HD Radio™ System
Persona Radio Project
Overview

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1.   Document Overview

This document provides the initial description of the Persona Radio project (i.e., smart radio concept) within the HD Radio™ system. The project spans the system concept, the broadcasting system, the receiver system processing, and the rendering of various data/audio elements. Best practices are also described so that the implementation of the project can achieve a satisfactory user experience.

Specifically, this document addresses the considerations leading to system design. Within this document, concept details are tracked and reflected through multiple use cases. Based on the operational scenarios, the document follows through with the complementary definitions for the broadcasting side and for the receiver side.

For the purpose of initial evaluation, the document provides definitions for receiver prototypes. The definitions allow for the assessment of the concept through a realistic 'touch and feel' description.

2.   Introduction

In the HD Radio system, the Persona Radio project allows the user to invoke radio signal reception based on user-defined personal preferences.

The project substitutes one content with another, as defined by the user, and consequently applies a personal touch to the HD Radio receiver. The user is at the center; the touch is driven by the user's personality.

A persona, in the word's everyday usage, is a social role or a character played by an actor.

2.1.   What may be Personalized

In general, every aspect of the service and its timing may be personalized. These aspects include:

- Audio content – entertainment
- Text related to the audio content
- Text independent of audio – messages and entertainment
- Advertisement – audio, text, and product tokens (including coupons)
- Time and association of the service – actual live play/display or content substitute (from memory)

The personalization level granted to a user depends on the capabilities of the specific device employed by the user. In particular, it may be affected by the storage, display type, and connectivity supported by the device.

2.2.   How may Personalization be Defined

Personalization is based on the combination of the user's preferences and the broadcaster's support.

The user's preferences are derived from:

- User's profile stored in the receiver
  o Relevant items may include age group, gender, etc.
- User's current state
  o Relevant items may include location, stated activity, etc.

The broadcaster's support may include:

- Enabling content with alternative audible formats
- Providing relevant advertisements, coupons, etc.
- Providing information regarding relevant events
- Supporting a portal that introduces the project and lays out station-specific details
  o Portal may support specific attachment/entitlements

Related to personalization is the receiver type (i.e., portable, automotive, table top).

2.3. Listener Retention

While realizing that the listener is in the center of the personalization, the station is expectedly looking for ways to retain the listener. Achieving such retention may require involvement (broadcaster-receiver feature interaction) in various operational scenarios and stages. Such operational scenarios may include the following:

- The receiver tunes to a specific station (or stations) at power up
- The receiver links to a specific website (or websites) when connected to the Internet
- A station's slogan lives long after an advertisement expires
- The alternatives for travel/out-of-coverage are also downloaded

2.4. Expanded Grade of Service

The initial set of capabilities supported by the Persona Radio project is based on "common market" receivers and limited user involvement, which may include static profile settings. Expanded features may require more capable receivers and may also include:

- Individual (or limited group) services in combination with Conditional Access
- Constantly updating services and point-of-interest services in combination with GPS receiver support

The distinction between the "initial set of capabilities" and the "expanded features" (and the introduction of the project across multiple levels) may drive receiver costs over time. The initial conceptual design may have the provision for the expanded capabilities, but the expanded capabilities are not expected to be included in a detailed initial design.

2.5. Persona Radio – How does it work?
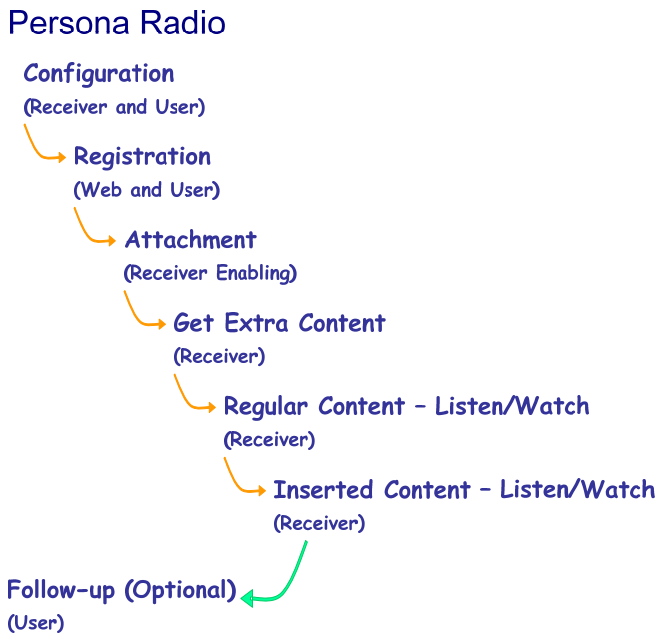
Figure 2-1: Persona Radio Project – How does it work?

3.   Concept Details

3.1.   Terminology

3.1.1.   Entitlement – the right to use substitution content

- Can be achieved by registering with the station
- May be achieved by following the station's posted (web) information, when available
- Applies to each station individually

3.1.2.   Attachment – enabling a receiver to use substitution content

- Achieved by a code
- May be achieved by direct tuning, depending on station's policy
- Applies to each station individually

3.1.3.   Time Unit – the shortest duration of audio content substitution

- Fixed at 15 seconds
- Substitution is applied only in time units (i.e., n × 15 seconds)

3.1.4.   User Profile – a set of user characteristic information items

- Information items include age, preferences, mood, location, etc.

3.1.5.   User Class – an identified group (classification) based on profiles

- Different profiles may fit into one class
- Multiple classes may be defined

3.2.   Profile and Class Management

3.2.1.   User profile is solely controlled by the user

A user is required to configure certain parameters in his receiver profile, in order to allow for the matching of the appropriate substitution content with the user's personality.

- User defines his profile in the receiver

- User may change information items at any time

- User may provide the station with all or part of the profile

    o   Subjected to station's privacy policy

    o   Providing may take place at registration or any other time

- User solely controls information disclosure via back channel

    o   Information may include profile, listening statistics, etc.

3.2.2.   Station defines user classes

- Stations define the classes independently of each other

    o   One station may manage only two classes while another up to 15 classes

    o   Stations may change classes (i.e., user classification) as they wish

- Classes have different meanings for different stations

    o   Same user, thus same user profile will be met by different substitution content

    o   Same profile may be differently associated, grouped, or classified

        - Depending on the station's supported formats

        - Results from number of classes managed by each station

- Look-up matrix for users is necessary

    o   Station's website needs to provide users with an understanding of their classification

    o   Classes need to have names, in addition to enumeration

- Class information is conveyed to users

    o   Required for identifying substitution content

    o   Necessary for user experience (display, feedback, etc.)

