Methods and devices for transmitting data to a mobile data processing unit

1. Technical field

The present invention relates to methods and devices for transmitting data to a mobile data processing unit.

2. The prior art

Mobile data processing units such as hand held computers, PDAs, intelligent mobile telephones, etc. become more and more popular. One reason is that the multimedia capabilities of these devices are constantly increasing. For examples mobile telephones nowadays include a wide variety of functions which exceed the basic necessities of communication.

However, one difficulty encountered with such mobile data processing systems is the download of data, in particular if the size of the data is comparatively large so that a download via a standard mobile communication network is slow and expensive. For example obtaining and installing a new processing application for a mobile telephone such as a new game over the GSM network is only feasible, if the game can be compressed to a small amount of data.

Another alternative is to connect the mobile data processing unit to a personal computer, which is in turn connected to the internet. This approach allows in case of a high speed internet access of the personal computer to quickly download large amount of data and to forward it to the connected mobile data processing unit. However, a considerable technical expertise about computers, the internet, etc. is required from a user, who intends to transmit data from a provider onto the mobile data processing unit in this manner.

To overcome this overall difficulty, it is known in the prior art, for example from the WO 2004/088983, the WO 03/088027 and the WO 03/088655, to provide a set top box or the like for receiving data, which comprise a convoluted television signal and additional data. The additional data are separated from the television signal and in a wireless manner transmitted to a PDA or to a mobile telephone to become accessible to a user.

In such a system, there are two conflicting objectives. On the one hand, the provider of the additional data may want to influence the content to be displayed on the mobile unit of the user. On the other hand, the user of the mobile unit itself wants to keep control, whether and which data are to be displayed on the mobile unit, preferably in a somewhat similar manner as browsing on the internet.

It is therefore a problem of the present invention to provide an improved method for transmitting data to a mobile data processing unit from a set top box or the like, which provides both, the provider of the additional data and the user of the mobile unit with balanced possibilities to influence the data, which are actually transmitted to the mobile unit.

3. Summary of the invention

According to one aspect of the invention, this problem is solved by a method for transmitting data to a mobile data processing unit, comprising the following steps:

- receiving the data with a digital audio and / or television reception device, wherein the data are included in a transport stream of digital audio and / or television signals;

- extracting the data from the transport stream of digital audio and / or television signals; and

- sending electromagnetic signals by the digital audio and / or television reception device to transmit the extracted data from the digital audio and / or television reception device to the mobile data processing unit, wherein the extracted data are transmitted from the digital audio and / or television reception device (100) to the mobile data processing unit (200) in response to periodical requests from the mobile data processing unit (200) to the digital audio and / or television reception device (100).

The invention is based on the idea to use the more and more popular digital audio and / or television reception devices, also called set top boxes, not only for receiving the broadcast digital television signals, but to include into the main transport stream of broadcast media additional data. Once the combined signal has been received, the additional data are extracted and sent as an electromagnetic signal from the set top box to the mobile data processing unit, i.e. a unit which is preferably separate and not related to the ordinary function of the digital audio and / or television reception device.

The periodical requests from the mobile data unit to the digital audio and / or television reception device provide preferably a regular possibility for the content provider to send new data to the mobile data processing unit. The new data may be data requested by the user but also data which the provider wants to be received and possibly displayed by the mobile data processing unit, such as an important message. The user, on the other hand, can also influence the overall communication, since it is preferably always the mobile station or the user itself, which initiates the communication with the digital audio and / or television reception device. Further, requests for other available data can be issued by the periodic requests or by additional asynchronous requests from the mobile data processing unit to the digital audio and / or television reception device.

Preferably, the method further comprises storing the extracted data in the digital audio and / or television reception device and presenting a message to a user about the availability of the extracted data, for example on the reception device and / or

an interconnected television set. Thus, the user can control if and when the data, which are stored in the digital audio and / or television reception device, are finally transmitted onto his mobile data processing unit. For example data representing a table with all results of a soccer tournament, which has been the subject matter of a related digital television broadcast, are made available to a user for transfer onto his mobile telephone or PDA.

The transmission of the data from the digital audio and / or television reception device to the mobile data processing unit, is in one embodiment performed in response to a user input at the digital television reception device or an interconnected television. This may for example be achieved by providing one or more suitable buttons on the remote control of the digital audio and / or television reception device or the device itself. In another alternative, the final transmission to the mobile data processing unit is performed in response to the digital audio and / or television reception device receiving a signal from the mobile data processing unit. Also a combination of the two initiating events is possible.

Preferably, the periodical requests from the mobile data processing unit serve to synchronize a least a part of the data in the mobile data processing unit with a set of data stored in the digital audio and / or television reception device. Accordingly, the content provider can influence the content of the data finally transmitted to the mobile station by sending new data to the digital audio and / or television reception device with the transport stream of digital audio and / or television signals wherein these data are forwarded to the mobile data processing unit in one of the subsequent synchronizations.

In a preferred embodiment, the periodic requests of the mobile data processing unit are executed automatically and preferably without user input. Furthermore, the refresh interval between the periodical requests can preferably be changed. The value for the refresh interval is transmitted from the digital audio and / or television reception device to the mobile data processing unit preferably together with the new data for synchronization. As a result, the content provider can easily

determine, how quickly the mobile data processing unit is to be updated with new data. Furthermore, the user is not disturbed by the repeated background polling of the mobile data processing unit. Preferably, the refresh interval has a length t of 1s $\leq t \leq$ 10s.

This is particularly advantageous, if, as presently preferred, the content of the transport stream of digital audio and / or television signals and the content of the included data are related. This aspect of the invention is particularly valuable, since it enables the content provider in a simple manner to assure that data (e.g. example a game or a piece of music) relating to a certain broadcast is without a substantial delay made available on the mobile data processing unit. In another situation, it might be advantageous to decrease the polling frequency of the mobile data processing unit, for example to reduce the processing load and to provide more processing capacity for running a downloaded application on the mobile data processing unit.

In a preferred embodiment, the transport stream comprises digital audio and / or television signals for a plurality of channels, wherein the data extracted from the transport stream and transmitted to the mobile data processing unit depend on the channel to which the digital audio and / or television reception device is tuned. This aspect expands the basic functionality of a download of data to a mobile data processing unit via a digital audio and / or television reception device so that a full new multimedia system is created, wherein additional information, games, music or other data are made available to a user on the mobile data processing unit in addition and relation to a currently selected television program.

Preferably, the extracted data for a first channel to which the digital audio and / or television reception device is tuned are stored in a memory of the digital audio and / or television reception device. In one embodiment, these data are purged, in case of a change from the first channel to a second channel, unless the extracted data for the first channel to be transmitted to the mobile data processing unit are the same as for the second channel. As a result, the maximum amount of memory

of the digital audio and / or television reception device is made available for the data of the new channel. In another embodiment the data stored in the memory are maintained in case of a change from the first channel to a second channel. This embodiment allows the data sent to the mobile data processing unit to more quickly follow a further change back to the first channel.

According to a further aspect of the present invention, a method of transmitting data to a mobile data processing unit is provided comprising the steps of

- including the data to be transmitted into a transport stream of digital audio and / or television signals to be broadcasted;

- broadcasting the transport stream of digital audio and / or television signals with the included data in a digital format adapted for a digital audio and / or television reception device to receive the digital audio and / or television signals, to extract the included data and to transmit them to the mobile data processing unit, wherein

- the included data are adapted to be transmitted in response to periodical requests from the mobile data processing unit to the digital audio and / or television reception device.

The sender of the digital television signals therefore emits a convoluted signal comprising both, the standard digital television signals to be broadcast and the additional signals for the final transmission, i.e. download, onto the mobile data processing unit. According to this aspect of the invention, the format of the convoluted signal is specifically adapted for the digital audio and / or television reception device to extract the included data from the main stream of signals so that the user can watch digital television and in addition obtain the additional data for his mobile data processing unit in response to periodical requests from the mobile data processing unit to the digital audio and / or television reception device. Pref-

erably, the included data cause a change of the refresh interval between the periodical requests of the mobile data processing unit.

In one embodiment, the first and or the second method steps are performed in response to a provider of the data receiving a signal from the digital audio and / or television reception device and / or the mobile data processing unit. Such an advanced embodiment allows the user to interactively influence, whether additional data are transmitted to one or more digital audio and / or television reception devices for subsequent download on one or more mobile data processing units.

According to a still further aspect, the present invention relates to a digital audio and / or television reception device comprising a first reception unit receiving a transport stream of digital audio and / or television signals for display on a television and/ or radio system, the transport stream of digital audio and / or television signals including additional data. The digital audio and / or television reception device further comprises an extraction unit extracting the additional data from the transport stream of digital signals, a transmission unit transmitting the extracted additional data to an external mobile data processing unit, wherein the digital audio and / or television reception device further comprises a second receiving unit adapted to receive periodic requests from the mobile data processing unit to initiate the transmission of the extracted additional data.

Finally, the present invention relates to a mobile data processing unit comprising a first transceiver unit for communication with a mobile telephone network, a second transceiver unit for communicating with a digital audio and / or television reception device, and control means with instructions for the second transceiver to periodically transmit a request to the digital audio and / or television reception device, which initiates the transmission of additional data, which are received by the digital audio and / or television reception device together with digital audio and / or television signals, to the second transceiver of the mobile data processing unit.

Further modifications of the claimed methods and the claimed devices are the subject matter of further dependent claims.

4. Short description of the drawings

In the following detailed description presently preferred embodiments of the invention are described with reference to the drawings which show:

Fig. 1: a schematic view of the various components of a digital television reception device to be used in the context of the present invention;

Fig. 2: a schematic view of the various components of a mobile data processing unit to be used in the context of the present invention;

Fig. 3: a more detailed overview of the various elements of the present invention in a presently preferred embodiment;

Fig. 4: an overview of the stack of communication layers used for the communication between the STB and the mobile device in the embodiment of Fig. 3; and

Fig. 5: an overview of the main commands for the communication between the mobile device and the STB in the embodiment of Fig. 3.

5. Detailed description of preferred embodiments

In the following the methods and devices according to the present invention are described with reference to a set top box 100 capable to receive digital television or radio signals. The arrangement of all of the functional units of the set top box 100 in a single electronic device as indicated by the dashed box in Fig. 1 is not essential. One or more components of the set top box 100 described in the following description can be realized in additional devices, which are suitably connected

to the other functional units of the set top box 100. Further, whereas in the following description reference is made to a set top box 100 as a device connected to a standard television set 102, the invention can – although presently less preferred - also be realized by means of a card with suitable electronics for the reception of broadcast digital television or radio signal signals, such as a PC-card to be used in a personal computer. Furthermore, it is noted that the term set top box comprises in the context of the present application not only devices for receiving digital television signals but also devices, which in addition or alternatively are adapted to receive digital radio programs. Finally, the set top box does not necessarily have to be separate device. It can also be integrated into another device, such as a television.

Fig. 1 presents an overview of the set top box 100. A broadcast signal, carrying in the data transport stream among the digital television signals an additional data set defining e.g. a special application for a mobile data processing unit 200 is received by an antenna 101. Instead of a satellite signal received by the antenna 101, the transport stream can also be received as a terrestrial digital TV program or via a cable (not shown). The provider (not shown) of the digital television signal has modulated the additional data set onto the standard stream of digital television data, for example by including data packets with a specific header allowing the set top box to extract the additional data set during the further steps explained below. All kinds of convolution techniques for the digital television signals and the additional set of data are conceivable, including an additional compression of the convoluted stream to maximize the bandwidth for the data transmission to the set top box 100.

In one embodiment (not shown), the transmission of the additional data set is performed in response to the provider receiving a signal from one or more users. Such an initiating signal may be received via a standard return line from the set top box 100 to the provider using a modem connection or the like, or the mobile data processing unit 200, for example a mobile telephone, communicates a request

for additional data to the provider via its communication network, for example a GSM, a GPRS or a UMTS network.

The content of the additional data set is preferably related to the content of the broadcast signal. One example is additional information relating to a live event, such as a soccer tournament. The additional data could then comprise a wide variety of data content, such as further statistics about the ongoing tournament or even a related computer game to be played by the user on the mobile data processing unit 200. Another application is the download of sound files relating to a movie presently broadcast in a channel of the digital television signals. The user can thus store the sound track of the movie on this mobile data processing unit, such as a MP-3 player to listen to it later again. These are only two examples and it is apparent to the person skilled in the art that many useful applications are conceivable wherein the content of the additional data complements in a meaningful manner the content of the digital television signals.

The set top box 100 can be operated using a remote control 3, which interacts with a remote control sensor 7 to issue commands to one or more central processing units (not shown) of the set top box 100. Alternatively or additionally, the set top box 100 may also comprise input means such as push buttons or switches (not shown in Fig. 1). A display 18 of the set top box 100 allows to display messages to a user.

In a front end unit 5 of the set top box 100, the broadcast signal provided from the antenna 101 is demodulated. Subsequently, the additional data set is filtered out by means of a data filter 6. The digital television signals are further processed by the set top box 100 in a standard manner. In Fig. 1 this is only schematically indicated by the unit 20, which represents the standard audio and / or video processing of the set top box 100.

It is to be noted that there are many ways to implement the data filter 6, for example by hardware or by software. A software solution may be more flexible, to

adapt the set top box 100 to new data formats, whereas a hardware solution may be faster. Also combinations of the two alternatives are possible. Further, the function of the initial demodulation of the received signal, including both the digital television signals and the additional data set, and the subsequent filtering can be combined in a single unit or the data set could even be filtered out from the received signal, before the television signal is demodulated.

After the additional data set has been filtered out, it is stored in a memory 8 and remains in a "wait" status. The memory can be realized in many different ways, for example as a RAM or even as a permanent memory such as a disk drive or a flash ROM. The memory 8 can also be simply a certain range of the ordinary memory range of the set top box 100. The additional data set remains in the memory 8 until it is downloaded onto the mobile data processing unit 200 as described below or erased in response to a user command. Further it is also possible to include a timer function in the set top box 100 so that an additional data set, which has not been downloaded within a predetermined amount of time, will be automatically erased or overwritten by new data. In a simpler embodiment, the extracted data is not stored within the set top box but immediately sent to the mobile data processing unit as described below.

In order to inform the user about the availability of additional data for download onto the mobile data processing unit 200, the set top box 100 can present a message either on its own display 18, as schematically indicated in Fig. 1 (*"Data File 1 Info..."*) or the message will be presented on the screen on the connected television set 102. Also a combination of the two display functions is possible, wherein for example the display 18 informs only about the general availability of an additional set of data and wherein the display of the television set 102 present upon user request additional information about the data set, such as content, size and possibly costs related to the download of the data onto the mobile data processing unit 200.

The actual transfer of the stored set of additional data from the set top box 100 to the mobile data processing unit 200 can be triggered by various means. One option is a user input at the set top box 100, either directly of via the remote control 3. In this case the set top box 100 will try to establish a communication link, preferably a wireless link, to the mobile data processing unit 200 using its transceiver 4. Such a transceiver 4 can for example be realized as an infrared port, which communicates with a corresponding infrared port of the unit 200 (not shown in Fig. 1). In another embodiment RF-signals are used, following for example the Bluetooth protocol (see below). Preferably, the set top box 100 comprises more than one possibility for a wireless communication so that it can flexibly adapt to different types of mobile data processing units 200. Finally, it is also possible to transfer the electromagnetic signals containing the data onto the mobile data processing unit using a connection via a cable (not shown).

Alternatively, the transfer of the stored data onto the mobile processing unit 200 could also be triggered by the unit 200. In this alternative embodiment, the user would simply position the unit 200 within the transmission range of the transmitter 4 and send a corresponding request to the set top box 100, which would then initiate the download of the stored data. Clearly also a combination is possible, wherein one side, the set top box 100 or the mobile data processing unit 200, sends at first a request, which is then confirmed by a user input at the other device to start the transmission.

Fig. 2 shows schematically a mobile data processing unit 200 in accordance with aspects of the present invention. Generally, there are many mobile devices, which may be used in conjunction with the present invention, such as PDAs, hand held computers, notebooks, MPEG-3 players. However, since cellular telephones are most common and allow not only to process the receive data but also to communicate signals relating to the processed data over a communication network (such as a GSM-network or a CDMA-network), the following description will be focused on the modifications of such a device for cooperation with the set top box 100 described above.

The cellular telephone comprises preferably two transceiving units, the first 15 for the standard communication network, such as a GSM-, a GPRS or a CDMA (UMTS) network, the other 9 for communicating with the transceiver 4 of the set top box 100. The second transceiver 9 may be provided as an infrared port or / and as a Bluetooth transceiver for RF-signals. In a preferred embodiment the cellular telephone 200 comprises a processor and a memory with instructions so that the transceiver 4 will send a request to the set top box 100 for transmission of available data. The request from the cellular telephone can be sent in response to a user input or automatically, when the cellular telephone is switched on. In the latter case, the download of the additional data stored in the set top box will automatically start, when the cellular telephone 200 is sufficiently close to the transceiver 4 of the set top box 100 and turned on. This is significantly easier for a user than downloading data from the internet with a personal computer and subsequently transferring it onto the cellular telephone for later use. The downloaded data is stored in the cellular telephone 200 in a memory 11, where it is available for further processing.

According to a more advanced aspect of the present invention, the downloaded data may comprise interactive features, which require that the user sends information from the cellular telephone 200 back to the provider (not shown) or another user of the digital television signals. For example an interactive game may be played by many users, wherein general information and / or results are broadcast on the television 102 and wherein each user plays with his cellular telephone 200 over the cellular network.

Since the interactive game (or the like) itself is created by the provider as additional data included in the digital television signals, the overall setup for such a game or a similar event is very easy for the user and does not require particular technical skills. Other functional units of the cellular telephone, such as a camera or a microphone may be involved in the interactive processing of the data received from the set top box 100.

The connection to the cellular network is reflected in Fig. 2, by the data filter 12 of the cellular telephone 200. Under the control of a processor and an operating system etc. of the cellular telephone (not shown) data resulting from processing the data received over the transceiver 9 can be sent out via the first transceiver 15 and an attached antenna. The data filter 12 assures that the transmission of this data does not interfere with other voice and data services 17 of the cellular telephone.

In the following parts of the present specification, a currently preferred embodiment of the invention is further described. In addition, the annexed two specifications of the "Blucom" Receiver Requirements and of the "Blucom" Browser Application explain all aspects of a presently preferred embodiment of a set top box 100 and of a browser application running on the mobile device 200 or another type of mobile data processing unit used in the context of the present invention. However, it is to be noted that a practical embodiment does not need to realize all of the features which are described below or in the attached specifications. On the contrary, some embodiments will only use individual or a few aspects of the system as described below. In particular, most of the described features can be implemented independently from other features of the system.

Fig. 3 presents an overview of the architecture. As can be seen, a content provider creates content of additional data by using an appropriate authoring system. In addition, a broadcaster is shown, which is in charge of formatting the additional data content according to the data carousel format used, and sends the convoluted data to a satellite. Alternatively, the convoluted data may be broadcast using a cable network or terrestrial broadcasting.

The transport stream of convoluted digital data comprising the television signal and the additional data is received by a digital receiver or set top box 100. The digital receiver or set top box (STB) acts as a content server towards any client device such as the mobile phone 200. The additional data is parsed from one or

more data carousels, which are carried in the transport stream in a similar manner as data components of any MPEG program. The STB stores the complete payload of all additional data carousels of the appropriate version (see below) in a cache, which is allocated in the STB's RAM. The cache of the STB can be regarded as a shared memory resource which is filled with data from the satellite. Data is requested out of the cache by a data server component, which is dedicated to handle client requests for the additional data, for example from the mobile phone 200.

The directory structure inside the cache is according to the path and filename information obtained from the headers as contained in the transport stream. This structure is used as a reference for client requests. In addition, the data carousel comprises further information, such as control parameters. Updates of the data carousel for the additional data, i.e. new versions, are detected by a change of a suitable identification.

More in detail, the cache of the STB is managed as follows: As soon as the STB detects a valid component of additional data on the actually tuned MPEG program, the STB immediately starts capturing the additional data and writes it to the cache. The cache is purged upon a change of the actual tuned service to another service which carries additional data and filled with the additional data of the then tuned service. However, if the identification of the new service matches the identification of the previously tuned service, the STB maintains the cache in order to allow for a better performance in case data is shared between services.

If the RAM space reserved for the cache does not need to be completely allocated to store the additional data of the new service, the STB may keep the previous data in order to speed up access if the STB is tuned back to the previous service. If the new service does not provide additional data, previously downloaded additional data is maintained in the cache in order to allow for a fast access in case the user switches back to the previously tuned service.

Control parameters relating to the additional data of a certain service or channel are deleted immediately upon a service change, regardless whether the new service carries any additional data or not. This provision ensures that only the additional data of any given service is available. However, if the identification of the new service matches the identification of the previously tuned service, the STB maintains the control parameters in order to allow for a better performance in the case where additional data is shared between services.

For transmitting control parameters relating to the additional data, a control file is preferably included in the transport stream to the STB. The purpose of the control file is to specify the receiver's reaction upon a client's request for the additional data. Unlike the actual data files with the content, which will be stored in the receiver's file system without any prior interpretation, the STB needs to parse the content of the control file and store the control parameters immediately after reception of the control file.

In the carousel sent from the satellite, the control file is identified by the presence of a control file descriptor in the respective data header. As soon as the STB detects a new control file in the received data carousel, it updates the control file data in the receiver's RAM. Upon the next client request, the STB reacts according to the rules determined by the new control file. In the preferred embodiment, the control file is based on the XML file format.

The communication between the STB 100 and the mobile device 200 (phone, PDA or the like) depends on the hardware and on the interface protocol. In the following, preferred embodiments thereof are briefly discussed.

As mentioned above, the STB 100 comprises preferably an interface capable to communicate with the mobile device 200 using the Bluetooth standard. Preferably, the performance of the interface ensures that under the conditions indicated below, the reaction time upon client requests does not exceed a defined limit. The conditions are as follows:

- Only one client is connected to the STB.
- Bluetooth data rate 500kb/s net.
- Measurement point is the Bluetooth radio layer.
- The requested file is already present in the STB's cache.

Upon a client request for a 10kB file, the STB completes the delivery of the whole file within 250ms after the issuing of the client request.

To meet the above requirement, preferred hardware for the STB comprises an amount of at least 16 MB to be assigned to the above discussed cache. For the communication with the mobile device 200, the STB preferably comprises a power class 2 Bluetooth radio device, which provides a stable connection over a distance of at least 10 meters from a front panel of the STB.

The Interface Protocol between STB 100 and Mobile Device 200 is preferably also based on the XML file format. In order to keep the amount of protocol data as small as possible, it is recommended to use the XML short-form for building the XML protocol. The low level communication is preferably based on the Bluetooth wireless technology. Fig. 4 shows the arrangement of the described protocol of the service to access additional data on top of the Bluetooth protocol stack.

Accordingly, to set up a connection between the mobile device 200 and the STB, the Bluetooth device (not shown) on the mobile phone needs to be enabled and ready for connecting a remote Bluetooth device before a communication software, the "browser", is started. After launching the browser, it verifies whether the Bluetooth device of the mobile device 200 is enabled and ready. If there is no Bluetooth device available or if it is not switched on, the browser will advice the user how to switch on the Bluetooth device.

Bluetooth device and service discovery are initiated by the browser application running on the mobile device 200. For finding the right device, the browser per-

forms a service inquiry on each discovered device in order to assure that the mobile device only connects to the corresponding application. When more than one device is discovered that offers a service to access additional data on a STB, a list of the Bluetooth specific, user-friendly device names is presented to the user for selection.

After the right device (STB) was discovered or selected by the user, the browser tries to set up a connection to it. Depending on the configuration on the STB side, it might be necessary to enter an authentication id (PIN) to get connected. After successfully connecting to the STB, the remote device has to be added to the trusted device list if the device supports correct list management in order to avoid recurring pin requests for subsequent connections to that device.

After successful device and service discovery, the browser preferably sends an initial request to the STB in order to get a copyright string compared with its counterpart on the STB side. In case of a negative response or even a missing response within a configured timeout period, the browser displays a message denoting that the STB is not authorized for the service to access additional data. The copyright string is a static text string that has no further meaning. It is required for legal reasons only and can be defined by the system provider.

After successful connection the browser has to display a first page. Therefore, browser has to execute a Sync-Command, which is further described below to get synchronised to the current service provided by the STB. Provided that there is a channel with additional data available, the browser receives an URL for which the content has to be retrieved and displayed.

In the following the content retrieval of the browser is further described: The content of the additional data may be prepared by different content providers. The providers use pages to logically structure the content. The browser displays a single page at a time. Each page is attached to a specific context. The context id is

delivered for each page retrieved from server. The context is significant for page requests and the maintenance of contextual variables.

The content is pulled from the STB 100 by the mobile device 200. There are two ways how content can be pulled from the STB:

For an automatic page request, the browser automatically requests a new page from the server according to a refresh interval, which is determined in the protocol. This refresh interval may change after each subsequent page or content request. All automatic page requests are executed silently: Since the user did not trigger the retrieval, no message may be displayed if the request, retrieval or processing of those pages fails.

The automatic page request enables also frequent updates of the content by the content provider. Two types of update are distinguished:

- The provider determines a new, different page, which must be displayed by the browser as soon as possible for example to adapt the displayed content to the presently running television program of a channel.

- The provider generates an update of the page currently displayed by browser, which is displayed instead of old (out-of-date) page.

Accordingly, which page to be displayed next is completely controlled by the STB. The browser requests and displays each new page indicated by the STB except page name, page version and context have not changed relating to the currently displayed page.

On the other hand, since the STB does not deliver new pages unless the browser requests them, the browser must periodically poll the server and ask for page updates. Preferably, the browser is capable to handle lookup intervals of 1 second or less. Preferably, the refresh interval is a dynamic value

In addition to automatic page request, there is preferably the option of a manual page request. The user may trigger a page request asynchronously by selecting a link inside the page currently displayed. The browser tries to retrieve all contents needed to display that page. All manual page requests are executed actively, i.e. the user gets a readable, visual feedback about the browser activity. If the requested page cannot be displayed due to an error, an error message is displayed.

Fig. 5 presents an overview of five different commands, which are used for the communication between the mobile device 200 and the STB 100.

The Initiate Command is a precondition for all further commands. If the STB is not able to answer an Initiate Command with OK, all following requests (except further Initiate Commands) will be answered with the return code FAILED.

Using the Sync Command the browser asks the STB for the sync page URL that is currently valid, i.e. data stored in the STB, which is to be synchronized with the mobile device. Beside the URL of the current sync page, the response delivers information about the present context and the new refresh interval. A return code informs about the response status. Once the response was successfully processed and the further conditions are fulfilled, the browser acquires the contents for the new page URL in order to display the new page.

With the Refresh Command the browser sends the URLs and the file versions for the page currently shown on display and for the present sync page, which may be different from the present one. Once the response to the Refresh Command was successfully processed and further conditions are fulfilled, the browser acquires the contents for the new page URL delivered in order to display the new page. A return code informs about the response status.

The new page might be either an update for the page currently displayed or a new sync page which is immediately displayed, as described above. Additionally, the

response code delivers information about the present context, the new refresh interval and above that a flag, which determines if the URL supplied is a sync page or not. In case that the new page is signalled as a sync page, the browser saves that URL and version as its current sync page.

The further command Get Command serve to ask the STB for the content of a certain page, whereas the fifth command Get Context serves to obtain relevant parameters such as an identification of the present service to which the STB is presently tuned.

Further aspects of the presently preferred embodiment of the invention are described in the two annexes.

Annexes:

"Blucom" Receiver Requirements Version 1.53a

Functional Specification "Blucom"Browser Application Version 1.6

APS
An SES ASTRA Company

«Blucom»

Receiver Requirements

Version 1.53a

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Document history

Version	Date	Author	Changes
1.0	2005/03/15	Jörg Eich, Uwe Wiedow	Document Creation.
1.1	2005/03/25	Jörg Eich, Uwe Wiedow	Session Handling at application level is no longer needed, therefore all chapters based on that subject have been removed from this document. Furthermore data exchange protocol and some application flow diagrams have been changed accordingly. Clarifications and examples added in section 4.1. Requirement for deleting control parameters upon service change added in section 4.2.2. Flowcharts added in 4.2.2. Added wording for performance requirements in section 4.4.1.
1.2	2005/04/05	Jörg Eich Uwe Wiedow	Added dual carousel option. Added mosaic requirement. Added return code value "DATA_NOT_YET_AVAILABLE" in Communication Protocol; drawings for application flow changed accordingly. Minor corrections.

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			Correction in Bluetooth section: Added SPP on top of plain RFCOMM. Deleted transaction_id out of PMT Descriptor (not needed, because STB has to listen always to DSI). GetCommand in Communication Protocol changed; drawing for application flow changed accordingly
		Jörg Eich	Added "reminder" for PDR requirements.
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			Term BluLink replaced by Blucom. Introduction of blucom_uid parameter in sections 3 and 4.2.3. Moved name_descriptors out of DSM-CC messages into newly created Blucom Header. GetCommand changed. GetContext command added. Communication protocol application flow diagrams revised. Context element c removed from Blucom control file. Context value is now determined by the blucom_data_descriptor (3).
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		Uwe Wiedow	STX and ETX added to communication protocol (4.5.1.1). RefreshResponse changed: IsSyncPage attribure has moved from element DisplayPage to root element RefreshResponse (4.5.4); Hex values for BLUCOM UUID corrected. Descriptors for data carousel added. Reference for control file in carousel changed. Minor
1.5.2	2005/05/31	Jörg Eich	corrections.
1.5.2a	2005/06/01	Uwe Wiedow	IsSyncPage attribte has moved again to Element DisplayPage where it belongs to (4.5.4); corresponding application flow changed accordingly.

