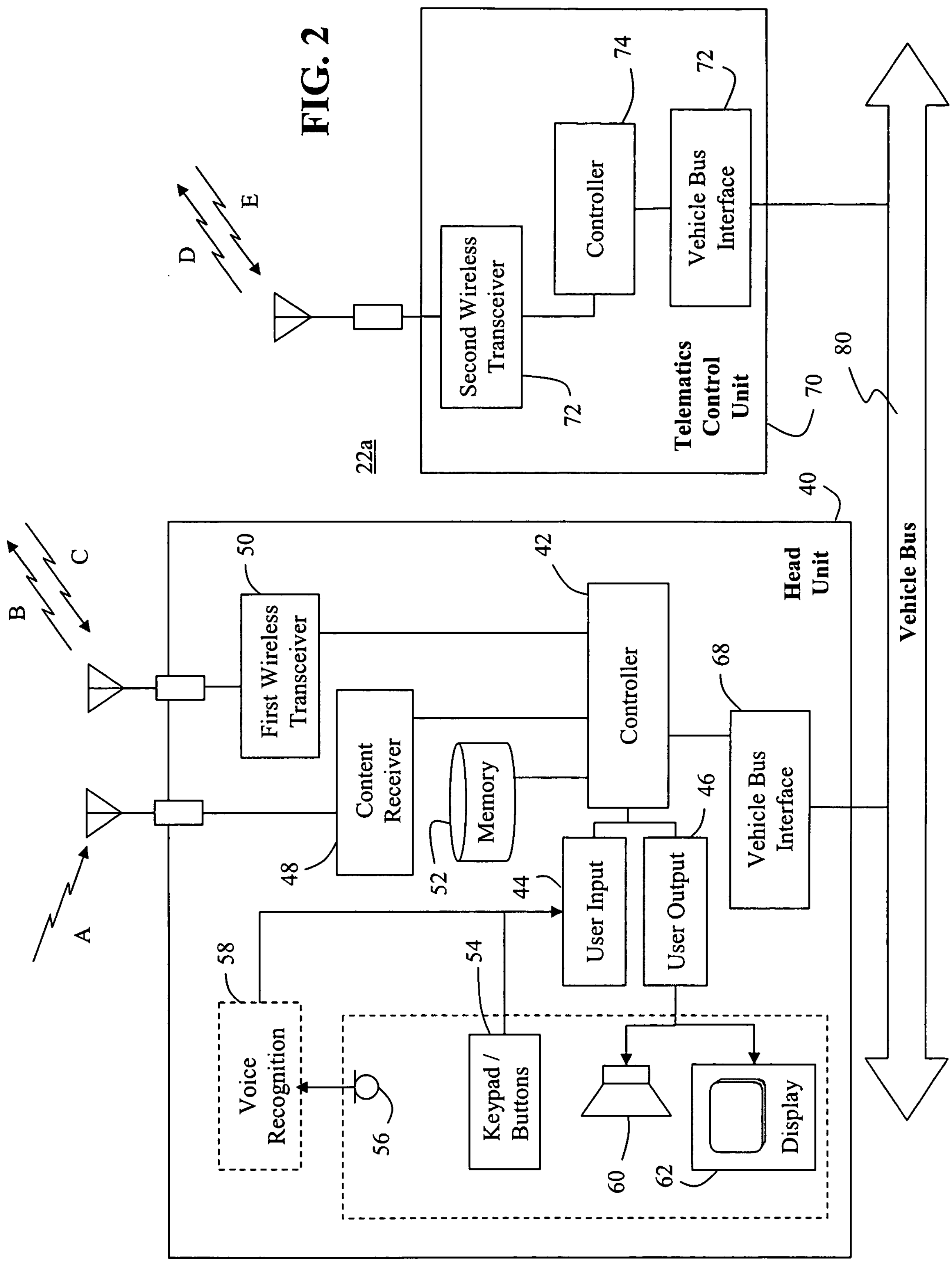

22a
Second Wireless Transceiver
72
Controller
74
Vehicle Bus Interface
72
Telematics Control Unit
70
80
D
E
B
C
A
First Wireless Transceiver
50
Content Receiver
48
Memory
52
Controller
42
Vehicle Bus Interface
68
User Input
44
User Output
46
Voice Recognition
58
Keypad / Buttons
54
56
60
62
Display
Head Unit
40
Vehicle Bus

FIG. 2

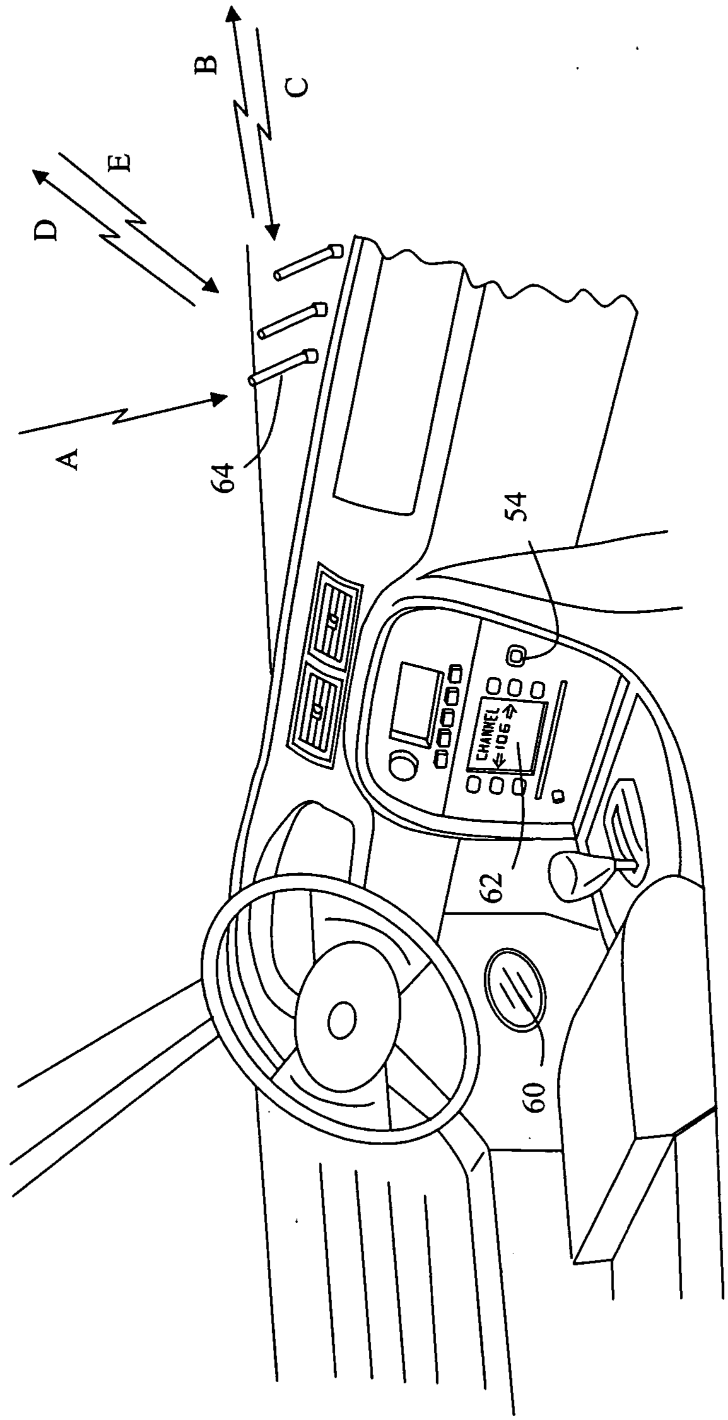



FIG. 3

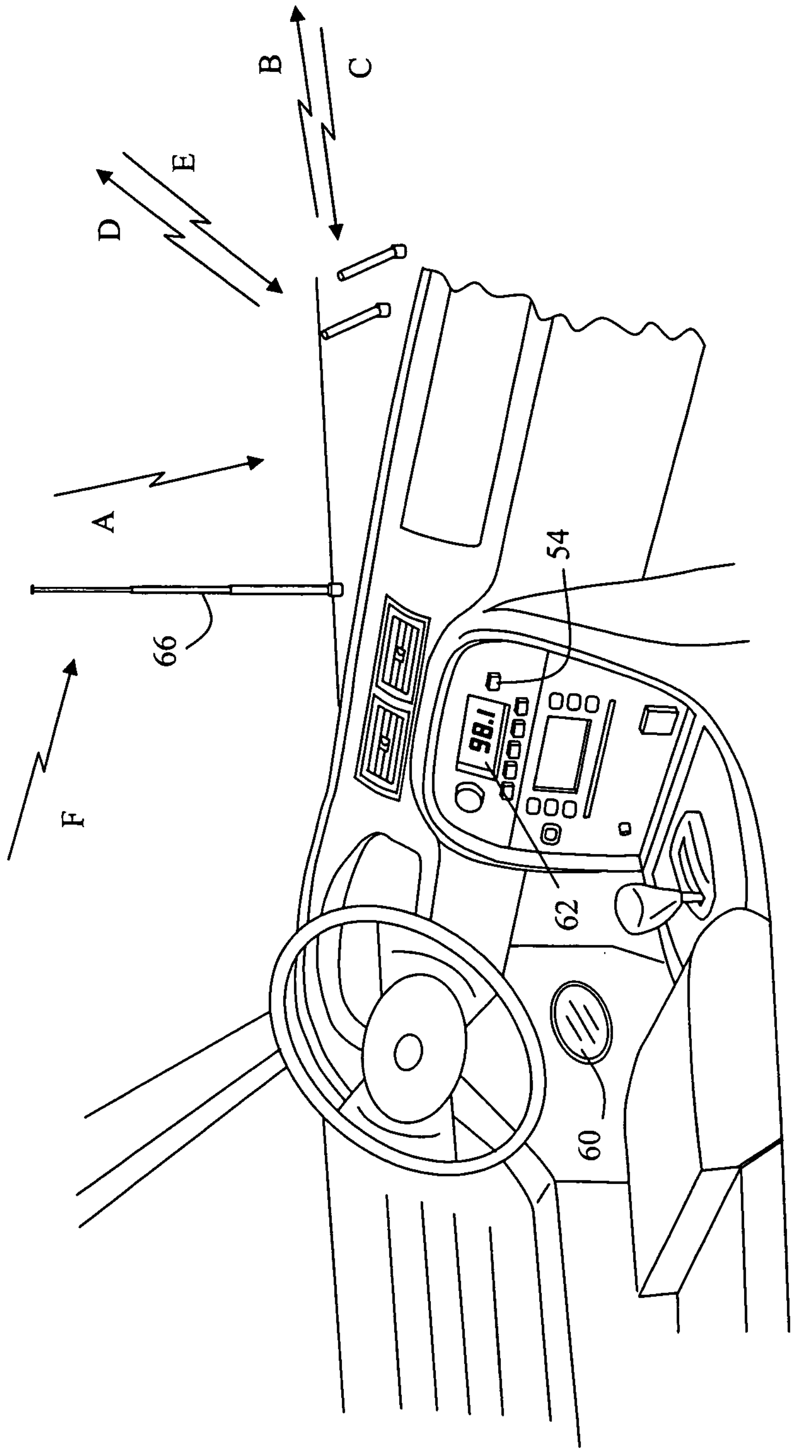



FIG. 4

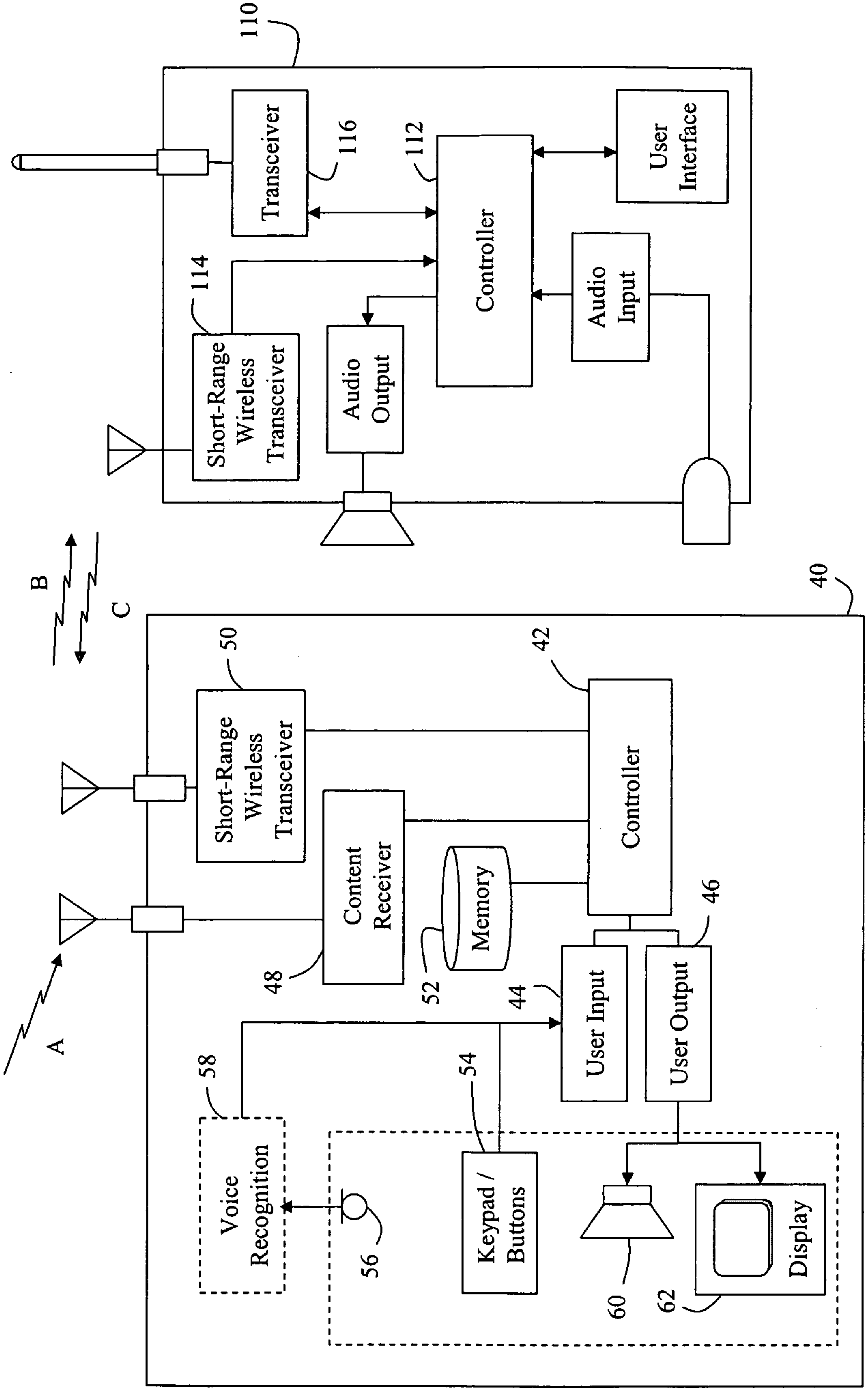
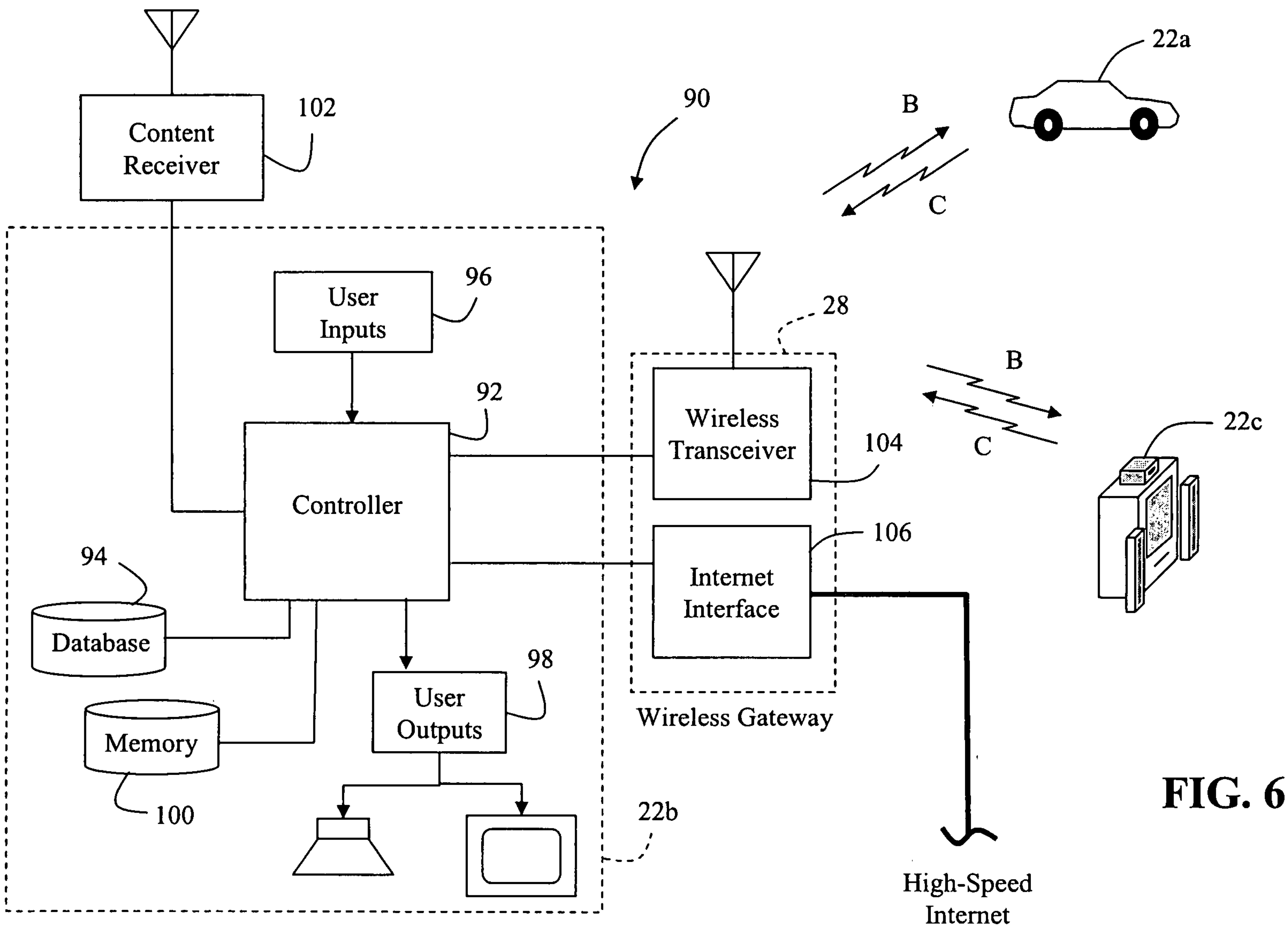

110
Transceiver
116
112
User Interface
Controller
114
Short-Range Wireless Transceiver
Audio Output
Audio Input
B
C
40
50
42
Short-Range Wireless Transceiver
Controller
Content Receiver
Memory
46
48
52
44
A
58
54
User Input
User Output
Voice Recognition
Keypad / Buttons
56
60
62
Display

FIG. 5



Content
Receiver
102
90
B
C
22a
User
Inputs
96
28
B
C
22c
92
Controller
Wireless
Transceiver
104
106
Internet
Interface
94
Database
98
User
Outputs
Memory
Wireless Gateway
100
22b
High-Speed
Internet


FIG. 6

94

**USER 1**

| 122 | 124 | 126 | 128 | 130 | 132 | 134 | 136 | 138 | 140 | 142 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Device ID** | **Client Type** | **Domain** | **Short-Range Transceiver** | **Cellular Transceiver** | **Memory Size** | **Stored Content** | **Internet Content** | **Satellite Content** | **RF Radio Content** | **Cable TV Content** | |
| D1 | Head-Unit | Vehicle | Y | Y | XXX | Y | N | Y | Y | N | |
| D2 | PC | Home | Y | N | XXX | Y | Y | Y | N | N | |
| D3 | Audio Recorder | Home | Y | N | XXX | Y | N | N | N | N | |
| D4 | Video Recorder | Home | Y | N | XXX | Y | N | Y | N | N | ••• |
| D5 | Cell Phone | Person | Y | Y | XXX | Y | N | N | N | N | ••• |
| D6 | MP3 Player | Person | Y | N | XXX | Y | N | N | N | N | |
| D7 | PDA | Person | Y | Y | XXX | Y | Y | N | N | N | |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |

FIG. 7

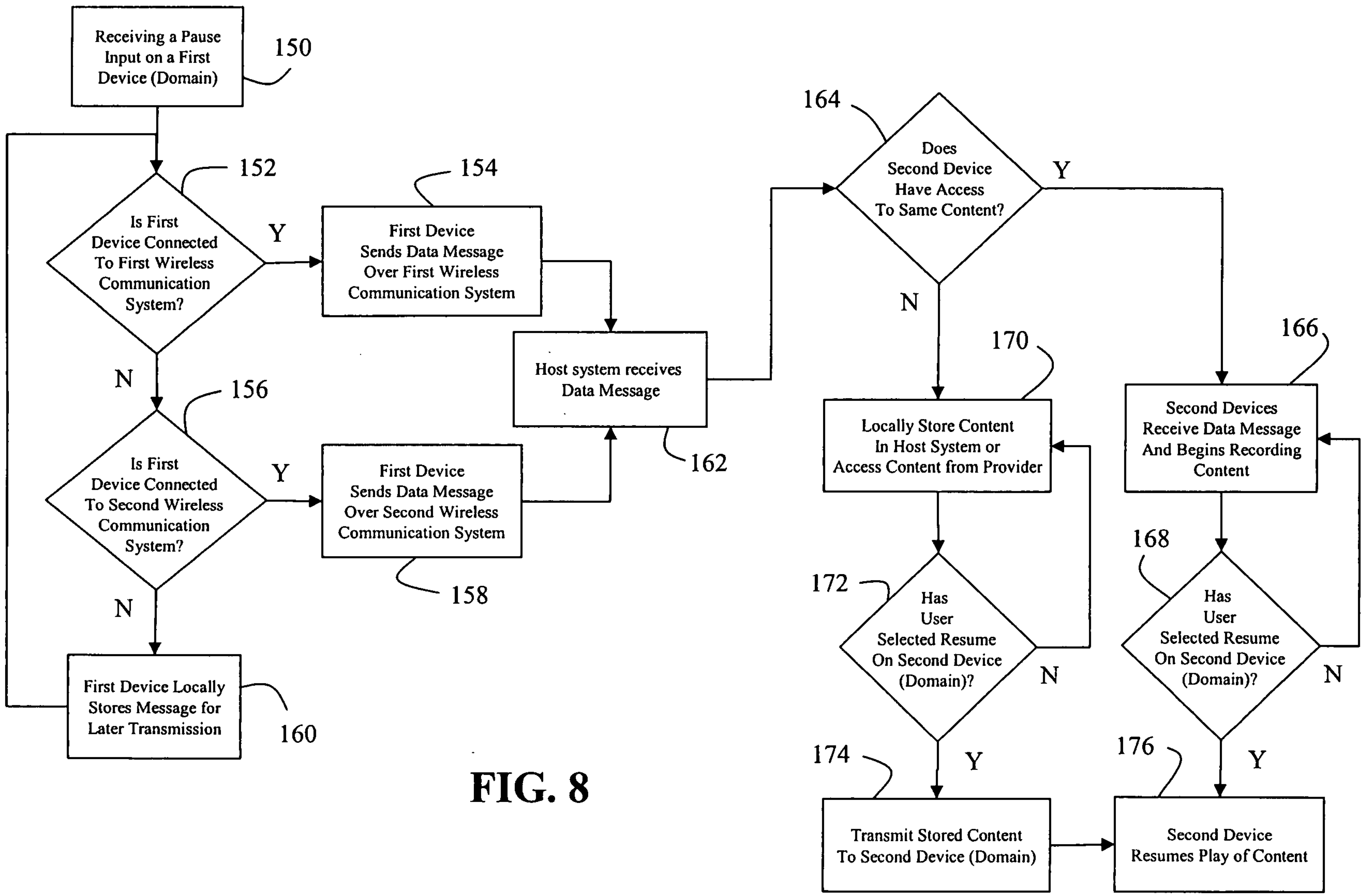

Receiving a Pause Input on a First Device (Domain)
150
Is First Device Connected To First Wireless Communication System?
152
Y
N
First Device Sends Data Message Over First Wireless Communication System
154
Is First Device Connected To Second Wireless Communication System?
156
Y
N
First Device Sends Data Message Over Second Wireless Communication System
158
First Device Locally Stores Message for Later Transmission
160
Host system receives Data Message
162
Does Second Device Have Access To Same Content?
164
Y
N
Locally Store Content In Host System or Access Content from Provider
170
Second Devices Receive Data Message And Begins Recording Content
166
Has User Selected Resume On Second Device (Domain)?
172
N
Y
Has User Selected Resume On Second Device (Domain)?
168
N
Y
Transmit Stored Content To Second Device (Domain)
174
Second Device Resumes Play of Content
176

FIG. 8

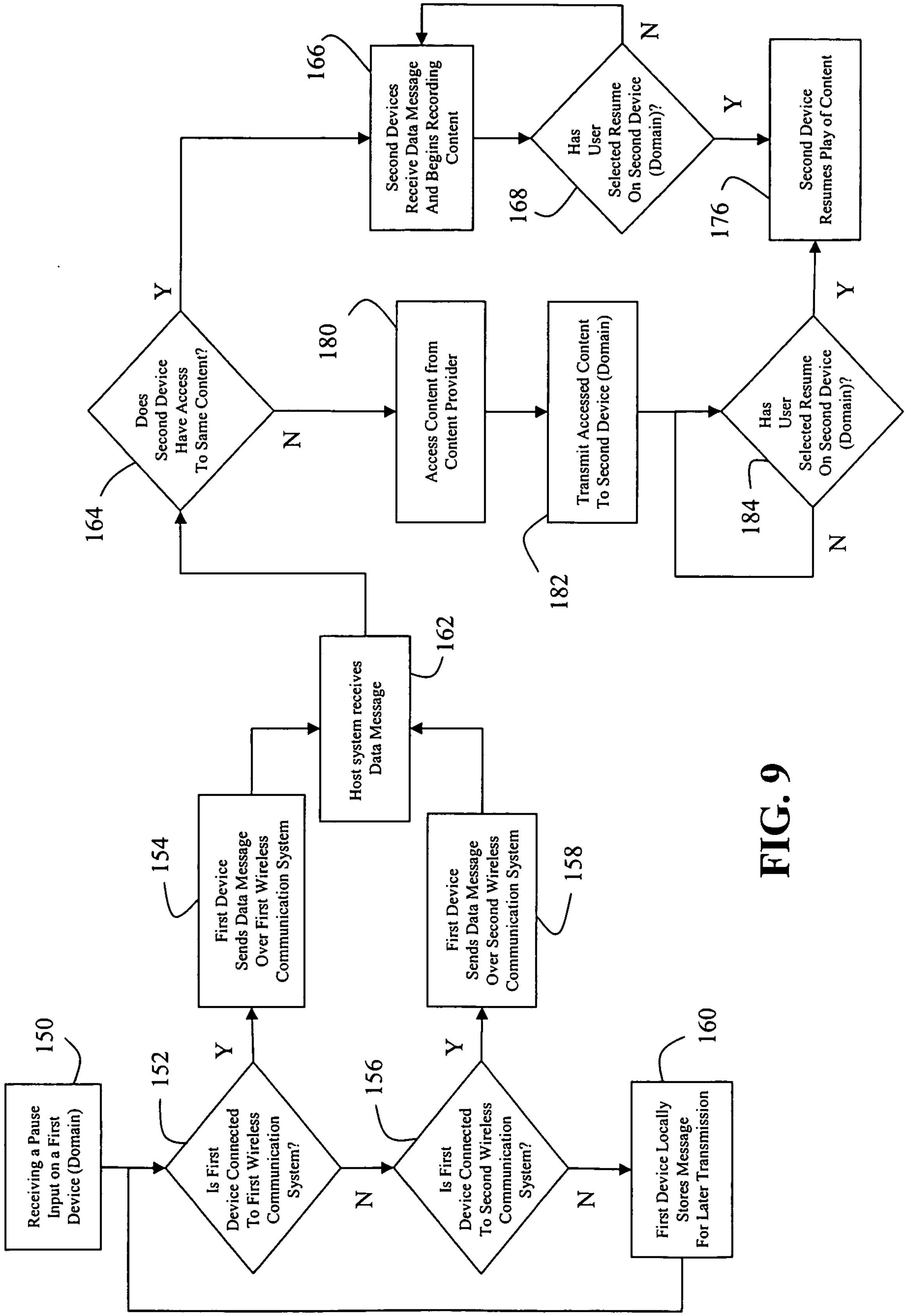

Receiving a Pause Input on a First Device (Domain)
150
Is First Device Connected To First Wireless Communication System?
152
Y
N
First Device Sends Data Message Over First Wireless Communication System
154
Is First Device Connected To Second Wireless Communication System?
156
Y
N
First Device Sends Data Message Over Second Wireless Communication System
158
First Device Locally Stores Message For Later Transmission
160
Host system receives Data Message
162
Does Second Device Have Access To Same Content?
164
Y
N
Second Devices Receive Data Message And Begins Recording Content
166
Has User Selected Resume On Second Device (Domain)?
168
Y
N
Second Device Resumes Play of Content
176
Access Content from Content Provider
180
Transmit Accessed Content To Second Device (Domain)
182
Has User Selected Resume On Second Device (Domain)?
184
Y
N

FIG. 9

International CES

iRadio™

# Brainstorming
# July 20th, 2004

# Results Brainstorming CES Demo scripts 7/20/04

- **Goals of CES Demo:**
  - Simplify to only 2 or 3 key messages
  - Big on behavior, lower on technology
  - “taking content you are used to somewhere else”

- **Key questions to answer:**
  - Which devices and key features will be demo’ed?
  - How does the demo vary if this is Yahoo Launcast centric vs. XM centric?
  - Why is it better than a combo XM in the car + iPOD plug n play?

# Bottom Line Concept V1.0:

- **User configuration webpage**
  - Allows to register for service, access catalog library of contents from service provider like webcast radios, personalized subscription channels
  - Allows to aggregate "owned" music library to mix with external content into daily sets
  - Preferably links with well known media players as Real, WM or iTunes rather than imposing its own (case of SimpleCenter)
- **My Daily Sets**
  - Create 128Mbytes of compressed music/ spoken words updated each day at least partially for the content either stale or listened to. In AAC+, that would allow between 1.5 hours to 2 hours per channel with a 50% mix music vs. talk, in WMA about 1hour/channel and probably 30 minutes/ channel in MP3
  - Channel #1: My "digital music"
    - CD ripped collection
    - Digital Music downloads
  - Channel #2: My "Yahoo" Personal Music Channel
    - AI based suggestion
  - Channel #3: My talk show radio shows
    - Car talk, CNBC McEnroe…
  - Channel #4: My Audible books
  - Channel #5: My Sports radio
    - Soccer news, stats, scores
  - Channel #6: My Lifestyles
    - Movies reviews, Entertainment gossip, Discovery, History …

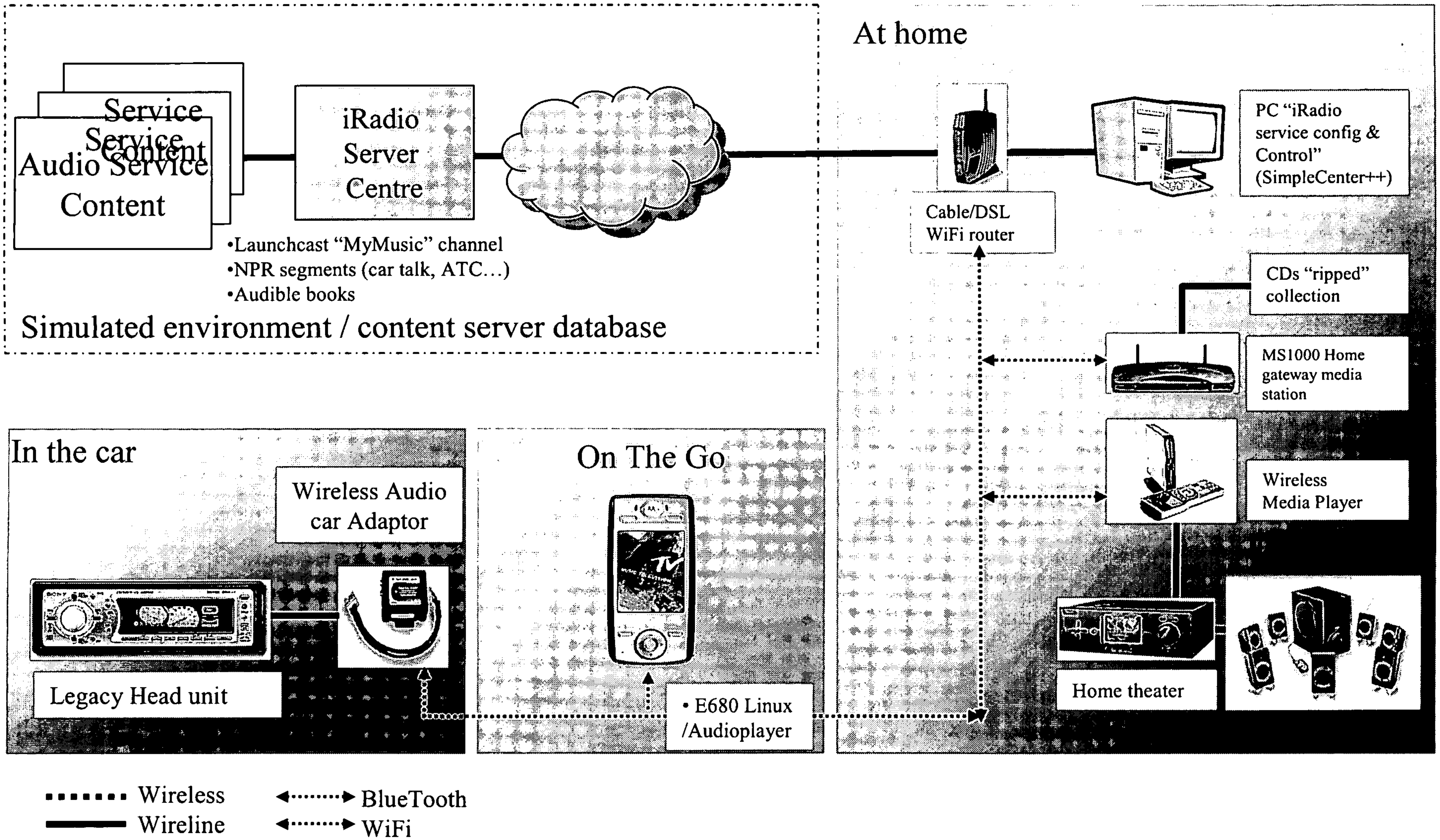
- **Key questions to answer:**
  - Which devices and key features will be demo'ed?:
    - *Organization into predictive daily sets, auto download and refresh daily, pause her play there and delayed one touch Push to Buy*
  - How does the demo vary if this is Yahoo Launcast centric vs. XM centric?
    - *May be very similar with the difference that the user can create playlist / advanced programming based on XM content and owner's library only and XM could be listened live as well as cache" in the car- No handover to phone if live music (possible at home)*
  - Why is it better than a combo XM in the car + iPOD plug n play?
    - Brings the user feedback and intelligent automated refreshment of some of the content (albeit more limited) and also automates the Listen on XM-purchase on iTunes scenario. Also, provides a true seamless continuity of the same content without plug- unplug (arguable if this is a BlueTooth –iPOD or Motorola iPTunes phone…Food for thoughts…)

# Use Case Compliance Matrix

DEMO CES use cases overview

| | Key Features | Use cases | HOME | | | | | On-The-Go | | | | | Car | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | PC gateway | MS1000 | Home Receiver | Wireless Audio Speaker | Graphic Remote Controller | E680 | MPX | iTunes Phone (tbd) | Portable media Player | iPAQ WiFi | OmniFi | Wireless car audio adapter | Legacy head-Unit |
| Content Customization | Custom Daily sets | provide web user interface to create and aggregate various | X | X | | | | | | | | | | | |
| | Personnalized channels | Yahoo Launchcast creating a subset of 1-2 hours as part of one of the daily set channels | X | X | | | | | | | | | | | |
| | Recently Purchased Music channel | Automatically load the song that will be acquired during the demo and display it with a delay to drive the point that it is not done in real-time through the phone | X | X | | | | | | | | | | | |
| | Access / conversion personal music library ("ripped" or downloaded) | can be part of the creation of personnalized channel or create a random playlist each day | X | X | | | | | | | | | | | |
| | Intelligent selection download = f(bandwidth, freshness, battery life, memory | Huge available content is filtered to 128MB and synchronized with content that was listened before... | | X | X | | | | | | | | | | |
| Pause / Skip / rewind / resume | Pause here...Play there | Light signalling service handoff between home receiver and car and phone. May need to create a buffer for "now playing" song if it is not part of the daily set | X | X | X | X | ? | X | | ? | | | ? | X | X |
| | Skip forward / backward Browse through Playlist | Use the left/right arrows of the CD keys on headunit or on the phone | X | X | X | X | ? | X | | ? | | | ? | X | X |
| | Events recording | N/A (IP TiVo and GoToIT? Done by daily sets off-line | | | | | | | | | | | | | |
| | Instant buffering (replay/rewind) | N/A (IP TiVo and GoToIT?) | | | | | | | | | | | | | |
| | TBD | | | | | | | | | | | | | | |
| Access Content I want | Legal push to buy | Demonstrate a live download from napster or Musicnet that will be transferred on both the phone and the car | X | X | X | X | | X | | ? | | | ? | X | X |
| | Find Music through mood engines | N/A | | | | | | | | | | | | | |
| | Find / Search music QBH, playlists | N/A could demonstrate QBH but may dillute key messages | | | | | | | | | | | | | |
| | DRM coordination | N/A | | | | | | | | | | | | | |
| | TBD | | | | | | | | | | | | | | |
| Interactivity / Community | Instant Music Clips Messenger | N/A | | | | | | | | | | | | | |
| | Share play-lists | N/A | | | | | | | | | | | | | |
| | Push to Vote / register | N/A | | | | | | | | | | | | | |
| | Push to learn more | N/A | | | | | | | | | | | | | |

# CES example for generic service content provider…



# A Day In The Life ...

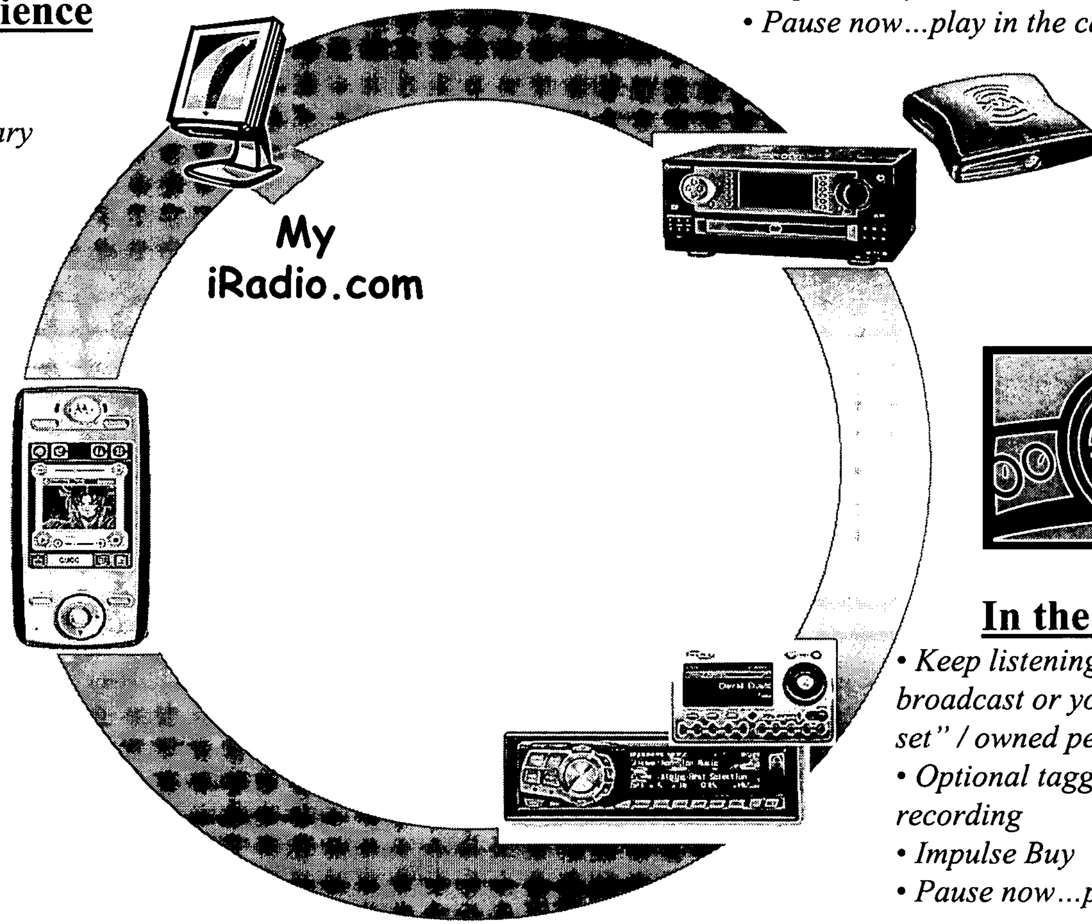
## At home

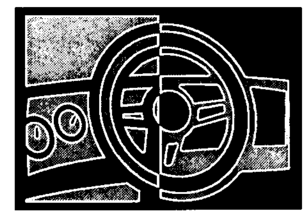
## Wake-up, get ready

- *Listen to XM live broadcast or XM cache "daily sets" or a mix Music I own / recently purchased*
- *Impulse Buy*
- *Pause now...play in the car...*

## Relax...Fine Tune the experience

- *Browse / tag new XM events*
- *Create /Update preferences daily sets:*
- *e.g. XM events, talk shows, music library*
- *Browse XM music store*



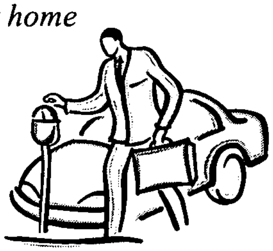



## In the car

- *Keep listening to XM live broadcast or your XM cache "daily set" / owned personal music*
- *Optional tagged XM event auto-recording*
- *Impulse Buy*
- *Pause now...play in the phone*

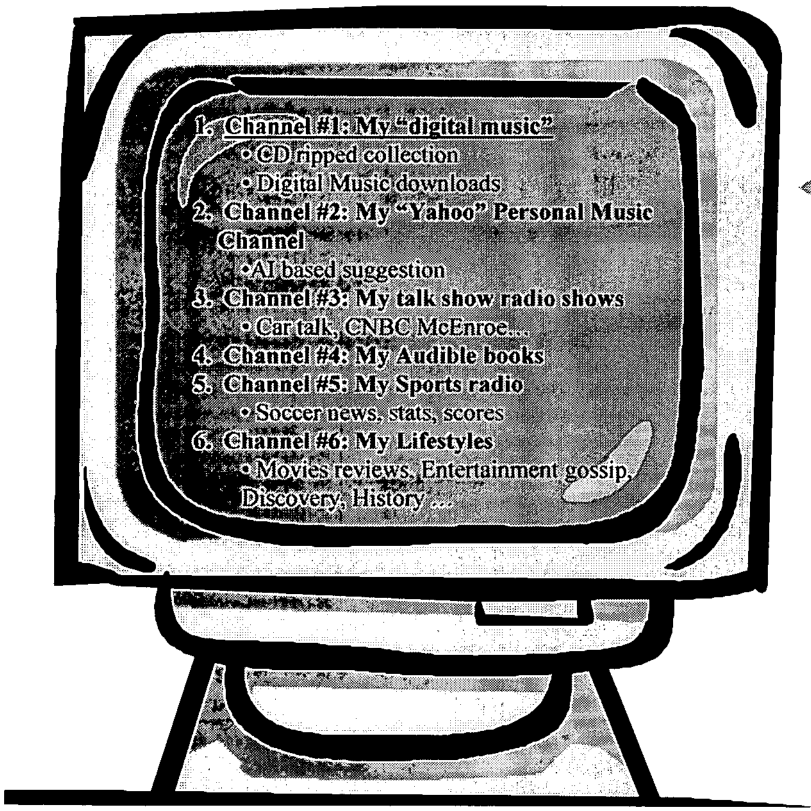
## On-the-Go

- *Keep listening to your XM cache daily set"*
- *Impulse Buy*
- *Pause now...play later in the car ...or back home*

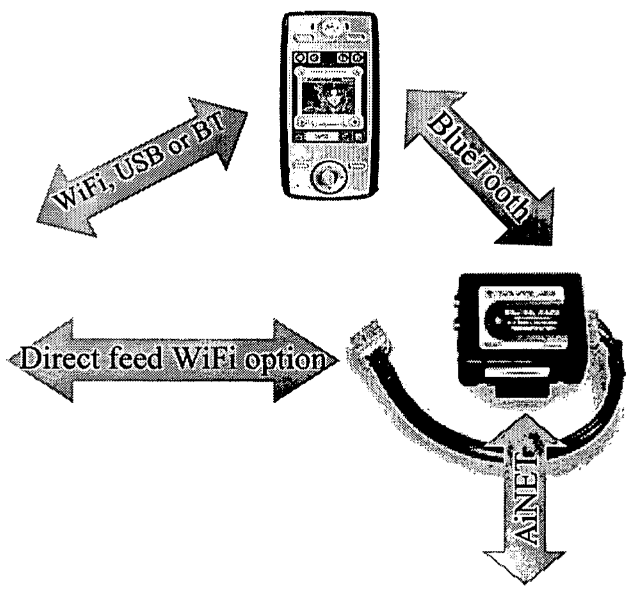


# Daily Set across domains

## My iRadio.com

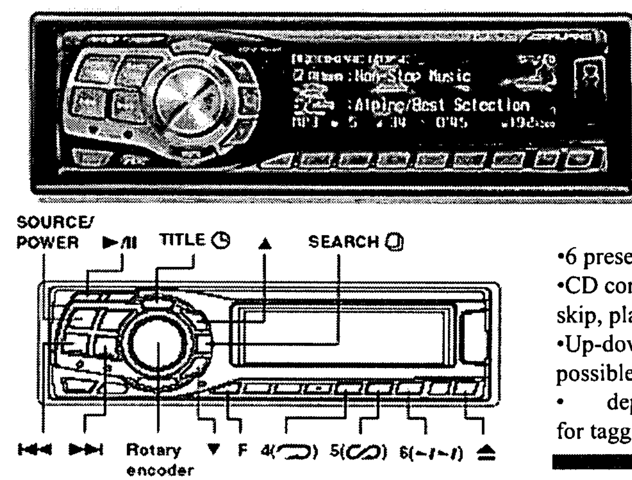



•PC configuration web browser or Microsoft Windows Application/Media player
•5 to 6 "Daily Sets"mapped to Radio or Home receiver




**E680 Linux-base media phone**
• Use internal 50Meg for 10 minutes of each channel content using REAL or WMA format @64kbps. AAC for future Apple phone?
•Use SD card slot for wiFi card
•Use BlueTooth for direct control memory-less Bluetooth wireless car adaptor

**Wireless Car Audio Adaptor:**
• WiFi (home, phone) or BlueTooth (phone)
•AiNet interface CD changer spoofing, CD text spoof for ID3 tags
•128MB storage (option)
• USB extension (option)
• Voice command (option)




•6 presets= 6 channels
•CD commands for skip, play, pause
•Up-down arrows for possible sub-playlists
• depress 2seconds for tagging PTB

# iRADIO CES Demo Script Description (preliminary)

## An "Audio Day" in the life of a consumer

- **On PC, user prepares 5-6 "Play-list" content to be automatically daily refreshed & downloaded to car and phone (pre-processing / set-up)**
  - Single user interface to access "owned music", service provider subscription library, Internet audible books and other spoken-words catalog based content
    - E.g. Itunes jukebox, Yahoo Launchcast,NPR's Car Talk, jokes of the day, trivia, horoscope, new movies reviews, sports reports,…
  - Organize in 5 or 6 main "supersets / genres" that will be available on the car radio head-unit 5-6 preset keys with user friendly interactive bargraph to mix % of content preferences (128Meg / 4-6 hours depending codecs & content)
    - E.g. My Ripped Music, My personal music channel, My Sports, My Talk radio, My Audible book.
    - Genres could also be organized by mood: My Morning Latte, My energy boost, My relaxation, My learning channel…
- **Start demo to show "domains" transitions over course of normal day:**
  - Start listening to 1st program streamed on Home Theater from MS1000 NAS
  - Jump in the car – Seamless handoff to legacy car stereo
    - Use familiar CD radio controls and memory preset to browse through various prepared contents, can pause, skip forward and back. Receive live phone call – interrupts music-handsfree on car stereo.
  - Park the car- Finish phone conversation and resume listening experience with phone earphones or external speakerphone
- **End of the day: Come back in the car at then back to home…**
  - Listen to a "pop tune" from subscription service and likes it: push-to-buy on radio depressing the CD start Key 2 seconds (tags the music title / artist/ CD)
  - When entering the home, request is uploaded (WiFi) from car and instantly donwloaded from Music services into "My recently purchased" folder on the PC
  - Purchased Content can then be listened to right away on Home Theater
  - Also, "Tag Event" could have a "Push-to-Learn more" function that flags artist bios on PC, possible concerts in the area etc…

## Key Messages

"My Audio Daily Set…

…Follows Me:
- Home to Car
- Car to Phone

…and I can interact with it"

**From:** Villevieille J-P26721
**Sent:** Tuesday, September 07, 2004 9:04 AM
**To:** Gaumond Mike-MGAUMOND; Clayton Mark-AMC036; Ulmer Dave-E42721
**Subject:** RE: Patent for wireless adapter

See my prior email. The email was around 6/22. the 6/23 powerpoint to MotoLabs does not mention it clearly. I have notes on 7/2 mentioning alternative to Apple solution and also 7/14 brainstorm session with Dave & Mark. Besides BT streaming, I do not recall we "spilled the beans" to UEI/SD on 6/30 visit on the presets mapping. I have not seen Mark's paperwork so it may be too narrow and we will have to rely on disclosing the "end2end" iradio simplified solution mapping auto content generation (including hot content updates) with presets.

regards...JMV

Jean-Marc Villevieille
Director Engineering Advanced Solutions
Motorola
Tempe, AZ
(W)602-659-8177
(M)480-236-3446
jmv@motorola.com

-----Original Message-----
**From:** Gaumond Mike-MGAUMOND
**Sent:** Tuesday, September 07, 2004 8:47 AM
**To:** Clayton Mark-AMC036; Villevieille J-P26721; Ulmer Dave-E42721
**Subject:** RE: Patent for wireless adapter

JMV - do you have anything in writing (powerpoint, email, etc.) dated prior to June 30?
mike

-----Original Message-----
**From:** Clayton Mark-AMC036
**Sent:** Friday, September 03, 2004 3:03 PM
**To:** Gaumond Mike-MGAUMOND; Villevieille J-P26721; Ulmer Dave-E42721
**Subject:** Patent for wireless adapter

I've created a draft disclosure for the wireless audio adapter, with you folks included as innovators so you will start to get weekly reminders until the draft is submitted. I expect the draft will be refined over the next couple of weeks. I included Tom as a witness since he has the iRadio background.

