(54) DYNAMIC MOSAIC EXTENDED ELECTRONIC PROGRAMMING GUIDE FOR TELEVISION PROGRAM SELECTION AND DISPLAY

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(57) ABSTRACT

The present invention teaches a method of creating and presenting a user interface comprising a Dynamic Mosaic Extended Electronic Programming Guide (DMXEPG) using video, audio, special applications, and service dynamic metadata. The system enables television or digital radio service subscribers to select and display of various programs including video, interactive TV applications, or any combination of audio or visual components grouped and presented in accordance with the dynamic program/show metadata, business rules and objectives of service providers, broadcasters, and/or personal subscriber choices, collectively referred to as mosaic element presentation criteria.
FIG. 1

Video for featured program 1
Content Category 1

Video for featured program 2
Content Category 2

Video for featured program 3
Content Category 3

Video for featured program N
Content Category N

Video for featured program 4
Content Category 4

Video for featured program 5
Content Category 5

Captioned text is synced with audio track (like a closed captioned subtitles, OR instant show info (Current Air date))
Mosaic Element - Component - Video for a channel chosen by a subscriber (favorite channel)

Mosaic Element - Component - Video for a program selected by a service provider

Mosaic Element - Component - Video for a program chosen by a subscriber (favorite program)

Mosaic Element - Component - Link to interactive application

Mosaic Element - Component - Image
Video for selected program

(program assigned to the mosaic element 3)

[Diagram with video program assignments to different elements]

Creeping line: text is synched with audio track (like a closed captioned subtitles) OR Showings instant info

(current / next showing)
Video for channel selected by service provider

FIG. 9
Video for Favorite Channel 2, assigned to ME 7

Scenario 1: use set-top-box multiple tuner capability
Scenario 2: use personal backend generated video mosaic screen (VOD/PTV)
FIG. 13

VIDEO for Selected Mosaic element

Mosaic Element 1
Mosaic Element 2
Mosaic Element 3
Mosaic Element 4
Mosaic Element 5
Interactive Mosaic Client Application will use static OSD image to overlay video for that corresponding audio, if rating for that program exceeds STB/user parental rating limit.

Enter Your PIN to disable Parental Control

Interactive Mosaic Client Application will remove static OSD image which covers video mosaic cells, after user enters correct PIN.
Matrix Split server will organize and process video audio information. Matrix Split server may program any program which has been assigned blackout information. Blackout may be assigned by another component of mosaic element. Interactive Mosaic Client may use static OSD image next to indicate cells with blackout properties. Interactive Mosaic Client may mark mosaic cell and disable member to set focus to that cell.
The subscriber is not authorized to watch TV Channel assigned to provider's ME 3.

- Restrict access to Interactive Mosaic Channel (IMC).
- Allow display cell's video, but disable corresponding audio.

Channel is not authorized to show this channel.

We are unable to show this channel (800) xxx-xxx to order this channel.

Please call customer service (800) xxx-xxx.
### Content Category

<table>
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<tr>
<th>Time</th>
<th>ME 1</th>
<th>ME 2</th>
<th>ME 3</th>
<th>ME 4</th>
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</tbody>
</table>

**FIG. 18**

- **Channel 21**: Mosaic Element 1
- **Channel 315**: Mosaic Element 2
- **Channel 315**: Mosaic Element 3
- **Channel 315**: Mosaic Element 4
- **Channel 333**: Mosaic Element 5
- **Channel 333**: Mosaic Element 6
- **Channel 333**: Mosaic Element 6
Content Category

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<td>Channel 47</td>
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FIG. 19
Interactive application - Weather - assigned to the mosaic element

To prevent TV screen burnout application always dynamically changes text and images in the mosaic cell and their positioning in the cell (for example - from today's forecast to morning/noon/afternoon/nights etc.). See Figure 25 for details.

Creeping line is used by Weather application. This screen space is shared among all applications (e.g. program info, weather, stock market, etc.), It disappears after timeout.
EPG Database

Filter Programs by Category "Cartoons"

"Cartoons" programs

Channel list with "Cartoons" programs and channel insertion schedule

Apply business/technical rules (e.g., channel priorities)

"Cartoons" programs mosaic insertion schedule

FIG. 23
TV screen "burnout" issues

Static (non-video) mosaic element component (e.g. image, interactive application, interactive ad)

Mosaic screen background (e.g. image)

Mosaic creeping line

- Dynamically change position of the static mosaic element generating new meta data and new mosaic video-feed.
- Dynamically rotate multiple "static" mosaic element components (e.g. multiple images assigned to the same mosaic element).
- Dynamically change text/images positioning inside static mosaic element.
- Don't use gaps between video cells.
- Dynamically change mosaic screen background.
- Use transition effects during background image updates.
- Use intelligent timeout.

FIG. 25
Subscriber tunes to the mosaic channel, using, for example:
- Channel Up/Down buttons
- Direct Channel Access by channel number
- From EPG Listings screens
- Rotating element
- Other available methods

Channel with video mosaic is displayed on the screen

1) DMXEPG Client Set top box Resident Application (DMXEPG-RA) is running.
2) DMXEPG-RA extracts and checks Service Type
3) DMXEPG-RA downloads mosaic meta data if Service Type is Interactive Mosaic Channel

DMXEPG-RA may download the meta data to the set-top-box RAM memory from:
- Mosaic digital video multiplex (e.g., in band data carousel – for example DSMCC)
- VBI data
- Return path interactive channel
- Out of band data carousel

Video mosaic continues to be displayed on the screen

Mosaic Meta data is downloaded to the set top box.
DMXEPG-RA draws UI on TV screen.
Focus on TV screen is set to the default mosaic element.

Subscriber can access interactive component of DMXEPG application

FIG. 27
Original Video Source
16 x 9

Video Source to be Clipped
16 x 9

Clipped Video Source
16 x 9

VIDEO PROCESSOR
Scale video to the Mosaic Element with aspect ratio of 16x9

VIDEO PROCESSOR
Insert scaled video mosaic element into mosaic screen

FIG. 34
Original Video Source
16 x 9

Video Source to be Clipped
4 x 3

Clipped Video source
4 x 3

FIG. 35
5.5.1.1 User may zoom in mosaic element (4x3 to 4x3)

User presses "Zoom IN" button on device's Remote control.
5.5.1.2 User may zoom in mosaic element (4x3 to 16x8)

User presses "Zoom IN" button on device's Remote control.
5.5.1.3 User may zoom in mosaic element (16x9 to 16x9)

User presses "Zoom IN" button on device's remote control.

FIG. 39
5.5.1.4 User may zoom in mosaic element (16×9 to 4×3).

User presses "Zoom In" button on device's remote control.
5.5.1.5 User may zoom in mosaic element (16x9 to variable)
5.5.1.6 User may zoom in mosaic element (4x3 to variable)
5.5.1.7 User may zoom in mosaic element (Variable to 4x3)
5.5.2 User may zoom in again scaled original video feed.
5.5.3 User may zoom out original video feed

User presses "Zoom OUT" button on device's Remote control

FIG. 46

Video ME 3 Video ME 6 Video ME 9
Video ME 7

Original Video Feed 1 (ME1)

Scaled Original Video Feed 1 (ME1)
5.5 User may move zoomed mosaic element on Mosaic Screen
5.5.8 Use "SELECT" button for "ZOOM IN"/"ZOOM OUT" operations.
5.5.7 Use "SELECT" button for "ZOOM IN"/"ZOOM OUT" operations.
<table>
<thead>
<tr>
<th>Mosaic Video Element</th>
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<th>HE</th>
<th>Mosaic Video Element</th>
<th>Mosaic Video Element</th>
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<td>Client Scaled Video Mosaic Element</td>
<td>Client Scaled Video Mosaic Element</td>
<td>HE</td>
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</table>

Client Scaled Video Mosaic Element overlaps or is generated by the Headend server.

FIG. 51

Mosaic video element generated by the back-end (Headend) server.

Mosaic video element selected by user on the client (set-top box / Digital TV) by scaling original video stream.

Client Scaled Video Mosaic Element

STB
FIG. 52a
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Table 1. DMXEPG with aspect ratio 4x3
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<td>22</td>
<td>MxN</td>
<td>16x9</td>
<td>MxN</td>
<td>4x3</td>
</tr>
<tr>
<td>23</td>
<td>MxN</td>
<td>16x9</td>
<td>MxN</td>
<td>16x9</td>
</tr>
<tr>
<td>24</td>
<td>MxN</td>
<td>16x9</td>
<td>MxN</td>
<td>MxN</td>
</tr>
<tr>
<td>25</td>
<td>MxN</td>
<td>16x9</td>
<td>MxN</td>
<td>4x3</td>
</tr>
<tr>
<td>26</td>
<td>MxN</td>
<td>16x9</td>
<td>MxN</td>
<td>MxN</td>
</tr>
<tr>
<td>27</td>
<td>MxN</td>
<td>16x9</td>
<td>MxN</td>
<td>MxN</td>
</tr>
</tbody>
</table>

Table 3. DMXEPG with aspect ratio MxN
Start page:
Focus on the default mosaic element.
Focus on the mosaic element 5.
User selects to play mosaic element 5

MAIN SCREEN

Scaled Video

Of

Video Stream, which is
linked to the Mosaic Element 5

THE GAMES

Mosaic Video Element 5

Mosaic Video Element 4

Mosaic Video Element 3

KIDS STARC

Mosaic Video Element 1

Mosaic Video Element 2

FIG. 71
Focus on the mosaic element 5.
User selects to show description of event/program info.
Focus on the mosaic element "The Games".
User selects this element (e.g., SELECT button on remote control).
Focus on the mosaic element 7 "Game 1". User may select this element (e.g. by pressing SELECT button on remote control) to play the game.
User moves focus (up/down arrows) on remote control from ME 1 to ME 3.
MAIN SCREEN Video Stream, which is linked to the Mosaic Element 3.

KIDS STARCOM

Mosaic Video Element 1

Mosaic Video Element 2

Mosaic Video Element 3

Mosaic Video Element 4

Mosaic Video Element 5

THE GAMES

User Selects Mosaic Element 3

FIG. 77.
User presses button "DOWN" on the remote control from "THE GAMES" mosaic element.

MAIN SCREEN
- Scaled Video Stream, which is linked to the Mosaic Element 3 of KIDS

KIDS STARCOM
- Mosaic Video 1
- Mosaic Video 2
- Mosaic Video 3
- Mosaic Video 4
- Mosaic Video 5
- Mosaic Video 6
- Mosaic Video 7
- Mosaic Video 8
- Mosaic Video 9
- Mosaic Video 10
- Mosaic Video 11
- Mosaic Video 12

The next page of the featured games.

Fig. 83
<table>
<thead>
<tr>
<th>My List</th>
<th>Default Channel Map</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CNN</td>
<td>2 KTVU (FOX)</td>
</tr>
<tr>
<td>2 MSNBC</td>
<td>4 KRON</td>
</tr>
<tr>
<td></td>
<td>5 KPIX (CBS)</td>
</tr>
<tr>
<td></td>
<td>7 KGO (ABC)</td>
</tr>
<tr>
<td></td>
<td>11 KNTV (NBC)</td>
</tr>
<tr>
<td></td>
<td>14 KDTV</td>
</tr>
<tr>
<td></td>
<td>20 KBWB</td>
</tr>
<tr>
<td></td>
<td>22 KRCB</td>
</tr>
<tr>
<td></td>
<td>26 KTSF</td>
</tr>
<tr>
<td></td>
<td>32 KMTP</td>
</tr>
</tbody>
</table>

User add this channel as next channel in his Channel Map.
<table>
<thead>
<tr>
<th>My List</th>
<th>Default Channel Map</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CNN</td>
<td>2 KTVU (FOX)</td>
</tr>
<tr>
<td>2 MSNBC</td>
<td>4 KRON</td>
</tr>
<tr>
<td>3 KNTV (NBC)</td>
<td>5 KPIX (CBS)</td>
</tr>
<tr>
<td></td>
<td>7 KGO (ABC)</td>
</tr>
<tr>
<td></td>
<td>14 KFTV</td>
</tr>
<tr>
<td></td>
<td>20 KBWB</td>
</tr>
<tr>
<td></td>
<td>22 KRCB</td>
</tr>
<tr>
<td></td>
<td>26 KTSF</td>
</tr>
<tr>
<td></td>
<td>32 KMTP</td>
</tr>
<tr>
<td></td>
<td>36 KICU</td>
</tr>
</tbody>
</table>

The new channel in the user list.
Video Stream (Video or Video Clip), which is linked to the Mosaic Element 8
Electronic Programming Guide Application of another Application

Screen

HGraphics Device

HVideo Device

HBackground Device

FIG. 139
VIDEO for SELECTED Mosaic Element - ME 20

ME 9
ME 10
ME 11
ME 12
ME 13
ME 14
ME 15
ME 16
ME 17
ME 18
ME 19
ME 20
ME 21
ME 22

FIG. 153
DYNAMIC MOSAIC EXTENDED ELECTRONIC PROGRAMMING GUIDE FOR TELEVISION PROGRAM SELECTION AND DISPLAY

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/647,287, filed Jan. 27, 2005 and U.S. Provisional Application No. 60/678,773, filed May 9, 2005, both of which are included by reference in their entirety for all purposes.