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			Clarifications on UI requirements, usage of descriptors in blucom data header and compression of modules. Company name changed from DPC to APS. ATTENTION: Authentication String changed!
1.5.3	2005/07/18	Jörg Eich Uwe Wiedow	The value "BLUCOM" does no longer specify an UUID but the name of a service based on the Serial Port Profile (7.4)
1.5.3a	2005/07/22	Jörg Eich	Changed DPC to APS in all locations

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Related Documentation

[1] ISO/IEC 13818-1 / ITU-T H.222.0 "Information technology - Generic coding of moving pictures and associated audio information: Systems"

[2] ISO/IEC 13818-6 "Information technology - Generic coding of moving pictures and associated audio information - Part 6: Extension for Digital Storage Media Command and Control"

[3] ETSI EN 300 468 "Digital Video Broadcasting; Specification for Service Information (SI) in DVB systems"

[4] ETSI EN 301 192 "Digital Video Broadcasting; DVB specification for data broadcasting"

[5] Technical Specification - ASTRA DVB Mosaic Application for TV/Radio and Data Channels

[6] Extensible Markup Language (XML) 1.0 (Third Edition)" W3C Recommendation, http://www.w3.org/TR/REC-xml

[7] IETF RFC 1950 (1996): "ZLIB Compressed Data Format Specification version 3.3"

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Conventions

Convention	Usage
DEFINE	Types, definitions and enumerations
ObjectProperty	Object properties and methods
`Filename`	Filenames and typed user input

Abbreviations and Acronyms

Abbreviation	Meaning
BL	Blucom
DPC	Digital Playout Center
PDA	Personal Digital Assistant
GSM	Global System for Mobile Communications
GPRS	General Packet Radio Service
HTML	Hypertext Markup Language
XHTML	Extensible Hypertext Markup Language
BCD	Binary Coded Decimal
DVB	Digital Video Broadcasting
MPEG	Moving Pictures Experts Group
PMT	Program Map Table
STB	Set Top Box (equivalent expression: receiver)
DSM-CC	Digital Storage Media – Command & Control
U-N	User to Network

Verbal forms for the expression of provisions

Verbal form	Indication	Equivalent expression
Shall	Requirement	Must
shall not	Requirement	must not
Should	Recommendation	it is recommended that
should not	Recommendation	it is not recommended that
May	Permission	is allowed
need not	Permission	it is not required that
Can	Possibility/Capability	be able to
Cannot	Possibility/Capability	be unable to

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1 Introduction

1.1 Purpose of document

This document specifies the requirements of the "Blucom" extension for digital receivers (STBs).

1.2 Audience

This document is intended for STB manufacturers, who intend to implement the Blucom extension in their products.

1.3 Product Scope

The Blucom extension allows digital receivers to capture a Blucom data stream, which is broadcasted along with any digital TV or radio service.

The receiver caches the complete Blucom data in it's RAM in order to provide fast response times upon client's requests.

Blucom clients (typ. handheld devices like mobile phones or PDAs) may connect to the Blucom Receiver via a Bluetooth wireless connection and request Blucom data from the receiver.

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2 System Overview

Fig. 1 gives an overview of the overall Blucom architecture.

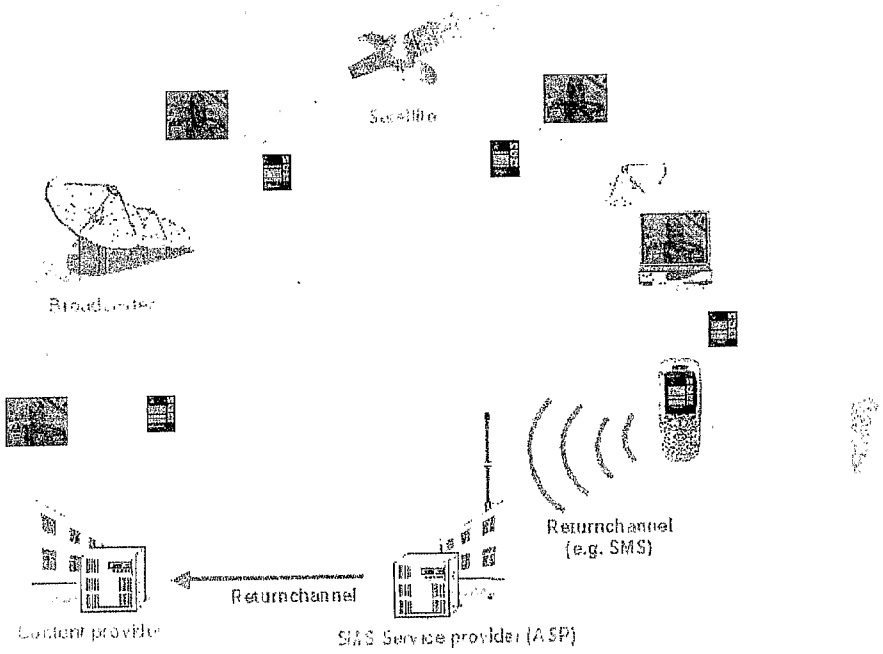


Fig. 1 – overview of Blucom architecture

2.1 Content Provider

The content provider creates the Blucom content by using an appropriate authoring system.

Specification not covered in this document.

2.2 Broadcast Center

The broadcast center is in charge of formatting the Blucom content according to the data carousel format specified in this document, broadcasting the data carousels and signalling according to the specification in this document.

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2.3 Set Top Box

In the context of the Blucom system, the digital receiver acts as a content server towards any client device.

The Blucom data is parsed from one or more DSM-CC data carousels, which are carried in the MPEG transport stream as data components of any MPEG program. The STB shall store the complete payload of all Blucom data carousels of the appropriate version (see 3) in the Blucom Cache, which is allocated in the STB's RAM.

The Blucom Cache can be regarded as a shared memory resource which is filled with data by the DSM-CC client. Data is requested out of the Blucom cache by the data server component, which is dedicated to handle client requests for Blucom data.

The receiver software implementation for the Blucom extension is up to the STB manufacturer. APS does not provide any software libraries and does not require any middleware implementation in the context of the Blucom extension.

However, the requirements described in this document shall be met by the manufacturer's implementation and will be tested by APS or a subcontractor of APS and, upon successful test pass, certified by APS.

Fig. 2 gives an overview of the functional receiver software structure.

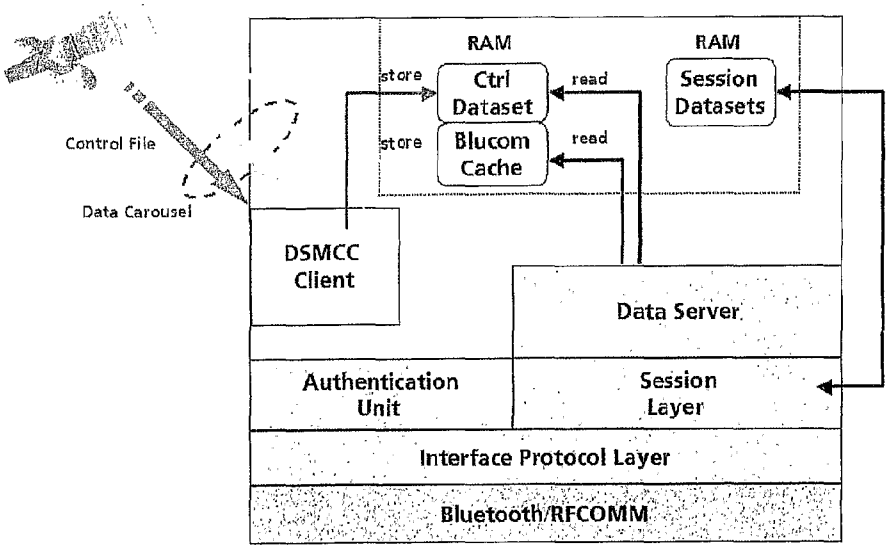


Fig. 2 - Overview of functional receiver software structure

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The functional specification of the receiver requirements for the Blucom extension is covered by this document.

2.4 Browser Application

The browser application typically runs on a handheld device. It establishes a connection between the handheld device and the STB and requests Blucom data from the STB via the established link. The Blucom data will be processed and displayed by the browser application.

Specification not covered in this document.

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3 TS - Signalling of Blucom Data

The stream loop in the PMT of any MPEG program may contain a reference (by an elementary PID field) to one or more elementary streams which carry the associated Blucom Data. The stream type of Blucom data streams is set to 0x0B to indicate that the Blucom data stream contains DSM-CC U-N Messages as specified in [2].

The stream reference to the Blucom data stream contains a private_data_specifier_descriptor as defined in [3] with the private_data _specifier field set to 0x00000001 (SES). Immediately following this private_data_specifier_descriptor there is a blucom_data_descriptor with a private data field of length 0.

A given MPEG program may contain more than one Blucom data carousel in order to allow an independent update and high speed cycle for specific data, such as control file and actual sync page, for instance. If the MPEG program carries more than one Blucom data carousels of the appropriate version, the STB shall parse all of them.

Note: This method of signalling has to be validated against the legacy receiver population. It may be subject to change until this validation process is completed.

Syntax	Bits	Identifier
blucom_data_descriptor(){		
descriptor_tag	8	uimsbf
descriptor_length	8	uimsbf
blucom_version	8	uimsbf
blucom_uid {		
blucom_uid_onid	16	uimsbf
blucom_uid_tsid	16	uimsbf
blucom_uid_sid	16	uimsbf
}		
for (i=0;i<N;i++){	8	uimsbf
private_data_byte		
}		
}		

Table 1: Syntax of Blucom_Data_Descriptor

Semantics of Blucom_Data_Descriptor:

descriptor_tag: This 8-bit field identifies a blucom_data_descriptor and **shall** be set to 0xD0.

descriptor_length: This 8-bit field specifies the number of bytes of the data portion of the descriptor, starting immediately following the descriptor_length field.

blucom_version: This 8-bit field defines the version of the referenced Blucom data carousel. The receiver shall only parse a Blucom data stream, if the version number is set to 0x01.

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blucom_uid: This field consists of 3 16-bit fields and is intended as a unique identifier for each Blucom service, which may consist of one or more Blucom carousels.

All carousels of one Blucom service shall have the same blucom_uid.

The blucom_uid shall be uniquely assigned. Therefore this field shall be composed of the Service Id , Transport Stream ID and Original Network ID of one of the services carrying the Blucom carousel as a data component.

Example:

ONID: 0x0085
TSID: 0x0001
SID: 0x001B
resulting blucom_uid: 0x00850001001B

The purpose of this field is to allow the sharing of one or more Blucom carousels between several services on a given transport stream while maintaining an optimal performance. In the case where an operator offers e.g. 3 movie channels on the same transport stream, he may want to share the same Blucom data between these 3 channels. In this case he would reference the same Blucom PIDs in the PMT of all 3 movie services. The STB knows by evaluating the blucom_uid, whether it shall delete the control parameters and purge the Blucom cache or if it shall maintain the data in order to allow for a better performance of a shared Blucom service upon a service change.

private_data_byte: This is an 8-bit field, the value of which is privately defined.

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4 Receiver software requirements

4.1 Data Carousel

4.1.1 Performance of DSM-CC parser

The DSM-CC Parser shall always be active in the background.

The STB shall be able to capture a Blucom data stream of up to 6Mb/s without affecting the overall performance of the receiver (i.e. A/V decoding, UI response time, zapping performance, teletext processing) and without discarding any Blucom data modules and control parameters in one turn of the carousel, provided all structural information regarding the carousel, such as DSI and DII has been obtained.

If a Blucom service is split up into more than one carousels, the performance requirement of 6Mb/s shall apply to the sum bitrate of all carousels.

4.1.2 Data carousel structure

The Blucom data carousel is based on the DVB data carousel specification as defined in [4].

The Blucom data carousel is formatted as a two layer data carousel and accordingly uses the following 3 message types:

DDB - Download Data Block

DII - Download Info Indication

DSI - Download Server Initiate

All Blucom messages are carried on one single PID.

The Blucom data files are structured as modules which are transmitted in one or more DDB messages. The modules are referenced by a DII message. All modules referenced in one DII are forming a group, which is identified by the transactionId of the DII message. The groups identified by the transactionId of the related DII messages are referenced in one DSI message. The groupId in the DSI message equals the transactionId of the DII message. All Blucom data files shall be stored under a dedicated Blucom directory (e.g. "/blucom) which shall be root for all Blucom related operations.

The structure of the DSM-CC messages required by the Blucom service is set out in annex A.

4.1.3 Descriptors in the data carousel

The Blucom data carousel supports the following subset of the descriptors specified in [4], which shall be evaluated by the STB. The syntax and semantics of each descriptor is set out in Annex A:.

- **Descriptor:** crc32_descriptor
  Support: Mandatory

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Location: DII - moduleInfo
Usage: This descriptor shall be evaluated by the STB, in order to assure that the data modules have been received correctly. If the CRC 32 received in this descriptor does not match the CRC 32 calculated form the respective data module, the data module shall be discarded and reloaded on the next carousel turn.

- **Descriptor:** compressed_module_descriptor
  Support: Mandatory
  Location: DII – moduleInfo
  Usage: Upon detection of this descriptor, the STB shall decompress the related module before further processing of the data, i.e. before evaluation of the blucom header and storing the data portion in the blucom cache.
  Note: A control file shall never be compressed.

- **Descriptor:** group_link_descriptor
  Support: Mandatory
  Location: DSI – groupInfo
  Usage: This descriptor shall be evaluated by the STB, in order to support large groups. It will be used by the carousel generator, when the description of the modules in a group exceeds the maximum size of a single DII message and has to be spread across a number of such messages.

- Descriptor: name_descriptor
  Support: Optional
  Location: DSI- groupInfo
  Usage: This descriptor carries the name of the top level directory, under which all files of the respective group are stored, resp. shall be stored in the blucom cache. A STB may evaluate this descriptor in order to optimize the blucom cache management.

4.1.4 Blucom data header

All Blucom files are preceded by a Blucom data header, according to the structure indicated in Table 2. Upon reception of a complete module, the STB shall split the Blucom Header from the payload, evaluate the Blucom data header information and process the payload (excluding the Blucom data header) according to the information provided in the Blucom data header.

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Syntax	Num. of Bytes
`blucom_data_header() {`	
`blucom_version` -	1
`blucom_info_length`	2

`for (I=0;I<N;I++) {`
`blucom_info_byte`
`}`
	1

`private_data_length`	2

`for (I=0;I<N;I++) {`
`private_data_byte`
`}`
	1

`}`	

Table 2: Blucom data header syntax

Semantics of the Blucom data header:

blucom_version: This field shall be set to 0x01 in Blucom version 1.0. The STB shall only process files with the blucom_version field set to 0x01.

blucom_info_length: This 16-bit field indicates the length in Bytes of the descriptor loop to follow.

blucom_info_byte: This field conveys a list of descriptors which each define one or more attributes of the Blucom file transported in the actual module.

For Blucom data files this field carries at least a name_descriptor indicating the full path and filename information of the related file. If this field does not carry a name_descriptor, the STB shall not regard the related file as a Blucom data file.

For a Blucom control file this field shall contain at least a control_file_descriptor.

If the Blucom header does not contain a name_descriptor or a control_file_descriptor, the STB shall not process the file transported in the related module. This provision shall allow the headend system to use additional descriptors in the future without affecting any legacy STBs.

private_data_length: This field defines the length in bytes of the following private data field. The STB shall ignore any following private data bytes.

private_data_byte: These fields are user defined and shall not be evaluated by the STB.

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4.1.5 Descriptors in the Blucom data header

4.1.5.1 Name descriptor

For Blucom data files, the Blucom data header shall at least contain a name descriptor according to the syntax as set out in Table 3. Additional descriptors in the blucom data header, which are not defined in this document, shall be ignored by the STB.

name_descriptor() {	Number of Bytes	Value
descriptor_tag	1	0x02
descriptor_length	1	

for (I=0;I<N;I++) {
text_char
}
	1	Filename and full path information

}		

Table 3: Syntax of the name_descriptor

Semantics of the name_descriptor:

descriptor_tag: This 8-bit field identifies the descriptor. For the name_descriptor this field is set to 0x02.

descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following this field.

text_char: This is an 8-bit field. A string of "char" fields specifies the filename and path information, which shall be used as the storage location, relative to the Blucom root directory, of the related file in the STBs filesystem. Text information is coded using the character sets and methods described in annex A of [3].

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4.1.5.2 Control file descriptor

A Blucom control file shall be indicated by a control_file_descriptor in the Blucom data header. If there are additional descriptors in the blucom data header, these shall be ignored by the STB. The presence of the control_file_descriptor always denotes the module payload following the blucom data header as control file data.

control_file_descriptor() {	Number of Bytes	Value
descriptor_tag	1	0x01
descriptor_length	1	

for (I=0;I<N;I++) {
descriptor_data
}
	1	

}		

Table 4: Syntax of the control_file_ descriptor

Semantics of the control_file_descriptor:

descriptor_tag: This 8-bit field identifies the descriptor. For the control_file_descriptor this field is set to 0x01.

descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following this field. This field may be set to zero in order to indicate no following descriptor bytes.

descriptor_data: This field may contain a number of descriptor bytes as indicated in the descriptor_length field.

4.1.6 Example of a Blucom data header

The example in Fig. 3 shall illustrate the format of the Blucom data header of a Blucom data file.

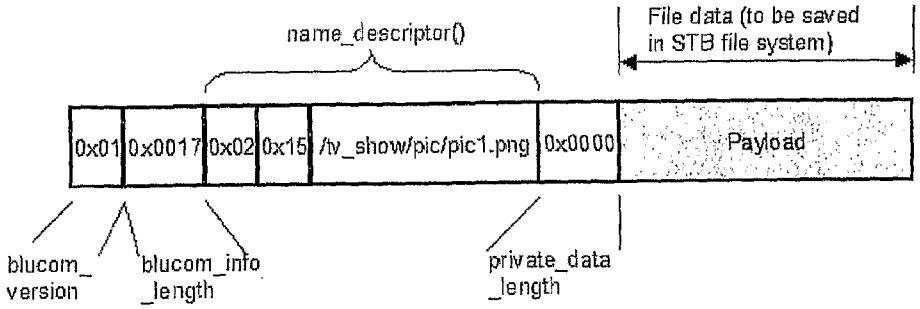


Fig. 3 – Example for a Blucom data header

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Upon reception of the complete module, the STB shall split the payload portion from the header and save the payload portion under the location /blucom/tv_show/pic/pic1.png where /tv_show/pic/pic1.png specifies the Blucom name in a Blucom GetRequest (4.5.5). In this example it is assumed that the STB's Blucom root directory is named /blucom.

Example GetRequest:

```
<GetRequest
  requestId="00-02-72-80-EC-FE-00004"
  context="0x00850001001B">
  <FileUrl name="/tv_show/pic/pic1.png" version="1"/>
</GetRequest>
```


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4.2 Blucom Cache

In order to allow fast access to the Blucom data by any connected client device, the STB shall buffer all Blucom data in the Blucom cache. The Blucom cache can be regarded as the linking element between the data carousel capture and the client data server. In that respective it can be regarded as a shared memory resource.

The directory structure inside the Blucom cache shall be according to the path and filename information obtained from the Blucom headers. This structure is used as a reference for client requests.

From the broadcast carousel side the information needed for maintaining the Blucom cache is the groupID and moduleID and the module version of each file.

Updates of the Blucom data carousel shall be detected by a change of the transaction_id of the DSI.

4.2.1 Blucom cache allocation

The Blucom cache shall be allocated in the STB's RAM.

The Blucom data cache size shall be as specified in section 6.1

4.2.2 Blucom cache management: Data capture

As soon as the STB detects a valid Blucom data component on the actual tuned MPEG program (according to section 3), the STB shall immediately start capturing the Blucom data and write it to the Blucom cache.

4.2.3 Blucom cache management: Service change

The Blucom cache shall be purged upon a change of the actual tuned service to another service which carries Blucom data and be filled with the Blucom data of the then tuned service.

Exception: If the blucom_uid of the new service matches the blucom_uid of the previously tuned service, the STB shall maintain the Blucom cache in order to allow for a better performance in the case where Blucom data is shared between services.

Note: If the RAM Space reserved for the Blucom cache does not need to be allocated completely to store the Blucom carousel data of the new service the STB may keep the previous Blucom data in order to speed up data access if the STB is tuned back to the previous Blucom service.

If the new service does not support Blucom, previously downloaded Blucom data shall be maintained in the Blucom cache in order to allow for a fast access to the Blucom data in case the user tunes back to the previously tuned Blucom Service.

The Blucom control parameters shall be deleted immediately upon a service change, regardless whether the new service carries any Blucom data or not. This provision shall make sure that Blucom data of any given service is only available

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to the mobile device, and to users consequently, if the STB is actually tuned to the said service.

Exception: If the blucom_uid of the new service matches the blucom_uid of the previously tuned service, the STB shall maintain the Blucom control parameters in order to allow for a better performance in the case where Blucom data is shared between services.

The required Blucom cache and control parameter management upon a service change is illustrated in Fig. 4 and Fig. 5.

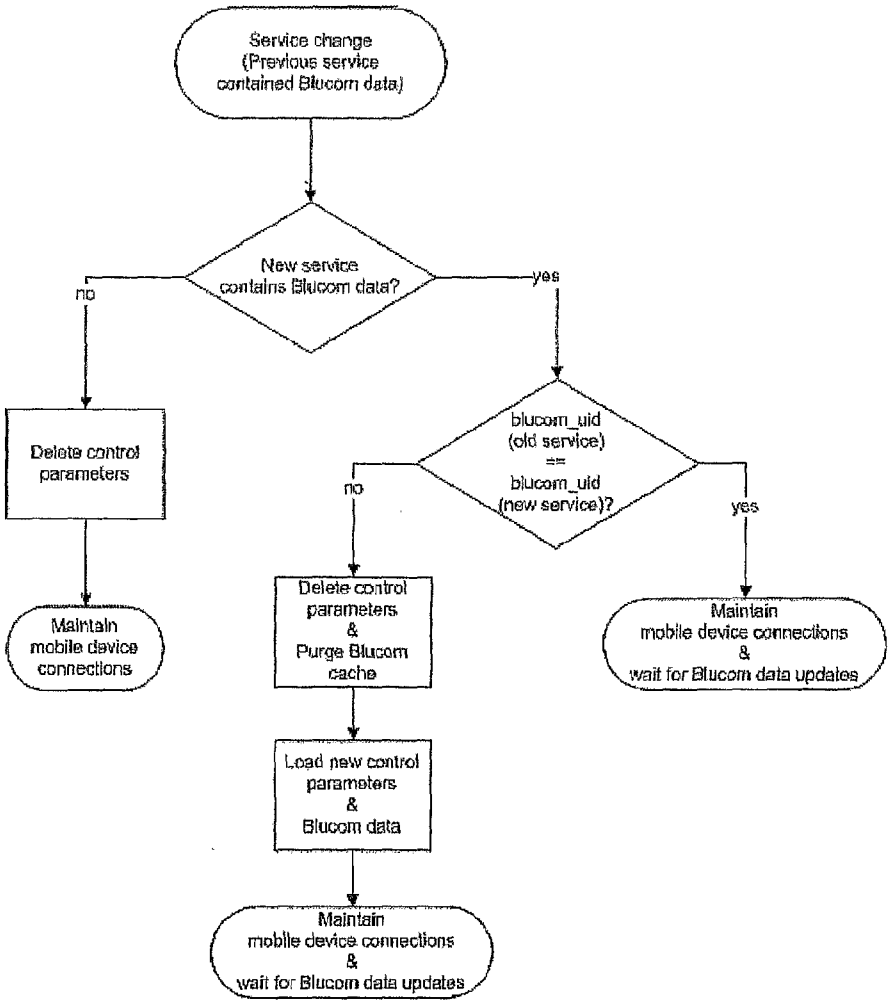


Fig. 4 - Blucom cache management upon Service change from Blucom service

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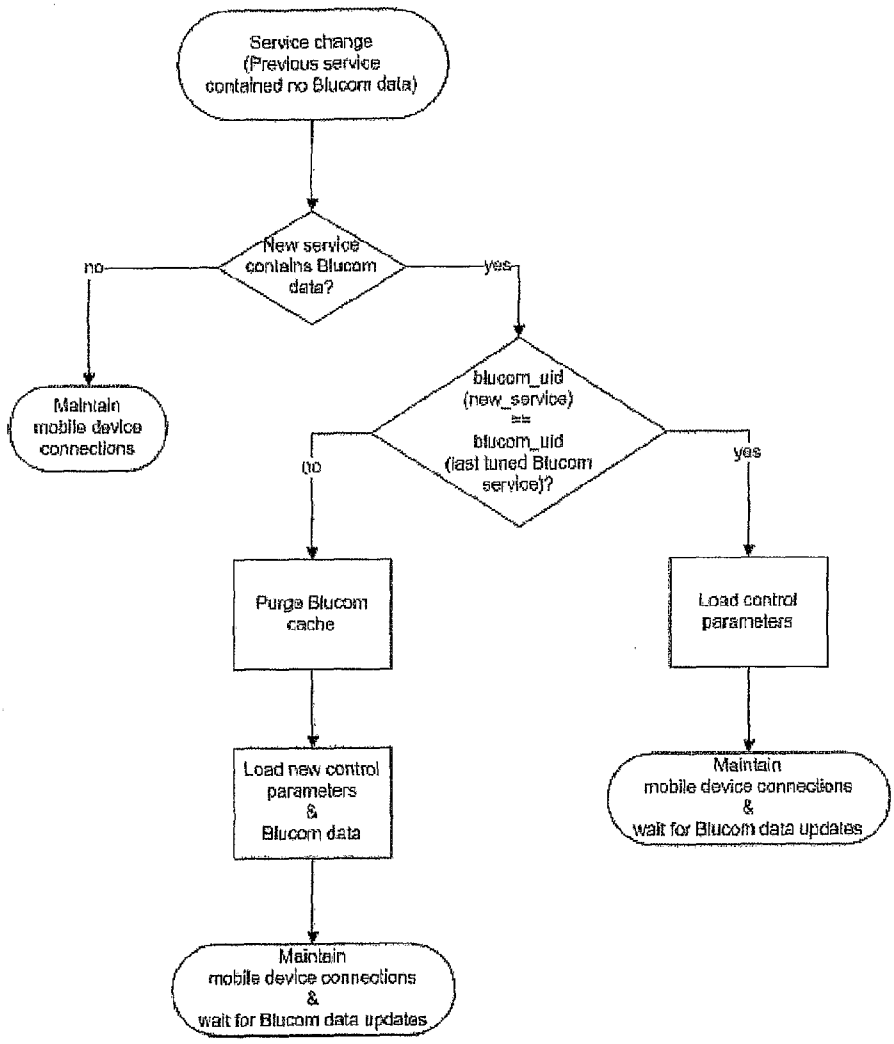


Fig. 5 – Blucom cache management upon service change from non-Blucom service

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4.2.4 Blucom cache management: Update

The Blucom data files stored in the receiver's Blucom cache shall be updated upon a change of the module version number of the related module.

The module version numbers of all Blucom files, being loaded in the Blucom cache, have to be maintained by the STB in order to allow:

a) a high performance updating procedure for cached Blucom files

b) re-using the module versions as transparent version information for serving the mobile device interface.

If upon an update of a module (i.e. change of module version number) the storage location indicated in the Blucom header changes, the STB shall delete the old file and store the updated file in the new storage location.

Any empty directories remaining after deletion of a file in the Blucom cache shall be removed from the Blucom cache.

4.2.5 Blucom cache management: Purge

A Blucom data file shall be purged from the receiver's Blucom cache as soon as it (i.e. the related module Id) is not referenced in the related DII anymore.

All Blucom data files of a given groupID shall be purged from the Blucom cache as soon as the related groupId is not referenced in the DSI of the related carousel anymore.

Any empty directories remaining after a purge operation shall be removed from the Blucom cache.

Note: This requires consistent data playout from the headend system at all times.

4.2.6 Blucom cache management: Overflow exception handling

If the amount of Blucom data being broadcasted in the context of the actual tuned Blucom Service is bigger than the defined Blucom cache size, the STB shall discard the oldest data in the Blucom cache. The determination of the age of the Blucom data shall be done by evaluation of the storage timestamp.

Exception: The actual sync page, as it is referenced by the actual control parameter set, shall not be discarded.

The intention of this provision is to make sure that the receiver does not crash in the case of a too big carousel being played out. However, the availability of the Blucom service will be unpredictable in this case. Therefore the Headend system shall make sure that the total playload of a Blucom service never exceeds the limit as specified in 6.1.

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4.3 Control file

The purpose of the control file is to specify the receiver's reaction upon a client's request for Blucom data. Unlike the Blucom data files, which will be stored in the receiver's file system without any prior interpretation, the STB needs to parse the content of the control file and store the control parameters immediately after reception of the control file.

In the carousel, the control file is identified by the presence of a control_file_descriptor in the blucom data header.

As soon as the STB detects a new Control File in the Blucom data carousel, it shall update the control file data in the receiver's RAM. Upon the next client request, the STB shall react according to the rules determined by the new control file.

4.3.1 Performance

The STB shall parse a new control file and store and activate the according parameters immediately after receiving said control file.

4.3.2 Format

The Blucom Control file is based on the XML file format.
In the following a brief XML schema description shows the structure of the Blucom control file.

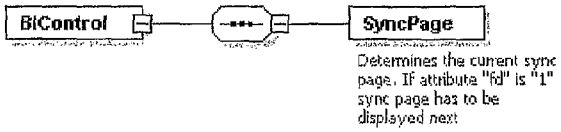


diagram	SyncPage Determines the current sync page. If attribute "forceDisplay" is "TRUE" sync page has to be displayed next					
attributes	Name	Type	Use	Default	Fixed	Annotation
	na	**xs:string**	required			Page name (na) including path
	fd	**xs:boolean**	required			ForceDisplay (fd) Valid values "1" or "0". Used to force mobile device to display current SyncPage.
	ri	**xs:integer**	required			Refreshinterval (ri) for mobile device in milliseconds.
annotation	documentation	Determines the current sync page. If attribute "fd" is "1" sync page has to be displayed next				

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4.3.3 Control File Download

The control file has to be downloaded from the data channel carousel (see 4.1) parsed and the acquired settings have to be stored to internal variables in order to serve the Blucom Protocol.

The blucom_uid as referenced in the blucom_data_descriptor inside the PMT of the actual tuned Blucom service (see 3), shall be assigned as the context.

If the actual tuned service does not contain a Blucom data component, the context shall be an empty string.

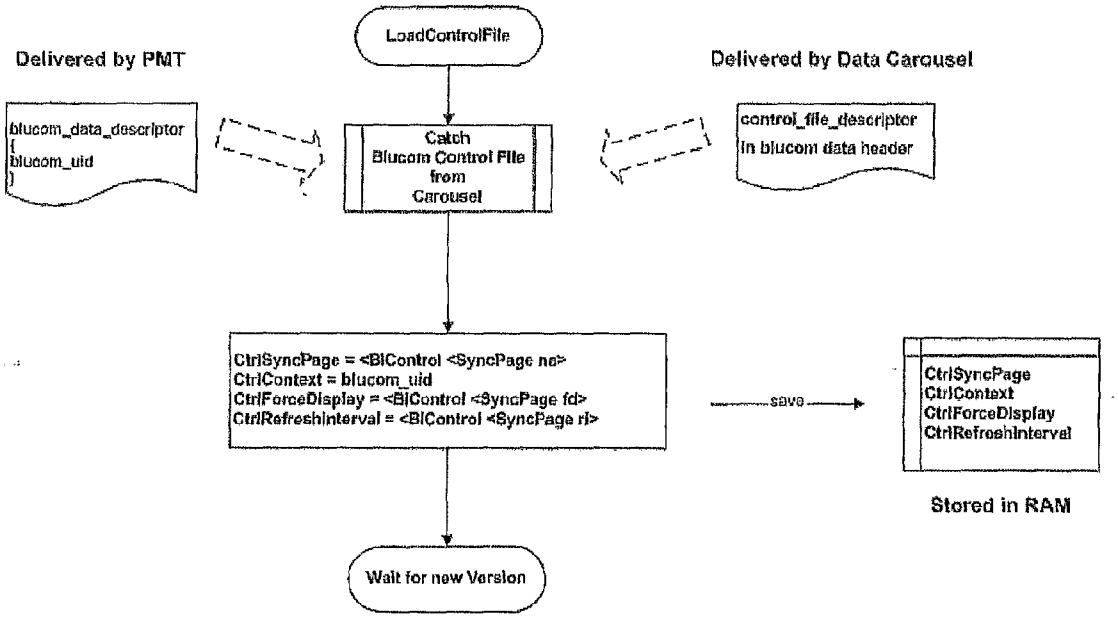


Fig. 6 – Application flow "LoadControlFile" from Data Carousel

4.3.4 Example

```
<?xml version="1.0" encoding="UTF-8"?>
<BlControl
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="blucomctrl.xsd">
   <SyncPage na="/index.htm" fd="1" ri="10000"/>
</BlControl>
```


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4.4 Mobile Device Interface

4.4.1 Performance

The mobile device interface performance definition shall ensure that under predefined conditions the reaction time upon client requests does not exceed the defined limit.