I recall discussing the idea with someone (Mike?) at least a few days before our June 30 visit to Simple Devices. It would be nice if we had some proof of those hallway discussions. Any suggestions? I'm a little concerned that Simple Devices may already have filed papers even though they hadn't thought of the key CD changer part when we visited.

Mark

**From:** Villevieille J-P26721
**Sent:** Tuesday, September 07, 2004 9:12 AM
**To:** Gaumond Mike-MGAUMOND; Clayton Mark-AMC036; Ulmer Dave-E42721
**Subject:** RE: Patent for wireless adapter
It was never backed up as there was no more server room at MCG for emails. If one of you are automatically backed-up then we should be able to retrieve it (Jeff may have been copied as well, 3rd week in June).
...JMV

Jean-Marc Villevieille
Director Engineering Advanced Solutions
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Tempe, AZ
(W)602-659-8177
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jmv@motorola.com

-----Original Message-----
**From:** Gaumond Mike-MGAUMOND
**Sent:** Tuesday, September 07, 2004 9:07 AM
**To:** Villevieille J-P26721; Clayton Mark-AMC036; Ulmer Dave-E42721
**Subject:** RE: Patent for wireless adapter

i don't have any notes from you prior to 7/16 - can we get IT to ressurect the June 15-July 15 emails you sent?

-----Original Message-----
**From:** Villevieille J-P26721
**Sent:** Tuesday, September 07, 2004 7:24 AM
**To:** Clayton Mark-AMC036; Gaumond Mike-MGAUMOND; Ulmer Dave-E42721
**Subject:** RE: Patent for wireless adapter

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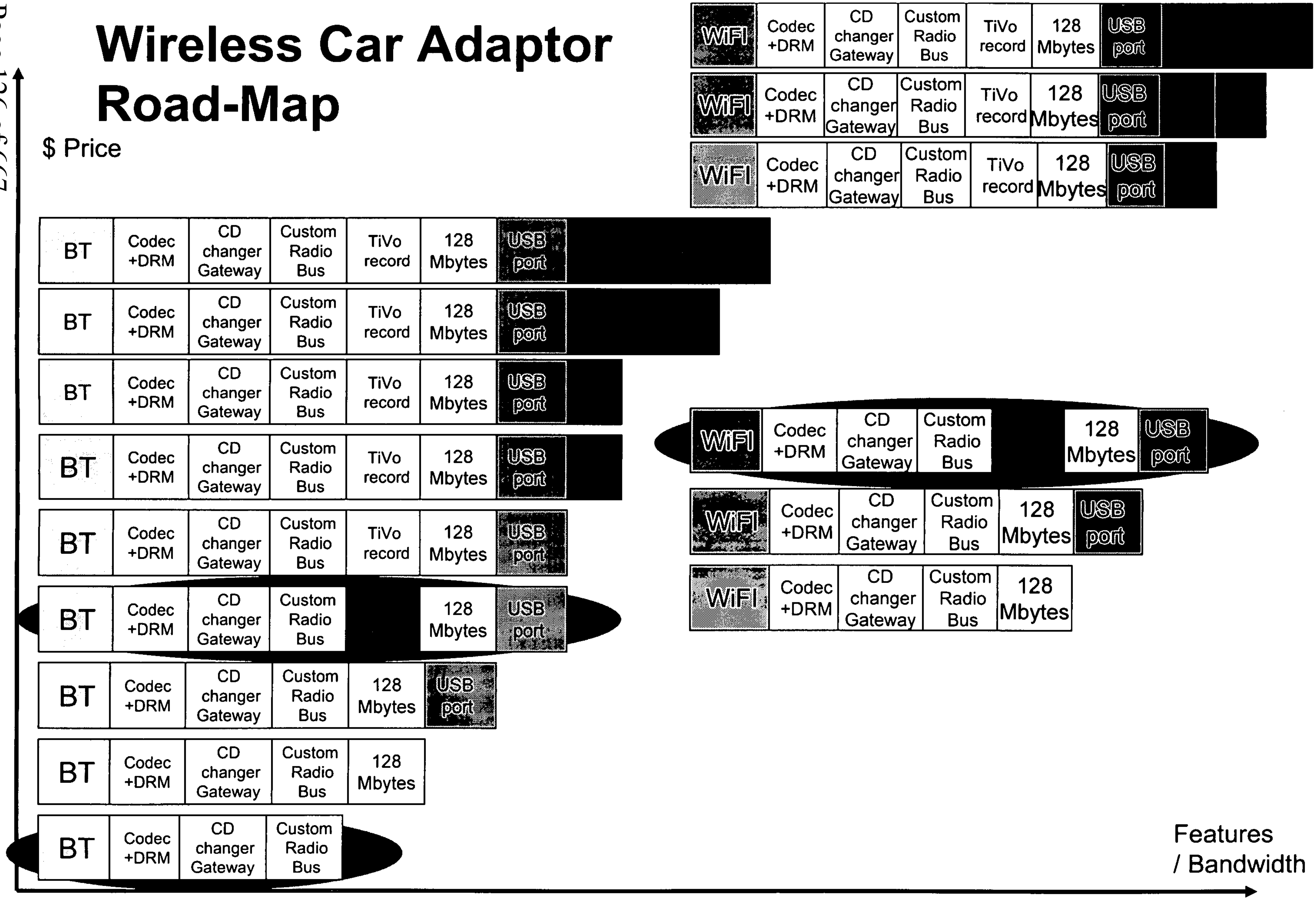
Mark

# Road-Map Wireless Clients

JMV 8/9/04

# Wireless Car Adaptor Road-Map

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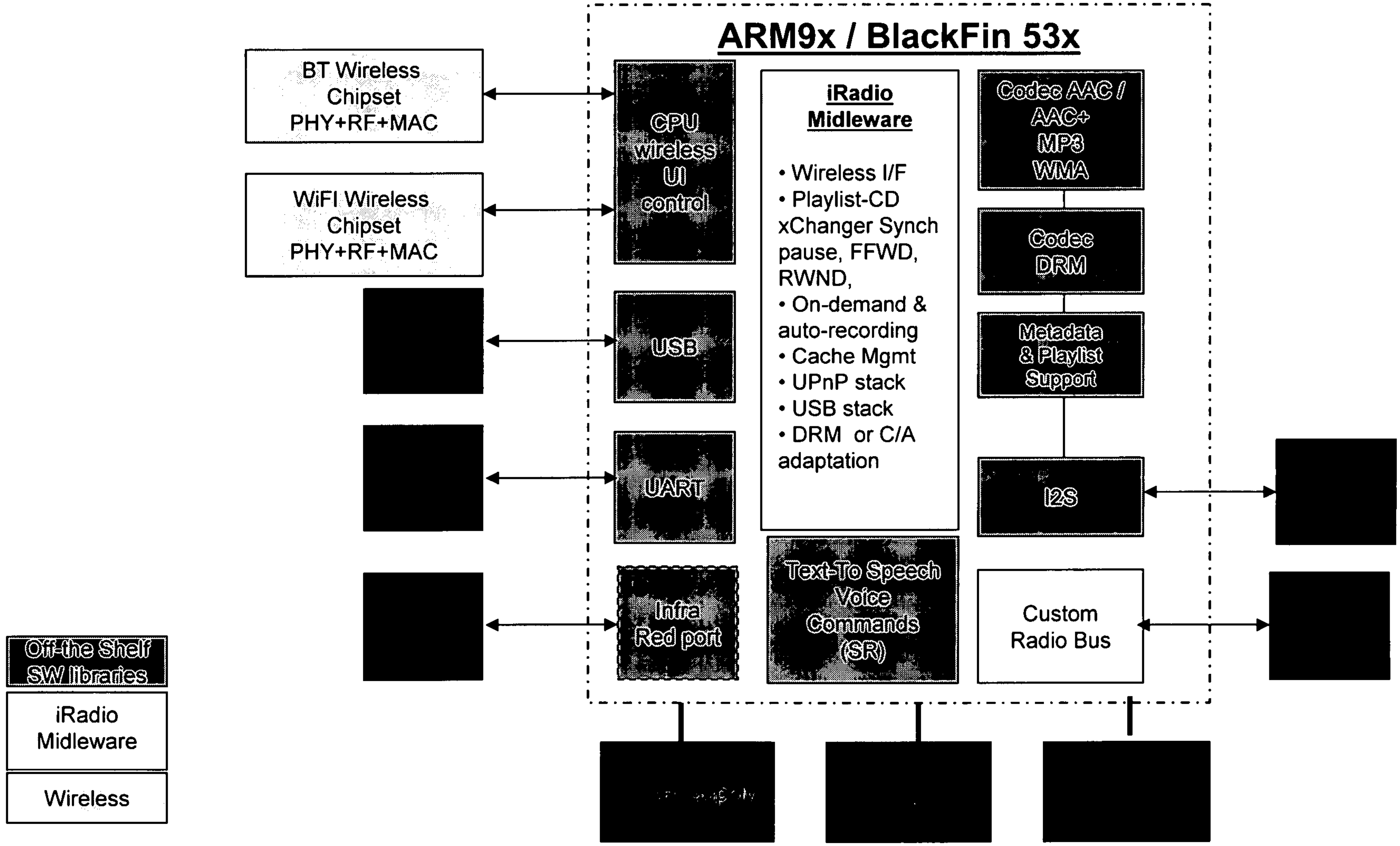
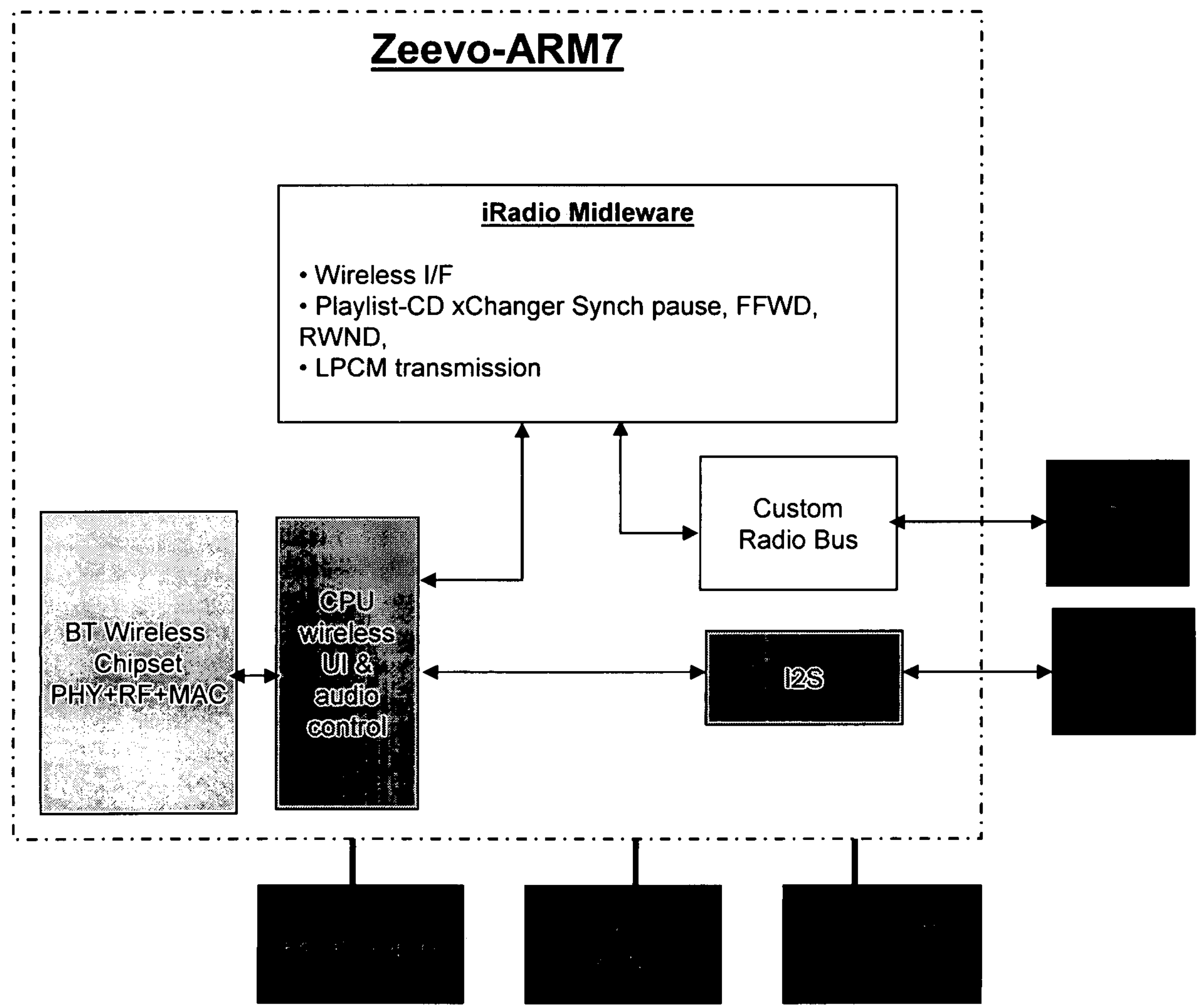
# Development Candidates

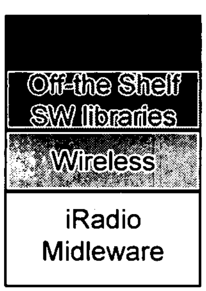
- Simple Devices:
  - Is going “alone” embracing our BT link but with their content management client in Java to be ported on the phone. Rely on an external “Soundgate”-like Cd changer adapter ($()!!!) and does not know about our pre-set keys mapping
  - Quote the same to the Telematics team!!! (Sean McBride)
- SSI America: have reverse-engineered multiple proprietary bus. We may be able to re-use some open source on their NEO programs (HDD)- Fast track people-engineering in Germany
- Zeevo & SMART: low cost Blue tooth ARM7 single chip solution for wireless CD-like stereo. SMART is doing embedded designs modules with memory caching expertise
- Soundgate: specialized in peripherals OEMs bus adaptors- can modify the XM or Sirius retrofit
- Blitzsafe: same as Soundgate- specialized for XM and CDs retrofit
- Rockford-Fosgate / Omnifi: may be able to strike a different deal from SD for developping direct hardware (next door neighbours)?
- Motorola Tomhawk4 platform: needs a low cost application – GSG team + some ACES automotive resources?

# Wireless Car Adaptor Topology

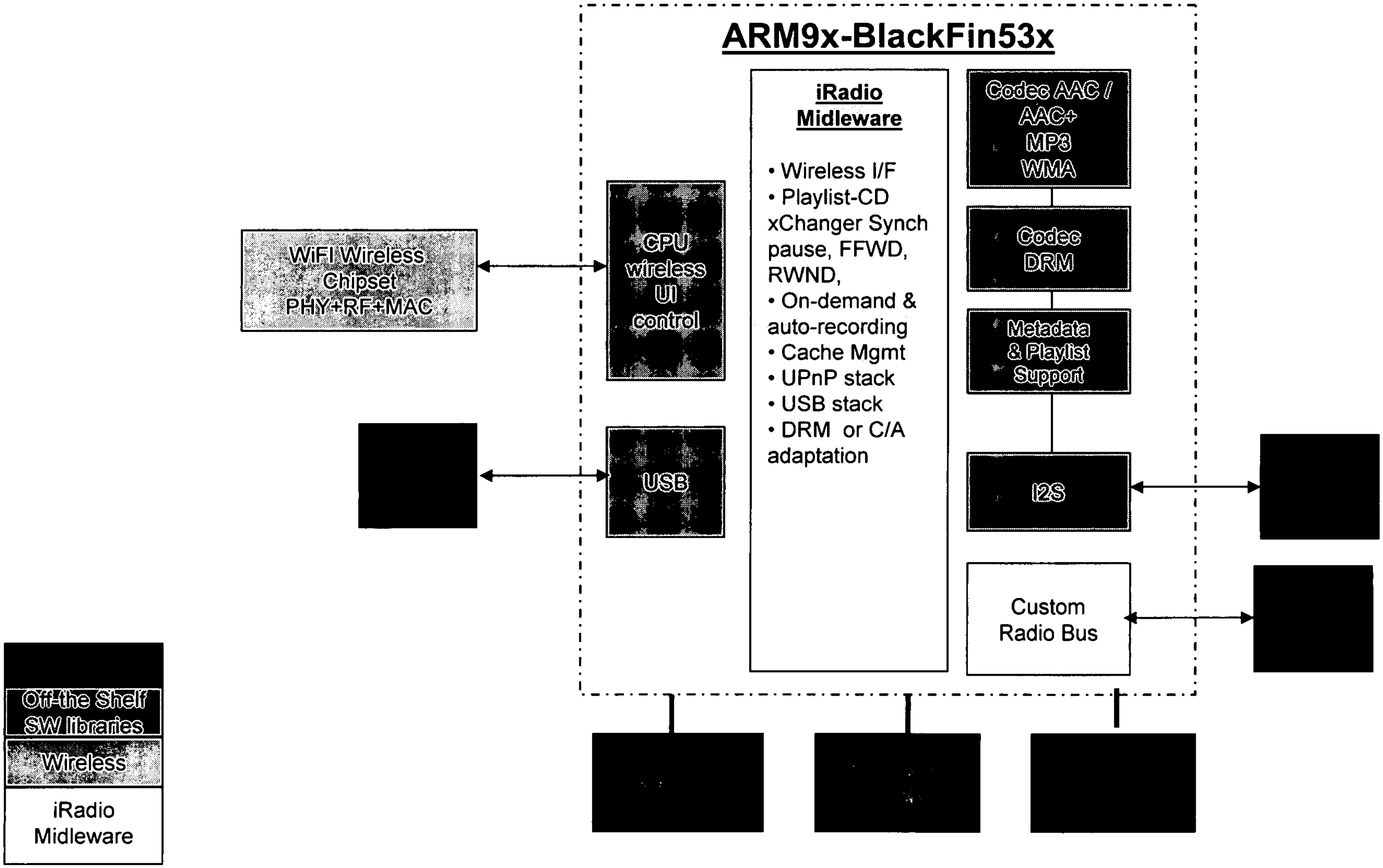


# Wireless Car Adaptor Topology- Low-end

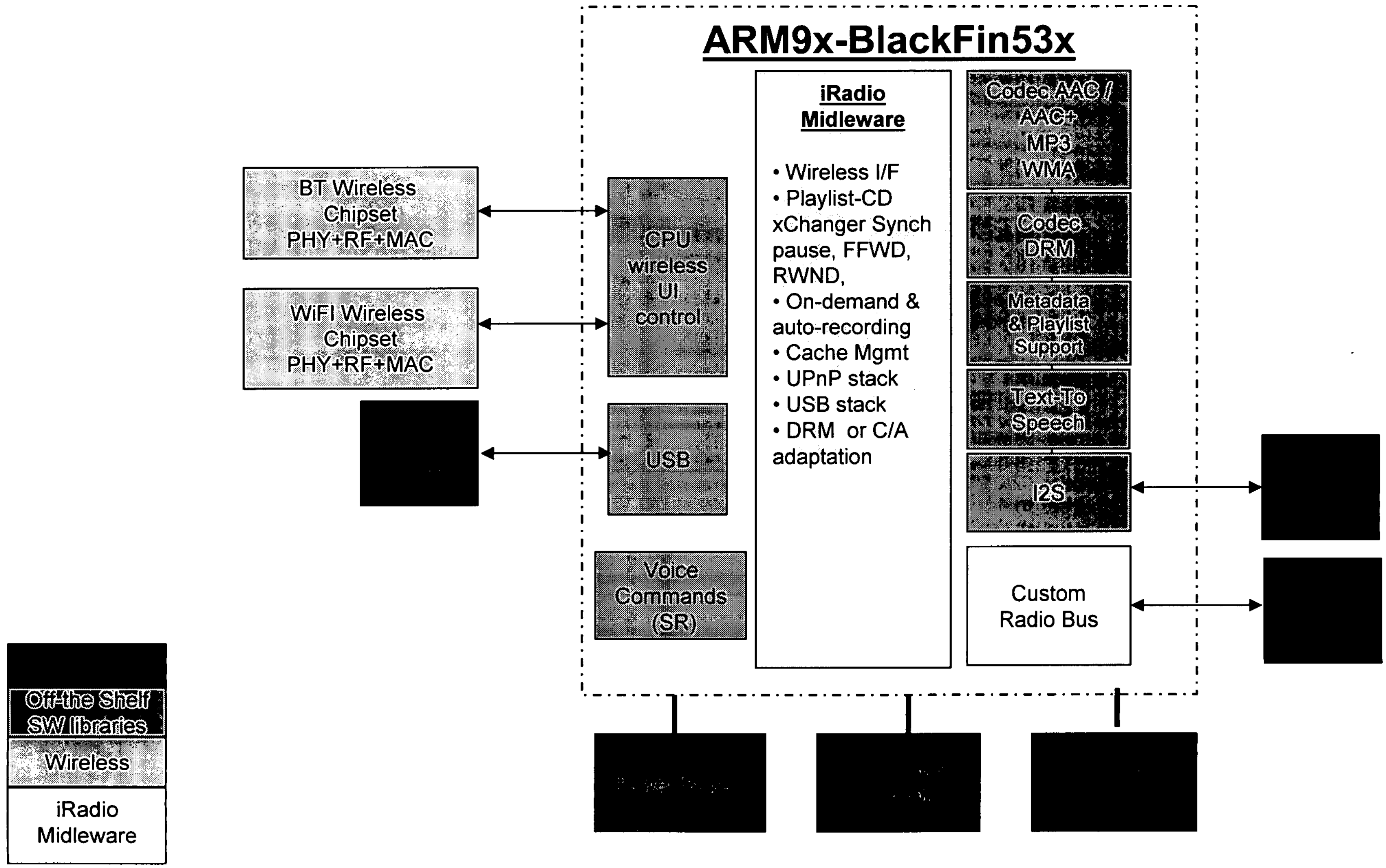


# Wireless Car Adaptor Topology- Mid-Tier



# Wireless Car Adaptor Topology- High-end



# SimpleDevices Opportunities

June 30, 2004

# Home System Comparison

| FEATURE | SC | SC+ | iRadio |
|---|---|---|---|
| Digital Media Library | X | X | X |
| Music Player | X | X | X |
| Media ID Tools | X | X | * |
| MP3 & WMA Support | X | X | X |
| Device Manager / *(Profile- Mood based Events Record “scheduler” & daily sets- browser based rather than .exe) | X | X | * |
| Wi-Fi Wireless Media Delivery | X | X | X |
| Watch Folders | X | X | ? |
| CD-Ripper- | | X | |
| Media Explorer | | X | * |
| Live365, LAUNCHcast, Virgin Radio, SHOUTcast (stream to PC) | | X | X |
| NewsCenter (legal download & automated upload to client) | | X | X |
| Other content partners download & multi domain upload | | | X |
| Song Downloads | | X | X |
| Audio Books | | X | X |
| Interactive Buy/Rate/ Vote | | | X |
| Interface with Server for Multi-Domain Coordination | | | X |
| Auto recording of content for controlled distribution | | | X |
| Community referrals/playlist eXchange | | | X |
| Multi codec / Multi DRM support | | | X |
| Subscriber Management System | | | X |

# Home

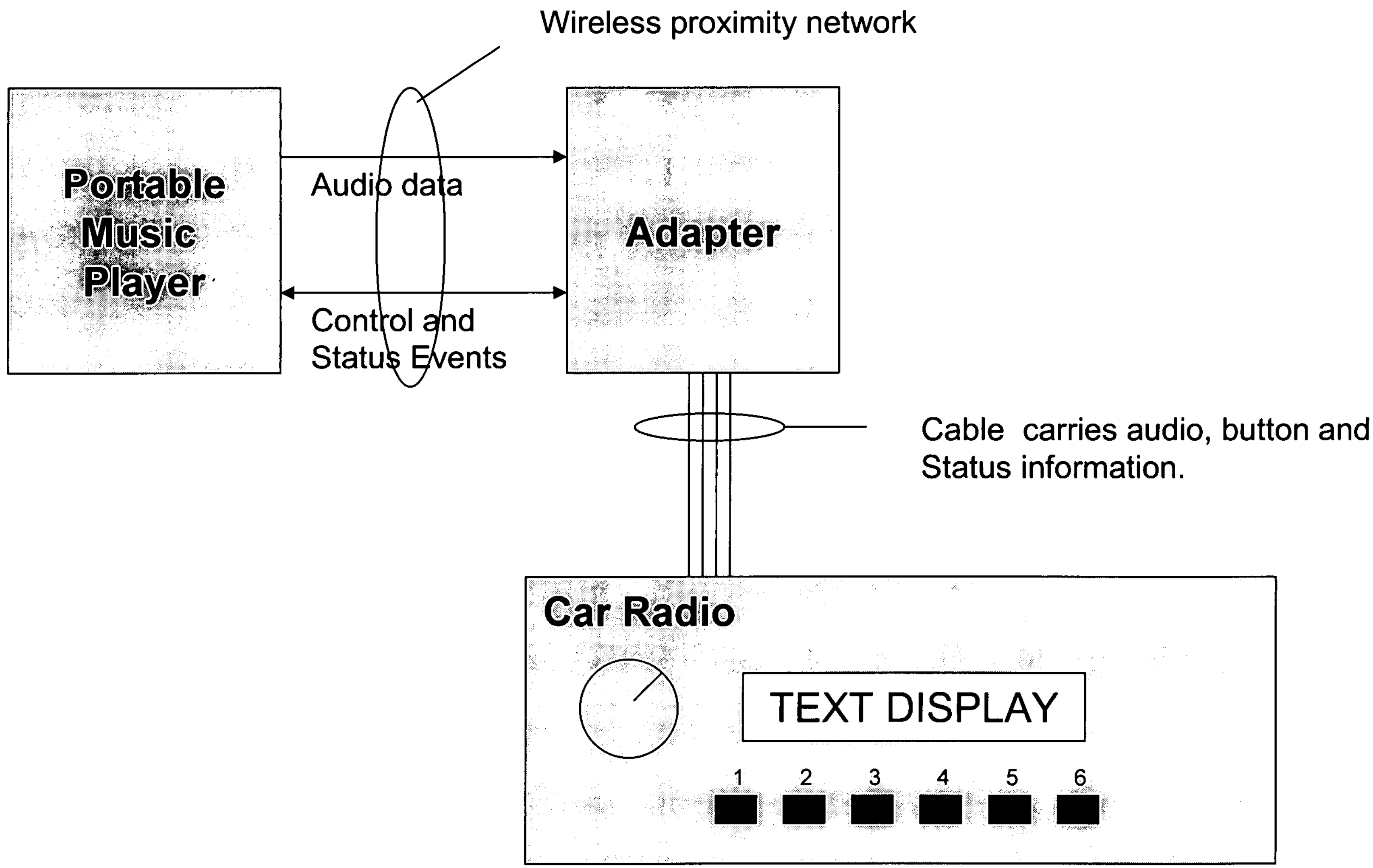
- Selection of appropriate controller/control point and renderer devices to support *i*Radio features.
- DRM solution for UPnP Renderer
- SimpleCenter enhancements to demonstrate *i*Radio type features

# Car

- Enhance Omnifi in the car to support/demonstrate *i*Radio features.
- If Omnifi won't work for some reason, then help select/build another device for demo and trials (PDA, media player with audio BT/WiFi node…?)

| | |
|---|---|
| Scope: | Products we want :<br>1- Initially for demonstration: a universal CD adaptor for a majority of OEM and aftermarket head-units forwarding on a 2 wire serial bus at 9.6kbps (RS232 or TTL) all the head-unit key events along with pushing CD text information back to the head-unit. This should be based on SSI iPOD or XM CD adaptor box technology<br>2- For trials: an integrated core reference design that could be licensed to an ODM of Motorola's choice based on ADI BlackFin technology or integrated into Zeevo BlueTooth system on chip. This reference design will integrate Motorola's iRadio BlueTooth stack and control middleware with SSI universal CD changer adapter technology<br>3- To be Negotiated: small series of 100-200 wireless adaptors based on reference design to be demonstrated in Q2 2005 for limited trial. |
| Licensing: | Source code and SW license from the CD adaptor +BT+iRadio middleware<br>Hardware reference design based on BlackFin |
| Ownership of SW | Motorola – SSI will be able to license it back close to royalty free |
| Warranties | |
| Technical assistance and Post Warranty Services | |
| IP Indemnification | SSI brings:<br>- universal CD adaptor codes<br>- Blackfin integration<br>- USB host solution<br>- FM broadcast synthesizer<br>- |
| Term | |
| Most Favored Customer | |
| | |

# Wireless audio adapter for car radios

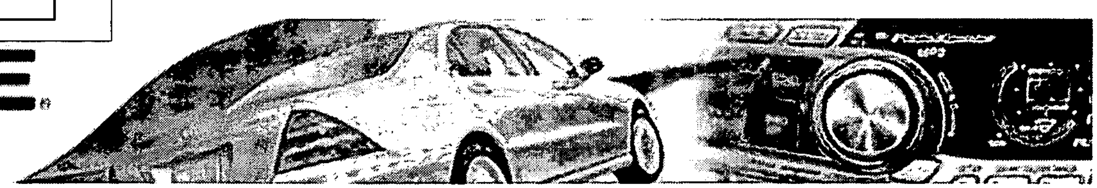


# Alpine Wireless Car Adpator Presentation

iRadio™

ALPINE
Car Audio & Navigation Systems

*JMV & MG*
*9/20/04*



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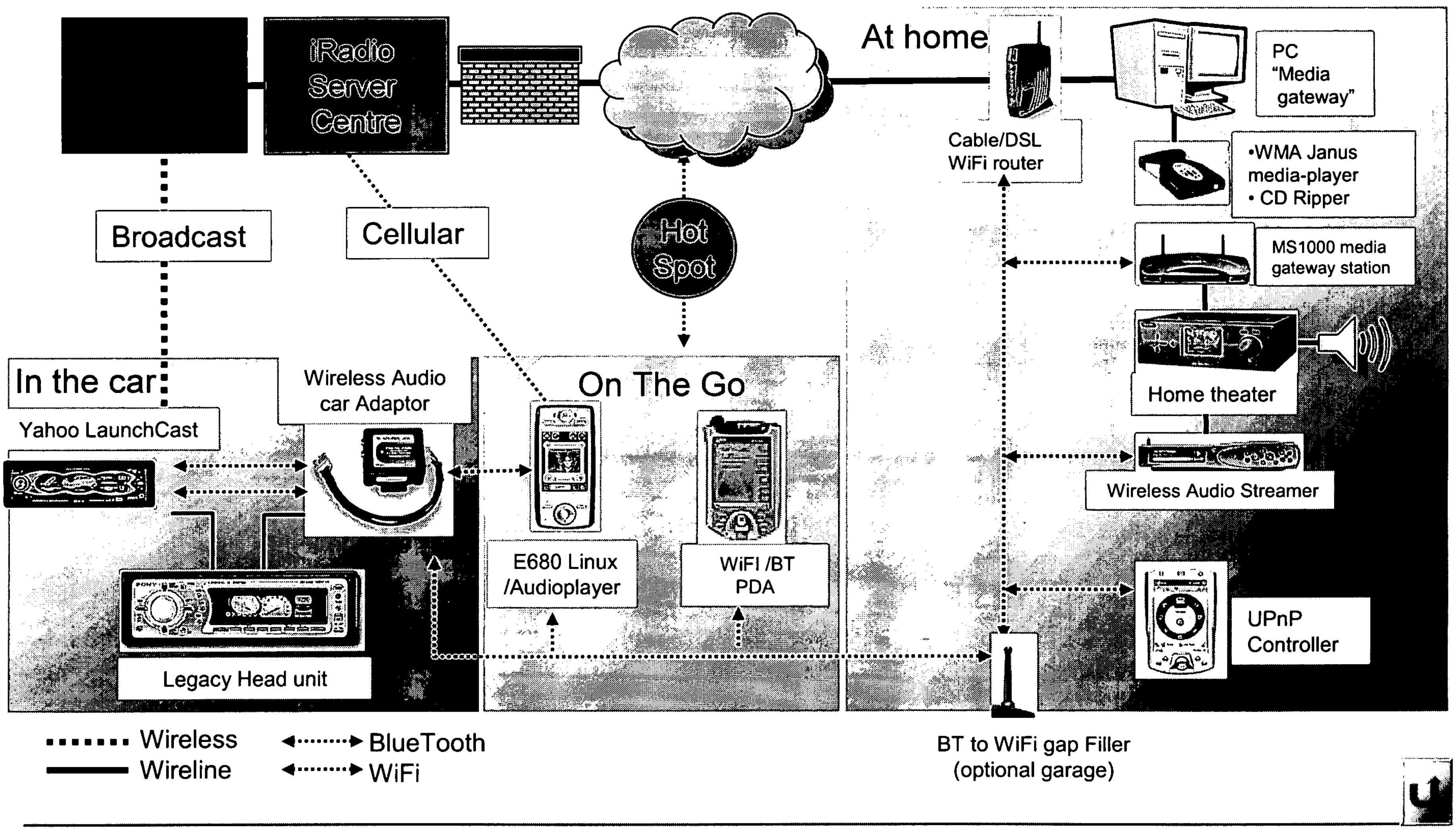
iRadio™