3.3. Use Cases

3.3.1. Use Case 1

3.3.1.1. Initialization and Attachment of Non-connected Receiver – Manually

1. User builds his profile on station's website
    a. Static limited personal data is captured
2. User adds a receiver to his profile
    a. Receiver ID and info (mobile/auto; connectivity) is added to entitlement list
    b. Entitlement may be provided OTA (optional automatic attachment with CA)
    c. User gets 'attachment code' to expedite entitlement (manual attachment)
        i. The code may be for long term or for a limited trial period
3. User tunes receiver to the station's frequency
    a. Receiver is not necessarily receiving audio/data (i.e., may be out of coverage)
4. User enters attachment code
    a. The station is locked as default station
    b. Persona function on default station is enabled
    c. Receiver plays welcome greetings
5. Persona Radio (on the specific receiver) is ready for use
    a. Recent (or otherwise default) profile options are in use
    b. Default feature options are in use

3.3.2.   Use Case 2

3.3.2.1.   Initialization and Attachment of Non-connected Receiver – Over-the-Air (OTA)

1. User builds his profile on station's website
    a. Static limited personal data is captured
2. User adds a receiver to his profile
    a. Receiver ID and info (mobile/auto; connectivity) is added to entitlement list
    b. User gets 'attachment code' to expedite entitlement (manual attachment)
        i. User elects to ignore
3. User tunes receiver to the station's frequency
    a. Receiver needs to receive digital signal
    b. Allow for one hour of reception
4. Entitlement is received OTA (with CA)
    a. The station is locked as default station
    b. Persona function on default station is enabled
    c. Receiver plays welcome greetings
5. Persona Radio (on the specific receiver) is ready for use
    a. Recent (or otherwise default) profile options are in use
    b. Default feature options are in use

3.3.3. Use Case 3

3.3.3.1. Initialization and Attachment of Connected Receiver

1. User builds his profile on station's website
    a. Static limited personal data is captured
2. User connects the receiver to the host computer (USB port)
3. Receiver is 'discovered' by the host computer
    a. Standard window prompts to select action ('view folder', 'player', etc.)
4. User initiates registration
    a. User selects 'view folder' from the standard window options list
    b. User selects (1-click action) the 'register' icon
        i. Registration form pops-up
        ii. User types target station URL, username and password
        iii. User clicks 'send'
    c. Receiver ID and user information is sent to station registry
5. Receiver completes the registration process
    a. Station adds the receiver to its registry and sends back entitlement
    b. The station is locked as default station
    c. Persona function on default station is enabled
    d. Radio plays welcome greetings
6. Persona Radio (on the specific receiver) is ready for use
    a. Recent (or otherwise default) profile options are in use
    b. Default feature options are in use

3.3.4. Use Case 4

3.3.4.1. Initializing and Prioritizing of a Receiver for Multiple Stations

1. User builds profile on station's website
    a. Static limited personal data is captured
2. User adds a receiver to his profile
3. Receiver completes the registration process
    a. Entitlement is received
    b. The station is locked as default station # 1
        i. Previously locked station moves to default station # 2
    c. Persona function on (new) default station is enabled
    d. Radio plays welcome greetings

3.3.5. Use Case 5

3.3.5.1. Tuning to Stations

1. Power-up tuning defers to entitled stations
    a. At power-up, the receiver tunes to entitled station #1 on the priority list
    b. If HD Radio signal is acquired, the receiver remains on station #1
        i. Normal operation takes place
        ii. The feature is invoked upon user's settings
    c. If HD Radio signal is not acquired, the receiver tunes to the next entitled station on the list
    d. If no HD Radio signal is acquired on entitled stations, the receiver tunes to station #1
        i. Analog signal may be available
2. Scan promotes entitled stations
    a. The scan goes first over entitled stations, based on their priority list
        i. A specific indication is provided to indicate the entitlement
    b. The process continues with other stations

3.3.6. Use Case 6

3.3.6.1. Getting Supplementary Content OTA – Single Station

1. Receiver starts search for content updates
   a. Immediately after configuration change to 'current station auto'
      i. This is also the factory default mode
      ii. User may change configuration at any time
   b. Immediately after power-up when configured to 'current station auto'
   c. Immediately after tuning to a new station when configured to 'current station auto'
   d. Immediately after pressing 'update current station' when not configured to 'auto'
   e. User is notified regarding 'seeking for content'
2. Receiver checks credentials before invoking update process
   a. Verify that the receiver is entitled for the feature on the current station
3. Receiver constantly checks for updated data availability
4. Receiver checks content relevancy
   a. User is notified regarding 'seeking for content'
   b. Verify match between available updates and user profile
   c. User is notified upon termination due to no relevant content availability
5. Receiver invokes content update process
   a. User may tune to a different station at any time
      i. Update process is terminated – no notification is provided
   b. New content is either appended to old content or replaces old content, depending on few factors
   c. User is notified upon completion of content update

3.3.7.   Use Case 7

3.3.7.1.   Getting Supplementary Content OTA – Multiple Stations

1. Receiver starts search for content updates
    a. Immediately after configuration, change to 'all stations auto'
        i. User may change configuration at any time
    b. Five minutes after power-up when configured to 'all stations auto'
    c. Every three hours of continuous 'On' state when configured to 'all stations auto'
    d. Immediately after pressing 'update all stations' when not configured to 'auto'
    e. User is notified regarding 'seeking for content'
2. Receiver tunes to default (entitled) station
    a. Starting with default station #1
    b. Repeating the seek/update process with default (entitled) station #2 through station #n
3. Receiver checks content relevancy
    a. Verify match between available updates and user profile
    b. Receiver returns to tuning stage when no relevant content is available
4. Receiver invokes content update process
    a. User may tune to a different station at any time
        i. Update process is terminated – no notification is provided
    b. New content is either appended to old content or replaces old content, depending on few factors
    c. Receiver returns to tuning stage upon completion of content update
    d. Receiver terminates the process upon completion of content update on last station
    e. User is notified upon completion of content update

3.3.8. Use Case 8

3.3.8.1. Getting Supplementary Content when Connected – Multiple Stations

1. User connects the receiver to the host computer (USB port)
2. Receiver is 'discovered' by the host computer
    a. Standard window prompts to select action ('view folder', 'player', etc.)
3. User initiates search for content updates
    a. User selects 'view folder' from the standard window options list
    b. User selects (1-click action) the 'updates' icon
        i. Updates window pops-up
        ii. User un-checks unwanted stations (all stations are checked by default)
        iii. User clicks 'send'
        iv. User is notified regarding 'seeking for content'
4. Receiver accesses default (entitled) station website (update folder)
    a. Starting with default station #1
    b. Repeating the seek/update process with default (entitled) station #2 through station #n
5. Receiver checks content relevancy
    a. Verify match between available updates and user profile
    b. Receiver returns to changing website stage when no relevant content is available
6. Receiver invokes content update process
    a. New content is either appended to old content or replaces old content, depending on few factors
    b. Receiver returns to changing website stage upon completion of content update
    c. Receiver terminates the process upon completion of content update on last website
    d. User is notified upon completion of content update

3.3.9.   Use Case 9

3.3.9.1.   Personalized Content Insertion – Automatic Process

1. User tunes to entitled station
    a. Receiver plays regular audio
    b. Receiver displays PSD and other station information
    c. Received product tokens are stacked up (in 'just arrived')
2. Station signals content substitution
    a. Receiver matches the indication with available (stored) content
    b. The display indicates content substitution details
        i. Displaying 'My personal class 1'
    c. Receiver starts playing indicated audio content
    d. Receiver inserts available product tokens (to 'just arrived') and events information (to 'events')
    e. Receiver completes playing the entire indicated audio content
    f. Receiver checks content attributes
        i. Receiver deletes content if expired
    g. Receiver updates station status records with recent insertion details
3. Receiver resumes regular reception and display
    a. Inserted product tokens and event information remain (on the respective lists)