Conditions:

- Only one client is connected to the STB.
- BT data rate 500kb/s net.
- Measurement point is the Bluetooth radio layer.
- The requested file is already present in the STB's Blucom cache.

Upon a client request for a 10kB file, the STB shall complete the delivery of the whole file within 250ms after the issuing of the client request.

If during the implementation of a prototype it turns out that the required performance cannot be reached by any technically reasonable implementation, this performance requirement may be changed accordingly. However the STB implementation shall ensure that the highest possible performance is reached.

4.4.2 Interface Protocol

The Interface Protocol between Set Top Box (STB) and Mobile Device is based on the XML file Format. All xml tags shall be built according to [6]. In order to keep the amount of protocol data as small as possible it is recommended to use the XML short-form for building the XML protocol.

Example long-form:
<InitiateResponse requestId="00-02-72-80-EC-FE-00001" retCode="OK">
</InitiateResponse>

Example short-form (recommended):
<InitiateResponse requestId="00-02-72-80-EC-FE-00001" retCode="OK"/>

The protocol definition is set out in 4.5. The low level communication is based on the Bluetooth wireless technology. The requirements for the Bluetooth implementation are described in 7.

4.4.3 Initiate Connection

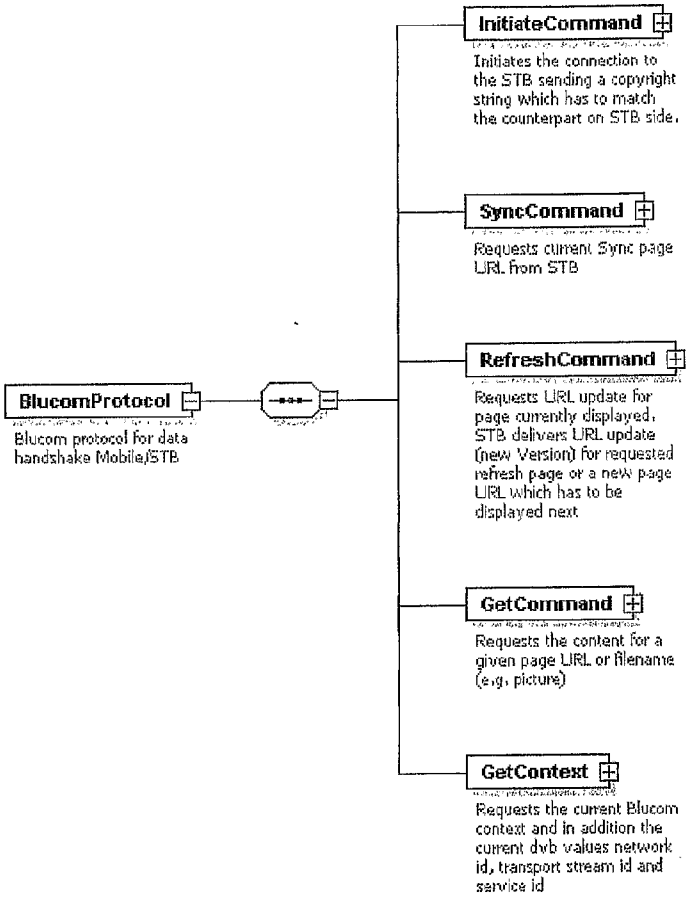
The Mobile Device initiates the communication channel to the STB. After finishing Device and Service discovery, the mobile device invokes an initial request delivering a copyright string, which must match the counterpart stored in the STB application. The STB itself reacts by sending a return code, which denotes the acceptance or refusal of the Mobile Device connection request.

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4.5 Mobile device interface protocol definition

There are five different commands defined which are described in the following sections.



4.5.1 Generics

4.5.1.1 Marking Commands

Each BLUCOM Command shall be opened by a leading Start Text (STX) byte and closed by an End Text (ETX) byte.

The corresponding values defined

- for STX byte: 0x02
- for ETX byte: 0x03

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Example:

```
ff02<InitiateRequest
requestId="00-02-72-80-EC-FE-00001"
cprString="Copyright by APS, ASTRA Platform Services
GmbH"/>ff03
```

In order to avoid any conflicts with values inside binary content, STB shall precede each STX or ETX byte with an additional 0xff byte. Regarding each regular 0xff inside binary content, STB shall precede those bytes with another 0xff byte as well.

Example:

Binary code sequence (4 byte): 0x01 0xa0 0xff 0x40

Will be changed by STB to (5 byte): 0x01 0xa0 0xff **0xff** 0x40

Note:

Regarding the BLUCOM GetCommand (4.5.5) the length attribute of the GetResponse command specifies always the length (number of bytes) of the original content excluding all expanded 0xff bytes.

Regarding the BLUCOM Command evaluation, STB may use the byte combination 0xff 0x02 (STX sequence) to detect the beginning of a BLUCOM command sent by the Mobile Device and the combination 0xff 0x03 (ETX sequence) to detect the end of the currently processed BLUCOM command.

In case that STB detects an unexpected STX sequence or an invalid successor byte after 0xff, all collected data for the currently processed command may be discarded and STB shall start listening for a new STX sequence.

4.5.1.2 requestId

Each Blucom command contains a requestId, which is unique for all commands sent by the connected Mobile Devices. The STB shall use the same requestId when building the response section for the corresponding request received from the Mobile Device.

4.5.1.3 Concurrent Requests

The STB shall be able to store up to 10 incoming requests per connected device. The STB shall respond each request in the same order as it was sent by the Mobile Device and accepted by the STB.
In order to store 10 requests for each connected Mobile Device, which means maximum 70 requests for 7 concurrently connected devices requires at least 50kB RAM space which needs to be reserved by the STB.

4.5.1.4 Case Sensitivity

All attribute values including URL and content file names are case insensitive.

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4.5.1.5 Blucom URL / File Name

The maximum length for all Blucom URL and content file names found in the all Blucom Commands is set to 256 bytes.

4.5.1.6 Protocol Handling

Specifies how the STB shall react on incomplete or incorrect Blucom commands.

- **Incomplete xml command**
  STB discovers a new begin tag before the close tag of the currently processed command was detected.
  Reaction:
  If STB is able to identify requestId and command type a command response according to the command type with **retCode="FAILED"** shall be returned and the incomplete command shall be discarded. Otherwise STB shall discard the incomplete command without sending a response.
- **Unkown attributes**
  STB detects unknown attributes within a complete Blucom command.
  Reaction:
  STB ignores all unknown attributes.
- **Missing required attributes**
  If STB is able to identify requestId and command type a command response according to the command type with **retCode="FAILED"** shall be returned and the incomplete command shall be discarded. Otherwise STB shall discard the incomplete command without sending a response.
- **Syntax Error**
  STB discovers one or more syntax error(s) within a Blucom command.
  Reaction:
  If STB is able to identify requestId and command type, a command response according to the command type with **retCode="FAILED"** shall be returned and the incomplete command shall be discarded. Otherwise STB shall discard the incomplete command without sending a response.

4.5.1.7 DATA_NOT_YET_AVAILABLE vs. DATA_NOT_AVAILABLE

The Blucom protocol distinguishes two states of content unavailability. DATA_NOT_AVAILABLE means the content requested is not available. This is typically the case, if all Blucom data of the actual tuned service is already downloaded to the cache, but the requested file is not present in the cache.

DATA_NOT_YET_AVAILABLE means the content requested is currently not available but it might be possible that it will be available soon. This is typically the case, if the Blucom data of the actual tuned service is not yet completely downloaded into the STB's blucom cache, i.e. there is a chance that the requested file is part of the remaining carousel data. This also applies for updates of the Blucom data carousel.

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4.5.1.8 Parental Control

In any case, i.e. even if the video and audio presentation of the actual service is blocked due to a parental control implementation, the STB shall continue, respectively start caching and updating of Blucom data in the background.

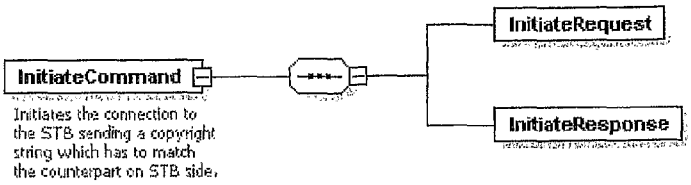
The STB shall, irrespective of any blocking rules for the video and audio presentation, at all times serve the mobile device interface according to this specification.

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4.5.2 InitiateCommand



The Mobile Device sends an InitiateRequest, which shall be answered by STB using InitiateResponse.

Diagram	InitiateRequest					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	cprString	**xs:string**	required			Copyright string, which shall be checked on STB side. The STB shall accept a connection solely if the mobile device has sent a correct string.

Example:

```
<InitiateRequest
   requestId="00-02-72-80-EC-FE-00001"
   cprString="Copyright by APS, ASTRA Platform Services GmbH"/>
```

diagram	InitiateResponse					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" Copyright string was valid "FAILED" something went wrong "REFUSED" Copyright string was invalid; connection was refused

Remark:

The Initiate Command shall be seen as a precondition for all further blucom commands. If STB is not able to answer an InitiateRequest with retCode=OK all fol-

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lowing requests (except InitiateRequest) shall be answered with retCode=FAILED.

Example:

```
<InitiateResponse
   requestId="00-02-72-80-EC-FE-00001" retCode="OK"/>
```


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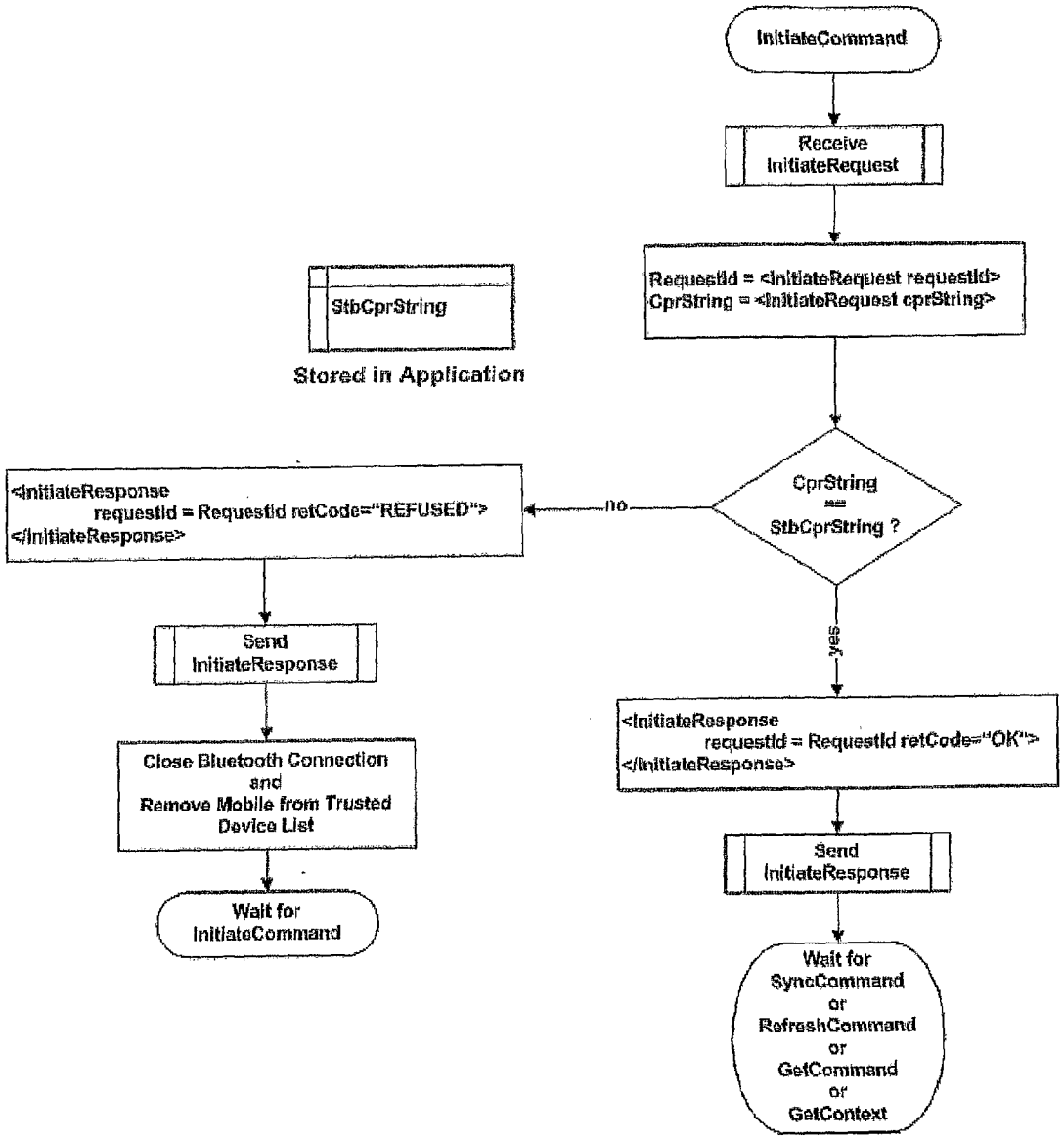


Fig. 7 – Application flow "InitiateCommand"

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4.5.3 SyncCommand

Objective of sending a SyncRequest is to synchronise the Mobile Device to the current SyncPage provided by the last Blucom Control File.

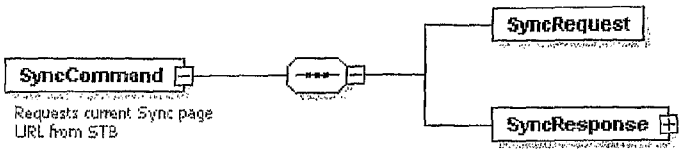


diagram	SyncRequest					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	context	**xs:string**	required			Context string; may be an empty string

Example:

```
<SyncRequest
    requestId="00-02-72-80-EC-FE-00002"
context="0x00850001001B"/>
```

diagram	SyncResponse — SyncPage					
children	**SyncPage**					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" Blucom control parameter are not available "DATA_NOT_YET_AVAILABLE" Sync page not yet downloaded "DATA_NOT_AVAILABLE" Sync page not available
	context	**xs:string**	required			Context string
	refreshInterval	**xs:integer**	required			Refresh Interval in milliseconds for mobile device supplied by Blucom control file

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diagram	SyncPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			SyncPage URL supplied by last Blucom Control File
	version	**xs:Integer**	required			SyncPage Version, corresponds to DDB module version.

Remark:
SyncPage element is optional and may not be filled for **retCode** not equal **"OK"**

Example:

```
<SyncResponse
   requestId="00-02-72-80-EC-FE-00002"
   retCode="OK"
   context="0x00850001001B"
   refreshInterval="10000">
   <SyncPage name="/index.htm" version="1"/>
</SyncResponse>
```


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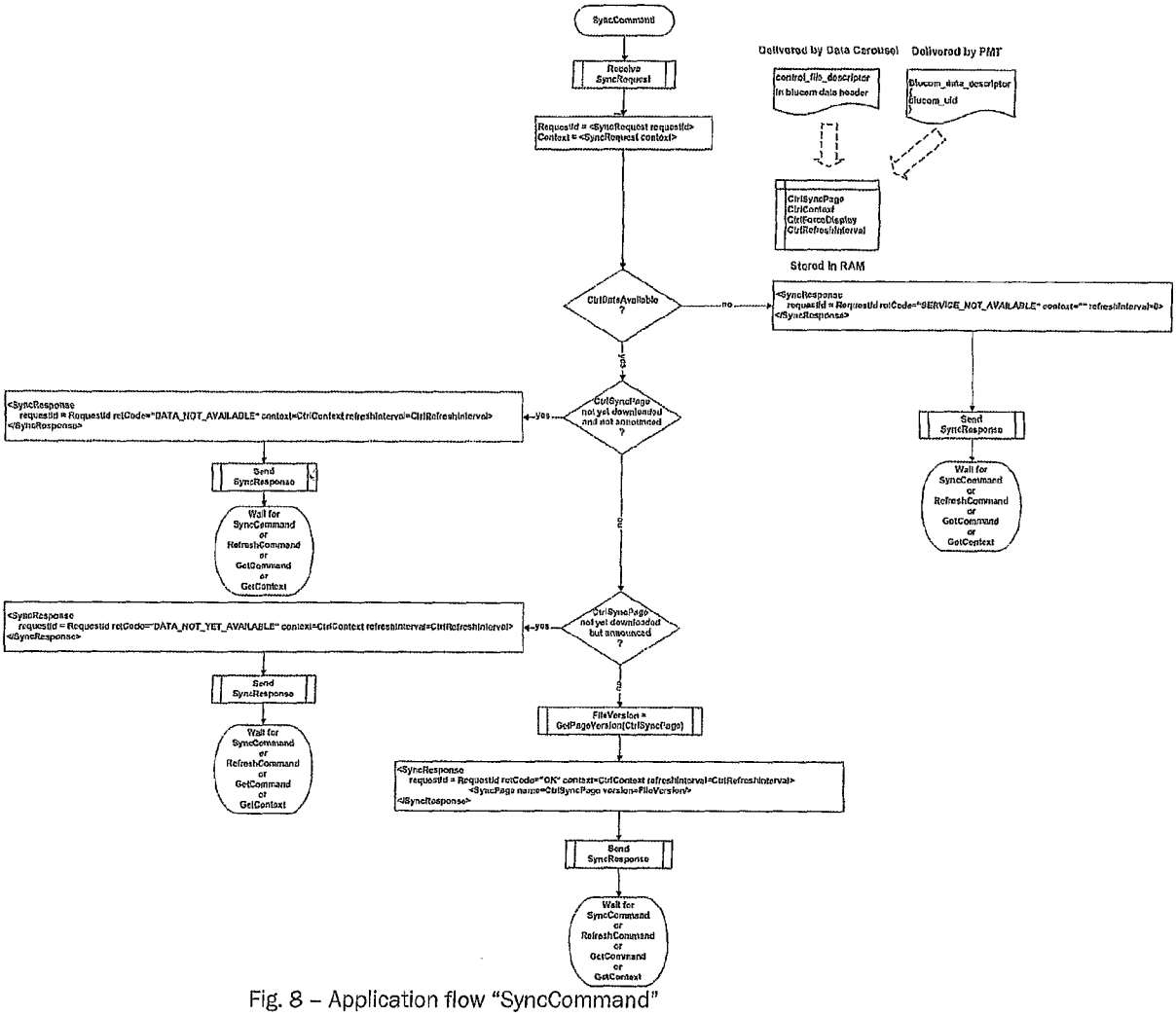


Fig. 8 – Application flow "SyncCommand"

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4.5.4 RefreshCommand

Objective of sending a RefreshRequest is to ask the STB for a new version of the page currently displayed. STB shall deliver a page URL to be displayed next. That could be either the current version of the requested page or the current sync page supplied by the Blucom control file. (See application flow below)

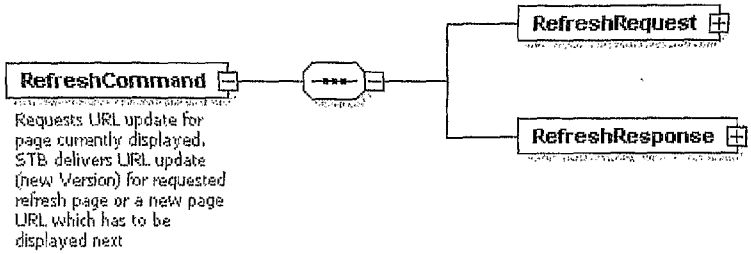


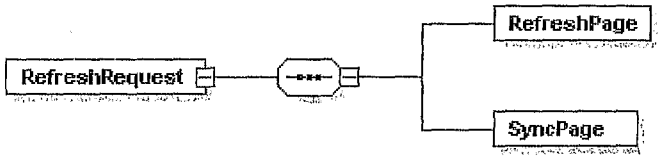
diagram						
children	**RefreshPage SyncPage**					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	context	**xs:string**	required			Context string

diagram	**RefreshPage** Page to be updated					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Page URL
	version	**xs:integer**	required			Page Version, corresponds to DDB module version of the actual displayed page

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diagram	SyncPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	xs:string	required			Present SyncPage URL from Mobile Device
	version	xs:integer	required			SyncPage Version, corresponds to DDB module version of the actual sync page

Example:

```
<RefreshRequest
   requestId="00-02-72-80-EC-FE-00003"
   context="0x00850001001B">
  <RefreshPage name="/link1.htm" version="1"/>
  <SyncPage name="/index.htm" version="2"/>
</RefreshRequest>
```

diagram	RefreshResponse — DisplayPage					
children	DisplayPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	xs:string	required			Identifies current request/response
	retCode	xs:string	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" Blucom control parameter are not available "DATA_NOT_AVAILABLE" Refresh or Sync page not available "DATA_NOT_YET_AVAILABLE" Refresh or Sync page not yet downloaded
	context	xs:string	required			Context string
	refreshInterval	xs:integer	required			Refresh interval in milliseconds for mobile device supplied by the Blucom control file

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diagram	DisplayPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			DisplayPage URL
	version	**xs:integer**	required			DisplayPage Version, corresponds to DDB module version
	isSyncPage	**xs:boolean**	required			"1" if delivered Page is a Sync Page URL (supplied by the Blucom control file) otherwise "0"

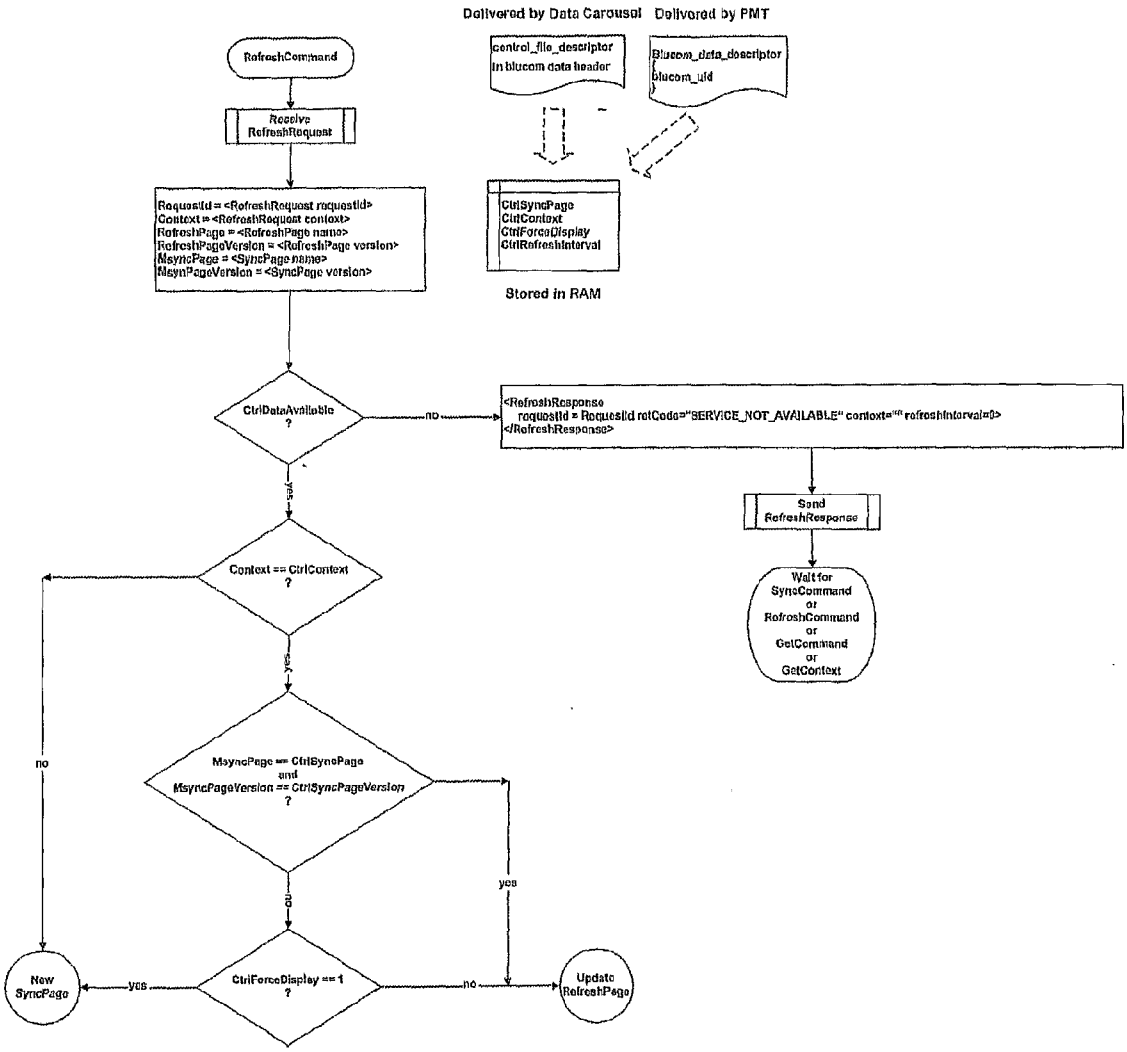
Remark:
DisplayPage element is optional and may not be filled for **retCode** not equal **"OK"**

Example:

```
<RefreshResponse
  requestId ="00-02-72-80-EC-FE-00003"
  retCode="OK"
  context="0x00850001001B"
  refreshInterval="10000"/>
    <DisplayPage
       name="/link1.htm" version="2" isSyncPage="0"/>
</RefreshResponse>
```

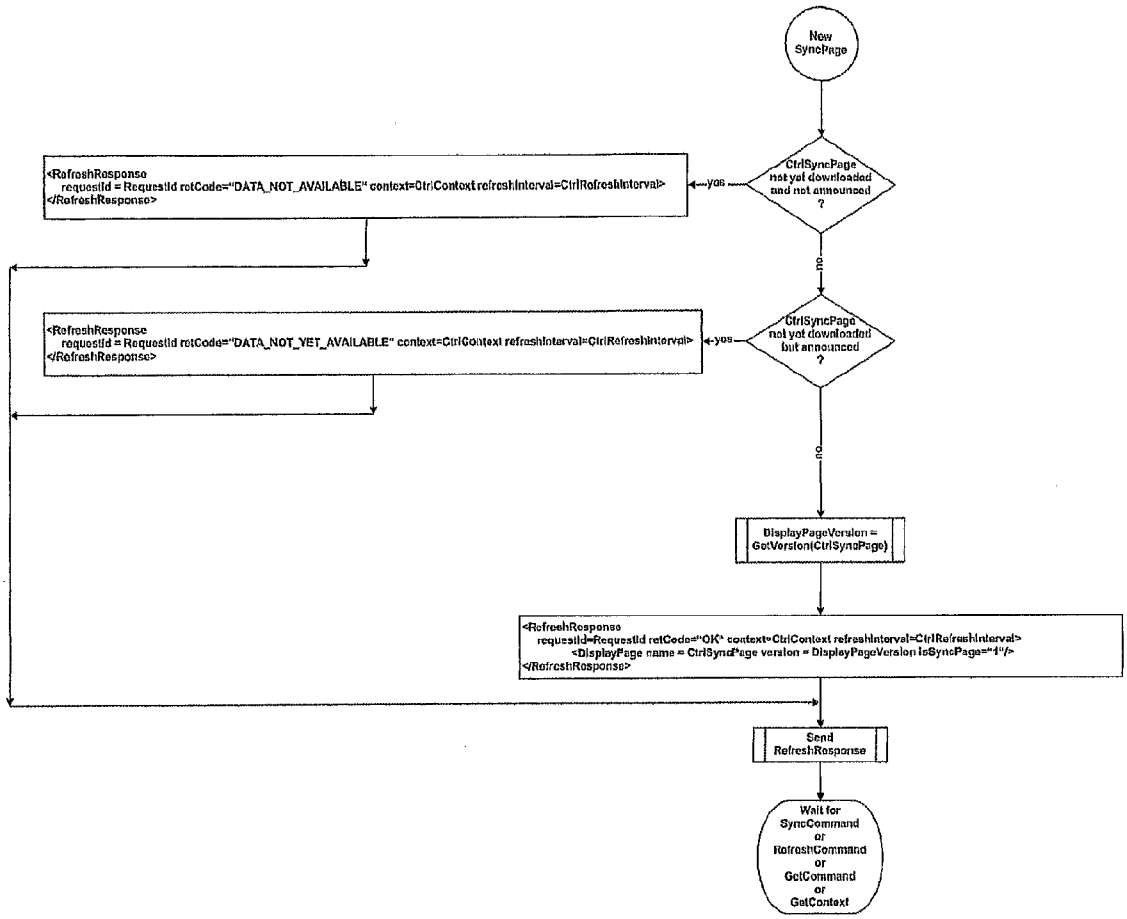

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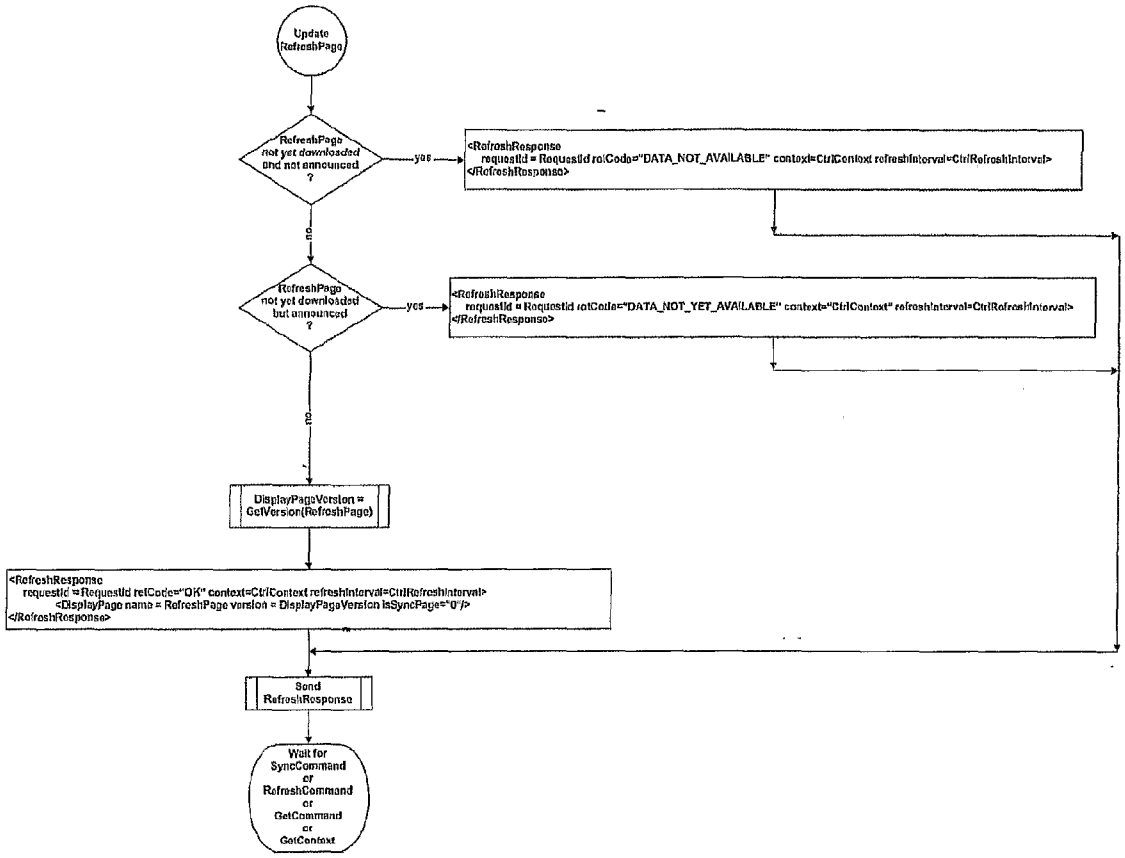


Fig. 9 – Application flow "RefreshCommand"

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4.5.5 GetCommand

Objective of sending a GetCommand is to ask the STB for the content of a certain page delivered by element FileUrl.