# iRadio "Physical" Concept Architecture



Radio™

# Daily Set automated aggregation & secure distribution…

My Music On-Demand

**Stream #1: Music Subscription**
- Yahoo Launch
- XM favoritesPersonnal Mix
- Webradio- Live365, Virgin radio

My Music collection

**Stream #2: Music I own**
- CD ripped collection
- Digital Music downloads

My News

**Stream #3: My News Talk**
- NPR morning news
- CNBC Talk shows…

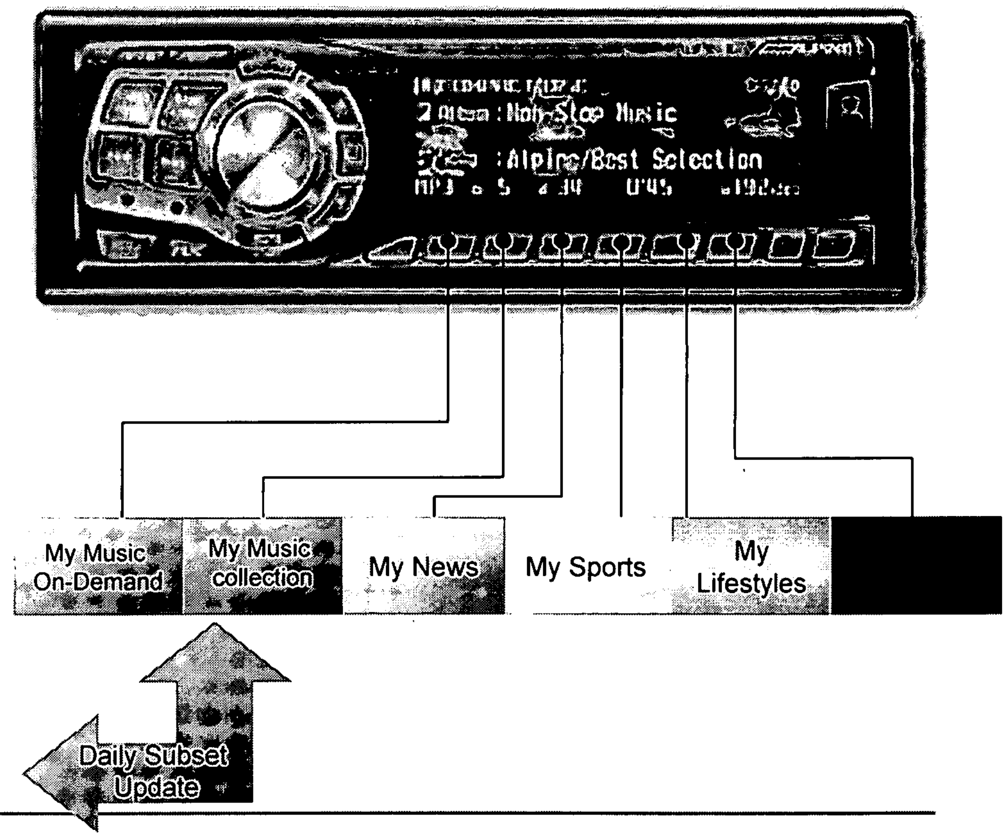
My Sports

**Stream #4 My Sports Talk**
- Webcast or TV feeds
- AM recordings

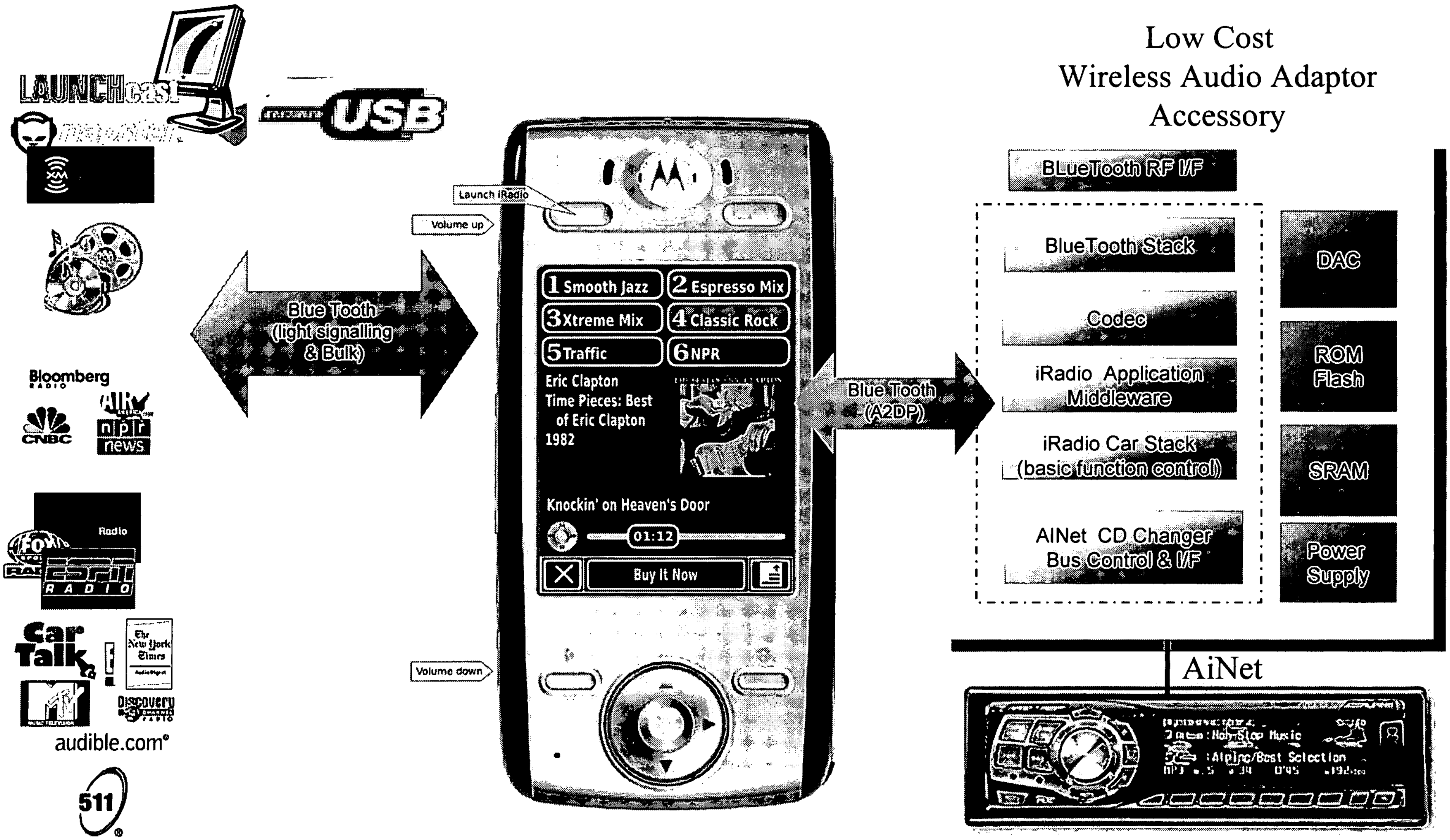
My Lifestyles

**Stream #5 My Lifestyles Talk**
- Car talk, Entertainment weekly,
- Discovery, History
- Audiobooks, Printed Magazines

**Stream #6: My Traffic**
- 511 personal service update
(pre-loaded or live from phone)

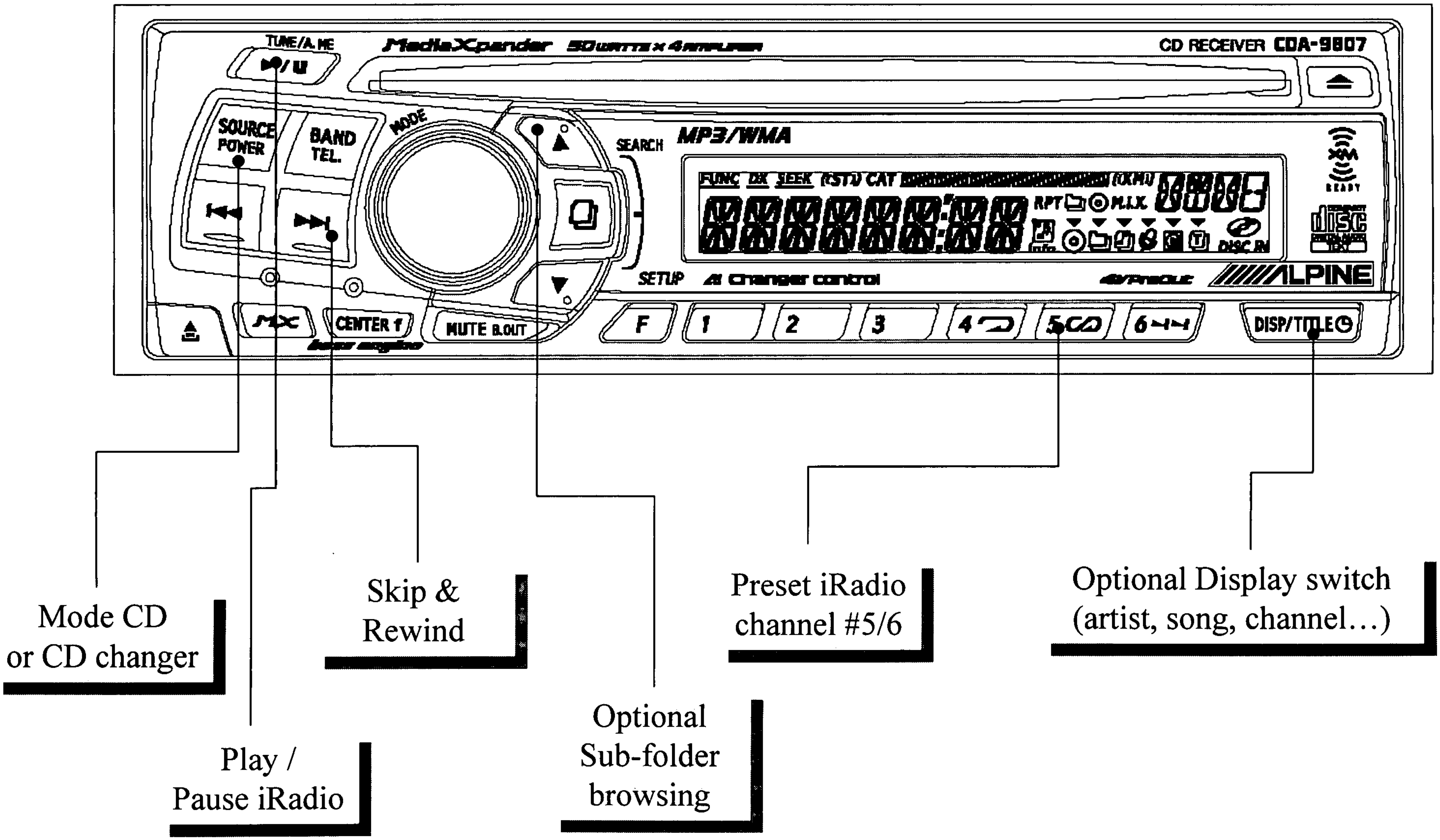


# iRadio™ From @Home to On-The-Go to in the Car…



iRadio™

# No new UI behavior to learn…



iRadio™

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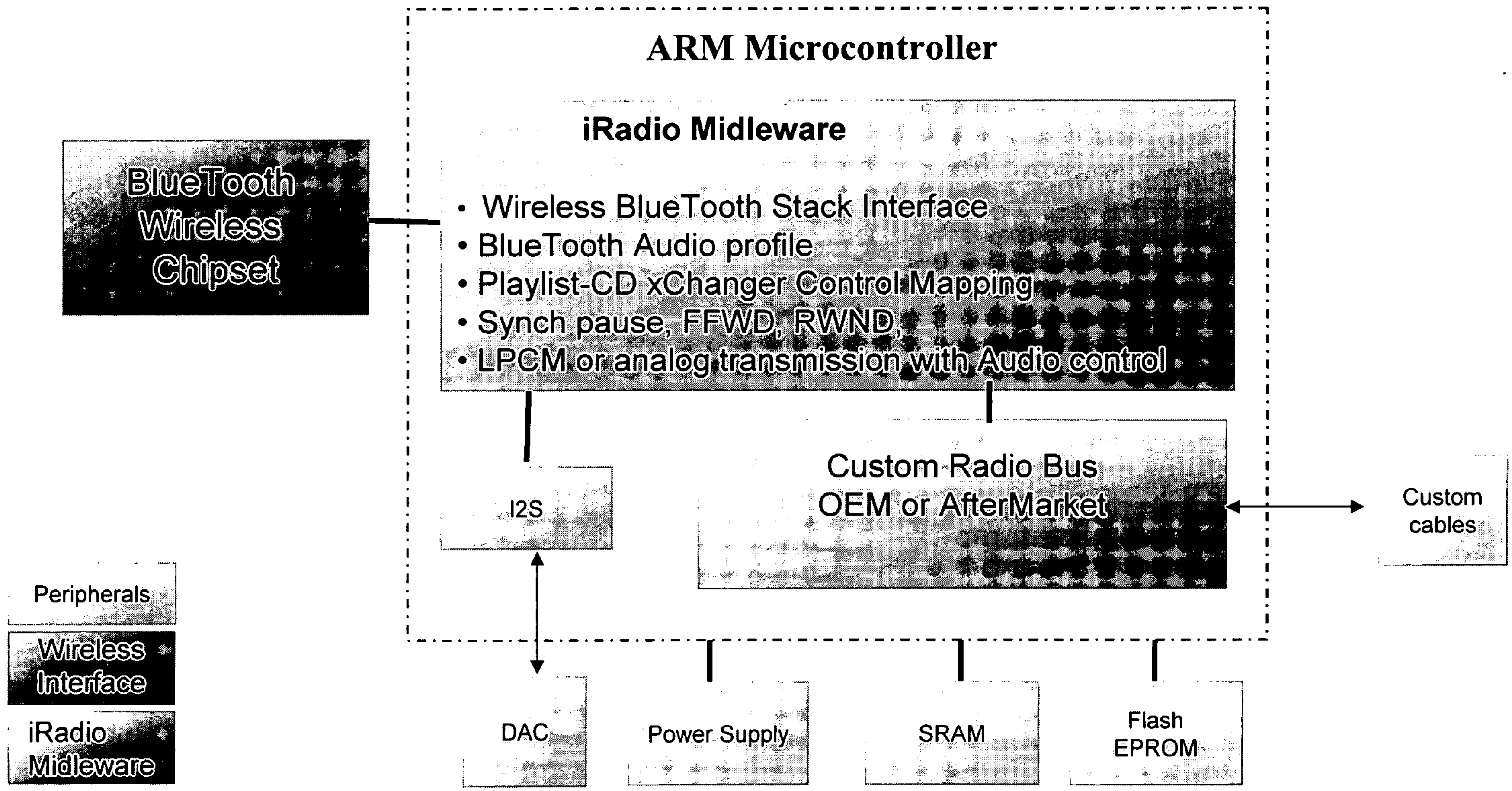
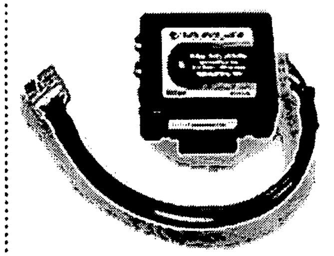
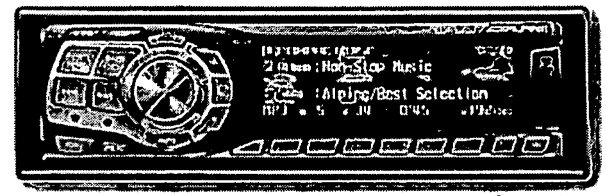


iRadio™

# iRadio Car Adaptation Road-Map

**Wireless Adaptor (Legacy)**





**Head-Unit Integration (NextGen)**

iRadio Middleware

| | Blue Tooth | Wi-Fi | Media Memory Card | USB Host | FM Broadcast | Multi-Codecs | Voice Commands |
|---|---|---|---|---|---|---|---|
| Low End | X | | | | | | |
| | X | | X | X | X | X | |
| High End | | X | X | | | | |
| | | X | X | X | X | X | X |

iRadio Middleware

| | Blue Tooth | Wi-Fi | Media Memory Card | Hard Drive |
|---|---|---|---|---|
| Low End | X | | | |
| | X | | X | |
| High End | | X | X | |
| | | X | | X |

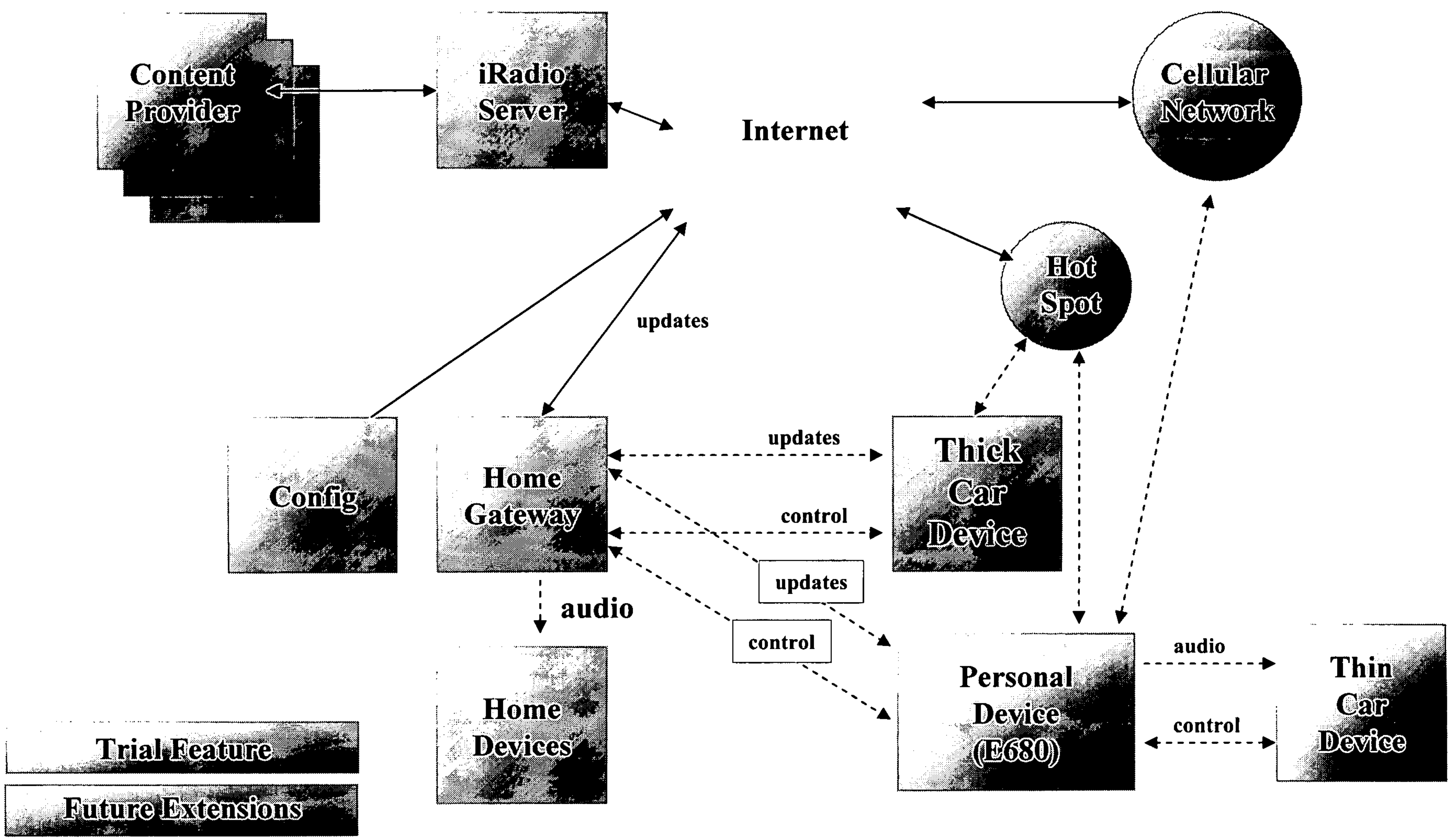
# Wireless Car Adpator Summary

iRadio™

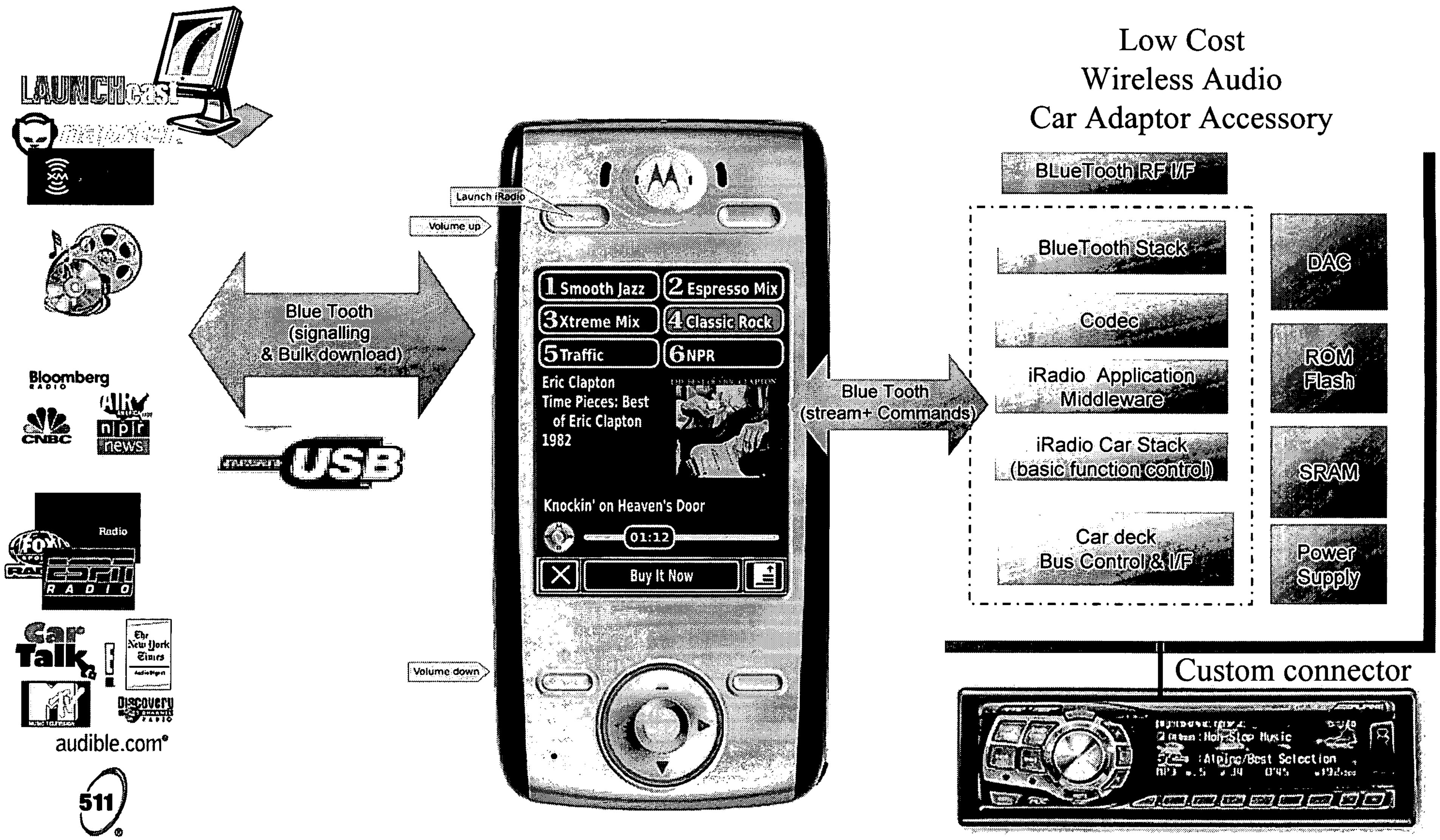
*JMV*

*9/22/04*

# iRadio™ Overview

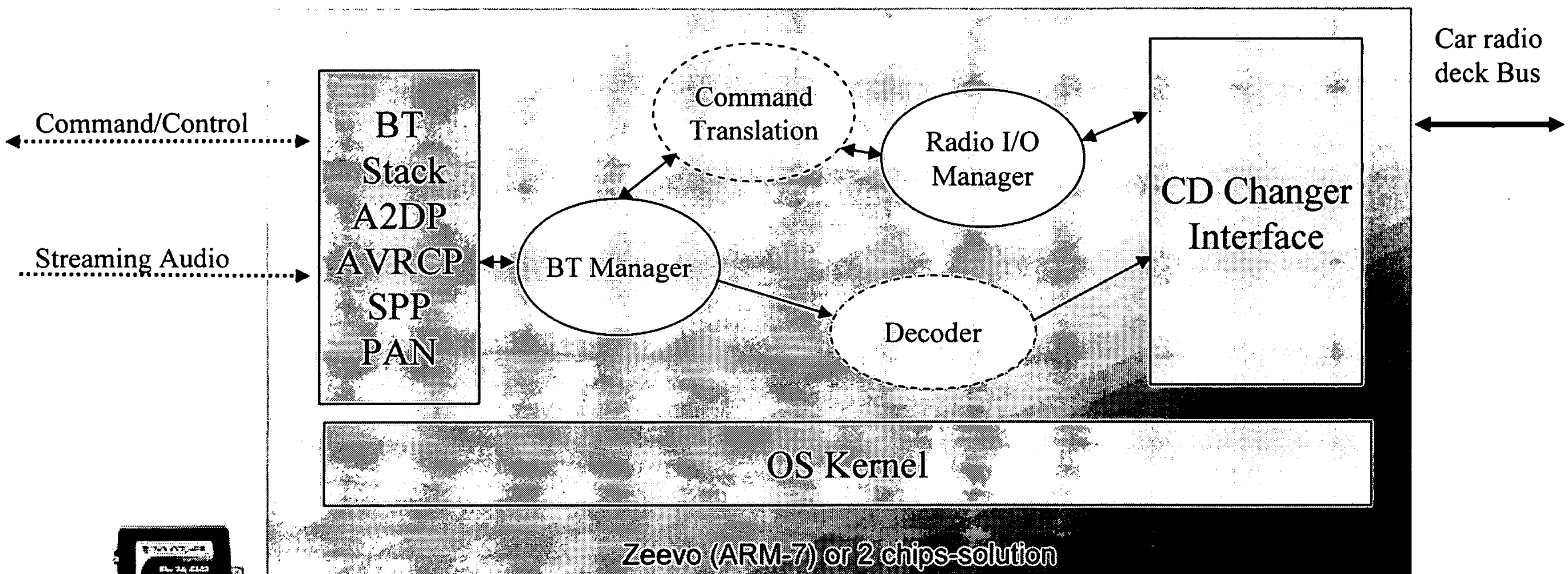


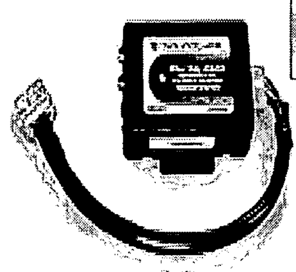
# iRadio™ Seamless Mobility Audio & Data Flow…



iRadio™

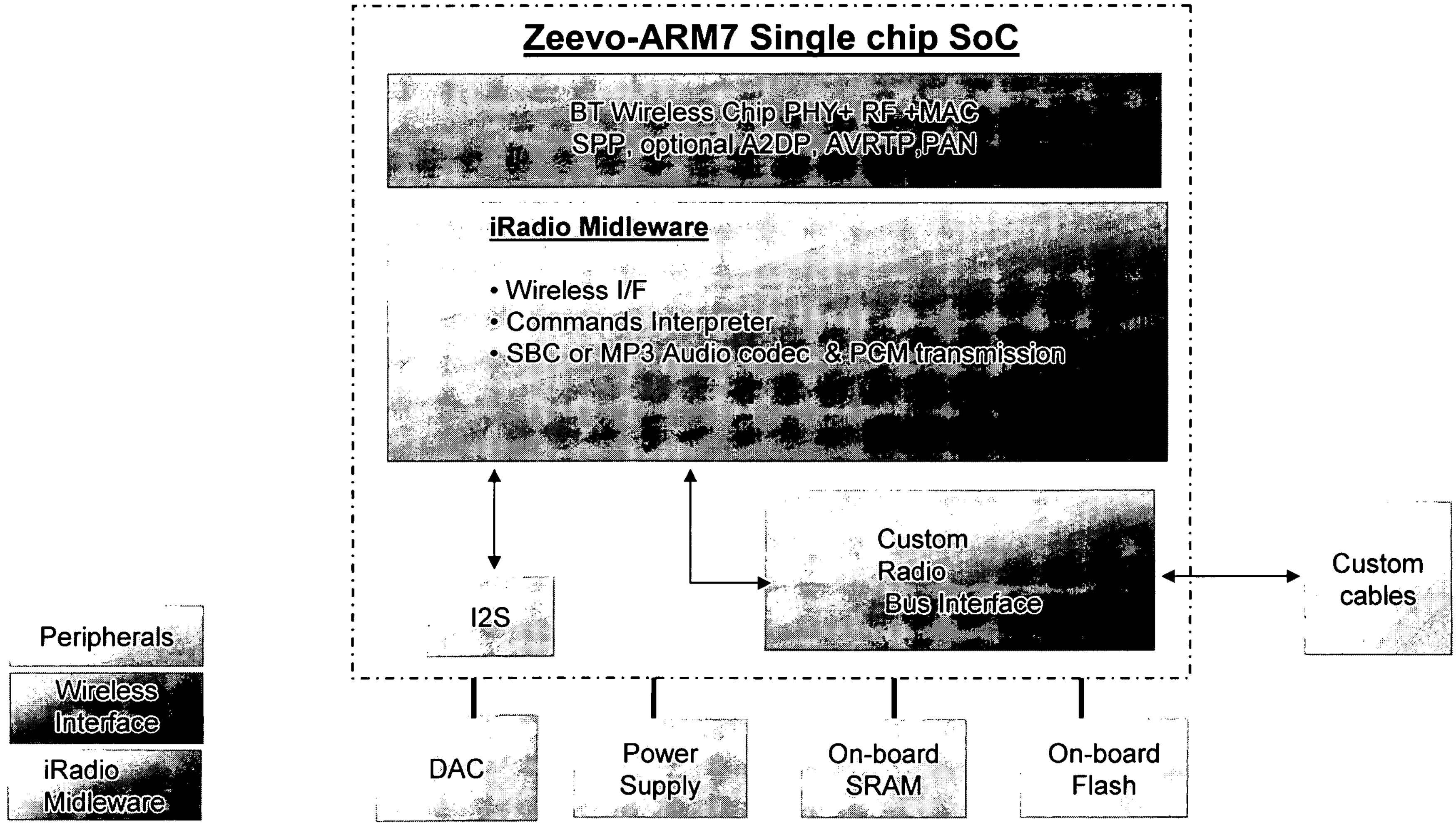
# Wireless Audio Car Adapter – Baseline Function



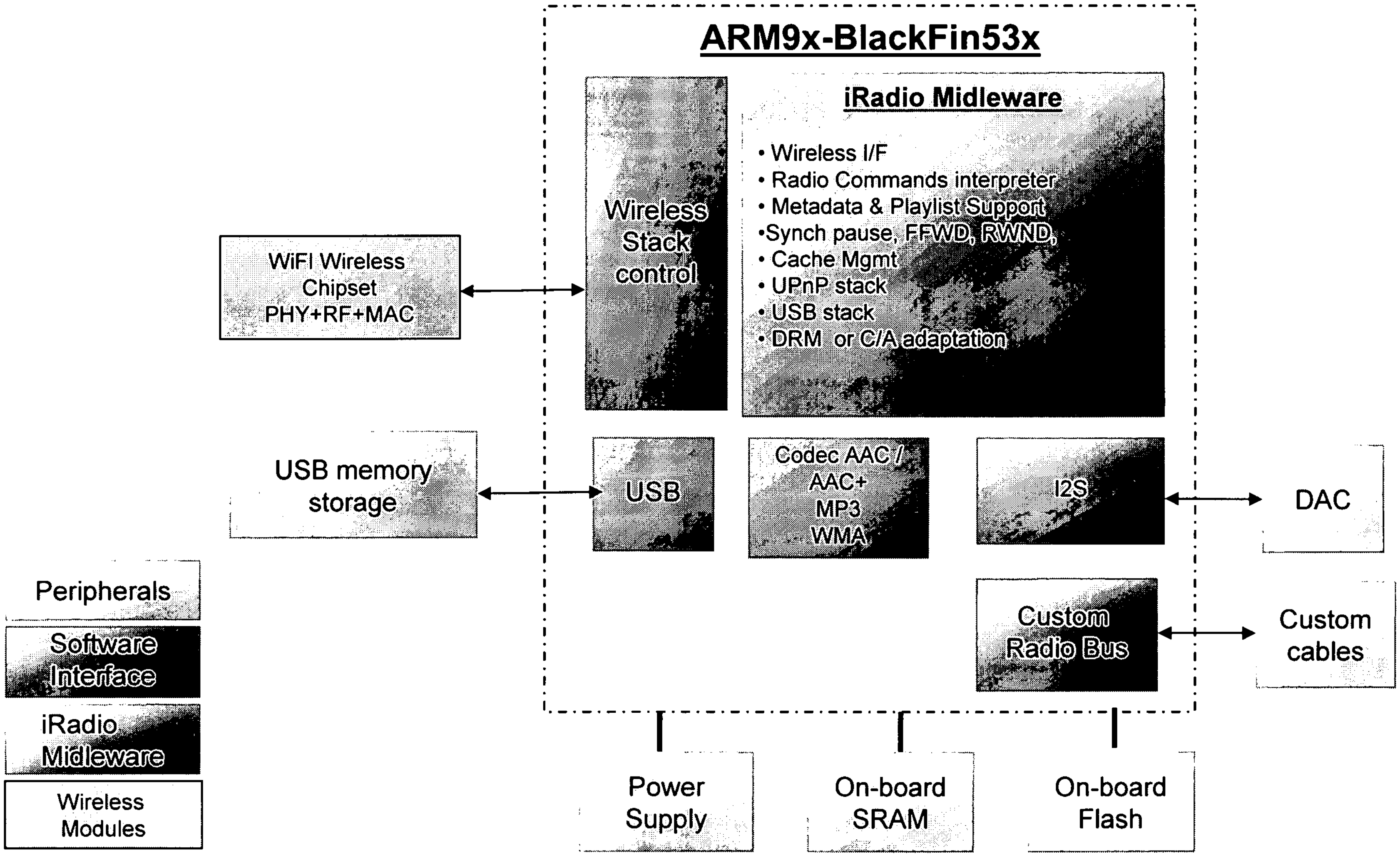



iRadio™

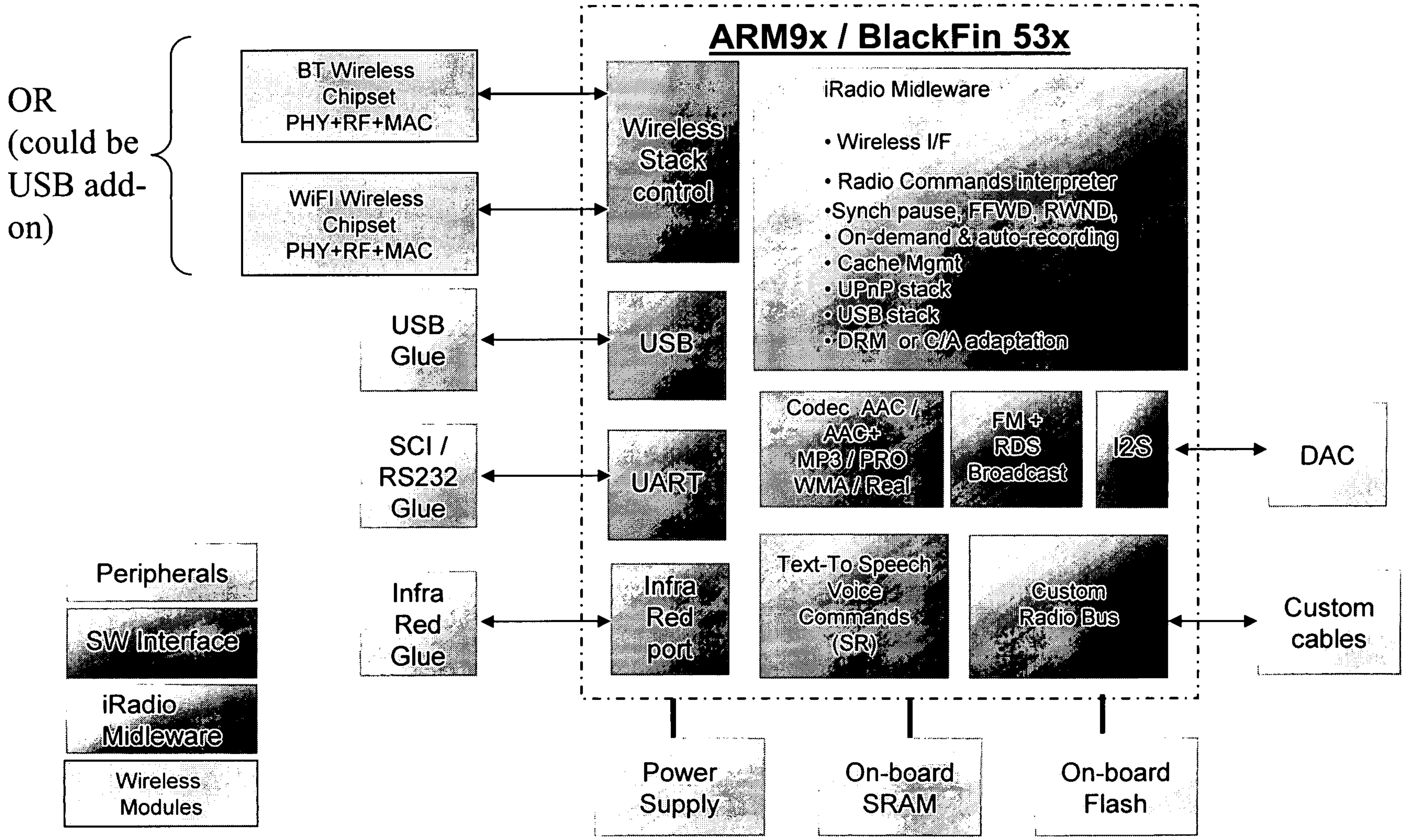
# Wireless Car Adaptor Closed Topology- Low Tier -



# iRadio™ Wireless Car Adaptor Topology- Mid-Tier



# iRadio™ Wireless Car Adaptor Opened Topology- High tier



iRadio™

# Car Universal Audio Adapter Road-Map

| Tier | Middleware | Blue Tooth | Direct Car Deck Connect | Wi-Fi | Media Memory Card | USB Host Dual USB slots | FM Broadcast + RDS | Codecs | Digital Recording | Voice Command | Processor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Low Tier | iRadio basic Middleware | X | X | | | | | SBC or MP3 only | | | Zeevo/ ARM7 |
| Low Tier | iRadio basic Middleware | X | | | | | X | SBC, MP3, WMA, AAC+ | | | ARM9 or BlackFin |
| Mid Tier | iRadio Middleware Full Renderer | X | X | | X | X | X | SBC, MP3, WMA, AAC+ | ? | | ARM9 or BlackFin |
| Mid Tier | iRadio Middleware Full Renderer | | X | X | X | | | SBC, MP3, WMA, AAC+ | | | ARM9 or BlackFin |
| High Tier | iRadio Middleware Full Renderer | | X | X | X | X | X | SBC, MP3, WMA, AAC+ | | | ARM9 or BlackFin |
| High Tier | iRadio Middleware Full Renderer | X | X | X | X | X | X | SBC, MP3, WMA, AAC+ | X | X | ARM9 or BlackFin |

# iRadio Media Control Protocol

Motorola Labs

| Revision History | | |
|---|---|---|
| Working Draft v0.1 | September 28, 2004 | Michael Pearce |
| Working Draft v0.2 | September 29, 2004 | Michael Pearce |
| Working Draft v0.3 | September 30, 2004 | Michael Pearce |
| Working Draft v0.4 | October 1, 2004 | Michael Pearce |
| Working Draft v0.5 | October 7, 2004 | Michael Pearce |
| Working Draft v0.6 | October 13, 2004 | Michael Pearce |
| Working Draft v0.7 | October 15, 2004 | Michael Pearce |
| Working Draft v0.8 | October 24, 2004 | Michael Pearce |
| Working Draft v0.9 | October 27, 2004 | Ed Costello |
| Working Draft v0.10 | October 28, 2004 | Michael Pearce |
| Working Draft v0.11 | November 2, 2004 | Michael Pearce |
| Working Draft v0.12 | November 19, 2004 | Michael Pearce |
| Working Draft v0.13 | December 2, 2004 | Michael Pearce |
| Working Draft v0.14 | December 16, 2004 | Michael Pearce |
| Working Draft v0.15 | January 26, 2005 | Andrew Will |

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# 1 Introduction

This protocol is intended to support playback of content in the distributed environment envisioned by iRadio. It supports distributed control of playback and supports optional streaming of content from a handset to a player via Bluetooth.

# 2 Theory of Operation

The system is envisioned to consist of three classes of devices:

1. The Mobile Client (a.k.a. handset), which contains a synchronized subset of the content. The Mobile Client also contains a playback control user interface and is capable of rendering the content locally as well as remotely controlling rendering of the content. The Mobile Client can optionally stream the content to a remote renderer.
2. The gateway, which contains the master copy of the content. The gateway also contains a playback control user interface and is capable of rendering the content locally or via remote control.
3. The WACA (Wireless Audio Car Adapter), which does not contain a copy of the content. The WACA contains a playback control user interface and is capable of rendering the content received in a stream from the Mobile Client.

Throughout this document, in contexts where either the gateway or the WACA would be playing the same role, the term "peer" is used to refer them interchangeably. However, this does not imply equivalence between these devices in the overall system architecture. Rather, it is used to in this specification to simplify the description of the protocol.

## 2.1 Initiation

iMCP operates over a Bluetooth serial port profile (SPP) connection. The Mobile Client is always the SPP server, while the gateway and WACA are always SPP clients. This means the gateway and WACA must be periodically scanning for the presence of the Mobile Client and, when its presence is detected, initiating an SPP connection to the Mobile Client. Once such a connection is established between the Mobile Client and either the gateway or the WACA, the control channel is used to exchange MSG_SYN and MSG_SYN_ACK messages (which includes an indication by the peer of whether it will require streamed audio content or not). At this point, the protocol is ready to carry other control messages as well as streamed audio content (if necessary).

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## 2.2 Termination

iMCP termination is implied by tearing down the Bluetooth SPP connection. A peer may optionally indicate termination via a MSG_POWERDOWN message prior to closing the Bluetooth SPP connection

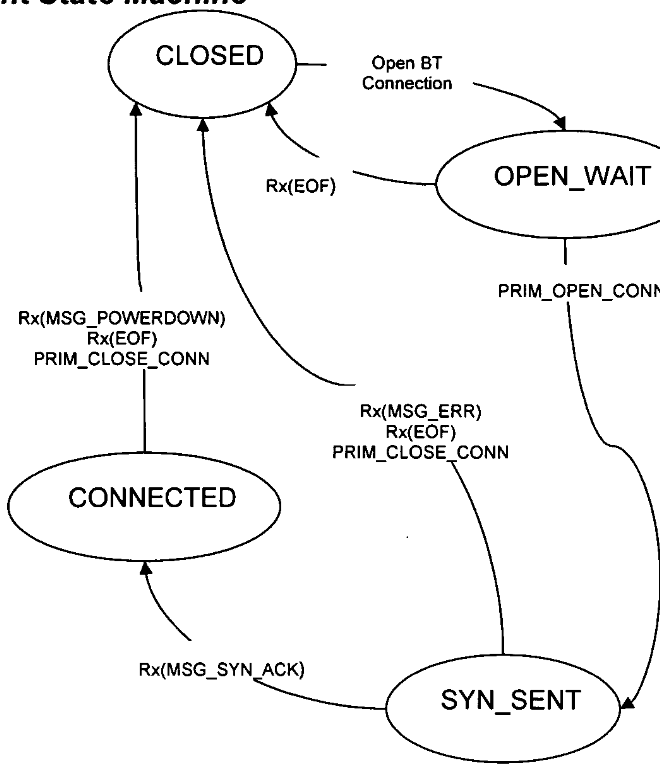
# 3 State Machines

In the following sections, the state machines are specified using tables (one per state). In each table, only the relevant events are included. Events that occur in a state that are not specified in these tables are to be ignored for purposes of state transitions. This includes any event that occurs without a matching condition to what is specified in the table.

The Mobile Client state machine should be implemented by the handset (or other non-handset controller).

The peer state machine should be implemented by the WACA and the gateway peers.

## 3.1 Mobile Client State Machine




Mobile Client State Diagram

### 3.1.1 CLOSED State

In this state, the Bluetooth transport connection is closed. The implementation should be listening for incoming Bluetooth SPP connections.

| Event | Condition | Next State | Action |
|---|---|---|---|
| New Transport Connection | | OPEN_WAIT | |

### 3.1.2 OPEN_WAIT State

In this state, the Bluetooth transport connection should be open. The state machine is waiting for the upper layer to request a connection.

| Event | Condition | Next State | Action |
|---|---|---|---|
| PRIM_OPEN_CONN | | SYN_SENT | Tx(MSG_SYN) |
| Rx(EOF) | | CLOSED | Notify(CONN_FAILURE) |

### 3.1.3 SYN_SENT State

In this state, the state machine is awaiting a response to the MSG_SYN message.

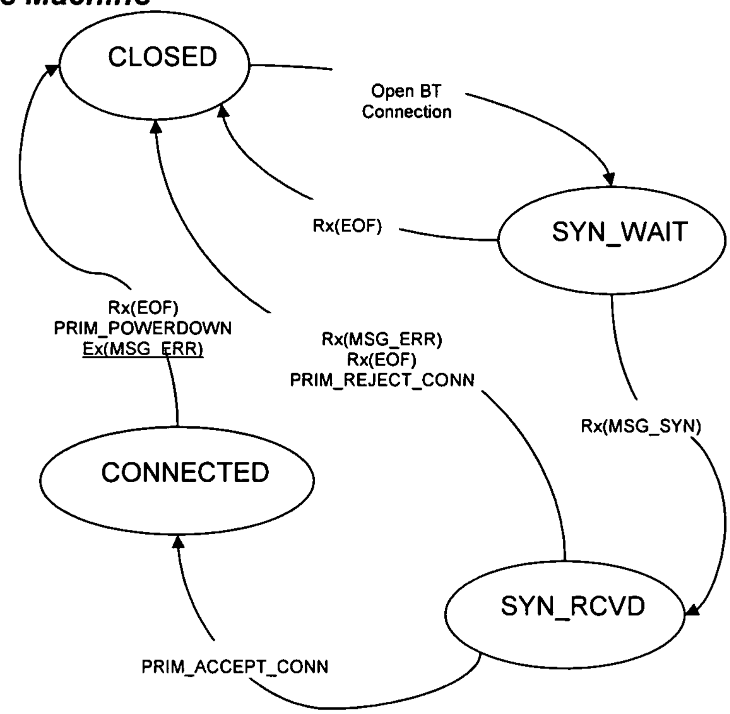
| Event | Condition | Next State | Action |
|---|---|---|---|
| Rx(MSG_SYN_ACK) | | CONNECTED | Notify(CONN_OPEN) |
| Rx(MSG_ERR) | | CLOSED | Notify(CONN_FAILURE) |
| Rx(EOF) | | CLOSED | Notify(CONN_FAILURE) |
| PRIM_CLOSE_CONN | | CLOSED | Tx(MSG_ERR) |

### 3.1.4 CONNECTED State

In this state, the connection has been successfully opened.

| Event | Condition | Next State | Action |
|---|---|---|---|
| Rx(MSG_POWERDOWN) | | CLOSED | Notify(CONN_CLOSED) |
| Rx(EOF) | | CLOSED | Notify(CONN_CLOSED) |
| PRIM_CLOSE_CONN | | CLOSED | |

### *3.2 Peer State Machine*




Peer State Diagram

#### 3.2.1 CLOSED State

In this state, the Bluetooth transport connection is closed. The implementation should be periodically scanning for the presence of the Mobile Client. When the Mobile Client is detected, a new SPP connection should be initiated to the Mobile Client.

| Event | Condition | Next State | Action |
|---|---|---|---|
| New Transport Connection | | SYN_WAIT | |

#### 3.2.2 SYN_WAIT State

In this state, the Bluetooth transport connection should be open. The state machine is waiting for an MSG_SYN message.

| Event | Condition | Next State | Action |
|---|---|---|---|
| Rx(MSG_SYN) | | SYN_RCVD | Notify(CONN_REQUEST) |
| Rx(EOF) | | CLOSED | Notify(CONN_FAILURE) |

### 3.2.3 SYN_RCVD State

In this state, the peer has received a MSG_SYN and is waiting for the upper layer to either accept or reject the connection.

| Event | Condition | Next State | Action |
|---|---|---|---|
| PRIM_ACCEPT_CONN | | CONNECTED | Tx(MSG_SYN_ACK) |
| PRIM_REJECT_CONN | | CLOSED | Tx(MSG_ERR) |
| Rx(MSG_ERR) | | CLOSED | Notify(CONN_FAILURE) |
| Rx(EOF) | | CLOSED) | Notify(CONN_FAILURE) |

### 3.2.4 CONNECTED State

In this state, the connection has been successfully opened.

| Event | Condition | Next State | Action |
|---|---|---|---|
| PRIM_POWERDOWN | | CLOSED | Tx(MSG_POWERDOWN) |
| Rx(EOF) | | CLOSED | Notify(CONN_CLOSED) |
| Rx(MSG_ERR) | | CLOSED | Notify(CONN_REJECT) |

## *3.3 Protocol Interface*

The primitives and notifications in the protocol interface describe only the state-changing events that drive (and are generated from) the state machines specified in section 3. Data types referenced in this section are abstract only (and should be self-explanatory).

This is not intended to be an application programming interface. It is merely intended to describe the events that are exchanged between the state machine and the upper layer. A primitive is an event received by the state machine from the upper layer, while a notification is an event delivered to the upper layer from the state machine.

### 3.3.1 Mobile Client Interface

#### 3.3.1.1 Primitives

##### *3.3.1.1.1 PRIM_OPEN_CONN*

Sent to the state machine by the upper layer when the upper layer wishes to initiate the iMCP connection establishment procedures.

##### *3.3.1.1.2 PRIM_CLOSE_CONN*

Sent to the state machine by the upper layer when the upper layer wishes to initiate the iMCP connection close procedures.

#### 3.3.1.2 Notifications

##### *3.3.1.2.1 CONN_OPEN*

Sent by the state machine to the upper layer to indicate the iMCP protocol is now open. Information included in this notification is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|
| iMCP_Version | Integer | Mandatory | Protocol version supported by peer |
| ContentAvail | Boolean | Mandatory | True: Peer has local content<br>False: Peer needs streamed content |
| HardwareId | Integer | Mandatory | 0: No Interaction Hardware<br>0x1-0xFFFFFFFF: Hardware Identifier |

#### *3.3.1.2.2 CONN_FAILURE*

Sent by the state machine to the upper layer to indicate the iMCP protocol failed to open. Information included in the notification is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|
| ErrorCode | Integer | Mandatory | Error Code |
| ErrorMsg | String | Mandatory | Error Message |

#### *3.3.1.2.3 CONN_CLOSED*

Sent by the state machine to the upper layer to indicate the iMCP protocol has been closed.

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#### *3.3.1.2.4 CONN_REJECT*

Sent by the state machine to the upper layer to indicate the mobile client does not wish to be connected to the peer at this time. Information included in the notification is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|
| ErrorCode | Integer | Mandatory | Error Code |
| ErrorMsg | String | Mandatory | Error Message |

## 3.3.2 Peer Interface

### 3.3.2.1 Primitives

#### *3.3.2.1.1 PRIM_ACCEPT_CONN*

Sent by the upper layer to the state machine to indicate the upper layer wishes to accept the offered connection. Information included in this primitive is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|

| | | | |
|---|---|---|---|
| ContentAvail | Boolean | Mandatory | True: Peer has local content<br>False: Peer needs streamed content |
| HardwareId | Integer | Mandatory | 0: No Interaction Hardware<br>0x1-0xFFFFFFFF: Hardware Identifier |

#### *3.3.2.1.2 PRIM_REJECT_CONN*

Sent by the upper layer to the state machine to indicate the upper layer does not wish to accept the offered connection. Information included in this primitive is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|
| ErrorCode | Integer | Mandatory | Error Code |
| ErrorMsg | String | Mandatory | Error Message |

#### *3.3.2.1.3 PRIM_POWERDOWN*

Sent by the upper layer to the state machine to indicate the upper layer is powering off and the iMCP protocol should be closed.