BACKGROUND OF THE INVENTION

[0002] Television service providers including cable, satellite, terrestrial, video over internet, IPTV, and others can deliver a large number of channels to subscribers. To choose and select desired program among hundreds of available channels, subscribers can browse channels one by one or use grid or mosaic based Electronic Programming Guides (EPG) by which they might search for possible choices, with the effect to that those subscribers are able to select one or more choices for presentation. However, while they achieve the general goal of allowing users to search and select, known systems are subject to several drawbacks.

[0003] Browsing a large number of channels in a search of a desired show is time consuming and inefficient. For example, to preview currently broadcasted shows subscriber can surf 300 channels one by one while spending 10 seconds on each, requires over 50 minutes, which is, in many cases, longer than subscriber choose to watch television program, or the duration of desired program itself. Grid based EPG, although listing titles of programs for several channels at once, including the option of selecting favorite channels and expediting program selection process, displays on average 2 shows per grid’s channel line, for the total of 600 shows subscriber has to view to select desired show. Moreover, grid based EPG does not allow users to observe the actual video content of several channels at once, thus forcing subscribers to decide on channel and program selection merely from its textual description, and not its actual content. Although some EPGs allow subscribers to preview in PIP a program selected from the grid, still users can not simultaneously observe content of more than one program. Grid based EPGs that allow subscribers to search programs by title or content category, displayed search results still in a textual representation of a matched program; at the same time not including in the search programs available over VOD, local or network PVR, or program available thru other service provider or source.

[0004] Existing mosaic based EPG (MEPG), used by CANAL+ in France for example, is also limiting since it creates pages made of mosaic element each of which is assigned for an extended period of time to a specific channel. CANAL+ offers 3 screens each with 20 elements for the total of 60 channels. However, for such static MEPG, 300 channels may be presented on 15 separate screens forcing a subscriber wishing to find all “News” programs to preview video content of 300 channels by surfing 15 separate screens each with 20 elements. When a subscriber wishes to compare content of two or more channels not present on the same screen, he or she has to toggle between two or more EPG screens, rendering such system as cumbersome, inconvenient, and difficult to use. Such static MEPG systems do not allow subscribers to customize EPG screens to simultaneously display video content of their favorite channels on the same screen. Also, existing MEPG systems, when attempting to group channels by category (e.g. movies, news, cartoons) fail because the same channel broadcasts shows that can belong to different content categories at different times of the day: “Cartoons” in the morning, “Soap Operas” in the afternoon, “News” in the evening, and “Movies” at night. As the result, with the existing MEPG system, when the channels are grouped by category and displayed on the same screen, subscriber that tunes to “cartoons” mosaic EPG page, expecting to see cartoons, actually sees programs that belong to other content categories.

[0005] In U.S Patent Application No. 20040070593, discloses a mosaic-like UI that can be dynamically rearranged in response, in part, to user selection and static metadata about the video titles stored in the library. However, this solution does not work for the television broadcasting environment where each channel’s metadata is not static, but dynamic, since it is being contentiously updated and changed. The ’593 application does not take into account business needs of service provider which might want to auction off locations of some or all of the mosaic elements on some or all MEPG screens to broadcasters or other third parties. The ’593 application does not allow subscribers to simultaneously view video feed from one of any broadcasting channels on one part of the screen while simultaneously accessing MEPG in the remaining portion of the same screen.

[0006] In addition to the difficulties of selecting among a large number of currently broadcasting programs, as described above, subscribers also have many challenges selecting upcoming shows using existing EPGs. Again, to find a show that matches their criteria, subscribers have to review set of hundreds of shows that immediately following currently broadcasting programs plus review another set of hundreds of shows that follow after. This task becomes very arduous because by default programs in the existing grid and mosaic based EPGs are organized by channel and time, but not by program category.

[0007] So, to choose desired program subscribers have to review hundreds of entries most of which do not belong to desired program category. The problem of program selection will be exacerbated in the future when even more channels and programs become accessible to subscribers thanks to proliferation of client PVR, VOD over cable, VOD over Internet, network PVR, and other program delivery methods and service. Not only subscribers would have to review hundreds of available programs many of which are irrelevant to the search since they belong to other program categories, subscribers have to juggle among several EPGs each of which is representing its own service. For example, digital cable service and VOD over cable are represented by their own EPGs, TiVo or ReplayTV PVR services are represented by their own EPGs, and VOD over Internet, like Akimbo, is also represented by its own EPG. With more and more content delivery options, subscribers are forced to spend greater amount of time searching and selecting desired content distributed among various systems represented by own EPGs.
What's more, existing EPG services use textural representation of programs and services, like interactive TV. However, it's been shown that people gravitate towards search of video information not by its textual representation but by its visual representation. The best example of this are display cases of a video store, like Blockbuster. There, latest movie releases are arranged in such a manner as to allow customers to view and select desire program by viewing front covers of the DVD cases. Most DVDs, on their front covers, show a visual representation of the video content that allows them to quickly and easily infer its genre, participating actors, and thus make a selection. Unfortunately, existing EPG services have not been designed to display program's visual representation and allow subscribers to choose desired program by it. Instead, subscribers have to choose desired program by its textual representation.

To simplify content selection process, subscribers ought to have a Content Portal that can allow them to choose desired program based on its visual representation and can consolidate access to programs available over multiple services, including those based on a locally or remotely stored content, and services based on programs broadcasted over various available media. Thus, Content Portal ought to allow subscribers to access currently broadcasted programs, soon to be broadcasted programs, locally stored and remotely stored programs by their visual representation. While consolidating access and selection of programs available over multiple networks, Content Portal should also preserve access to advanced value-added services like interactive television and on-demand advertisement.

In addition to EPGs, subscribers can choose desired program using other program sources including printed TV guides, and TV guides offered over the Internet. There, subscribers have to deal with the same problems of choosing desired content based on its textual representation, but not on its visual representation.

Similarly to the digital TV service providers, providers of digital and satellite radio services like XM and Sirius have not incorporated visual representation of broadcasted or soon to be broadcasted content, although amount of available content over hundreds of available channels is large. Similarly to the digital TV service, subscribers to the digital radio service have to choose desired program based on its textual representation. With hundreds of simultaneously available programs, this task becomes as challenging as selecting video content from digital TV service providers.

**BRIEF SUMMARY OF THE INVENTION**

The invention provides a method and system capable of solving many problems of content preview and selection for visual or audio content offered over digital TV or digital radio networks, and generally a user interface (UI) for accessing content. One aspect of the invention is a method of creating and presenting a Dynamic Mosaic Extended Electronic Programming Guide (DMXEPG) using video, audio, special applications, and service dynamic metadata. The system enables television or digital radio service subscribers to select and display various programs including video, interactive TV applications, or any combination of audio or visual components grouped and presented in accordance with the dynamic program/show metadata, business rules and objectives of service providers, broadcasters, and/or personal subscriber choices. Another aspect of the invention is to print programming guides or guides in electronic form using the same solution of utilizing dynamic metadata to group, consolidate, and display program information with the purpose of allowing subscribers to view and select desired program using program's visual representation.

In accordance with an aspect of the present invention, the system can merge channel programs/shows metadata for multiple services offered by one or more than one service provider using a unique channel identifier, e.g., a service source ID either for digital TV or radio services. Such merger is performed on the backend and merged metadata is displayed on a client device or in a printed program information guide. This invention differs from the mechanism described in U.S. Pat. No. 6,072,983, which describes merging channel metadata on the client side.

In accordance with an aspect of the present invention, an application can be provided on devices with more than one tuner that can simultaneously display video and applications graphics of that application on more than one display.

In accordance with an aspect of the present invention, applications can be provided on devices with more than one tuner that can simultaneously display a program chosen by the subscriber on one portion of the screen, while displaying DMXEPG or its components on the rest of the screen.

In accordance with an aspect of the present invention, metadata from different value-added services can be integrated into a matrix element (ME) of the DMXEPG and displayed to subscribers for currently broadcasted or soon to be broadcasted programs.

In accordance with an aspect of the present invention, integrated metadata can be recorded for later playback.

Further aspects of the present invention include:

(a) it can dynamically assign channels to Mosaic Element (ME) using: continuously updated metadata (programming schedule) about television (broadcasted) channel (EPG programming/listings), criteria received from one or more sources. For example a subscriber, service provider, or third party. Example of third party can be broadcaster, content critic, and the like.

(b) it can dynamically assign iTV applications, Interactive advertisement, VOD program links to Mosaic Element (ME) using criteria received from one or more sources. For example a subscriber, service provider, or third party. Example of third party can be broadcaster, content critic, and the like.

(c) it allows to support DMXEPG where subscribers can simultaneously observe any pre-selected channel chosen by them or video content from other sources, like DVD players or programs offered by another digital TV service provider, on one portion of the screen while observing other ME with or without program related textual information on the rest of the screen.

(d) it allows service providers to collect payments from broadcasters, content owners, or third par-
ties for assigning without service subscriber input their programs to pre-selected ME and DMXEPG screens

[0023] (e) it allows service providers to collect payments from advertisers for assigning, without service subscriber input, logos, videos, or other visual or audio materials to ME or DMXEPG screens

[0024] (f) it allows service providers to create more than one variant of DMXEPG pages, and without subscriber input associate the specific DMXEPG variant to subsets of subscribers. These subscriber subsets can be defined by one or more criteria. For example, subscriber demographic data, capabilities of subscriber device, or capabilities of service provider head-end equipment, etc.

[0025] (g) it simplifies for subscribers channel, program, and iTV application selection, usage of interactive TV applications and DMXEPG by using available buttons on the remote control in conjunction with the optional rotating element integrated into the remote control

[0026] (h) it allows subscribers to customize DMXEPG page which can be set to display in some or all MEs either channels, programs or interactive applications chosen by the subscriber

[0027] (i) it allows subscribers to choose currently broadcasted or upcoming show which are organized according to their type, business rules or service provider, or client equipment capabilities

[0028] (j) it allows subscribers to choose desired program among currently broadcasted or soon to be broadcasted audio or video programs based on their visual representation

[0029] (k) it allows subscribers using services of multiple digital TV or digital radio service providers, to choose desired program from a single programming guide and also use the same programming guide to choose desired program stored either locally or remotely

[0030] (l) it allows subscribers using programming guide to access value added services, like VOD, which are integrated into related ME of DMXEPG. For example, ME displaying currently broadcasting or soon to be broadcasted show can have embedded sign indicating to subscribers availability of previously broadcasted episodes of the same show over VOD service

[0031] (m) it allows to created application on devices with more than one tuner that can simultaneously display video and applications graphics of that application on more than one display, for example allowing subscribers to view and navigate DMXEPG on one display, which can be a touch screen display, and view selected show on another display

[0032] (n) it allows subscribers with devices with multiple tuners to simultaneously view DMXEPG on one portion of the screen while viewing desired program delivered from local or remote source on the other portion of the screen.

[0033] (o) it allows subscribers to record desired program along with metadata of related services like TV commerce, interactive advertisement, VOD, interactive TV applications, and others

[0034] (p) it allows to virtually increase size of displayed video in the ME to improve content recognition by the subscriber by zooming in and truncating source video

[0035] (q) it allows subscribers to search channels by channel name

[0036] (r) it allows subscribers to create one or more customized DMXEPG channel line up by reassigning channel numbers to numbers selected by the subscriber. For example, subscriber can group desired channels by assigning numbers to the channels that would allow channels to be located closely to each other during channel surfing. This system can be implemented by processing original channel line up on the client side or on the headend side

[0037] (s) it allows to create content representation system using ME which is a visual and or audio representation, in addition to the textual description, of accessible content (information) or representation of content category and type.

[0038] (t) it allows subscribers to browse, view, and select desired program from all subscriber accessible content information using DMXEPG which comprises ME

[0039] (u) it allows to pre-search and display to subscribers related information including showing times, channel number, or location (VOD, PVR) of past or upcoming episodes of the show in the selected ME. For example, subscriber reviewing a show in specific ME, can ascertain show times of upcoming or past episodes as well as VOD ordering or PVR start play options

[0040] (v) it allows to indicate to subscribers availability of video trailer or show video preview or related value added service stored on PVR, network PVR, or VOD server on ME representing currently broadcasted or soon to be broadcasted shows

[0041] (w) it allows subscribers to enable content filtering service managed by service provider or third party in addition to or instead of TV Parental Guidance (TVPG) or Motion Picture (MPAA) ratings. For example, based on user preference, DMXEPG service (back-end service suite, client software, or their combination) can deny access to one or more channel, program, or portion of a program in accordance with the criteria managed by either service provider and/or third party.