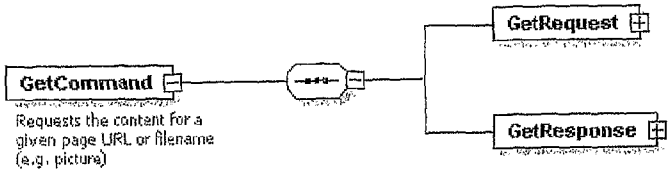


diagram	GetRequest — FileUrl					
children	FileUrl					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	xs:string	required			Identifies current request/response
	context	xs:string	required			Context string

diagram	FileUrl					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	xs:string	required			Page URL or file name
	version	xs:integer	optional			Page URL or file name version; corresponds to DDB module version

Remark:
The version attribute is optional. If it is omitted STB shall deliver the content for the current version available. Otherwise STB shall send the content only if its current version is not equal to the version delivered by the FileUrl element (see application flow).

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Example:

```
<GetRequest
  requestId="00-02-72-80-EC-FE-00004"
  context="0x00850001001B">
  <FileUrl name="/pic/pic1.png" version="1"/>
</GetRequest>
```

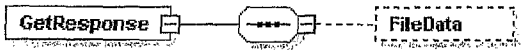
diagram						
children	FileData					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" Blucom Control parameter are not available "WRONG_CONTEXT" Context has changed "DATA_NOT_YET_AVAILABLE" data for page URL not yet downloaded "DATA_NOT_AVAILABLE" no data available for page URL "DATA_UP_TO_DATE" data version is equal to requested version
	context	**xs:string**	required			Context string
	refreshInterval	**xs:integer**	required			Refresh interval in milliseconds for the Mobile Device supplied by last Blucom Control File

diagram						
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Page URL or file name
	version	**xs:integer**	required			Page or file version, corresponds to DDB module version
	length	**xs:integer**	required			Specifies the length (number of bytes) of the original byte block without any expanded 0xff byte according to 4.5.1.1.

Remark:
FileData element is optional and may not be filled for Response **retCode** not equal **"OK"** or **retCode** equal **"DATA_UP_TO_DATE".**
DATA_UP_TO_DATE will never be returned if the optional attribute "version" is omitted in the FileUrl element of GetRequest.

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The data block is stored to the text node of the FileData element in the case retCode = "OK". The first byte of the data block follows immediately the '>' sign closing the attribute list of the FileData element.

Note:
The length attribute specifies always the length (number of bytes) of the original content excluding all expanded 0xff bytes according to 4.5.1.1.

Example:

```
<GetResponse
  requestId ="00-02-72-80-EC-FE-00004"
  retCode="OK"
  context="0x00850001001B"
  refreshInterval="10000">
  <FileData
     name="/pic/pic1.png"
     version="1"
     length="1000">
     <!-data block according to attribute "length" →
  </FileData>
</GetResponse>
```


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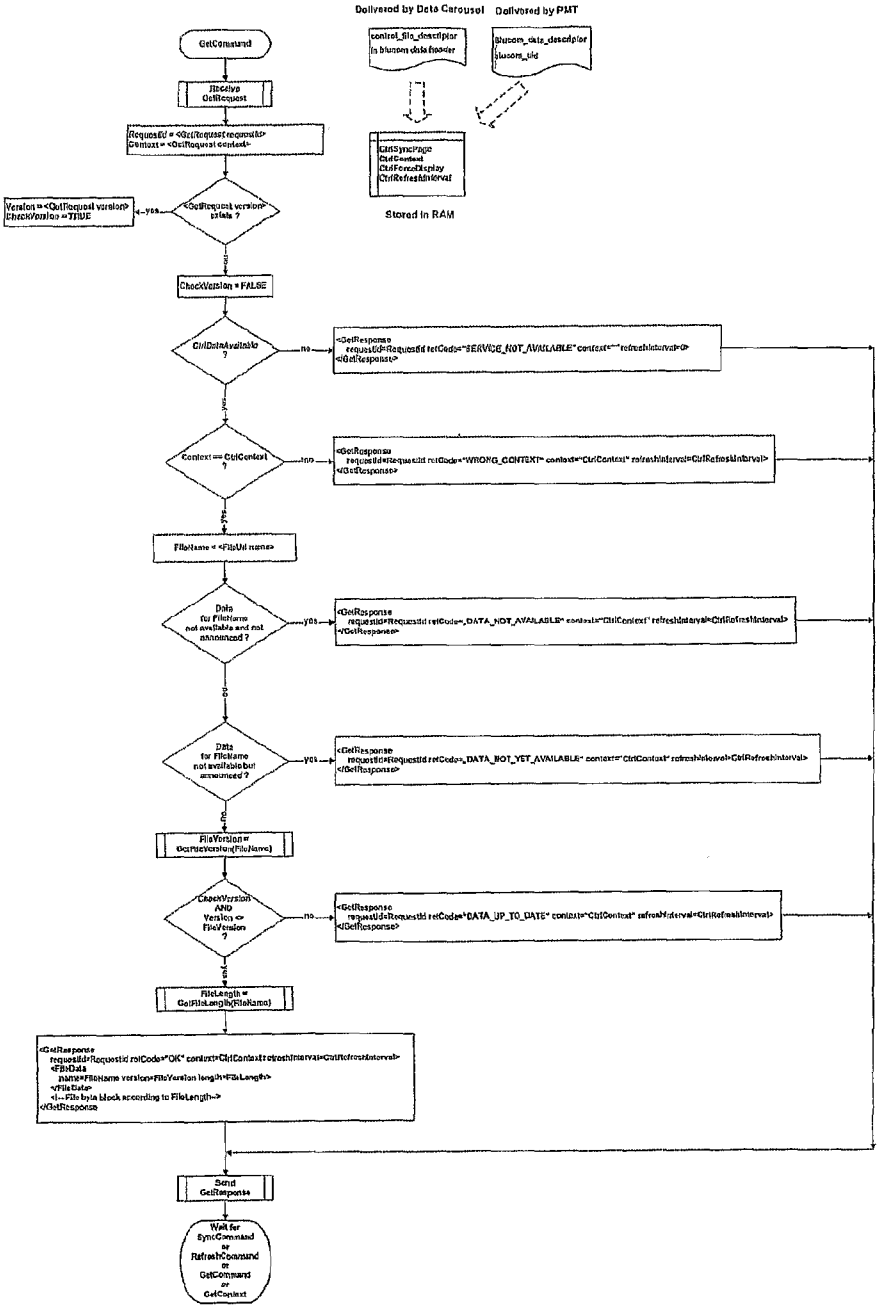


Fig. 10 – Application flow "GetCommand"

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4.5.6 GetContext

Objective of sending a GetContext command is to ask the STB for the current Blucom context. The additional purpose is to retrieve the DVB values for Service ID, Transport Stream ID and Original Network ID corresponding to the service where the STB is currently tuned on. In addition to that triplet a flag (visible) is returned to show if current service is visible on TV screen or not. The current service could be invisible, if e.g. it is scrambled and the smartcard is not entitled to decrypt the ECMs of the service. The latter values have to be sent back in any case independent from an existing Blucom service available on that service.

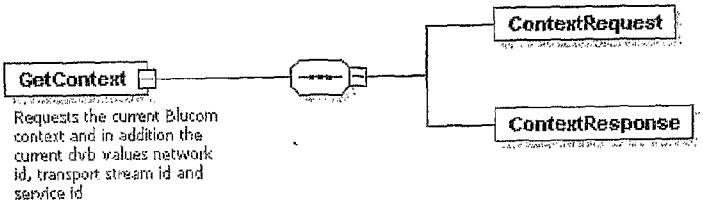


diagram	ContextRequest					
children						
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	xs:string	required			Identifies current request/response

Example:

```
<ContextRequest requestId="00-02-72-80-EC-FE-00005"/>
```


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diagram	ContextResponse					
children						
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" Blucom control parameter are not available "NOT_TUNED" STB is not tuned to any service
	onid	**xs:string**	required			Original Network ID of actual tuned service, six byte string (see 3) If STB is not tuned to any service "0xFFFF" is returned
	tsid	**xs:string**	required			Transport Stream ID of actual tuned service, six byte string (see 3) If STB is not tuned to any service "0xFFFF" is returned
	sid	**xs:string**	required			Service ID of actual tuned service, six byte string (see 3) If STB is not tuned to any service "0xFFFF" is returned
	visible	**xs:boolean**	required			"1" current service is visible "0" current service is not visible If STB is not tuned to any service "0" is returned
	context	**xs:string**	optional			Context string

Remark:
STB has to deliver the values for onid, tsid, sid and the visible flag in any case independent from an existing Blucom service on that channel. In case of a missing Blucom service the value for the Blucom context may be omitted.

Example:

```
<ContextResponse
  requestId="00-02-72-80-EC-FE-00005"
  retCode="OK"
  onid="0x0085"
  tsid="0x0001"
  sid="001B"
  visible="1"
  context="0x00850001001B"/>
```


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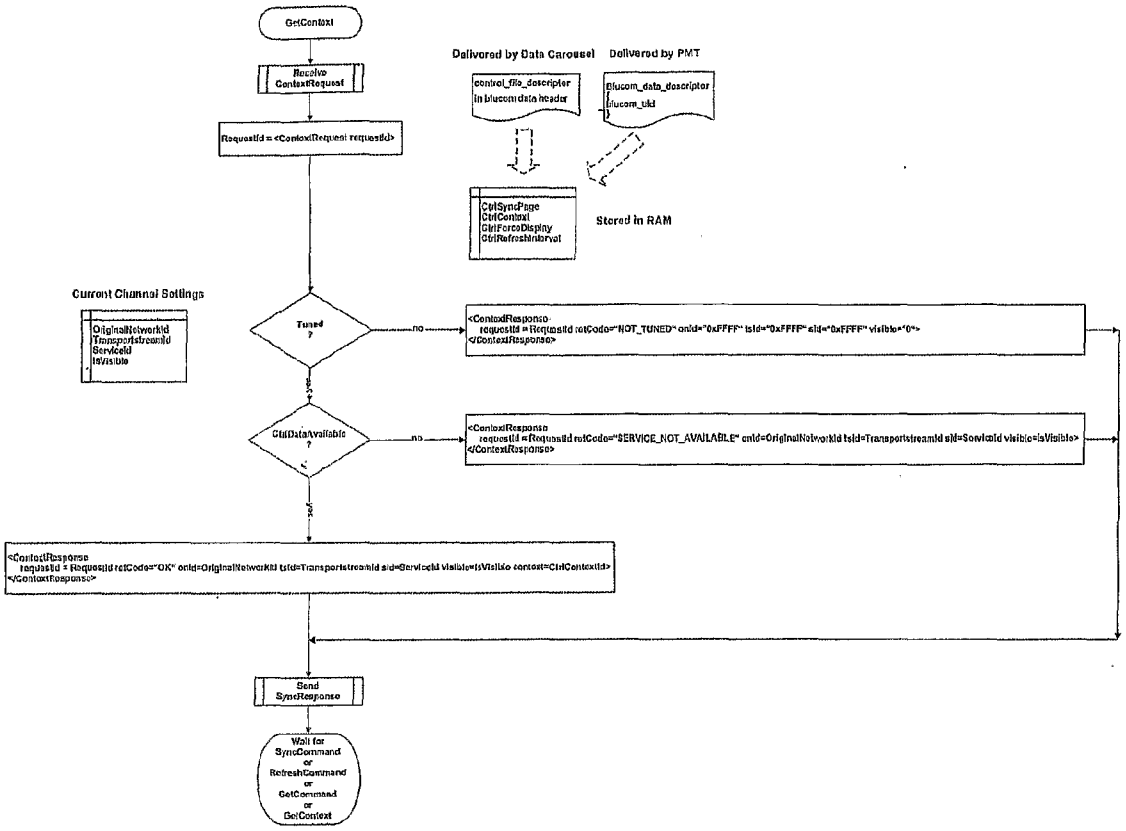


Fig. 11 – Application flow "GetContext"

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5 UI Requirements

5.1 Info Banner

If the STB is tuned to a service which is according to the PMT signalling offering a Blucom data component and there is one or more Blucom clients actually connected to the STB, it shall display "Blucom Icon with active client connections" as outlined in Annex C in the Info Banner.

If the STB is tuned to a service which is according to the PMT signalling offering a Blucom data component and there is no Blucom client actually connected to the STB, it shall display "Blucom Icon with no active client connections" in the Info Banner as outlined in Annex C.

5.2 When the STB is tuned to a service which is according to the PMT signalling not offering a Blucom data component, it shall display no Blucom related icon in the Info Banner.Setup Menu

The receiver's setup menu shall contain a Bluetooth settings entry, which at least allows to change the following settings:

Reference	Format	Actions	Default value	Item name (to be displayed in STB UI)
device name	Char[248]	Change device name	To be defined by STB manufacturer	Bluetooth Gerätename
Visibility	Discoverable | Non-discoverable	Change mode	Discoverable	Für andere Bluetooth Geräte sichtbar (ja|nein)
List of paired devices	List of device names	Delete selected device	- (empty)	Gekoppelte Geräte
Bluetooth Authorisation	on|off	Change mode	on	Authentisierung von Mobilfunkgeräten (ein|aus)

Note: The item name, which shall be displayed in the STB's menu, in the table above shows the texts for the german speaking markets. Translations for other markets will be mutually agreed upon and added to this specification as soon as this is required.

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5.3 Mosaic

The STB's navigator shall shall support the mosaic signalling as specified by SES Astra in [5]. The STB mosaic implementation shall conform with the mandatory elements as specified in [5].

The mosaic feature shall allow support of a Blucom Service Portal, which offers various Blucom services, each being broadcasted as part of a MPEG program with a video component containing at least a still picture. The access to these Blucom services shall happen through the mosaic navigation functionality, which is signalled on one or more mosaic services.

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6 Hardware Requirements (Bluetooth, Cache Memory Size)

This section describes the minimum hardware requirements a STB shall fulfil in order to support the Blucom service.

6.1 Memory

The STB shall assign an amount of 16 MB RAM to the Blucom cache.

6.2 Bluetooth

The STB shall provide a power class 2 Bluetooth radio device, which shall provide a stable connection over a distance of at least 10 meters from the front panel of the STB.

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7 Bluetooth implementation requirements

7.1 Bluetooth protocol stack

The STB shall support those elements of the Bluetooth protocol stack, which are marked in red in Fig. 12 in order to support the Blucom extension. However, the STB manufacturer is free to support also other Bluetooth related protocols and services, as long as the Blucom performance requirements and the conditional access requirements as referred to in this document are not affected.

The Bluetooth related implementation shall meet the actual Bluetooth specifications of the Bluetooth Special Interest Group.

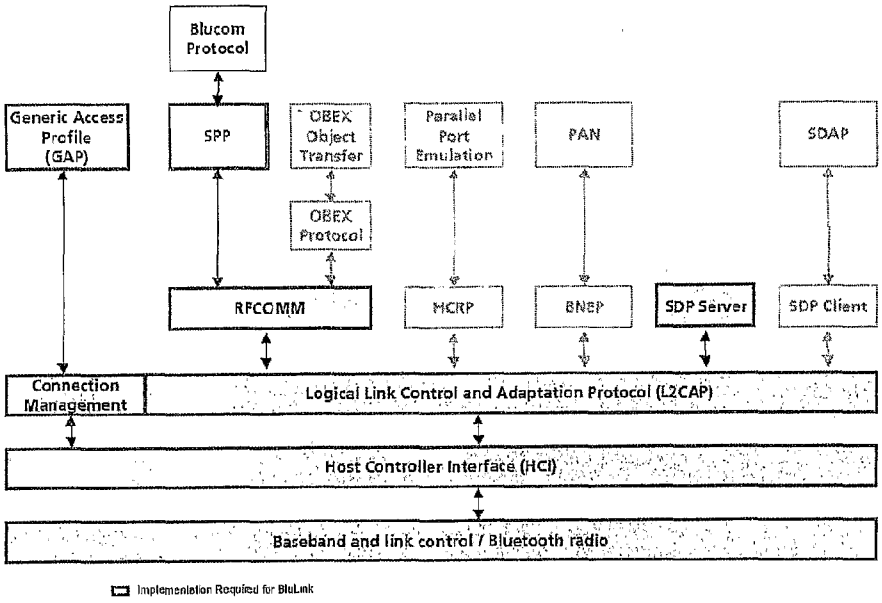


Fig. 12 – Bluetooth protocol elements required for Blucom

7.2 Network topology

The STB shall handle up to 7 client connections simultaneously, which reflects the size of one Piconet.

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7.3 Generic Access Profile (GAP) requirements

7.3.1 Visibility setting

When the STB is turned on, it shall be discoverable according to its visibility setting. Explicitly it shall also be discoverable according to its visibility setting when the STB is tuned to a service which does not carry any Blucom data.

With respect to the Blucom implementation, device discovery is initialized by the client devices.

7.3.2 Device name

The device name shall be changeable by the user in the STB's setup menu. The STB shall support Bluetooth device names of up to 248 characters.

7.3.3 Connectable mode

When the STB is turned on, it shall always be connectable by any client device. Explicitly it shall also be in connectable mode when the receiver is tuned to a service which does not carry any Blucom data.

7.3.4 Device type and device class

These parameters shall be agreed upon with the STB manufacturer during the prototype development.

7.3.5 Security aspects

The STB shall support Bluetooth security mode 2, i.e. service level enforced security shall apply.

The Bluetooth stack implemented in the STB shall comprise the Bluetooth security model as described in Fig. 13.

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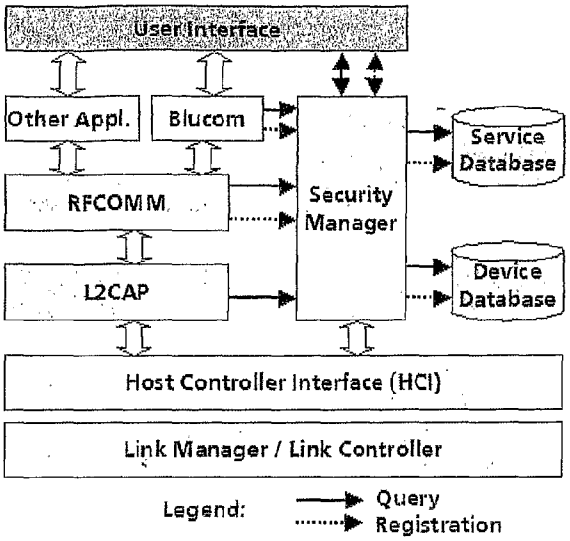


Fig. 13 – Bluetooth security architecture

The security manager shall perform the following tasks:

- Store security-related information on services
- Store security-related information on devices
- Answer access requests by protocol implementation or applications
- Enforce authentication and/or encryption before connecting to the application
- Initiate or process input from the user interface to set up trusted relationships on device level.
- Initiate pairing and query PIN entry by the user.

7.3.6 Security level of the Blucom service

The security level of the Blucom service shall be set according to the setting in the STB's setup menu entry „Bluetooth Authorisation".

Setup menu setting	Blucom service security level
Bluetooth Authorisation = "on"	Authorisation and authentication required
Bluetooth Authorisation = "off"	Service open to all devices, no authentication required

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7.3.7 Pairing

The STB shall be pairable, i.e. it shall maintain a list of trusted devices in the security manager's device database.

If the Bluetooth authentication setting is changed in the STB's setup menu, this shall not affect the information being stored in the security manager's devices database.

7.3.8 Access of new devices

The term "new device" in this context means a device, which is not stored in the security manager's device database as a trusted device.

Case 1 – applies when Bluetooth authorisation is set to "on" in setup menu:
When a client device connects to the STB for the first time, the security manager shall trigger the presentation of a PIN code (i.e. pass key) entry dialog, which asks the user to type in the same PIN code, he used for authentication in his mobile device before. Once a client device is successfully paired according to this case 1, the device information and the corresponding link key shall be stored in the security manager's device database as a trusted device.

Case 2 - applies when Bluetooth authorisation is set to "off" in setup menu:
When a client device connects to the STB, the Bluetooth stack shall accept the connection request without any authentication on the Bluetooth layers and without consulting the security manager's device database. In this case 2 no client device information shall be stored in the security manager's device database.

7.3.9 Access of trusted devices

If a client, which is already listed in the security manager's device database as a trusted device, connects to the STB and the Bluetooth authorisation is set to "on" in the STB's setup menu, the authentication shall happen without any need for user interaction, i.e. no PIN code entry shall be necessary.

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Fig. 14 shows the information flow sequence for access by a trusted device.

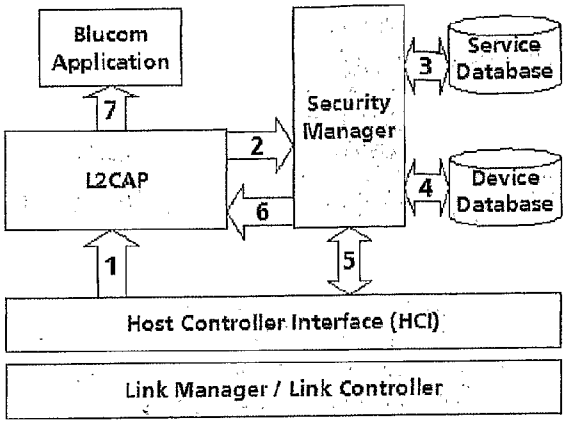


Fig. 14 – Information flow for access from a trusted device

The following steps are performed during the connection request sequence of a trusted device:

1. Connect request to L2CAP
2. L2CAP requests access data from the security manager
3. Security manager: lookup in service database
4. Security manager: lookup in device database
5. Depending on the service database settings, security manager enforces authentication and encryption
6. Security manager grants access
7. L2CAP continues to set up the connection.

7.3.10 Changes in the device database

When the user deletes a client device from the list of trusted devices in the setup menu, the STB shall flush all keys related to this device in order to avoid accepting any connection request of this formerly trusted device without user interaction while the Bluetooth authorisation is set to "on".

7.3.11 Passkey recommendations

The STB shall support full length passkeys (16 digits).

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7.4 Service discovery protocol

The STB's Bluetooth stack shall support the service discovery protocol and in that context maintain a Service Discovery DataBase (SDDB) to store service records.

Since the BLUCOM service bases on the Serial Port Profile (SPP), the UUID of the service must equal the standardized value 0x1101 (16 bit short form). Additionally, STB shall set the value for the service attribute "ServiceName" (Attribute ID 0x0100) to "BLUCOM" in order to differ BLUCOM from other serial port related services.

The Blucom client will query the Bluetooth service records from the STB and will connect only to those Blucom data servers, which support the Service named "BLUCOM".

7.5 Serial port profile

The STB shall have the serial port profile implemented as specified by the Bluetooth Special Interest Group. The Blucom protocol implementation shall use the serial port profile as the next lower layer.

7.6 Bluetooth Qualification

The Bluetooth implementation in the STB shall have successfully passed the certification process according to the Bluetooth Qualification Program. The certification tests shall be carried out by an officially recognized (i.e. recognized by the Bluetooth Qualification Review Board) Qualification Testing Facility.

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8 Conditional Access Requirements

If the STB has an embedded conditional access implementation, the STB shall meet the specific security requirements for digital interfaces as defined by the CA System vendor, if applicable.

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9 PDR Requirements

If the STB manufacturer intents to implement the Blucom functionality in a PDR STB, there are specific rules regarding the recording of the Blucom data carousel stream to be considered.

These rules will be defined in a later version of this document.

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Annex A: DSM-CC Messages (informative)

This annex shall provide the message structure of the DSM-CC messages used by the Blucom service. The information provided in this annex is extracted from the documents [2] and [4] and enhanced with the Blucom specific usage of fields where appropriate.

A.1 DSM-CC message header

The DSM-CC message header is defined in [2].

Syntax	Num. of Bytes
DsmccMessageHeader() {	
ProtocolDiscriminator	1
DsmccType	1
MessageId	2
TransactionId	4
Reserved	1
AdaptationLength	1
MessageLength	2

if(adaptationLength>0) {
dsmccAdaptationHeader()
}	

}	

Table 5: Syntax of DSM-CC message header

Semantics of the DSM-CC message header:

protocolDiscriminator: This field is used to indicate that the message is a MPEG-2 DSM-CC message. The value of this field is set to 0x11

dsmccType: This field is always set to 0x03 to indicate that all messages are U-N Download messages.

messageId: This 16-bit field is coded according to the following table:

MessageId	Message Type
0x1006	DSI message
0x1002	DII message
0x1003	DDB message

Table 6: Message types used in the Blucom data carousel

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transactionId: For DSI messages the 2 least significant bytes of the transactionID shall be set to 0x0000 or 0x0001. For DII messages the 2 least significant bytes of the transactionID shall be assigned in the range 0x0002 to 0xFFFF.

adaptationLength: Blucom does not use DSM-CC adaptation headers. Therefore this field is set to 0x00.

messageLength: This field is used to indicate the total length in bytes of the message following this field. This length includes any adaptation headers indicated in the adaptationLength and the message payload indicated by the messageId field.

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A.2 DSI message format

The DSI message is formatted according to the standards [2] and [4].

Syntax	Num. of Bytes
DownloadServerInitiate() {	
DsmccMessageHeader()	
serverId	20
compatibilityDescriptor()	2
privateDataLength	2
groupInfoIndication () {	
numberOfGroups	2
for (i=0;i<NumberOfGroups;i++) {	
groupID	4
groupSize	4
groupCompatibility()	2
groupInfoLength	2
for (i=0;I<N;i++) { groupInfoByte }	1
}	
privateDataLength	2
for (i=0;i<privateDataLength;i++) { privateDataByte }	1
}	
}	

Table 7: Syntax of DSI message

Semantics of the DSI Message:

serverId: This field is set to 20 Bytes with the value of 0xFF.

compatibilityDescriptor(): This field only contains the compatibilityDescriptor-Length field of the compatibilityDescriptor as defined in [2]. It is set to the value 0x0000.

privateDataLength: This field conveys the GroupInfoIndication structure as defined in [4].

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numberOfGroups: This is a 16-bit field that indicates the number of groups described in the loop following this field.

groupId: This is a 32-bit field which shall be equal to the transactionId of the DII message that describes the group.

groupSize: This is a 32-bit field that shall describe the cumulative size in bytes of all the modules in the group.

groupCompatibility: The groupCompatibility structure is equal to the compatibilityDescriptor structure of DSM-CC as defined in [2]. The STB shall only download data modules of groups which have the groupCompatibilityDescriptorLength set to 0x0000.

groupInfoLength: This is a 16-bit field indicating the length in bytes of the descriptor loop to follow.

groupInfoByte: This field conveys a list of descriptors which each define one or more attributes.

privateDataLength: This field defines the length in bytes of the following privateDataByte fields.

privateDataBytes: These fields are user defined and not used in Blucom version 1. They shall be ignored by a Blucom version 1 STB.

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A.3 DII Message Format

The DII message is formatted according to the standards [2] and [4].

Syntax	Num. of Bytes
DownloadInfoIndication() {	
dsmccMessageHeader()	
downloadId	4
blockSize	2
windowSize	1
ackPeriod	1
tCDownloadWindow	4
tCDownloadScenario	4
compatibilityDescriptor()	
numberOfModules	2
for(i=0;i< numberOfModules;i++) {	
moduleId	2
moduleSize	4
moduleVersion	1
moduleInfoLength	1
for(i=0;i< moduleInfoLength;i++) { moduleInfoByte }	1
}	
privateDataLength	2
for(i=0;i< privateDataLength;i++) { privateDataByte }	1
}	

Table 8: Syntax of the DII message

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Semantics of the DII Message:

downloadId: This field is the identifier of the download scenario in progress. The downloadId shall be uniquely defined within the Network. This identifier shall be used in all of the subsequent DownloadDataBlock messages used by the download scenario in progress.

blockSize: This field is the length in bytes of the data in every block carried in the DownloadDataBlock messages, except for the last block of each module which may be smaller than blockSize.

windowSize: This field is not used and set to 0.

ackPeriod: This field is not used and set to 0.

tcDownloadWindow: This field is not used and set to 0.

tcDownloadScenario: This field is not used and set to 0.

compatibilityDescriptor(): This field only contains the compatibilityDescriptor-Length field of the compatibilityDescriptor as defined in [2]. It is set to the value 0x0000.

numberOfModules: This field is the number of modules described in the loop following this field.

moduleID: This 16-bit field is an identifier for the module that is described by the moduleSize, moduleVersion, and moduleInfoByte fields. The moduleId is unique within the scope of the downloadId. The moduleId shall be in the range 0x0000 to 0xFFEF (0xFFF0 to 0xFFFF is reserved for DAVIC).

moduleSize: This field is the length in bytes of the described module.

moduleVersion: This field is the version of the described module. Upon a change of the moduleVersion, the STB shall update the related file in the Blucom data cache.

moduleInfoLength: This field defines the length in bytes of the moduleInfo field for the described module.

moduleInfoByte: This field conveys a list of descriptors which each define one or more attributes.

privateDataLength: This field defines the length in bytes of the following private-DataByte fields.

privateDataBytes: These fields are user defined and not used in Blucom version 1. They shall be ignored by a Blucom version 1 STB.