### 3.3.2.2 Notifications

#### *3.3.2.2.1 CONN_REQUEST*

Sent by the state machine to the upper layer to indicate an new connection has been requested. Information included in this notification is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|
| iMCP_Version | Integer | Mandatory | Protocol version supported by Mobile Client |

#### *3.3.2.2.2 CONN_FAILURE*

Sent by the state machine to the upper layer to indicate the connection has failed. Information included in this notification is described below.

| Parameter | Type | Required | Description |
|---|---|---|---|
| ErrorCode | Integer | Mandatory | Error Code |
| ErrorMsg | String | Mandatory | Error Message |

#### *3.3.2.2.3 CONN_CLOSED*

Sent by the state machine to the upper layer to indicate the connection has been closed.

## 3.4 Example Message Sequences

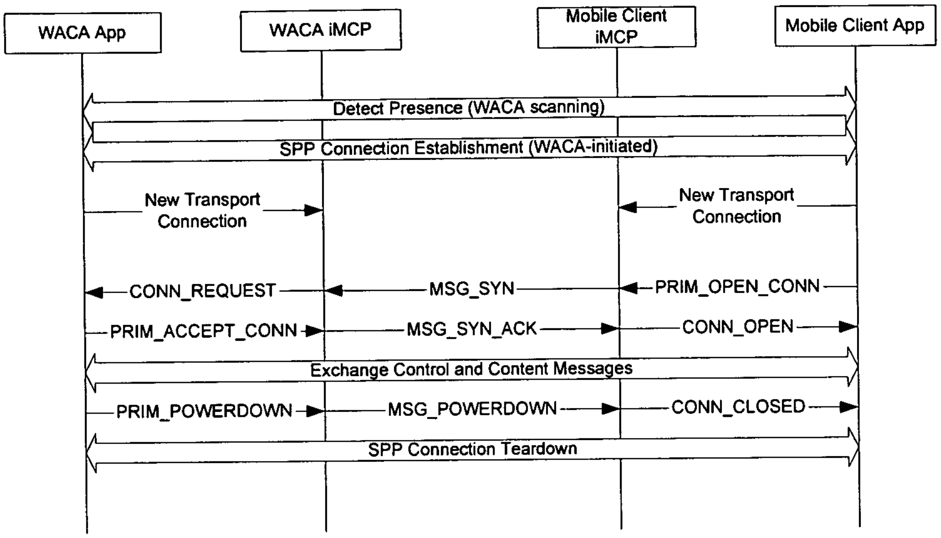



**Figure 1 Normal Connection Open and Close**

# 4 Message Framing and Encoding

Boolean data is encoded as a single byte having either a 0x00 (false) or 0x01 (true) value.

Integer data is encoded in big-endian variable length fields, depending on the maximum range of values allowed for the field in question. Integer field lengths must be 1, 2, 4, or 8 bytes long. Integers are unsigned unless otherwise indicated.

String data is encoded using a 2-byte (big-endian) length prefix followed by the specified number of bytes of UTF8-encoded character data (note: the length prefix specifies the number of bytes of character data, not the number of characters in the string). The longest string that may be transferred using this encoding is 65535 characters, assuming none of the characters requires more than one byte.

Note that this encoding scheme is compatible with the commonly used java.io.DataInputStream and java.io.DataOutputStream classes.

## 4.1 Framing

All messages begin with a 4-byte synchronization sequence[1] (0xDEADBEEF) followed by a 1-byte channel identifier, allowing control and content information to be multiplexed across a single byte stream.

Each message is framed using a length-prefix scheme. Immediately following the channel identifier is a 2-byte message length field. The 7 bytes of synchronization, channel

[1] The synchronization sequence is present in every message, but is only included in table 1 in this document.

identification and message length information are not included in the message size, allowing a maximum enclosed message size of 65535 bytes.

**Table 1 Framing Header**

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| SYNC | Integer | 4 | 0xDEADBEEF | Synchronization Sequence |
| CHANNEL | Integer | 1 | 0-1 | Channel Identifier:<br>0: Control<br>1: Content<br>2: Harmonization<br>255: Management |
| MSG_LEN | Integer | 2 | 0-65535 | Message Length |

## *4.2 Control Channel*

Control messages begin with a 1-byte message type field. The remainder of the message format is type-specific. The message types are enumerated below:

**Table 2 Control Message Types**

| Message Type | Value |
|---|---|
| MSG_SYN | 0x00 |
| MSG_SYN_ACK | 0x01 |
| MSG_ERR | 0x02 |
| MSG_DISPLAY | 0x03 |
| MSG_META | 0x04 |
| MSG_CREDIT | 0x05 |
| MSG_FLUSH | 0x06 |
| MSG_POWERDOWN | 0x07 |
| MSG_RENDER_CMD | 0x08 |
| MSG_SERVER_CMD | 0x09 |
| MSG_ECHO | 0x0A |

### 4.2.1 MSG_SYN

This message is only sent by the Mobile Client to either the gateway or WACA peers.

| Field | Type | Length | Value | Description |
|---|---|---|---|---|

| | | (bytes) | | |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | 2 | Message Length |
| MSG_TYPE | Integer | 1 | 0x00 | MSG_SYN |
| IMCP_VERSION | Integer | 1 | 0x01 | Protocol Version Number |

### 4.2.2 MSG_SYN_ACK

This message is only sent by the gateway or WACA peers to the Mobile Client in response to a MSG_SYN. If the peer has a local content cache (e.g., the gateway), then it should set the FLAG_CONTENT_AVAIL to true, causing the Mobile Client to avoid sending content on the content channel as well as metadata in MSG_META messages. If the peer does not have a local content cache (e.g., the WACA), then it should set the FLAG_CONTENT_AVAIL to false, causing the Mobile Client to stream content on the content channel as well as send metadata in MSG_META messages.

The HW_ID field indicates the interaction hardware identifier. The gateway should return a zero for this field, while the WACA should return an identifier specific to the head unit it's attached to. This will enable the Mobile Client to properly interpret the interaction events for that device.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | 7 | Message Length |
| MSG_TYPE | Integer | 1 | 0x01 | MSG_SYN_ACK |
| IMCP_VERSION | Integer | 1 | 0x01 | Protocol Version Number |
| FLAG_CONTENT_AVAIL | Boolean | 1 | 0, 1 | True: Local content available<br>False: Need content |
| HW_ID | Integer | 4 | 0x0-0xFFFFFFFF | 0: No Interaction Hardware<br>0x1-0xFFFFFFFF: Hardware Id |

### 4.2.3 MSG_ERR

This message may be sent by either the Mobile Client or the peers in response to MSG_SYN or MSG_EVT messages.

<u>Alternatively, this message may be sent by the Mobile Client in response to a MSG_SYN_ACK message.</u>

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | Variable | Message Length |
| MSG_TYPE | Integer | 1 | 0x02 | MSG_ERR |
| ERR_CODE | Integer | 1 | 0-255 | Error Code |
| ERR_MSG | String | Variable | | Error Message |

**Table 3 Error Codes**

| Error Type | Code | Description |
|---|---|---|
| UNKNOWN_EVENT | 0x80 | An unknown or invalid event message was received |
| PEER_REJECTED | 0x81 | The peer receiving this message should temporarily stop its attempts to connect to the mobile client. |

### 4.2.4 MSG_DISPLAY

This message is sent from the Mobile Client to a content-receiving peer to indicate a request to display a short text message for a minimum amount of time.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | Variable | Message Length |
| MSG_TYPE | Integer | 1 | 0x03 | MSG_DISPLAY |
| MESSAGE | String | Variable | | Message to display |
| EXPIRES | Integer | 1 | 0-255 | 0: Display until explicitly cancelled by user<br>1-255: Display for EXPIRES seconds (or until cancelled) |

### 4.2.5 MSG_META

This message is sent from the Mobile Client to a content-receiving peer to indicate a change in the relevant content metadata, and will be inserted immediately prior to the content message to which it applies. This message would be sent as a result of a GOTO_CHANNEL event or a transition from one track to another within a channel. Note that not all of the tag information will be sent in every META message – the Mobile Client may only include the most relevant information in a given message. For example, when a new track begins within a channel, the CHANNEL_NUM and CHANNEL_NAME tags would not be sent again since they haven't changed.

This message will also be sent from the WACA and Gateway to the Mobile Client to indicate when the playback process actually makes the metadata relevant. In the WACA case, this is necessary due to the buffering on the WACA, while in the Gateway case, the Mobile Client has no other way to determine exactly when track playback begins.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | Variable | Message Length |
| MSG_TYPE | Integer | 1 | 0x04 | MSG_META |
| NUM_TAGS | Integer | 1 | 1-255 | Number of metadata tags that follow |
| Repeat the following NUM_TAGS times: | | | | |
| TAG_ID | Integer | 1 | 0-255 | Tag Identifier |
| TAG_LENGTH | Integer | 2 | 0-65535 | Tag Length (bytes that follow) |
| TAG_DATA | | Variable | | Tag Data |

**Table 4 Tag Identifiers**

| Tag | Id | Comment |
|---|---|---|
| ARTIST | 0x00 | Artist Name |
| TITLE | 0x01 | Track Title |
| ALBUM | 0x02 | Album Title |
| GENRE | 0x03 | Genre |
| CHANNEL_NUM | 0x04 | Channel Number |
| CHANNEL_NAME | 0x05 | Channel Name |
| TRACK | 0x06 | Track Number |
| NUM_TRACKS | 0x07 | Number of Tracks in Channel |
| CHANNEL_LEN | 0x08 | Length of Channel |
| TRACK_LEN | 0x09 | Length of Track |
| CHANNEL_REMAIN | 0x0A | Channel Time Remaining |
| TRACK_REMAIN | 0x0B | Track Time Remaining |
| ALBUM_ART_PNG | 0x0C | binary image in PNG format |
| ALBUM_ART_GIF | 0x0D | binary image in GIF format |
| ALBUM_ART_JPG | 0x0E | binary image in JPG format |

### 4.2.5.1 Artist Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| ARTIST | String | Variable | | Artist Name |

### 4.2.5.2 Track Title Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| TITLE | String | Variable | | Track Title |

### 4.2.5.3 Album Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| ALBUM | String | Variable | | Album Title |

### 4.2.5.4 Genre Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| GENRE | String | Variable | | Genre |

### 4.2.5.5 Channel Number Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL_NUM | Integer | 1 | 0-255 | Channel Number |

### 4.2.5.6 Channel Name Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL_NAME | String | Variable | | Channel Name |

### 4.2.5.7 Track Number Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| TRACK | Integer | 1 | 0-255 | Track Number |

#### 4.2.5.8 Total Tracks Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| NUM_TRACKS | Integer | 1 | 0-255 | Number of Tracks in Channel |

#### 4.2.5.9 Channel Length Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL_LEN | Integer | 2 | 0-65535 | Length of Channel (in seconds) |

**Comment:** Using a 16-bit integer here allows just over 18 hours to be expressed. If we think we need more than that, then we should bump this up to 32 bits.

#### 4.2.5.10 Track Length Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| TRACK_LEN | Integer | 2 | 0-65535 | Length of Track (in seconds) |

#### 4.2.5.11 Channel Time Remaining Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL_REMAIN | Integer | 2 | 0-65535 | Channel Time remaining (in seconds) |

**Comment:** Using a 16-bit integer here allows just over 18 hours to be expressed. If we think we need more than that, then we should bump this up to 32 bits.

#### 4.2.5.12 Track Time Remaining Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| TRACK_REMAIN | Integer | 2 | 0-65535 | Track Time remaining (in seconds) |

**Formatted:** Bullets and Numbering

#### 4.2.5.13 Album Art PNG Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| ALBUM_ART_PNG | binary | variable | | binary image in PNG format |

**Formatted:** Heading 4

#### 4.2.5.14 Album Art GIF Tag

| Field | Type | Length | Value | Description |
|---|---|---|---|---|

| | | (bytes) | | |
|---|---|---|---|---|
| ALBUM_ART_GIF | binary | variable | | binary image in GIF format |

Formatted: Heading 4

#### 4.2.5.15 Album Art JPG Tag

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| ALBUM_ART_JPG | binary | variable | | binary image in JPG format |

### 4.2.6 MSG_CREDIT

This message is sent from a content-receiving peer to the Mobile Client to control the flow of content. The CREDIT field indicates the number of bytes of new content should be transmitted to the receiver before waiting for another CREDIT message.

New content bytes need not be delivered in a single message matching the value in the CREDIT field. They may be delivered in several content messages as long as no more than CREDIT bytes of new content are delivered prior to receiving a new MSG_CREDIT message (this may be necessary, for example, if the tail of one track contains fewer bytes than the advertised credit; in this case, two content messages would be sent, one with the tail of the current track, and another with the head of the next track in the channel).

New MSG_CREDIT messages may be transmitted before all of the content fulfilling the previous MSG_CREDIT message has been delivered. This pipelining may be necessary to minimize buffering in the receiver.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | 3 | Message Length |
| MSG_TYPE | Integer | 1 | 0x05 | MSG_CREDIT |
| CREDIT | Integer | 2 | 0-65535 | Content Credit |

### 4.2.7 MSG_FLUSH

This message is sent from the Mobile Client to a content-receiving peer to cause the peer's content buffers to be flushed. This message would be sent as a result of a discontinuity in the playback due to, for example, a GOTO_CHANNEL event. This message resets any accumulated credit to zero. As a result, the content-receiving peer should immediately send a new MSG_CREDIT message indicating a new credit value.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |

| | | | | |
|---|---|---|---|---|
| MSG_LEN | Integer | 2 | 1 | Message Length |
| MSG_TYPE | Integer | 1 | 0x06 | MSG_FLUSH |

### 4.2.8 MSG_POWERDOWN

This message is sent from the WACA to indicate it is powering down and the session should be terminated.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | 1 | Message Length |
| MSG_TYPE | Integer | 1 | 0x07 | MSG_POWERDOWN |

### 4.2.9 MSG_RENDER_CMD

This message is sent from the Mobile Client to either the WACA or the gateway peer to control playback. It may also be sent from the WACA to the Mobile Client to indicate a local change in playback state (as a result of the user interaction), in which case it is informative only and will not result in a corresponding MSG_RENDER_CMD from the Mobile Client to the WACA.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | 2 | Message Length |
| MSG_TYPE | Integer | 1 | 0x08 | MSG_RENDER_CMD |
| RCMD_TYPE | Integer | 1 | 0-255 | Command Type |

**Table 5 Render Command Types**

| Command Type | Code | Comment |
|---|---|---|
| RCMD_PLAY | 0x00 | Begin Playback |
| RCMD_PAUSE | 0x01 | Pause Playback |

### 4.2.10 MSG_SERVER_CMD

This message is sent from the Mobile Client to the gateway peer or from the WACA to the Mobile Client to control content selection.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |

| | | | | |
|---|---|---|---|---|
| MSG_LEN | Integer | 2 | 3 | Message Length |
| MSG_TYPE | Integer | 1 | 0x09 | MSG_SERVER_CMD |
| SCMD_TYPE | Integer | 1 | 0-255 | Command Type |
| CMD_PARAM | Integer | 1 | 0-255 | Command Parameter |

**Table 6 Server Command Types**

| Command Type | Code | Comment |
|---|---|---|
| SCMD_FFW | 0x00 | Skip Forward CMD_PARAM tenths of a second |
| SCMD_REW | 0x01 | Skip Backwards CMD_PARAM tenths of a second |
| SCMD_NEXT_TRACK | 0x02 | Next Track |
| SCMD_PREV_TRACK | 0x03 | Previous Track |
| SCMD_NEXT_CHANNEL | 0x04 | Next Channel |
| SCMD_PREV_CHANNEL | 0x05 | Previous Channel |
| SCMD_GOTO_CHANNEL | 0x06 | Go to Channel in CMD_PARAM (zero-based) |
| SCMD_PURCHASE | 0x07 | Purchase Current Track |
| SCMD_GOTO_TRACK | 0x08 | Go to Track in CMD_PARAM (zero-based) |
| SCMD_GOTO_OFFSET | 0x09 | Go to Track offset CMD_PARAM seconds |

**Comment:** Interpreting this as a skip ahead should minimize the messaging overhead and will keep the user interface implementation local.

**Comment:** If 255 seconds isn't enough, then we may need to widen the CMD_PARAM field out to beyond 8 bits.

The expected operation of the SCMD_FFW and SCMD_REW messages is as follows: the CMD_PARAM field indicates a skip forward or backward in tenths of a second. A single SCMD_FFW or SCMD_REW command can therefore indicate up to 25.5 seconds of skip. For typical user interfaces that use the >> and << buttons held down as FFW/REW, this means the user interface will need to show the user a clock running forward or backward while the button is held down. If the user accumulates more than 25.5 seconds of skip, a SCMD_FFW or SCMD_REW will need to be sent. When the user releases the button, another message will need to be sent with the remainder.

The SCMD_GOTO_CHANNEL command uses zero-based channel indexing for the CMD_PARAM field. This allows up to 256 channels numbered zero through 255.

The SCMD_GOTO_TRACK command uses zero-based track indexing for the CMD_PARAM field. This allows up to 256 tracks numbered zero through 255.

The SCMD_GOTO_OFFSET command CMD_PARAM field indicates an absolute track offset at which playback should continue. Interpreting the CMD_PARAM field in seconds allows this command to indicate an offset up to 255 seconds (4 minutes 15 seconds) into the track.

Many of the server commands imply a discontinuity in the audio stream. If the mobile client is streaming audio content to a peer, the discontinuity will be handled by sending a MSG_FLUSH (see Section 4.2.7).

### 4.2.11 MSG_ECHO

This message is sent from either the Mobile Client or one of the peers (gateway or WACA). MSG_ECHO with FLAG_REQ_RESP == 0 is an echo request, while FLAG_REQ_RESP == 1 is an echo response. On reception of an echo request, an echo response must be sent immediately. The echo response ECHO_DATA field must exactly match the ECHO_DATA field of the original echo request message (in order to correlate a response with a particular request). If a response to an echo request is not received in some implementation-defined interval, the sender may determine the connection is no longer usable and disconnect.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 0 | Control Channel |
| MSG_LEN | Integer | 2 | 5 | Message Length |
| MSG_TYPE | Integer | 1 | 0x0A | MSG_ECHO |
| FLAG_REQ_RESP | Integer | 1 | 0-1 | Request/Response Flag<br>0: Echo Request<br>1: Echo Response |
| ECHO_DATA | Integer | 4 | Any | Response Correlation |

## *4.3 Content Channel*

Blocks of encoded audio content are sent in messages across the content channel from the Mobile Client to the peer if the peer indicated a need for content during the control channel establishment (see Section **Error! Reference source not found.**). The size and pacing of content messages is determined by the receiving peer, which sends MSG_CREDIT messages on the control channel to the Mobile Client indicating how many more bytes of content it wishes to receive (see Section 4.2.6). There is no correlation between content channel message boundaries and MPEG frames.

**Deleted:** Error! Reference source not found.

**Inserted:** Error! Reference source not found.

**Deleted:** 4.2.2

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| CHANNEL | Integer | 1 | 1 | Control Channel |
| MSG_LEN | Integer | 2 | Variable | Message Length |
| CODEC_TYPE | Integer | 1 | 0-255 | Codec Identifier |
| CONTENT | Bytes | Variable | | Audio Content |

**Table 7 Codec Identifiers**

| Codec | Id | Comment |
|---|---|---|
| WAV | 0x00 | Microsoft WAV File Format |

| | | |
|---|---|---|
| SBC | 0x01 | Sub Band Codec |
| MP3 | 0x02 | MPEG Layer 3 Audio |
| MP3_PRO | 0x03 | MP3 Pro |
| AAC | 0x04 | Advanced Audio Codec |
| AAC_PLUS | 0x05 | AAC w/SBR |
| WMA | 0x06 | Windows Media Audio |
| OGG_VORBIS | 0x07 | Ogg Vorbis Audio |

### 4.4 Harmonization

The iRadio Harmonization Protocol (iHP) messages may be carried in iMCP channel 2 when the Mobile Client is connected to the Gateway. iHP is not supported between the Mobile Client and WACA. All Mandatory and Optional iHP fields must be included in iHP messages.

At this time, only the Playpoints message (iradio.plp, type 0x0011) is supported. Immediately following transition to the CONNECTED state, the Mobile Client will transmit its current Playpoint information to the Gateway in a channel 2 iMCP frame. The Gateway should immediately respond with a harmonized Playpoint message which the Mobile Client will use to replace its current Playpoint information.

### 4.5 Management Channel

Need to capture the management channel requirement and protocol. Fundamentally, the Mobile Client is able to send firmware or other operationally-relevant information (e.g., model-specific translation tables) to the WACA. The WACA should be capable of updating this information by re-flashing itself or otherwise remembering it. The Management Channel will be used to update the WACA when new car radio models are introduced with new user event commands or new features.

## 5 Security Considerations

Since this protocol is intended to run over Bluetooth, this specification relies on the Bluetooth authentication and encryption facilities for security.

# iRadio Car Radio Interface Serial Protocol

iRadio Group
Motorola, Inc.

| Revision Number | Date of revision | Author | Comments |
|---|---|---|---|
| X0.1 | 12/1/2004 | Brian Tucker | Initial draft |
| X0.2 | 12/1/2004 | JMV | Formatting |
| X0.3 | 12/1/2004 | Brian Tucker | Formatting, Additional Button Codes, Return Radio Type Command Added |
| X0.4 | 12/1/2004 | Brian Tucker | Formatting, Additional display types |
| X0.5 | 12/3/2004 | Ronny | Theory of Operation, key codes, radio type answer, <= Modify<br>3.3.8 is <= new |
| X0.6 | 12/15/2004 | Ronny | Scroll speed |
| | | | |
| | | | |
| | | | |
| | | | |

## Table of Content

# 1 Introduction

This iRadio Car radio Interface Serial Protocol (iCRISP) is intended to unify the interface between the Wireless Audio Car Adapter (WACA) and the Car Radio Serial Interface. The primary purpose of this protocol is to notify the WACA of key presses and releases on the car radio and provide a mechanism for the WACA to display METADATA text on the car radio interface.

# 2 Theory of Operation

The system will consist of two primary functionalities:

2.The WACA needs to be aware of key presses and key release on the car radio head unit. Each possible key will be assigned a value that will provide a universal set of key codes across all car radio makes and models. The Car Radio Serial Interface will send a message to the WACA for each key press and key release.

3.The WACA needs to provide information to the user via the user interface of the car radio. This protocol will provide a consistent interface for sending audio METADATA text and general informational messages to the car radio for display

4.It'sn't gruanted that every head unit supports the key release function.

# 3 Messages

## 3.1 Message Overview

### *3.1.1 Message Structure*

iCRISP messages will be consistent for all messages sent to and from the WACA and Car Radio Serial Interface. Each message will consist of a 4 bytes header followed by the message payload followed by a two byte checksum of the Header and payload message.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Header | Integer | 4 | See next paragraph | Indicates the start of an iCRISP message. Includes start header and message length |
| Payload Message | Integer | Variable | See rest of document | Commands or car radio events codes |
| Checksum | Integer | 2 | 0x0-0xFFFF | Sum of header and payload Message |

### *3.1.2 Physical Layer*

The physical layer is an USART. The protocol is one start bit, eight data bits, and one stop bit. The baud rate is 9600 or preferred 56kbauds.

### *3.1.3 Transmission Order*

The transmission order is Octet 0, Octet 1, . . . , Octet n. Within each octet, the transmission order is Bit7, Bit 6, . . . Bit 1, Bit 0.

### *3.1.4 Byte Order*

In all cases where a data element is greater than one byte, a Little Endian format will be used.

### *3.1.5 Checksum Calculation*

The checksum is calculated by summing up all of the bytes in the message into a 16 bit counter.

### 3.2 Message Header

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0-65535 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |

### 3.3 Message Payload

#### 3.3.1 Key Press

This message is sent from the Car Radio Serial Interface to the WACA when a key on the car radio is pressed.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0x0002 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x10 | Key press command |
| Key Pressed | Integer | 1 | 0-255 | Key code of key that was pressed. See included chart for valid key codes |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

##### 3.3.1.1 Valid Key Codes

Here are the valid key codes that the Car Radio Serial Interface can send to the WACA.

| Key Description | Code | Radio Type |
|---|---|---|
| Channel 1 | 0x41 | 0x01,0x04 |
| Channel 2 | 0x42 | 0x01,0x04 |
| Channel 3 | 0x43 | 0x01,0x04 |
| Channel 4 | 0x44 | 0x01,0x04 |
| Channel 5 | 0x45 | 0x01,0x04 |
| Channel 6 | 0x46 | 0x01,0x04 |
| Channel Band | 0x50 | 0x01 |

| | | |
|---|---|---|
| Right | 0x51 | 0x01 |
| Left | 0x52 | 0x01 |
| Up | 0x53 | 0x01 |
| Down | 0x54 | 0x01 |
| Text Display Change | 0x55 | 0x01 |
| Tune Right | 0x60 | 0x04 |
| Tune Left | 0x61 | 0x04 |
| p Type Right | 0x62 | 0x04 |
| p Type Left | 0x63 | 0x04 |
| Previous Track | 0x10 | 0x00 |
| Next Track | 0x11 | 0x00 |
| Disc Up | 0x12 | 0x00 |
| Disc Down | 0x13 | 0x00 |
| Repeat | 0x14 | 0x00 |
| Shuffle | 0x15 | 0x00 |
| Fast Forward | 0x16 | 0x00 |
| Reverse | 0x17 | 0x00 |
| Mute | 0x18 | |
| Enter/Select | 0x19 | |
| Cancel | 0x20 | |
| Menu | 0x21 | |
| Source | 0x22 | |
| Mode | 0x23 | |
| Play/pause | 0x24 | |
| Unknown | 0xFF | |

### *3.3.2 Key Release Pioneer*

This message is sent from the Car Radio Serial Interface to the WACA when a key on the car radio is released (as available per car radio models)

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0x0002 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x13 | Key release command |
| Key Released | Integer | 1 | 0-255 | Key code of key that was pressed. See included chart for valid key codes |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

### 3.3.3 Radio Power Change

This message is sent from the Car Radio Serial Interface to the WACA when the car radio is turned on or off. This message implies that the car radio has been turned off or on and not the car ignition as the WACA draw its power from the +12V ignition.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0x0002 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x11 | Radio power command |
| On/Off | Integer | 1 | 0x00, 0x01 | 0x00 = Radio OFF<br>0x01 = Radio ON |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

### 3.3.4 Source Change

This message is sent from the Car Radio Serial Interface to the WACA when the user selects/deselects the iRadio source. This command should not be confused with the concept of changing bands within a source. For example, FM presets may have multiple bands or pages. This command detects a change in source, i.e.: CD, Tuner, Aux, iRadio, etc… Band change detection is accomplished through key press and release commands.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message.. |
| Message Length | Integer | 2 | 0x0002 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x12 | Source select command |
| Select/Deselect | Integer | 1 | 0x00, 0x01 | 0x00 = iRadio deselected<br>0x01 = iRadio selected |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

### 3.3.5 Request Radio Type

This message is sent from the WACA to the Car Radio Serial Interface to retrieve the car radio type that is connected to the Car Radio Serial Interface.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0-65535 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x15 | Return radio type command |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

### 3.3.6 Radio Type Answer

This message is sent from the Car Radio Serial Interface to the WACA after the WACA has asked for the type of car radio that is connected to the Car Radio Serial Interface.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0x0003 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x14 | Radio type command |
| Type | Integer | 1 | 0-255 | Type of radio that is connected to the Car Radio Serial Interface. |
| Source status | Integer | 1 | 0x00, 0x01 | 0x00 = iRadio deselected<br>0x01 = iRadio selected<br>0xFF=Unknown |
| Text size | Integer | 1 | 0-255 | Length of Text on the radio display |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

#### 3.3.6.1 Valid Car Radio Types

Here are the valid car radio types

| Key Description | Code | Supported Radios (Tested) |
|---|---|---|
| Sony 1 | 0x00 | XR-CA350X |
| Pioneer 1 | 0x01 | DEH-P4600MP |

| | | |
|---|---|---|
| Alpine 1 | 0x02 | |
| Kenwood 1 | 0x03 | |
| GM 1 | 0x04 | |
| TBD | | |

### *3.3.7 DISPLAY Text Sony*

This message is sent from the WACA to the Car Radio Serial Interface to send DISPLAY text to the car radio with various time constraints parameters and scroll types.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0-65535 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x20 | DISPLAY text command |
| Text Type | Integer | 1 | 0-255 | Type of DISPLAY being sent to the car radio. See the include chart for valid types. |
| DISPLAY text | String | Variabl e | | DISPLAY text |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

#### *3.3.7.1 DISPLAY Types*

Here are the valid DISPLAY text types

| DISPLAY Type | Code |
|---|---|
| Artist Name | 0x00 |
| Song Title | 0x01 |
| Time Remaining | 0x02 |
| Preset Channel Names | 0x03 |
| Banner | 0x04 |

### 3.3.8 *DISPLAY Text* GM/Pioneer

This message is sent from the WACA to the Car Radio Serial Interface to send DISPLAY text to the car radio without scrolling.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0-65535 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x40 | DISPLAY text command |
| Channel Number | Integer | 2 | 0-9999 | [LSB][MSB]. |
| DISPLAY text | String | Variable | | DISPLAY text max 16 chars |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

This message is sent from the WACA to the Car Radio Serial Interface to send DISPLAY text to the car radio with scrolling. The text must be zero terminate.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0-65535 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x50 | DISPLAY text command |
| Channel Number | Integer | 2 | 0-9999 | [LSB][MSB]. |
| DISPLAY text | String | Variable | | DISPLAY text max 255 chars |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

This message is sent from the WACA to the Car Radio Serial Interface to send DISPLAY scroll speed to the car radio.
It's only supported for pioneer with the actual version.

| Field | Type | Length (bytes) | Value | Description |
|---|---|---|---|---|
| Start Header | Integer | 2 | 0xA5, 0x5A | Indicates the start of an iCRISP message. |
| Message Length | Integer | 2 | 0-65535 | Length of message payload. This does not include the 4 byte header of 2 byte checksum. |
| Command | Integer | 1 | 0x60 | DISPLAY scroll-speed command |
| Channel Number | Integer | 1 | 0-1 | 0 -> faster<br>1 -> lower. |
| DISPLAY text | Integer | 1 | 0-255 | speed offset |
| Checksum | Integer | 2 | 0-65535 | Sum of header and payload Message |

Feb 8, 2004

Ever since we first talked about the Wireless Audio Car Adapter we have used the analogy to the car being a really big set of bluetooth head phones. This gives the basics of the goal and presents a strong (slightly ridiculus image). The WACA does much more than a set of head phones since it includes content metadata and a variety of sepcific actions which the listener can take. For the January demo we used a propriatary Bluetooth protocol to meet our goals becuase of platform limitations.

For trials, we planned to use a standard Bluetooth protocol A2DP if it would meet our needs. AVRCP would also be used if it could meet our goals.
In the last month, Brian identified a vendor specific loophole in AVRCP which will allow use to be standards complient and still meet our goals.

Mark

# iRadio WACA (Wireless Audio Car Adapter) Use Cases

| Revision Number | Date of revision | Author | Comments |
|---|---|---|---|
| 0.1 | 12/2/2004 | Mark Clayton | Initial draft |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

**Table of Contents**

## Introduction

Use cases describe the functionality which is required at a particular point in time. The iRadio project has the following timing requirements:

| | |
|---|---|
| Dec 8, 2004 | iHollywood show |
| Jan 6, 2005 | CES Demo |
| Apr 4, 2005 | Trial start |
| Sep 30, 2005 | Product launch |

This note covers the first two items in the list with a testing focus rather than software development.

## iHollywood Show

Hollywood has the following high-level WACA requirements:

- fits in the Hummer
- supports Pioneer car radio
- supports BT receipt and display of metadata
- supports BT streaming of MP3 audio (at least 96 Kbps)
- supports BT switching of MP3 audio streams

The following WACA use cases exist for this show:

- Cold start to audio streaming
- Switching iRadio channels from streamer
- Playing next track in iRadio channel
- Pause and resume of streaming content
- Not discoverable by other Bluetooth devices

**Comment:** WACA is never discoverable, or so I thought...

## CES Demo

The CES functionality is based on the 0.4 Demo Script for CES.

The CES demo has the following high-level WACA requirements:

- o fits in the CES kiosk
- o supports Pioneer car radio
- supports BT transmission of car radio presets
- supports BT transmission of pause, resume, and purchase
- o supports BT receipt and display of metadata
- o supports BT streaming of MP3 audio (at least 96 Kbps)
- o supports BT switching of MP3 audio streams
- supports BT echo of metadata back to streamer

The following WACA use cases must be supported for the demo:

- Cold start to audio streaming
- Switching iRadio channels from car radio
- Switching iRadio channels from streamer
- Playing next track in iRadio channel
- Pause and resume of streaming content
- Purchase current content
- Not discoverable by other Bluetooth devices

**Comment:** Are we still supporting this?

**Comment:** WACA is never discoverable, or so I thought...

## Trial

The Trial will add use cases associated with installation and tighter metadata presentation.

## Use Cases

All use cases are from the perspective of the WACA as the system.

### *Cold start to audio streaming*

This use case describes the process of the streaming device and WACA coming together and content being played.

**Actors:** Streamer (E680), Car radio

**Pre-Conditions:**

- Bluetooth binding/association has already occurred
- Streamer already has content
- WACA is already connected to the car radio
- Car radio is already powered and in iRadio mode

**Flow of Events:**

1. WACA uses iMCP to connect to streamer
2. Streamer sends initial car radio text over iMCP
3. Car radio displays initial text on car radio
4. Streamer sends metadata for song
5. Metadata is displayed on car radio display
6. Streamer sends MP3 audio data as a stream
7. iRadio channel audio is playing from car radio

**Post-Conditions:**

- Audio content is playing from car radio
- Associated metadata is displayed on car radio

### *Switching iRadio channels from car radio*

This use case describes the process of changing from one iRadio channel to another via the preset buttons on the car radio. This same series of steps occurs then a track is skipped within a channel.

**Actors:** Streamer (E680), Car radio

**Pre-Conditions**:
- Bluetooth binding/association has already occurred
- Streamer already has content and is streaming an iRadio channel
- WACA is powered and already connected to the car radio which is in iRadio mode

**Flow of Events:**
1. Car radio sends preset press notification to WACA
2. WACA notifies streamer via iMCP connection of button press
3. Streamer commands WACA to stop an flush current content
4. Streamer sends metadata for song on new channel
5. Metadata is displayed on car radio display
6. Streamer sends MP3 audio data as a stream
7. iRadio channel audio is playing from car radio

**Post-Conditions:**
- Audio content for new channel is playing from car radio
- Associated metadata is displayed on car radio

### *Switching iRadio channels from streamer*

This use case describes the process of changing from one iRadio channel to another without using the car radio interface. This same series of steps occurs then a track is skipped within a channel without using the car radio interface. Since the car radio interface isn't used to initiate the change in audio flow, presumably some user interface associated directly with the streamer is used.

**Actors:** Streamer (E680), Car radio

**Pre-Conditions**:
- Bluetooth binding/association has already occurred
- Streamer already has content and is streaming an iRadio channel
- WACA is powered and already connected to the car radio which is in iRadio mode

**Flow of Events:**
1. Streamer commands WACA to stop an flush current content
2. Streamer sends metadata for song on new channel
3. Metadata is displayed on car radio display
4. Streamer sends MP3 audio data as a stream
5. iRadio channel audio is playing from car radio

**Post-Conditions:**
- Audio content for new channel is playing from car radio
- Associated metadata is displayed on car radio

### *Playing next track in iRadio channel*

This use case describes the process associated with one track naturally ending and a new one starting.

**Actors:** Streamer (E680), Car radio

**Pre-Conditions**:

- Bluetooth binding/association has already occurred
- Streamer already has content and is streaming an iRadio channel
- WACA is powered and already connected to the car radio which is in iRadio mode

**Flow of Events:**

1. Streamer streams last bit of previous track to WACA
2. Streamer sends metadata for song on new channel
3. Last bit of previous track plays on car radio
4. Metadata is displayed on car radio display
5. Streamer sends MP3 audio data as a stream
6. iRadio channel audio is playing from car radio

**Post-Conditions:**

- Audio content for new channel is playing from car radio
- Associated metadata is displayed on car radio

### *Pause and resume of streaming content*

This use case describes the process associated with pausing the current track and resuming it a short time later. This use case assumes that the pause and resume were initiated from the streamer interface rather than the car radio interface. The only difference is the button information received by the WACA from the car radio and the additional iMCP button notifications.

**Actors:** Streamer (E680), Car radio

**Pre-Conditions**:

- Bluetooth binding/association has already occurred
- Streamer already has content and is streaming an iRadio channel
- WACA is powered and already connected to the car radio which is in iRadio mode

**Flow of Events:**

1. Streamer sends a pause command to WACA via iMCP
2. WACA stops sending audio information to the car radio
3. Time passes with the car radio being silent
4. Streamer sends resume command to the WACA via iMCP
5. WACA resumes sending audio information to the car radio

**Post-Conditions:**

- Audio content is playing from car radio
- Associated metadata is displayed on car radio

### *Purchase current content*

This use case describes the process associated with purchasing the current audio track.

**Actors:** Streamer (E680), Car radio

**Pre-Conditions**:

- Bluetooth binding/association has already occurred
- Streamer already has content and is streaming an iRadio channel
- WACA is powered and already connected to the car radio which is in iRadio mode

**Flow of Events:**

1. Car radio sends button press notification to WACA which corresponds to purchase
2. WACA notifies streamer via iMCP connection of button press
3. Streamer sends a "Purchased" text display command to WACA via iMCP with a TBD (5?) second timeout
4. car radio displays the "Purchased" text for TBD (5?) seconds

**Post-Conditions:**

- Audio content is playing from car radio
- Associated metadata is displayed on car radio

**Issues:**

- What type of feedback does the user get if the track can not be purchased or is already owned?

### *Not discoverable by other Bluetooth devices*

This use case describes the process associated with ignoring other Bluetooth devices in the vicinity, including other streamers which the WACA doesn't already have a relationship with.

**Actors:** Streamer (E680), Car radio, a 3rd Bluetooth device

**Pre-Conditions**:

- Bluetooth binding/association has already occurred with associated streamer
- WACA is powered and already connected to the car radio which is in iRadio mode
- A second Bluetooth device (not associated with the WACA) is present

**Flow of Events:**

1. A Bluetooth SDP scan by a device (with is not the associated streamer)
2. WACA does not respond and WACA doesn't show up in the list of close Bluetooth devices

**Post-Conditions:**
- No change to WACA
- WACA is not in list of discovered devices

# iRadio what it is/isn't

For the purposes of this note Phase 1 (P1) is the first trial system and P0 is an internal proof of concept. Finally, Px is some phase in the far future. The in between phases are pretty arbitrary to me right now.

## My System Assumptions

- Our goal is to have a user's content available to the user where ever the user is.
    - The primary means of achieving this is to sync relavent content into storage/rendering which travel with the user. -- P1
    - Sharing of of content with others (either copy or independent capability to render at will) would only be done under a license which allowed this. -- Px

- Streaming within the home is a problem solved by UPnP and we will use that as our mechanism possibly with extensions to meet specific requirements.

- Initially iRadio is about commercially prepared content (on-line purchased or CD ripped), not user generated content like movies or photos.

- If content deals allow controlled access to content over Internet rather than recording XM, then we only need to sync media content from server to car. No need to sync media content the other way. Still need to sync metadata back to home or service provider.

- Service provider would keep track of all purchases and supply content if it wasn't on your gateway/cache.

- Devices (car and home) always update service provider of significant media events when a free high capacity connection is available. (Events would include: content paused/stopped, content listened to, user feedback)

- Initially I assume that a hotspot will just be a pipe back to the service provider which could be used for syncing.

## Initial (P1) System roles and variables

Initial (P1) system has components with the following roles and capabilities:
(Some combinations, like no service provider, are won't work because of business reasons, but might work for P0.)

**Place to purchase content from**

- Service Provider aggregates content -- strong iRadio tie-in
- Some existing music store used -- weak iRadio relationship

Very important business issue, but not big technical issue for a simple system.

**Home Internet connection**

- high capacity download (DSL, Cable, Satellite)
- moderate capacity download ~256Kbps (capped: DSL, Cable, Satellite)
- low capacity download ~ 56Kbps POTS

Lower speed increases importance of local cache.

**Server (sync functionality & main content store)**

- Home PC is repository, syncer and purchaser (no service provider)
- Home PC is local repository cache and syncer (backed by service provider for non-cached content)
- No home PC, remote Service Provider is syncer and content store. Home network is just a packet router/wireless gateway with NAT.
- MS-1000 takes place of PC as local repository cache, syncer and purchaser (no service provider)
- MS-1000 takes place of local repository cache and syncer (backed by service provider for non-cached content)

Without a local cache & syncer, download speed will suffer or require protocol tweaks.

**Wireless connectivity in home/garage**

- 1 Mbps (BlueTooth)
- 11 Mbps (802.11b)
- 54 Mbps (802.11a/g)
- 480 Mbps (UWB)

Affects device download speed.

**In home music listening solution (UPnP assumed)**

- Thin dedicated render & controller device
- Stereo component render & controller device
- Does MS-1000 have an audio output?

**Car device with local content storage**

- Main variable is amount of storage, given a car, huge is possible.

Small storage will place more emphasis on syncer to make right choices, but no architecture difference.

**Car device network connectivity**

- high capacity only (needs to match home/garage)
- cellular and high capacity only (needs to match home/garage)

A WiFi only device wouldn't give you the immediacy of a cellular packet enabled system for "buy" but would fill most use cases.

# Less Tame Thoughts

User can select and play any of their content where ever they are so long as there is an "available" renderer.

The user's actual presence could confidently be inferred from:

- SIM/smartcard
- Personal BlueTooth device (cellphone) which implies user is very close.

If accessing his media store via a foreign device then password and BlueTooth signal would both be required to select content. If via a personal device (cellphone app), then no password required. The rendering of the user's content would require the user's presence more-or-less continuously. Of course, your private rendering devices would work without the enabling SIM or signal.

I think there are some pretty strong arguments that this approach could be as secure as the iTunes

3 device limit.