BRIEF DESCRIPTION OF THE DRAWINGS

[0042] Various aspects of the present invention are described in the following detailed discussion of an illustrative embodiment of the invention. The embodiment is explained in the figures listed below and in the following detailed discussion.

[0043] FIG. 1 is the screen for the first level of multidimensional DMXEPG which, according to the invention, dynamically generated by assigning to ME programs that match program content, business, and subscriber preference rules.
[0044] FIG. 2 is one of the layouts for the second or other levels of DMXEPG which, according to the invention, is dynamically generated by the DMXEPG service, assigning to the MEs the programs that match program content, business, and subscriber preference rules.

[0045] FIG. 3 is the multi-level DMXEPG for the systems with a multi-tuner set-top box (STB) or VOD system.

[0046] FIG. 4 is an example of tri-level DMXEPG access path to the channel.

[0047] FIG. 5 is an anatomy of the ME components used in DMXEPG.

[0048] FIG. 6 is an example of a DMXEPG page dynamically created in the morning hours.

[0049] FIG. 7 is an example of a DMXEPG page dynamically created in the evening hours.

[0050] FIG. 8 is an example of a DMXEPG page generated by an STB with two or more tuners.

[0051] FIG. 9 is an example of a DMXEPG page generated by the service provider.

[0052] FIG. 10 is an example of a DMXEPG page with video channel(s) assigned to ME(s) by the subscriber and facilitated by multi-tuner STB or VOD system.

[0053] FIG. 11 is a DMXEPG page generated when 16 or more programs for selected content category are available at a given time and where the subscriber has the ability to display video that is selected from an ME within another ME.

[0054] FIG. 12 is a DMXEPG page generated when 9 programs for selected content category are available at a given time.

[0055] FIG. 13 is a DMXEPG page generated when 5 programs for selected content category are available at a given time.

[0056] FIG. 14 is an example of a DMXEPG page simultaneously displaying an interactive application on one or more MEs while displaying assigned video programs on another ME, where each ME can have more than one iTV application assigned to it.

[0057] FIG. 15 is a DMXEPG page generated when customer does not have rights to access programs with parental rating exceeding maximum allowed limit.

[0058] FIG. 16 is a DMXEPG page generated when the customer does not have rights to access channels assigned to one or more ME.

[0059] FIG. 17 is a DMXEPG generated by the service provider with one or more MEs displaying a channel for which subscriber is not authorized.

[0060] FIG. 18 is an assignment schedule for existing static DMXEPG.

[0061] FIG. 19 is an assignment schedule for DMXEPG that dynamically assigns channels to MEs.

[0062] FIG. 20 is an assignment schedule for DMXEPG that dynamically assigns programs from different channels to MEs.

[0063] FIG. 21 is a DMXEPG page with rotating interactive content assigned to ME.

[0064] FIG. 22 is a DMXEPG page with rotating interactive applications assigned to ME.

[0065] FIG. 23 is head-end data flow through the Matrix TV Server Suite (MTVSS).

[0066] FIG. 24 shows logical components of the MTVSS.

[0067] FIG. 25 is an algorithm for avoiding TV screen burnout.

[0068] FIG. 26 shows ways to activate the DEPG Client application.

[0069] FIG. 27 shows ways to activate the DMXEPG Client resident application.

[0070] FIG. 28 shows relations between standard MPEG2 transport tables and additional private Interactive Mosaic Tables/descriptors.

[0071] FIG. 29 shows local and national MTVSS configurations.

[0072] FIG. 29a shows MTVSS configurations for DMXEPG screen generation on client device.

[0073] FIG. 30 is a remote control which, in accordance with the invention incorporates a rotating element used by subscribers to navigate DMXEPG or iTV applications.

[0074] FIGS. 31-36 illustrate how to virtually increase size of the video or visual program in the ME for various aspect ratios.

[0075] FIGS. 37-45 illustrate ‘zooming’ in on an ME that is in focus.

[0076] FIGS. 46 and 47 show ‘zooming’ out of an ME.

[0077] FIG. 48 is a general flow chart showing the subscriber steps zooming in and zooming out of an in-focus ME.

[0078] FIG. 49 is a general flow chart showing an alternative process for zooming in and zooming out of an in-focus ME.

[0079] FIG. 50 shows changing the location of an expanded ME on the screen.

[0080] FIG. 51 shows that DMEPX can comprise MEs generated at the headend or on the subscriber (client) side.

[0081] FIG. 52 shows major system elements which allow connection of additional content from any source that is available to subscriber.

[0082] FIG. 52a shows major system elements which allow DMXEPG screen to be created by subscriber device.

[0083] FIG. 53 shows major system elements which allow connection of additional content from more than one additional content source that is available to subscriber.

[0084] FIG. 54 shows major system elements and their connections to enable subscribers to display expanded ME in the DMXEPG using the same content source.

[0085] FIG. 55 shows major system elements and their connections to enable subscribers to display expanded ME in the DMXEPG using more than one content source.
[0086] FIGS. 56-58 show a table that explains how to scale and display video when aspect ratio of DMXEPG, ME, or original video stream, or display are different.

[0087] FIG. 59 shows process of scaling source video to ME when source and destination aspect ratios are or are not the same.

[0088] FIGS. 60-63 show options of assembling DMXEPG when DMXEPG and ME aspect ratios are or are not the same.

[0089] FIGS. 64-69 show various aspects of a Pay Per View portal created with MEs.

[0090] FIGS. 70-90 show various aspects of a UI and navigation with the UI according to the present invention.

[0091] FIG. 91a shows example of UI and navigation of a DMXEPG portal.

[0092] FIGS. 91b, 91c, 91d show DMXEPG UI navigation within specific content category.

[0093] FIGS. 92a, 92b, 92c, 92d show DMXEPG UI navigation and program information following changes in focus of MEs.

[0094] FIG. 93 shows UI and navigation of DMXEPG of future (not yet broadcast) programs.

[0095] FIG. 94 shows an option for enlarging selected ME to larger portion of the screen and the full screen.

[0096] FIGS. 95, 96 shows UI and navigation of DMXEPG in program information display mode when some ME display trailers one ME is in focus and optionally continue to play trailers when focus moves to another ME.

[0097] FIG. 97 shows UI and navigation of DMXEPG in program information display mode.

[0098] FIGS. 98-109 show UI and navigation of DMXEPG in channel browsing mode.

[0099] FIGS. 110-112 show zoom in and zoom out of ME in DMXEPG in show browsing mode.

[0100] FIGS. 113-117 show UI and navigation of DMXEPG in channel browsing mode.

[0101] FIG. 118 shows DMXEPG ability to enter PVR content browsing mode.

[0102] FIG. 119 shows how VOD portal is built with ME.

[0103] FIGS. 120 and 121 show how availability of the same or similar content on VOD system can be indicated in DMXEPG ME as well as grid based EPG.

[0104] FIG. 122 shows a diagram describing process of encapsulation of VOD program metadata into DMXEPG metadata.

[0105] FIG. 123 shows a system that merges metadata for programs supplied by multiple digital TV service providers.

[0106] FIG. 124 shows a system that allows subscribers to select channel auto merge or perform manual channel merge for channels delivered over multiple networks.

[0107] FIGS. 125, 126 show a UI subscriber can access to perform manual merge of channels delivered over multiple networks.

[0108] FIG. 127 shows how subscriber can tune to the desired channel using channel name (for example CNN, HBO, etc) or its mnemonic representation using telephone keypad—letter association.

[0109] FIG. 128 shows set top box with the application that can utilize more than one display for video output, graphics output, or their combination.

[0110] FIG. 129 shows a digital TV set with the application that can utilize more than one display for video output, graphics output, or their combination.

[0111] FIG. 130 shows set top box that runs two applications each of which is using separate display for video output, graphics output, or their combination.

[0112] FIG. 131 shows digital TV set that runs two applications each of which is using separate display for video output, graphics output, or their combination.

[0113] FIG. 132 shows set top box that runs two applications each of which is using a portion of multiple displays for video output, graphics output, or their combination.

[0114] FIG. 133 shows digital TV set that runs two applications each of which is using a portion of multiple displays for video output, graphics output, or their combination.

[0115] FIGS. 134-137 show examples of multi screen applications according to various aspects of the present invention.

[0116] FIGS. 138 and 139 show logical structures of DMXEPG for multiple displays.

[0117] FIGS. 140-148 show system diagrams and UIs for multi-display DMXEPG application implemented with a touch sensitive display.

[0118] FIG. 149 shows remote control that allows subscribers to change focus from one display to another for multi-display applications.

[0119] FIG. 150 shows system diagram of a digital TV set or set top box which enable applications with multi-display functionality.

[0120] FIG. 151 shows a system diagram for a touch screen display that can be used with systems that support multi-display DMXEPG.

[0121] FIG. 152 shows system diagram of a digital TV set or set top box utilizing touch screen display for multi-display DMXEPG or other multi-screen applications.

[0122] FIG. 153 shows DMXEPG screen displayed in three dimensions.

[0123] FIG. 154 shows DMXEPG screen displayed in three dimensions.

DETAILED DESCRIPTION OF THE INVENTION

[0124] Following is a lexicography of terminology used in this specification:

[0125] “Select” button—STB remote control button shown on some remote controls as “Select”, or “OK”, or “Enter”, or under other equivalent name
DMXEPEG—Dynamic Mosaic Extended Electronic Programming Guide

Focus—highlighted or otherwise emphasized screen element

iTV—interactive television. Any content that involves subscriber input and provides response to that input

ME—Mosaic Element

MEC—Mosaic Element Component

pressing a button—the specification discloses a conventional button-based remote control device. However, any suitable control device is contemplated, and it need not necessarily contain buttons which are pressed. It is understood that all references herein to pressing a button refers to activating an action, whether by actual button press or some other action; e.g., a voice command.

Program—any show or event transmitted over a channel

Service Provider—entity that offers video services over cable, satellite, terrestrial digital, video over internet, IPTV, fiber, or other types of infrastructure.

STB—set top box. When applicable, STB may be used as a substitute for the terms Subscriber Device or Client Device. The STB is a device which allows service subscriber to receive and decode digital stream.

VOD—video-on-demand. Service that allows a subscriber to start chosen video program stored by the service provider. Term VOD is also used to substitute term COD (content-on-demand). COD may or may not include video in addition to a combination of audio, interactive, graphical, or any other type of transmittable content.

MTVSS—Matrix TV Server Suite

Tuner—system module that allows to filter desired program stream. For example, program stream can be transmitted over RF network; it can also be transmitted over digital packet delivery network, like Internet.

Following is a list of the reference numerals used in FIGS. 1-127 of the specification:

