

Cygnus System

Set Top Box Functional Specification

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Introduction

Overview This document describes the operational specifications for the National Semiconductor Cygnus Set Top Box (STB) running Century Software's Web Media software tool suite.

The Web Media software suite consists of a number of software components designed for use on a multimedia hardware platform. For the Cygnus STB, this software suite includes:

- Linux 2.4.0 Kernel
- Assorted device driver support for Linux 2.4.0
- Video for Linux Two API
- Century Software's Microwindows Graphical Environment
- Century Software's port of the Fast-Light Toolkit, FLNX
- Century Software's ViewML web browser and viewer
- National Semiconductor's Geode device driver
- National Semiconductor's Audio Subsystem device driver
- National Semiconductor's Middleware API's

Web Media Development Platform The Web Media software development tools are installed on a standard Intel-based desktop computer, which is used to develop and compile software for the target Cygnus STB. The desktop computer should be running the Red Hat Linux distribution version 6.2 or later, with the full software development environment installed. As software applications, drivers, or utilities are developed, they are copied over to the STB using the network (ftp) or via a floppy disk.

HTML Editing Tools The menus and displays are created using a version of the Hypertext Markup Language (HTML) that is compatible with the ViewML browser. This is roughly equivalent to (but not exactly compliant with) HTML 3.2. Any text editor or HTML editing tool may be used to create and modify these displays.

In addition to the text found on the menus and displays, images may be used to enhance the user interface look and feel. Because the menus and displays are based on HTML, the image formats used must also be compatible. Image editing tools must be able to create and output images in the GIF, JPG, or PNG formats.

Device Drivers & API's The Web Media software suite relies on the underlying framebuffer device drivers to manage the configuration of the hardware for NTSC, PAL, SECAM, and other video formats. It also relies on a variety of middleware API's, device drivers, and associated software modules for controlling, accessing, modifying, and configuring the various hardware subsystems. These hardware subsystems include

the DVD player, MPEG2 Decoder, video scaler and chromakeyer, television tuner, audio codecs, infrared remote control devices, and related subsystems.

National Semiconductor will supply the framebuffer drivers, NTSC/PAL/SECAM configurations, as well as any other device drivers, middleware libraries, API libraries, and any other required software modules necessary for manipulating the STB and it's hardware subsystems.

Normal Display

Overview During normal operation, no menu or other information is generated by the STB; only a full-screen rendition of the video coming from the currently selected video source is displayed.

There are two areas set aside for displaying information in the normal display mode. The first is the closed-caption area; the second is used for displaying prompts to the user when changing video sources or tuner channels. These areas are shown in Figure 1:



Figure 1 - Normal Display

On-Screen Mode & Channel Display When the user selects a video source or changes channel from the handheld remote or wireless keyboard, a black “mode” area is displayed on top of the existing video in the upper-right hand area of the display. If the user has selected a different video source, the mode area will display the name of the new video source for a short duration and then disappear. Likewise, if the user is changing channels (either by using channel-up or channel-down buttons or entering the channel numbers), the mode area will display the user’s selection as entered.

Closed Caption Display If closed-caption operation is selected, a black area will be displayed at the bottom of the display and the closed-caption text will be displayed inside. The size of the text, as well as the size and position of the black area may change based on the number of letters/words needing to be displayed.

The mode and closed-caption areas will be displayed inside “TV Safe Title”, which is an area 10% in from the borders of the television signal. This guarantees that the text can be viewed on any television receiver.

Closed-captioning is disabled when the STB menu is displayed, or anytime the display is not in the default “normal” position.

Home Menu

Overview During normal operation, no menu or other information is generated by the STB; only a full-screen rendition of the video coming from the currently selected video source is displayed.

When the user wishes to make changes or menu selections on the STB, they must first display the “home” menu. To do this, the user must depress the MENU button on the handheld remote or depress the MENU key on the wireless keyboard. When this is accomplished, the STB will display the home menu, as shown in Figure 2:



Figure 2 - Home Menu Display

Home Menu Areas The Home Menu is made up of four primary areas: the menu buttons along the left side of the display; a scaled video image of the currently selected video source; a source control area below the scaled video image; and a zone area that can display brief information on a variety of topics.