# Miscellaneous: (When) Do We ...

I need to grow this list over time.

| Function | P0 | P1 | P1.5 | P2 | P3 | Px | notes |
|---|---|---|---|---|---|---|---|
| Bridge DRM from say Microsoft to OMA domains | | | | | | ? | As needed by requirements and content deals |
| Support user generated content (movies & photos) | | | | ? | | | |
| Support user's MP3 files | ? | | | | | | |
| Support Cellphone as audio controller | | | | ? | | | Depends of use cases/requirements |
| Support remote or for foreign device rendering | | | | | ? | | Depends of use cases/requirements |

# Engineering Status Brainstorm session

iRadio™

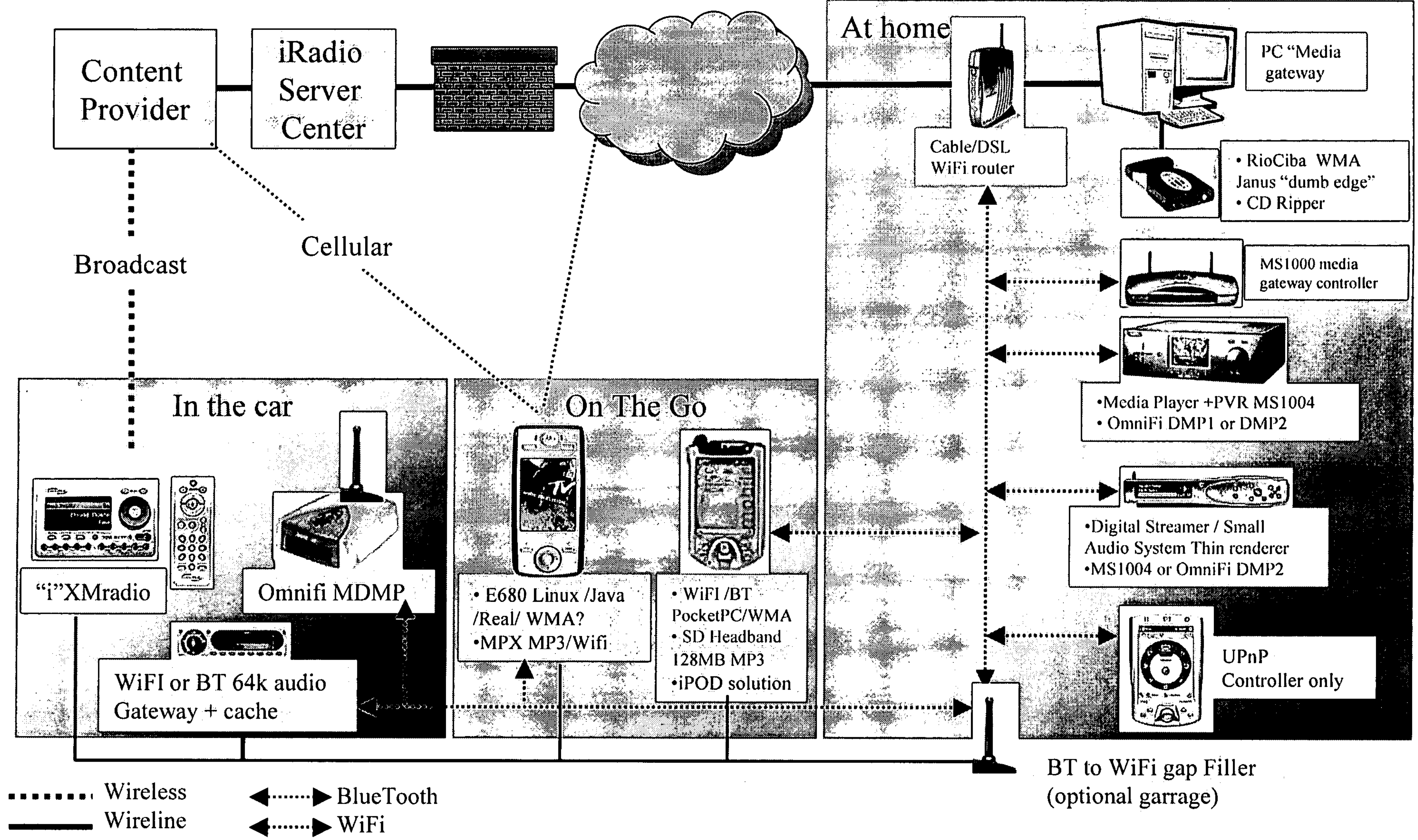
July 2nd, 2004

Radio™

# Services Partners Assumptions

| Content / Services providers | XM / SDARS | INTERNET SUBSCRIPTION MUSIC LIBRARY (Napster, MusicNet) | INTERNET PERSONAL RADIO & MUSIC STORE (Yahoo Launcast, iTunes?) |
|---|---|---|---|
| Key Value proposition | ▪ Broadcast Rich niche aggregated content<br>▪ Interactive back-channel<br>▪ Cache & autorecord XM specific events/ tunes<br>▪ XM community IM interaction<br>▪ Possible Internet Radio/Music Store | ▪Unlimited library subscription<br>▪ Pre-canned Internet radio catalog<br>▪ Few music sales for out of circle users (hard CD copy)<br>▪ Extremely strong community / playlist referrals | ▪ "personal" Content Push subscription<br>▪ Focused on trigger song purchase through music suggestions<br>▪ Some community / playlist referrals and teasers exchane (Instant Music messenger) |
| Detailed Features | ▪Interactive button:<br>• Live or delayed buy action<br>•Vote, data mining, PTL<br>▪ Cache of XM contents<br>• on live 1st hand segments<br>• scheduled broadcasts EPG based<br>• Scheduled events catalog based<br>▪ Pause and Xdomains resume<br>▪ "Deferred" community interactivity<br>▪ Possible Internet Direct play:<br>• Personal radio channels referal-based engine<br>• XM Music store | ▪Unlimited Music streaming & download:<br>• Music DRM-clock based<br>• Possible migration Talk segments<br>• renders legacy libraries and "shady P2P content obsolete<br>▪Personnalized or pre-tuned channels (>100+)<br>▪ Personalized Play-lists<br>▪ Pause and Xdomains resume<br>▪ Community exchanges (play-lists, music pointers, teasers<br>▪ Legal Music xfer on CDs on the top of secured clock devices | ▪Limited "personal Music" or pre-tuned channels streaming"<br>▪Rating to influence referral engine<br>▪ Pay-per-song download / Interactive purchase<br>▪ Pause and Xdomains resume<br>▪ IM messenger music community for chat, referrals, teasers exchange |

# iRadio™ "Physical" Devices-Centric Architecture



iRadio™ **Building Blocks Status (1)**

| DOMAINS | Detailed description | Availability (new or preferred source) Demo | Trial | Product |
|---|---|---|---|---|
| **MOBILE CLIENTS cars/phone/home** | | | | |
| Connection Services | | | | |
| - registry of possible connections to iRadio Server/Home Gateway | | SD | SD | |
| - updating engine (iRadio Server and Home Gateway) | | SD | SD | |
| Media Services (only need to cover one or a small number of users) | | | | |
| - media storage | | SD | SD | |
| - content channel storage | | SD | SD | |
| - content auxilary metadata storage (dynamic & static) | | SD | SD | |
| - player with appropriate encoding/DRM support | | SD | SD | |
| - DRM enforcement daemon (expiring stale content) | | SD | SD | |
| - Broadcast recorder | | | | |
| UI - User Interface | | | | |
| - preferences/configuration of UI heirarchy (interface abstraction) | | SD] [Core | NA | NA |
| Support Services | | | | |
| - dispostion & significant event log | | SD | SD | |
| - updated metadata log | | SD/NA | SD/NA | |
| **HOME** | | | | |
| - UPnP A/V renders and controllers | | SD | SD | SD |
| - enhancements/hooks to capture content disposition and allow instant buy capture | | SD | SD | SD |
| - enhancements/hooks enforce/support DRM? | | SD | SD | SD |
| **HOME GATEWAY** | | | | |
| Media Services (only need to cover a small number of users) | | | | |
| - media storage | | SD | SD | |
| - content channel storage | | SD | SD | |
| - content auxilary metadata storage (dynamic & static) | | SD | SD | |
| - DRM enforcement daemon (expiring stale content) | | NA | NA | |
| Connection Services | | | | |
| - Remote device discovery registry | | SD | SD | |
| - Device updating engine (proxy) | | SD | SD | |
| - iRadio Server updating engine/interface | | | | |
| UPnP A/V Services | | | | |
| - device discovery registry | | SD | SD | SD |
| - content repository | | SD | SD | SD |
| Common Services (lightweight slaves to counterparts on the iRadio Server) | | | | |
| - profile/preferences | | SD | SD? | |
| - user/device authentication | | SD | SD? | |
| ? session management | | NA | NA | NA |
| - usage tracking | | SD? | SD? | |
| - clock synchronization | | NA? | NA? | |

# iRadio™ Building Blocks Status (2)

| DOMAINS | | | Detailed description | Availability (new or preferred source) Demo | Trial | Product |
|---|---|---|---|---|---|---|
| IRADIO SERVER | | | | | | |
| | Web Pages | | | | | |
| | | - user playlist creation pages | | SD* | SD | |
| | | - user configuration web site | | SD* | | |
| | | - customer relations management web site | | NA | NA | |
| | | - OA&M adhoc website | | | | |
| | | - usage tracking report generatation | | | | |
| | | | | | | |
| | Media Storage Services (need to cover millions of users) | | | | | |
| | | - media storage | | | | |
| | | - content channel storage | | | | |
| | | - content auxilary metadata storage (dynamic & static) | | | | |
| | | - audio format conversion | | | | |
| | | - content encoding | | | | |
| | | - DRM enforcement daemon (expiring stale content) | | NA | NA | |
| | | | | | | |
| | Broadcast Media Services | | | | | |
| | | - Radio guide storage & lookup | | | | |
| | | | | | | |
| | Connection Services | | | | | |
| | | - Remote device discovery registry | | NA | NA | NA |
| | | - Home Gateway discovery registry | | | | |
| | | - Device updating engine (proxy) | | NA | NA | NA |
| | | - Home Gateway updating engine (proxy) | | | | |
| | | - Content Provider Interface(s) | | | | |
| | | | | | | |
| | Common Services | | | | | |
| | | - profile/preferences | | Core \| NA | Core \| NA | |
| | | - user/device authentication | | Core \| NA | Core \| NA | |
| | | ? session management | | | | |
| | | - user groups, buddy and community functionality | | NA | NA | NA |
| | | - usage tracking | | Core | Core | Core |
| | | - usage tracking reporting and mining interface | | | | |
| | | - billing support | | NA | NA | |
| | | - clock synchronization | | NA | | |
| | | | | | | |
| | | | | | | |
| CONTENT PROVIDER | | | | | | |
| | - Secure Internet access to pull user content | | | NA? | | |
| | - Internet access to pull radio schedule (both future and historical) | | | NA? | | |
| | - clock synchronization (we may need to know the provider's idea of current time) | | | NA? | | |
| | | | | | | |

# Feature Set SIMPLE CENTER vs iRADIO center

Radio™

| FEATURE | SC | SC+ | IRadio |
|---|---|---|---|
| Digital Media Library | X | X | X |
| Music Player | X | X | X |
| Media ID Tools | X | X | * |
| MP3 & WMA Support | X | X | X |
| Device Manager / *(Profile- Mood based Events Record "scheduler" & daily sets- browser based rather than .exe) | X | X | * |
| Wi-Fi Wireless Media Delivery | X | X | X |
| Watch Folders | X | X | ? |
| CD-Ripper- | | X | |
| Media Explorer | | X | * |
| Live365, LAUNCHcast, Virgin Radio, SHOUTcast (stream to PC) | | X | X |
| NewsCenter (legal download & automated upload to client) | | X | X |
| Other content partners download & multi domain upload | | | X |
| Song Downloads | | X | X |
| Audio Books | | X | X |
| Interactive Buy/Rate/ Vote | | | X |
| Interface with Server for Multi-Domain Coordination | | | X |
| Auto recording of content for controlled distribution | | | X |
| Community referrals/playlist eXchange | | | X |
| Multi codec / Multi DRM support | | | X |
| Subscriber Management System | | | X |

iRadio™

# Use cases / Features Phase Plan (prelim for discussion)

| DEMO CES | TRIAL Q1 2005 | Product 1.0 Q2-Q3 '05 |
|---|---|---|
| ▪Home to Phone<br>• Remote controller<br>• E680 Media daily set update<br>• Seamless pause & resume Xdomains<br><br>▪ Home to Car<br>•E680 Media daily set update<br>• Seamless pause & resume Xdomains<br>• Auto record / wake-up from web profile EPG or catalog based<br><br>▪Home to phone to car<br>• Seamless synch home theatre to phone/media player to HiFi car stereo<br>• Push to buy from car or phone delivered to the home directly | ▪Home to car<br>• "My daily" content auto update<br>• Seamless pause-resume home theatre to HiFi car stereo<br>• Push to Buy "differed" through Internet<br>• EPG or catalog based event recording with power/resource available & bandwidth management<br>• ...TBD | ▪ TBD |

Radio™

# Key Challenges/Holes

- Need definition – CES, trial, product
- Engineering Hiring is a little behind
- Need rules of engagement with SimpleDevices
- DRM
- Legacy content support (if needed)

iRadio™

# CES Demo Script
# High-Level Requirements

## Draft Revision 0.2

Motorola, Inc.
iRadio, Media Services
Dave Ulmer /JMV/ MC /SR/EC
September 9th, 2004

# 1 Goal

Showcase key tenets of iRADIO initial service:

1. Notion of a personalized "daily set" selection out of a library of audio choices, whether thematic music channels personalized to your tastes or spoken words / talks segments mixed with personal collection of owned music

**Expectations:**

- User friendly drag & drop selection menu on a PC emulating the Serenade Player interface with the addition of creating channels from the consumer's owned music library.
- High Speed Synchronization through USB with the phone

2. Seamless mobility between domains: demonstrate seamless portability and playability from "at home" to "on the go" to "in the car" through wireless synchronization without user's interaction.

**Expectations:**

- After USB Synchronization, downloaded content can be played through home, being paused and resumed over the phone then switched to car radio.
- Phone call interruptions or other interferences in the listening pattern results in resuming where the listener left off, regardless of the media player used.

3. User friendly experience moving from home to car. Re-use of "car legacy" to turn it into a digital media player using very well known CD user interface and preset keys.

**Expectations:**

- Phone user interface mimics the car radio preset keys and can be used as remote control of the car radio
- Car radio buttons are also used as direct user interface to control the audio streaming coming from the phone
- The pre-sets keys are automatically mapped to the "channels categories" configured on the PC
- Program associated data are displayed on the car radio 1 or multiple lines as well as on the phone.

4. Multi-domain Push-to-Buy: Show that a "discovered" song in one media player (coming from dynamic content refreshed daily by the content provider) can be tagged and stored in one domain (car or in the phone) for temporary usage while a permanent selection, potentially with better codec bandwidth and attributes like 5:1 channels

**Expectations:**

- Depressing a key x seconds on the phone or pushing the CD play button x seconds simulate a Push-to-buy: the song is automatically appended to "my owned music library" subset and can be replayed/skipped unlike the other "webcast" channels
- When at home, the song also appears on the "My owned music library" potentially in a different compression format (128k or 192kbps vs 32k-64kbps original webcast
- Billing account is incremented by one transaction

■ = Domain
■ = Event
■ = Content
* = SFX

# 2 Tentative Script: "A Day in the Life" Script

## 2.1 Home to Work

### 2.1.1 *Alarm**

- Dave wakes up, and smashes his alarm off –(regular alarm)
- Picks up his phone near the bed and selects his "Smooth Jazz #1" channel, which starts to play on his stereo
- During his morning coffee, he switches over to his high-energy "Espresso Mix #2"

### 2.1.2 *Pause Here*

- Pausing the mix, he runs out the door, leaving his MP3 player on the dresser

### 2.1.3 *Resume There*

- He hits resume as he drives away to work
- Along the way, Dave quickly checks a "Traffic #3" report, then switches back to "Espresso Mix #2" and it's smooth sailing on into work

## 2.2 Work to McDonalds

### 2.2.1 *Drive McDonalds*

- Dave decides to grab a Big Mac and heads to McDonalds, playing through his "home MP3 collection #4"

### 2.2.2 *Skip**

- He skips ahead through multiple tracks looking for one he wants
- He decides to switch over to "NPR #5" to hear his favorite talk show

### 2.2.3 *Pause*

- Not wanting to miss a word, he hits pause as he pulls into the drive-up, then

## 2.3 McDonalds to Gym

### 2.3.1 *Resume*

- Resumes the talk show as he pulls away chomping on a burger

### 2.3.2 *Phone rings**

- The phone rings in mid sentence
- He answers and the radio mutes during the call and resumes afterwards

## 2.4 Gym to Home

- He plugs earphones into his cell phone and works out to his ""home MP3 collection #4"" channel
- Heading home he puts his radio on "Classic Rock #6"

### 2.4.1 *Push to Buy*

- Hearing his favorite Eric Clapton track and remembering that concert back in '82, he decides to buy the album on the spot

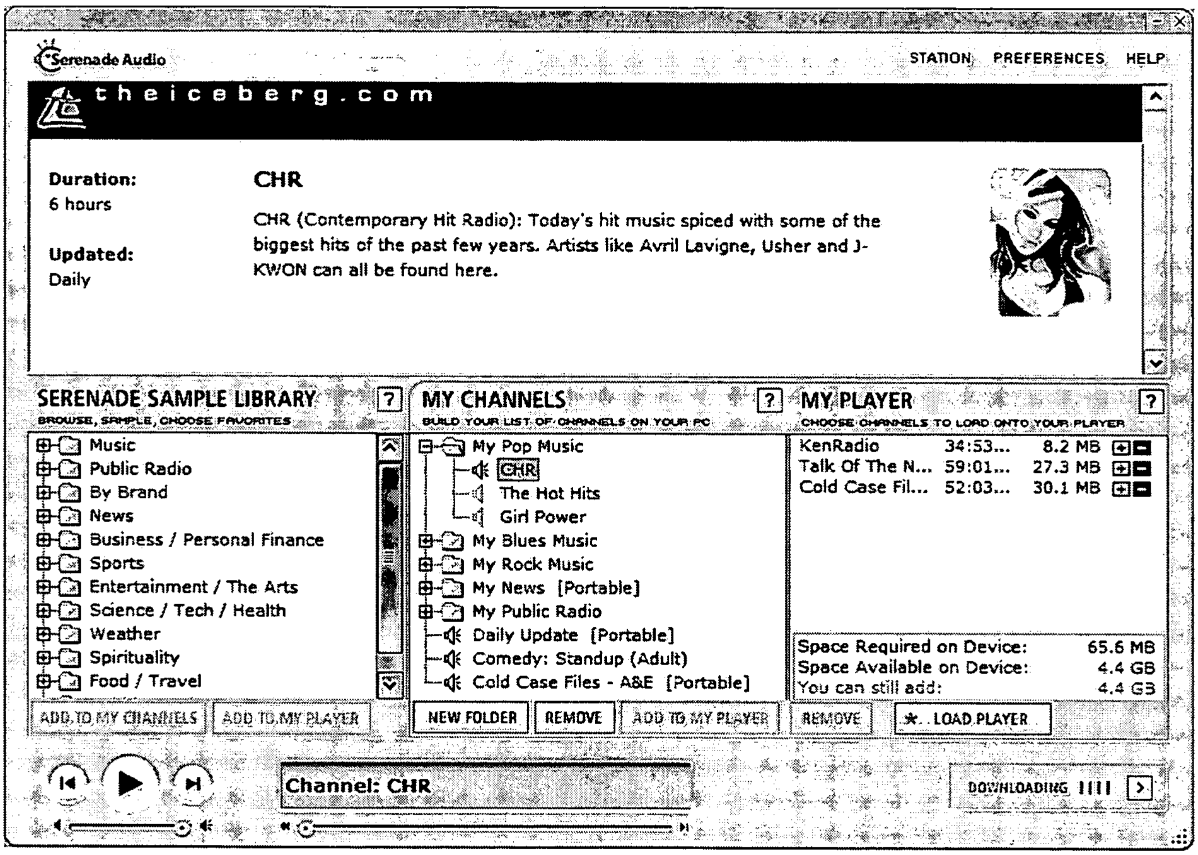
### 2.4.2 *Play*

- Pulling into his garage, he shuts off the car, goes inside, grabs a beer, and settles down in his easy chair, clicking play on his phone to play the song he just bought on his home stereo (higher definition codec potentially surround sound...)

# 3 User Interface Concept

## 3.1 On the PC

Example of Serenade UI which would need to be "hyped up" to facilitate the similar look and feel home-phone-car application concept with presets keys:




**Stream #1: Music Subscription**
- Yahoo Launch
- XM favorites
- Webradio- Live365, Virgin radio

**Stream #2: Music I own**
- CD ripped collection
- Digital Music downloads

**Stream #3: My News Talk**
- CNBC talk shows
- NPR Morning Edition

**Stream #4 My Sports Talk**
- Webcast or TV feeds
- AM recordings

**Stream #5 My Lifestyles Talk**
- Car talk, Entertainment weekly,
- Discovery, History
- Audio books, Printed Magazines

**Stream #6: My Traffic**
- 511 personal service update
(pre-loaded or live from phone)

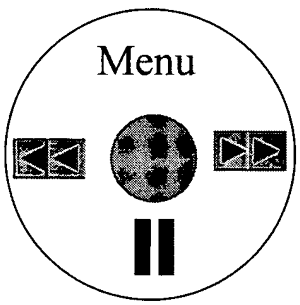
## 3.2 On the phone

### *3.2.1 E680 example*

*3.2.2 E680 Navigation keys*

Idea is to emulate the behavior of "the leader of the pack" in user friendliness a.k.a iPOD and anticipate the fact that the future entertainment phone from MOT will duplicate iPOD functionality. The 4+1 rocking switch / joystick will be used for all Play/pause/Skip back and forth and access to the extended menu . The central rocker switch is used to ENTER/SELECT and short-cut functions like PTB

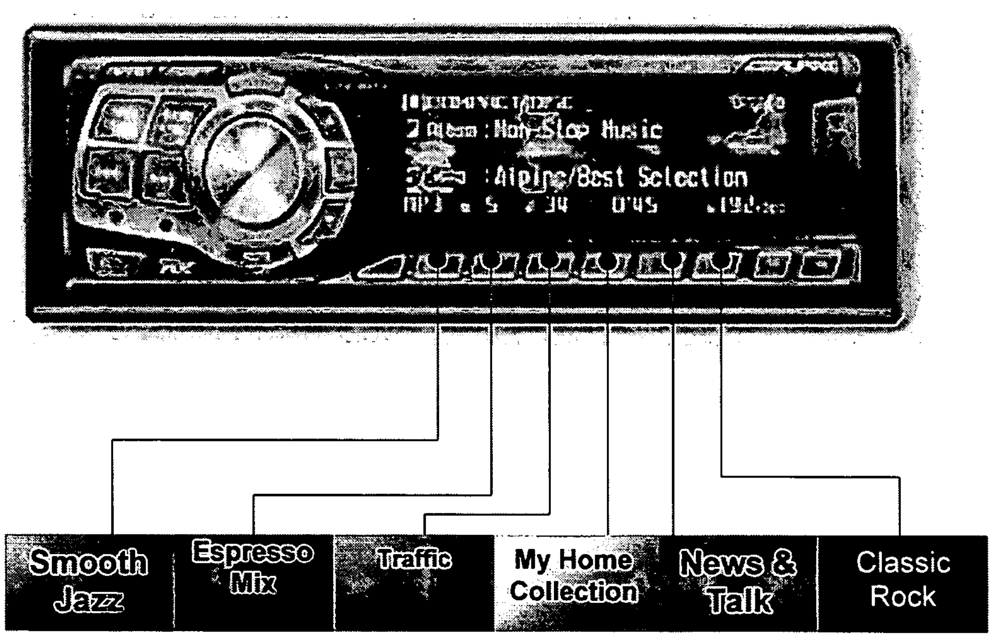
A small icon representing the key functions can be displayed just likein the V600 player as a visual reminder of the 'soft keys"for total user transparency: Pause will appear when playing and vice-versa




| Keys | Role | Comments |
|---|---|---|
| Up Arrow | MENU access<br>Serves also as the Escape/back key in hierarchical menus | Just like IPOD accesses playlists browsing, set-up menus. In our case, can also open the "Vote +/-" menu or the Push-to-Buy selection |
| Down Arrow | Play or Pause | Alternatively- Pause acts as a stop |
| Right arrow | Skip to next track or fast forward within a track | Continuous activation fast forward like in a CD player |
| Left arrow | Skip back track or fast rewind | Same idea |
| Center key | 1. SELECT/ENTER or NEXT SCREEN<br><br>2. NEXT DISPLAY | Used for hierarchical tree based menu navigation. Will ultimately allow scroll through various playlists within a given channel (major genre and sub-genre...)<br><br>e.g. In non MENU mode (play mode), it is used as toggle key for various display like Name |

| | | |
|---|---|---|
| | 3. Push-To-Buy | artist and song in big letters or CD coverart with artist data as represented in the picture Shortcut key activation for the PTB function: depressing 3 seconds could display the PTB window with the usual: do you confirm you really want to buy it requiring a second push (unless you have activated the Amazon IP protected single button activation!) |
| Red Phone key | Phone level escape key / ON-OFF | Could be potentiall |
| Green Phone Key | Phone level menu access / phone answer etc... | |
| Top left hard key | Iradio Launcher | May be coming from other main menus and may not be needed |
| Top Right hard key | Unused | May have some other functions in the phone |

### 3.3 On the car radio



# Core Solutions Platform Architecture

Parvathy Bhaskaran

Motorola Confidential and Proprietary Version: 1.0 Date: 031003

MOTOROLA

intelligence everywhere

# Core Solutions Platform

- Goals
- Concept Architecture

# Goals: Enabling a Rich Solution Space

- Support rapid development and deployment of distributed solutions in multiple domains (home, person, car, work/school):
  - **Enable common user experience (not UI) across domains**
  - **Seamless transition between domains**
  - **Personalized for user, device and domain**
  - **Interacting solutions to enrich user experience**
  - **Easy re-branding for different service providers**
- Support for incremental adoption of solutions
- Support for multiple deployment models:
  - **Independently hosted with loose administrative coupling to customer operations, e.g., Avis, BREW**
  - **Independently hosted with tighter administrative coupling to customer operations, e.g., OnStar,**
  - **Integrated into customer operations, e.g., 4thpass carrier deployments**
- A vibrant developer community

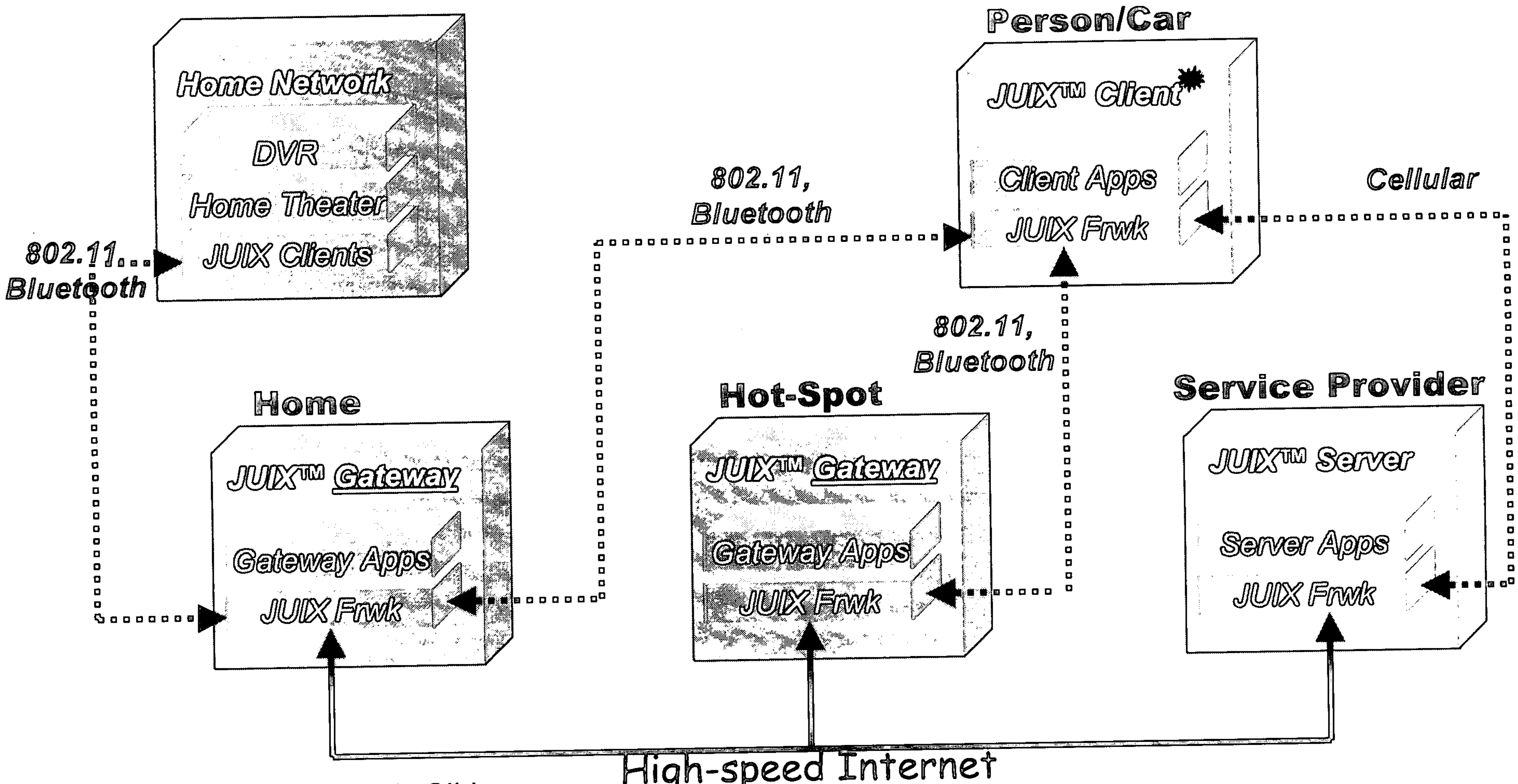
# A "Seamless" Solution Space

- Seamless delivery of solutions in multiple domains (home, person, car, work/school):
  - **Solution available in multiple domains**
  - **Experience optimized in each domain**
  - **Intelligent hand-off between domains to provide a seamless user experience**
- Platform support to reduce development load:
  - **Look-and-Feel components to ensure consistent UI for each domain, e.g., JUIX UI components**
  - **Consistent APIs enabling ease of transfer of functionality between domain, e.g., location APIs,**
  - **Enablers to seamlessly transfer experience across domains, e.g., Audio**
  - **Seamless connectivity/hand-off between solution spaces**
  - **Platform/domain emulators with consistent core APIs**

# Core Solutions Platform

- Goals
  - Concept Architecture

# System Architecture




* Click on underlined boxes in Slide Show Mode for more details

JUIX Clients include non-Java clients, e.g., BREW

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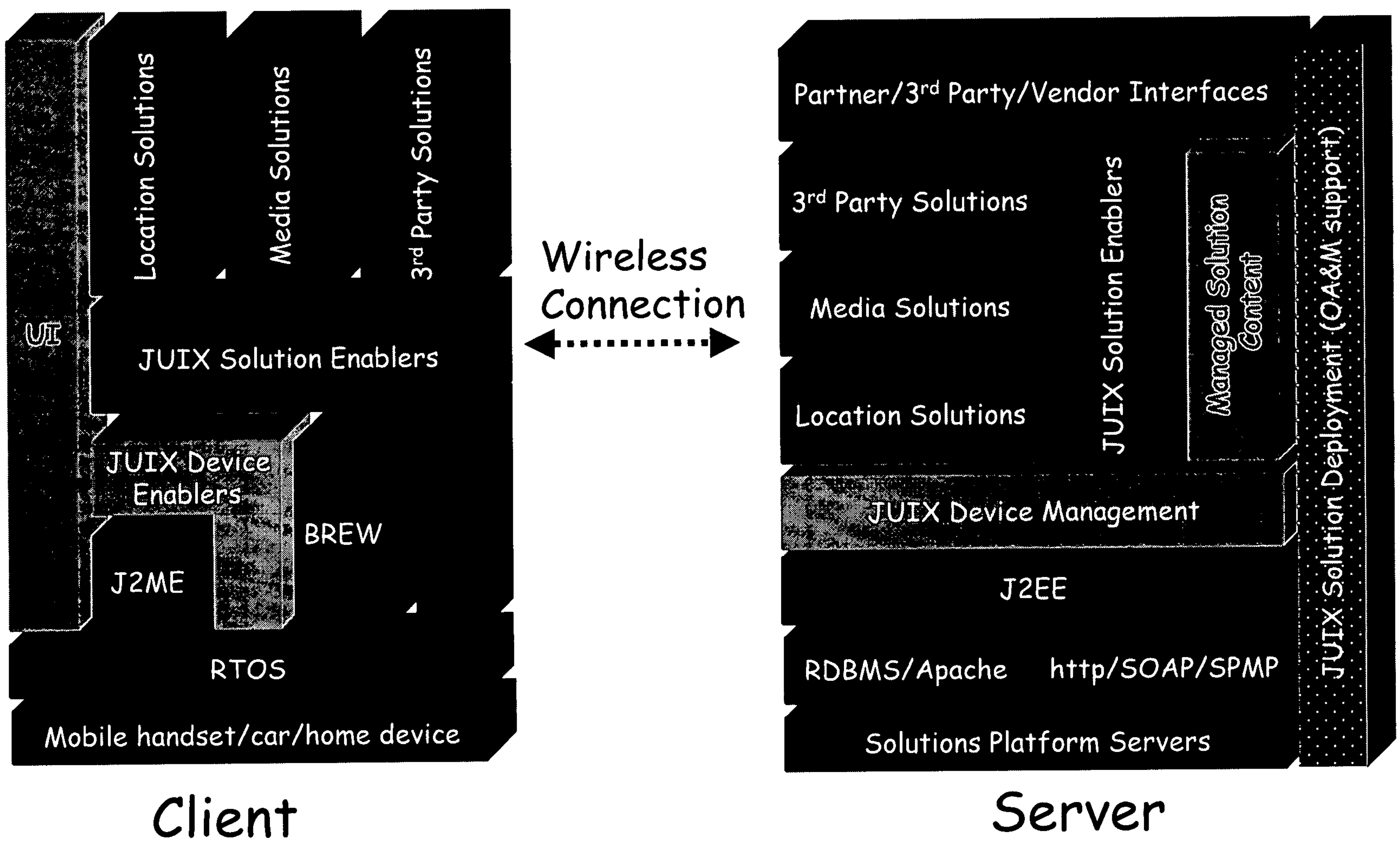
# End-to-End Software Architecture



# Solution vs. Device JUIX

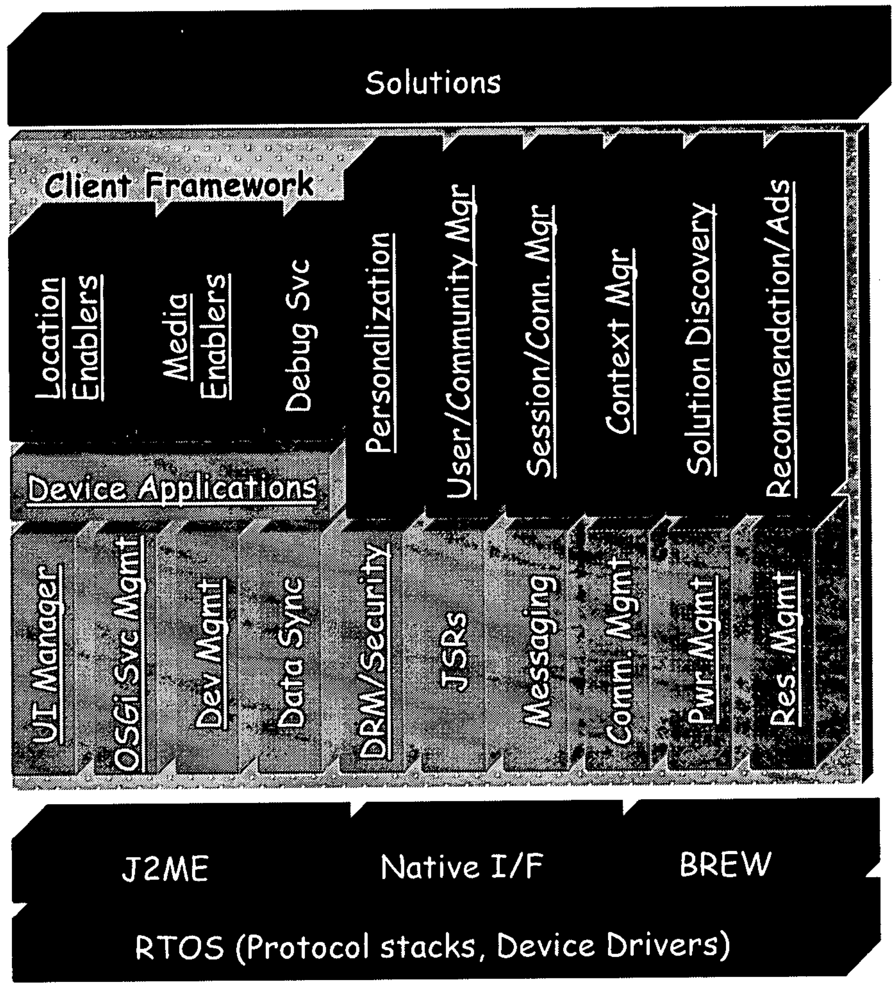
**Device JUIX**

- Enablers whose implementation is more tightly coupled with a device platform
- E.g., UI Mgr, JVM, OSGi stack, Device Mgmt, etc.
- Includes the current phone JUIX platform and those planned for the vehicle and home

**Solution JUIX**

- Enablers that leverage Device JUIX whenever available
- Also straddles non-Java platforms like BREW
- Device independent and straddle domains

# JUIX Client Software Stack

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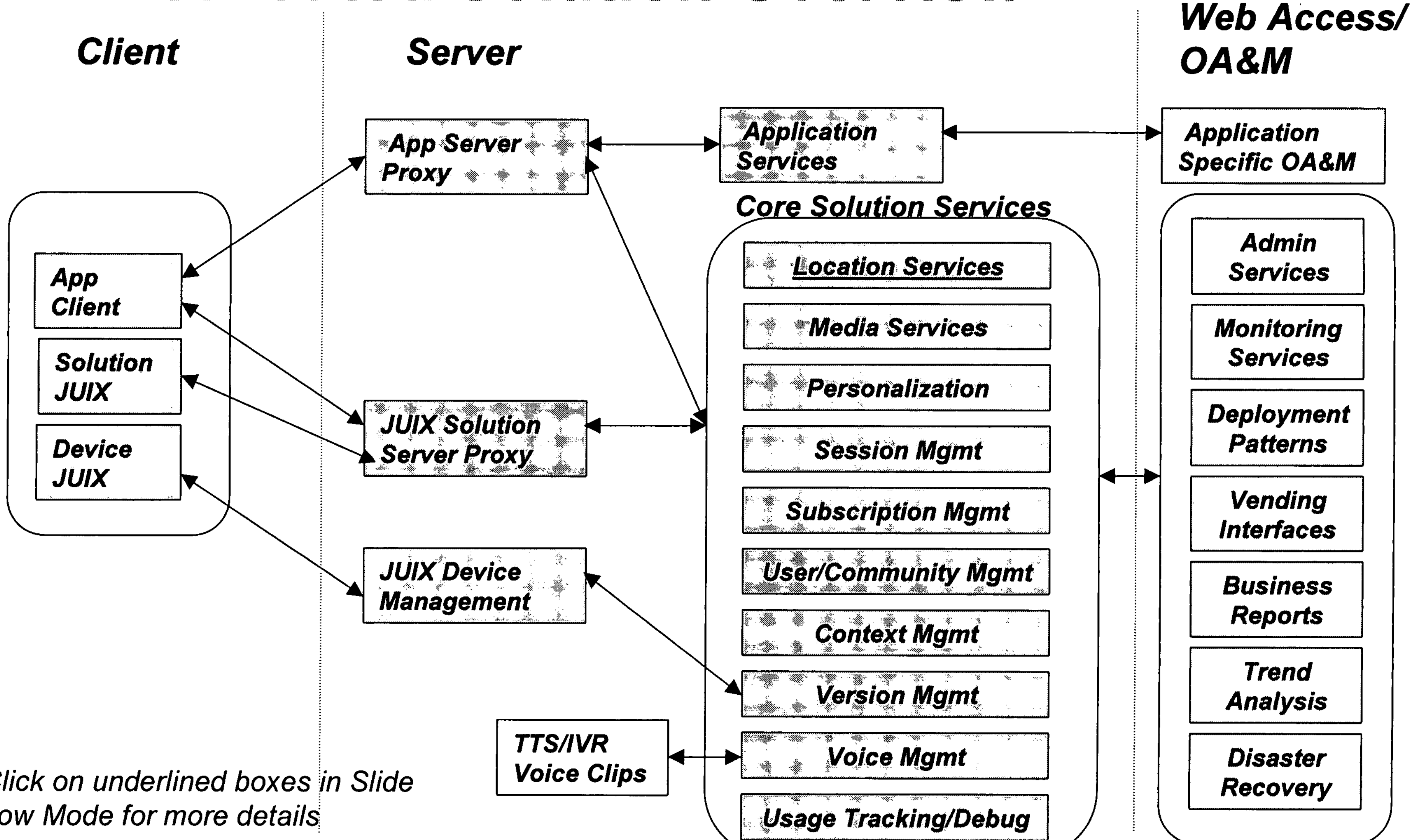
# Distributed Solution Overview




* Click on underlined boxes in Slide Show Mode for more details

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# Backup

# The Solutions Gateway

- The need for a Gateway:
  - **Another (cheaper/free) way to access the remote server**
- Home vs. hot-spot:
  - **Hot-spot is transient – mainly a fat pipe to back-end or home server**
  - **Home is permanent: personal content store**
- The advantages of a Hot-spot:
  - **Location specific caching: e.g., Nashville country, NOLA blues, Detroit motown, etc.**
  - **Hot-spot specific content: e.g., Starbucks musak, Blockbuster videos**
  - **Business transaction support: e.g., free Wireless LAN with purchase, etc.**

# Device JUIX

# Platform Applications

- Applications specific to a domain/platform
- Mobile Handset
  - **Phone settings (ring tone, answer modes, etc)**
  - **Phone book, calendar, etc**
  - **Phone browser**
- Vehicle
  - **Vehicle settings**
  - **Vehicle diagnostics**
  - **Secure vehicle gateway**
- Home
  - **Home network settings**
  - **Home network component settings**

# UI Manager

- Abstract UI widget set that supports multi-modal I/O for each platform/domain.
- Third-party application developers sheltered from the various look-and-feels
- OEMs may provide their own branding look-and-feel.

# Application Manager

- Allows rapid deployment of a rich portfolio of services culled from multiple vendors
- Secure installation/update of applications
- Remote administrative functionality
- Server support for preprocessing apps:
  - **byte code verification, compiling, signatures, profile/manifest**
- OSGi compliance

# Device Management

- Remotely set/monitor device parameters (DM Tree/SyncML)
- Firmware/native software patching
- Secure content downloads
- Interface to Application Management
- On handsets:
  - **PIM Data Sync**
  - **Secure content (e.g., ringtones) downloads**

# Security Manager

- Executes on top of Java 2 Security to provide:
  - authentication, authorization, non-repudiation
  - containment, privacy
  - Auditing
  - Gated access to sensitive services
  - Policy objects manage relationships between CodeSource objects and Permission objects
- Provide device/HW level DRM security
- Supports interfaces with VPN framework

# Power Manager

- Deliver Power status change events to applications:
  - **Power ON**
  - **Power OFF**
  - **Sleep/Accessory Mode**
- Enforce low-power behavior in emergency situations
- Monitor power consumption to detect power hogs and enforce appropriate policies

# Resource Manager

- Manage priority based access to system resources:
  - **processor, threads**
  - **Memory**
  - **UI: display, input devices, audio/speech**
  - **communications**
- Enforce priority/precedence policies
  - **For example, free required resources for an emergency call: kill/suspend current applications**

# Solution JUIX

# Personalization - Profile Manager

- Portable User Profiles
  - **Access same profile from multiple devices and domains**
  - **Supports user profile segmentation by domain, solution**
  - **Supports preferences at the Solution and core enabler levels**
- Device/Domain Profiles
  - **Allows preferences to control solution behavior based on device or domain.**
    - **E.g., allow audio content transcoding based on device capabilities/domain preferences**
- Application Configurations
  - **Allow service providers to turn on/off features**
  - **Control access and usage of features**
- User-friendly, intuitive web based profile editor
  - **User profiles**
  - **Device provisioning/App config. facilities for service providers**

# User/Community Manager

- Secure, distributed User administration
  - Common shared model for a User across solutions
  - Create and administer Users
  - Share User between solutions

- Secure Community management:
  - Support simple buddy-lists on server
  - Leverage existing messaging services on client, e.g., SMS
  - Leverage existing communities when possible, e.g., AOL
  - Support anonymous, ad-hoc community leaders:
    - E.g., an “influencer” play-list sharing community

# Session/Connection Manager

- Manage mobile session across networks and domains
  - Persistent, intermittently connected sessions
  - secure each session (authentication, encryption)
  - handoffs between interfaces
  - BW and link-cost aware
- Straddle session across networks, domains:
  - Internet, enterprise intranets
  - Seamlessly transfer between home, person, car

# Context Manager

- Manage Solution context
  - Across domains - seamless hand-offs
  - Support Context based UE:
    - E.g, location based adaptation of DP – local news, weather
    - E.g., time based adaptation of iRadio play-lists
  - Enforce policies based on Context:
    - E.g., DRM policies that vary in different domains
- Share context between Solutions:
  - Supports interaction of solutions
- Context synchronization support:
  - Support Pause-Resume across domains
  - Update Context based on time, location
- Works closely with Session Management & Solution Disovery

# Solution Discovery

- Detect the docking of Devices and Gateways
  - **E.g., a handset being brought into a car**
  - **E.g., a car being driven within range of a hotspot/home gateway**

- Lightweight, secure Service Discovery:
  - **Discover available components as a result of docking that result in new Service**
  - **E.g., A music download service when near a Gateway**
  - **E.g., Starbucks Drive-thru service near their hotspot**
  - **E.g., Hands-free phone call when entering a car.**

- Works closely with Session and Context Management:

# Recommendation Engine

- Recommendation Engine/Agent based on usage observation:
  - **Enforce privacy policies, if any**
  - **Interface implementation may leverage commercial engines if available, e.g., Gracenotes for music**
- Support for common tools for usage analysis
  - **Leverage common Usage Tracking enabler component**
- Works closely with Usage Tracking/Debug service:

# Location Enablers

**Route Guidance**
- Address Entry
- Set Alt. origin
- Set Destination
- Robust Route
- Re-route Control
- Map Display/Control
- Nav Preferences

**Safe-zone Tracking**
- Location Tracking
- Safe-zone Monitor
- Location Sharing
- Location Data Sync
- Tracking Preferences

**Destination Select/Mgmt**
- POI Search
- Favorite Destinations
- Breadcrumb Mgmt
- Dest Mgmt Preferences

**Traffic**
- Area Incident Report
- Rte Incident Report
- Incident Avoidance
- Segment Avoidance
- Traffic Preferences

# Address Entry

- Allows applications to use their own address books:
  - **List of friends**
  - **List of places to go to for errands/business travel**
  - **List of houses to check out for real-estate deals**
- Allows street addresses to be validated as navigable, i.e., can be geo-coded to the map-database.
- Allows application to enter street addresses easily (optional).