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Full screen video</td>
</tr>
<tr>
<td>2</td>
<td>Clipped video source</td>
</tr>
<tr>
<td>3</td>
<td>Video processor</td>
</tr>
<tr>
<td>4</td>
<td>Mosaic element processed for insertion into DMXEPEG</td>
</tr>
<tr>
<td>5</td>
<td>Mosaic element inside DMXEPEG</td>
</tr>
<tr>
<td>6</td>
<td>Headend generated DMXEPEG video stream</td>
</tr>
<tr>
<td>7</td>
<td>Remote control</td>
</tr>
<tr>
<td>7a</td>
<td>Arrow Up button</td>
</tr>
<tr>
<td>7b</td>
<td>Arrow Down button</td>
</tr>
<tr>
<td>7c</td>
<td>Arrow Left button</td>
</tr>
<tr>
<td>7d</td>
<td>Arrow Right button</td>
</tr>
<tr>
<td>7e</td>
<td>Zoom in button</td>
</tr>
<tr>
<td>7f</td>
<td>Zoom out button</td>
</tr>
<tr>
<td>7g</td>
<td>Select button</td>
</tr>
<tr>
<td>7h</td>
<td>Info button</td>
</tr>
<tr>
<td>8</td>
<td>Display device</td>
</tr>
<tr>
<td>9</td>
<td>DMXEPEG application screen (video and graphics) displayed on client device</td>
</tr>
<tr>
<td>10</td>
<td>Generic Mosaic Element (Video, Picture, Application, etc. see FIG. 5) that is “in focus”</td>
</tr>
<tr>
<td>11</td>
<td>Video feed scaled by the client device</td>
</tr>
<tr>
<td>12</td>
<td>Full screen video on a client device</td>
</tr>
<tr>
<td>13</td>
<td>Digital TV headend</td>
</tr>
<tr>
<td>14</td>
<td>Client video source (DVD, VCR, Camera, etc.)</td>
</tr>
<tr>
<td>15</td>
<td>Video input in the client device</td>
</tr>
<tr>
<td>16</td>
<td>DVR or PVR video decoder</td>
</tr>
<tr>
<td>17</td>
<td>Digital video decoder</td>
</tr>
<tr>
<td>18</td>
<td>Video tuner (digital/analog)</td>
</tr>
<tr>
<td>19</td>
<td>RF Splitter</td>
</tr>
<tr>
<td>20</td>
<td>RF Switch</td>
</tr>
<tr>
<td>21</td>
<td>Microprocessor</td>
</tr>
<tr>
<td>22</td>
<td>Mosaic Application Memory</td>
</tr>
<tr>
<td>23</td>
<td>RF input</td>
</tr>
<tr>
<td>24</td>
<td>Video Processor (Scaler)</td>
</tr>
<tr>
<td>25</td>
<td>Video Processor Combiner</td>
</tr>
<tr>
<td>26</td>
<td>Client device (e.g., STB/Media center, Digital television system module, video processing card in a PC, any portable wireless device such as a PDA or a cell phone, and so on)</td>
</tr>
<tr>
<td>27</td>
<td>Graphic component of the DMXEPEG application</td>
</tr>
<tr>
<td>28</td>
<td>Interactive Application Canvas (Partial Screen)</td>
</tr>
<tr>
<td>29</td>
<td>DMXEPEG Screen Title</td>
</tr>
<tr>
<td>30</td>
<td>Interactive Application Canvas (Full Screen)</td>
</tr>
<tr>
<td>31</td>
<td>Original DMXEPEG video feed with aspect ratio 4 x 3</td>
</tr>
<tr>
<td>32</td>
<td>Original DMXEPEG video feed with aspect ratio 16 x 9</td>
</tr>
<tr>
<td>33</td>
<td>Original DMXEPEG video feed with aspect ratio M x N</td>
</tr>
<tr>
<td>34</td>
<td>ME with aspect ratio 4 x 3</td>
</tr>
<tr>
<td>35</td>
<td>ME with aspect ratio 16 x 9</td>
</tr>
<tr>
<td>36</td>
<td>ME with aspect ratio M x N</td>
</tr>
<tr>
<td>37</td>
<td>Background</td>
</tr>
<tr>
<td>38</td>
<td>DMXEPEG video stream on display</td>
</tr>
<tr>
<td>39</td>
<td>Screen Title (also referred to as Screen name)</td>
</tr>
<tr>
<td>40</td>
<td>Current Time</td>
</tr>
<tr>
<td>41</td>
<td>Screen branding area</td>
</tr>
<tr>
<td>42</td>
<td>ME with the “IDLE focus”</td>
</tr>
<tr>
<td>43</td>
<td>The Show/program title bar</td>
</tr>
<tr>
<td>44</td>
<td>The Show/program title bar which is belongs to the focused mosaic element</td>
</tr>
<tr>
<td>45</td>
<td>Show/program description</td>
</tr>
<tr>
<td>46</td>
<td>The sign to show ability to scroll description information</td>
</tr>
<tr>
<td>47</td>
<td>Screen title</td>
</tr>
<tr>
<td>48, 50</td>
<td>(unused)</td>
</tr>
<tr>
<td>51</td>
<td>ME HIE</td>
</tr>
<tr>
<td>52</td>
<td>ME STB</td>
</tr>
<tr>
<td>53</td>
<td>ME video loop</td>
</tr>
<tr>
<td>531</td>
<td>ME audio loop</td>
</tr>
<tr>
<td>54</td>
<td>ME image</td>
</tr>
<tr>
<td>55</td>
<td>ME Application</td>
</tr>
<tr>
<td>56</td>
<td>ME link to the Application</td>
</tr>
<tr>
<td>57</td>
<td>ME link to the video program chosen by a subscriber</td>
</tr>
<tr>
<td>58, 59</td>
<td>(unused)</td>
</tr>
<tr>
<td>60</td>
<td>ME video (HIE or STB)</td>
</tr>
<tr>
<td>61</td>
<td>ME picture</td>
</tr>
<tr>
<td>62</td>
<td>ME Application</td>
</tr>
<tr>
<td>63</td>
<td>ME Game (may include any combination of 51, 52, 53, 54, 55, or 56)</td>
</tr>
<tr>
<td>64</td>
<td>ME Entry to the Games or Game Categories list</td>
</tr>
<tr>
<td>65</td>
<td>The Game title bar</td>
</tr>
<tr>
<td>66</td>
<td>The game title bar belongs to the focused Game Mosaic Element</td>
</tr>
<tr>
<td>67</td>
<td>ME Game in PAUSE state</td>
</tr>
<tr>
<td>68</td>
<td>ME Game Category (may include any combination of 51, 52, 53, 54, 55, or 56)</td>
</tr>
<tr>
<td>69</td>
<td>The Game Category screen title, which includes name of the game category and branding area</td>
</tr>
<tr>
<td>70</td>
<td>ME Program/show-event (may include any combination of 51, 52, 53, 54, 55, or 56)</td>
</tr>
<tr>
<td>71-79</td>
<td>(unused)</td>
</tr>
<tr>
<td>80</td>
<td>ME - entry to the Program Browser Mosaic for specific category (may include combination of 51, 52, 53, 54, 55, or 56)</td>
</tr>
</tbody>
</table>

-continued
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>ME: Link to the application</td>
</tr>
<tr>
<td>82</td>
<td>ME: Link to the channel browser</td>
</tr>
<tr>
<td>83</td>
<td>ME: Link to the VOD program browser</td>
</tr>
<tr>
<td>84</td>
<td>ME: Link to the PVR recorder program browser or to the Program Grid</td>
</tr>
<tr>
<td>85</td>
<td>Creeping line</td>
</tr>
<tr>
<td>86</td>
<td>ME: headend generated video</td>
</tr>
<tr>
<td>87</td>
<td>ME: STB generated scaled video</td>
</tr>
<tr>
<td>88</td>
<td>Generic Mosaic Element in the focus in the DESCRIPTION (info) MODE</td>
</tr>
<tr>
<td>89</td>
<td>Sign &quot;PLAY&quot;, which indicates that user may play scaled/full screen video for this mosaic element (video loop is stored on STB HD or on the VOD server)</td>
</tr>
<tr>
<td>90</td>
<td>Non-broadcast program video-on-demand (VOD)</td>
</tr>
<tr>
<td>91</td>
<td>Non-broadcast program. Program is recorded by PVR. This program belongs to the selected program category (KIDS)</td>
</tr>
<tr>
<td>92</td>
<td>Infonferential title</td>
</tr>
<tr>
<td>93</td>
<td>ME: Infonferential</td>
</tr>
<tr>
<td>94</td>
<td>The Title of the program, which is belongs to the selected channel</td>
</tr>
<tr>
<td>95</td>
<td>The Title of the currently broadcasted program, which is belongs to the selected channel</td>
</tr>
<tr>
<td>96</td>
<td>Infonferential description</td>
</tr>
<tr>
<td>97</td>
<td>ME, which is in LOST focus, focus on the listings line</td>
</tr>
<tr>
<td>98</td>
<td>The title of the program in the focus</td>
</tr>
<tr>
<td>99</td>
<td>Program description ME with the focus on it</td>
</tr>
<tr>
<td>100</td>
<td>The Title of the program for specific channel</td>
</tr>
<tr>
<td>101</td>
<td>The Title of the program for the focused ME</td>
</tr>
<tr>
<td>102</td>
<td>Program Grid</td>
</tr>
<tr>
<td>103</td>
<td>ME, which is an entry to the specific VOD category</td>
</tr>
<tr>
<td>104</td>
<td>Sign on the program title bar, which indicates that this program or similar programs are available on VOD system</td>
</tr>
<tr>
<td>105</td>
<td>EPG National Meta Data Server</td>
</tr>
<tr>
<td>106</td>
<td>EPG Local Meta Data Server</td>
</tr>
<tr>
<td>107</td>
<td>Local VOD Assets server</td>
</tr>
<tr>
<td>108</td>
<td>EPG data encapsulator</td>
</tr>
</tbody>
</table>

**[0139]** Following is a list of the reference numerals used in FIGS. 128-152 of the specification:

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Display device</td>
</tr>
<tr>
<td>2</td>
<td>The screen of the display device</td>
</tr>
<tr>
<td>3</td>
<td>Generic input for video and/or data</td>
</tr>
<tr>
<td>4</td>
<td>Composite Audio/Video Input</td>
</tr>
<tr>
<td>5</td>
<td>DVI 1.0 Digital HDTV input with HDCP Copy Protection</td>
</tr>
<tr>
<td>6</td>
<td>IEEE 1394 Digital Input with SC copy protection</td>
</tr>
<tr>
<td>7</td>
<td>USB input</td>
</tr>
<tr>
<td>8</td>
<td>WIRELESS connection</td>
</tr>
<tr>
<td>9</td>
<td>DVI 1.0 Digital HDTV output with HDCP Copy Protection</td>
</tr>
<tr>
<td>10</td>
<td>IEEE 1394 Digital output with SC copy protection</td>
</tr>
<tr>
<td>11</td>
<td>USB output</td>
</tr>
<tr>
<td>12</td>
<td>WIRELESS connection</td>
</tr>
<tr>
<td>13</td>
<td>a client device (e.g., STB/Media center, Digital television system module, video processing card in a PC, any portable wireless device such as a PDA or a cell phone, and so on)</td>
</tr>
<tr>
<td>14</td>
<td>Video/Data connection for the wired implementation or videodataflow for wireless connection</td>
</tr>
<tr>
<td>15</td>
<td>Remote control receiver device</td>
</tr>
<tr>
<td>16</td>
<td>Remote Control device</td>
</tr>
<tr>
<td>17</td>
<td>Interactive Application Canvas (Partial Screen)</td>
</tr>
<tr>
<td>18</td>
<td>Generic Mosaic Element in focus</td>
</tr>
<tr>
<td>19</td>
<td>Generic Mosaic Element</td>
</tr>
<tr>
<td>20</td>
<td>Full Screen Video</td>
</tr>
<tr>
<td>21</td>
<td>Program Title bar in focus</td>
</tr>
<tr>
<td>22</td>
<td>Program Title bar</td>
</tr>
</tbody>
</table>

**[0140]** Aspects of a user interface in accordance with the present invention are explained in detail in the illustrative embodiment of the present invention disclosed below relating to electronic program guides for accessing broadcast content. It will be appreciated by one of ordinary skill that any type of content can be accessed using a user interface that incorporates the various elements disclosed hereinbelow.

**[0141]** FIG. 1 is a DMXEPC main page (EPG screen) which, in accordance with the invention, displays multi-dimensional UI with dynamically assigned programs, ITV applications, video loops, icons, sound, pictures or any other content components to each ME taking into consideration service provider infrastructure and subscriber STB capabilities, business rules of service provider; business rules of a broadcaster, customer profile: geographic location, time of the day in the location, past personal preferences; channel metadata, program properties, and other program or subscriber relevant data. Subscriber can observer multiple video streams displayed on the screen and navigate the screen by changing the focus from any one displayed object to another displayed object. For the subscriber, a change in focus is indicated by visual or audio elements; for example, a beeping noise can be emitted, and visual cues such as blinking or highlighted outlines can be presented. Once in focus, ME enables audio for the corresponding program and gives the
ability to the subscriber to trigger predefined response once
the subscriber presses “Enter” on the remote control or STB.

[0142] Returning to FIG. 1, the DMXEPG main page can
accommodate various numbers and sizes of displayed MEs.
Program types that are assigned to the MEs can be added,
removed, or relocated. The number of programs assigned to
one ME and their rotation schedule. Changes to the DMX-
EPG main page can be triggered by time of the day, day of
the week, week of the month, etc., special events, or other
program or business criteria.

[0143] FIG. 1 shows the MEs as rectangle-shaped ele-
ments. However, it is possible to use other shapes for the
MEs; e.g., circular MEs, elliptical, other polygonal shapes,
combinations of various shaped MEs, and so on. However,
for the specification, rectangle-shaped MEs will be dis-
cussed.

[0144] FIG. 2 is DMXEPG second or lower level screen
which, in accordance with the invention, comprises dynami-
cally assigned MEs. This means that each ME is assigned to
a program that matches predefined content category while
taking into consideration criteria such as program properties,
business rules of the service provider, business rules of a
broadcast, customer profile, and preferences. Similarly to
DMXEPG main screen, a subscriber can navigate the page,
change focus from any to any screen elements and by
pressing “Enter” on the remote control or STB, thus trig-
gering predefined response. Such response includes display
of a lower level DMXEPG screen; launch of iTV applica-
tion; tuning to a channel; switch of audio channel; display of
the text synchronized with audio track (closed captioned or
subtitles); information for the current or the next program,
or other predefined action.

[0145] FIG. 3 is multi-dimensional DMXEPG which, in
accordance with the invention, enables a subscriber to view
and select ongoing programs which are grouped, among
other criteria, by content category, thus simplifying and
expediting a task of identifying, viewing, comparing, and
selecting one of desired programs. The system is capable of
dynamically generating necessary number of DMXEPG
levels to expose to subscribers some or all programs in a
content category and satisfy business and technical objec-
tives of broadcaster and service provider.