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A.4 DDB message format

The DDB message is formatted according to the standards standards [2] and [4].

Syntax	Num. of Bytes
DownloadDataBlock() {	
dsmccDownloadDataHeader()	
moduleId	2
moduleVersion	1
reserved	1
blockNumber	2

for(i=0;i<N;i++) {
blockDataByte
}
	1

}	

Table 9: Syntax of DDB message

Semantics of the DDB message:

moduleId: This field identifies to which module this block belongs.

moduleVersion: This field identifies the version of the module to which this block belongs. The module version for all files has to be maintained in the STB's file system in order to allow for updates of the file.

reserved: This field is reserved by [2] and shall be set to 0xFF.

blockNumber: This field identifies the position of the block within the module. Block number 0 shall be the first block of a module.

bockDataByte: This field conveys the data of the block.

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The dsmccDownloadDataHeader() is formatted according to the following syntax:

Syntax	Num. of Bytes
dsmccDownloadDataHeader() {	
protocolDiscriminator	1
dsmccType	1
messageId	2
downloadId	4
reserved	1
adaptationLength	1
messageLength	2

for(adaptationLength>0) {
dsmccAdaptationHeader()
}	

}	

Table 10: Syntax of dsmccDownloadDataHeader

Semantics of the dsmccDownloadDataHeader:

protocolDiscriminator: This field is used to indicate that the message is a MPEG-2 DSM-CC message. The value of this field is set to 0x11

dsmccType: This field is always set to 0x03 to indicate that all messages are U-N Download messages.

messageId: This field indicates the type of message which is being passed. The values of the messageId for DDB messages is set to 0x1003.

downloadId: This field is used to associate the download data messages and the download control messages of a single instance of a download scenario. The value of the downloaded field shall be equal to the value of the downloaded field in the delated DII message.

reserved: This field is reserved by [2] and shall be set to 0xFF.

adaptationLength: Blucom does not use DSM-CC adaptation headers. Therefore this field is set to 0x00.

messageLength: This field is used to indicate the total length in bytes following this field. This length includes the dsmccAdaptationHeader indicated in the adaptationLength and the message payload indicated by the messageId field.

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A.5 Descriptors used in the blucom data carousel

A.5.1 CRC32 descriptor

The CRC32_descriptor indicates the calculation of a CRC32 over a complete module. Table 11 shows the syntax of the CRC32_descriptor.

CRC32_descriptor(){	Number of bytes	Value
descriptor_tag	1	0x05
descriptor_length	1	
CRC32	4	
}		

Table 11: Syntax of CRC32_descriptor

Semantics of the CRC32_descriptor:
descriptor_tag: This 8-bit field identifies the descriptor. For the CRC32_descriptor it is set to 0x05.
descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following this field.
CRC_32: This is a 32-bit field which contains the CRC calculated over this module, which shall be calculated
according to annex B of the MPEG-2 Systems ISO/IEC 13818-1 [1].

A.5.2 Compressed module descriptor

The presence of the compressed_module_descriptor indicates that the data in the module has the 'zlib' structure as defined in RFC 1950 [16]. Table 12 shows the syntax of the compressed_module_descriptor.

compressed_module_descriptor(){	Number of bytes	Value
descriptor_tag	1	0x09
descriptor_length	1	
compression_method	1	
original_size	4	
}		

Table 12: Syntax of compressed_module_descriptor

Semantics of the compressed_module_descriptor:
descriptor_tag: This 8-bit field identifies the descriptor. For the compressed_module_descriptor it is set to 0x09.
descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following this field.
compression_method: This is an 8-bit field identifying the compression method used. This identification follows the definition of zlib structure of RFC 1950 [7].
original size: This is a 32-bit field indicating the size in bytes of the module prior to compression.

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A.5.3 Group link descriptor

The group_link_descriptor contains the information about which group descriptions are to be linked to describe a single larger group. This is necessary when the description of modules in a group exceeds the maximum size of a single downloadInfoIndication message and has to be spread across a number of such messages. It also informs the decoder on the order of the linked group descriptions. This is not strictly necessary since the order of linking is not important. It is purely to provide a means to identify all the group descriptions that are to be linked. Table 13 shows the syntax of the group_link_descriptor.

group_link_descriptor(){	Number of bytes	Value
descriptor_tag	1	0x08
descriptor_length	1	
Position	1	
group_id	4	
}		

Table 13: Syntax of group_link_descriptor

Semantics of the group_link_descriptor:
descriptor_tag: This 8-bit field identifies the descriptor. For the group_link_descriptor it is set to 0x08.
descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following this field.
position: This is an 8-bit field identifying the position of this group description in the chain. The value of 0x00 shall indicate the first group description of the list. The value of 0x01 indicates an intermediate group description in the list and the value of 0x02 indicates the last group description of the list.
group_id: This is a 32-bit field that identifies the next group description in the list. This field shall be ignored for the last value in the list.

A.5.4 Name descriptor

The name_descriptor contains the name of the module or group. Table 14 shows the syntax of the name_descriptor.

name_descriptor(){	Number of bytes	Value
descriptor_tag	1	0x02
descriptor_length	1	
for (i=0; i<N;i++) {		
text_char	1	Name of the module, e.g. "index"
}		
}		

Table 14: Syntax of name_descriptor

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Semantics of the name_descriptor:
descriptor_tag: This 8-bit field identifies the descriptor. For the name_descriptor it is set to 0x02.
descriptor_length: This 8-bit field specifies the number of bytes of the descriptor immediately following this field.
text_char: This is an 8-bit field. A string of "char" fields specifies the name of the module or group. Text information is
coded using the character sets and methods described in annex A of [3].

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Annex B: XML schema for Blucom control file

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XMLSPY v2004 rel. 4 U (http://www.xmlspy.com)
by SW Developement (APS GmbH) -->
<xs:schema elementFormDefault="qualified"
           attributeFormDefault="unqualified"
           xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="BlControl">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="SyncPage">
          <xs:complexType>
            <xs:attribute
                name="na" type="xs:string" use="required"/>
            <xs:attribute
                name="fd" type="xs:boolean" use="required"/>
            <xs:attribute
                name="ri" type="xs:integer" use="required"/>
          </xs:complexType>
        </xs:element>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```


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Annex C: Blucom Icons

The following graphics show the Blucom Icons to be displayed in the STBs Info Banner.

Blucom Icon with active client connections:



Blucom Icon with no active client connections:



------ End of document ------

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Functional Specification
«BLUCOM» Browser Application

03.08.2005
Version 1.6 Change Request 2
APS SW Development

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Customer Support

N/n for this product

Document history

Version	Date	Author	Changes
Draft	2005/02/13	M. Kreilein, U. Wiedow	Document Creation
Draft	2005/03/24	M. Kreilein, U. Wiedow	Draft
1.0	2005/04/05	M. Kreilein	Minor changes to complete Version 1.0
1.1	2005/04/13	U.Wiedow, M.Kreilein	- Added return code value "DATA_NOT_YET_AVAILABLED" in Communication protocol; drawings for application flow changed accordingly (4.2) - GetCommand changed (4.2.9) - Bluetooth requirements added (4.1) - vertical-align style added (3.5.3, 3.6.4.2) - DATA_NOT_YET_AVAILABLE reaction clearified (3.6.1.1) - base64 Encoding mentioned (3.5.5) - Content Decryption changed (3.3)
1.2	2005/04/14	U.Wiedow	- base64 encoding for default channel replaced by standard ULR encoding (3.5.5); document reference [4] changed accordingly.

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1.3	2005/05/02	M. Kreilein U.Wiedow	changed and revised according to Document "Änderungsliste Functional Spec1_290405.xls"; GetContext Command added (4.2.10); GetCommand changed 4.2.9); Verbal forms for expression of provisions added.
1.4	2005/05/13	M.Kreilein U.Wiedow	- changed and revised according to Document "Änderungsliste Functional Spec.xls" - Additions in chapter 5
1.4 RC1	2005/05/20	M.Kreilein U.Wiedow	- changed and revised according to Document "Änderungsliste Functional Spec.xls"
1.4 RC2	2005/05/23	U.Wiedow	Minor changes (wording)
1.4 RC3	2005/06/01	U.Wiedow	RefreshCommand changed (4.2.8); isSyncPage attribute has moved from root element RefreshResponse to child element DisplayPage; figure 5 changed accordingly.
1.5 CR1	2005/06/20	M.Kreilein	• BLUCOM Uuid exchanged by service name "BLUCOM" for indication of service during discovery (3.1.1) • Processing instruction 'bl' is optional (3.5.4) • No default background-color for -Elements, unit 'px' shall be supported in style-sheets (3.5.3) • <object>-Tag supports 'data'-Attribute instead of 'href' (3.5.2.2) • Minor changes in wording
1.6 CR2	2005/07/12	M.Kreilein	• 'home' action becomes default action instead of 'sync' (3.5.4) • Variable default value section moved unchanged (3.5.8.2) • Application Startup modified substantially (3.1), section 3.1.6 "Start-up Sequence" erased due to redundancy with state diagram [5]. • Minor changes and corrections in wording
1.7 CR2	2005/07/20	M.Kreilein	• Authentication String changed (4.2.6) • DPC consequently replaced by APS

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Related Documentation

[1] "XHTML™ Basic" W3C Recommendation, http://www.w3.org/TR/XHTML-basic

[2] "Extensible Markup Language (XML) 1.0 (Third Edition)" W3C Recommendation, http://www.w3.org/TR/REC-xml

[3] "Cascading Style Sheets, level 1" W3C Recommendation, http://www.w3.org/TR/REC-CSS1

[4] "URL Encoding", http://www.w3schools.com/html/html_ref_urlencode.asp

[5] "State Diagram BLUCOM Browser Application", APS

Conventions

Convention	Usage
DEFINE	Types, definitions and enumerations
ObjectProperty	Object properties and methods
`Filename`	Filenames and typed user input

Aberrations and Acronyms

Abkürzung	Bedeutung
BL	BlueLink
CSS	Cascading Style Sheets
DOM	Document Object Model
APS	Astra Platform Services
PDA	Personal Digital Assistant
GSM	Global System for Mobile Communications
GPRS	General Packet Radio Service
HTML	Hypertext Markup Language
UMTS	Universal Mobile Telecommunications System
SAX	Simple API for XML
W3C	World Wide Web Consortium
XHTML	Extensible Hypertext Markup Language
XML	Extensible Markup Language

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Verbal forms for the expression of provisions

Verbal form	Indication	Equivalent expression
Shall	Requirement	Must
shall not	Requirement	must not
Should	Recommendation	it is recommended that
should not	Recommendation	it is not recommended that
May	Permission	is allowed
need not	Permission	it is not required that
Can	Possibility/Capability	be able to
Cannot	Possibility/Capability	be unable to

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1 Introduction

1.1 Purpose of document

This document specifies the functional requirements of the "BLUCOM" browser application (BL-Browser) and gives an abstract description the system environment.

1.2 Product Scope

The BL-Browser is an application driven on handheld devices like mobile phones or PDAs. The consumer may pay and download the application.

Once installed, the BL-Browser uses a wireless Bluetooth connection to retrieve frequently changing information from a near content server. The information is presented to the user visually, acoustically and haptically. The consumer shall interact with this data being presented by using the input capabilities of the handheld device.

The consumer's interaction results in a feedback which is sent back to the content provider by means of built-in return channels via GSM, GPRS or UMTS for the provider's benefit.

1.3 Overview of document

Chapter 2 gives an abstract description of the system environment.

Chapter 3 specifies the functional requirements of the BL-Browser application, including the user interface.

Chapter 4 specifies external interface requirements of the BL-Browser application.

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2 System Overview

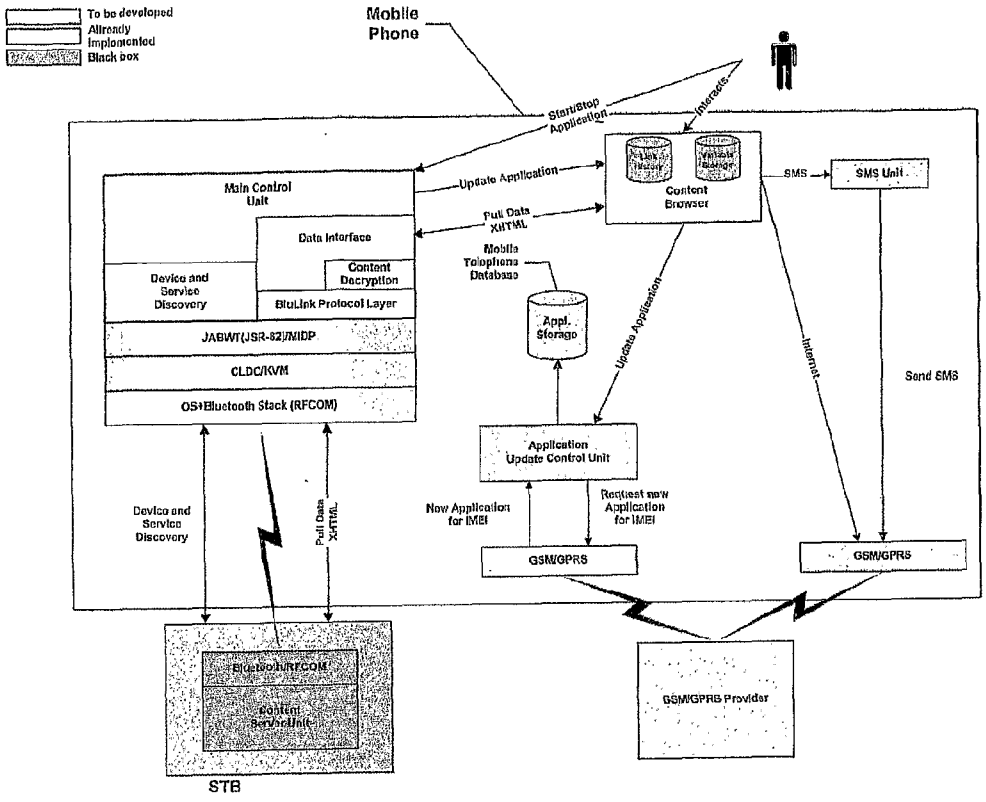


Fig. 1 - System Overview

2.1 STB

The Set Top Box is considered as a Content Server providing all Data requested by the Mobile Device. The Bluetooth connection is always initiated by the BL-Browser. The STB is always prepared to accept an authorized connection request. Once the connection is established STB has the role of a server providing data for the BL-Browser on the Mobile Device side.

Not covered in this document.

2.2 Browser Application

The role of the BLUCOM Browser Application (BL-Browser) is to initiate the connection to the STB and to pull the data provided in order to present it on the mobile screen.

Covered in this document.

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3 Functional Requirements

3.1 Application Start-up

The Bluetooth device on the mobile phone needs to be enabled and ready for connecting a remote Bluetooth device before the BL-Browser is started.

After launching the BL-Browser, the application has to check if the Bluetooth device is enabled and ready. If there is no Bluetooth device available or if it is not switched on, the BL-Browser shall advice the user how to switch on the Bluetooth device.

3.1.1 Recovery of Last Connected Device

After validating the availability of Bluetooth, the browser shall recover the last connected device from persistent parameters. All parameters that are required for connecting res. presentation of the device must be restored which is the user-friendly device name and the connection URL.

If a last connected device is known, BL-Browser shall present the device's name and an option for discovering other devices to the user. If the user chooses to reconnect to the recovered device, the browser directly tries to establish the connection, using the restored connection URL, without doing a lengthy device and service discovery. If the user's sake is to connect to a different device, the browser has to perform the device and service discovery instead.

If no last connection can be restored, the browser directly enters the device and service discovery, without need to ask for the user's confirmation.

3.1.2 Device and Service Discovery

Bluetooth Device- and Service-Discovery are initiated by the BL-Browser application. For finding suitable devices, the BL-Browser shall perform a Service Inquiry on each discovered device in order to assure that the Mobile Device only connects to the corresponding BLUCOM application.

When at least one device is discovered that offers the BLUCOM service, a list of the Bluetooth specific, user-friendly device names is presented to the user for selection. This list again shall always include an option to repeat the discovery process. When the user selects a device presented by the list, the BL-Browser tries to set up a connection to it. If the user chooses to repeat the discovery, the browser has to do that.

3.1.2.1 BLUCOM Service Identification

To identify the BLUCOM service, BL-Browser must evaluate both the Bluetooth UUID and name of the service.

Since the BLUCOM service bases on the Serial Port Profile (SPP), the UUID of the service must equal the standardized value 0x1101 (16 bit short form). Additionally, the value of the service attribute "ServiceName" (Attribute ID 0x0100) must match "BLUCOM" to differ BLUCOM from other serial port related services. Case-insensitive evaluation and whitespace normalization of the attribute value may be required to receive the pure service name.

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3.1.3 Connection

Dependent on the configuration on STB side, it might be necessary to enter an authentication id (PIN) to get connected. After connecting the STB successfully, the remote device has to be added to the trusted device list if the mobile supports correct list management in order to avoid recurring pin requests for subsequent connections to that device.

3.1.4 Authentication

After successful connection the BL-Browser has to send an initial request (4.2.6) to the STB in order to get a copyright string compared with its counterpart on STB side. In case of a negative response or even a missing response within the configured timeout period the BL-Browser shall display a message denoting that the STB is not authorized for the BLUCOM Service. Authentication (say the initial request) has also to be done (repeated) when the browser reconnects to the STB after a connection loss, otherwise the STB might refuse further communication with the browser.

The copyright string is a static text string that has no further meaning to the BL protocol or authentication. It is required for legal reasons only and will be defined by APS. An example can be found in 4.2.6.

As long as the BL-Browser has not yet verified its copyright string successfully, it shall display a built-in splash-screen.

3.1.5 First Request

After successful authentication or handling the version control file (see 5.4) the BL-Browser has to display a first page. Therefore BL-Browser has to execute a SyncCommand (4.2.7) in order to get synchronised to the current BLUCOM Service provided by the STB. Provided that there is a BLUCOM channel available, BL-Browser receives an URL for which the content has to be retrieved and displayed.

3.1.6 Start-up Sequence

For the complete start-up sequence, please refer to [5].

3.2 Content Retrieval

3.2.1 Generics

The BL-Content is prepared by different content providers. The provider uses pages to structure its content logically. The BL-Browser displays a single page at a time.

As long as the BL-Browser has not verified its copyright string successfully (3.1.3) it shall display a built-in splash-screen. Once the STB has confirmed the authentication, the browser always tries to display pages it receives from the STB upon request.

Each page is attached to a specific context. The context id is delivered for each page retrieved from server. The context is significant for page requests and the maintenance of contextual variables (3.5.7).

There are two ways how content can be retrieved (pulled) from STB.

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3.2.1.1 Automatic Page Request

The BL-Browser requests a new page from server automatically according to a refresh interval, which is determined by the BLUCOM protocol (4.2). It may change after each subsequent page or content request. The content request itself is separated in three steps.

- Step1: BL-Browser requests a new page URL by sending a Sync (4.2.7) or Refresh Command (4.2.8) to the STB. Whether ã Sync or Refresh command needs to be executed is determined by the processing instruction defined inside the page currently displayed (3.5.4).
  If the BL-Browser is not able to obtain the processing instruction, e.g. in case of a missing page etc. the default processing instruction is "sync".
- Step2: BL-Browser shall compare delivered URL name and version to the page currently displayed. If there is a difference in at least one of these values the content for the delivered URL shall be retrieved and displayed. If the context delivered is different to that currently known, all contents for the delivered URL shall be retrieved and displayed anyway, even if URL and version is equal to that page currently displayed.
- Step3: After Step1 and Step2 have been executed successfully BL-Browser retrieves all contents needed to display that page.

All automatic page requests are executed silently: Since the user did not trigger the retrieval, no messages shall be displayed if the request, retrieval or processing of those pages fails.

3.2.1.2 Manual Page Request

The user may trigger a page request asynchronously by selecting a hyper reference link inside the page currently displayed. The BL-Browser tries to retrieve all contents needed to display that page.

All manual page requests are executed actively, i.e. the user gets a readable, visual feedback about the browser activity. If the requested page cannot be displayed due to an error, an error message is displayed.

3.2.2 Automatic Content Retrieval

The content provider updates the content frequently. Two types of update are distinguished:

1.) The provider determines a new, different page, which must be displayed by the BL-Browser (BL-Slang: "Hotsync") as soon as possible.

2.) The provider generates an update of the page currently displayed by BL browser, which shall be displayed instead of old (out-of-date) page.

Which page to be displayed next is completely controlled by the STB. The BL-Browser requests and displays each new page indicated by the STB except page name, page version and context have not changed relating to the currently displayed page.

Since the STB does not deliver new pages unless the BL-Browser requests them, the BL-Browser must periodically poll the server and ask for page updates. The BL-Browser shall be capable to handle lookup intervals of 1 second. Beside the browser internal lookup interval, a refresh interval must be considered as a dynamic value, finally driven by the content provider delivered by the BLUCOM protocol (4.2).

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Note: All application flowcharts in this document shall describe only the principle and cannot be considered as a complete implementation guide for the BL-Browser.

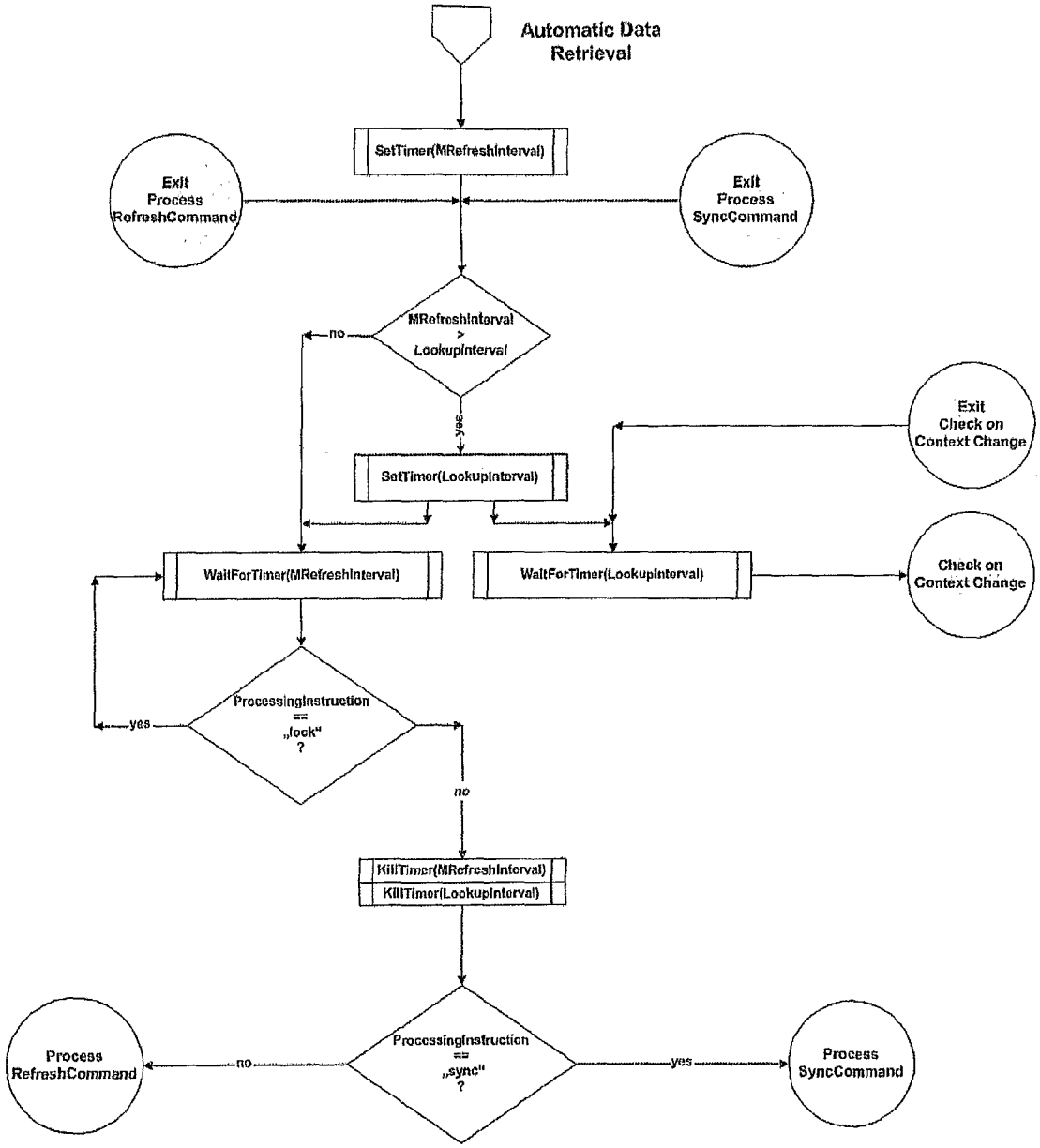


Fig. 2 - Application flow "Automatic Retrieval"

The update request works as follows:
In Accordance with the Processing Instructions (3.5.4) included in the currently displayed page, the BL-Browser invokes one of the following commands:

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3.2.2.1 SyncCommand (4.2.7)

Condition: The `req` instruction of the actual page is set to 'sync' (3.5.4)

Using the SyncCommand BL-Browser asks the STB for the sync page URL that is currently valid. Beside the URL of the current sync page, SyncResponse delivers information about the present context and the new refresh interval. A return code informs about the SyncResponse status. How BL-Browser has to react on certain return codes is described in document [5].

Once SyncResponse was processed successfully, and the conditions according to Step2 (3.2.1.1) are fulfilled, BL-Browser shall acquire the contents for the new page URL in order to display the new page.

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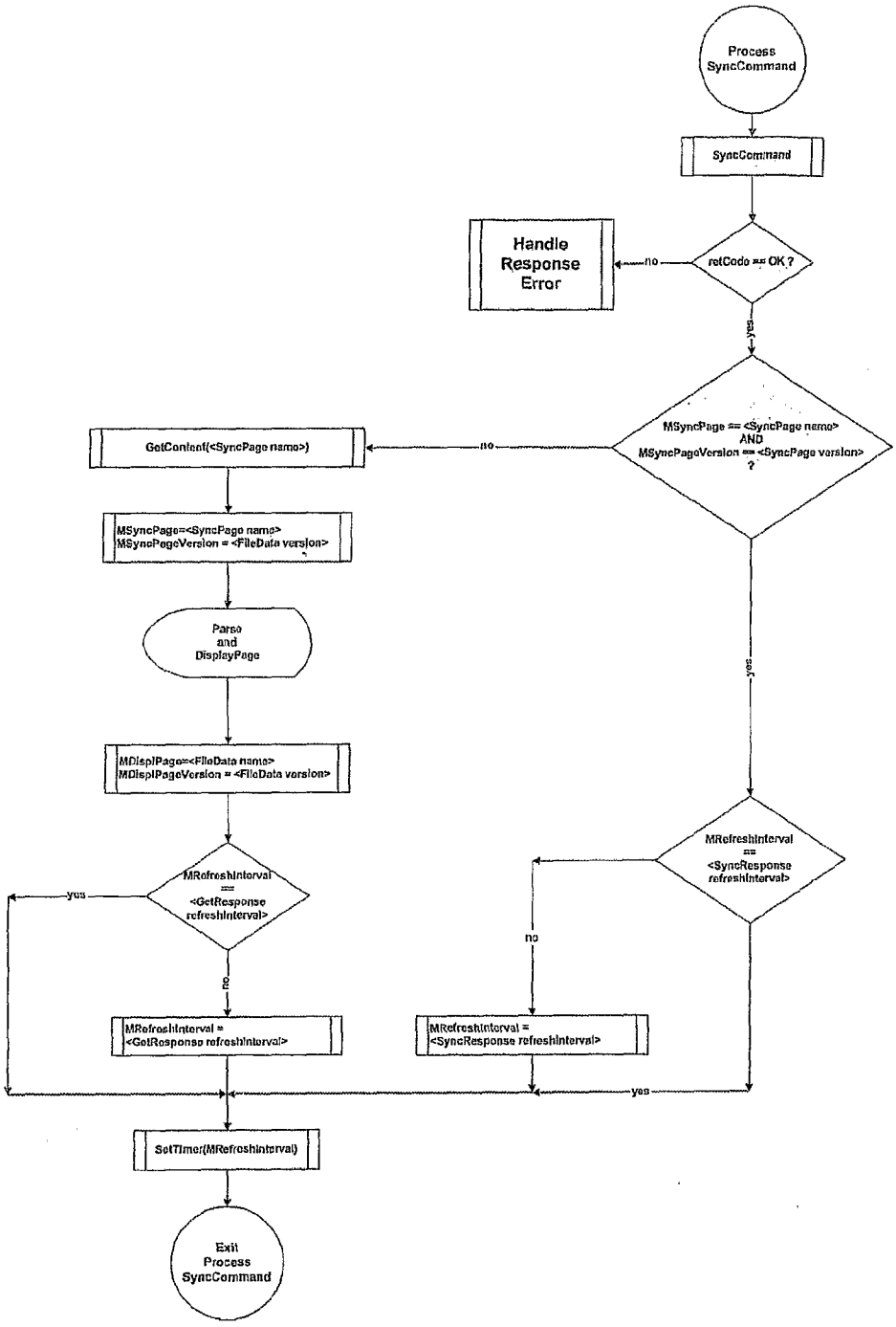


Fig. 3 – Application flow "SyncCommand"

3.2.2.2 RefreshCommand (4.2.8)

Condition: The `req` instruction of the actual page is set to 'refresh' (3.5.4)

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With the RefreshCommand BL-Browser sends the URLs and the file versions for the page currently shown on display and for the present sync page (may be different!). Once RefreshResponse was processed successfully, and the conditions according to Step2 (3.2.1.1) are fulfilled, BL-Browser shall acquire the contents for the new page URL delivered in order to display the new page. A return code informs about the RefreshResponse status. How BL-Browser has to react on certain return codes is described in document [5].

The new page might be either an update for the page currently displayed or a new sync page (Hotsync), which shall be displayed immediately. Additionally, RefreshResponse delivers information about the present context, the new refresh interval and above that a flag, which determines if the URL supplied is a sync page or not. In case that the new page is signalled as a sync page, BL-Browser shall save that URL and version as its current sync page.