# Set Alternate Origin

- Allows application to set an alternate origin
- Default is usually the current position.
- Alternate origin useful for:
  - Setting an origin on a navigable point when living in un-mapped remote areas
  - Setting an origin closer to destination when you are familiar with most of the route except near the end (freer to listen to music uninterrupted by unnecessary maneuver instructions)

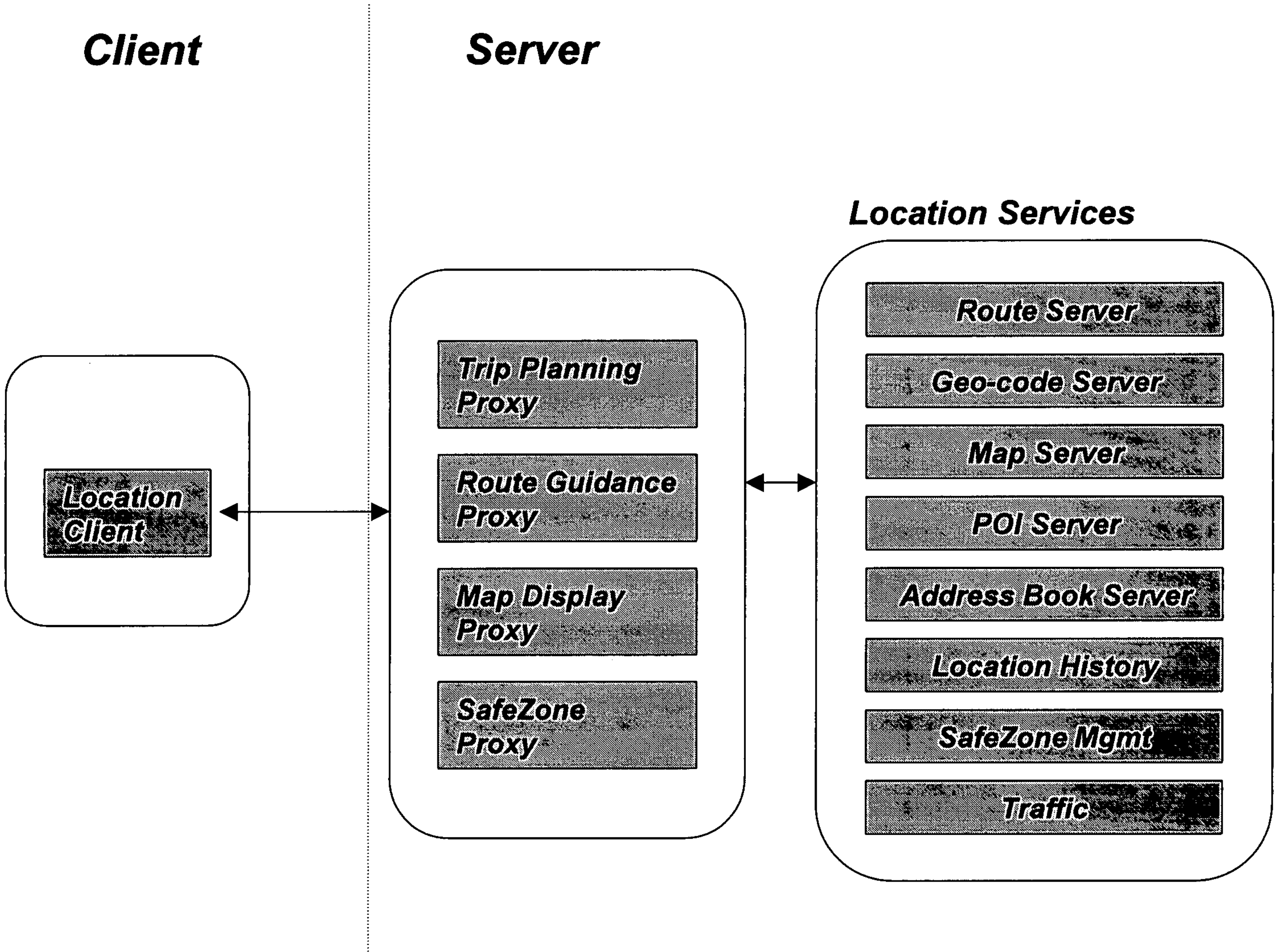
# Robust Route (upcoming feature)

- Allows system to "carpet" a specified area with potential alternative "routelets" that merge back into the main route
- Robust route useful for efficiently:
  - **Getting on route for the first time when not starting from a navigable area, e.g., parking lot, large malls/campuses**
  - **Getting back on route when straying off-route by accident**

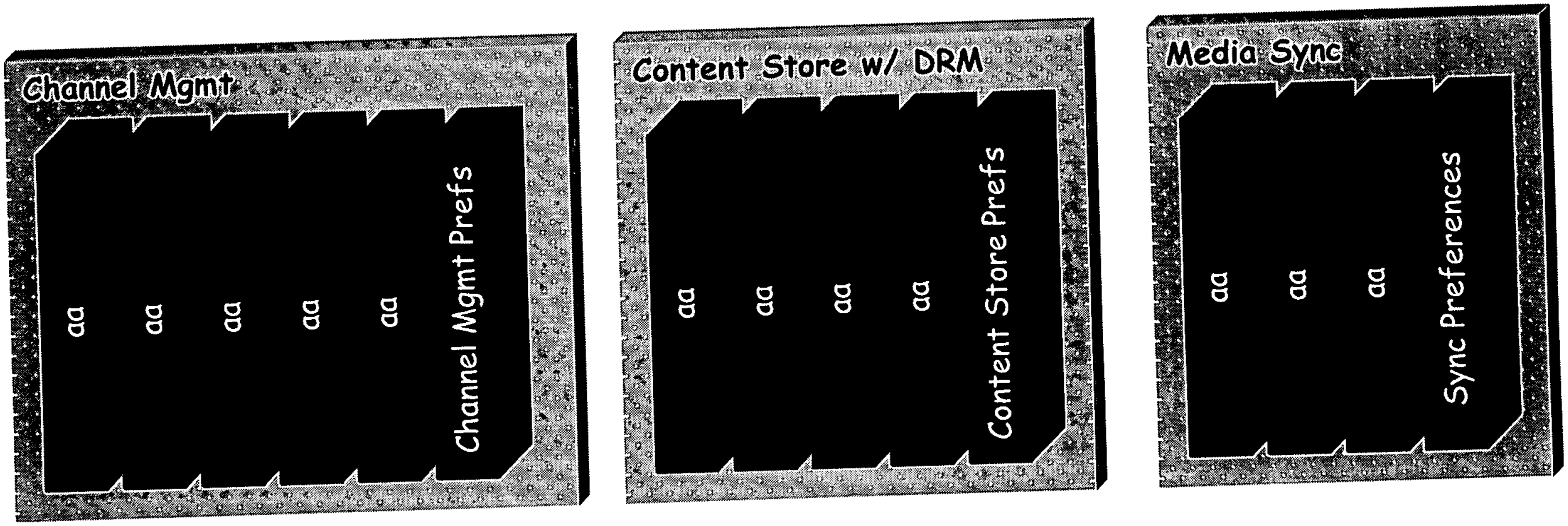
# Navigation Preferences

- Allows application to set preferences for route calculation
- Preferences include:
  - **Fastest (balanced) route – *default***
  - **Avoid freeways**
  - **Avoid tollways**
  - **Avoid bridges, tunnels, …**

# Location Services



# Media Enablers



# 3rd Party Developer Support

# A Vibrant Development Community

- Client SDKs
- Server SDKs

# Enabling a Rich Seamless Solution Space

- Easy portability across multiple platforms
  - A stable Java environment with common core APIs
  - Developer friendly platform emulators with consistent core APIs
  - Provide Look-and-Feel components to remove consistent UI design load from developer, e.g., SavaJe or JUIX
- Platforms embedded with seamless enablers
  - Provide enablers to seamlessly transfer experience across solution spaces: handset, auto, home:
    - Location – more capable GPS with DR in auto than in handset
    - Audio – seamlessly upgrade/downgrade based on platform
  - Seamless connectivity/hand-off between solution spaces
- A vibrant developer community
  - Provide easy-to-use client and server SDKs
  - Leverage Motocoder forum
  - Host app writing competitions
  - Provide hosting/billing services leveraging 4thpass, VIAMOTO

International CES

# iRadio™

# Brainstorming
# July 20th, 2004

# Results Brainstorming CES Demo scripts 7/20/04

- **Goals of CES Demo:**
  - Simplify to only 2 or 3 key messages
  - Big on behavior, lower on technology
  - "taking content you are used to somewhere else"
- **Key questions to answer:**
  - Which devices and key features will be demo'ed?
  - How does the demo vary if this is Yahoo Launcast centric vs. XM centric?
  - Why is it better than a combo XM in the car + iPOD plug n play?

# Bottom Line Concept V1.0:

- **User configuration webpage**
  - Allows to register for service, access catalog library of contents from service provider like webcast radios, personalized subscription channels
  - Allows to aggregate "owned" music library to mix with external content into daily sets
  - Preferably links with well known media players as Real, WM or iTunes rather than imposing its own (case of SimpleCenter)
- **My Daily Sets**
  - Create 128Mbytes of compressed music/ spoken words updated each day at least partially for the content either stale or listened to. In AAC+, that would allow between 1.5 hours to 2 hours per channel with a 50% mix music vs. talk, in WMA about 1hour/channel and probably 30 minutes/ channel in MP3
  - Channel #1: My "digital music"
    - CD ripped collection
    - Digital Music downloads
  - Channel #2: My "Yahoo" Personal Music Channel
    - AI based suggestion
  - Channel #3: My talk show radio shows
    - Car talk, CNBC McEnroe…
  - Channel #4: My Audible books
  - Channel #5: My Sports radio
    - Soccer news, stats, scores
  - Channel #6: My Lifestyles
    - Movies reviews, Entertainment gossip, Discovery, History …
- **Key questions to answer:**
  - Which devices and key features will be demo'ed?:
    - *Organization into predictive daily sets, auto download and refresh daily, pause her play there and delayed one touch Push to Buy*
  - How does the demo vary if this is Yahoo Launcast centric vs. XM centric?
    - *May be very similar with the difference that the user can create playlist / advanced programming based on XM content and owner's library only and XM could be listened live as well as cache" in the car- No handover to phone if live music (possible at home)*
  - Why is it better than a combo XM in the car + iPOD plug n play?
    - Brings the user feedback and intelligent automated refreshment of some of the content (albeit more limited) and also automates the Listen on XM-purchase on iTunes scenario. Also, provides a true seamless continuity of the same content without plug- unplug (arguable if this is a BlueTooth –iPOD or Motorola iPTunes phone…Food for thoughts…)

# Use Case Compliance Matrix

DEMO CES use cases overview

| | Key Features | Use cases | HOME: PC gateway | HOME: MS1000 | HOME: Home Receiver | HOME: Wireless Audio Speaker | HOME: Graphic Remote Controller | On-The-Go: E680 | On-The-Go: MPX | On-The-Go: iTunes Phone (tbd) | On-The-Go: Portable media Player | On-The-Go: IPAQ WiFi | Car: OmniFI | Car: Wireless car audio adapter | Car: Legacy head-Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Content Customization | Custom Daily sets | provide web user interface to create and aggregate various | X | X | | | | | | | | | | | |
| | Personnalized channels | Yahoo Launchcast creating a subset of 1-2 hours as part of one of the daily set channels | X | X | | | | | | | | | | | |
| | Recently Purchased Music channel | Automatically load the song that will be acquired during the demo and display it with a delay to drive the point that it is not done in real-time through the phone | X | X | | | | | | | | | | | |
| | Access / conversion personal music library ("ripped" or downloaded) | can be part of the creation of personnalized channel or create a random playlist each day | X | X | | | | | | | | | | | |
| | Intelligent selection download = f(bandwidth, freshness, battery life, memory | Huge available content is filtered to 128MB and synchronized with content that was listened before... | | X | X | | | | | | | | | | |
| Pause / Skip / rewind / resume | Pause here...Play there | Light signalling service handoff between home receiver and car and phone. May need to create a buffer for "now playing" song if it is not part of the daily set | X | X | X | X | ? | X | | ? | | | ? | X | X |
| | Skip forward / backward Browse through Playlist | Use the left/right arrows of the CD keys on headunit or on the phone | X | X | X | X | ? | X | | ? | | | ? | X | X |
| | Events recording | N/A (IP TiVo and GoToIT? Done by daily sets off-line | | | | | | | | | | | | | |
| | Instant buffering (replay/rewind) | N/A (IP TiVo and GoToIT?) | | | | | | | | | | | | | |
| | TBD | | | | | | | | | | | | | | |
| Access Content I want | Legal push to buy | Demonstrate a live download from napster or Musicnet that will be transferred on both the phone and the car | X | X | X | X | | X | | ? | | | ? | X | X |
| | Find Music through mood engines | N/A | | | | | | | | | | | | | |
| | Find / Search music QBH, playlists | N/A could demonstrate QBH but may dillute key messages | | | | | | | | | | | | | |
| | DRM coordination | N/A | | | | | | | | | | | | | |
| | TBD | | | | | | | | | | | | | | |
| Interactivity / Community | Instant Music Clips Messenger | N/A | | | | | | | | | | | | | |
| | Share play-lists | N/A | | | | | | | | | | | | | |
| | Push to Vote / register | N/A | | | | | | | | | | | | | |
| | Push to learn more | N/A | | | | | | | | | | | | | |

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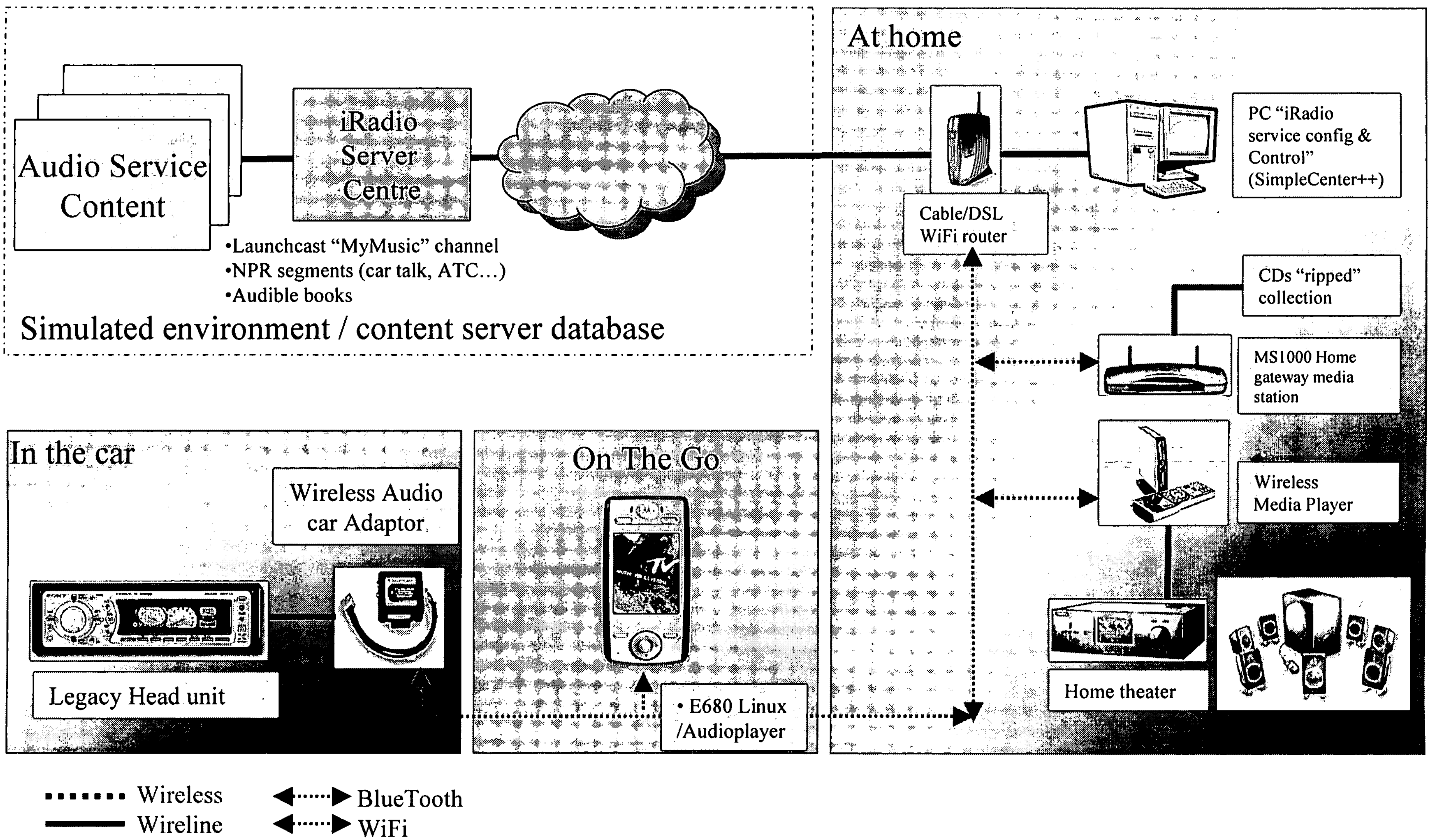
# CES example for generic service content provider…



# A Day In The Life ...

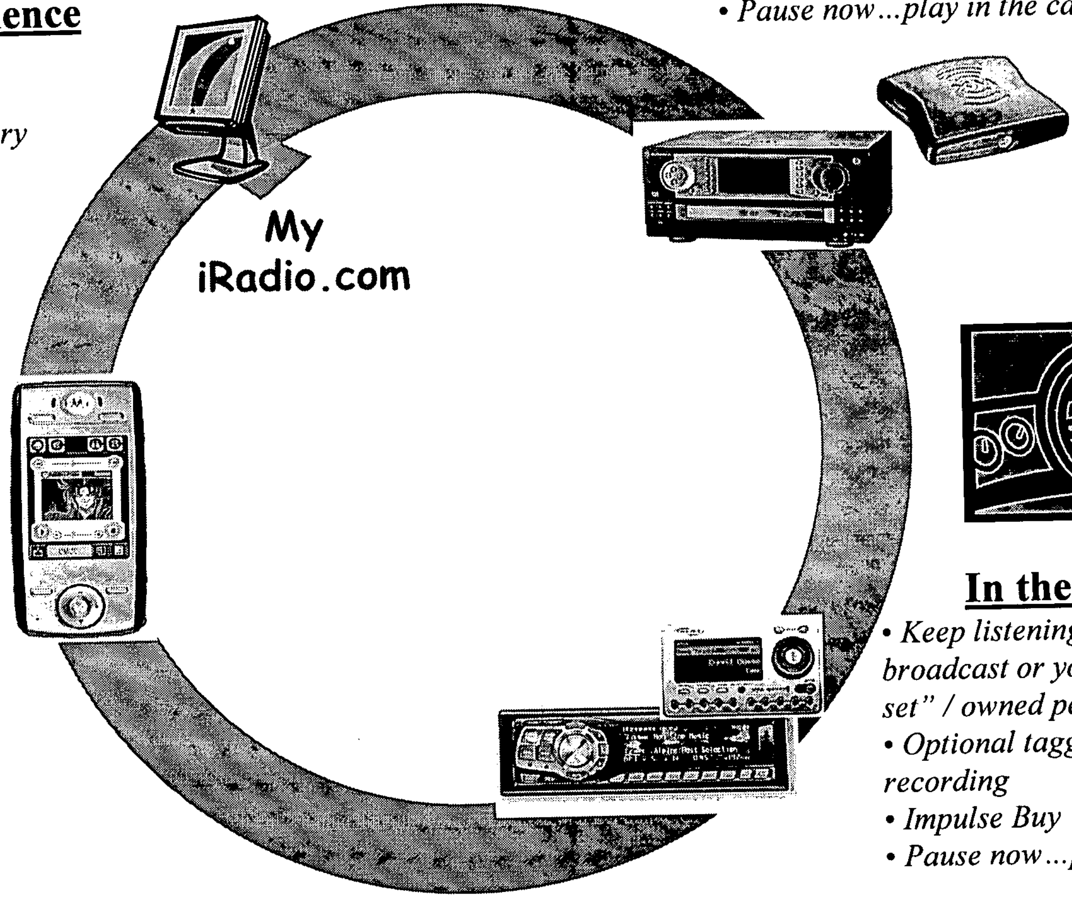
## At home

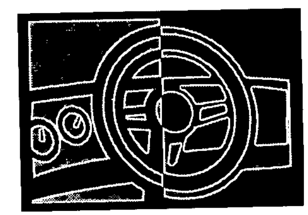
## Wake-up, get ready

- *Listen to XM live broadcast or XM cache "daily sets" or a mix Music I own / recently purchased*
- *Impulse Buy*
- *Pause now…play in the car…*

## Relax…Fine Tune the experience

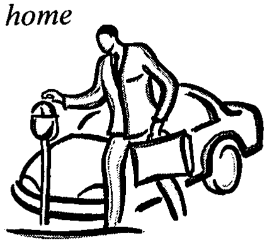
- *Browse / tag new XM events*
- *Create /Update preferences daily sets:*
- *e.g. XM events, talk shows, music library*
- *Browse XM music store*



## On-the-Go

- *Keep listening to your XM cache daily set"*
- *Impulse Buy*
- *Pause now…play later in the car …or back home*



## In the car

- *Keep listening to XM live broadcast or your XM cache "daily set" / owned personal music*
- *Optional tagged XM event auto-recording*
- *Impulse Buy*
- *Pause now…play in the phone*

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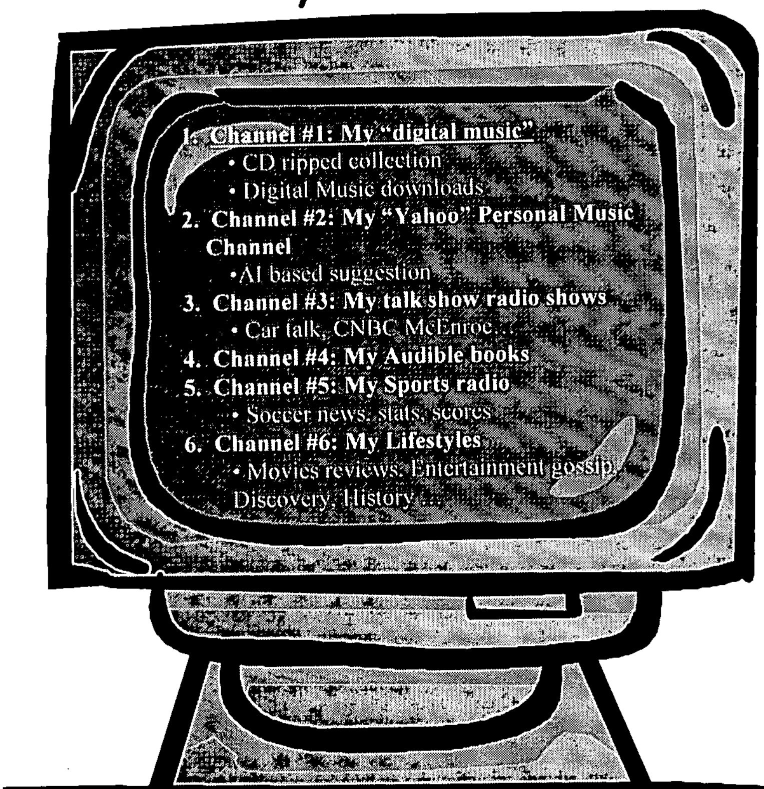
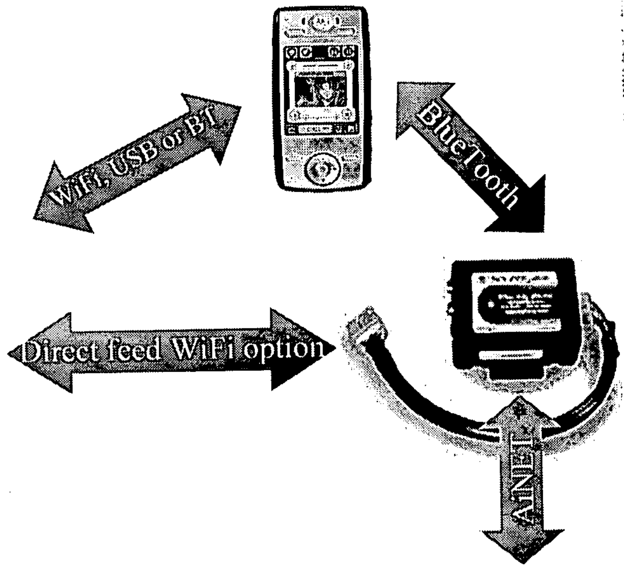
# Daily Set across domains

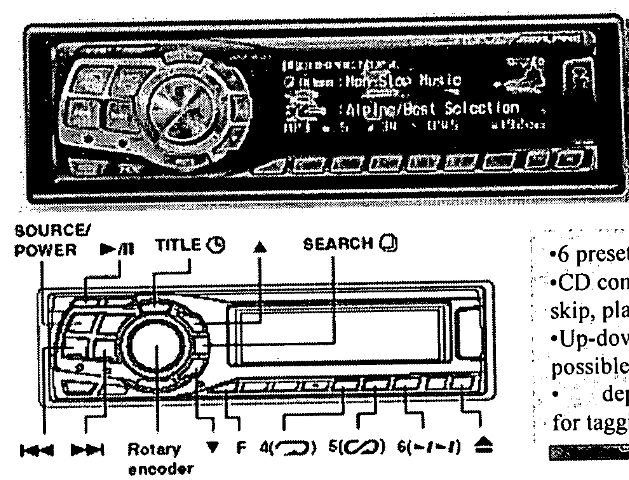
## My iRadio.com




**E680 Linux-base media phone**
- Use internal 50Meg for 10 minutes of each channel content using REAL or WMA format @64kbps. AAC for future Apple phone?
- Use SD card slot for wiFi card
- Use BlueTooth for direct control memory-less Bluetooth wireless car adaptor

**Wireless Car Audio Adaptor:**
- WiFi (home, phone) or BlueTooth (phone)
- AiNet interface CD changer spoofing, CD text spoof for ID3 tags
- 128MB storage (option)
- USB extension (option)
- Voice command (option)




- 6 presets= 6 channels
- CD commands for skip, play, pause
- Up-down arrows for possible sub-playlists
- depress 2seconds for tagging PTB

- PC configuration web browser or Microsoft Windows Application/Media player
- 5 to 6 "Daily Sets" mapped to Radio or Home receiver

# iRADIO CES Demo Script Description (preliminary)

## An "Audio Day" in the life of a consumer

- **On PC, user prepares 5-6 "Play-list" content to be automatically daily refreshed & downloaded to car and phone (pre-processing / set-up)**
  - Single user interface to access "owned music", service provider subscription library, Internet audible books and other spoken-words catalog based content
    - E.g. Itunes jukebox, Yahoo Launchcast,NPR's Car Talk, jokes of the day, trivia, horoscope, new movies reviews, sports reports,…
  - Organize in 5 or 6 main "supersets / genres" that will be available on the car radio head-unit 5-6 preset keys with user friendly interactive bargraph to mix % of content preferences (128Meg / 4-6 hours depending codecs & content)
    - E.g. My Ripped Music, My personal music channel, My Sports, My Talk radio, My Audible book.
    - Genres could also be organized by mood: My Morning Latte, My energy boost, My relaxation, My learning channel…
- **Start demo to show "domains" transitions over course of normal day:**
  - Start listening to 1st program streamed on Home Theater from MS1000 NAS
  - Jump in the car – Seamless handoff to legacy car stereo
    - Use familiar CD radio controls and memory preset to browse through various prepared contents, can pause, skip forward and back. Receive live phone call – interrupts music-handsfree on car stereo.
  - Park the car- Finish phone conversation and resume listening experience with phone earphones or external speakerphone
- **End of the day: Come back in the car at then back to home…**
  - Listen to a "pop tune" from subscription service and likes it: push-to-buy on radio depressing the CD start Key 2 seconds (tags the music title / artist/ CD)
  - When entering the home, request is uploaded (WiFi) from car and instantly donwloaded from Music services into "My recently purchased" folder on the PC
  - Purchased Content can then be listened to right away on Home Theater
  - Also, "Tag Event" could have a "Push-to-Learn more" function that flags artist bios on PC, possible concerts in the area etc…

## Key Messages

"My Audio Daily Set…

…Follows Me:
- Home to Car
- Car to Phone

…and I can interact with it"

# Motorola

## August 6, 2004

# Agenda

- **Motorola presentation**
  - OnStar Telematics road-maps & XM synergy
  - Home consumer network strategies & XM synergy
  - iRadio Concept and XM synergy
- **XM presentation:**
  - Technology & products road-map
  - Future vision and Challenges for S-DARS
- **Brainstorming session**
  - Joint opportunities short and medium term (new products, enhanced interactive premium services, CES demos...).

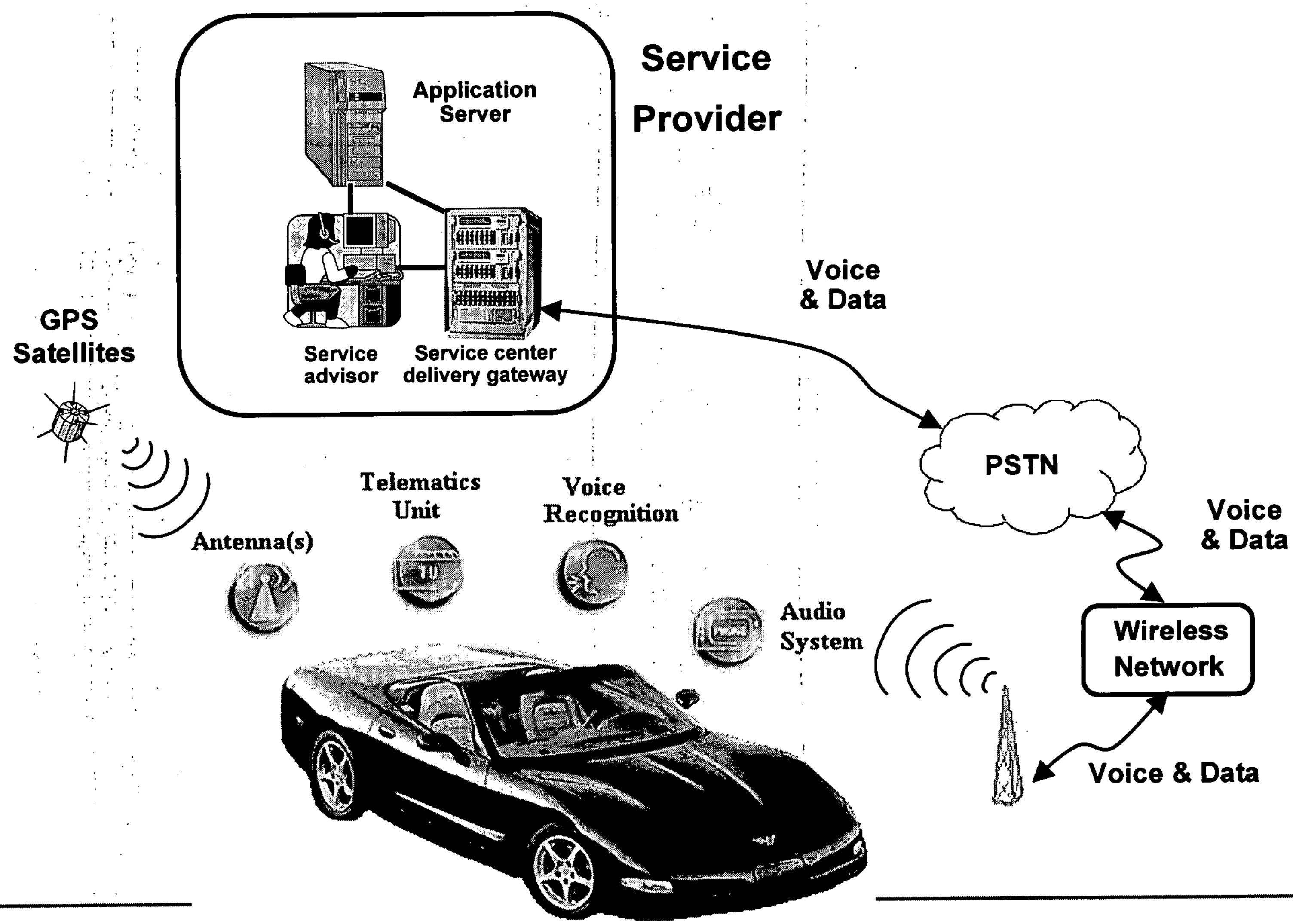
# Motorola Brings To XM . . .

- **Leverage strength of Motorola brand and channel distribution**
- **Reduce dependencies on few head-unit suppliers**
- **Accelerate the extension of XM brand & service beyond car**
  - Leverage Motorola's footprint in home and on the person
- **Extend XM brand and value through premium services**
  - Enabled by backchannel integration (cellular, Internet…)
  - Enabling e-commerce / digital storefront capabilities
- **Extend differentiation gap with SIRIUS**

# Topics

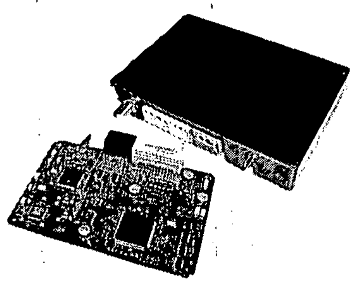
- Telematics
- Broadband
- iRadio - Growth

# Telematics System Design



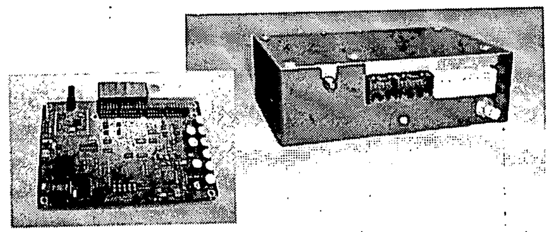
# OnStar™ Portfolio

## Gen4
**MY02**



- Pre-Paid Cellular
- Memo Record
- Vehicle Data Upload
- Demo Play
- Class2 Dialing / Modem Sharing
- Man/Auto Emergency Call
- Advisor Call
- Lock/Unlock Request
- Personal Calling
- Hands-Free Audio
- Discrete Voice Recognition
- Voice Prompts
- Analog NAD
- GPS (on-board discrete)

## Gen5
**MY03**



- Pre-Paid Cellular
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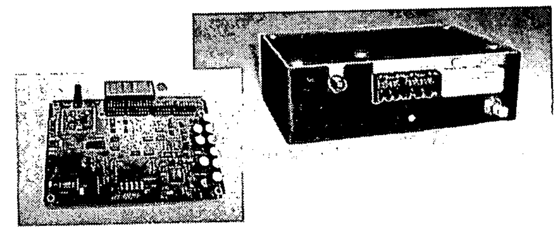
- Advisor Call
- Lock/Unlock Request
- Personal Calling
- Hands-Free Audio
- Discrete Voice Recognition
- Voice Prompts
- Analog NAD
- GPS (on-board integrated)
- LS/HS-GMLAN Support
- Class2 Flash Programming
- MMHU GPS Interface
- Button Barge-In
- VR DTMF Tones
- French VR & Prompts

## Gen6
**MY04**



- Pre-Paid Cellular
- Memo Record
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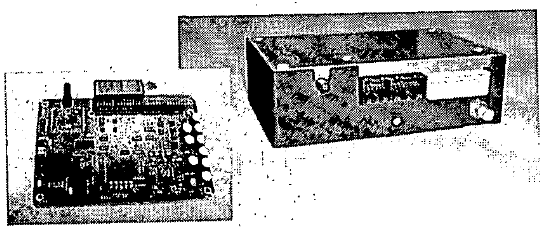
- Class2 Dialing / Modem Sharing
- Man/Auto Emergency Call
- Advisor Call
- Lock/Unlock Request
- Personal Calling
- Hands-Free Audio
- Continuous Voice Recognition
- Voice Prompts
- Digital NAD
- GPS (on-board integrated)
- Class2 Flash Programming
- MMHU GPS Interface
- Button Barge-In
- VR DTMF Tones
- French/Spanish VR & Prompts
- E911 Compliance

# OnStar™ Portfolio

## Gen6.1 MY04/05



- Digital NAD
- E911 Compliance
- Continuous Voice Recognition
- French/Spanish VR & Prompts
- Pre-Paid Cellular
- Memo Record
- Vehicle Data Upload
- Demo Play
- Class2 Dialing / Modem Sharing
- Man/Auto Emergency Call
- Advisor Call
- Lock/Unlock Request
- Personal Calling
- Hands-Free Audio
- Voice Prompts
- GPS (on-board integrated)
- Class2 Flash Programming
- MMHU GPS Interface
- Button Barge-In
- VR DTMF Tones

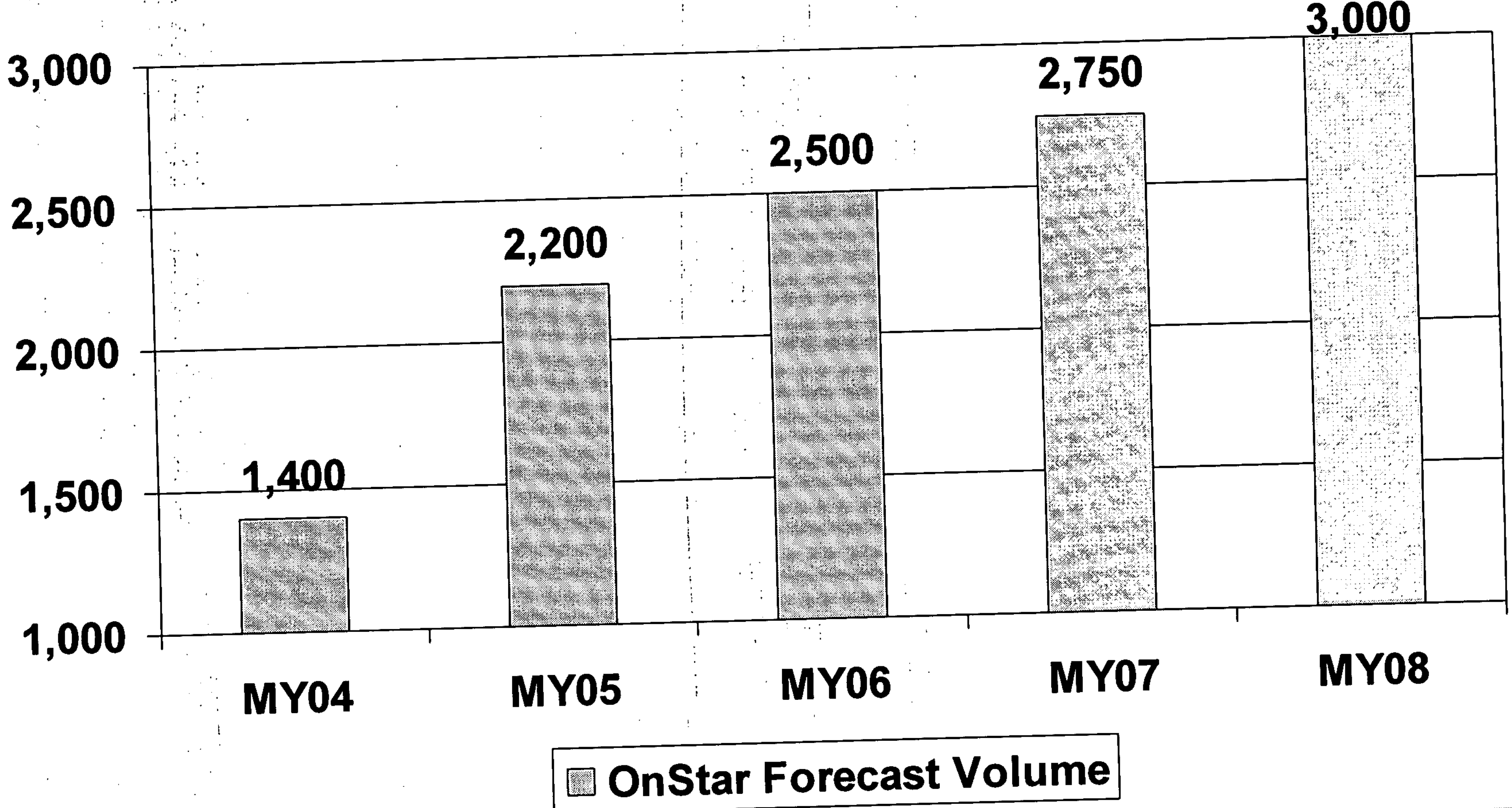
## Gen7.0 MY06

- **NEW FEATURES:**
- VIAMOTO™ off-board navigation
- Packet data
- HTTP/SIP/SOAP capable
- Speech Recognition enhancements
- Handsfree enhancements
- Improved GPS accuracy and urban canyon performance
- Caller ID/Waiting/Hold functions
- Enhanced Vehicle data upload
- Abstract Diagnostics Access

## Gen7.1 MY07

- **NEW FEATURES:(tentative)**
- VIAMOTO™ off-board navigation enhancements
- Speech Recognition enhancements
- Handsfree enhancements
- Next Generation InStantGPS solution
- DRx (sleep mode) enhancements
- Event driven audio playback
- Remote vehicle control
- Audio and ring tone replacement
- User interface enhancements
- Vehicle theft notification

# OnStar volume is forecast to increase to 3 million units by MY08 in North America




Source: Motorola analysis

# Motorola offers the opportunity to increase XM penetration in General Motors vehicles

- General Motors is growing Telematics penetration beyond North America
- Motorola is the largest share Telematics supplier to General Motors
- Telematics penetration will likely exceed the penetration of high-end head units
- Telematics control unit (TCU) is the natural back end Digital Rights Management platform into the vehicle
- TCU is also the RF box in the vehicle

# GM/OnStar would like to integrate XM receiver hardware and software in the TCU

- **GM/OnStar requesting Telematics suppliers to chose one of two component design options**
  - XM chipset integration
  - XM module integration
- **Integrated XM receiver will provide the same features and functionality as remote receiver**
- **GM/OnStar intends to augment XM audio services with new digital data services**
  - OnStar enhanced XM traffic
  - OnStar reverse path B2B
  - Group messaging
  - Large and multimedia file broadcast

# Topics

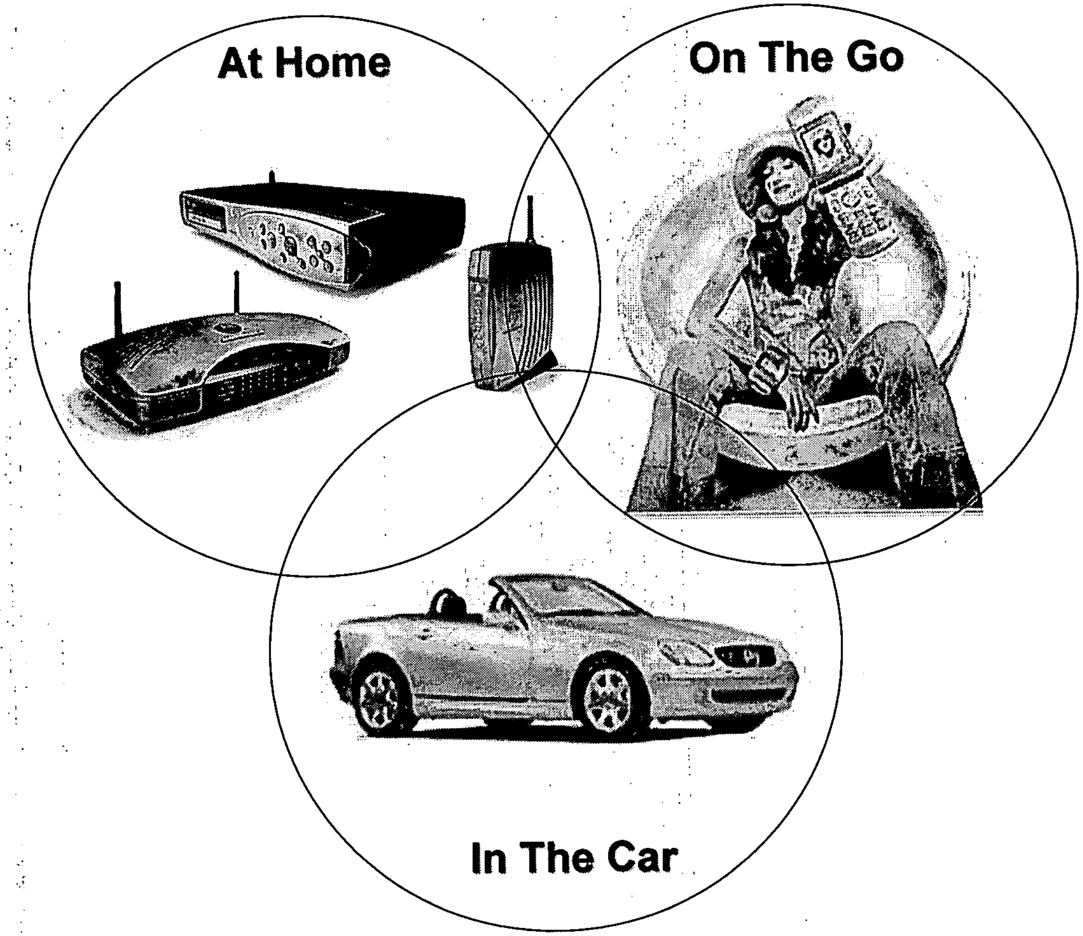
- Telematics
- Broadband
- iRadio - Growth

- Insert package Dwight Sakuma

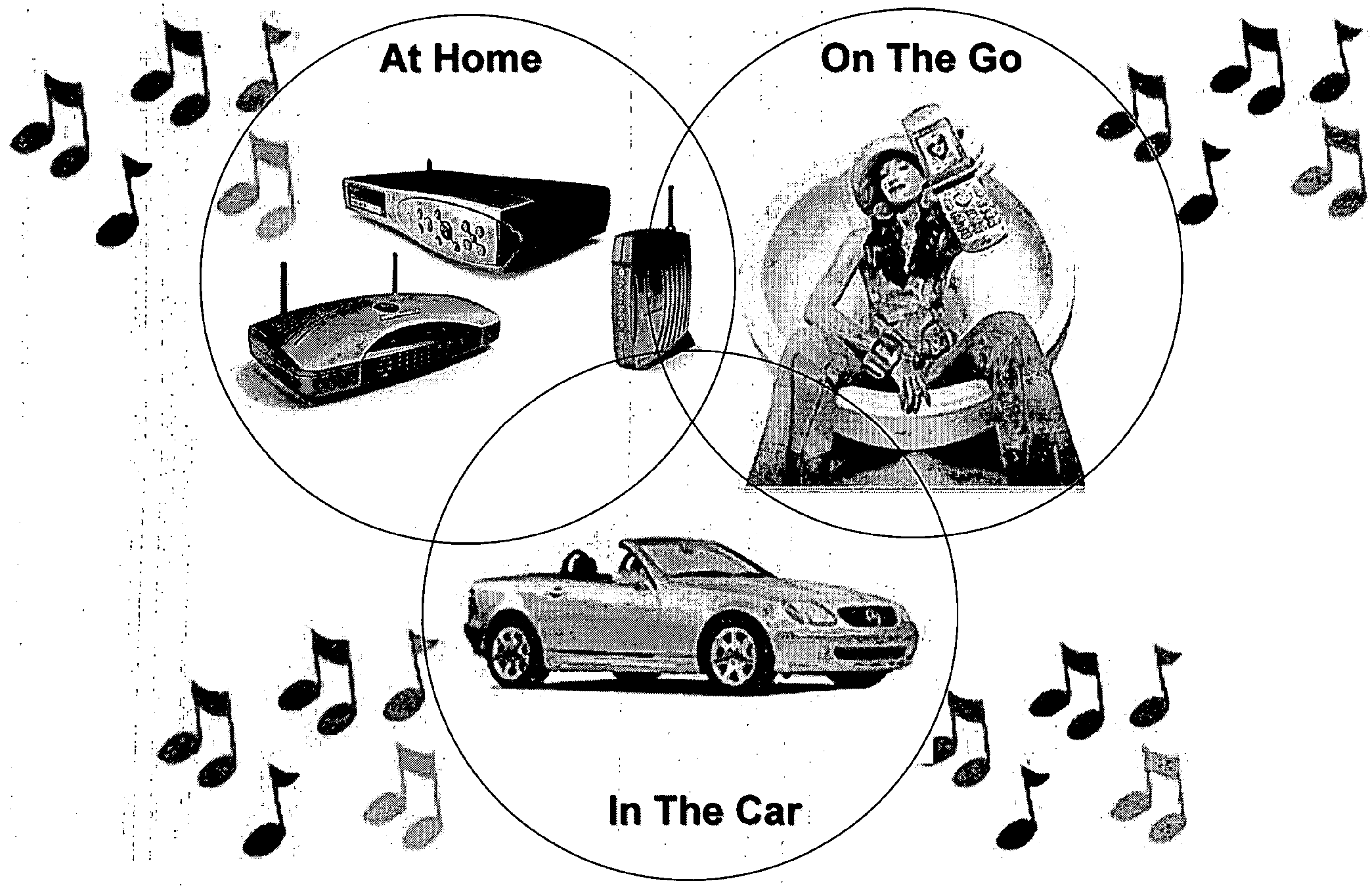
# Topics

- Telematics
- Broadband
- iRadio - Growth

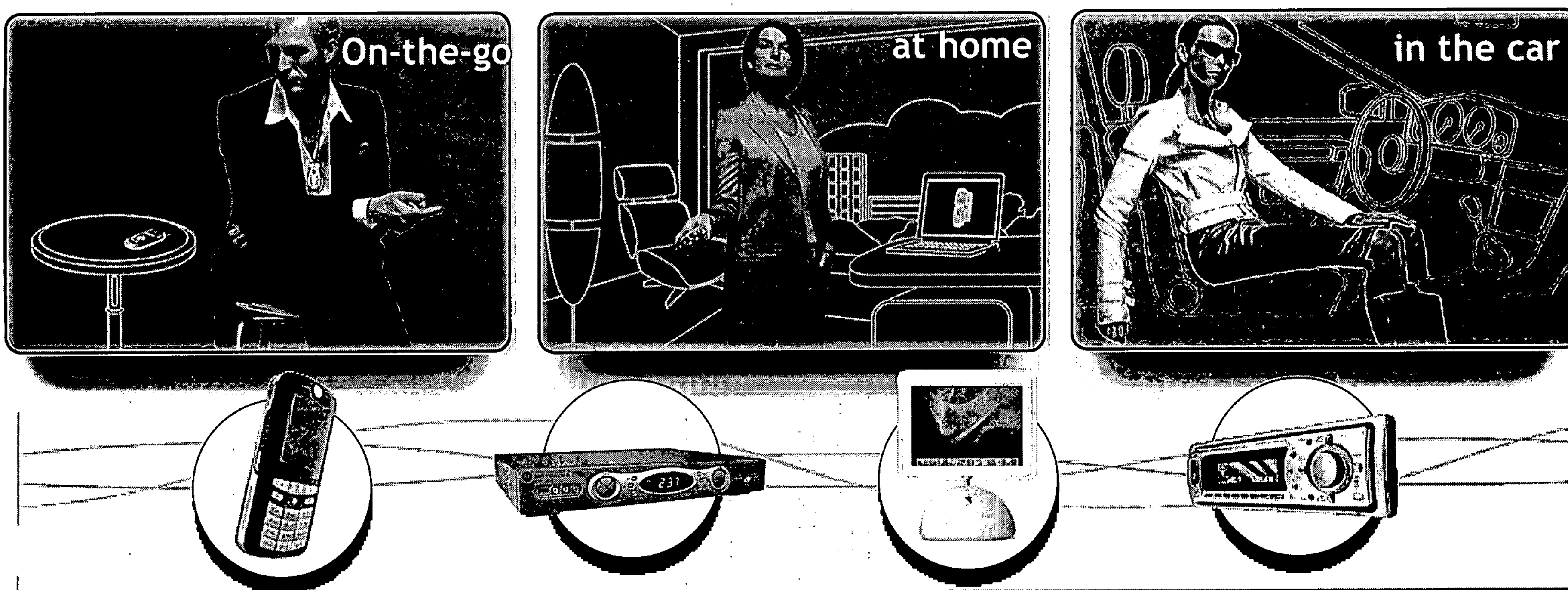
# Where is Motorola in *your* life?