3.3.10. Use Case 10

3.3.10.1.   Personalized Content Insertion – With User Intervention

1. User tunes to entitled station
    a. Receiver plays regular audio
    b. Receiver displays PSD and other station information
    c. Received product tokens are stacked up (in 'just arrived')
2. Station signals content substitution
    a. Receiver matches the indication with available (stored) content
    b. The display indicates content substitution details
        i.   Displaying 'My personal class 1'
    c. Receiver starts playing indicated audio content
3. User prefers real-time content over substitute
    a. User 'cancels' substitution
    b. Receiver inserts available product tokens (to 'just arrived') and events information (to 'events')
    c. Receiver immediately stops playing the indicated audio content
    d. Receiver deletes content from storage
    e. Receiver updates station status records with recent insertion details
4. Receiver resumes regular reception and display
    a. Inserted product tokens and event information remain (on the respective lists)

3.3.11. Use Case 11

3.3.11.1.   User Follows-up on Content (Advertisements)

1. User may tag audio content
   a. Content information (metadata) is stored in tagging associated folder
2. Advertisement metadata may be accumulated without user's involvement
   a. Content information (metadata) is stored in 'free arriving ads' folder
3. User browses stored advertisements
   a. User may query or conduct e-commerce on tagged ads (limited; at will)
      i. D-Clipper feature is utilized
   b. User may query or conduct e-commerce on free arriving ads (may be large amount)
      i. D-Clipper feature is utilized
   c. User may delete the advertisements
   d. User may turn off stacking free arriving advertisements

3.3.12. Use Case 12

3.3.12.1.   Personalized Content Insertion – Special Cases

1. Current date matches user's birthday
    a. On power up, receiver matches the indication with available (stored) content
    b. The display indicates content substitution details
        i. Displaying 'Happy Birthday'
    c. Receiver starts playing birthday greetings
    d. Received product tokens are stacked up (in 'just arrived')
    e. The process repeats every power-up through that date
2. Current date matches national holiday
    a. On power up, receiver matches the indication with available (stored) content
    b. The display indicates content substitution details
        i. Displaying 'Happy Holiday'
    c. Receiver starts playing holiday greetings
    d. Received product tokens are stacked up (in 'just arrived')
    e. The process occurs only once

3.3.13. Use Case 13

3.3.13.1.   User Changes Profile

1. User modifies a profile item
    a. Receiver stores the updated item
2. Receiver checks for class impacts
    a. Receiver compares updated profile to latest class definitions
    b. If class's association has changed, follow-up action takes place
3. Receiver follow-up action (if required)
    a. Display notification 'content updates are required'
    b. Receiver deletes stored content from stations for which the class has changed
    c. If the receiver is in use, search for content takes place upon regular schedule
    d. If the receiver is not in use, search for content takes place immediately

4. Design Details

4.1. Storage and Bandwidth Analysis

The following calculations are based on several initial assumptions regarding the real deployment paradigm. Parameters such as bit rates, formats, classes, substitution time, etc. may noticeably vary from one station to another. The calculations are structured and linked; by changing the specific/desired parameters, their impact on station operations, station resources, and receiver resources will be understood.

4.1.1. Substitute Content Rates

The indicated rates are instantaneous content playable rates (i.e., values apply only to the duration of usage), regardless of the content delivery and storage. The rates are primarily derived from the station's resource allocation (for HD-1, HD-2, data, etc.), assuming that the substitution is expected to match the real-time content audio quality.

The following are assumed:

    a. Audio default rate is 24 kbps

    b. Audio high rate employs 48 kbps

    c. Inserted text data rate is equivalent to 1 kbps

    d. Inserted (optional) images data rate is equivalent to 8 kbps

    e. Encapsulation (transport) is assumed to result in 20% overhead

        i. Required for reliable delivery OTA

        ii. May be present for connected delivery, but becomes insignificant

Based on the assumptions given above, the expected (total) payload is calculated as follows:

    a. Low: 24 + 1 = 25 kbps > encapsulated: 30kbps

    b. Mid: 24 + 1+ 8 = 33 kbps > encapsulated: ~40kbps

    c. High: 48 + 1 + 8 = 57 kbps > encapsulated: ~69kbps

4.1.2. Duration of Inserted Content

The daily insertion duration and the daily insertion updates may differ noticeably. In some cases, the daily insertion may utilize the same content over a few days, which may require only minor updates from one day to another. In other cases, new content may be used every day, thus requiring noticeable daily content updates. While the actual daily updates may change significantly from one station to another, average values are assumed for the purpose of storage and delivery calculations.

It is assumed that the average daily content update is distributed as follows:

- Average daily content update spans 12 minutes of real-time playback
    - Initial assumption considers 3 x 3 minutes for music
    - Initial assumption considers 6 x 30 seconds for commercials
- Insertion is accumulated over HD-1 to HD-4
- Average value is per class, averaged across all classes
- Average is across participating stations

4.1.3. Content Volume

For the purpose of calculating the higher range ('bound') of content volume, the highest level payload rates are used. It is also assumed that a station will typically support six classes of users.

The resulting daily content volume is:

- For a single class: 69 x 720 = 49,680 kbits (~ 6.2 MByte)
- For six classes: 6.2 x 6 = ~37.2 MByte

4.1.4. Storage Requirements

Substitute content storage occurs on both the station side and the receiver side. It results from the daily updates and the storage period encapsulating the alternative content. However, the station approach is expected to be different from the receiver approach. A station may aggregate the alternative content, which it intends to provide, for a relatively long time. The receiver, on the other hand, may not be capable of loading, downloading, or even storing content for such a long time, but it is expected to support storing content from multiple stations. For that purpose, a typical receiver is assumed to store content from six stations.

The resulting storage is calculated as follows:

Station perspective

- Single day: ~ 37.2 MByte
- Single week: 37.2 x 7 = ~ 260 MByte
- Single month: 37.2 x 30 = ~ 1.1 GByte

Receiver perspective

- Single station, single day: ~ 37.2 MByte
- Single station, single week: 37.2 x 7 = ~ 260 MByte
- Six stations, single day: 37.2 x 6 = ~ 223 MByte
- Six stations, single week: 223 x 7 = ~ 1.6 GByte
- Storage may be doubled due to transition overlap

4.2. Content Delivery Options

Content delivery has to occur in sufficient time before the intended use of the content. The fastest and most efficient way to deliver the content is via direct connection or otherwise attachable media, such as a memory card. However, certain classes of receiver may not be equipped with direct connection or attachable media support. In some cases, temporarily, receivers may not be able to exercise connectivity.

Delivery over-the-air (OTA) of content for substitution is necessary. For some receivers, it may be the only delivery method, while others may often benefit from it.

4.2.1. Near Real-time Delivery

The substitution content may be delivered just in time for actual utilization. In that case, the delivery is considered near real-time. Since near real-time delivery is expected to occur when listenership is either ramping up or already at a high level, it is likely that the station is attempting to fully utilize its capacity for other services, such as HD-1 through HD-4, at the best available audio quality or other data services. Therefore, the available capacity for delivering substitution content may be limited.

For analysis purposes, it is assumed that a data service at 8 kbps (1 kbyte/s) is employed for near real-time delivery. The resulting delivery limitations are as follows:

Station perspective

- Delivery time for a single day content   37.2 MByte / 1 kByte/s = 37,200 seconds (~ 10.5 minutes)
- Delivery time for a single week content   10.5 x 7 = ~ 73 minutes

Receiver perspective

- Receiving time single station/single day   37.2 MByte / 1 kByte/s = 37,200 seconds (~ 10.5 minutes)
- Receiving time single station/one week   10.5 x 7 = ~ 73 minutes
- Receiving time 6 stations/single day   10.5 x 6 = ~ 63 minutes
- Receiving time 6 stations/one week   73 x 6 = ~ 438 minutes

The potential conclusion, based on these assumptions and calculations, is that near real-time delivery may be a viable method for delivering one day's content for one station and possibly a few stations. However, it seems to be an impractical method for delivering one week of substitution content, even for a single station.