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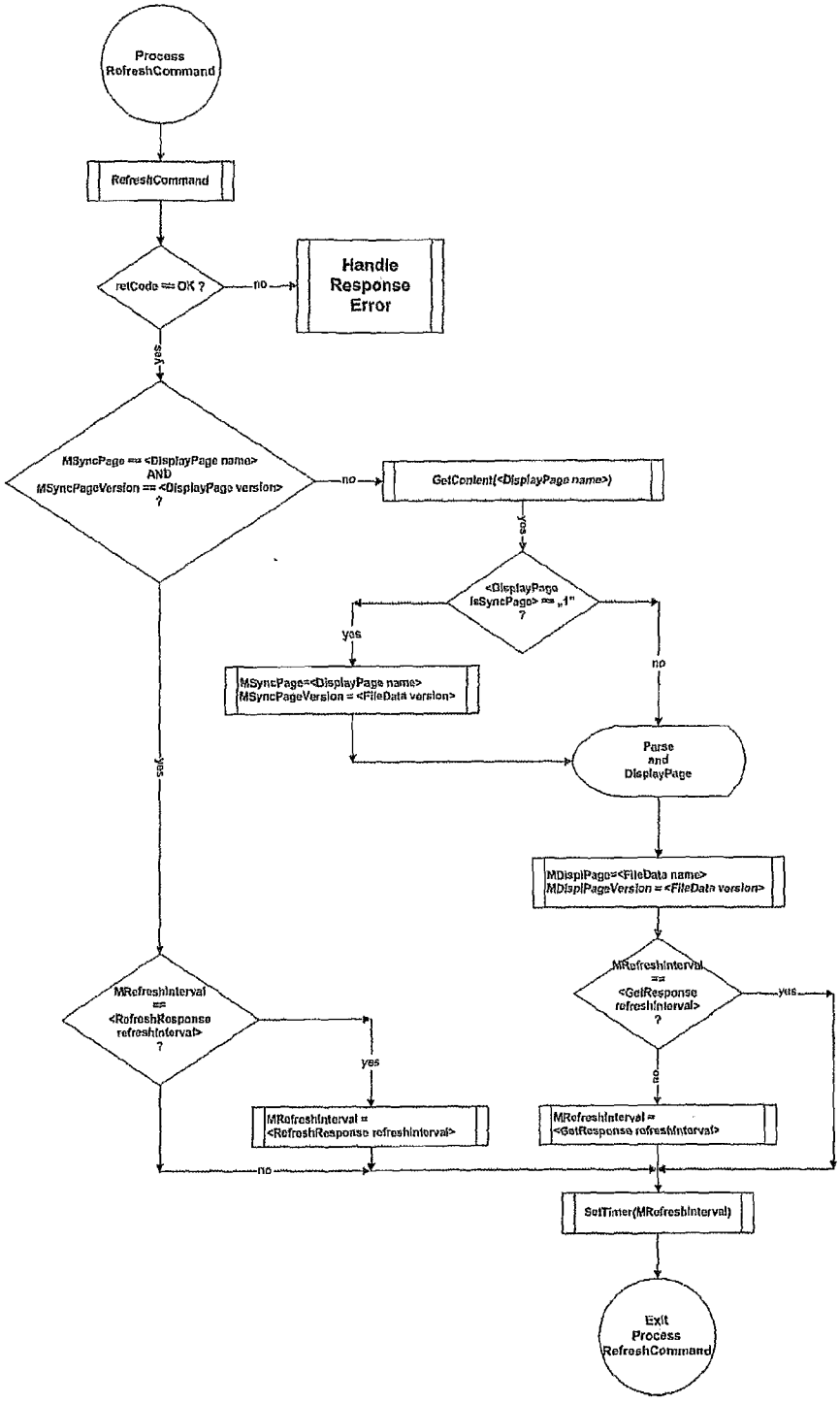


Fig. 4 – Application flow "RefreshCommand"

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3.2.2.3 Context Change Lookup

As described above, the refresh interval can be defined either by the Content Provider or by the broadcast centre. In either case, the BLUCOM Protocol (4.2) will deliver it. Therefore it might happen that the interval value is too long to notice a channel or context switch within an acceptable time period.
Hence it is necessary to look for a context change from time to time when the BL-Browser is in an idle state. In order to achieve that, the BL-Browser must be able to handle two timer loops simultaneously (see also Fig. 2). The following Figure shows the principle of such a context change lookup sequence.

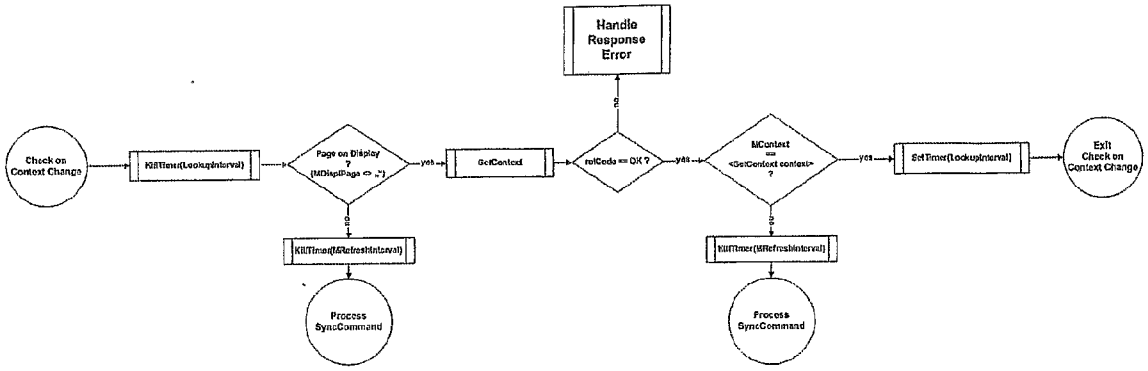


Fig. 5 – Application flow "Context Change Lookup"

Note:
The condition "Page on Display" is fulfilled if a BLUCOM page is shown on Display actually. In the case that BL-Browser was not able to display the last page retrieved from STB for various reasons, a SyncCommand shall be executed next time instead of GetContext.

3.2.2.4 Locked Update

Condition: The `req` instruction of the actual page is set to '`lock`' (3.5.4)

If the currently displayed page indicates that the refresh is locked by means of processing instruction, no automatic content retrieval must be preformed. Consequently, the RefreshTimer is not started res. evaluated for these pages (see Fig. 2), only context lookups are to be executed. The page is only left if the user himself requests a new page or if the context lookup indicates that the context has changed.

3.2.3 Manual Content Retrieval

Beside the ability to retrieve content updates automatically, BL-Browser has to offer a way to update content in terms of the user's manual navigation through the page currently being displayed.

The user may manually request a page either by selecting a link inside the currently displayed page (3.4.3.2), by initiating one of the exposed page commands (3.5.6), accessible via the function keys (3.4.2.2), or by reloading the page (3.2.5).

In either case, the BL-Browser must evaluate the link to determine which data connection must be used (3.5.5). If the data has to be requested from the BL-Server, the GetCommand must be sent (4.2.9).

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3.2.4 Link History

In order to implement a personal cache holding all retrieved pages (like a WEB Cache) it is intended to set up a RAM pool, which saves all retrieved URLs instead of the contents for each page.

The BL-Browser saves each page URL requested (and displayed) including name, version and context to that pool named Link History. The processing instruction 'his' must be set to 1 (3.5.4) for a page to be saved in history. There is an exception for pages retrieved via WAP which are never stored in history (4.3.2.4).

The BL-Browser is not responsible for the existence of content for pages stored in the Link History. Therefore it is up to the BL-Browser to configure the size for that pool dependent on the storage capabilities of the mobile phone.

3.2.4.1 History Management

The Link History is implemented as a LIFO Buffer with limited size of 5k. For each new page dataset to be added, the BL-Browser is free to remove the last (oldest) entry or entries from that pool if required. If the user restores a link from the history and launches a new link from there which must be added to the history again, all newer links in history are deleted, too.

The link history shall be kept alive until the application is stopped or a new context is indicated by the BL Server (Note: If no BLUCOM is available, the history is to maintained).

3.2.4.2 History Access

The user can access the history if allowed by the content provider. The content provider uses processing instructions to enable or disable the corresponding page commands for history access.

If enabled, the page command 'back' or 'next' shall only be displayed resyp. accessible if there is a corresponding link present in history. If the user selects a link from history, the browser must request the page by means of a GetCommand (4.2.9).

3.2.5 Page Reload

The options menu of BL-Browser offers the user to reload the currently displayed page. The user will use this function to refresh the page manually, e.g. if some embedded images are missing or he wants the sound of the page to be played again.

If the user initiates reloading of the current page, BL-Browser shall send a GetRequest to check if a newer version of the page is available. Additionally, all resources embedded in the page must be checked for updates, especially if the version of the page itself did not change. The necessity of checking for updated resources resides independent of the page's processing instructions (3.5.4).

3.3 Content Decryption

All files that are retrieved via the BLUCOM protocol's GetCommand (4.2.9) include a leading byte (preamble byte) which denotes whether the following data block representing the payload (content) is encrypted or not. When receiving the data block the BL-Browser application has to read this byte first in order to decide if the following data block needs to be passed to the decryption unit.

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The preamble byte may have the following values:

0x00 following data block is not encrypted
0x01 following data block is encrypted

The BL-Browser has to assure that only the valid data block, without the preamble byte, is passed to the decryption unit respectively to further processing.

In case of an invalid preamble byte (neither 0x00 nor 0x01) BL-Browser shall act the same way as if it detects invalid XHTML code.

3.3.1.1 Used Algorithm

Used Algorithm is a Rijndael following the Advanced Encryption Standard (AES). The used Key Length is 128 bit.

3.4 User Interface

3.4.1 Ouput Channels

The BL-Browser shall make use of all device capabilities to present content. Typical handheld devices offer visual, acoustical and/or haptic output channels, but differ in the functional range of these channels.

The BL-Browser identifies the following output channels:

Channel	Type	Availability	Limitations
Display	visual	always	Different resolution, different color depth
Backlight	visual	optional	None
Sound	acoustical	optional	Supported sound format
Vibration	haptic	optional	None

Tabelle 3.4-A Supported Output Channels

The BL-Browser supports all above output channels. Those output channels that are not supported by a specific device will be disabled within the browser version for that device. If an output channel is disabled, the browser skips the output, even if requested by the content provider. This also affects sound output if no supported sound format is provided.

3.4.1.1 Display

The BL-Browser distinguishes several device media types to summarize varying display limitations. A media type concludes all devices that have similar limitations, mainly the display resolution on x-axis.

The content provider shall address known display limitations by means of styles, controlled by defined media types (3.5.3.1).

Media Type	Description
x128	Summarizes all gadgets working with a display width of 128 pixels
x176	Summarizes all gadgets working with a display width of 176 pixels
x240	Summarizes all gadgets working with a display width of 240 pixels

Tabelle 3.4-B Display type distinction

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3.4.1.2 Status Bar

The BL-Browser splits the display and reserves a small part for status information. Height and position of this status bar may be media-type dependent. The status bar shall display the following information according to [5]):

1.) Connection Status

2.) Description of the available function keys

3.) Scrolling indicator

To comply with 2.), the status bar has to be placed close to the function keys (3.4.2.2). Function key f1 always opens the options menu (3.4.2.3), therefore the status bar displays a localised text to describe key. Function key f2 always triggers a page-specific action assigned by the provider, therefore the status bar displays a localised text to describe the key.

The scrolling indicator symbolizes that the page content exceeds the available display size. The visualization of the indicator may be realized by a pair of arrows indicating the direction in which the page can be scrolled.

3.4.1.3 Activity Indicator

The activity indicator is always displayed when the browser is busy or waiting and does not accept user input. Activity is either indicated by displaying an icon (e.g. clock symbol) or by manipulating the status bar (e.g. changing its colour).

3.4.1.4 Backlight

The backlight may be addressed from the source-code by processing instruction (3.5.4). Backlight is switched on for a device-specific period which cannot be controlled by the content provider's markup. The content provider shall be aware that the backlight may flicker on various target devices, dependent on the vendor's native implementation of the backlight control. The BL-Browser skips this instruction if backlight control is not available on the target device.

3.4.1.5 Sound

The BL-Browser shall determine the sound formats (MIDI, MP3, etc.) that are supported by the target device.

The BL-Browser has a built-in, BL-branded acoustical event for every supported sound format. The content provider may address this sound by processing instruction (3.5.4) to signal that a particular (maybe important) page is being displayed. If the target device does not support sound at all, the BL-Browser skips this instruction.

The content provider might want to embed different or additional sound in its content. The provider is then responsible of supplying multiple sound files of different sound formats. In the content markup, the provider must list all sound files, each with a dedicated mime type assigned. The BL-Browser shall then choose the suitable sound file by evaluating the mime type (3.6.5).

Mime Type	Description
audio/mpeg	MPEG Audio, to be used for all mpeg audio formats, mainly mpeg 2 layer 3 (mp3)
audio/midi	MIDI Audio, requires a midi interpreter
audio/x-wav	WAV Audio, uncompressed audio

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audio/amr	AMR Audio (adaptive multi rate), for high compressed audio (e.g. ringtones)

Tabelle 3.4-C Supported sound mime types

3.4.1.6 Vibration Alarm

The content provider may address the vibration alarm within the content markup by processing instruction (3.5.4). If accessible on the target device, the BL-Browser triggers the vibration alarm for a device-specific period (e.g. once), otherwise the Browse simply skips the instruction.

3.4.2 Input Channels

The BL-Browser requires a channel for haptic input to be present on any target device. The browser shall accept key- and/or pointer-controlled user input. An optional Speech-Control may be applicable dependent on the device. The BL-Browser distinguishes two types of keys, navigational and functional ones.

3.4.2.1 Navigation Keys

Key	Availability	Action
up	mandatory	Moves Cursor/Marker up to previous link on page
down	mandatory	Moves Cursor/Marker down to following link on page
ok	mandatory	Activates the currently focussed link (3.4.3.2) or confirms the actual input and executes the belonging action
left	optional	Moves Cursor/Marker up to previous link on page
right	optional	Moves Cursor/Marker down to following link on page

Tabelle 3.4-D Supported Navigation Keys

The layout of navigation keys is device-dependent. The BL-Browser shall detect which keys are available and assign the functionality appropriately: First all mandatory keys are assigned; second the optional keys are enabled.

3.4.2.2 Function Keys

The function keys, also called soft keys, offer the user access to Page Commands (3.5.6) or form actions (3.6.6.2). These commands are determined page-wise by the content provider in the page code (3.5.4).

Key	Function	Effect
f1	option	When key is pressed, the BL-Browser presents the Options-Menu, that allows the user to access all assigned options
f2	action	When key is pressed, the BL-Browser executes the action currently assigned to the function key

Tabelle 3.4-E Supported Navigation Keys

The layout of function keys is device-dependent. The BL-Browser detects which keys are available and assigns the functionality appropriately:

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The function keys are assumed to be arranged close to the display, so that the currently assigned functionality can be indicated in the status bar (3.4.1.2). The left function key is f1, the key on the right is f2.

3.4.2.3 Options Menu

The options menu holds all Page Commands assigned by the provider for the currently displayed page (3.5.6). Additionally, the menu always holds the Exit-Command, which allows the user to quit the application, and the Reload-Command, which can be called to reload the currently displayed page (Compare to 3.2.5).

The options menu is opened when the user presses the function key f1. The options menu is closed when the user cancels the menu or when an option is selected and executed.

3.4.3 Navigation and Scrolling

The BL-Browser must be able to determine the overall height of a page in pixels as soon as the page is being displayed. If the page does not fit the display height, scrolling is to be indicated (3.4.1.2). The scrolling indicator is adapted appropriately as the user navigates through the page. Horizontal scrolling shall not be supported.

3.4.3.1 Initial page state

Once a loaded page is displayed, the upper left corner of the page matches the upper left corner of the display. No item (link) is focussed.

3.4.3.2 Navigation scheme

The consumer will use the navigation keys 'up', 'down', 'left' and 'right' (3.4.2.1) to step through the content of the page. The BL-Browser shall support the following basic navigation scheme:

The BL Browser determines the order of interactive items as they occur in the HTML markup. It's in the content providers responsibility to put the hyper links in a suitable sequence. If the user hits 'down' or 'right', BL-Browser aims for the next hyper link downward in HTML markup, based on the currently focussed item. If the user hits 'up' or 'left', BL-Browser aims the next link upward in HTML markup, based on the currently focussed item.

If the aimed item is at least partly drawn, the browser sets the focus to the new item. Otherwise, the browser tries to scroll the page in the required direction.

When the currently focussed item becomes invisible caused by scrolling, it looses the focus.

Even items not or not fully visible due to other items drawn above are focussed, although the focus might not be obvious to the user. The user may press the 'ok' navigation key to activate the currently focussed link.

3.4.3.3 Scrolling

If the browser detects that scrolling of a page is required to satisfy the user input (seek the next link to focus or display the remainder of a page), it shall shift the page by a configurable amount of pixels either up or down. The configuration is required to allow powerful devices a smoother scrolling (small amount of pixels, down to 1 pixel) than less powerful ones (big amount of pixels, up to display height).

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A conservative estimation of a page wise scrolling is accepted for the prototype of BL-Browser. Even weak mobile devices shall be able to flip the HTML-content page wise. For more powerful mobile devices, the scrolling value for best user experience shall be figured out when the application is customized for these devices.

The browser should pre-process scrolling in idle state to enhance the usability of the specified scrolling behaviour.

3.4.3.4 Focus Representation

In the BL-Browser, an interactive item respectively link is always represented as rectangle box that is filled with colour, an image and/or. The content provider can supply dedicated styles for the focussed and the unfocussed state of each interactive item (See 3.5.3.2 for code examples). If the provider does not supply a style for the focussed state (using the pseudo selector '`a:hover`'), an inline border of 1 pixel width is drawn for the division to represent the focus. This border is also drawn in the specified colour if a style for the focussed state is supplied and does include a border-colour style assignment. In all other cases, the border is not drawn.

When a link gets the focus, the BL-Browser applies the style supplied by the provider. If the provider does not supply dedicated styles for the focussed item, the BL-Browser applies a default style (e.g. draws a rectangle border in aggressive color).

3.4.4 Localisation

All built-in text for status- or error messages and description of function keys shall be localised. BL-Browser will use a single language only but shall implement a mechanism so that all text can be localised easily in different versions of the application.

3.5 Content Coding

3.5.1 Coding Format

The content provider uses XHTML to mark up his content. XHTML serves flexibility for layout and branding of the content while being an accepted and well-known coding standard for page-oriented content presentation.

The X(HT)ML parser implemented in BL-Browser must be able to recognize any allowed syntactical elements like tags, comments, DTD, Notations, CDATA sections etc. All recognized elements except those specified in the remainder of this chapter shall be discarded without interpretation.

All HTML-Pages are encoded in UTF-8 Unicode representation.

3.5.2 Allowed Tags

The required parts of XHTML found on the W3C recommendation of XHTML Basic [1]. The range of XHTML to be supported by the BL Browser is initially restricted to the following elements:

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Module	Elements
Structure	body, div, head, html, style[1]
Hypertext	a
Basic Module	form, input, option, select, textarea
Object	object

Table 3.5-1 Supported XHTML elements

3.5.2.1 Tag Hierachy

The XHTML-tags supported by the BL-Browser must appear in a particular hierarchy. The following table illustrates the allowed tag hierarchy.

Tag	Parents	Children	Tag Condition
html	-	head, body	Always root element
head	html	style	Only 1 instance per page, before body
body	html	div, form	Only 1 instance per page, after head
style	head	-	Multiple instances per ancestor
form	body	div	Only 1 instance per ancestor
div	body, form	one or none of: a, object, input, select, textarea	Multiple instances per ancestor
a	div	-	Only 1 instance per ancestor
object	div	-	Multiple instances per ancestor
input	div	-	Only 1 instance per ancestor
select	div	option	Only 1 instance per ancestor
option	select	-	Multiple instances per ancestor
textarea	div	-	Only 1 instance per ancestor

Table 3.5-2 BL tag hierarchy

Tags that are not known by the BL-Browser may be omitted by the parser as well as known tags that are annotated outside the predefined hierarchy.

3.5.2.2 Attributes

The XHTML Standard [1] defines the attributes for each element. The BL-browser must support a subset of attributes and values as follows. Other attributes and values may be ignored by the browser.

Tag	Attribute	Values	Description

[1] The style-Element is excepted in [1] but must be supported by the BL-Browser since external style-sheets shall be avoided.

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html	–		
head	–		
body	class	see [1]	Assigns a style to the body
style	media	see 3.4.1.1	Selects the media type the styles apply for
div	class	see [1]	Assigns a style to the division
a	href	see 3.5.5	Defines the URL to be requested when the link is activated
	target	see 3.5.5	Defines the URL of a follow-up page for SMS links
object	data	see 3.5.5	Defines the URL of the object
	type	see 3.4.1.5	Selects the mime type of the object
form	action	see 3.5.5	Defines the URL to be called to complete the form
	method	POST GET see 3.5.7.5	Defines the method how form data must be sent to a (HTTP) server
	target	see 3.5.5	Defines the URL of a follow-up page for SMS links
input	type	text password checkbox radio submit reset see 3.5.7.2	Defines the type of a form input element
	name	see 3.5.8.1	Defines the name of the variable connected to the input element (not type submit or reset)
	value	see 3.5.8.1	Defines the (default) value of the variable
	checked	checked	Defines the default state of the input elements typed radio or checkbox
	maxlength	see [1]	Defines the maximum length of value for input elements typed text or password
select	name	see 3.5.8.1	Defines the name of the variable connected to the select element
option	value	see 3.5.8.1	Defines the (default) value for the belonging variable in case of selection
	selected	selected	Defines the that the option is selected by default
textarea	name	see 3.5.8.1	Defines the name of the variable connected to the textarea element
	rows	see [1]	Defines the number of rows (the height) of the textarea, used to calculate the number of allowed characters

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	cols	see [1]	Defines the number of cols (the width) of the textarea used to calculate the number of allowed characters

Table 3.5-3 BL tag hierarchy

3.5.2.3 Text Nodes

HTML-elements may have text nodes that typically maintain text to be displayed. The BL-Browser must be aware of text nodes for the following, dedicated tags:

Tag	Text Meaning
style	A style-sheet that is to be parsed and resolved by the BL-Parser
div	One paragraph of flowing text to be displayed
a	Text to be displayed as link
input	Text to be displayed as declaration of a radio button or checkbox
option	Text to be listed as option in a selection
textarea	Predefined text in a textbox

Table 3.5-4 Tags supporting text nodes

For all tags unlike those listed in the upper table, the BL-Browser may omit the textual information. The text will not be displayed.

Special handling applies to those elements that can contain either text or further child elements, which is the -Element (Compare to 3.5.2.1). If a division contains both text and further child elements, the parser may omit the text.

3.5.2.4 Predefined Character Entity References

Entities do not need to be supported by BL-Browser, except those predefined in XML [2]. The following predefined entities must be recognized and interpreted as they are used to escape the XHTML syntax:

Representation	Entity Meaning
<	'<' less than
>	'>'greater than
'	"' apostrophe
"	'"' quotation mark
&	'&' ampersand

Table 3.5-5 Predefined character entity references

3.5.3 Styles

With using XHTML Basic for content markup, the content provider syntactically separates information from presentation. The syntax for declaring styles is defined in [3]. The following list of styles represents a subset of the styles defined in [3] and must be supported by the BL-Browser:

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Style	Values	Default	Applies to	Description
top	*number*[px]	see 3.6.2	div	Absolute y-position of a box measured in pixels from the upper border of the display
left	*number*[px]	0, see 3.6.2	div	Absolute x-position a box measured in pixels from the left border of the display
width	*number*[px]	display width, see 3.6.2	div	Absolute width of a box measured in pixels
height	*number*[px]	see 3.6.2	div	Absolute height of a box measured in pixels
background-color	*#RRGGBB*	#FFFFFF (for body only)	body div	Background color of display, box or active link
background-image	*URL*	-	body div	Background image for display, box or active link
color	*#RRGGBB*	#000000	body div	Color of text
font-size	small medium large	medium	body div	Size of font, dependent on target device
font-weight	normal bold	normal	body div	Indication whether text shall be displayed bold or not
font-style	normal italic	normal	body div	Indication whether text shall be italicised or not
text-decoration	none underline	none	body div	Indication whether text shall be underlined or not
text-align	left center right	left	body div	Indication how text shall be aligned horizontally in box
vertical-align	top middle bottom	top	div	Indication how text shall be aligned vertically in box
border-color	*#RRGGBB*	#000000	div	Color of rectangle border for focussed links, applies for a:hover pseudo selector only.

Table 3.5-6 Supported style declaration

The significance of each style declaration depends on the HTML element the style is assigned to. Particular styles do only apply to particular elements as shown in the table above, differing assignments may be skipped by the BL-Browser.

Despite the specification of CSS [3], BL-Browser does not require the mandatory unit identifier for non-zero values in `height`, `width`, `top`, and `left`. If no unit identifier is given, BL-Browser shall anticipate 'px' as default. Unit identifiers other than 'px' do not need to be supported.

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3.5.3.1 Media Type Dependent Styles

To make the content presentation best fit the device's capabilities concerning display size, color depth etc., the BL-Browser distinguishes several media types (3.4.1.1).

The content provider shall add different styles to his content, each designed for a dedicated media type. The BL-Browser must resolve the required style by detecting the target device's media type and apply the concerned styles when presenting the content.

The provider defines styles by means of <style>-Elements in the header of the HTML-document. External style-sheets do not need to be supported.

Beside predefined media types, also global, unconditional styles are allowed that apply to any media type. Global styles have no or an empty "media"-Attribute.

<style>-Elements with any other (custom) media type assigned that is not known by BL-Browser shall be ignored.

Example:

The following XHTML excerpt marks up styles for all supported media types, including a global, unconditioned style declaration which applies to all media types.

```
<head>
    <style><!--global style for all media types--></style>
    <style media="x128"><!--styles for type x128--></style>
    <style media="x176"><!--styles for type x176--></style>
    <style media="x240"><!--styles for type x240--></style>
</head>
```

Styles are always applied "in addition", meaning that several <style>-Elements for the same media type (including global styles>) may be defined, which have to be parsed one by one, each supplementing or overwriting the style definitions of its predecessors.

Example:

In case of a x128 mobile device the <style>-Elements 1 (global), 2 and 4 would be applied, each supplementing the style definitions.

```
<head>
    <style><!--global style for all media types--></style>
    <style media="x128"><!--styles for type x128--></style>
    <style media="x176"><!--styles for type x176--></style>
    <style media="x128"><!--styles for x128 again--></style>
</head>
```

3.5.3.2 Style Assignment

The specification of CSS [3] defines various so-called selectors to assign styles to the content. The BL-Browser must basically support the class-selector to assign styles to HTML-elements. Thus, the provider can assign styles only to elements, which the class-attribute applies to (3.5.2.2).

Example:

The following HTML-excerpt defines a style for class "div1" which is referenced by a dedicated division in the HTML body. In effect, the background of

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the box made up by the -Element would be paint black, the text would be white.

```
<head>
    <style>
            .div1{  background-color:#000000;
                    color:#FFFFFF }
    </style>
</head>
<body>
    <div class="div1">white text on black ground</div>
</head>
```

Additionally, the pseudo selector "a:hover" must be supported to enhance styling of visual feedback when the user focuses a link.

Example:

The following HTML-excerpt defines a style for class "div1" including the `a:hover` selector. When the user activates the subsidiary link, the background-color changes from black to white, the text color changes from white to black and the rectangle border is displayed red.

```
<head>
    <style>
            .div1{  background-color:#000000;
                    color:#FFFFFF }
            .div1 a:hover { color:#000000;
                    background-color:#FFFFFF;
                    border-color:#CC0000}
    </style>
</head>
<body>
    <div class="div1">
            <a href="#">Hover me to change my color!</a>
    </div>
</body>
```

The same mechanism serves the effect of rollover images. The inactive background-image is paint over with the active image when the link is hovered.

```
<head>
    <style>
            .div1 {background-image:url(/inactive.png)}
            .div1 a:hover{background-image:url(/active.png)}
    </style>
</head>
<body>
    <div class="div1">
            <a href="/yesno.htm"> </a>
    </div>
</body>
```

3.5.3.3 Style Inheritance

The specification of CSS [3] defines the inheritance of styles, thus called "cascading". The BL-Browser must support inheritance, inherited style declarations are listed by the lower table. All other style declarations must not be inherited.

Style	Description
color	Inherits the text color

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font-size	Inherits the font size (small, medium or large)
font-weight	Inerits the font weight (bold or not)
font-style	Inherits the font style (italic or not)
text-decoration	Inherits the text decoration (underline or not)
text-align	Inherits the horizontal text alignment (left, center or right)
vertical-align	Inherits the text vertical text alignment (top, middle, bottom)
border-color	Inherits the rectangle border color of focussed links

Table 3.5-7 Inherited style declarations

Inheritance of styles allows the provider to appoint generic appearance of text once, e.g. to the HTML-body. The text styles are then applied to all text items of the page as long as no other style is classified for a child element.

Example:

The following HTML-excerpt illustrates style inheritance. All text is written black in normal size (default), normal weight (default), without decoration (default) and italic style. This style is inherited by all text divisions, but the division of class p1 overwrites the generic italic style with "normal".

```
<head>
    <style>
            .general{       color:#000000;
                            font-style:italic;
                            text-align:center}
            .p1{            font-style:normal}
    </style>
</head>
<body class="general">
    <div>
            Text style inherited (font style italic)
    </div>
    <div class="p1">
            Text style inherited but font style normal
    </div>
</body>
```

3.5.4 Processing instructions

At the top of each HTML markup, the content provider may add processing instructions that tell the BL-Browser which application specific actions need to be preformed beside visualization of the page. Processing instructions are coded conform to the W3C XML- Standard [2], BL-specific instructions are indicated by name 'bl'.

The following processing-instructions must be understood by the BL-Browser. If one instruction is missing (i.e. not supplied by the content provider), the browser must anticipate a default value.

Instruction	Values	Default	Processing
req	sync|refresh|lock	refresh	determines how updates of the page shall be requested (3.2.2)

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his	0 | 1	1	indicates if the page shall be added to the history (3.2.2.4)
var	0 | 1	0	indicates if variables shall be resolved (3.5.7)
snd	0 | 1	0	indicates if the page shall be announced acoustically (3.4.1.5)
vib	0 | 1	0	indicates if the page shall be announced by haptic feedback (vibration alarm) ()
lit	0 | 1	0	indicates if the backlight shall be switched on (3.4.1.4)
img	0 | 1	0	indicates if the page makes use of dynamic images (3.6.3.3)
back	action | option		determines how the indicated Page Command (3.5.6) can be accessed via function keys (3.4.2.2) by the user
next	action | option		
home	action | option	action	
sync	action | option		

Table 3.5-8 Mandatory processing instructions

Example:

The following XHTML excerpt would trigger the following behaviour: Page updates are synchronized, variables will be resolved, the page is added to the history (default). The commands "next" and "sync" are added to the options menu, while command "home" is applied as action by default.

```
<?xml version="1.0" encoding="UTF-8"?>
<?bl req="sync" var="1" next="option" sync="option"?>
<html>
...
</html>
```

In the next example, the provider omits or has forgotten to add processing instructions at all. Nevertheless, BL-Browser sends RefreshCommands for the page, adds it to the history and supplies the command "home" as action.

```
<html>
...
</html>
```

The assignment of the action is exclusive. If the provider marks up more than one command to be the page's action, the BL-Browser may choose the last action notified in page code.