[0146] FIG. 4 is DMXEPG arranged in two levels. DMX-
EPG screen of the first level displays content categories and
matched video feeds. Subscribers by moving focus on the
screen switch corresponding audio and by pressing “Enter”
view larger number of video feeds that match content category
in the DMXEPG second level screen. There, by pressing “Enter” on focused ME subscribers may leave
DMXEPG and trigger STB to tune to a channel which is
carrying currently displayed program.

[0147] FIG. 5 shows the composition of an ME. Each ME
can include any number of the following components (each
component being referred to as “media content”, or simply
“content”): video program selected by the service provider;
video channel chosen by a subscriber; video program chosen
by a subscriber; video loop from broadcast stream, RAM, or
hard drive; image; service provider or subscriber chosen iTV
application as well as a link to iTV application. When
applicable, an ME can include: channel number, program
name, program status bar which displays program remaining
time. When permitted by STB or service provider infrastruc-
ture (for example dual tuner STB or VOD system) sub-
scriber can select channel assigned to the ME.

[0148] FIG. 6 shows a DMXEPG that was generated in the
morning hours. The figure shows that the DMXEPG
matches most common subscriber program preferences or
service provider or broadcaster business objectives. On the
other hand, FIG. 7 shows a DMXEPG generated in the
evening hours which matches most common subscriber
program preferences or service provider or broadcaster
business objectives. As can be seen between FIGS. 6 and 7,
the same level DMXEPG screen has different program compo-
position in the morning and evening hours.

[0149] FIG. 8 shows a DMXEPG screen configured with
peripheral MEs of different sizes. A subscriber moves the
focus to a desired peripheral ME, presses “Select” or its
equivalent button on the remote control or STB and a larger
ME in the center of the display switches its video program
and its audio to the program that matches the in-focus ME.
This capability is possible on STBs with two or more tuners
or on an infrastructure that supports a VOD system.

[0150] FIG. 9 is a DMXEPG screen similar to the screen
in FIG. 8, but for a configuration where the STB has only
one tuner and where there is no VOD system. In this
configuration, the service provider assigns a program to the
center ME. When the focus is changed from one peripheral
ME to another, only the audio can be switched. The “Select”
button allows subscriber to switch to the next DMXEPG
level or to tune to desired program.

[0151] FIG. 10 is a DMXEPG screen comprising some
MEs which display programs assigned by the service pro-
vider and other MEs which display channels or iTV applica-
tions selected by the subscriber. This functionality can be
provided by an STB with multiple tuners or by a VOD
system.

[0152] FIG. 11 is a DMXEPG screen which is generated
with 16 peripheral MEs. The number of displayed MEs and
their location was generated by the system which takes into
account number of available programs that match selected
content category, iTV applications and favorite channels
selected by subscriber, TV screen size and resolution.

[0153] FIG. 12 is a DMXEPG screen which is generated
with 9 peripheral MEs. The number of displayed MEs and
their location was generated by the system which takes into
account number of available programs that match selected
content category, iTV applications and favorite channels
selected by subscriber, TV screen size and resolution.

[0154] FIG. 13 is a DMXEPG screen which is generated
with 5 peripheral MEs. The number of displayed MEs and
their location was generated by the system which takes into
account number of available programs that match selected
content category, iTV applications and favorite channels
selected by subscriber, TV screen size and resolution.

[0155] FIG. 14 is a DMXEPG screen with some MEs
having association to more than one iTV application. Pointer
to iTV applications can be assigned by the service provider
and by subscriber. Multiple iTV applications assigned to
an ME are displayed one at a time and can rotate at preset
or default time interval. Subscriber can link any accessible iTV
application to desired ME.
FIG. 15 is a DMXEPG screen showing the case when some MEs are set to display programs that match screen content criteria but fail subscriber parental rating limit. In such a case, subscriber has an option to enter PIN code to let a DMXEPG client application remove overlay and display programs that fail parental rating limit. If subscriber does not enter correct PIN code, programs that exceed parental rating limit will continue to be blocked. MEs with blocked programs can be overlaid with static on-screen display (OSD) image. The DMXEPG client application allows the user to navigate the DMXEPG hierarchy (e.g., as shown in FIG. 3) on the client device.

FIG. 16 is a DMXEPG screen showing the case when video or audio content that is removed from some MEs; for example as a result of “blackout” properties using head-end’s conditional access information (sports events can be blacked out). The Matrix SuperSplit server discussed below can dynamically replace a program marked as “blackout” by another program. Alternatively, Interactive Mosaic Client Application may use static OSD image or text to indicate cells with blackout properties or mark ME and disallow subscriber to set focus to that cell.

FIG. 17 is a DMXEPG screen showing the case when video or audio content is removed by the DMXEPG client application from the MEs because subscriber has not been authorized to access that channel. Service provider can choose to disallow subscriber to set “focus” to the ME for the duration of program on non-authorized channel, or corresponding audio.

FIG. 18 is a conventional DMXEPG with channels statically assigned to the MEs. The channels assigned to the DMXEPG are shown below, illustrated in a conventional programming guide format. Each ME represents a channel and not a program. ME association to the channel does not change for the extended period of time. Each DMXEPG screen displays semi-permanent group of channels.

FIG. 19 is an example of a schedule for a DMXEPG screen composition according to an aspect of the present invention with its MEs being assigned and reassigned to channels to match service provider or broadcaster business rules. For explanatory purposes, the schedule of channels that are assigned to this DMXEPG screen are illustrated below the DMXEPG screen in conventional programming guide format.

FIG. 20 is an example of schedule for DMXEPG screen composition according to an aspect of the present invention with its MEs being assigned and reassigned to different channels with programs that match pre-defined content category for that ME. For explanatory purposes, the schedule of channels that are assigned to this DMXEPG screen are illustrated below the DMXEPG screen in conventional programming guide format.

FIG. 21 is an example of a DMXEPG that incorporates an iTV application in one ME. To prevent screen’s burnout, iTV data is rotated, and its position is continuously changed. If a subscriber selects an ME to which an iTV application is assigned, additional information related to that iTV application can appear on a creeping line. Also, to prevent screen burnout information in the creeping line is rotated among application or disappears after timeout.

FIG. 22 is a DMXEPG page with one of its ME allocated to a group of iTV applications. iTV applications share an ME’s space and rotate, appearing one at a time for pre-set time interval.

FIG. 23 is a head-end data flow through MTVSS. MTVSS gets raw EPG data from an EPG listings data provider (e.g. Tribune Media Services, TV Guide, or TV-Anytime). Available data delivery mechanisms include downloading from an FTP site, a Virtual Private Network, or a Data Broadcast Carousel. MTVSS imports raw EPG data into the MTVSS database. In most cases, EPG listings data provider supplies accurate data, which includes local programming, for 14 days.

MTVSS filters all programs by program category, subcategory, and genre. The figure depicts filtering by program subcategory “CARTOONS”. As a result of this data processing, system creates record set of all programs during the next 14 days across multiple channels (uniquely identified by source_id) and multiple head-ends (cable, satellite, or other) with the subcategory “CARTOONS”.

MTVSS will process data set made during step 233 and generate Interactive Mosaic channel insertion schedule for all channels that includes “CARTOONS” programs across multiple head-ends. MTVSS will generate schedule for short period (e.g., 1 day), because EPG schedule might dynamically change even inside 14 days windows.

On the local head-end MTVSS will apply (step 235) the local channel lineup, local business rules (e.g., channel priorities, non-video interactive mosaic element components), local conditional access rules (e.g., program rating, blackout), “last-minute” listings update data.

After step 235, MTVSS will generate real-time insertion schedule 236 for CARTOON programs which are broadcasted on this local head-end.

FIG. 24 shows logical components of the MTVSS. EPG listings data aggregator server 241 provides data to the Matrix Meta Data Server (MMDs). Daily, EPG data server refreshes data set and provides listings data for the next 14 days. The daily data set is the most accurate for the next day. There are two ways to retrieve the data: data “push” and data “pull”. For example Tribune Media Services (TMS) provides the “pull” method using their secure FTP site. To get data from TMS, MMDs uses a secure ftp connection to retrieve EPG listings data.

Matrix Remote Monitoring Terminal (MRMT) 242 is a web based interface that allows a system operator to access MTVSS. Once authenticated, the system operator accesses tasks and processes enabled by his security level. The system operator can perform a number of functions including: retrieval of Matrix Meta Data Server status, retrieval of Matrix Scheduler status, retrieval of Matrix SuperSplit status, and retrieval of logs, traces, and statistics for all MTVSS components. Matrix remote management portion of MRMT is a web based interface that allows the system operator to access MTVSS. Depending on granted permissions, the system operator can manage specific tasks and processes. The system operator can perform the following functions: start and stop any process on any MTVSS component, update configuration parameters for any MTVSS component.
Matrix Meta Data Server 243 comprises four components: Data Delivery Manager, Data Translation Manager, Data Cache Manager, and Matrix National resolution EPG database.

Data Delivery Manager (DDM) is designed to retrieve EPG data from data aggregator server and store data in the local database. Data Delivery Manager can be customized with configuration file which includes data delivery schedule and secure connection login parameters (e.g. secure ftp connection). DDM can deliver data from multiple data sources (e.g. Tribune Media Services, TV Guide, TV-Anytime).

Data Translation Manager (DTM) translates and converts original EPG data using Data Translation Plug-ins (DTP). DTM may support multiple DTPs for different EPG data providers (e.g. one for TMS, one for TV Guide, etc.).

Data Cache Manager provides database interface for all MDMs tasks.

Matrix National resolution EPG database stores original EPG data (retrieved from EPG aggregation server) and data translated to the Matrix Meta Data database. This database stores the channel lineup for all service providers in a region.

Matrix Scheduler (MS) 244 receives and retrieves the following data:

Matrix Local resolution EPG database data (for specific head-end, or set of head-ends) from Matrix Meta Data Server.

Additional conditional access data (e.g. program rating, program blackout, etc.) from local digital access controller (e.g. DAC 6000—Motorola head-end, DNCS—Scientific Atlanta head-end, DCAS server).

“Last minute” program update data from EPG listings update terminal 245

Enhanced data and Interactive Application insertion Terminal (EIAT) 247. EIAT provides data for all mosaic element components except “video program selected by service provider” e.g.:

Images
Video loops
Audio loops
Interactive applications
Still images
Texts
Interactive advertisement

Content Filtering Criteria received from either service provider or third party.

Matrix scheduler comprises five major components: Local Headend Configuration Manager, STB Mosaic GUI Configuration Manager, DMXEPG Application Configuration Manager, Mosaic Meta Data generator, and Matrix Local resolution EPG database importer. Local Headend Configuration Manager is designed to apply local technical (e.g. channel lineup, MPEG2/DCII SUP/SIP tables configuration) and business rules (e.g. channel assignment priority) to the final program mosaic video stream and mosaic meta data. STB Mosaic GUI Configuration Manager allows a service provider to configure the graphical user interface and provides navigation for the DMXEPG Client application.

Mosaic meta data generator builds Interactive Mosaic descriptor, Interactive Mosaic Master Table, control and scheduling data for the Matrix SuperSplit, and additional mosaic meta data discussed in more detail below. Matrix Local resolution EPG database importer stores EPG listings data in the local database.

Real time or manual EPG listings update terminal 245 is a web based interface that allows system operator to update EPG listings data on local and national head-end before broadcasting.

Matrix Scheduler Configuration terminal 246 is a web based interface that allows system operator to configure program mosaic video stream, DMXEPG Client Application, insert local technical information, insert local business rules, and assign mosaic element components (FIG. 5) to the different mosaic elements.

Enhanced data and Interactive application insertion terminal 247 is a web based interface that allows system operator to insert/assign mosaic element components (FIG. 5) to the Interactive mosaic. Matrix SuperSplit (MSS) 248 is a real time digital video processor which can:

Tune to the scheduled channel and program using Matrix Scheduler control information
Compose mosaic video stream
Compose mosaic audio stream
Encapsulate Interactive Mosaic private data
Encapsulate modified Service Information tables

The MSS receives:

private interactive mosaic tables descriptors, mosaic element components scheduling data (for example, which broadcasted video program should be inserted in the final mosaic video stream) from Matrix Scheduler

additional mosaic element components content (e.g., video/audio loops) from Enhanced data and Interactive application insertion terminal 247

video feed which includes all channels sent by service provider

The MSS composes the final mosaic digital stream which comprises:

Mosaic video stream
Multiple audio streams, if applicable
DMXEPG Client Application, if applicable
Modified Service Information Data (E.g. PMT, SDT, CVT), if applicable
Private Interactive Mosaic tables and descriptors
QAM/upconverter 249 (or its IPTV equivalent) modulates Matrix SuperSplit output
RF combiner 2410 (or its IPTV equivalent) combines original video feed with the Interactive Mosaic Virtual channel.