4.2.2. Down-time Delivery

At relative down-time periods, which may typically occur at night, stations may face different service requirements from those at peak-time. That may allow stations to temporarily change their capacity resource allocation. Specifically for substitution content delivery, a station may increase the bit rate, until the delivery of the desired content is complete.

For analysis purposes, it is assumed that a data service at 24 kbps (3 kbyte/s) is employed for down-time delivery. The resulting delivery limitations are as follows:

Station perspective

- Delivery time for a single day content   37.2 MByte / 3 kByte/s = 12,400 seconds (~ 3.5 minutes)
- Delivery time for a single week content   3.5 x 7 = ~ 24 minutes

Receiver perspective

- Receiving time single station/single day 37.2 MByte / 3 kByte/s = 12,400 seconds (~ 3.5 minutes)
- Receiving time single station/one week   3.5 x 7 = ~ 24 minutes
- Receiving time 6 stations/single day   3.5 x 6 = ~ 21 minutes
- Receiving time 6 stations/one week   24 x 6 = ~ 144 minutes

The potential conclusion, based on these assumptions and calculations, is that down-time delivery may be a viable method for delivering one week's content for one station and possibly a few stations. It may also be a viable method for delivering one week's content for 6 or more stations, but it may be inconvenient from the receiver perspective and may require additional conditions and/or limitations. Increasing the instantaneous capacity allocation for the delivery of a data service may help noticeably and potentially simplify the delivery requirements.

It should be noted that down-time delivery may be coupled with 'wake-up' indication capability; thus, allowing the station to signal the receiver when the service is in effect and providing for efficient power management and simplified delivery.

4.3. Class Content Delivery Details

Near real-time delivery of broadcast audio and data content requires that the total bandwidth of the main program and the total number of the alternative program class streams must fit within the available transmission mode bandwidth and the same logical channel partition.

4.4. Broadcasting System Functional Structure

The Persona Radio broadcast system may be envisioned as a series of applications that fall under the heading of the Persona Radio Application. The Persona Radio Application communicates with the Importer through the defined audio and data protocols. The protocols may include the regular HD Radio audio encoder (HDC) and the HD Radio Link Subsystem (RLS) for handling data packets.
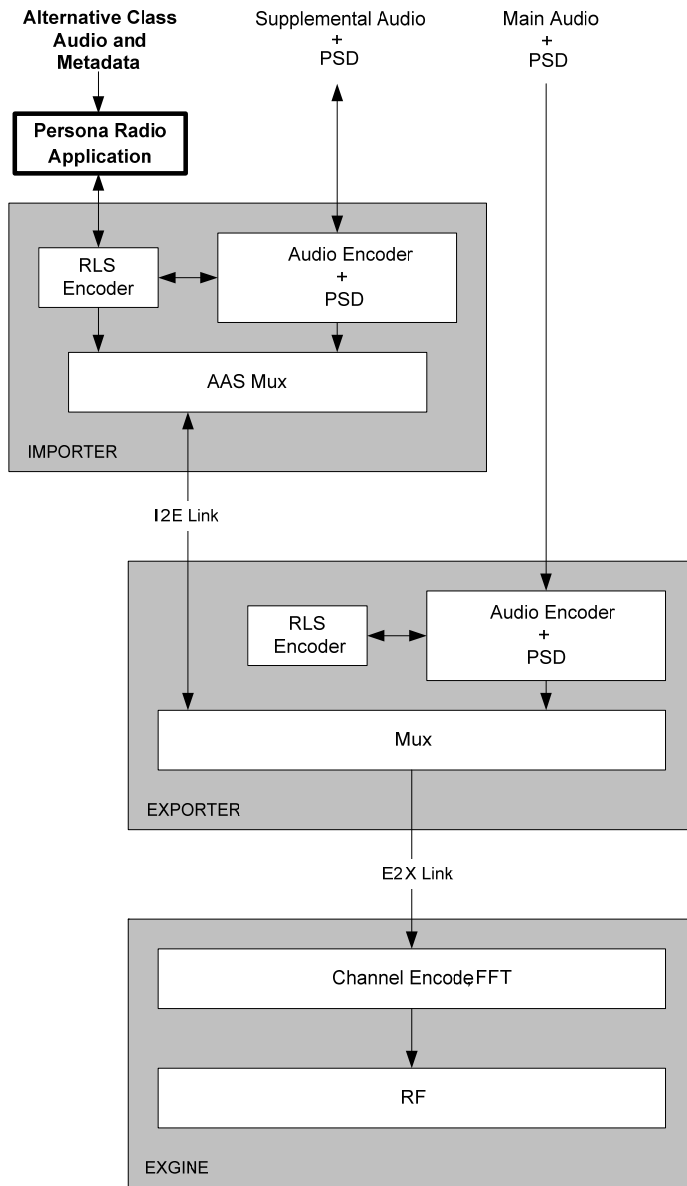
Figure 4-1: Persona Radio System Topology

While the specific Persona Radio implementation may take a variety of forms, the diagram in Figure 4-2 represents the functional components and the relationship between existing broadcast subsystems.

Person Radio Application Elements
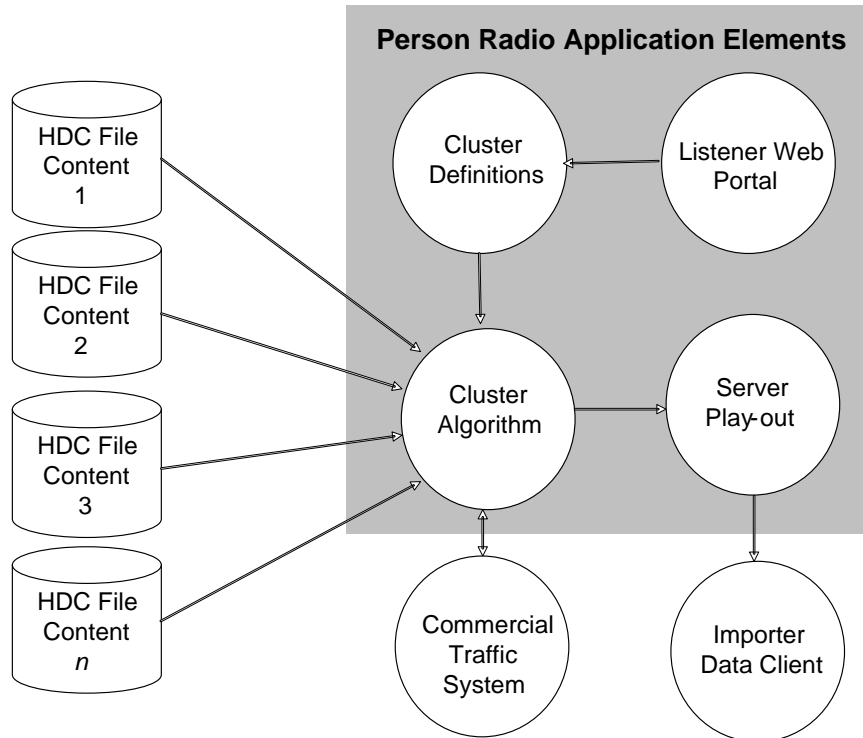
Figure 4-2: Sub-components of the Persona Radio Application Layer

4.5.   Broadcast User Interface – Web Portal

A web portal may be used to configure the profile and features of the end user's Persona Radio experience.