3.5.5 Linkage

The provider embeds links (typically tagged <a href="*link*"> or <form action="*link*">) to allow the consumer to interact with the content. A link can request another page from the content server, can launch a Built-In command (3.5.6) or can trigger dedicated handheld functionality like sending an SMS or sending form data via GPRS.

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A link syntax is proposed to meet the requirements of uniquely identifying the action that the BL-Browser shall perform. Links are annotated as follows:

```
link ::= [action]url
```

The BL-Browser must detect and perform the following actions:

Action	Processing
action omitted	If the link does not appoint an action, the given URL is to be requested from the BL-Content Server using the GetCommand (see 4.2.9). The URL always represents the absolute path of a file on the BL content server, therefore it must always start with a slash "/". Example: `<a href="/news/overview.htm">Nachrichten</a>`
sms:	Sends an SMS (see 4.3.1 for details). Example: `<form action="sms:0190666666?Domina" >`
http:	Opens the default data channel (WAP) and requests the URL (see 4.3.2 for details). Example: `<a href=http://www.aps.tv">Ihr Provider</a>`
bl:	The action 'bl' indicates that the URL shall be interpreted as page command (3.5.6) Example: `<a href="bl:back">Zurück</a>`

Table 3.5-9 Link resolution

The URL in links must not exceed the limit of 256 characters. BL-Browser does not need to check the URL for maximum length, the content provider is in charge to do so.

3.5.5.1 SMS Link Coding

A link that indicates that an SMS must be sent contains all data required to format and send the SMS. BL-Browser must intepret the link in order to prepare the SMS:

```
sms:<TelephoneNumber>[?<MessageText>]
```

`<TelephoneNumber>` contains the number where the SMS shall be sent. The question mark separates the message body from the telephone number and is to be omitted. `<MessageText>` carries the message to be sent. The indication of a message body "`?<MessageText>`" is optional an can be missing. In this case an empty SMS is to be sent.

The content provider may use variables to customize the link (3.5.8.6).

3.5.5.2 HTTP Link Coding

BL-Browser must be aware of HTTP-Links occurring either as hyper reference in <a>-Elements to request HTML-Pages or as action in <form>-Tags to complete the form. HTTP-Links for resources in style definitions (e.g. background-images) are to be omitted by the browser.

In both valid cases, the Link is coded according to the following scheme:

```
http:<url>
```

and may contain variables for customization (3.5.8.6).

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3.5.6 Page Commands

The BL-Browser supports a list of built-in commands that allow the provider to make accessible application specific page navigation features from within the XHTML code:

Command	Processing
`next`	Requests the following page in history (3.2.4)
`back`	Requests the previous page in history (3.2.4)
`home`	Requests the fixed start page 'index.htm' using the GetCommand (4.2.9)
`sync`	Forces display of the current Sync Page, uses the GetCommand (4.2.9), refer to [5]

Table 3.5-10 Page Command resolution

The provider assigns Page Commands either by processing instruction (3.5.4) or as link (3.5.5) in his XHTML markup.

3.5.7 Form Handling

The content provider may use forms to collect user input interactively. The BL-Browser must support all common HTML form elements (3.5.1).

Due to technical limitations concerning the size of the BL-Browser executable, the application may switch to a dedicated form mode which makes use of native, built-in input controls.

3.5.7.1 Form Mode

The BL-Browser shall enter the form mode if the first child of the <body>-Element is the <form>-Element. If the <form>-Element appears at a different point of HTML-tag hierarchy, the browser may skip it completely.

Example:

```
<body>
    <form>
            ...
    </form>
    <div>...</div>
</body>
```

In the previous example, the browser would enter the form mode but may skip the following -Tag. In the next example, the browser should display the divisions but may skip the form completely

```
<body>
    <div>...</div>
    <form>
            ...
    </form>
    <div>...</div>
</body>
```

3.5.7.2 Form Elements

The form elements to be supported are listed in the following table. Tags not listed may be skipped by the browser.

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Tag	Parents	Description
`div`	`form`	Adds descriptive text or a picture to the form
`input`	`div`	Defines different types of input fields, dependent on the type attribute: `text` defines a common edit-box `password` defines a common edit-box where input is scrambled `checkbox` defines a checkbox (non-exclusiv selection in group) `radio` defines a radio button (exclusive selection in group) `submit` defines the text to complete the form `reset` defines the text to reset the form
`select`	`div`	Defines a dropdown box
`option`	`select`	Defines a pair of text and value for the dropdown box
`textarea`	`div`	Defines an area of multiple rows and columns where the user may enter lengthy text

Table 3.5-11 BL form elements

All form elements `input`, `select` and `textarea` shall have a division as their ancestor in the content provider's markup, although it is not necessarily required in form mode as no styles are applied here (Compare to 3.5.7.3). But: The BL-Browser shall be aware of form elements embedded in divisions to make the content markup upward compatible when future versions of the application do no longer rely on a dedicated form mode.

Example:

The following code excerpt would make up a form, starting with a picture, having an input field and a dropdown box, each named by a line of text

```
<head>
    <sytle>
          .logo{background-image:url(/pic/logo.png)}
    </style>
</head>
<body>
  <form action="#">
    <div class="logo" />
    <div>Name:</div>
    <div><input name="name" type="text"/></div>
    <div>Ihr Anliegen:</div>
    <div>
       <select name="anliegen">
            <option>Nichts besonderes</option>
            <option>BLUCOM</option>
       </select>
    </div>
  </form>
</body>
```

3.5.7.3 Form Styles

In form mode, the BL-Browser may omit all styles that are assigned to any element, including the <body>-Tag. Only exception is the `background-image` definition applied to -Elements that is used to add pictures to a form. However, the background-image is only displayed if the division is empty, i.e. it does not

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contain a cild-element or text. Otherwise, the image is omitted and the child-element is displayed instead. **Note:** This behaviour is form mode specific.

3.5.7.4 Limited Form Input

The provider may limit the user input to a maximum number of characters. This behaviour applies to both <input>-Elements of type "`text`" or "`password`" and <textarea>-Elements.

For <input>-Elements the limit is set by attribute "`maxlength`". BL-Browser must survey the limit, although the input control cannot be sized adequately in form mode.

For <textare>-Elements the limit is calculated by multiplying the values of attribute "`rows`" and "`cols`". BL-Browser must survey the limit, although the textarea control cannot be sized adequately in form mode. If one of the operands is missing, it defaults to 1.

3.5.7.5 Form Completion

A Form is completed when the user carries out the submit-action (Compare to 3.6.6.2). The BL-Browser must first store the form variables (3.5.8.1) and then call the URL coded in the `action`-Attribute of the <form>-Element to complete the form. If the `action`-Attribute is missing or does not contain a valid URL, the browser shall not request the URL but at least must store the form variables.

Example:

The form-Element has an action-Attribute without a valid URL (Actually "#" is a valid URL which references the currently displayed page). The BL-Browser stays on the current page when the form is submitted, but stores all form data in variables.

```
<form action="#"> ... </from>
```

In case of the action indicates a BL- or SMS-Link (3.5.5), the browser calls this URL without completing the link with form data, unless the URL itself requires variable replacement (3.5.8.6).

Example:

The form has offered a Selection with name="anliegen" an the user might have selected one. When the form is submitted, first the variables are stored and then the action-URL is resolved with these variables. A selection of "BLUCOM" would result in the URL "/foo/BLUCOM.htm"

```
<form action="/foo/$$anliegen$$.htm"> ... </form>
```

In case of the action indicates a http-Link, the BL-Browser must respect the common rules of form transmission via HTTP (see 4.3.2.1).

3.5.8 Variables

It is required that dynamic data entered or determined on one page is made available to follow-up pages. Unlike client/server scenarios known form the internet, the BL-Content Server is not able to process or store dynamic data that results from an user interaction, therefore the BL-Browser must be able to do so.

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Example:
A page contains a form offering the selection of one item from a group of items, e.g. by radio button. In the follow-up page, the selected item shall be displayed again and finally be sent by SMS to the content provider.
On the internet, the selected item would be post to the server which inserts the item on the dynamically generated follow-up page. As the BL-Content Server is not capable of doing it, the BL-Browser must store the item variably and insert it in the follow-up page(s) where required, for both display and the SMS text.

The BL-Browser must supply contextual variables to store dynamic data. The content provider may declare variables in two ways, using either forms or links.

3.5.8.1 Variable Declaration In Forms

In forms, variables are always declared by the `name`-attribute of the form elements `input`, `select` and `textarea`. The initial value of a form variable is determined by the `value`-attribute of either the `input`-element or the pre-selected `option`-element (see 3.5.8.2). The value may change with the user's interaction.

Example:
Divisions (-Tags) are omitted in this example:

```
<form action="/form/complete.htm" method="GET">
    <input name="start_time" value="12:45" type="text"/>
    <input name="title" value="Matrix" type="text"/>
    <input value="Abschicken" type="submit" />
</form>
```

The BL-Browser must store/update form variables when the user submits the form. Additionally, the follow-up page is requested which is given by the `action`-attribute of the spanning `form`-element.

3.5.8.2 Default Value Declaration

For all form elements, default values can be defined by either attribute or text node:

Element	Markup
Editbox	`<input type="text" value="default"/>`
Checkbox	`<input type="checkbox" checked="checked"/>`
Radio Button	`<input type="radio" checked="checked"/>`
Textarea	`<textarea> default </textarea>`

Dropdown List	`<select>`
	`  <option selected="selected">default</option>`
	`</select>`

Table 3.5-12 Form element default value markup

The default value needs to be assigned when the form is displayed the first time and the belonging variables do not yet exist. If a variable already has a value assigned from any former variable declaration (refer to 3.5.8), BL-Browser shall ignore the default value and display the adequate text instead.

Examples:

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Variable name = "ME". In the following form, "ME" would be displayed in the Editbox instead of default "Your Name":

```
<form>
    <input type="text" name="name" value="Your Name"/>
</form>
```

Variable category = "news". In the following form, option "news" would be pre-selected and "Nachrichten" would be displayed, instead of the default category "erotic" text "Erotik & Sex":

```
<form>
    <select name="category">
      <option value="news">Nachrichten</option>
      <option value="erotic" selected="selected">
           Sex &amp; Erotik
      </option>
    </select>
</form>
```

3.5.8.3 Variable Declaration In Links

The provider may use links to encode variables. He extends the URL as an internet browser would do to pass variable data to a server. The extension starts with a question mark '?' and then lists tuples of variable name and value. Name and value of a variable hereby are separated by equal sign '=', tuples are separated by ampersand '&'.

Example:

```
<a href="/ent/complete.htm?start_time=12:45&title=Matrix">
```

The BL-Browser must store/update the variables when the link is activated by the user. In case of an URL requesting data from a BL content server (as shown in the example above), the BL-Browser must certainly omit the variable part of the URL, beginning with the question mark.

3.5.8.4 Storage Of Variables

The context (3.2.1) guarantees that variable names do not collide. Variables are always stored un-typed (text-only). Variables are always used "as is" in their textual representation, mathematical operation on variables is not supported by the BL-Browser.

Once a variable is stored, it shall be available until a new context is indicated or the application is quit. If the browser loses the context because the STB is tuned to a channel without BLUCOM (SERVICE_NOT_AVAILABLE), the variables need to be maintained.

The BL-Browser should reserve 5k of memory to store variables (names and values). If the buffer for variables exceeds, the "oldest" variables shall be deleted.

3.5.8.5 Variable Resolution

Variables can be referenced by naming them anywhere in the XHTML sourcecode according to the following convention: "**$$VariableName$$**" where `VariableName` is the name originated from a form or link variable declaration.

Whether a page requires resolution of variables is controlled by the content provider who must add a processing instruction at the top of the page (3.5.4). If variable resolution is indicated, the BL-Browser replaces any `$$VariableName$$` code-piece with the belonging value if known before displaying a page.

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The BL-Browser will resolve variables at the following dedicated positions:

- URLs to customize image, object or page paths
- Displayed text
- Form values

3.5.8.6 Variable Resolution In URLs

The BL-Browser must resolve variables in URLs before the URL is requested from a server.

Example:

```
<a href="/weather/$$CityName$$.htm">
```

The resolution with a variable `currentContext.CityName` = "Munich" would result in an URL "/wheather/Munich.htm"

```
<sytle>
 .cityWeather{background-image:url(/w/pic/$$CityName$$.png)}
</style>
```

The resolution would result in the URL "/w/pic/Munich.png" for the image to be requested from the BL-Server.

If an URL cannot be resolved due to a unknown variable value, BL-Browser shall not request the URL but display an error message instead.

3.5.8.7 Variable Resolution In Text

The BL-Browser must resolve variables in text before the text is displayed (3.6.4). Text to be displayed is stored in text-nodes of the elements , <input>, <option>, <textarea> or <a>.

Example:

```
<div>Ihr Wetter in $$CityName$$:</div>
```

The resolution with currentContext.CityName = München would result in "Ihr Wetter in München:"

If text cannot be resolved due to an unknown variable value, the variable declaration is removed completely and the text is displayed without.

3.5.8.8 Variable Resolution In Attributes

The BL-Browser must resolve variables in certain attributes of form elements before the attribute's value is evaluated. This applies to the value-Attribute of <input>-Elements only.

If an attribute value cannot be resolved due to an unknown variable value, the variable declaration is removed completely and the attribute value is applied without.

3.6 Content Presentation

3.6.1 Content Processing

The following drawing proposes the steps that are necessary to process a HTML page in an effective way, assuming that the page was decrypted successfully in a preceding step. The proposed procedure bases on tag-wise iteration through the

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HTML-code. Therefore, beside native coding a parser either implementation using SAX or DOM is possible, where SAX could be faster than DOM.

Since it is a proposal only, a different algorithm may be chosen to implement the parser engine of BL-Browser.

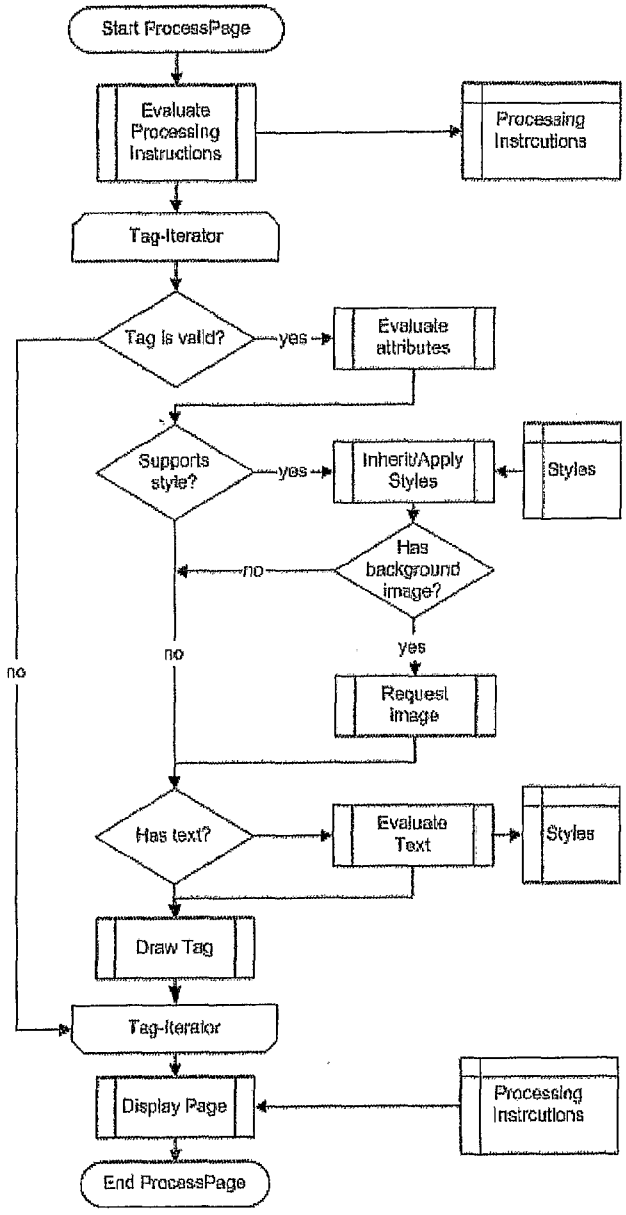


Fig. 6 – Application flow "Process Page"

3.6.1.1 Requesting External Resources

The BL-Browser will determine required external resources while iterating through the HTML markup. This concerns background images when applying styles to

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<body> and -tags as well as sounds when evaluating the attributes of <object>-tags.

The URL of an external resource may contain variables. The parser must resolve the variables before requesting the URL (3.5.8.6).

Images shall be cached locally as long as possible as they might be required on follow-up pages, too. Only when not available in the local cache, external resources must be requested from the server. Additionally, the processing instruction 'img' may indicate that images shall be refreshed (3.5.4). In this case, BL-Browser must check the concerned images for updates before the cached version of an image is used (compare to 3.6.3.3).

In case of an external resource is not present on the server, the server tells the browser whether it make sense to repeat the request (DATA_NOT_YET_AVAILABLE) or not (DATA_NOT_AVAILABLE). After the browser has tried to receive each resource once, he tries all missing resources not yet available again (but skips the not available ones). This is iteration is repeated as long as the browser gets at least one of the missing resources.

Resources that finally cannot be retrieved from the server will not be displayed (images) or played (sound objects).

3.6.1.2 Style Application

Styles are extracted from the text node of <style>-tags. The parser must be aware of bad style-sheet markup, i.e. the parser must ensure that all relevant style-sheets have been processed before the first style needs to be applied to any <body>, -element etc.

Example:

Handheld media type is x128 and the content provider has split the relevant styles onto 3 relevant style definitions (compare to 3.5.3.1)

```
<head>
    <style media="x128"><!--styles for type x128--></style>
    <style media="x176"><!--styles for type x176--></style>
    <style media="x240"><!--styles for type x240--></style>
    <style media="x128"><!--more styles for x128--></style>
    <style><!--global style for all media types--></style>
</head>
```

If the provider does not supply a style-sheet for the media type detected on the handheld device, the BL-Browser must try with the global style only. If the global style is also missing, BL-Browser must display the content without style, assigning the defaults (3.5.3).

3.6.1.3 Parser Activity

The page shall not be displayed until the whole page was parsed and all external resources have been tried to be retrieved (3.6.1.1). In the moment the page is displayed, all BL built-in actions defined by processing instructions are executed and contained sound is played.

Meanwhile, the BL-Browser shall indicate parser activity visually (3.4.1.3).

While the parser is active (i.e. preparation of a page for display), the BL Browser may reject any user input. Furthermore, the BL-Browser may suspend or not react to all Refresh- respectively Lookup-timers while the parser is active.

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The currently displayed page shall be maintained as long as possible, at least visually. BL-Browser may discard the HTML-code representation of this page in memory if required to parse the new page. Consequently, the user may can neither interact with nor return to the this page and no page will displayed if the processing of the new page fails. This behaviour is to be changed in future (5.5).

3.6.2 Positioning And Sizing Of Content

All layout, i.e. positioning and sizing of the content, is done by means of divisions (-Elements). The HTML-markup may contain multiple divisions, parent element of all divisions is either the element <body> or <form>.

3.6.2.1 Positioning Of Divisions

The BL-Browser shall display divisions as they appear in markup from back to front, i.e. each division is drawn in front of its predecessor.

The -Element is the only element for which the BL-Browser supports the styles '`left`' and '`top`' for defining the x- and y-coordinate on screen. If the provider appoints both styles, a division is positioned absolutely, independent of the content the division maintains.

If the provider omits the style '`top`' for a particular -Element, the division is positioned relatively on y-coordinate. The BL-Browser must then determine the y-coordinate by summarizing '`top`' + '`height`' of the preceding division.

If the provider omits the style '`left`', the position on x-axis defaults to 0.

3.6.2.2 Sizing Of Divisions

The -Element is the only element for which the BL-Browser supports the styles '`width`' and '`height`' for defining the width and height on screen. If the provider appoints both styles, a division is sized absolutely independent of the content the division maintains.

If the provider omits the style '`height`' for a particular -Element, the division is extended relatively on y-coordinate. The BL-Browser must then determine the height from the content maintained by the division. If a division contains both text and image, BL-Browser shall anticipate the bigger value.

If the provider omits the style '`width`', the division is extended to the right border of the screen if it contains text. If the division contains only a picture, the width of the division shall equal the image size.

Divisions are never resized, although a link inside might apply different styles for text or differently sized images in focussed state.

3.6.3 Image Presentation

The BL-Browser supports images that the provider adds to his markup by means of background-image styles (3.5.3). The generic <img>-Element does not need to be supported by the BL-Browser.

The browser shall be able to handle JPEG and PNG image formats.

3.6.3.1 Recurring Images

Images are either assigned to the HTML body or to a division (3.5.3). The BL-Browser must determine the area to be filled with the image. In case of the HTML-

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body, the area is the complete canvas. In case of a division, the area must be calculated from the applied style information (3.6.2).

In either case, the image must be repeated to fill the complete area on both x- and y-axis. The BL-Browser must be able to determine the original width and height of an image in order to handle recurrence of the image correctly.

With recurring images, the provider may reduce image data to a required minimum, e.g. a color gradient in background can be supplied by an image that is only one pixel high. Repetition of this image on y-axis extends the gradient to fill the whole screen. This relieves the overall load of the BL system.

3.6.3.2 Scrolling Images

Background images assigned to the <body>-Tag are attached resp. fixed to the display canvas and are never scrolled, whereas images within -Tags are scrolled with the page.

3.6.3.3 Refreshing Images

Dynamic images can be used by the content provider in order to update specific, graphical parts of one or many pages without need to supply a new version of each page. The provider must explicitly indicate usage of dynamic images by setting the processing instruction "img=1" (3.5.4) of each concerned HTML page.

If refreshing of images is indicated by the page, BL-Browser must try a refresh for each image embedded in the page either when the page is initially parsed and displayed or when a RefreshRequest is sent for the page. The GetCommand can be used to ask the STB for a new version of an image. If a new version is present on server side, the image data is contained in the GetResponse, otherwise the server indicates that the image is up-to-date (4.2.9). Images must also be refreshed when the user reloads the page manually via the options menu (3.2.5).

The size and position of a division carrying a refreshed image does not change, even if the new version of the image differs in width and or height from his predecessor. But: the rules for recurring images have to be respected when a image is refreshed.

3.6.4 Text Presentation

3.6.4.1 The Text Box

The box in which text is to be displayed is determined by the size of the parental division (3.6.2). If the height of the box is sized absolutely, the BL-Browser masks all text that does not fit into the box.

If the height of the box is sized relatively instead, the browser extends the box on y-axis so that the complete text fits into and is visible when being displayed. The required height of the box is then the height of the division for further calculations.

3.6.4.2 Text Style

The provider may appoint text-styles for the element maintaining the text (3.5.2.3). The styles that apply to text are `color`, `font-size`, `font-weight`, `font-style`, `text-decoration`, `text-align` and `vertical-align`.

Text always utilizes the whole size of the box, no padding is applied in horizontal or vertical direcation.

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The BL-Browser must apply the styles to the text before displaying. Furthermore, the applied style (e.g. `font-weight = bold`) may influence calculation of the text flow. The style definition `vertical-align` shall only be assigned if the height of the text box is sized absolutely, otherwise the default value `top` applies.

The text may contain variables (3.5.8.7). The parser must resolve the variables before performing any calculations on text length and flow.

3.6.4.3 Hyphenation

The BL-Browser does not need to support hyphenation. But: The BL-Browser must be able to recognize words that do not fit into the width of the surrounding box. In this case, the concerned word is cut on the right when hitting the box' border.

3.6.4.4 Character Sets

No special character sets need to be defined as all text is UTF-8 encoded Unicode. Additionally, BL-Browser must resolve any character entity references (3.5.2.4) before displaying the text.

3.6.5 Sound Presentation

The content provider may embed sound into a page by means of the <object>-Elements.

3.6.5.1 Mime Type Matching

To supply different sound formats, the provider will use multiple <object>-Elements, each assigned with the corresponding mime type (3.4.1.5) of the sound file.

The BL-Browser shall detect the first sound object in HTML markup whose format matches the target device's playback capabilities.

3.6.5.2 Sound playback

The determined sound file is requested from the server and played once when the page is being displayed.

The BL-Browser does not need to offer sound controls like play, stop, pause etc. to the user. Once a page serving sound is refreshed or reloaded (e.g. from history), the sound has to be played again.

Playback of sound must not interfere with the user's interaction, e.g. blocking the cursor navigation. If the user navigates to another page, the sound must be stopped when the new page is displayed.

3.6.6 Form Presentation

The first version of BL-Browser may enter a dedicated form mode to present and allow interaction with forms (3.5.7.1). The form mode makes use of controls built into the device. Therefore, form presentation may differ from device to device. The content provider and BL-Browser must be aware of this. Even in form mode, certain guidelines should apply to make from presentation somehow predictable.

3.6.6.1 Positioning And Sizing Of Form Elements

The form mode does not know about absolute positioning of form elements because no styles are applied.

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Therefore, the display is implicitly divided into one column and multiple rows. Each form element – represented by its division - becomes a row, displayed in the order the elements appear in the HTML markup. Each row spans the available display size.

To determine the height of a row, the same rules apply as for relative positioning (3.6.2.2).

With future versions of the BL-Browser, the form mode might become obsolete, hence identical rules for positioning and sizing will be applied to all divisions.

3.6.6.2 Form Actions

The HTML syntax for form elements defines two actions 'submit' and 'reset', declared by `input`-Elements of either type. The content provider may customize the text to be displayed for these actions by assigning the `value`-Attribute.

Example:

```
<form>
    <input type="submit" value="Ab Damit"/>
    <input type="reset" value="Nochmal Neu"/>
</form>
```

In the upper example, BL-Browser shall display the text "Ab Damit" for the submit action and "Nochmal Neu" for the reset action.

In form mode, the actions are typically assigned to the function keys (3.4.2.2) since the form mode does not support links. The 'reset' action is to be added to the options menu triggered by function key f1, the 'submit' action shall always be assigned to function key f2. Any Page Command (3.5.6) assigned to f2 is overruled in this case. The overruled Page Command should then be moved to the options menu.

A 'submit'-action shall always be present to the user. If the content provider does not supply the submit action in his markup, BL-Browser shall assign the default text 'OK'.

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4 External Interface Requirements

We describe all interfaces here, which are "external" from the application's point of view

4.1 Bluetooth Communication

4.1.1 Bluetooth Stack Requirements

All red framed elements in Fig. 7 represent the Bluetooth components required for BLUCOM Communication between STB and Mobile Device. All those elements are also required being implemented on STB side (except SDP Server instead of SDP Client).

The BLUCOM Communication protocol is located beyond the Bluetooth Serial Port Profile (SPP).

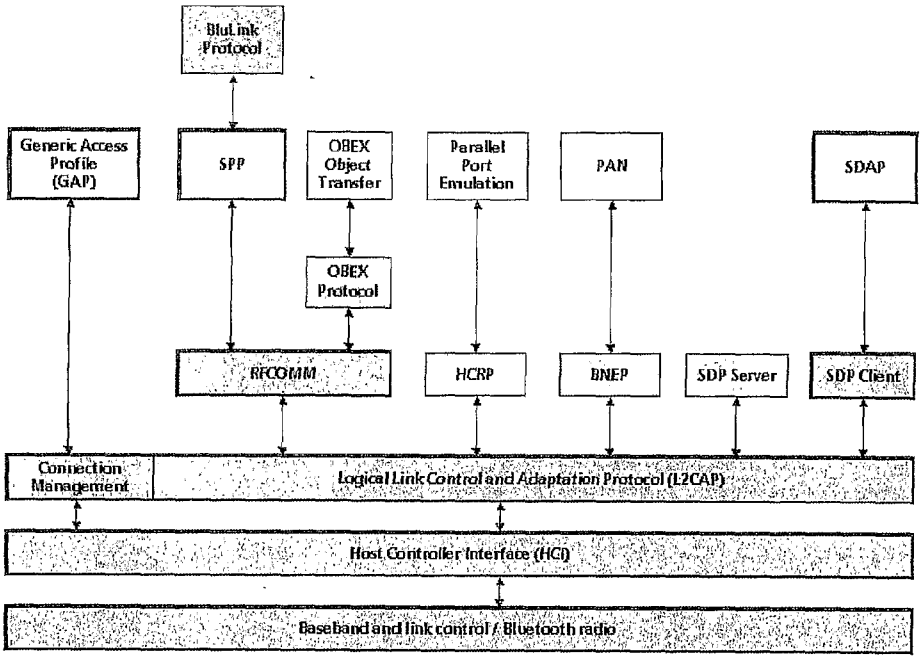


Fig. 7 - Bluetooth protocol elements required for BLUCOM

4.1.2 Serial Port Profile Communication

BL-Browser uses the Serial Port Profile to communicate with the STB on Bluetooth Level.

The communication may be asynchronous, i.e. the browser may decouple sending of BL-requests from reception of BL-responses. The STB is specified to handle up to 10 BL-requests asynchronously. The server will handle all incoming requests sequentially.

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However, BL-Browser shall implement a mechanism to couple transmission of requests with the reception of responses in order to limit the amount of asynchronously sent requests to a configurable number. A suitable number is to be determined in the prototype phase when the performance of different STBs can be evaluated.

4.1.3 Timeout Handling

The BL-Browser must handle a timeout for each sent request. The STB is specified to answer any request within 250ms which species the duration from point of request detection to point of response sending on STB side.

With respect to Bluetooth communication latency in between, BL-Browser shall apply a configurable timeout from point of request sending to point of response detection. As several requests can be sent asynchronously, this timer shall be reset with every detected response in case of any further responses are outstanding.

The initial value for the timeout shall be 1 second. A suitable timeout value is to be determined during the prototype phase.

Once a request timed out without reception of the belonging response, the request must be repeated.

4.1.4 Connection Loss

The Bluetooth connection to the STB can get lost for various reasons:

- The STB is switched off
- The user leaves the Bluetooth transmission radius of the STB
- The mobile device suspends the Bluetooth connection due to an incoming phone call

BL-Browser must detect the loss of the Bluetooth connection and try to re-establish it. Once the connection is up again, the browser shall restore the actual state.

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4.2 BLUCOM Communication Protocol Definition

The Interface Protocol between Set Top Box (STB) and Mobile Device is based on the XML file Format. All xml tags shall be built according to [2]. In order to keep the amount of protocol data as small as possible it is recommended to use the XML short-form for building the XML protocol.

Example long-form:
<InitiateResponse requestId="00-02-72-80-EC-FE-00001" retCode="OK">
</InitiateResponse>

Example short-form (recommended):
<InitiateResponse requestId="00-02-72-80-EC-FE-00001" retCode="OK"/>

There are five different commands defined which are described in the following sections.