# And where do *you* listen to music?



# iRadio . . . Enabling your digital music to seamlessly follow you!




Impulse Purchase Pause & Resume across domains Referral Engine "Cache" Buffered Audio

Cellular Bluetooth Hi-Speed Internet 802.11

Digital Music Store Satellite Radio Internet Radio Streaming Video

MOTOROLA XM

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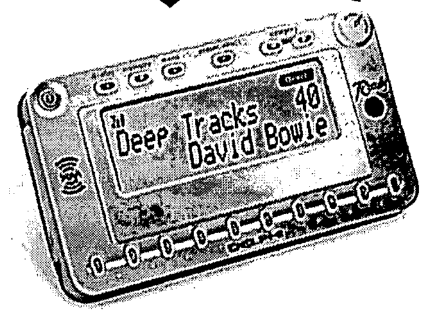
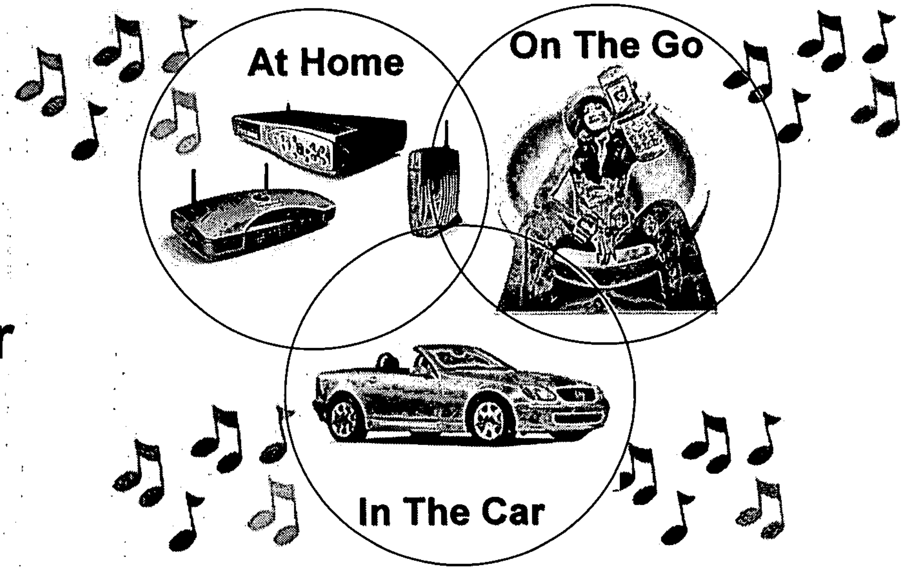
# Access to the content you want . . .

- **Content you own:**
  - Home music collection
  - Downloaded purchases
- **Content you "rent":**
  - Satellite radio broadcasts
- **Content you receive:**
  - Broadcast radio



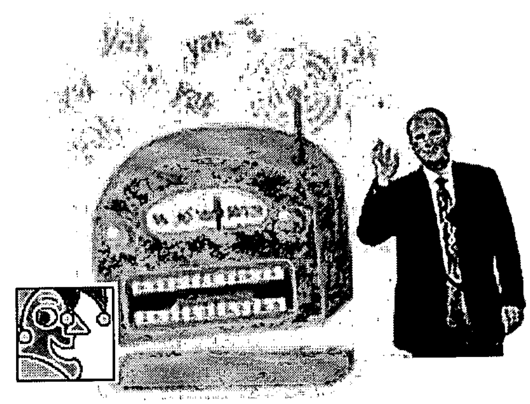

# Where you want it . . .

- Home entertainment system
- Home PC
- Car stereo
- Portable digital music player
- Cellular handset
- And whatever comes next!



# When you want it!

- Schedule your favorite programs to playback when you want to hear them
- Synchronize your playlists across domains and devices
- Access your home collection while driving your car or your satellite subscription at the gym



# Key iRadio Capabilities

- **Push-to-Buy**
  - Buy the track or CD of the songs you're listening – "No Hassle" automation
- **Pause here – Play there**
  - Pause play on one device and resume on another
- **Time-shifted programming**
  - Pause/Rewind/Skip
  - Record unique XM events
  - Play-back your favorite sports & talk radio programs or owned music collection when and where it's convenient
- **Viral marketing engine**
  - Provide referrals & exchange playlists to your music community
  - "Amazon-like" recommendations

# Benefits to XM

- **Drive Revenue Growth**
  - Increase ARPU through premium service
  - New subscribers adoption (multi sources, multi-domain, multi-features)
- **Capitalize on XM unique content**
- **Capture share of impulse buying revenue**
  - Turns the XM radio into a digital storefront
  - Integrated impulse purchasing of tracks and CD

# Benefits to consumers

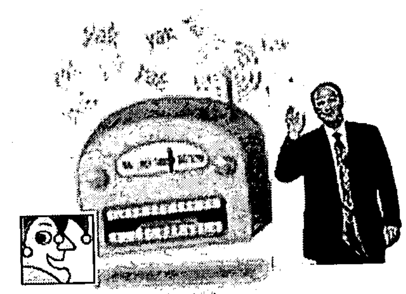
- **Seamless mobility**
  - Cures music schizophrenia
    - Multiple playlists, codecs, libraries, devices, and protocols
- **Unprecedented access to catalogs and choices**
  - Discover new music that matches your tastes
  - Wherever you are, whenever you want it
  - All available content is *actually* available
- **Connects you to your music community**

My favorite music

anytime

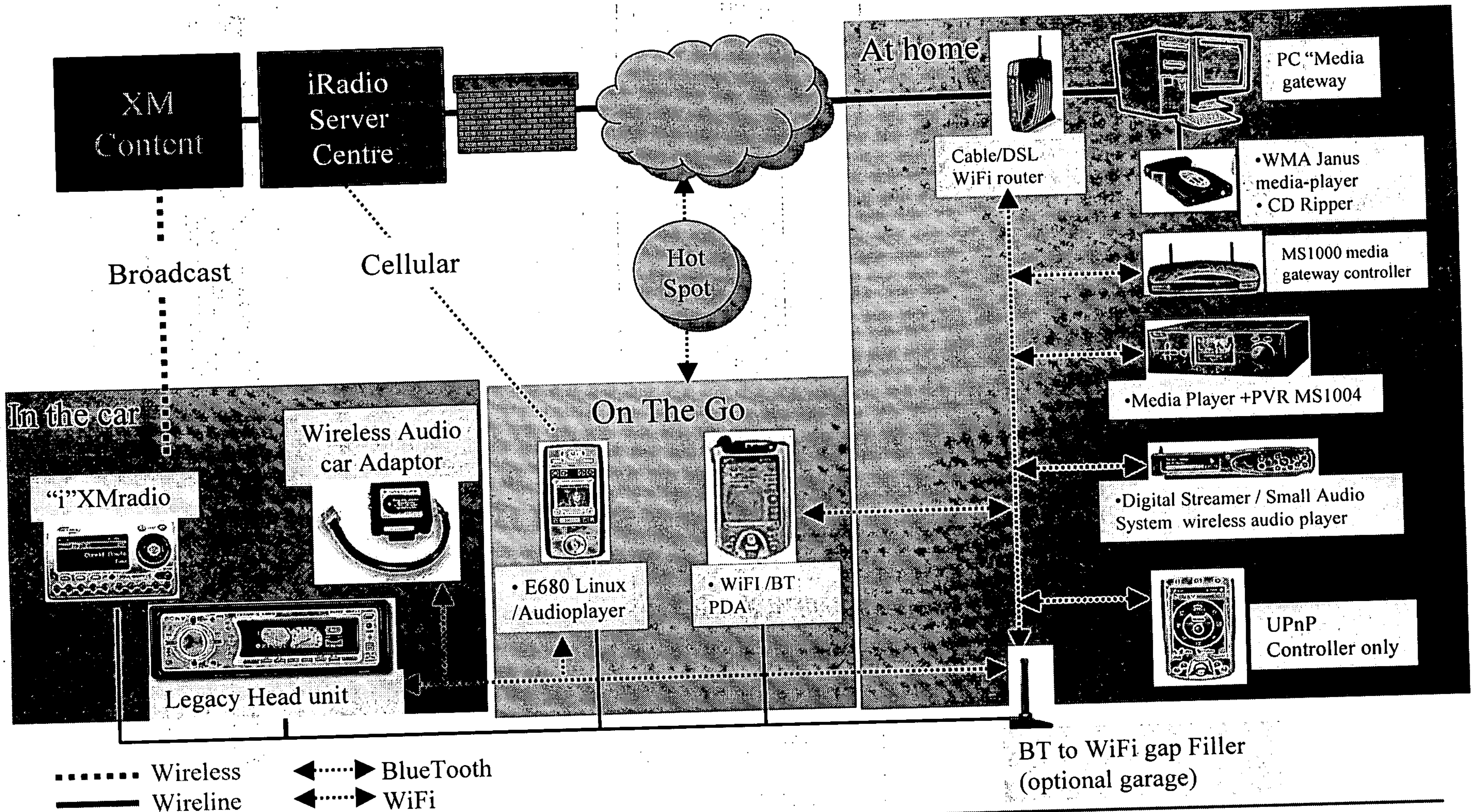
My favorite mixes

anywhere



My favorite programs

# iRadio "Physical" Architecture example...

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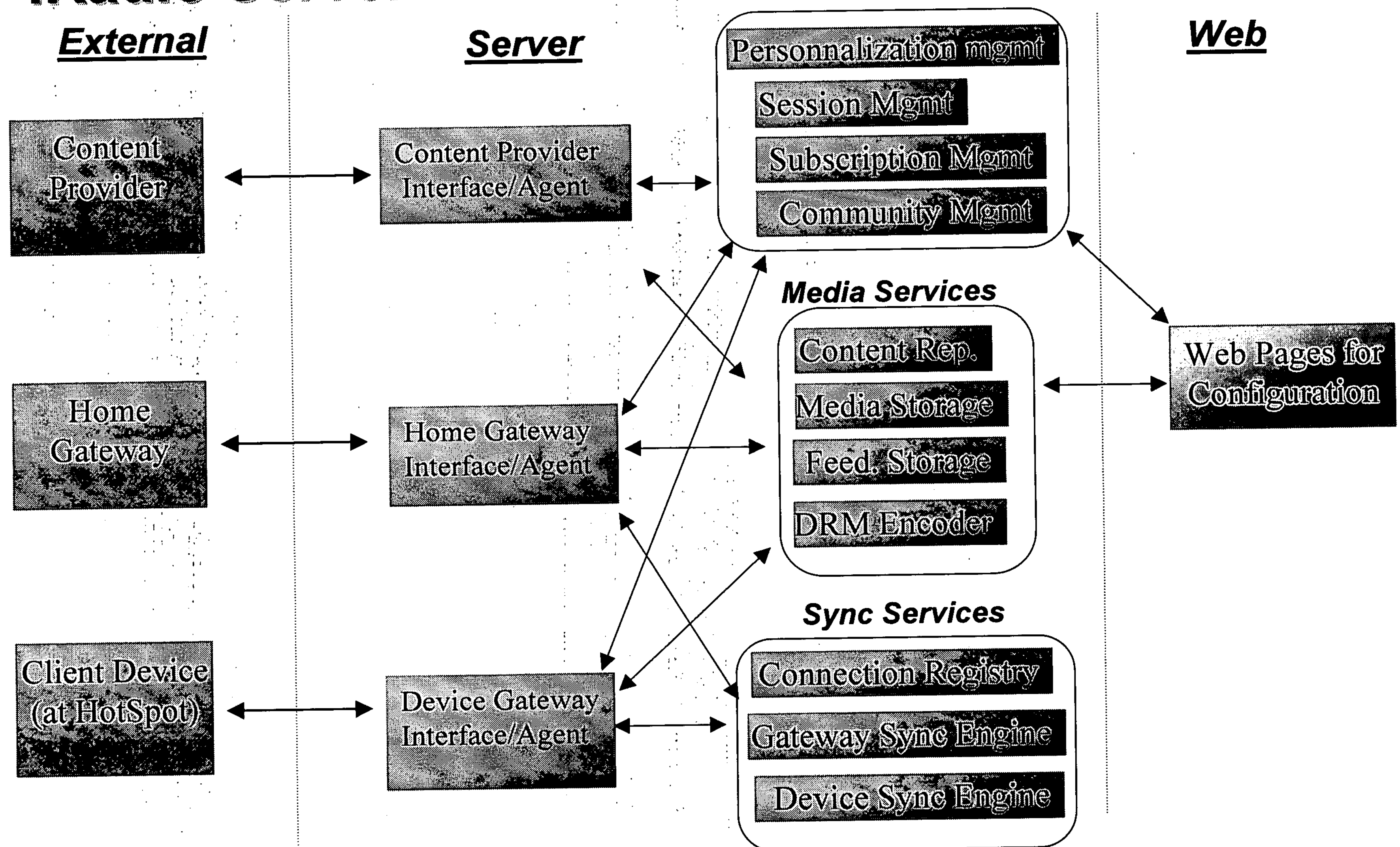
# iRadio Server Details



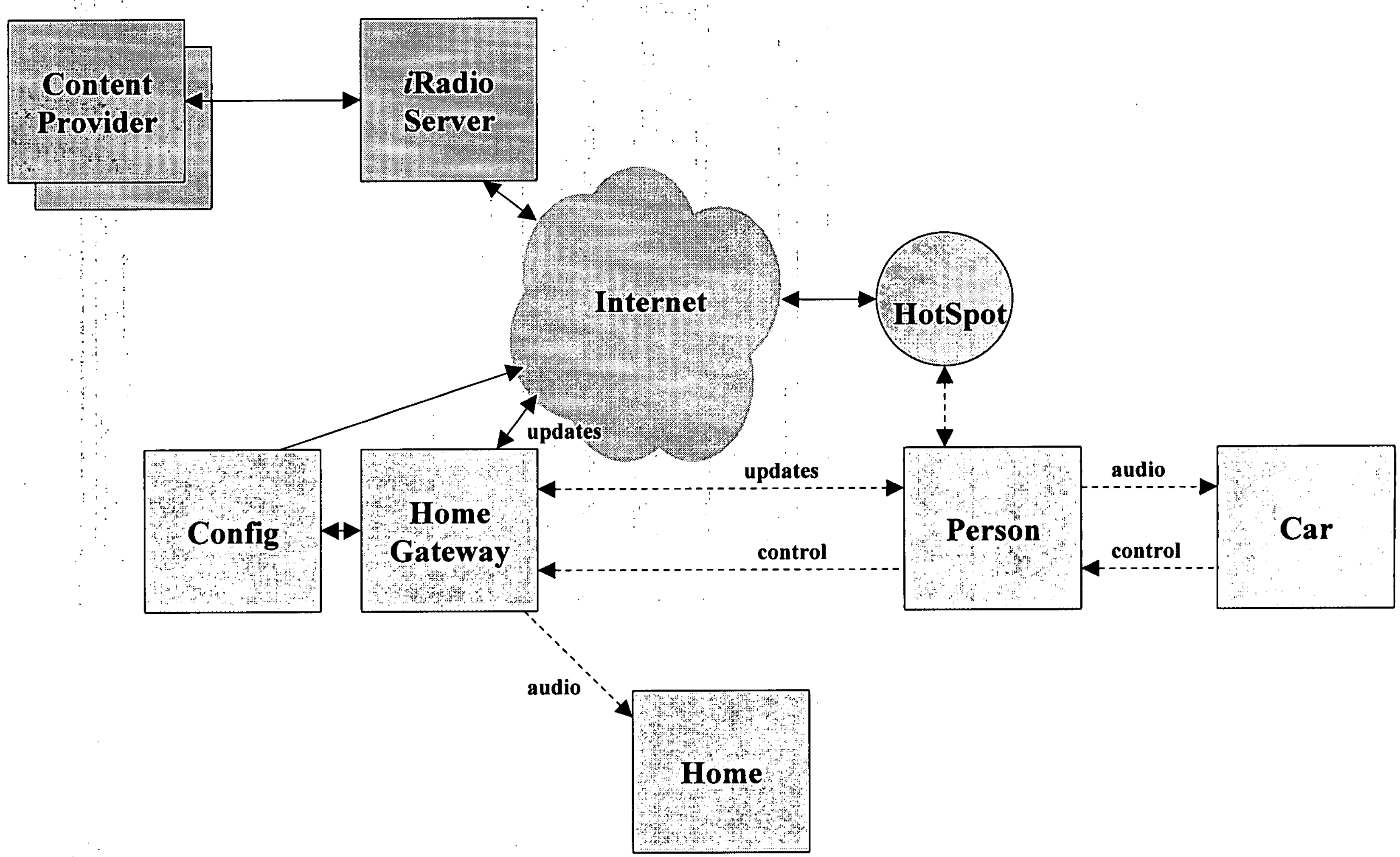
# An Audio entertainment day in the life of consumer

- Script for demo CES or other scenario tightly coupled to XM relevance

# Collaboration Opportunities Assessment

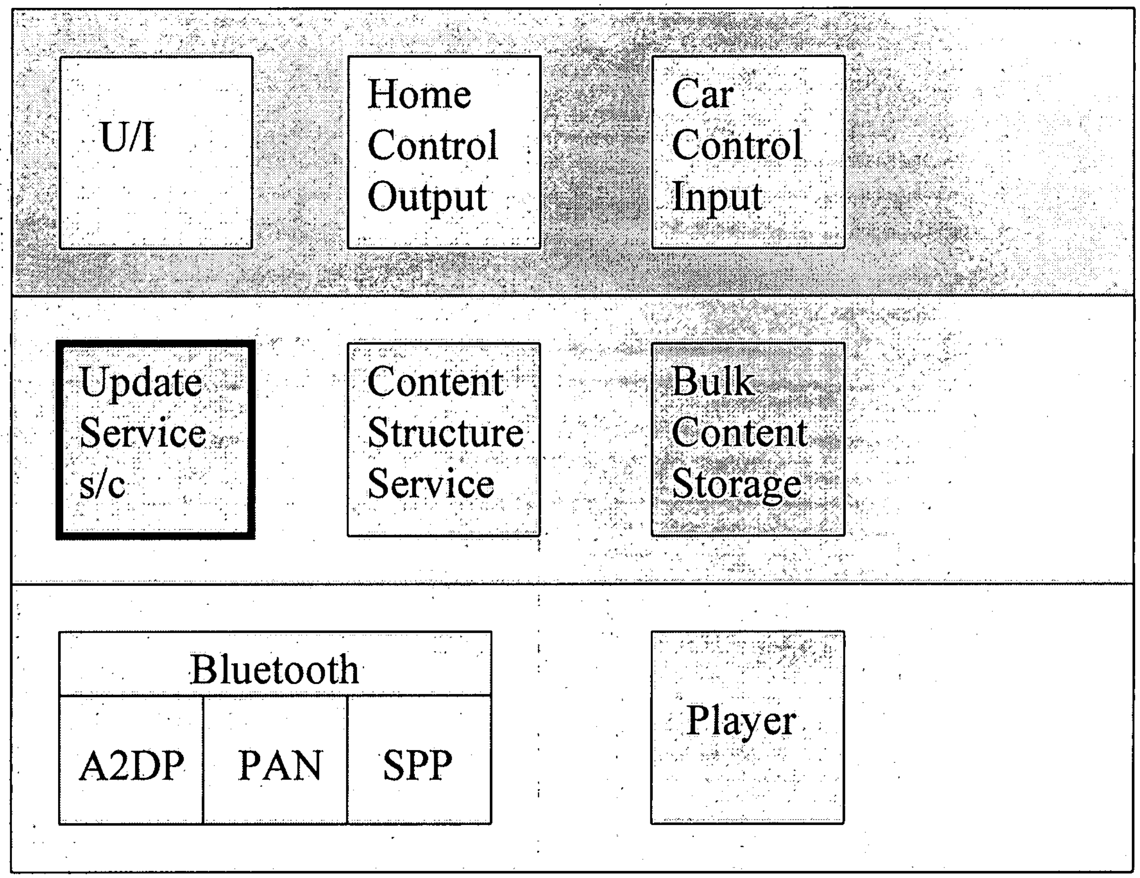
- XM road-map & challenge presentation
- Joint Brainstorming…

# Overview


Content Provider
iRadio Server
Internet
HotSpot
updates
Config
Home Gateway
updates
control
Person
audio
control
Car
audio
Home

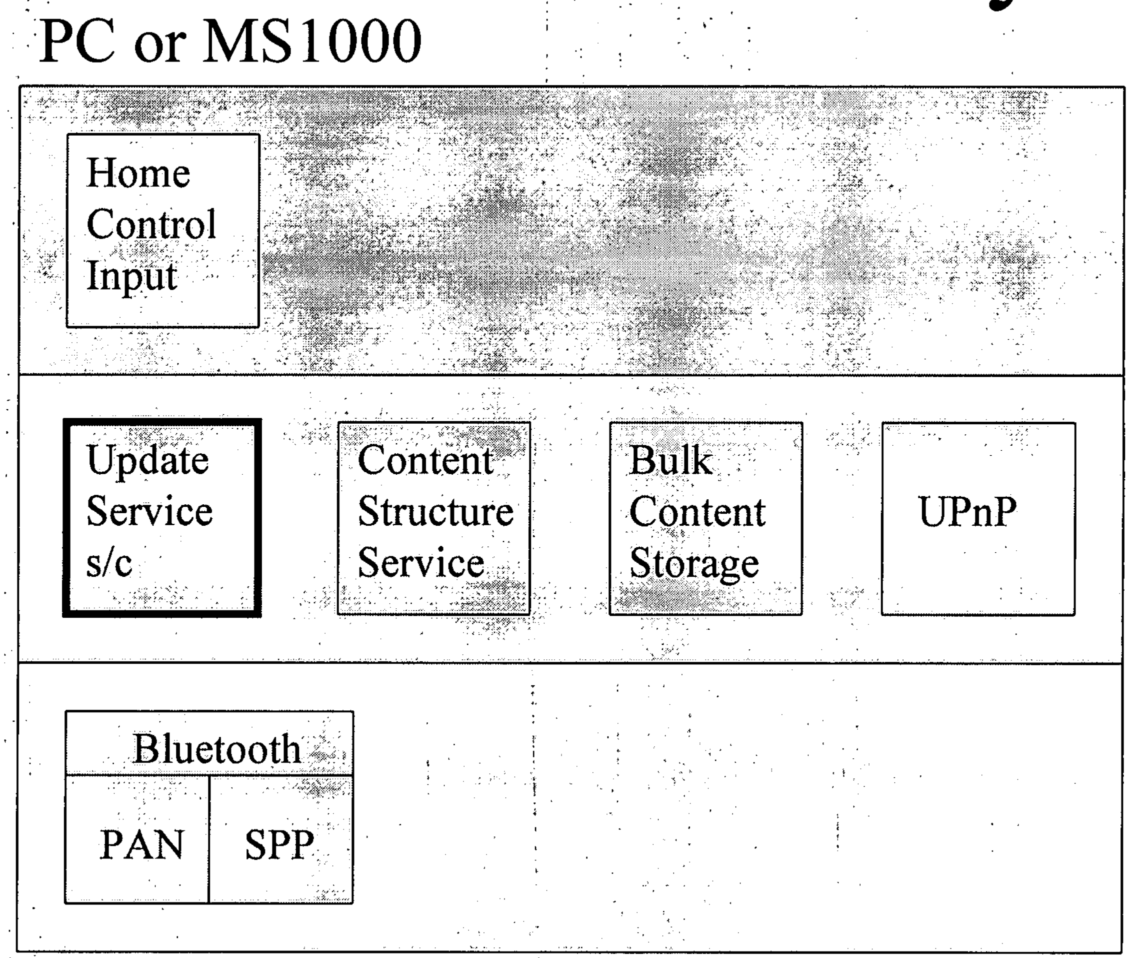
# Person

E680

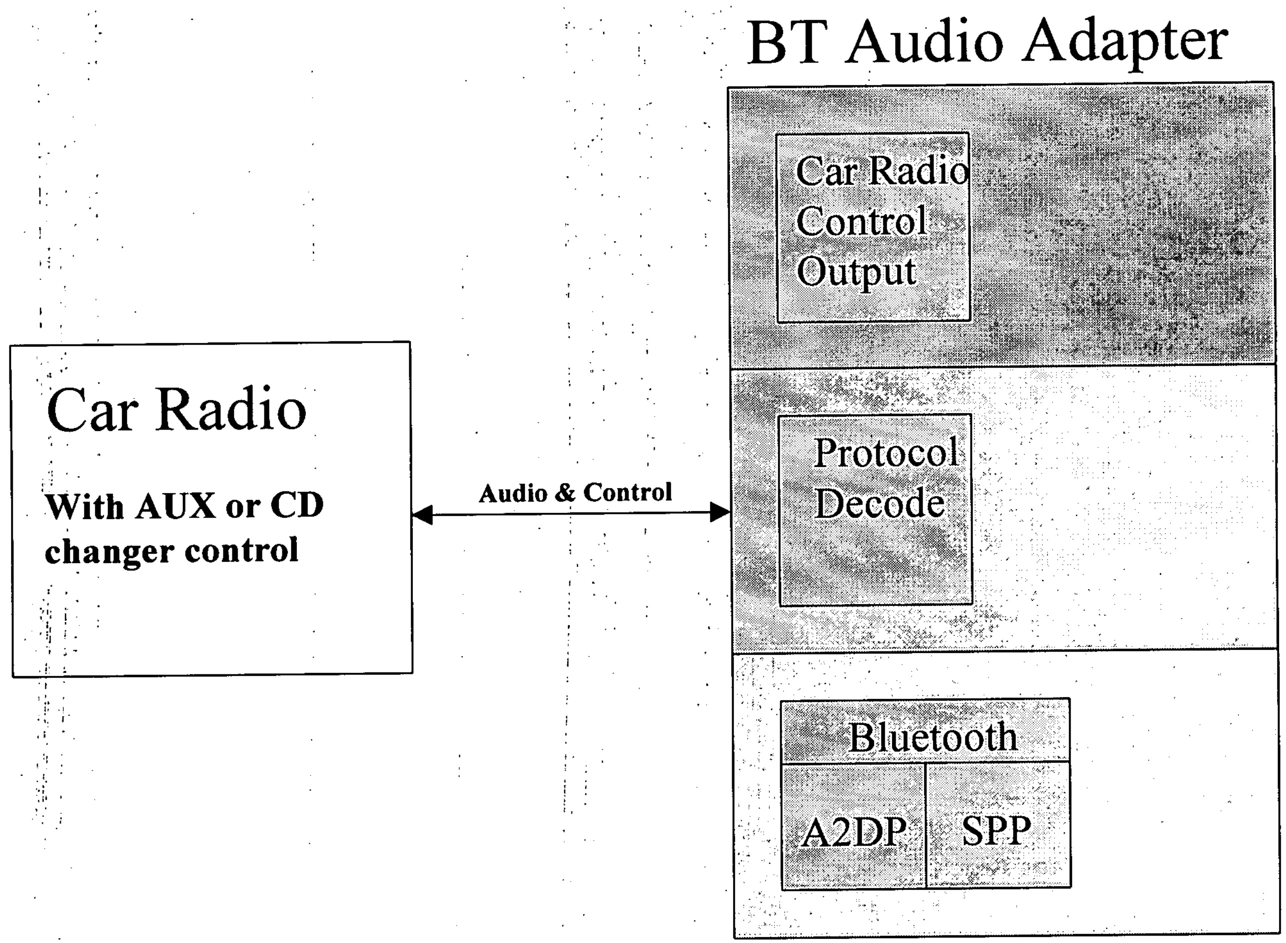


U/I
Home Control Output
Car Control Input
Update Service s/c
Content Structure Service
Bulk Content Storage
Bluetooth
A2DP
PAN
SPP
Player

# Home Gateway

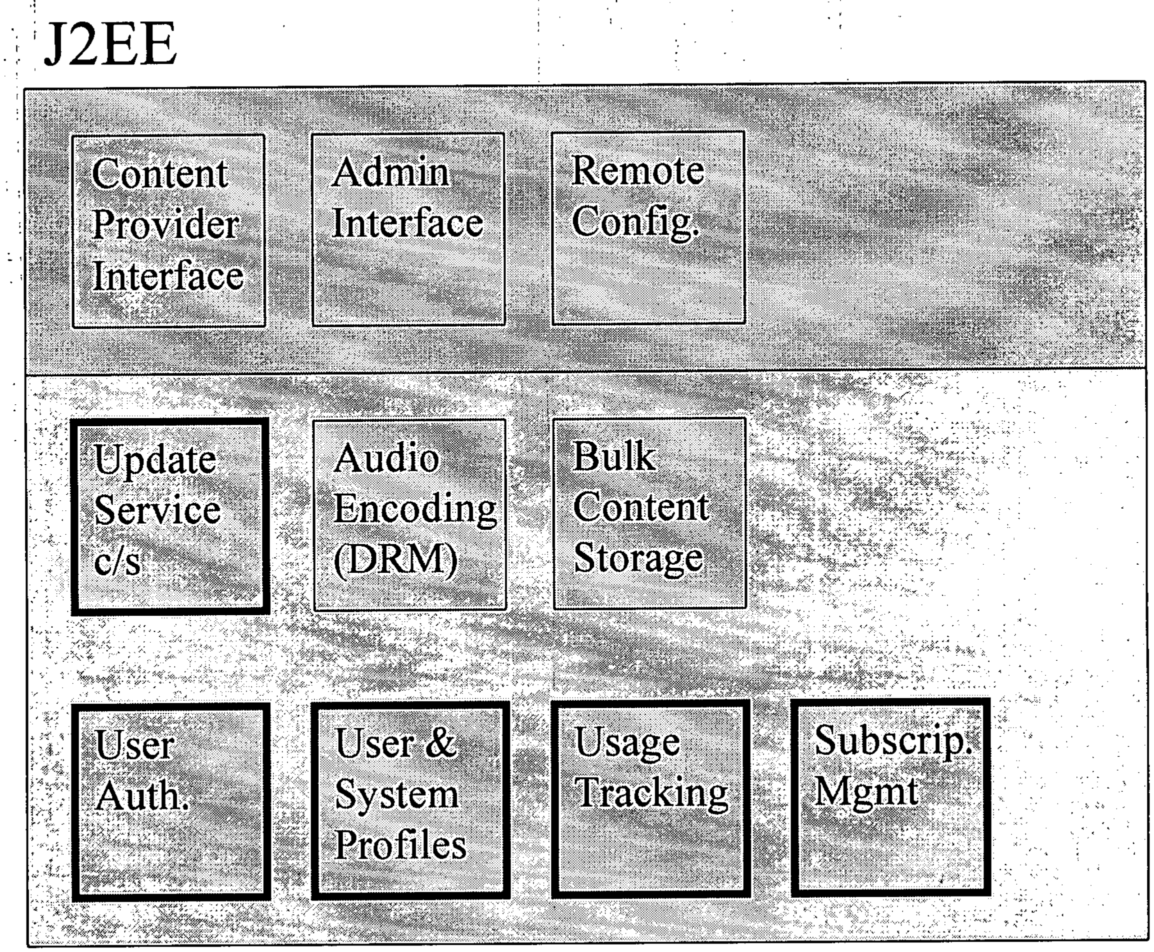


# Car



BT Audio Adapter
Car Radio
With AUX or CD changer control
Audio & Control
Car Radio Control Output
Protocol Decode
Bluetooth
A2DP
SPP

# Server


J2EE
Content Provider Interface
Admin Interface
Remote Config.
Update Service c/s
Audio Encoding (DRM)
Bulk Content Storage
User Auth.
User & System Profiles
Usage Tracking
Subscrip. Mgmt

# Demo Use Case Assumptions

- Bluetooth used for all mobile device communications.
- In-car device is a thin rendering client.

# Use Case Actors

| | |
|---|---|
| User | The end user of the system. |
| Content Provider | This is one of many possible content providers which provide content including playlists and genre channels. |
| System | This includes the iRadio Server and the Home Gateway. Their respective roles are no separated at this level of detail. |
| Home Player & Remote | This includes the render device and remote control. (At this level it doesn't matter whether the remote is the personal device or a dedicated remote. Behind the scenes the Home Gateway provides extra Home capabilities. |
| Personal Device | For the demo this is the E680. |
| Car Device | This is a standard car radio with the iRadio functionality contained in a device attached to the CD changer connector. |

# Demo Use Cases

| # | Name | Description |
|---|---|---|
| 1 | Wakeup alarm | A previously set alarm wakes up the user at home |
| 2 | Change iRadio channels in home from remote | In any domain, change to another iRadio channel |
| 3 | Play content on an isolated personal device | Play content on the personal device, not at home or in the car |
| 4 | Buy currently playing content | The currently playing conten t is purchased with a single button press |
| 5 | Skip currently playing track | Skip to the next track/song on the same iRadio channel |
| 6 | Phone call | Take a phone call while listening to iRadio content using car or personal device |
| 7 | Load daily set into personal device | Load or update newly purchased content onto the personal device |
| 8 | Play content in the car | Play content in the car |
| 9 | Play content at home | Play content at home |

# Use Case 1
# Wakeup alarm

Initial Conditions:

- User is sleeping at home
- Alarm has been set

| # | Actor | Description |
|---|---|---|
| 1 | Home device | Starts playing configured content at proscribed time and volume |
| 2 | User | Cancels the or changes the content using the in-home remote. (See stop or change use cases) |

# Use Case 2
# Change iRadio channels in home from remote

## Initial Conditions:

- Home device is already playing iRadio channel content

| # | Actor | Description |
|---|---|---|
| 1 | User | Selects another iRadio channel via the remotef |
| 2 | Home Device | Notifies the system via the update mechanism that the old content was stopped at a particular point |
| 3 | Home Device | Notifies the system via the update mechanism that new content has been selected |
| 3 | Home device (remote control) | Remote works with other home device components stop the old content and start new content |
| 4 | Home device (renderer) | Starts playing content on the specified channel |

# Use Case 3
# Play content on an isolated personal device

## Initial Conditions:

- The personal device is powered on and the iRadio application has focus.

| # | Actor | Description |
|---|---|---|
| 1 | User | Personal device U/I is used to select an iRadio channel |
| 2 | Personal device | Notifies the system via the update mechanism that content has been selected |
| 3 | Personal device | Starts playing content on the specified channel |

# Use Case 4
# Buy currently playing content

## Initial Conditions:

- An iRadio U/I is available in some domain
- iRadio content is already playing

| # | Actor | Description |
|---|---|---|
| 1 | User | Pushes the buy button on the iRadio U/I |
| 2 | Device | Locally moves the playing content into the owned content list |
| 3 | Device | Notifies the system via the update mechanism of the content id associated with the purchase |
| 4 | Device | Starts playing content on the specified channel |
| 5 | System | When update finally occurs, Content provider is contacted to purchase the content |
| 6 | System | Uses update mechanism to move purchased content into the new content iRadio Channel |

# Use Case 5
# Skip currently playing track

Initial Conditions:

- An iRadio U/I is available in some domain
- iRadio content is already playing

| # | Actor | Description |
|---|---|---|
| 1 | User | Pushes the skip button on the iRadio U/I |
| 3 | Device | Notifies the system via the update mechanism that the current content was skipped at a certain point and that nest content was started |
| 4 | Device | Starts playing the next content on the same channel |

# Use Case 6
# Phone Call

## Initial Conditions:

- An iRadio U/I is available in the car or phone domain
- iRadio content is already playing

| # | Actor | Description |
|---|---|---|
| 1 | Cellular phone system | A call comes in to the user's mobile phone |
| 2 | Car or Phone Device | Stops the currently playing content |
| 3 | Car or Phone Device | Notifies the system via the update mechanism that the current content has been paused at a certain point for a phone call |
| 4 | Car or Phone Device | Handles the phone call in the natural way for that domain |
| 5 | Car or Phone Device | Resumes the previously playing content |
| 6 | Car or Phone Device | Notifies the system via the update mechanism that the content has been resumed |

# Use Case 7
# Load daily set into personal device

Initial Conditions:

- Personal device is on and iRadio software is active (although not necessarily playing)

| # | Actor | Description |
|---|---|---|
| 1 | Personal Device | Update mechanism contacts system on a regular basis |
| 2 | System | Sends daily set to personal device |

# Use Case 8
# Play content in the Car

Initial Conditions:

- The car device (and personal device if needed) is powered on and capable of playing

| # | Actor | Description |
| --- | --- | --- |
| 1 | User | Car device U/I is used to select an iRadio channel |
| 2 | Car device | Notifies the system via the update mechanism that content has been selected |
| 3 | Car device | Starts playing content on the specified channel on the car speakers |

# Use Case 9
# Play content at home

Initial Conditions:

- The home devices are powered on and the iRadio application has focus.

| # | Actor | Description |
|---|---|---|
| 1 | User | Home device U/I (remote control) is used to select an iRadio channel |
| 2 | Home device | Notifies the system via the update mechanism that content has been selected |
| 3 | Home device (renderer) | Starts playing content on the specified channel |

# The Saguaro Session

## July 14th brainstorming on iRadio top-level use cases and product functionality

Jean-Marc Villevieille, Mark Clayton & Dave Ulmer

# What we hoped to accomplish

- To identify the top compelling categories of product requirements
- To start thinking about the minimum performance criteria necessary in these categories
- To agree on some common terminology

# The Purple Points

These are the top categories of capabilities that we feel we must deliver, at least at some minimally acceptable level, that may or may not require direct iRadio development, but must be addressed.

- **Ad-free**
- **Hot traffic and weather**
- **Content customization**
- **Access to the content I want**
- **Pause/Rewind/Skip**
- **Community features**

Disclaimer: This is our first communal pass at this, and is open for discussion, requires validation, and is subject to, and will, change.

# Ad-free

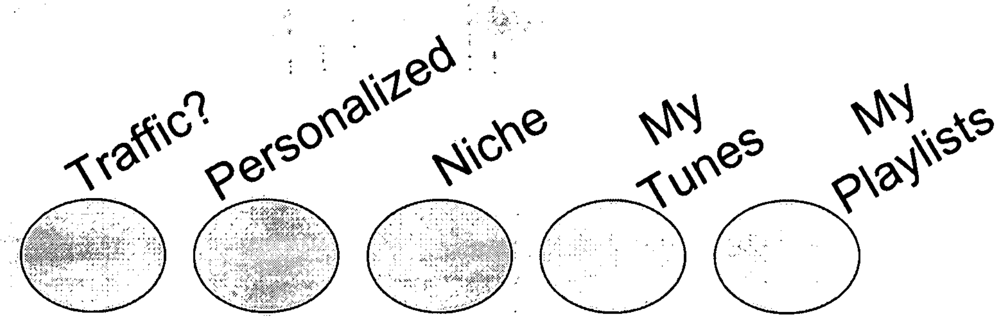
- Whatever we do and however we do it, we want to take as much credit as possible for Ad-free content
- Are there things we can do that solve this problem even better for consumers?
- Can we add "skip" to commercial broadcasts?

# Hot traffic & weather

- Clearly this is a major consumer requirement for car audio services
- Our low end solution can be merely the AM dial
- The mid-level approach would be to use the same warm content XM has
- Hot content is available, costs money & development time. Is it required?