The portal shall have the ability to:

- Register Listeners
- Create Listener Profile (optional - not mandatory)
  - o   User defines his profile in the receiver
  - o   User may change information items at any time
  - o   User may provide the station with all or part of the profile
- Create Class Dictionary
- Create Class Definition by User Profile
  - o   User solely controls information disclosure via back-channel
  - o   Information may include profile, listening statistics, etc

4.6. Content Authoring

Program audio and data content will need to be authored in a suitable format employing HDC encoded audio.

The production authoring tools shall:

- Enable file based HDC content creation

- Accept AES 44.1-kHz sampled audio

- Be scalable from 96 to 12 kbit/s

- Include an audio processing module to match dynamic profile to MPS

- Enable association of Artist Experience images (using the dedicated XHDR tag in PSD). The following images shall be supported:

    o Artist Image

    o Alternate Artist Image

    o Station Logo

    o Commercial Image

- Enable dynamic PSD messages within the file construct (using the XHDR tag)

- Content shall be stored with XHDR markers in PSD throughout the segment

- Recorded content shall support watermark of Arbitron™ PPM and allow proper operation

- Encoding should support for an alternate back-channel to track listener behavior

- Encoded content shall match stored UPC/QR code (using XHDR tag and Commercial tag) with dynamic indication throughout the segment
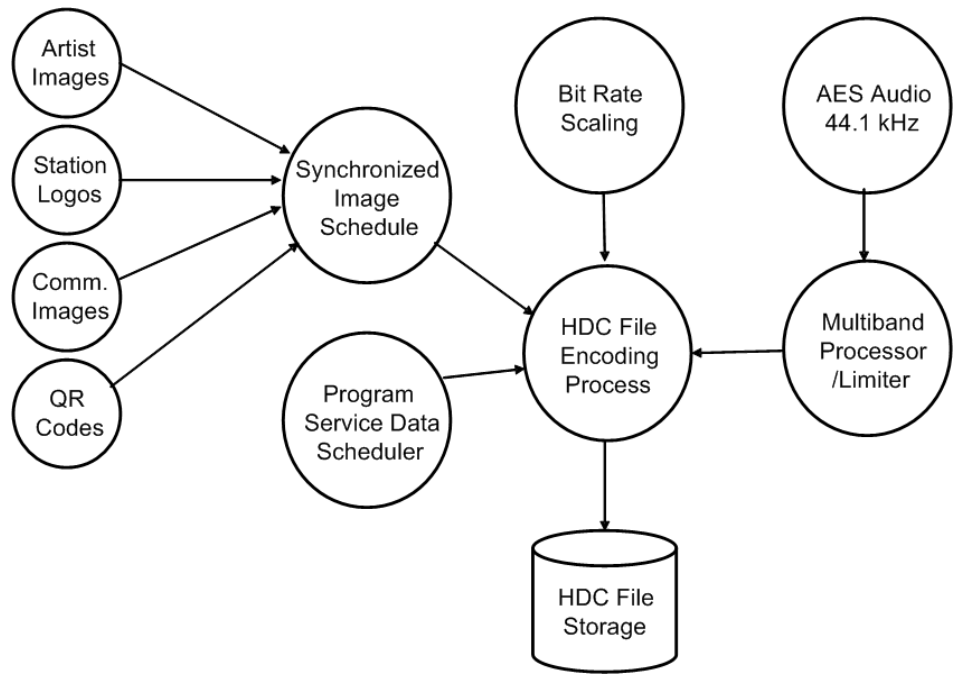
Figure 4-3: Relationship of Production Authoring Elements

4.7. Alternative Content Distribution

The Persona Radio Alternative Content may be delivered to the application via a dedicated subnet of the broadcast station program Ethernet. Whether the Importer is located at the broadcast point of origination or at the transmitter site connected via a Wide Area Network (WAN), the apportioned bandwidth of the subnet must account for all audio and data services that are operating. This calculation must also include headroom for any retransmission if the TCP/IP protocol is employed.

5. Implementation Snapshots

A Persona Radio featured receiver is menu driven. Some of the menu items may be general and apply to many HD Radio receivers, while others may be feature specific. The prototype receiver includes 4 menu items at the high level menu. The items are,

- Persona Radio
- My Profile
- My Treasure
- Look and Feel

When selected, each of these menu items expands to provide the user with several options for configuration and action.

5.1. User Interface – Persona Radio Menu Tree Functional Description

The Persona Radio menu allows the user to configure the feature's 'behavior'. The menu tree allows for attaching/detaching stations; users may change their preferred access priority via the 'My Attachments' and 'Attaché' sub-menu branches. Statistics are complementary to the attachments and may be accessed via the 'Station Stats' sub-menu.

The 'Content Updates' and 'Auto Update' sub-menu branches allow for defining the method and source for retrieving/receiving substitute content.

Privacy aspects are addressed via the 'Permission' sub-menu and account for the user profile, as well as the usage statistics.

Operation mode, allowing 'On'/'Off'/'Standby', is controlled directly from this menu.

Persona Radio
My Profile
My Treasure
Look and Feel

Persona Radio Menu
- ❑ Content updates
- ❑ My Attachments
- ❑ Operation   xxx
- ❑ Privacy

Content Updates

Apply when highlighted and clicking "enter"

Get Current Station
Get All Stations

Auto update for:

My Attachments
Select

While pointing at a station, allow for:
- Move: changing the order, "enter" to select, then use up/down buttons
- Delete: ask for confirmation
- More: open status window

1. WBEB   101.1
2. WXYZ   95.5
3. WACR   91.1

Add

Permission
Select

My Profile
    Block
    Display only
    Allow

Statistics
    xxxxxx

Station Stats

WBEB   101.1
Enabled   8/11/10
Expired   Not indicated
Invoked   8/13/10 19:03
Class   4
Sub-content   Available

Attache

Code: 00000000000000
Apply

Current Station

Go to upper menu after applying the code or indicate: 'code error'

ON
Standby
OFF

Scroll through options.
Show one at a time or show the selected one.

Same for statistics

Block: no report, no QR code
Display only: only QR
Allow: report and QR

Auto Update
Set

WBEB   ♫
WXYZ
WACR   ♫

Figure 5-1: User Interface – Persona Radio Menu Tree Functional Description

5.2.   User Interface – My Profile Menu Tree Functional Description

User's profile is entered via this menu and is considered the most influential in driving the substitution content and scenarios. The menu may be used to enter the user's age group and/or birth date and gender.

The user may enter his/her current activity state, via the 'Now I am' menu option, and may change it as often as desired.