4.2.1 Marking Commands

Each BLUCOM Command shall be opened by a leading Start Text (STX) byte and closed by an End Text (ETX) byte.

The corresponding values defined

- for STX byte: 0x02
- for ETX byte: 0x03

Example:

```
ff02<InitiateRequest
requestId="00-02-72-80-EC-FE-00001"
cprString="Copyright by APS, ASTRA Platform Services
GmbH"/>ff03
```

In order to avoid any conflicts with values inside binary content retrieved from STB, each STX and ETX byte shall be preceded with an additional 0xff byte.

Regarding each regular 0xff byte inside binary content STB precedes those bytes with another 0xff byte as well.

Example:

Binary code sequence (4 byte): 0x01 0xa0 0xff 0x40

Will be changed by STB to (5 byte): 0x01 0xa0 0xff **0xff** 0x40

Note:

Regarding the BLUCOM GetCommand (4.2.9) the length attribute of the GetResponse command specifies always the length (number of bytes) of the original content excluding all expanded 0xff bytes.

According to the rule described above each 0xff can have only one of the following successor bytes:

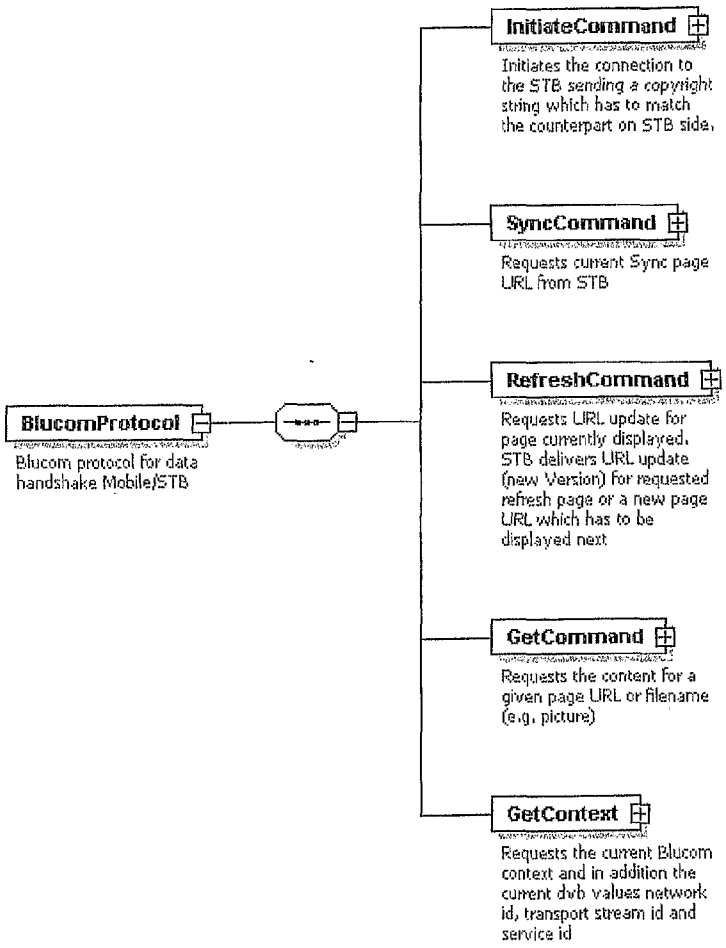
0x02, 0x03, 0xff

In case of a following 0xff, which might only occur when retrieving scrambled or binary content data, BL-Browser has to read over one 0xff byte.

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If BL-Browser detects none of the valid successors (0x02, 0x03, 0xff) when reading the next byte after 0xff, BL-Browser shall abort reading the current command and wait for a new 0xff0x02 (STX) combination. All collected data up to that point may be discarded.



The STB is able to store up to 10 requests therefore the BL-Browser may does not need to wait for the response to its first request before sending a second one.

4.2.2 RequestId Assignment

All BL requests and responses carry the parameter "requestId". The requestId is to be assigned by BL-Browser and allows a matching of requests and responses when communicating asynchronously.

The requestId shall contain the Bluetooth MAC-Address of the mobile device and a running number to make the id unique throughout a BLUCOM session:

RequestId := <Bluetooth MAC>-<RunningNumber>

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The RunningNumber must change with each request that is sent, even if a request is repeated. However, the incrementation of the RunningNumber does not necessarily need to be without gap.

4.2.3 Case Sensitivity

All attribute values including URL and content file names are case insensitive.

4.2.4 BLUCOM URL / File Name

The maximum length for all BLUCOM URL and content file names found in the all BLUCOM Commands is set to 256 bytes.

4.2.5 DATA_NOT_YET_AVAILABLE vs. DATA_NOT_AVAILABLE

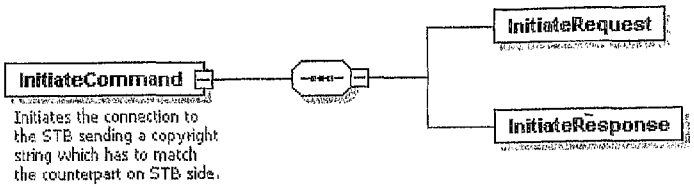
The BLUCOM protocol distinguishes two states of content unavailability.
DATA_NOT_AVAILABLE means the content requested is not available.
DATA_NOT_YET_AVAILABLE means the content requested is currently not available but it might be possible that it will be available soon.

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4.2.6 InitiateCommand



The Mobile Device sends an InitiateRequest, which shall be answered by STB using InitiateResponse. Input parameter is a copyright string, which is hard coded on both sides.

diagram	InitiateRequest					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	xs:string	required			Identifies current request/response
	cprString	xs:string	required			Copyright string, which shall be checked on STB side. The STB shall accept a connection solely if the mobile device has sent a correct string.

Example:

```
<InitiateRequest
   requestId="00-02-72-80-EC-FE-00001"
   cprString="Copyright by APS, ASTRA Platform Services GmbH"/>
```

diagram	InitiateResponse					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	xs:string	required			Identifies current request/response
	retCode	xs:string	required			"OK" Copyright string was valid "FAILED" something went wrong "REFUSED" Copyright string was invalid; connection was refused

Remark:
The Initiate Command shall be seen as a precondition for all further blucom commands. If STB is not able to answer an InitiateRequest with **retCode=OK** all following requests (except InitiateRequest) will be answered with **retCode=FAILED.**

Example:

```
<InitiateResponse
  requestId="00-02-72-80-EC-FE-00001" retCode="OK"/>
```


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4.2.7 SyncCommand

Objective of sending a SyncRequest is to synchronize the Mobile Device to the present SyncPage available on the STB.

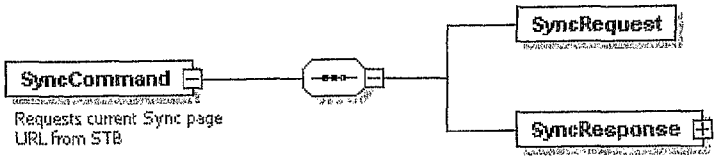


diagram	SyncRequest					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	context	**xs:string**	required			Context string; may be an empty string

Note: As long as no context is known, an empty string has to be sent.

Example:

```
<SyncRequest
  requestId="00-02-72-80-EC-FE-00002"
  context="0x00850001001B"/>
```

diagram	SyncResponse SyncPage					
children	**SyncPage**					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" BLUCOM service is not available on present channel "DATA_NOT_YET_AVAILABLE" Sync page not yet downloaded "DATA_NOT_AVAILABLE" Sync page not available
	context	**xs:string**	required			Context string
	refreshInterval	**xs:integer**	required			Refresh Interval in milliseconds

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diagram	SyncPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Present Sync Page URL
	version	**xs:integer**	required			Sync Page version

Remark:
SyncPage element is optional and may not be filled for **retCode** not equal **"OK"**

Example:

```
<SyncResponse
   requestId="00-02-72-80-EC-FE-00002"
   retCode="OK"
   context="0x00850001001B"
   refreshInterval="10000">
   <SyncPage name="/index.htm" version="1"/>
</SyncResponse>
```


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4.2.8 RefreshCommand

Objective of sending a RefreshRequest is to ask the STB for a new version of the page currently displayed. STB shall deliver a page URL to be displayed next. That could be either the current version of the requested page or a sync page, which has to be displayed next. In case that the display page is a sync page the BL-Browser shall store that URL (including version) as its present sync page.

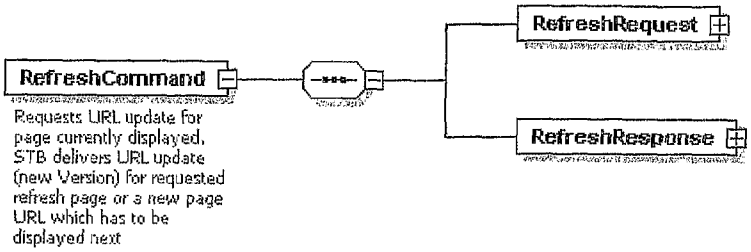


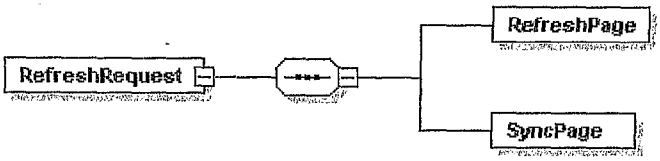
diagram						
children	**RefreshPage SyncPage**					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	context	**xs:string**	required			Context string

diagram	**RefreshPage** Page to be updated					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Page URL
	version	**xs:integer**	required			Page version

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diagram	SyncPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Present SyncPage URL
	version	**xs:integer**	required			SyncPage version

Example:

```
<RefreshRequest
   requestId="00-02-72-80-EC-FE-00003"
   context="0x00850001001B">
  <RefreshPage name="/link1.htm" version="1"/>
  <SyncPage name=" /index.htm " version="2"/>
</RefreshRequest>
```

diagram	RefreshResponse — DisplayPage					
children	**DisplayPage**					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" BLUCOM service is not available on present channel "DATA_NOT_AVAILABLE" Refresh or Sync page not available "DATA_NOT_YET_AVAILABLE" Refresh or Sync page not yet downloaded
	context	**xs:string**	required			Context string
	refreshInterval	**xs:integer**	required			Refresh interval in milliseconds

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diagram	DisplayPage					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	xs:string	required			DisplayPage URL
	version	xs:integer	required			DisplayPage version
	isSyncPage	xs:boolean	required			"1" if delivered Page is a SyncPage URL otherwise "0": In case of a sync page BL-Browser has to store that URL as it's present SyncPage

Remark:
DisplayPage element is optional and may not be filled for **retCode** not equal **"OK"**

Example:

```
<RefreshResponse
  requestId ="00-02-72-80-EC-FE-00003"
  retCode="OK"
  context="0x00850001001B"
  refreshInterval="10000">
    <DisplayPage
     name="/link1.htm" version="2" isSyncPage="0"/>
</RefreshResponse>
```


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4.2.9 GetCommand

Objective of sending a GetCommand is to ask the STB for the content of a certain page delivered by element FileUrl.

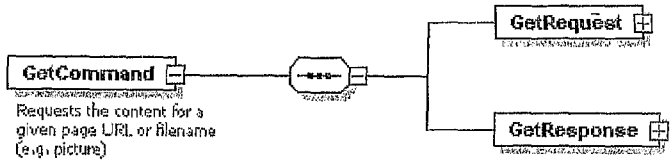


diagram	GetRequest — FileUrl					
children	FileUrl					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	context	**xs:string**	required			Context string

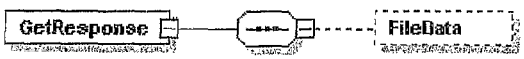
diagram	FileUrl					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Page URL or file name
	version	**xs:integer**	optional			Page URL or file name version

Remark:
The version attribute is optional. If it is omitted STB shall deliver the content for the current version available. Otherwise STB will send the content only if its current version is higher (newer) than the version delivered by the FileUrl element (see application flow).

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Example:

```
<GetRequest
  requestId="00-02-72-80-EC-FE-00004"
  context="0x00850001001B">
  <FileUrl name="/pic/pic1.png" version="1"/>
</GetRequest>
```

diagram						
children	**FileData**					
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current request/response
	retCode	**xs:string**	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" BLUCOM service is not available on present channel "WRONG_CONTEXT" Context has changed "DATA_NOT_YET_AVAILABLE" data for page URL not yet downloaded "DATA_NOT_AVAILABLE" no data available for page URL "DATA_UP_TO_DATE" data version compared with requested version is lower or equal
	context	**xs:string**	required			Context string
	refreshInterval	**xs:integer**	required			Refresh interval in milliseconds

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diagram	FileData					
attributes	Name	Type	Use	Default	Fixed	Annotation
	name	**xs:string**	required			Page URL or file name
	version	**xs:integer**	required			Page or file version
	length	**xs:integer**	required			Specifies the length (number of bytes) of the original byte block without any expanded 0xff byte according to 4.2.1.

Remarks:
FileData element is optional and may not be filled for Response **retCode** not equal **"OK"** or equal **"DATA_UP_TO_DATE"**

DATA_UP_TO_DATE is never returned if the optional version attribute in element FileUrl is omitted.

The data block is stored to the text node of the FileData element in the case **retCode = "OK"**. The first byte of the data block follows immediately the '>' sign closing the attribute list of the FileData element.

Note:
The length attribute specifies always the length (number of bytes) of the original content including preamble byte (3.3) but excluding all expanded 0xff bytes according to 4.2.1.

Example:

```
<GetResponse
   requestId ="00-02-72-80-EC-FE-00004"
   retCode="OK"
   context="0x00850001001B"
   refreshInterval="10000">
   <FileData
      name="/pic/pic1.png"
      version="1"
      length="1000">
      <!--data block according to attribute "length"-->
   </FileData>
</GetResponse>
```

4.2.10 GetContext

Objective of sending a GetContext command is to ask the STB for the current BLUCOM context. The additional purpose is to retrieve the DVB values for Service ID, Transport Stream ID and Original Network ID corresponding to the service where the STB is currently tuned on. The latter values will be sent back in any case independent from an existing BLUCOM service available on that service.

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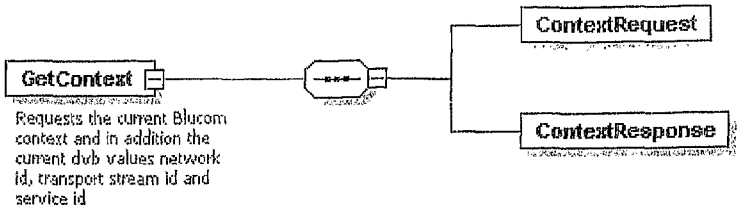


diagram	ContextRequest					
children						
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	**xs:string**	required			Identifies current *request/response*

Example:

```
<ContextRequest requestId="00-02-72-80-EC-FE-00005"/>
```


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diagram	ContentResponse					
children						
attributes	Name	Type	Use	Default	Fixed	Annotation
	requestId	xs:string	required			Identifies current request/response
	retCode	xs:string	required			"OK" "FAILED" something went wrong "SERVICE_NOT_AVAILABLE" BLUCOM service is not available on present channel
	onid	xs:string	required			Original Network ID, six byte string (Not relevant for BL-Browser)
	tsid	xs:string	required			Transport Stream ID, six byte string (Not relevant for BL-Browser)
	sid	xs:string	required			Service ID, six byte string (Not relevant for BL-Browser)
	visible	xs:boolean	required			"1" current service is visible "0" current service is not visible If STB is not tuned to any service "0" is returned (Not relevant for BL-Browser)
	context	xs:string	optional			Context string

Remark:
STB has to deliver the values for onid, tsid, sid and the visible flag in any case independent from an existing BLUCOM service on that channel. In case of a missing BLUCOM service (retCode = "SERVICE_NOT_AVAILABLE") the attribute context is omitted.
At the present time the DVB triplet onid, tsid, sid and the visible flag does not affect the BLUCOM functionality therefore the BL-Browser may ignore these values.

Example:

```
<ContextResponse
  requestId="00-02-72-80-EC-FE-00005"
  retCode="OK"
  onid="0x0085"
  tsid="0x0001"
  sid="001B"
  visible="1"
  context="0x00850001001B"/>
```

4.3 Content Provider Interaction

This section covers all browser functionality that directly interacts with the content provider, leaving the Bluetooth communication path.

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4.3.1 SMS

The content provider may use a dedicated link syntax (3.5.5) to code an SMS that is to be sent by BL-Browser when the link is activated.

4.3.1.1 SMS Transmission

Once the SMS link is interpreted and the message is prepared, BL-Browser sends it. The mobile device may popup a dialog to ask for the user's confirmation to send the SMS.

BL-Browser must wait until the device returns a status on either successful SMS transmission or transmission failure. While waiting for that status, BL-Browser shall not accept any user input but display the activity indicator instead (3.4.1.3). As the mobile device does necessarily implement a timeout for sending SMS, BL-Browser does not need to track the timeout itself.

Once the device returns an error, BL-Browser shall display an error message and stay on the current page.

4.3.1.2 SMS Follow-up Page

Once the device indicates successful SMS transmission, BL-Browser requests and displays the follow-up page, coded by the "target"-Attribute of the <a>-or <form>-Tag (3.5.5.1). If no target is specified, BL-Browser displays a message that the SMS was sent successfully and stays on the current page.

Example:

```
<form action="sms:+4918756273?Forum entry=$$fb$$"
      target="/forum/thanks.htm" forum>
    <div><textarea name="fb"/>Ihr Eintrag ins Forum </div>
    <div><input type="submit" value="Eintragen"/></div>
</form>
```

As soon as the form in the upper example is confirmed via "Eintragen", the URL in the action-Attribute is resolved to "sms:+4918756273?Forum entry=Ihr Eintrag ins Forum" (default value). The link indicates an SMS to be send to :+4918756273 with "Forum entry=Ihr Eintrag ins Forum" as message text. As soon as the SMS was sent successfully, the browser requests the page "/forum/thanks.htm" and displays it.

4.3.2 WAP

The content provider may use common link syntax (3.5.5) to indicate that a specific HTML page shall be retrieved via WAP, using the HTTP protocol. The provider will mainly use this feature to collect personalized user data from form input (3.5.7.5).

4.3.2.1 HTTP Request

Any URL send with a HTTP-Request has to be URL-encoded. [4].

In case of the HTTP-Link occurs as hyper reference in an <a>-Element, BL-Browser simply sends the URL part of the link as HTTP GET Request.

In case of the HTTP-Link occurs as action to complete a form, the content provider may choose either method "GET" or "POST" to send the data, indicated by the "method"-Attribute of the <form>-Element. If the method-Attribute is missing, POST shall be the default value.

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In case of method "GET", the action URL shall be extended with the from data (url encoded). In case of method "POST", the form data (if any) is transmitted in the body of the HTTP Request.

Example:

```
<form action="http://www.aps.tv/feedback.htm" method="GET">

    <div><input name="name" type="text" value="Me"/></div>
    <div><textarea name="feedback"/>Sehr Gut</div>
</form>
```

In the upper example, submission of the form would result in an URL to be called that is "http://www.aps.tv/feedback.htm?name=Me-&feeback=Sehr+gut" as long as the user did not change the form default values.

Attention:

In case the provider uses variables along with method "GET", BL-Browser should not apply form data itself to the URL. The provider is then responsible to do so. Consequently, the action-Link in the next example would be resolved to "http://www.aps.tv/feedback.htm?name=Me", omitting the feedback value.

```
<form action="http://www.aps.tv/feedback.htm?name=$$name$$"

method="GET">
    <div><input name="name" type="text" value="Me"/></div>
    <div><textarea name="feedback"/>Sehr Gut</div>
</form>
```

4.3.2.2 HTTP Response

The content provider has to assure that the content requested from outside the BL platform via HTTP is a HTML page that complies with the BL coding standard. All other data may be omitted by BL-Browser. The browser shall evaluate the MIME/Type of the HTTP-Response which must be "text/html".

The returned HTML-Page is never encrypted and furthermore does not carry any preamble byte (compare to 3.3).

4.3.2.3 WAP Communication

As soon as the user requests a HTTP-Link, BL-Browser shall open the default data channel (e.g. GPRS). The mobile device or the browser itself must ask the user's confirmation to open the channel.

While the data channel is open, BL-Browser or the mobile itself must indicate the connection visually. BL-Browser may close the connection as soon as the requested data was retrieved successfully or an error occurred.

As soon as the channel is open, BL-Browser sends the HTTP-Request. While waiting for the response, the browser shall neither react to any user input nor elapsing Refresh- or Lookup timers. The activity indicator is displayed meanwhile (3.4.1.3).

The HTTP Get Request can be handled similar to the native BL GetCommand (4.2.9), but with a longer timeout (.e.g. 10 Seconds) applied.

As soon as the HTTP Response is received, the HTML-page is extracted and the parser is activated to process the page (3.6.1). If an error occurs or the response times out, an error message is displayed (similar to "DATA_NOT_AVAILABLE").

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4.3.2.4 WAP Context

Any HTML Page that is retrieved via WAP does not belong to any context. Therefore, these pages are never added to the browser's history, even when indicated by processing instruction (3.2.4).

Furthermore, these pages are never refreshed, even when indicated by processing instruction (3.2.2.2). While a WAP-Page is displayed, the BL-Browser shall always send Sync Commands to the BL-Server when the Refresh Timer elapses.

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5 Future aspects

This chapter covers features that have already been discussed but do not need to be implemented in the prototype of BL-Browser. The functionality is mentioned here to encourage sensibility for the required features throughout the design of application core components.

5.1 Persistence

Persistence will be introduced to store pages including embedded images on the handheld device for offline reading.

The BL-Browser will support additional processing instructions (3.5.4) that allow the content provider to enable additional page commands (3.5.6) like "save" and "load", e.g. in scope of a newspaper's portal. The consumer may use this commands to handle locally stored BL-Content.

Instruction	Values	Default	Processing
`save`	`action|option`		determines how the indicated Page Command can be accessed via function keys (3.4.2.2) by the user
`load`	`action|option`		

Table 5.1-1 Processing instructions for persistence

Command	Processing
`save`	Stores the displayed page persistently
`load`	Recovers a persisting page

Table 5.1-2 Page Command for persistence

As persistence of BL-Content has an impact on the local file system respectively the available flash size and shall be implemented as soon as target devices support it.

5.2 Embedded Forms

In future versions, the BL-Browser shall implement form controls itself to support fully styled forms so no dedicated form mode is needed any longer.

The content provider may then embed form elements anywhere in HTML-content markup, given that syntactical rules of XHTML for forms are respected.

5.3 Localisation

In future, the application shall carry different localisations within a single version. The language is then either determined from the mobile device settings or selected by the user.

5.4 Version Control File

Not relevant for prototype of BL-Browser, but to be implemented in first release of the application:

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Once the BL-Browser has processed the authentication successfully, it has to acquire the content (4.2.9) for a file named "/BIVersion.xml". This file contains information, whether BL-Browser application version is up to date and in case of a version mismatch if an update is recommended or even required.

5.4.1 Syntax BIVersion.xml

BIVersion.xml is based on the XML file format.

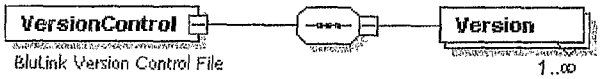


diagram	Version

attributes	Name	Type	Use	Default	Fixed
	number	**xs:integer**	required		Version number
	updCtrl	**xs:string**	required		There are two valid values: "UPD_RECOMMD" If BL-Browser version matches version specified by number an update is recommended "UPD_REQUIRED" If BL-Browser version matches version specified by number an update is required

BIVersion.xml holds a history of all BL-Browser Versions ever deployed. The list of version tags is in descending order. The BL-Browser application has to find the right version number matching its own one and then it has to evaluate the updCtrl parameter.

- UPD_RECOMMD
  User has to be informed that it is recommended to update the BL-Browser application. If User denies that offer BL-Browser shall continue. Otherwise user shall be advised to quit BL-Browser in order to start an application download.
- UPD_REQUIRED
  User has to be informed that it is required to update the BL-Browser application. If User denies that offer BL-Browser should quit.

Note: The full extent of the version control file is not yet fixed completely and must be discussed again.

5.5 Enhanced Usability

Enhanced usability is to be evaluated as soon as the prototype of BL-Browser is available:

5.5.1 Scrolling

The browser shall implement smooth scrolling for all pages

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5.5.2 Page Maintenance

While parsing a new HTML-page to be displayed, the currently displayed page shall be fully maintained so that the user is still able to interact with this page. The interaction includes navigation of the focus as well as scrolling and activating links of the page. The described interaction is also desired for silent activities like loading of missing resources or update of refreshed images.

When the user activates a link while a new page is prepared, the page in preparation is abandoned, already retrieved resources for this page may be purged and the activated link is executed instead.

5.5.3 Pre-emptive Content Maintenance

The browser shall send pre-emptiv GetRequests for all BL-Links in the currently displayed page. The retrieved pages are decrypted and processed in background in order to speed up the display of the page as soon as the user selects one of links.

The pre-emption could include maintenance of the first page in history.

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Claims

1. A method for transmitting data to a mobile data processing unit (200), the method comprising the following steps:

   a. receiving the data with a digital audio and / or television reception device (100), wherein the data are included in a transport stream of digital audio and / or television signals;

   b. extracting the data from the transport stream of digital audio and / or television signals; and

   c. sending electromagnetic signals by the digital audio and / or television reception device (100) to transmit the extracted data from the digital audio and / or television reception device (100) to the mobile data processing unit (200), **characterized in that**

   d. the extracted data are transmitted from the digital audio and / or television reception device (100) to the mobile data processing unit (200) in response to periodical requests from the mobile data processing unit (200) to the digital audio and / or television reception device (100).

2. Method according to claim 1, wherein the periodical requests from the mobile data processing unit serve to synchronize a least a part of the data in the mobile data processing unit (200) with a set of new data stored in the digital audio and / or television reception device (100).

3. Method according to claim 2, wherein the periodic requests are executed automatically.

4. Method according to claims 2 or 3, wherein the refresh interval between the periodical requests can be changed.

5. Method according to claim 4, wherein the value for the refresh interval is transmitted from the digital audio and / or television reception device (100) to the mobile data processing unit (200), preferably together with the new data for synchronization.

6. Method according to any of the preceding claims, wherein the mobile data processing unit (200) can in response to a user input asynchronously issue manual requests for data to be transmitted from the digital audio and / or television reception device (100).

7. The method of any of the preceding claims, wherein the content of the transport stream of digital audio and / or television signals and the content of the included data are related.

8. Method according to claim 7, wherein the transport stream comprises digital audio and / or television signals for a plurality of channels and wherein the data extracted from the transport stream and transmitted to the mobile data processing unit (200) depend on the channel to which the digital audio and / or television reception device (100) is tuned.

9. The method of claim 8 wherein the extracted data for a first channel to which the digital audio and / or television reception device (100) is tuned are stored in a memory of the digital audio and / or television reception device (100).

10. The method of claim 9, wherein the data stored in the memory are purged, in case of a change from the first channel to a second channel, unless the ex-

tracted data for the first channel to be transmitted to the mobile data processing unit (200) are the same as for the second channel.

11. The method of claim 9, wherein the data stored in the memory are maintained in case of a change from the first channel to a second channel.

12. A method of transmitting data to a mobile data processing unit (200), comprising the following steps:

a. including the data to be transmitted into a transport stream of digital audio and / or television signals to be broadcasted;

b. broadcasting the transport stream of digital audio and / or television signals with the included data in a digital format adapted for a digital audio and / or television reception device (100) to receive the digital audio and / or television signals, to extract the included data and to transmit them to the mobile data processing unit (200), **characterized in that**

c. the included data are adapted to be transmitted in response to periodical requests from the mobile data processing unit (200) to the digital audio and / or television reception device (100).

13. Method according to claim 12, wherein the included data cause a change of the refresh interval between the periodical requests of the mobile data processing unit (200).

14. The method of claim 12 or 13, wherein the method steps a. and / or b. are performed in response to a provider of the data receiving a signal from the

digital audio and / or television reception device (100) and / or the mobile data processing unit (200).

15. A method according to any of the claims 1 – 14, wherein the refresh interval has a length t of $1s \leq t \leq 10s$.

16. A digital audio and / or television reception device (100) comprising:

a. a first reception unit (5) receiving a transport stream of digital audio and / or television signals for display on a television and/ or radio system (102), the transport stream of digital audio and / or television signals including additional data;

b. an extraction unit (6) extracting the additional data from the transport stream of digital signals;

c. a transmission unit (4) transmitting the extracted additional data to an external mobile data processing unit (200), **characterized in that** the digital audio and / or television reception device further comprises:

d. a second receiving unit adapted to receive periodic requests from the mobile data processing unit (200) to initiate the transmission of the extracted additional data.

17. Digital audio and / or television reception device (100) according to claim 16, further comprising a memory adapted to synchronize the data in the mobile data processing unit (200) with new data in response to the periodical requests from the mobile data processing unit (200).

18. Digital audio and / or television reception device (100) according to claim 17, further adapted to change the refresh interval between the periodical re-

quests, preferably together with transmitting the new data for synchronization.

19. Digital audio and / or television reception device (100) according to any of the claims 16 - 18, wherein the transport stream comprises digital audio and / or television signals for a plurality of channels and wherein the extracted data which are to be transmitted to the mobile data processing unit (200) for a first channel to which the digital audio and / or television reception device (100) is tuned, are stored in a memory of the digital audio and / or television reception device (100).

20. Digital audio and / or television reception device (100) according to claim 19, further adapted to purge the data stored in the memory, in case of a change from the first channel to a second channel, unless the extracted data for the first channel to be transmitted to the mobile data processing unit (200) are the same as for the second channel.

21. Digital audio and / or television reception device (100) according to claim 19, further adapted to maintain the data stored in the memory, in case of a change from the first channel to a second channel.

22. A mobile data processing unit (200) comprising:

a. a first transceiver unit (15) for communication with a mobile telephone network;

b. a second transceiver unit (9) for communicating with a digital audio and / or television reception device (100);

c. control means with instructions for the second transceiver (9) to periodically transmit a request to the digital audio and / or television reception device (100), which initiates the transmission of additional data, which are received by the digital audio and / or television reception device (100) together with digital audio and / or television signals, to the second transceiver (9) of the mobile data processing unit (200).

23. Mobile data processing unit (200) according to claim 22, wherein the periodical requests from the mobile data processing unit serve to synchronize the data in the mobile data processing unit with new data stored in the digital audio and / or television reception device (100).

24. Mobile data processing unit (200) according to claim 23, further adapted to receive a value for the refresh interval between subsequent periodical request, preferably transmitted from the digital audio and / or television reception device (100) as part of the synchronization data.

25. Mobile data processing unit (200) according to claim 23 or 24, wherein the control means comprises instructions to asynchronously issue additional requests for further data in response to a user input.

26. Mobile data processing unit (200) according to claim any of the claims 22 - 25, wherein the control means further comprise instructions for the first transceiver unit (15) to transmit a request for the additional data to a provider of the digital audio and / or television signals.