# Content customization

- "Niche" channels
  - *Genre-specific channels programmed by the service provider, i.e. Progressive brazilian jazz*
- "Personalized" channels
  - *Self-customized content channels, i.e. Mike's favorite jazz artists or My Driving Tunes playlist*
- Our edge = 'owning the buttons"
  - *Enabling presets to select various content category options*



# Access to the content I want

- **Within & across domains**
  - *New terminology suggested = "Pause here – Play there" since "pause-resume" means something else*
- **How much of my collection do I need on the go?**
  - *Intelligent selection feels acceptable (most played, most recent)*
- **Discover new music**
  - *Mood engines / "Amazon" referrals*
- **Find/Search**
  - *Find new music (Query by Humming?)*
  - *Can easily search via PC, but what about car/phone?*
  - *Find music I own and music I want to own/lease*
- **Push to Buy**
  - *How does this function vis-à-vis Push to lease*
  - *How soon can we give mobile access to purchased content? How soon does consumer expect/require?*

# Pause/Rewind/Skip

- **Easy use case for buffered content**
- **Let's consider how to implement and whether to implement for AM/FM**
  - ***Could be high-value consumer requirement, especially with regard to the concept of Ad-free (TiVO analogy)***

# Community

- **Suggested community features are:**
  - *Share playlists with friends, send links, exchange clips, chat with peers*
- **Internal leaning has been to dismiss this as Version 2 and beyond**
- **But what is consumer priority here?**
  - *If important, what is minimal acceptance level?*
- **"peers", "share", "community" and "buddy list" discussions will raise alarm with content owners**

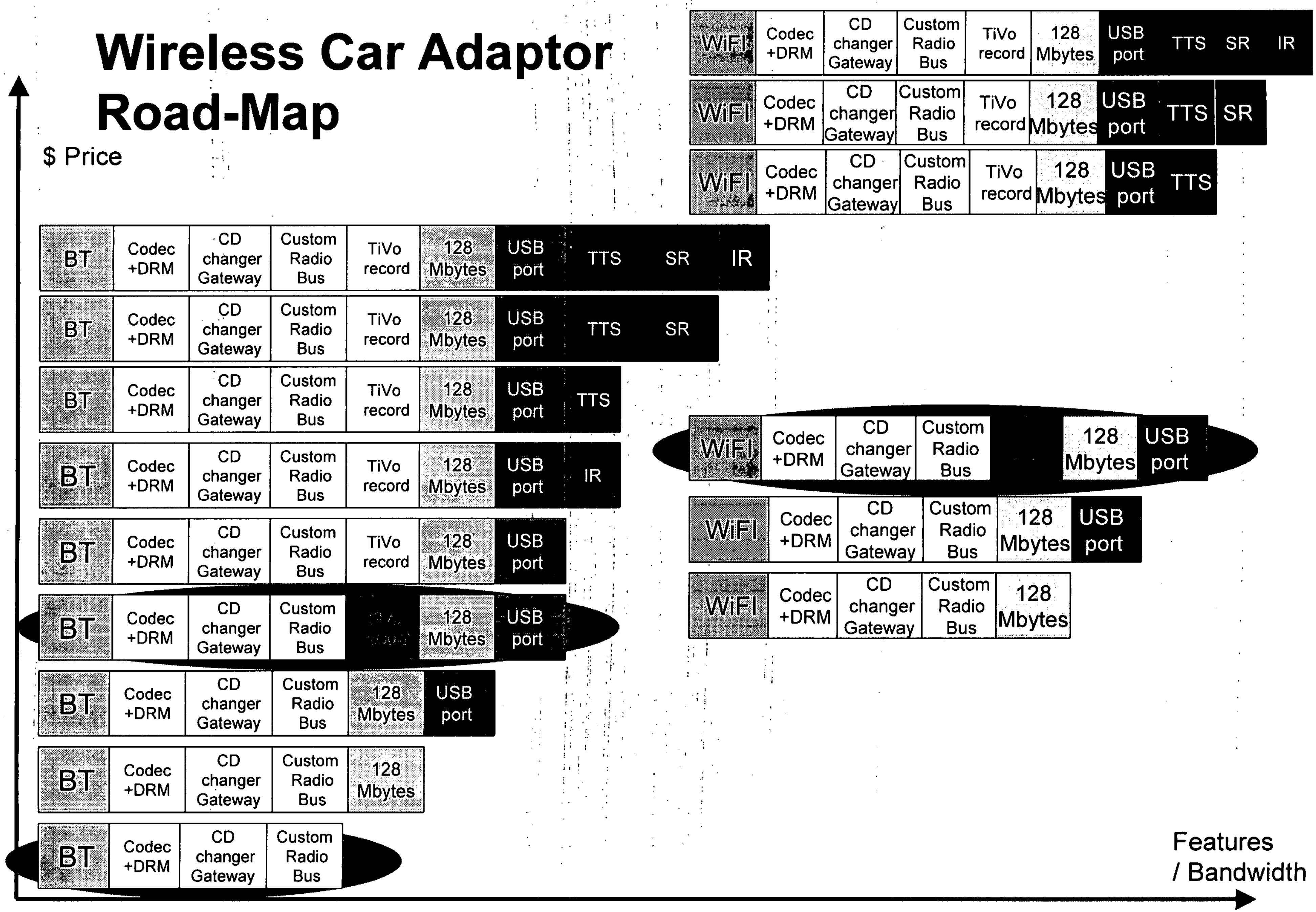
# Next steps

- Need to validate if these are the right Purple points
- Need to start defining the range of solutions in each – from minimal (V1.0) to full (3.0 roadmap)
- Must calibrate against the problems consumers express they need to solve and the "jobs" that consumers are trying to get done

# Road-Map Wireless Clients

JMV 8/9/04

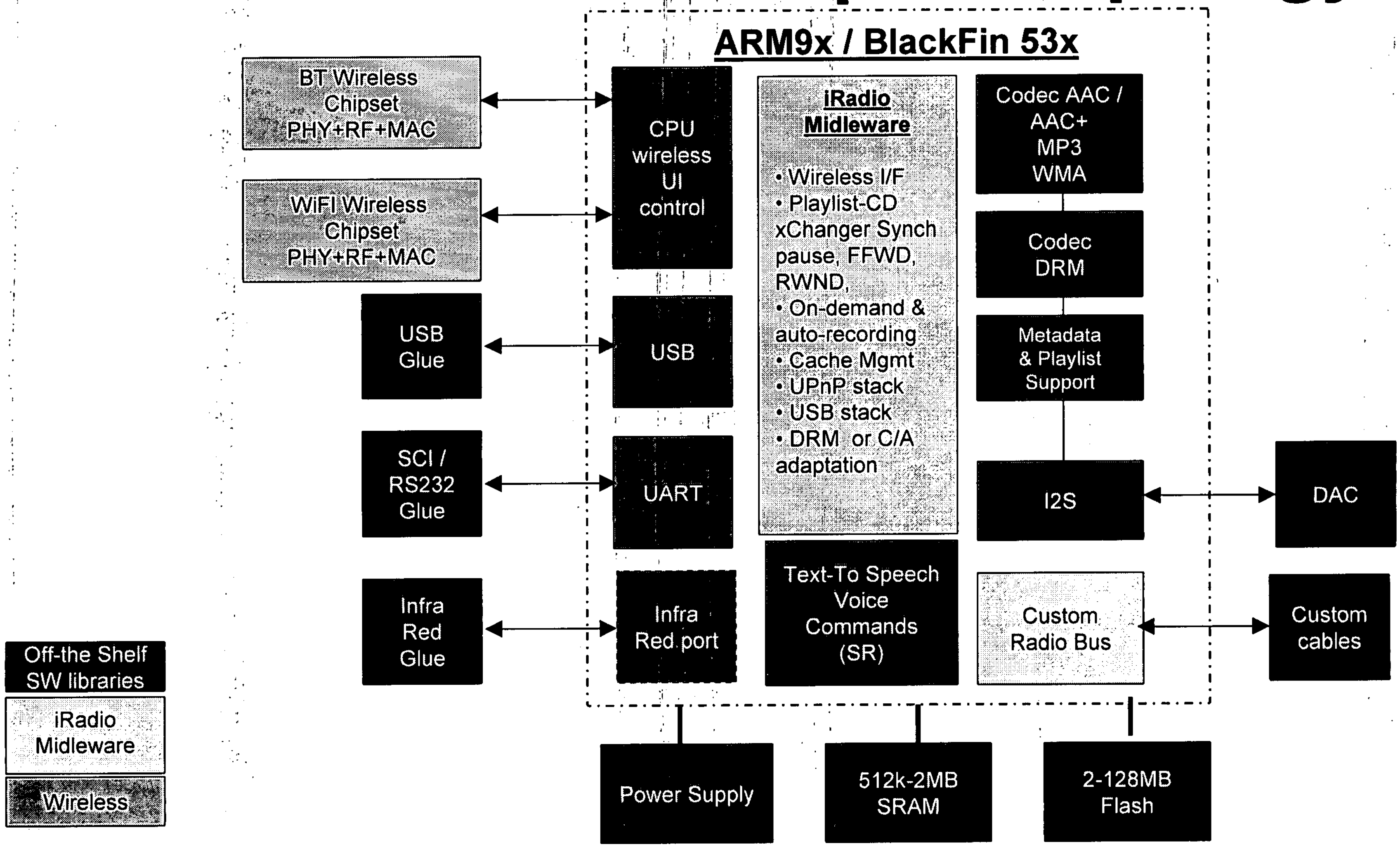
# Wireless Car Adaptor Road-Map



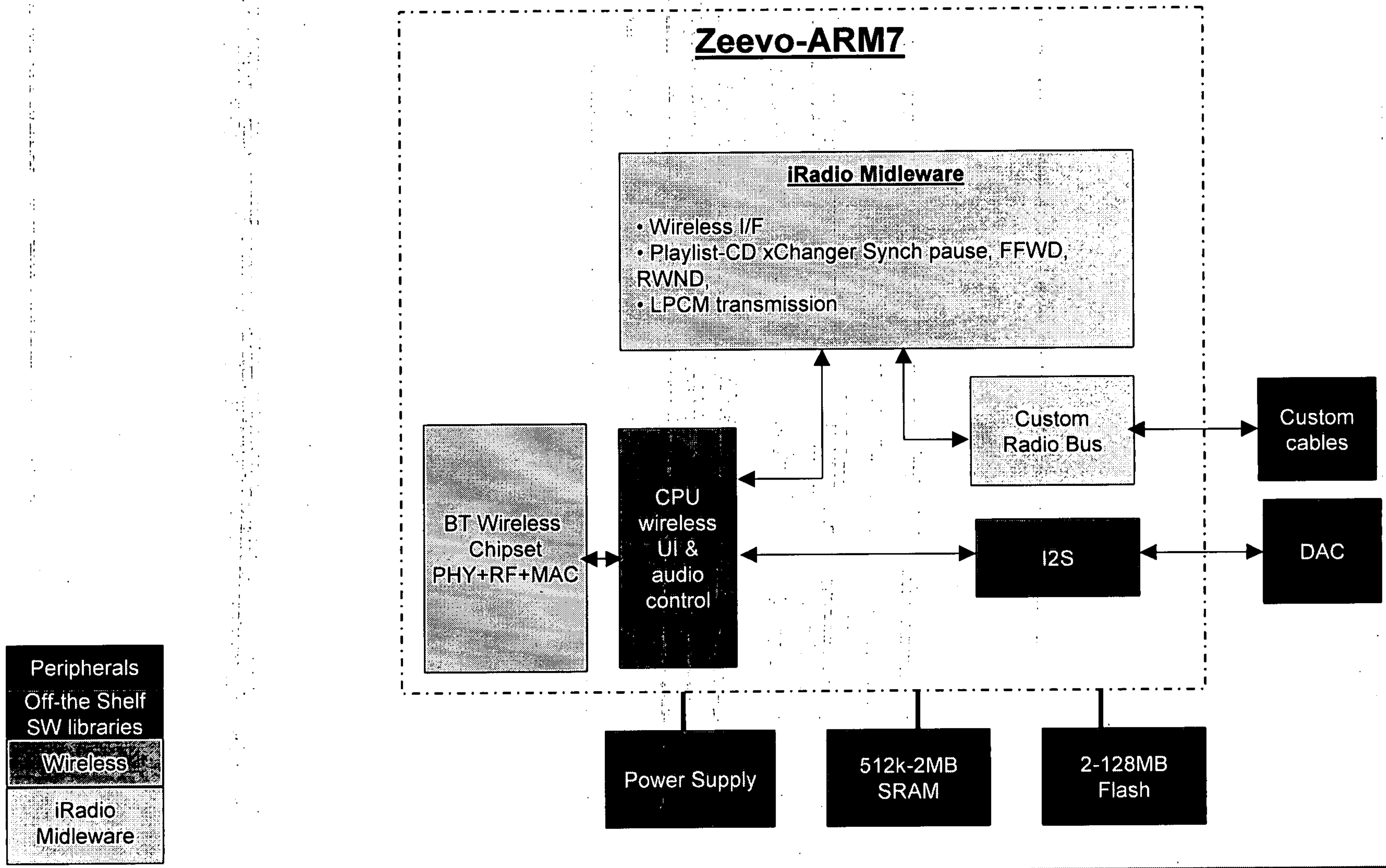
# Development Candidates

- Simple Devices:
  - Is going “alone” embracing our BT link but with their content management client in Java to be ported on the phone. Rely on an external “Soundgate”-like Cd changer adapter ($()!!!) and does not know about our pre-set keys mapping
  - Quote the same to the Telematics team!!! (Sean McBride)
- SSI America: have reverse-engineered multiple proprietary bus. We may be able to re-use some open source on their NEO programs (HDD)- Fast track people-engineering in Germany
- Zeevo & SMART: low cost Blue tooth ARM7 single chip solution for wireless CD-like stereo. SMART is doing embedded designs modules with memory caching expertise
- Soundgate: specialized in peripherals OEMs bus adaptors- can modify the XM or Sirius retrofit
- Blitzsafe: same as Soundgate- specialized for XM and CDs retrofit
- Rockford-Fosgate / Omnifi: may be able to strike a different deal from SD for developping direct hardware (next door neighbours)?
- Motorola Tomhawk4 platform: needs a low cost application – GSG team + some ACES automotive resources?

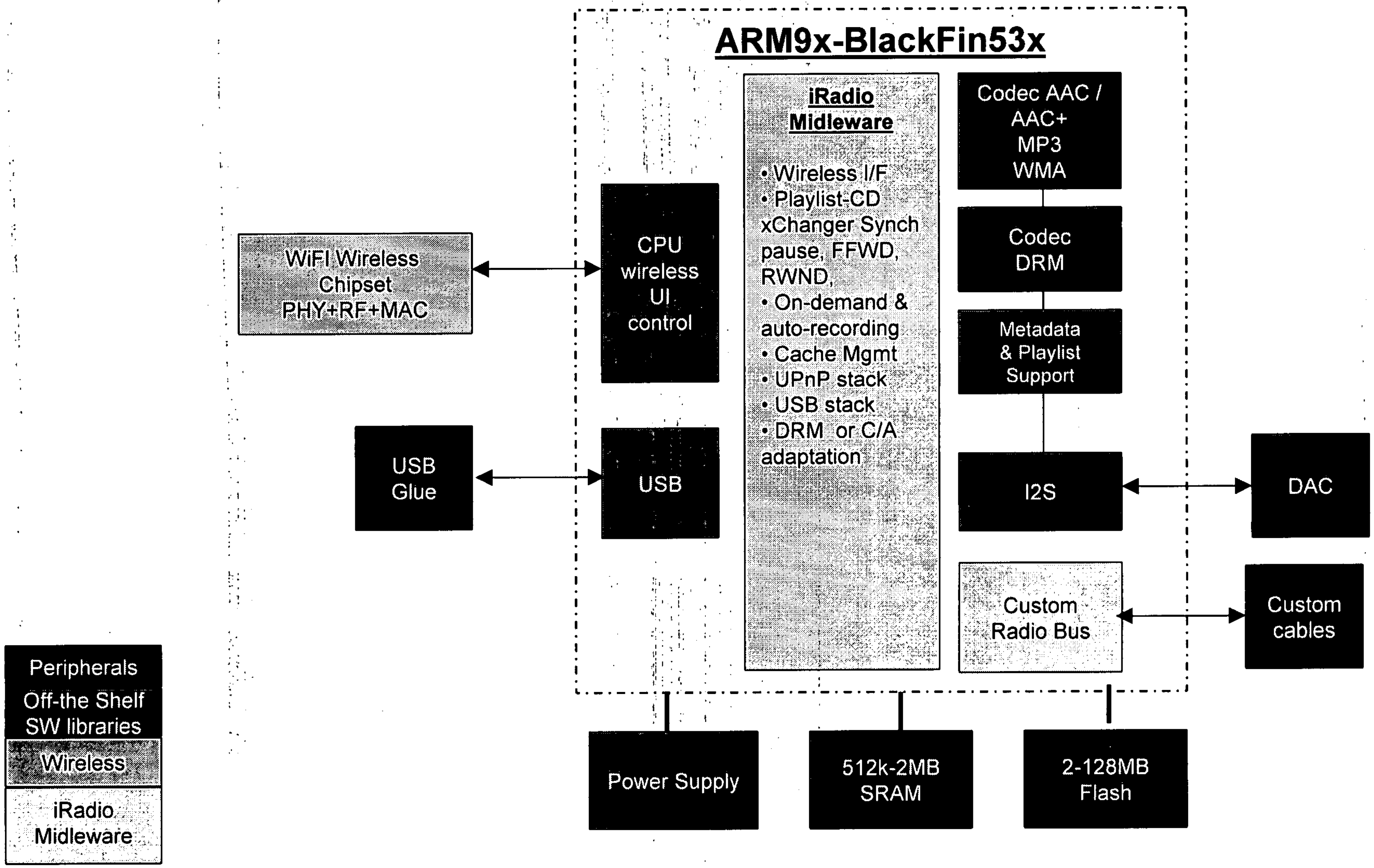
# Wireless Car Adaptor Topology



# Wireless Car Adaptor Topology- Low-end



# Wireless Car Adaptor Topology- Mid-Tier

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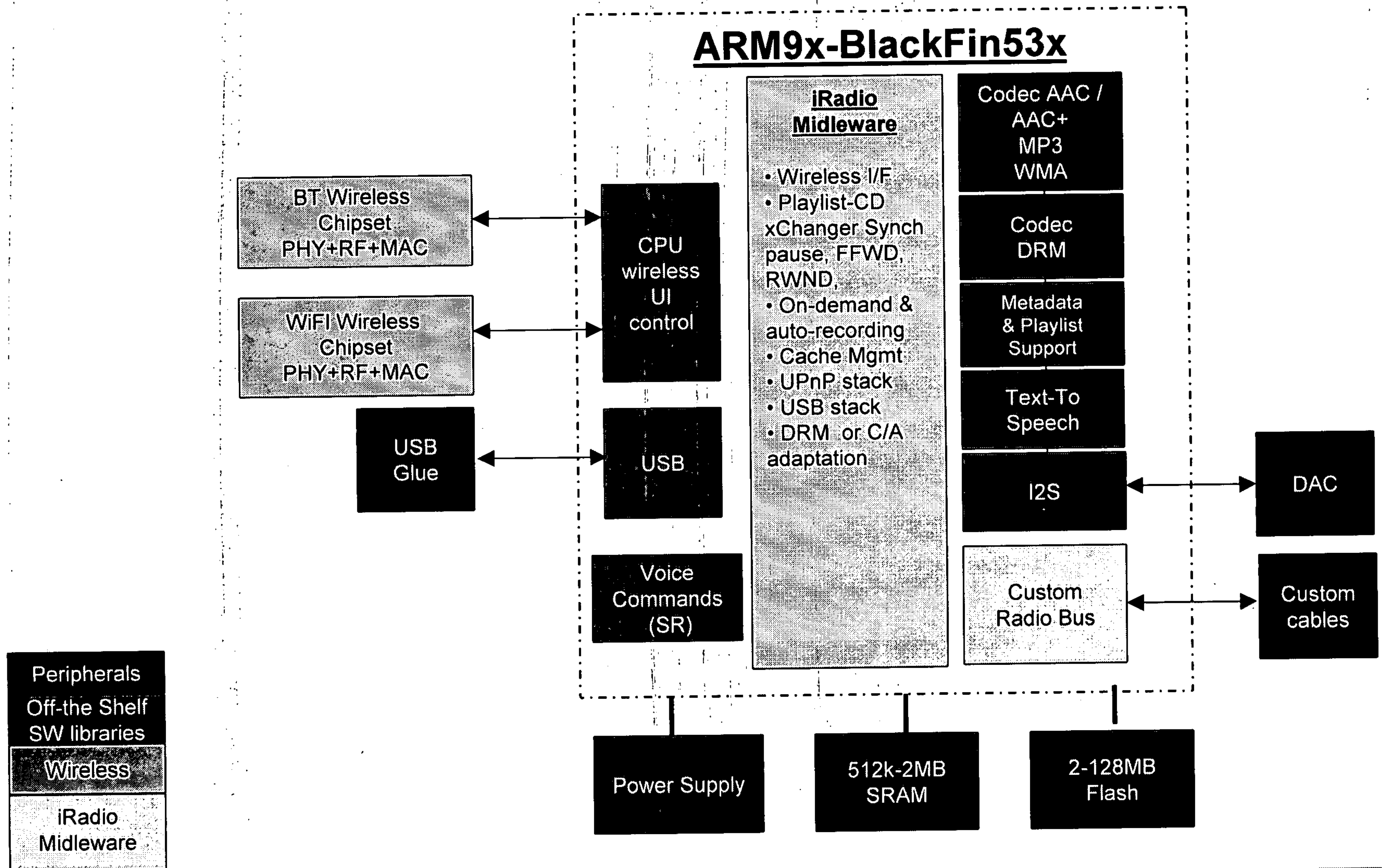
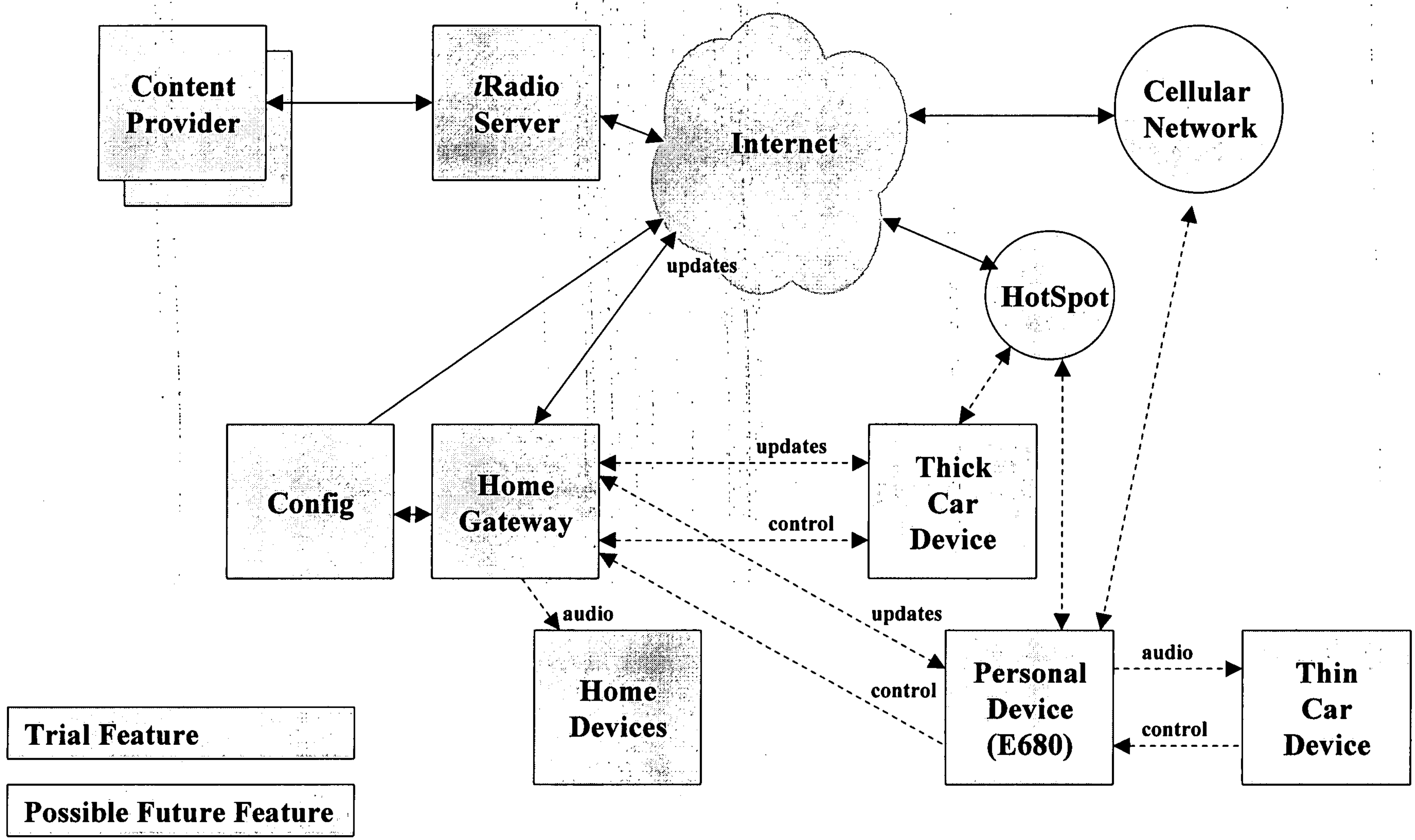
# Wireless Car Adaptor Topology- High-end

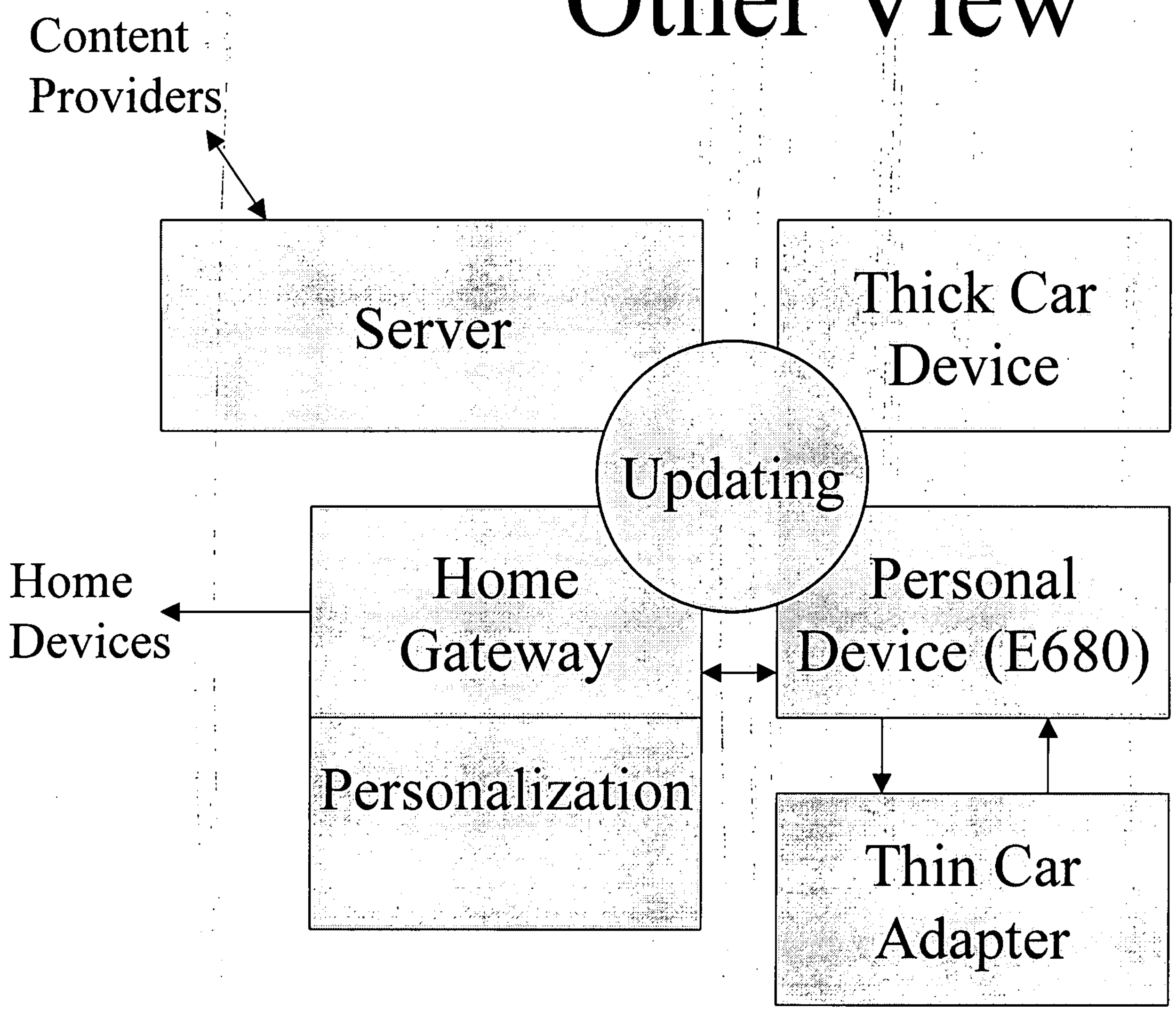


# Overview



Content Provider
iRadio Server
Internet
Cellular Network
updates
HotSpot
Config
Home Gateway
updates
control
Thick Car Device
audio
Home Devices
updates
control
Personal Device (E680)
audio
control
Thin Car Device
Trial Feature
Possible Future Feature

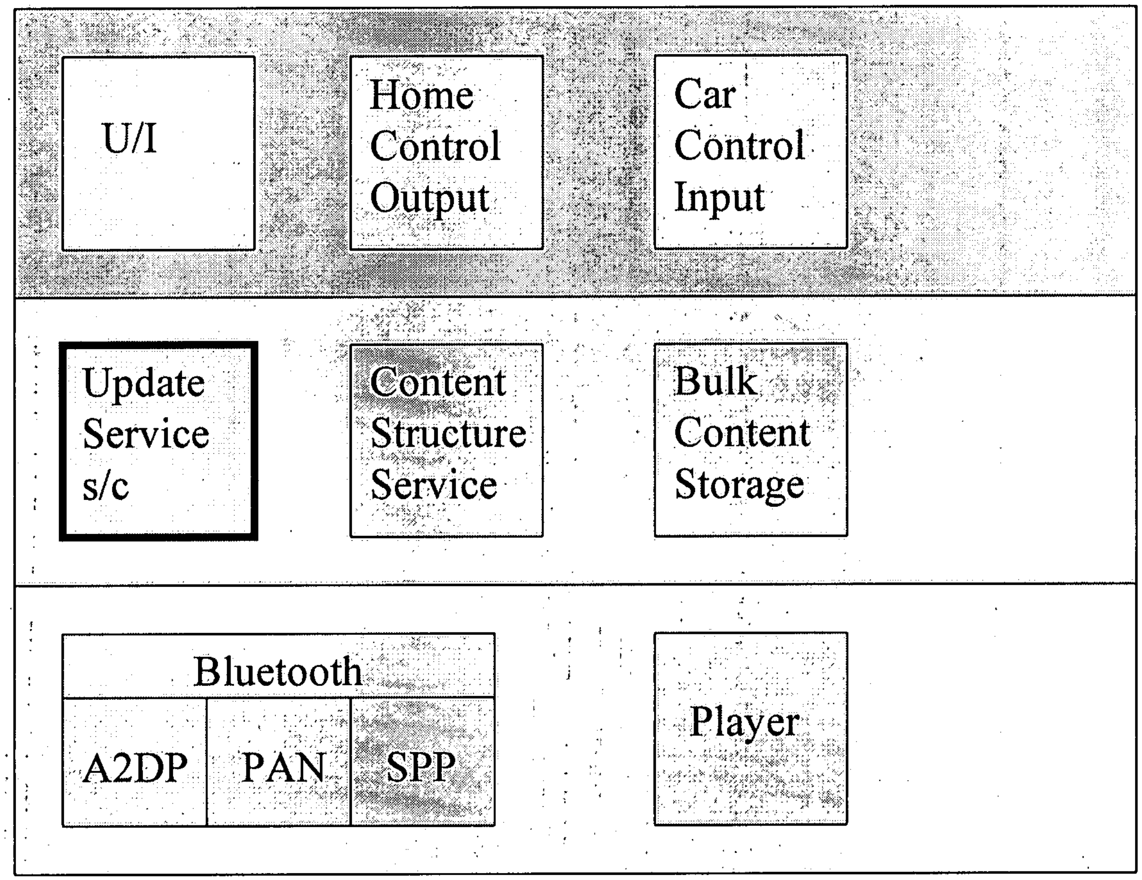
# Other View



Content Providers
Server
Thick Car Device
Updating
Home Devices
Home Gateway
Personalization
Personal Device (E680)
Thin Car Adapter

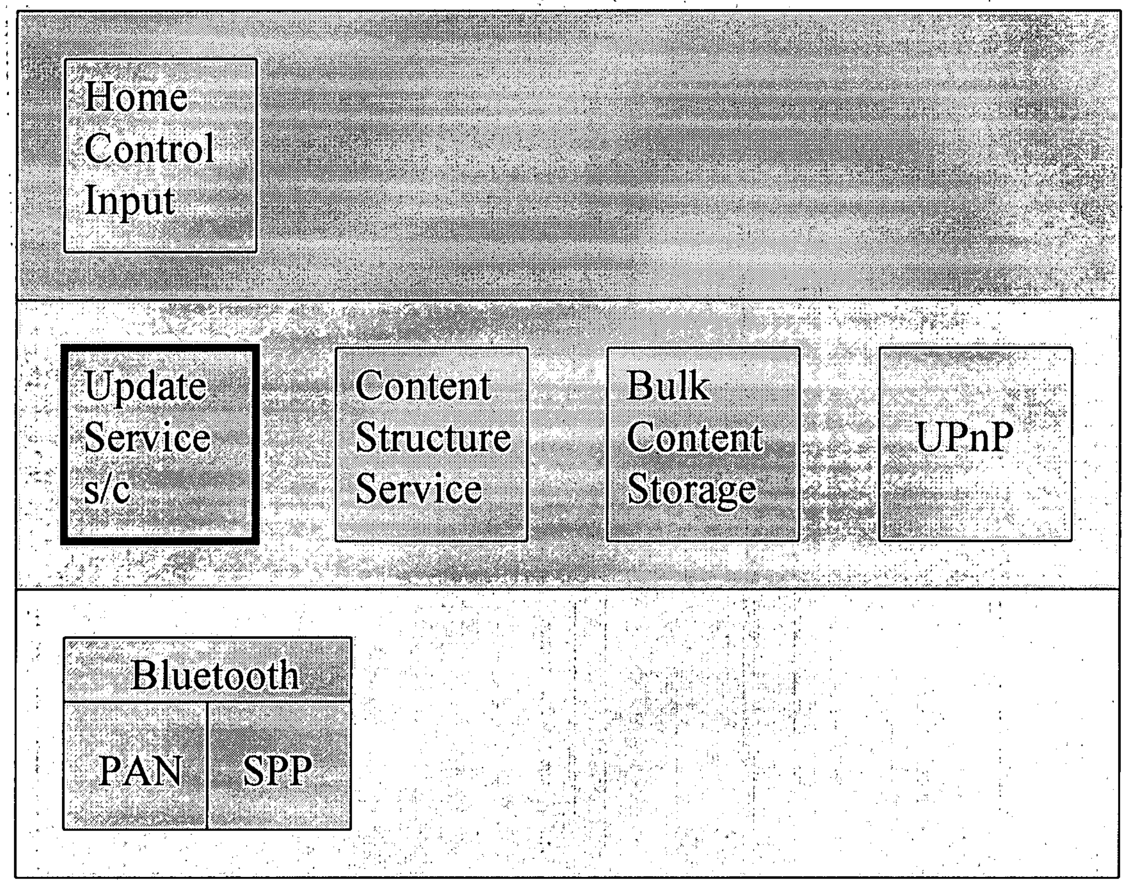
# Person

E680

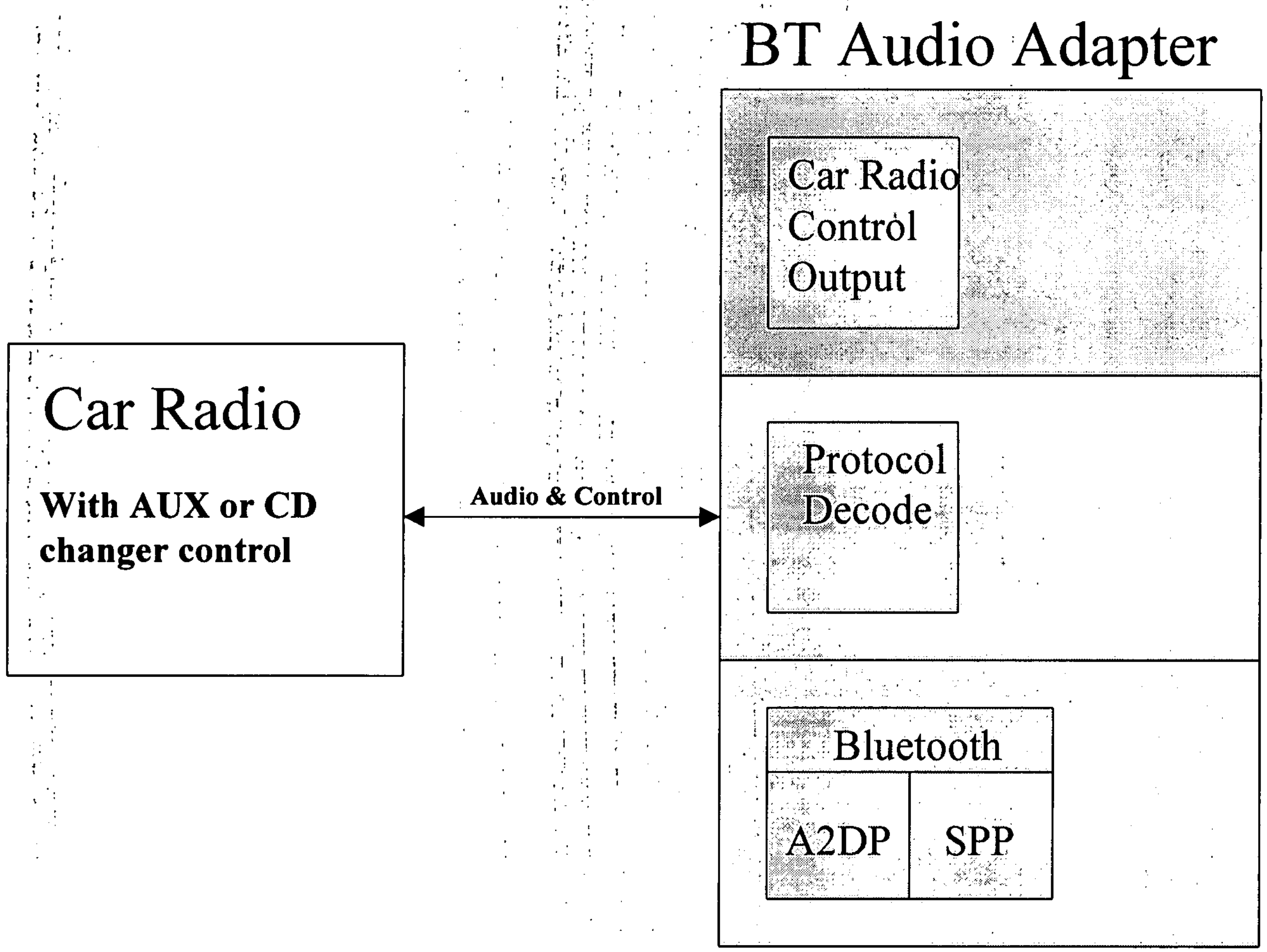

U/I
Home Control Output
Car Control Input
Update Service s/c
Content Structure Service
Bulk Content Storage
Bluetooth
A2DP
PAN
SPP
Player

# Home Gateway

## PC or MS1000



# Car



BT Audio Adapter
Car Radio
Control
Output
Protocol
Decode
Bluetooth
A2DP
SPP
Audio & Control
Car Radio
With AUX or CD
changer control

# Issues

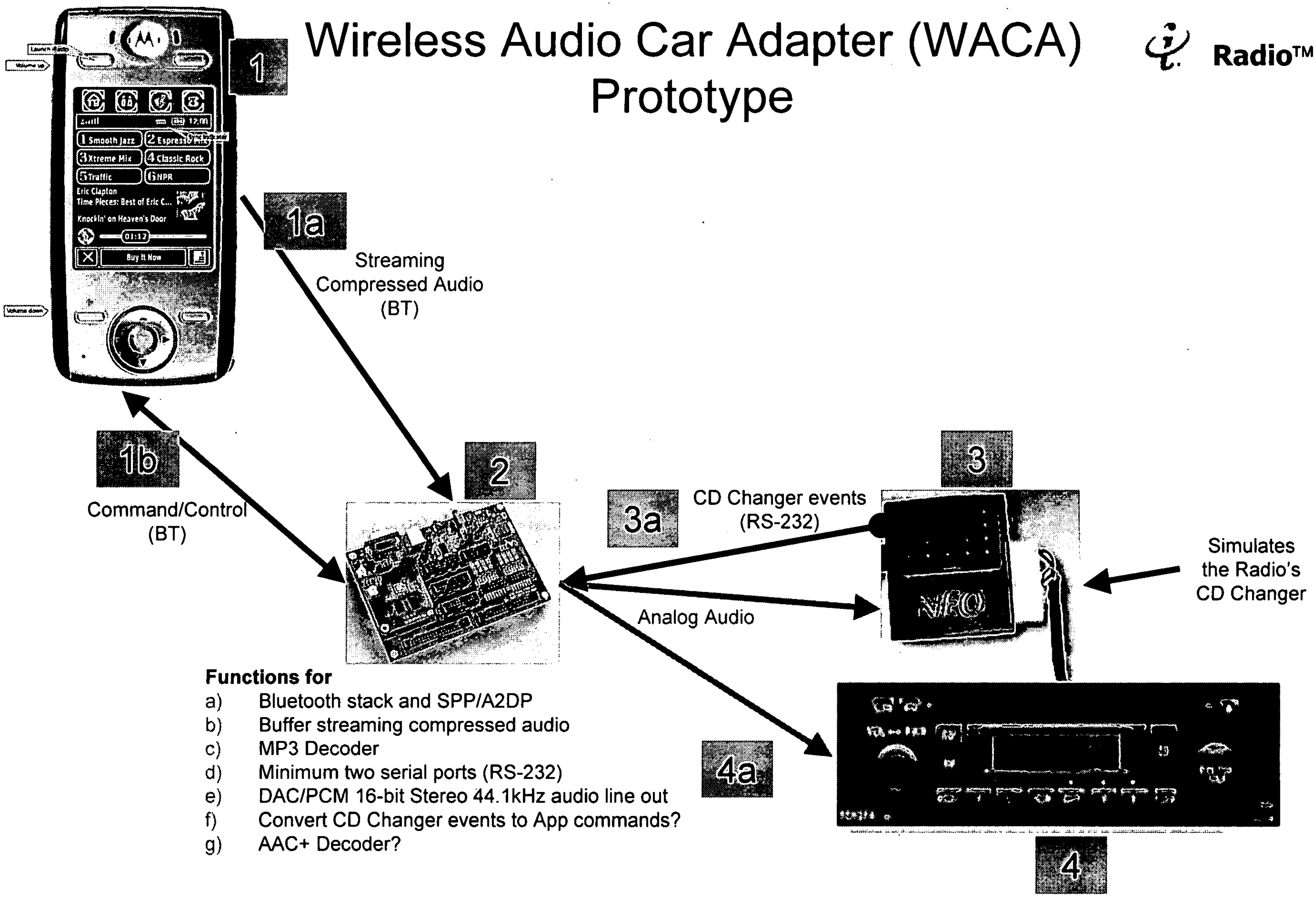
- Licensing approaches – hopefully content is encrypted once with relatively small individual license files for each device to access the content.
- Personalization approaches – what is the user experience. Meeting scheduled for Friday to discuss.
- How do we browse owned content via the phone (local phone content and home content). Best case is we don't.

# Issues (cont.)

- How much does server bandwidth cost? iRadio will transfer LOTS of data.
- How will we work with our Content Provider(s)?

# Wireless Audio Car Adapter (WACA) Prototype

iRadio™




**Functions for**

a) Bluetooth stack and SPP/A2DP
b) Buffer streaming compressed audio
c) MP3 Decoder
d) Minimum two serial ports (RS-232)
e) DAC/PCM 16-bit Stereo 44.1kHz audio line out
f) Convert CD Changer events to App commands?
g) AAC+ Decoder?

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# Wireless Audio Car Adaptor Introduction

## Draft Revision X0

Motorola, Inc.
Jean-Marc Villevieille
October 25th, 2004

| Revision Number | Date of revision | Author | Comments |
|---|---|---|---|
| X0 | 10/25/04 | JM Villevieille | Initial draft |
| X1 | 10/26/04 | Jeff Stinson | Mark up for distribution |
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# 1 Background & Scope

## 1.1 Background Overview

As part of its "Seamless Mobility "strategy, Motorola desires to develop a user friendly aural experience, allowing seamless transition between the cellular domain and in-vehicle car radio, without resorting to a full Telematics architecture for its "Entertainment Series" phones (new generation cellular phones with media player and associated media storage capabilities along with some short range wireless "personal area network" (PAN) capabilities such as BlueTooth or WiFi). This feature is part of the more global "iRadio" solution, which will provide a new "end-to-end" audio entertainment listening experience to the user starting summer of 2005.

The goal is to develop a "smart" and inexpensive mass-production wireless audio adaptor which will decode audio streaming content coming from the phone and interface with a majority of already installed or available OEM and aftermarket car radio head-units which have either an auxiliary port or a CD changer port or some kind of satellite digital radio compatibility.

The basic concept is a "Master" phone driving a "Slave" head-unit through this wireless adaptor and can be define into multiple device variations in a road map that is identified in this document.

## 1.2 Phases

### 1.2.1 Demo

The CES 2005 demo will take place Jan 6–9. The current demo will use at least 2 or 3 entertainment phones with different operating systems (Linux, Pocket PC, Symbian) communicating with 2 to three different radio head-units deck, preferably one after-market and one OEM with various degrees of display capabilities. Wireless adaptor could be in two pieces, one for the cellular phone interface and one for the head-unit interface, communicating through a two-wire serial port.

### 1.2.2 Trial

A trial with two hundred users will occur during the second quarter of 2005. The Trial will demonstrate seamless operation between the home, on-the-go and car domains. Ideally the Trial system will be a natural evolution of the Demo system. This evolution would include the implementation of missing features from the CES demo as well as testing and function enhancements. In addition to securing valuable user feedback, the trial also has an important