In order to expand and allow for the relating of services to a user's location, the user may enter his/her favorite locations, potentially associated with home/work/visited categories, via the 'Locations' sub-menu.
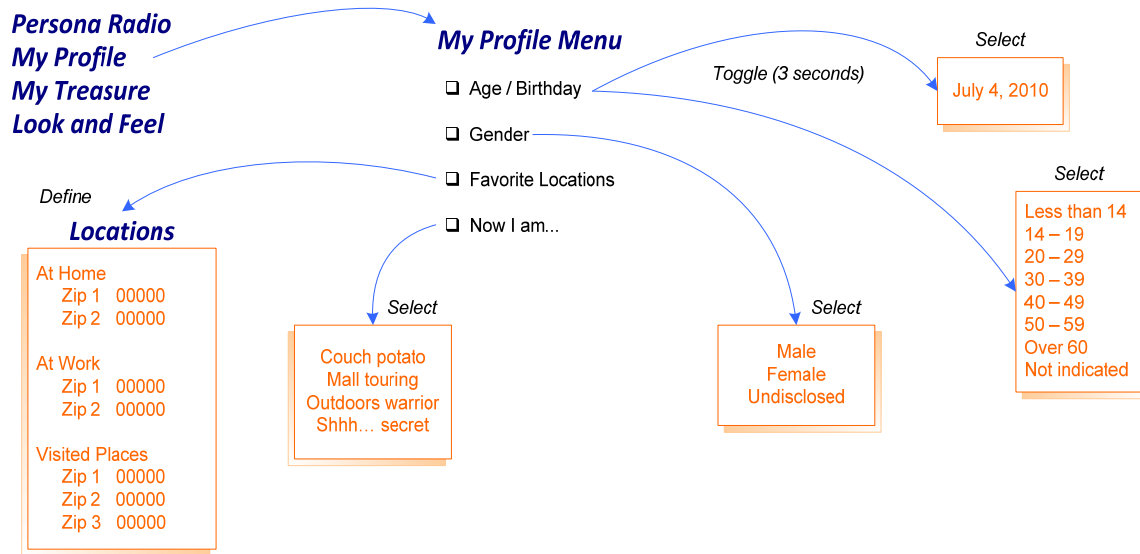
Figure 5-2: User Interface – My Profile Menu Functional Description

5.3. User Interface – My Treasure Menu Tree Functional Description

The user's captured or pushed information, related to products, advertisements, and event descriptions can be accessed via this menu tree. This menu tree provides a powerful means for further user action.

The user may tag any audible content by pressing the receiver's 'tag' button. The information, including PSD elements, is captured and can be accessed via the 'I tagged It List'. The user can then explore the captured information or delete it.

Advertisement-related content, including applicable PSD descriptors and/or coupons, may be pushed to the receiver. It may arrive as related or unrelated to the audio content and it may take place along with personal content substitution. Such content may be accessed via the 'Just Arrived List' sub-menu. The user can then explore the captured information or delete it.

Event-related information may be pushed to the receiver; but, this information is accessed and managed via the 'Events' menu.

The user is provided with the power of taking further action for the purpose of query or purchase (direct or e-commerce) that is related to any item in all of the three sub-menus. That may be achieved by using the HD Radio Technology D-Clipper feature, which allows for the conveying of UPC/QR codes for these items. By scrolling and selecting an entry in any of these sub-menus, the receiver may display the UPC code or QR code that is associated with that entry. The user then may use a smartphone to capture and complete the actionable cycle or take the receiver (portable only) directly to the point of sale.

Persona Radio
My Profile
My Treasure
Look and Feel

My Treasure Menu

q I Tagged It
q Just Arrived
q Events

Note: No duplicates in list; all UPC or QR received coupons go to 'just coupons'. If tagged, then they go only to tagged list.

List of artist / title of tagged items
Tokens (UPC or QR) may be included

I Tagged It List

1. ABC Vitamin supports both…
2. Lucky Pizza $2 off…
3. Superstore drinks 2 for 1…
4. Jonny Smith / Living the…
5. Cindy Luck / Singing for the…
6. Jack Joke / Laughing all the…

One line; scroll from right to left if too long.

When one full line is selected, displayed, or scrolled over, then UPC or QR should be displayed under that line.

Press 'enter'.

● UPC 6-00603-12527-0 for (1)
● UPC 0-46838-04158-7 for (2)
● UPC 0-27108-93347-4 for (3)
● UPC 0-27242-73032-8 for (4)
● UPC 8-82224-85809-0 for (5)
● UPC 0-43774-02425-4 for (6)

List of UPC or QR received tokens

Just Arrived List

1. 20% off at B&B Books…
2. $2 off large pizza at…
3. $1 off any shampoo…
4. Shop smart $5 off $25 for…
5. 48 hours 25% discount on…
6. Free diet for 2 weeks only…

One line; scroll from right to left if too long.

When one full line is selected, displayed, or scrolled over, then UPC or QR should be displayed under that line.

Press 'enter'.

None

Figure 5-3: User Interface – My Treasure Menu Tree Functional Description

5.4. User Interface – Look and Feel Menu Tree Functional Description

This menu tree allows the user to configure the receiver and browse the receiver's information. The language sub-menu selection may be used in regards to content substitution, as managed by the Persona Radio feature.

Persona Radio
My Profile
My Treasure
Look and Feel

Look and Feel Menu
q Brightness
q Contrast
q Language
q Time Zone
q Version

Brightness
Select
Scale: 1 to 15

Select
GMT --- hh:00

Language
Select
English
Français
Español

Contrast
Select
Scale: 1 to 15

Version
Display only
DSP Version   XXyyzz
Firmware Version   NNN
Build Date: Date / Time
SD Card: 4 GB Brand
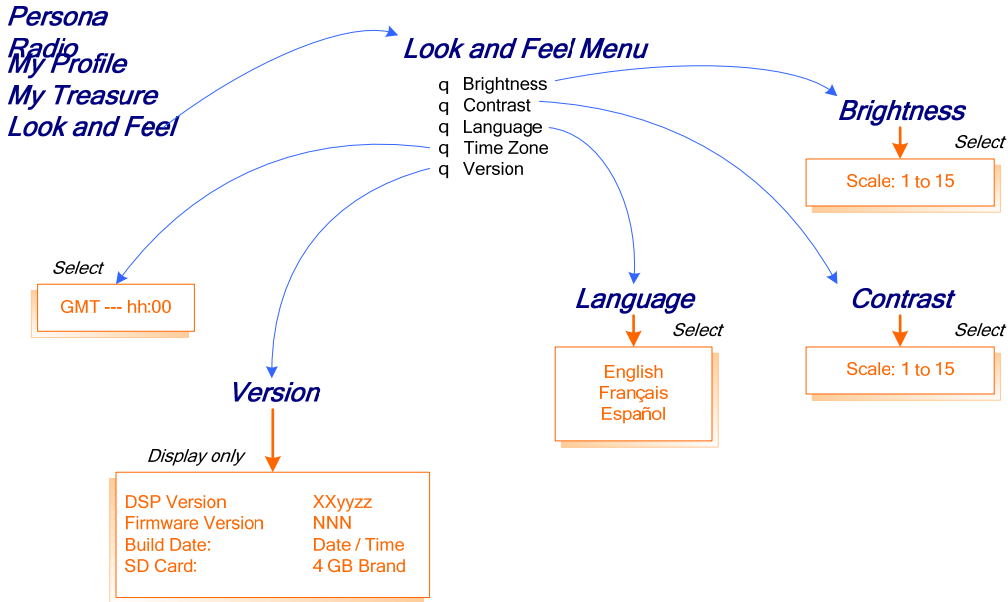
Figure 5-4: User Interface – Look and Feel Menu Tree Functional Description

5.5.   Content Insertion Case 1

In this insertion demonstration case, the current content (audio content) is replaced by an inserted content, while additional textual content is pushed and appended for later use.