FIG. 25 is an algorithm to minimize or eliminate TV screen “burnout” caused by an interactive mosaic which may comprise a number of static graphics elements like “non-video” mosaic element components, mosaic screen background, and mosaic screen creeping line. To prevent TV screen “burnout”, system uses a combination of following rules and actions:

For “non-video” mosaic components (e.g. image, text, application):

Dynamically change position of the mosaic element with “non-video” mosaic component. In this case we have to regenerate mosaic video feed by MSS 248 and interactive mosaic private tables/descriptors by MS 244.

Dynamically rotate multiple “non-video” mosaic components, using transition effects (e.g. rotate weather application and market stock application).

Dynamically change text/images positioning inside static mosaic element

For Mosaic screen background:

Try do not use gaps between video cells

Dynamically change mosaic screen background

Use transition effects during background image update

Use intelligent timeout for mosaic creeping line

FIG. 26 and FIG. 27 show ways to activate the DMXEPG Client application (DMXEPG-C). The DMXEPG-C can be downloaded to the STB RAM memory via any available transport mechanisms:

In band data carousel (e.g. DSMCC)

In band private tables or message (MPEG2—private section, DCI—text message)

VBI data

Return path interactive channel

Out of band data carousel

Out of band private messaging

DMXEPG-C also can be stored in the available medium such as flash memory, hard drive, or another STB’s persistent storage as STB’s resident application. There are two scenarios to activate DMXEPG-C, depending on its location. FIG. 26 shows activation process when DMXEPG-C is downloaded to the box after subscriber tunes to the mosaic channel. FIG. 27 shows activation process when DMXEPG-C is stored in the STB persistence storage.

FIG. 28 shows relation between standard MPEG2 transport tables and additional private Interactive Mosaic Tables and descriptors. Following is a discussion of the descriptors and tables showing an example of the syntax for Interactive Mosaic Descriptor and Interactive Mosaic Master Table.

Interactive Mosaic Private Tables and Descriptor (MPEG 2 Private Section)

The interactive mosaic descriptor can be located in the following MPEG 2/ATSC SI/PSIP/DVB S1 tables:

ATSC PSIP:
- Virtual Channel Table (VCT)
  - Satellite_virtual_channel( ) - descriptors loop
  - SMATV_virtual_channel( ) - descriptors loop
  - Broadcast_virtual_channel( ) - descriptors loop
  - Virtual_channel( ) - descriptor loop

DVB S1:
- Service Description Table (SDT) - descriptors loop
- MPEG 2
  - Program Map Table (PMT)
    - TS_program_map_section( ) - program_info descriptor loop

A digital program which carries interactive mosaic can include the interactive mosaic descriptor inside its Program Map section in the program information descriptors loop.

TABLE 1

<table>
<thead>
<tr>
<th>Syntax of private Interactive Mosaic Descriptor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syntax</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Interactive_mosaic_descriptor( ){</td>
</tr>
<tr>
<td>Descriptor_tag</td>
</tr>
<tr>
<td>8 1</td>
</tr>
<tr>
<td>Descriptor_length</td>
</tr>
<tr>
<td>8 1</td>
</tr>
<tr>
<td>For (j=0; j&lt;NE_table_id; j++){</td>
</tr>
<tr>
<td>MatrixTV_table_id</td>
</tr>
<tr>
<td>8 1</td>
</tr>
<tr>
<td>}</td>
</tr>
</tbody>
</table>

TABLE 2

<table>
<thead>
<tr>
<th>MatrixTV_table_id</th>
<th>Matrix TV data stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>0xD0</td>
<td>Interactive Mosaic Master Table</td>
</tr>
<tr>
<td>0xD1</td>
<td>Interactive Mosaic Resources Table</td>
</tr>
<tr>
<td>0xD2</td>
<td>Interactive Mosaic Applications Table</td>
</tr>
<tr>
<td>0xD3</td>
<td>Reserved</td>
</tr>
<tr>
<td>0xD4</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
### TABLE 3
**Syntax of Interactive Mosaic Master Table (IMMT)**

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Bits</th>
<th>Bytes</th>
<th>Mnemonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interactive_mosaic_master_table(</td>
<td>) {</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Table_id (see table 1)</td>
<td>1</td>
<td>0.5</td>
<td>bbf</td>
</tr>
<tr>
<td>Reserved_future_use</td>
<td>1</td>
<td>0.5</td>
<td>bbf</td>
</tr>
<tr>
<td>Reserved</td>
<td>2</td>
<td>1</td>
<td>bbf</td>
</tr>
<tr>
<td>Section_length</td>
<td>12</td>
<td>2</td>
<td>Uimsbf</td>
</tr>
<tr>
<td>Table_id_extension</td>
<td>16</td>
<td>2</td>
<td>Uimsbf</td>
</tr>
<tr>
<td>Reserved</td>
<td>2</td>
<td>1</td>
<td>bbf</td>
</tr>
<tr>
<td>Version_number</td>
<td>5</td>
<td>1</td>
<td>Uimsbf</td>
</tr>
<tr>
<td>Current_next_indicator</td>
<td>1</td>
<td>0.5</td>
<td>bbf</td>
</tr>
<tr>
<td>Section_number</td>
<td>8</td>
<td>1</td>
<td>Uimsbf</td>
</tr>
<tr>
<td>Last_section_number</td>
<td>8</td>
<td>1</td>
<td>Uimsbf</td>
</tr>
<tr>
<td>Interactive_mosaic_entry_level</td>
<td>1</td>
<td>0.5</td>
<td>bbf</td>
</tr>
<tr>
<td>Reserved</td>
<td>7</td>
<td>1</td>
<td>Bbf</td>
</tr>
<tr>
<td>For(=0;mosaic.component.count&gt;1;++)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>mosaic_element_id</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>mosaic_element_type</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mosaic_cell_record_length</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>On_left_key_press_mosaic_element_id</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>On_right_key_press_mosaic_element_id</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>On_up_key_press_mosaic_element_id</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>On_down_key_press_mosaic_element_id</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Horizontal_offset</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Vertical_offset</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Vertical_size</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mosaic_element_components_count</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>For(=0;mosaic.component.count&gt;1;++)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeat_flag</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If(repeat_flag ==0){</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Start_time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>}</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duration_in_seconds</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mosaic_element_component_descriptor( )</td>
<td>5</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 4
**Syntax of mosaic element component descriptor**

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Bits</th>
<th>Bytes</th>
<th>Mnemonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>mosaic_element_component_descriptor(</td>
<td>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Descriptor_tag</td>
<td>8</td>
<td>1</td>
<td>uimsbf</td>
</tr>
<tr>
<td>If(descriptor_tag == 0x01){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Video_stream_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CA_descriptor( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x02){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Audio_stream_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CA_descriptor( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x03){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Video_loop_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CA_descriptor( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x04){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Audio_loop_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>CA_descriptor( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x05){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Still_picture_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 4-continued**

<table>
<thead>
<tr>
<th>Syntax</th>
<th>Bits</th>
<th>Bytes</th>
<th>Mnemonic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x06){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Image_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x07){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Application_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If(descriptor_tag == 0x08){</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Private_data_locator( )</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>}</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[0234] The resource locators’ descriptors and Interactive Mosaic Resources Table and Interactive Mosaic Application Table are protocol/transport depended (may be one for DVB SI, one for ATSC PSIP, one for OCAP, one for DSMCC).
FIG. 29 shows local and national MTVSS configurations. MTVSS have three configuration options: National-1 (MTVSS-N1), National-2 (MTVSS-N2), and Local (MTVSS-L).

a) MTVSS-N1 291 generates local real-time program insertion schedule in the national network operation centre (NNOC) and delivers the data to the local Matrix SuperSplit server(s), which generates DMXEPG screens.

b) MTVSS-N1 292 generates local video stream generated by the Matrix SuperSplit server(s) located in NNOC. This option has better scalability because it does not require any changes on a local head-end where DMXEPG screens are delivered over existing digital TV infrastructure.

c) MTVSS-L 293 generates local real-time program insertion schedule using local Matrix Scheduler Server(s) and delivers the data to the local Matrix SuperSplit server(s), which generates DMXEPG screens.

FIG. 29a shows MTVSS configurations for DMXEPG screen implementation on client device. MTVSS implementation in 294 comprises a Matrix Scheduler as part of service provider backend. That configuration allows service provider to control ME mosaic element presentation criteria.

The MTVSS implementation in 295 consists of Matrix Scheduler as part of subscriber device. That configuration allows subscriber or third party to control ME mosaic element presentation criteria. The criteria service provider can be any third party that provides mosaic element presentation criteria that is used by the Matrix Scheduler. The criteria service provider can be the manufacturer of the client subscriber device. The criteria service provider can be the subscriber. In the general case, the mosaic element presentation criteria may comprise criteria from any combination of third party providers, the manufacturer, and/or the subscriber.

Mosaic element presentation criteria can be delivered using any suitable delivery medium including an Internet connection, a dial-up service, over the airwaves, satellite link, cable link, and so on. The subscriber can be provided with criteria on a CD that can be installed in the subscriber device.

FIG. 30 shows remote control which, in accordance with the invention, incorporates rotating element which can be used by subscriber to simplify navigation of DMXEPG or any iTV application. Subscriber can manipulate the rotating element by rotating it up or down, as well as pushing it toward or away from himself, or depressing it into the remote control, or finally releasing it after it has been depressed into the remote control. STB maps movements of the rotating element with the DMXEPG or iTV application functions.

FIG. 31 shows how to “virtually” increase the size of the video or visual program displayed in an ME since the ME size can be too small to show the entire video in a discernible manner. To solve the problem, the video or visual program can be virtually expanded by clipping less critical area around the center of the video and stretching the remaining video to fill in a ME. The figure shows clipping to extract a central portion of the video. The user can clip other regions of the video to extract portions of the video other than the central portion.

Numerous combinations of aspect ratios of video sources and aspect ratios of the display area are possible. Typical combinations include:

- a 16x9 video source converted to a 4x3 ME
- a 4x3 video source converted to a 16x9 ME
- a 16x9 or a 4x3 video source converted to an ME of non standard aspect ratio

To virtually increase the size of the video, it is necessary to clip a percentage of the original video feed (which is usually lost because of TV overscan) and scale it to the size and aspect ratio of the target ME. As shown in FIG. 31, the video is clipped to produce a clipped video source. The clipped video source is then expanded (scaled up, sized up, etc.) and incorporated into the target ME. The figure shows the original video has a 4x3 aspect ratio and the target ME has a 4x3 aspect ratio. The clipped video source therefore has a 4x3 video source.

FIG. 32 shows clipping for an original video source having a 4x3 aspect ratio that is targeted for an ME that has a 16x9 aspect ratio. The clipping is performed with a rectangle having an aspect ratio of 16x9 so the video can be scaled up to fit the target ME without distorting the original video.

To further illustrate this clipping aspect of the present invention, FIG. 33 shows clipping for a 4x3 original video source (i.e., its aspect ratio is 4x3) to fit into a target ME having a non-standard aspect ratio. FIG. 34 clipping for a 16x9 original video source to fit a 16x9 ME (i.e., its aspect ratio is 16x9). FIG. 35 clipping for a 16x9 original video source to fit a 4x3 ME. FIG. 36 shows clipping for a 16x9 to fit a non-standard ME.

FIGS. 37-44 show that a subscriber can zoom in on an ME that is in focus. FIG. 37 shows how a subscriber can expand the size of a 4x3 ME (i.e., its aspect ratio is 4x3) that is in focus including the video displayed in it to a larger (zoomed in) 4x3 ME. This operation is done by a second tuner connected directly or indirectly to the display, and is performed when the user activates a control to perform zooming. For example, the figures shows “zoom in” button on a remote control that can be used to activate zooming in. The original aspect ratio of ME may or may not be preserved in the expanded ME. For example, FIG. 37 illustrates an example where the aspect ratio is preserved when zooming is performed on the ME in focus.

Other aspect ratios can be accommodated. FIG. 38 shows zooming in of a 4x3 original ME to an expanded ME having a 16x9 aspect ratio. FIG. 39 shows zooming in of a 16x9 original ME to a 16x9 enlarged ME. FIG. 40 shows zooming in of a 16x9 original ME to a 4x3 enlarged ME. FIG. 41 shows zooming in of a 16x9 original ME to a non-standard zoomed-in ME (i.e., the ME has a non-standard aspect ratio). FIG. 42 shows zooming in of a 4x3 original ME to a non-standard zoomed-in ME (i.e., the ME has a non-standard aspect ratio). FIG. 43 illustrates a configuration where the in-focus ME has a non-standard aspect.
ratio where zooming results in a 4x3 expanded ME, while FIG. 44 shows an 16x9 expanded ME.

[0254] FIG. 45 illustrates that the subscriber can further expand the size of the zoomed-in ME to a full-screen video. This action can be activated by an additional press of the zoom-in button on the remote control. The full-screen video may take on the aspect ratio of the display, or take on its original aspect ratio as broadcast.

[0255] FIGS. 46 and 47 show that the subscriber can reverse the series of zoom-in's by zooming out. This action is activated by pressing the zoom-out button on the remote control. FIG. 46 shows that a full-screen display can be reduced to its previous state (size) which is the expanded ME. A further activation of the zoom-out button will cause the expanded ME to return to its original size, as illustrated in FIG. 47.