The insertion is triggered by the station or locally (self-timed for demonstration purpose). The currently tuned station HD Radio format audio is replaced by the personally-matched substitute audio file 1. Simultaneously, two advertised menu items, as well as single event information are pushed and may be accessed and managed at any later time via the respective sub-menus.

The substitution/insertion is matched with the personal information provided in the profile; language is matched (pointed here by 'Settings') and the personalization is indicated by scrolling text across the main display (pointed here by 'Display'), as long as the audio replacement is in effect.

Trigger   N/A

Persona Radio

Settings
Gender --- female
Age --- 40 and above
Language --- English

Display   Personal Commercial --- Women's new age / rejuvenated
(1 scrolling line at the very bottom)

Audio Insertion   Audio file1

Ad / Token Insertion

● ISBN 9-780240-808444 for (1)
●● QR Code for (2)

Content Insertion

Just Arrived List

After Insertion

Before Insertion

1. 20% off at B&B Books…
2. $2 off large pizza at…
3. $1 off any shampoo…
4. Shop smart $5 off $25 for…
5. 48 hours 25% discount on…
6. Free diet for 2 weeks only…

1. Concurring the Challenge, by Mrs. Beauty
2. Build your Confidence : Workshops every Week
3. 20% off at B&B Books…
4. $2 off large pizza at…
5. $1 off any shampoo…
6. Shop smart $5 off $25 for…
7. 48 hours 25% discount on…
8. Free diet for 2 weeks only…

Event Insertion

Content Insertion

None

Take part in cosmetics products demo and have a chance to win a day at the spa.
Details at www.beautystore.com

●● QR Code for this event

Figure 5-5: Content Insertion Case 1

5.6. Content Insertion Case 2

The insertion is triggered by the station or locally (self-timed for demonstration purpose). The currently tuned station HD Radio format audio is replaced by personally-matched substitute audio file 2. Simultaneously, two advertised menu items, as well as single event information are pushed and may be accessed and managed at any later time via the respective sub-menus.

The substitution/insertion is matched with the personal information provided in the profile; language is matched (pointed here by 'Settings') and the personalization is indicated by scrolling text across the main display (pointed here by 'Display'), as long as the audio replacement is in effect.

Persona Radio

Trigger	N/A
Settings	Gender --- male Age --- 40 and above Language --- English
Display	Personal Commercial --- Men and mood (1 scrolling line at the very bottom)
Audio Insertion	Audio file2

Ad / Token Insertion

Just Arrived List

Content Insertion

- ISBN 9-780240-810027 for (1)
- QR Code for (2)

After Insertion

Before Insertion

1. 20% off at B&B Books…
2. $2 off large pizza at…
3. $1 off any shampoo…
4. Shop smart $5 off $25 for…
5. 48 hours 25% discount on…
6. Free diet for 2 weeks only…

1. The New Comics, by Arthur Funny
2. Dream Vacations in the Caribbean : Sale!
3. 20% off at B&B Books…
4. $2 off large pizza at…
5. $1 off any shampoo…
6. Shop smart $5 off $25 for…
7. 48 hours 25% discount on…
8. Free diet for 2 weeks only…

Event Insertion

Content Insertion

None

Special multilingual standup comedy contest at the midtown playhouse on Saturday. Details at www.comedy.com

QR Code for this event

Figure 5-6: Content Insertion Case 2

5.7.   Content Insertion Case 3

The insertion is triggered by the station or locally (self-timed for demonstration purpose). The currently tuned station HD Radio format audio is replaced by personally-matched substitute audio file 3. Simultaneously, one advertised menu item, as well as single event information are pushed and may be accessed and managed at any later time via the respective sub-menus.

The substitution/insertion is matched with the personal information provided in the profile; language is matched (pointed here by 'Settings') and the personalization is indicated by scrolling text across the main display (pointed here by 'Display'), as long as the audio replacement is in effect.

Persona Radio

Trigger	N/A
Settings	Gender --- male Age --- 40 and above Language --- Spanish
Display	Personal Commercial --- Trabajadores y el estado de ánimo (1 scrolling line at the very bottom)
Audio Insertion	Audio file3

Ad / Token Insertion

Content Insertion

●● QR Code for (1)

Just Arrived List

Before Insertion

After Insertion

1.   20% off at B&B Books…
2. $2 off large pizza at…
3. $1 off any shampoo…
4.   Shop smart $5 off $25 for…
5.   48 hours 25% discount on…
6.   Free diet for 2 weeks only…

1.   Sueño de vacaciones en el Caribe : Venta!
2.   20% off at B&B Books…
3. $2 off large pizza at…
4. $1 off any shampoo…
5.   Shop smart $5 off $25 for…
6.   48 hours 25% discount on…
7.   Free diet for 2 weeks only…

Event Insertion

Content Insertion

None

Especial standup multilingüe concurso de comedia en el teatro de Midtown, en sábado.
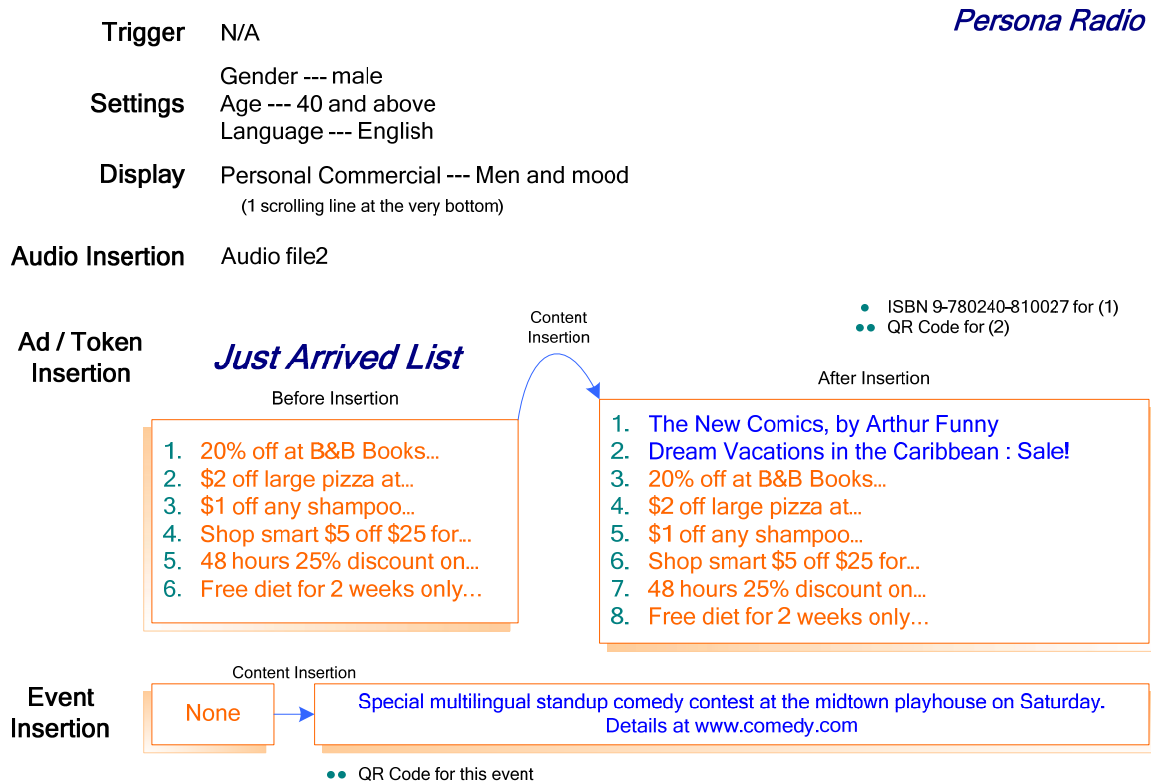Más detalles en www.comedy.com

●● QR Code for this event

Figure 5-7: Content Insertion Case 3

5.8. Content Insertion Case 4

The insertion is triggered by the station or locally (self-timed for demonstration purpose). The currently tuned station HD Radio format audio is replaced by personally-matched substitute audio file 4. Simultaneously, information about a single event is pushed and may be accessed and managed at any later time via the 'Events' sub-menus.