[0256] FIG. 48 shows the use of the SELECT button to expand the size of ME and bring it back to its original state. By repeated activation of the SELECT button, the in-focus ME can cycle from original size, then to expanded size, then to full-screen size as shown in the figure. Further activation of the SELECT button may restore the video in reverse order. Thus, the full-screen size is reduced to the expanded ME, then to the original-sized ME with another press of the SELECT button.

[0257] FIG. 49 shows an alternative embodiment of FIG. 48. When the video is displayed in full-screen mode, the press of the SELECT button returns the video to the original sized ME. This may be preferable over the sequence shown in FIG. 48 in that the user who is viewing the full-screen video may simply want to return to the display of MEs without having to traverse through the intermediate step of the expanded ME.

[0258] FIG. 50 shows that the subscriber can change location of an expanded ME on the screen by using the arrow keys on the remote control (or by a voice command in the case of a voice-based control device). The expanded ME can move about the screen in pixel-sized increments, or on other increments of distance. Keeping an arrow key depressed can cause the expanded ME to accelerate from a small increment in movement to larger increments in movement. These and other motion dynamics can be provided.

[0259] FIG. 51 shows that DMXEPG can comprise MEs which are generated on the headend MEs which are generated on the subscriber (client) side. The notation “HE” refers to those MEs that were generated at the headend, while the notation STB indicates MEs generated on the subscriber side; e.g., by the subscriber’s STB.

[0260] FIG. 52 shows major system elements and their connections to enable subscribers to display DMXEPG with some of the MEs selected by subscriber from an additional content any source available to subscriber. The components of the client device according to the present invention are enclosed by the phantom lines. The figure shows that the subscriber subscribes on one content provider, e.g., a cable company, a satellite dish, and so on. Additional content sources, identified in the figure as client video sources 1 and 2, can be connected to the client device.

[0261] FIG. 52a shows major system elements which allow entire D EPG screen to be created by subscriber device with multi-tuner capability. As an example, when input signal is transmitted over RF, subscriber device can include input module that splits incoming signal to feed subscriber device tuners.

[0262] FIG. 53 is similar to FIG. 52, but for a configuration where the subscriber has access to more than one content provider. The configuration of FIG. 53 shows a switch for switching among the multiple content providers.

[0263] FIG. 54 shows major system elements and their connections to enable subscribers to display expanded ME in the DMXEPG using the same content source.

[0264] FIG. 55 shows major system elements and their connections to enable subscribers to display expanded ME in the DMXEPG using more than one content source.

[0265] FIGS. 56-58 are tables that illustrate combinations of scaling and displaying video for different combinations of aspect ratios among the DMXEPG application screen 9 (FIG. 37, for example), an in-focus ME, the original video stream, and the display. The DMXEPG application screen contains an array of MEs.

[0266] FIG. 59 shows process of scaling source video to ME when source and destination aspect ratios are or are not the same.

[0267] FIG. 60 shows examples of different arrangements of MEs in a DMXEPG application screen (e.g., element 9 in FIG. 37), for different combinations of aspect ratios of the DMXEPG application screen and the MEs. Thus, for example, a 4x3 DMXEPG application screen (i.e., having an aspect ratio of 4x3) can accommodate a 3x3 array of MEs having an aspect ratio of 4x3. A 16x9 DMXEPG application screen can fit a 4x3 array of MEs having an aspect ratio of 4x3. More generally, an MxN DMXEPG application screen can fit an array of 4x3 MEs leaving some unused space which can be filled with a suitable background pattern. Table 4 in FIG. 60 lists examples of various combinations of DMXEPG application screen and ME arrangement. FIGS. 61-63 illustrate examples where MEs of different aspect ratios can be used to populate a DMXEPG application screen.

[0268] FIG. 64 illustrates an example of a Pay Per View portal created with MEs. A screen name area identifies that this screen is a “pay per view” portal. A screen branding area allows for a sponsor’s logo; e.g., STARCOM.

[0269] FIGS. 64 and 65 illustrate that the title bar corresponding to the in-focus ME is highlighted in addition to the in-focus ME. In addition, the titles for the row of MEs that includes the in-focus ME are displayed in an area below the array of MEs. Thus, in FIG. 65, ME3 is in focus and the titles for ME1 to ME4 are shown. In FIG. 66, the in-focus ME is ME7, and so the titles for ME5 to ME8 are shown. Further examples are shown in FIGS. 67-69. FIG. 69 shows that an in-focus ME can be purchased for viewing by pressing the SELECT button on the remote control.

[0270] FIG. 66 shows Pay Per View portal created with MEs.

[0271] FIG. 67 shows Pay Per View portal created with MEs.

[0272] FIG. 68 shows Pay Per View portal created with MEs.
[0273] FIG. 69 shows Pay Per View portal created with MEs.

[0274] FIG. 70 shows example of UI and navigation in the DMXEPG in accordance with the present invention. The example is a DMXEPG for the specific content category of GAMES for content category of KIDS. The main screen defaults to an ME that is selected to be the default ME. In this case the default ME is ME6.

[0275] FIG. 71 shows that the ME5 is in focus. The main screen is updated with the video currently associated with ME5 when the user presses the SELECT button on the remote control.

[0276] FIG. 72 shows the display of additional information for the in-focus ME when the user requests additional information. The video is scaled to allow for room to display the additional information.

[0277] FIG. 73 shows that the display including scaled video and additional information will change when the user changes the focus from one ME to another ME. Here, ME5 was in focus as shown in FIG. 72, and in FIG.>73 ME2 becomes focused.

[0278] FIGS. 74 and 75 show a sequence when the focus is changed to the GAMES ME. As can be seen in FIG. 75 the main screen is replaced with a set of MEs for different games that can be accessed.

[0279] FIG. 76 shows that the user can navigate from a game ME to a non-game ME. For example, FIG. 75 shows that the game ME for Game 1 was in focus. In FIG. 76, the user can navigate to ME3 by using the arrows keys on the remote.

[0280] FIG. 77 shows that the main screen can be once again replaced with the scaled video when the SELECT button is pressed for the in-focus ME.

[0281] FIG. 78 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0282] FIG. 79 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0283] FIG. 80 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0284] FIG. 81 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0285] FIG. 82 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0286] FIG. 83 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0287] FIG. 84 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0288] FIG. 85 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0289] FIG. 86 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0290] FIG. 87 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0291] FIG. 88 shows example of UI and navigation of DEPG created for specific content category (Kids)

[0292] FIG. 89 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0293] FIG. 90 shows example of UI and navigation of DMXEPG created for specific content category (Kids)

[0294] FIG. 91a shows example of UI and navigation of DMXEPG portal

[0295] FIGS. 91b, 91c, 91d show DMXEPG UI navigation within specific content category

[0296] FIGS. 92a, 92b, 92c, 92d show DMXEPG UI navigation and program information following changes in focus of MEs.

[0297] FIG. 93 shows UI and navigation of DMXEPG of future programs

[0298] FIG. 94 shows option of enlarging selected NE to larger portion of the screen and the full screen

[0299] FIGS. 95, 96 shows UI and navigation of DMX-EPG in program information display mode when some ME display trailers one ME is in focus and optionally continue to play trailers when focus moves to another ME

[0300] FIG. 97 shows UI and navigation of DMXEPG in program information display mode

[0301] FIG. 98-109 show UI and navigation of DMXEPG in channel browsing mode

[0302] FIG. 110-112 show zoom in and zoom out of ME in DMXEPG in show browsing mode

[0303] FIG. 113-117 show UI and navigation of DMX-EPG in channel browsing mode

[0304] FIG. 118 shows DMXEPG ability to enter PVR content browsing mode

[0305] FIG. 119 shows how VOD portal is built with ME

[0306] FIG. 120-121 shows how availability of the same or similar content on VOD system can be indicated in DMXEPG ME as well as grid based EPG

[0307] FIG. 122 shows a diagram describing process of encapsulation of VOD program metadata into DMXEPG metadata

[0308] FIG. 123 shows a system that merges metadata for programs supplied by multiple digital TV service providers

[0309] FIG. 124 shows a system that allows subscribers to select channel auto merge or perform manual channel merge for channels delivered over multiple networks

[0310] FIGS. 125, 126 show UI subscriber can access to perform manual merge of channels delivered over multiple networks

[0311] FIG. 127 shows how subscriber can tune to the desired channel using channel name (for example CNN, HBO, etc) or its mnemonic representation using telephone keypad—letter association.

[0312] FIG. 128 shows set top box with the application that can utilize more than one display for video output, graphics output, or their combination.

[0313] FIG. 129 shows digital TV set with the application that can utilize more than one display for video output, graphics output, or their combination.
FIG. 130 shows set top box that runs two applications each of which is using separate display for video output, graphics output, or their combination.

FIG. 131 shows digital TV set that runs two applications each of which is using separate display for video output, graphics output, or their combination.

FIG. 132 shows set top box that runs two applications each of which is using a portion of multiple displays for video output, graphics output, or their combination.

FIG. 133 shows digital TV set that runs two applications each of which is using a portion of multiple displays for video output, graphics output, or their combination.

FIG. 134 shows example of multi screen application for set top box where the Mosaic portion is directed by DMXEPG application to the Video/Data Output 1 (Secondary Display) and the Full screen Video stream is directed by DMXEPG application to the Video/Data Output 2 (Primary Display).

FIG. 135 shows example of multi screen application for digital TV set where the Mosaic portion is directed by DMXEPG application to the Video/Data Output 1 (Secondary Display) and the Full screen Video stream is directed by DMXEPG application to the Video/Data Output 2 (Primary Display).

FIG. 136 shows example of multi screen application for set top box where the EPG is directed to the Video/Data Output 1 (Secondary Display) and the Full screen Video stream is directed by application to the Video/Data Output 2 (Primary Display).

FIG. 137 shows example of multi screen application for set top box where the EPG is directed to the Video/Data Output 1 (Secondary Display) and the Full screen video clip for future program is directed by application to the Video/Data Output 2 (Primary Display).

FIG. 138 shows logical structure of DMXEPG for multiple displays where:

FIG. 139 shows the instance on DMXEPG application.

FIG. 140 shows the instance on DMXEPG application.

FIG. 141 shows the instance on DMXEPG application.

FIG. 142 shows the instance on DMXEPG application.

FIG. 143 shows the instance on DMXEPG application.

FIG. 144 shows the instance on DMXEPG application.

FIG. 145 shows the instance on DMXEPG application.

FIG. 146 shows the instance on DMXEPG application.

FIG. 147 shows the instance on DMXEPG application.

FIG. 148 shows the instance on DMXEPG application.

FIG. 149 shows the instance on DMXEPG application.

FIG. 150 shows the instance on DMXEPG application.

FIG. 151 shows the instance on DMXEPG application.

FIG. 152 shows the instance on DMXEPG application.

FIG. 153 shows the instance on DMXEPG application.

FIG. 154 shows the instance on DMXEPG application.

FIG. 155 shows the instance on DMXEPG application.

FIG. 156 shows the instance on DMXEPG application.

FIG. 157 shows the instance on DMXEPG application.

FIG. 158 shows the instance on DMXEPG application.

FIG. 159 shows the instance on DMXEPG application.

FIG. 160 shows the instance on DMXEPG application.

FIG. 161 shows the instance on DMXEPG application.

FIG. 162 shows the instance on DMXEPG application.

FIG. 163 shows the instance on DMXEPG application.

FIG. 164 shows the instance on DMXEPG application.

FIG. 165 shows the instance on DMXEPG application.

FIG. 166 shows the instance on DMXEPG application.

FIG. 167 shows the instance on DMXEPG application.

FIG. 168 shows the instance on DMXEPG application.

FIG. 169 shows the instance on DMXEPG application.

FIG. 170 shows the instance on DMXEPG application.

FIG. 171 shows the instance on DMXEPG application.
that displays mosaic of real time video feeds for the corresponding content category. Similarly to the previous screen, subscriber can switch audio tracks, or select desired program to view it in the “full screen” mode. Also, service providers might choose to display DMXEPG page with incongruent mosaic elements, allocating more space for one or more ME, while still allowing subscribers to switch audio tracks by navigating to the corresponding ME. Furthermore, service providers might choose to create DMXEPG pages that reflect user content preferences associated with the different time of the day, day of the week, age, sex, income, geographical location, and other subscriber demographic data and use conditional access system to match user profile to specific DMXEPG pages. FIG. 6 shows DMXEPG page generated for the morning hours to match viewing preferences of subscribers in selected ZIP codes.

With the set-top box with 2 or more tuners, in accordance with the invention, subscriber, after accessing mosaic DMXEPG landing page, selecting content category, and viewing corresponding DMXEPG page is given the option of selecting any video stream, including video from other sources like DVD player, on one ME while observing DMXEPG elements on the rest of the screen FIG. 10. Similarly to other DMXEPG pages, subscriber can switch corresponding audio track by navigating to the corresponding mosaic element. Subscriber can also move position of mosaic element by selecting the video stream including video from other sources like VCR, DVD player, video camera, digital camera, etc.) to uncover hidden DMX-

With the set-top box with 2 or more tuners, in accordance with the invention, subscriber, after accessing DMXEPG screen, can optionally select size of ME in focus by pressing “ENTER” or any other button assigned to that function. In ease of subscriber device capable of three dimensional rendering, subscriber can also choose Z coordinate of ME.

Service Provider, in accordance with the invention, can dynamically change rules responsible for dynamic association of channels with the mosaic DMXEPG elements. For the main landing page, service providers can choose to change displayed content categories, advertisement, or other visual or audio data depending on the time of the day, day of the week, customer demographic data, capabilities of the head-end equipment, as well as its business needs.

A method of generating a user interface (UI) display comprising a plurality of mosaic elements (MEs), the method comprising:

selecting a subset of content from a plurality of available content in accordance with mosaic element presentation criteria;

associating the selected subset of content with an ME comprising the UI display, wherein the ME outputs the subset of content that is associated therewith;

repeating the selecting and associating for other MEs that comprise the UI display;

outputting the UI display on an output device; and

subsequent to outputting the UI display, changing the UI display in accordance with the mosaic element presentation criteria, including changing the associated subset of content of at least one of the MEs that comprise the UI display by selecting another subset of content from the available content based at least on the mosaic element presentation criteria and associating the other subset of content with said at least one of the MEs, thereby changing output of the UI display on the output device.

The method of claim 1 wherein each ME comprising the UI display outputs information that is representative of its associated subset of content.

The method of claim 2 wherein the information that is representative of the content includes a video program, a video channel, a video loop, an audio program, content stored in a random access memory (RAM), content stored on a hard drive, an image, content from an interactive TV (iTV) application, and/or content accessed via a link to an iTV application.

The method of claim 1 wherein the mosaic element presentation criteria includes one or more of metadata associated with the content, user preferences, business rules, or third party rules.

The method of claim 4 wherein the program meta-data is either publicly available data organized in a standardized format, publicly available data organized in a non-standardized format, private data organized in a standardized format, or private data organized in a non-standardized format.

The method of claim 1 wherein the mosaic element presentation criteria is provided by a service provider of content, by a subscriber, or by a third party other than the service provider and the subscriber.

The method of claim 1 wherein the ME criteria are provided by a provider, the method further comprising the provider receiving both business rules and payment from a business rule provider and incorporating the business rules in the mosaic element presentation criteria in response to receiving the payment.

The method of claim 7 wherein whether the business rules are considered or not in the step of selecting a subset of content is based on payment history of the business rule provider.

The method of claim 1 wherein the size of the MEs and X and Y coordinates of the MEs are determined according to the mosaic element presentation criteria.

The method of claim 1 wherein the size of the MEs and X, Y, and Z coordinates of the MEs are determined according to the mosaic element presentation criteria.

The method of claim 1 wherein changing the UI display further includes adding one or more MEs to the UI display and/or deleting one or more MEs that comprise the UI display in accordance with the mosaic element presentation criteria.

The method of claim 1 wherein changing the UI display further includes changing the position of one or more of the MEs that comprise the UI display in accordance with the mosaic element presentation criteria.

The method of claim 1 wherein changing the UI display further includes changing the position of one or more of the MEs that comprise the UI display in accordance with the mosaic element presentation criteria.

The method of claim 1 wherein changing the UI display is performed absent user input.
15. The method of claim 1 wherein display of the subset of content associated with an ME is arranged in the ME in accordance with the mosaic element presentation criteria.

16. The method of claim 11 wherein changing the UI display is performed based on user input.

17. The method of claim 16 wherein the user is a subscriber.

18. The method of claim 11 wherein changing the UI display is performed based on subscriber-provided mosaic element presentation criteria.

19. The method of claim 1 wherein the UI display is generated by a backend server system and transmitted to a subscriber.

20. The method of claim 1 wherein the UI display is generated by a subscriber device.

21. The method of claim 20 wherein the subscriber device is a set-top box.

22. The method of claim 20 wherein the subscriber device is an electronic device with video rendering capability.

23. The method of claim 22 wherein the electronic device includes a video processing card in a personal computer (PC), a digital television system module in a digital television, or a portable device including a personal digital assistant (PDA) or a cellular telephone.

24. The method of claim 1 wherein a first portion of the UI display is generated by a backend server system and transmitted to a subscriber and a second portion of the UI display is generated by a subscriber device of the subscriber.

25. The method of claim 1 wherein the plurality of available content comprises a video program, a video channel, a video loop, an audio program, content stored in a random access memory (RAM), content stored on a hard drive, an image, content from an interactive TV (iTV) application, and/or content accessed via a link to an iTV application.

26. The method of claim 1 wherein the UI display is generated by a backend server system and transmitted to a subscriber, the method further comprising a subscriber device generating additional MEs and incorporating the additional MEs with the UI display received from the backend server system.

27. The method of claim 26 wherein the additional MEs are generated by selecting additional subsets of content from a second plurality of available content and associating the additional subsets of content with the additional MEs, wherein the additional subsets of content are displayed by the additional MEs.

28. The method of claim 27 wherein the second plurality of available content comprises a video program, a video channel, a video loop, an audio program, content stored in a random access memory (RAM), content stored on a hard drive, an image, content from an interactive TV (iTV) application, and/or content accessed via a link to an iTV application.

29. The method of claim 1 wherein the UI display is an electronic program guide (EPG) screen.

30. The method of claim 1 wherein the UI display is displayed in 3-D space.

31. The method of claim 1 wherein the output device is a video display.

32. The method of claim 1 wherein the output device is a printer.

33. A method for displaying a UI comprising one or more MEs, the method comprising:

- for each of the one or more MEs, selecting one or more media content from among available media content based on mosaic element presentation criteria and associating the one or more media content therewith;
- arranging the one or more MEs in the UI;
- displaying the UI on a display device to produce a displayed output, including, for each of the one or more MEs, outputting the one or more media content associated therewith; and
- subsequent to displaying the UI, selecting, for at least one of the one or more MEs, one or more new media content from among available media content based on the mosaic element presentation criteria and associating the one or more new media content with said at least one of the one or more MEs, whereby the displayed output of the UI on the display device changes.

34. The method of claim 33 wherein the UI is an electronic program guide (EPG) screen.

35. A method for accessing content comprising:

- generating a UI comprising one or more MEs, each ME being associated with one or more content selected from among available content based on mosaic element presentation criteria, each ME displaying its associated one or more content;
- changing the UI absent subscriber input, including one or more of:
  a) associating each ME with one or more new content selected from among available content based on the mosaic element presentation criteria;
  b) adding one or more new MEs to the UI; or
  c) deleting one or more of the MEs; and
- changing the UI in response to subscriber input, including:
  - receiving selection information from the subscriber indicative of a subscriber-selected ME; and
  - generating a second UI comprising one or more MEs, each ME in the second UI being associated with one or more content selected from among available content based on the mosaic element presentation criteria that was used to select content that is associated with the subscriber-selected ME.

36. A method of managing mosaic element presentation criteria used for generating a user interface (UI) display comprising a plurality of mosaic elements (MEs), the method comprising:

- receiving one or more bids from third party sources, each third party source having an associated set of business rules that it desires to be incorporated into the mosaic element presentation criteria; and
- incorporating the business rules of a selected third party source into the mosaic element presentation criteria, the selected third party source being determined based at least on the one or more bids, wherein:
a subset of content is selected from a plurality of available content in accordance with mosaic element presentation criteria;
the selected subset of content is associated with an ME comprising the UI, the ME outputting the subset of content that is associated therewith;
the selecting and associating is repeated for other MEs that comprise the UI;
the UI is output on an output device; and
the UI is changed in accordance with the mosaic element presentation criteria, including changing the associated subset of content of at least one of the MEs that comprise the UI by selecting another subset of content from the available content based at least on the mosaic element presentation criteria and associating the other subset of content with said at least one of the MEs, thereby changing output of the UI on the output device.

37. The method of claim 36 wherein the selected third party has the highest bid among the received bids.

38. The method of claim 36 wherein the UI is an electronic programming guide (EPG) screen.

39. A method of presenting an electronic program guide (EPG) on a display device at a viewer location, comprising the steps of:
dynamically assigning a plurality of program source materials to a plurality of mosaic elements in accordance with criteria received from one or more sources;
merging the mosaic elements at the location of the viewer;
and
displaying the mosaic elements on the display device as a matrix of separate windows.

40. The method of claim 39, wherein the source materials represent program metadata.

41. The method of claim 39, including source materials from different service providers.

42. The method of claim 39, wherein at least one of the windows displays a live television broadcast.

43. The method of claim 39, wherein at least one of the windows displays graphical information regarding a television program scheduled for broadcast.

44. The method of claim 39, wherein at least one of the windows displays information regarding a video-on-demand offering.

45. The method of claim 39, wherein the step of dynamically assigning a plurality of source materials to a plurality of mosaic elements is based upon continuously updated program schedule metadata.

46. The method of claim 39, wherein the criteria received from one or more sources includes criteria input at the viewer location.

47. The method of claim 39, wherein the criteria received from one or more sources includes criteria received from a program subscriber.

48. The method of claim 39, wherein the criteria received from one or more sources includes criteria received from a programming service provider.

49. The method of claim 39, wherein the criteria received from one or more sources includes criteria received from a program broadcaster.

50. The method of claim 39, wherein the criteria received from one or more sources includes criteria received from a critic.

51. The method of claim 39, wherein at least one of the windows displays an interactive television application.

52. The method of claim 39, wherein at least one of the windows displays an interactive advertisement.

53. The method of claim 39, wherein at least one of the windows displays a television channel pre-selected by a viewer.

54. The method of claim 39, wherein at least one of the windows displays source material from a video player at the viewer location.

55. The method of claim 39, further including the step of displaying a different matrix of mosaic elements to a different viewer location in accordance with criteria received from one or more sources.

56. The method of claim 39, further including the step of displaying a different matrix of mosaic elements to a different viewer location in accordance with demographic data.

57. The method of claim 39, further including the step of displaying a different matrix of mosaic elements to a different viewer location in accordance with viewing capabilities of the viewer location.

58. The method of claim 39, further including the step of displaying a different matrix of mosaic elements to a different viewer location in accordance with the capabilities of service provider capabilities.

59. The method of claim 39, further including the step of enabling a viewer to customize the display of the mosaic elements.

60. The method of claim 39, further including the step of enabling a viewer to choose which channels, programs or interactive applications will appear in the matrix of separate windows.

61. The method of claim 39, further including the step of organizing the windows according to type of source material, business rules or service provider, or viewer equipment capabilities.

62. The method of claim 39, further including the step of enabling a viewer to select one of the source materials for immediate or future viewing by clicking on a window associated with that source.

63. The method of claim 39, further including the step of enabling a viewer to select one of the source materials stored locally or remotely.

64. The method of claim 39, wherein at least one of the windows displays source material selected for viewing with other windows displaying program guide information.

65. The method of claim 39, further including the step of enabling a viewer to record desired program source material along with service-related metadata.

66. The method of claim 39, further including the step of enabling a viewer to record desired program source material along with television commerce services.

67. The method of claim 39, further including the step of enabling a viewer to record desired program source material along with an interactive advertisement.

68. The method of claim 39, further including the step of enabling a viewer to record desired program source material along with a VOD request.

69. The method of claim 39, further including the step of enabling a viewer to record desired program source material along with an interactive TV application.
70. The method of claim 39, further including the step of adjusting one or more characteristics of the display to improve content recognition.

71. The method of claim 39, further including the step of zooming at least a portion of the display to improve content recognition.

72. The method of claim 39, further including the step of truncating at least a portion of the display to improve content recognition.

73. The method of claim 39, further including the step of enabling a viewer to search channels by channel name as opposed to, or in addition to, channel number.

74. The method of claim 39, further including the step of enabling a viewer to create a customized channel line-up through channel number reassignment.

75. The method of claim 39, further including the step of enabling a viewer to group desired channels as a function of channel surfing.

76. The method of claim 39, further including the step of providing a viewer with information relating to show times of upcoming or past episodes of a program being viewed or a program selected for viewing.

77. The method of claim 39, further including the step of providing a viewer with information relating to VOD ordering of a program being viewed or a program selected for viewing.

78. The method of claim 39, further including the step of providing a viewer with information relating to personal video recorder (PVR) start or play options relating to a program being viewed or a program selected for viewing.

79. The method of claim 39, further including the step of providing a viewer with a video trailer or preview information relating to a program being viewed or a program selected for viewing.

80. The method of claim 39, further including the step of providing a viewer with value-added service information relating to a program being viewed or a program selected for viewing.

81. The method of claim 39, further including the step of providing content filtering managed by service provider or third party.

* * * * *