The substitution/insertion is matched with the personal information provided in the profile (pointed here by 'Settings') and the personalization is indicated by scrolling text across the main display (pointed here by 'Display'), as long as the audio replacement is in effect.

Trigger   N/A   *Persona Radio*

Settings   Now I am… couch potato

Display   Personal music --- Relaxing moments, Slowing down a notch
                    (1 scrolling line at the very bottom)

Audio Insertion   Audio file4

Ad / Token Insertion   N/A

Content Insertion

Event Insertion   None → Get ready for New Orleans and Connecticut jazz festivals.
                                    Details at www.alljazz.com

●● QR Code for this event

Figure 5-8: Content Insertion Case 4

5.9.   Content Insertion Case 5

The insertion is triggered by the station or locally (self-timed for demonstration purpose). The currently tuned station HD Radio format audio is replaced by personally-matched substitute audio file 5. Simultaneously, information about a single event is pushed and may be accessed and managed at any later time via the 'Events' sub-menus.

The substitution/insertion is matched with the personal information provided in the profile (pointed here by 'Settings') and the personalization is indicated by scrolling text across the main display (pointed here by 'Display'), as long as the audio replacement is in effect.

Persona Radio

Trigger	N/A
Settings	Age --- 14 to 29
Display	Personal music --- Stepping up, getting energized (1 scrolling line at the very bottom)
Audio Insertion	Audio file5
Ad / Token Insertion	N/A

Content Insertion

Event Insertion

None → Summer's biggest rock concert!   Check for tickets at www.summerrock.com!
Act now!   Tickets are going fast!!
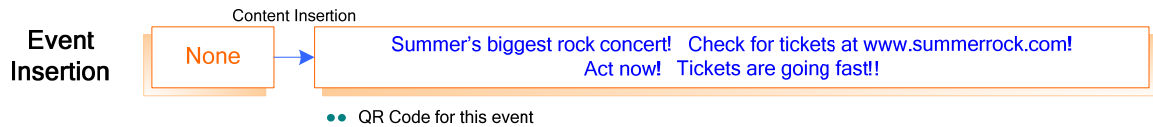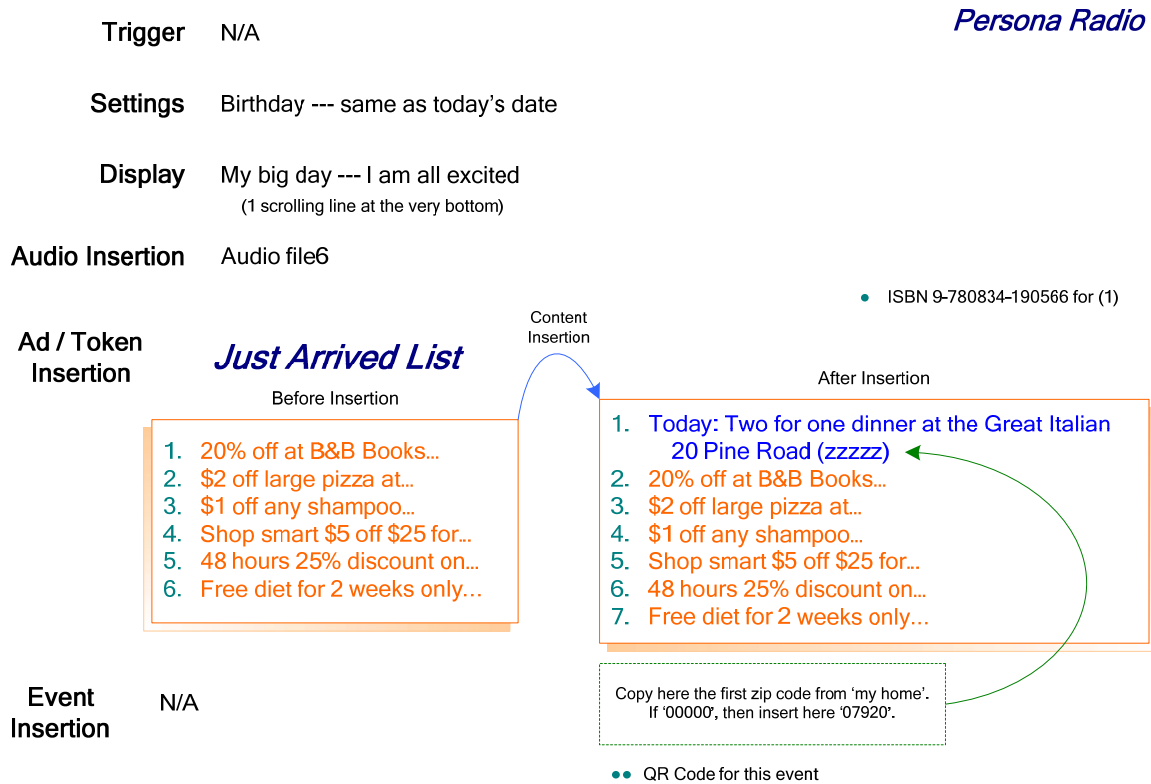
●● QR Code for this event

Figure 5-9: Content Insertion Case 5

5.10. Content Insertion Case 6

The insertion is triggered by the station or locally (self-timed for demonstration purpose). The currently tuned station HD Radio format audio is replaced by personally-matched substitute audio file 6. Simultaneously, one advertised menu item is pushed and may be accessed and managed at any later time via the 'Just Arrived List' sub-menus.

The substitution/insertion is matched with the personal information provided in the profile (pointed here by 'Settings') and the personalization is indicated by scrolling text across the main display (pointed here by 'Display'), as long as the audio replacement is in effect.

Persona Radio

Trigger   N/A

Settings   Birthday --- same as today's date

Display   My big day --- I am all excited
(1 scrolling line at the very bottom)

Audio Insertion   Audio file6

● ISBN 9-780834-190566 for (1)

Ad / Token Insertion

Content Insertion

Just Arrived List

After Insertion

Before Insertion

1. 20% off at B&B Books…
2. $2 off large pizza at…
3. $1 off any shampoo…
4. Shop smart $5 off $25 for…
5. 48 hours 25% discount on…
6. Free diet for 2 weeks only…

1. Today: Two for one dinner at the Great Italian 20 Pine Road (zzzzz)
2. 20% off at B&B Books…
3. $2 off large pizza at…
4. $1 off any shampoo…
5. Shop smart $5 off $25 for…
6. 48 hours 25% discount on…
7. Free diet for 2 weeks only…

Copy here the first zip code from 'my home'.
If '00000', then insert here '07920'.

Event Insertion   N/A

●● QR Code for this event

Figure 5-10: Content Insertion Case 6