Depending on which video source is currently selected, the source control area will display the associated label and control set.

| | |
|----------------------------------|---|
| Navigating the Home Menu | <p>There are a number of ways to navigate the Home Menu. By using the up/down/left/right arrow keys located on either the handheld remote or the wireless keyboard, the user may move the highlight (the red border surrounding the Source button in Figure 2) around the screen to any active button or control. Once the highlight is on the desired button, the user can depress OK on the handheld remote or the Enter key on the wireless keyboard to active their choice.</p> <p>In addition to moving the highlight around the menu, the user may also make video selections, display the web browser, or make other choices by depressing the associated key on the handheld remote or wireless keyboard. See the section on Remote Shortcuts for more information.</p> |
| Selecting Video Sources | <p>To select a video source, move the highlight to the Source button and then depress OK repeatedly until the desired video source label is displayed in the control area. The current video available on the selected video source will be displayed in the scaled video window, and any associated controls will be displayed in the control area.</p> |
| Selecting the Web Browser | <p>To select the web browser, move the highlight to the Web button and then depress OK. The Home Menu will be replaced with the web browser.</p> |
| Program Guide Button | <p>The “pgm guide” button is non-functional, and is included as a placeholder that suggests that the STB could display on-screen program listings, play times, descriptions, and other information that might be found in a STB program guide.</p> <p>The methods, display, database formats, and delivery technologies for the program guide are TBD.</p> |
| Email Button | <p>The “email” button is non-functional, and is included as a placeholder that suggests the STB could be used to send and receive email. The email client might include a setup screen, lists of messages received, lists of messages sent, email address manager, and other information that might be found in an email program.</p> <p>The methods, display, database formats, and send/receive technologies for email are TBD.</p> |
| Shopping Button | <p>The “shopping” button is non-functional, and is included as a placeholder that suggests the STB could be used to shop electronically at home. The shopping client might include lists of product categories, lists of products, text descriptions, photos, ordering screens, and other information that might be found in a shopping program.</p> <p>The methods, display, database formats, shopping security, encryption, database formats, and send/receive technologies for the shopping client are TBD.</p> |

For the first version of the STB, only the Tuner, DVD, Video, and S-Video sources are available.

The Web Media, Century Software, and National Semiconductor logos are only included in the STB reference system; these will be removed and/or replaced by the customer for their custom design requirements.

Web Browser

Overview When the user selects the web browser, the Home Menu is replaced with the browser display, as shown in Figure 3:



Figure 3 - Web Browser Display

Home Page When the web browser is displayed, it will default to a customer-specified home page. This page is displayed initially, and anytime the user selects the HOME button on the handheld remote or the HOME key on the wireless keyboard.

Navigating the Web Browser There are a number of ways to navigate the Web Browser. By using the up/down/left/right arrow keys located on either the handheld remote or the wireless keyboard, the user may move the highlight (the red border surrounding the “Colin Powell to visit Middle East” text in Figure 3) around the screen to any active button or hyperlink. Once the highlight is on the desired button or link, the user can depress OK on the handheld remote or the Enter key on the wireless keyboard to select their choice.

Scrolling the Web Browser Most websites on the Internet contain web pages that are too wide or too tall to fit within a standard television screen. When this is the case, the user must scroll the display up/down/left/right to see the entire display.

The methods used to scroll the web browser are **TBD**.

**Entering a
Web Page
URL**

In many cases, the user will want to display a web page from a specific website, rather than selecting a link from the existing web page. In this case, it will be necessary for the user to enter a web page location (URL) from the wireless keyboard.

The methods used to enter a web URL from the wireless keyboard are **TBD**.

**Entering
Form Data**

In many cases, web pages found on the Internet contain forms or text areas that need to be filled out. This is especially true when using a web browser to purchase products from E-commerce enabled websites. In these cases, it will be necessary for the user to enter this text from the wireless keyboard.

The methods used to enter form data from the wireless keyboard are **TBD**.

**Web
Browser
Security**

Most web browsers support the use of Secure Socket Layer (SSL) security and encryption for safeguarding sensitive data being sent between the web browser and web server. This sensitive data includes credit-card numbers, social security numbers, banking account numbers, passwords, and so on.

SSL encryption in the web browser is not included in this release, but can be added at a later time.

The handheld remote can not be used to enter web page URL's (text).

The handheld remote can not be used to enter form data (text).

Overview When the user selects the Tuner video source from the Home Menu, the Tuner label appears in the source control area along with channel up and down buttons and the current tuner channel; tuner video will appear in the scaled video window as shown in shown in Figure 4:



Figure 4 - Home Menu with Tuner Selected

Changing Channels To change the tuner channel, the user must highlight either the channel up or channel down buttons. Once one of these is highlighted, repeatedly depressing the OK button on the handheld remote or the ENTER key on the wireless keyboard will increase or decrease the channel with each keypress.

As the channel is changed, the current tuner channel is displayed in the source control area as shown above.

Channel Wrap When the tuner channel is set to '2' and the user selects "channel down", the tuner channel will wrap around to the top-most channel. When the tuner channel is set to the top-most channel and the user selects "channel up", the tuner will wrap around to channel 2.

Overview When the user selects the Video video source from the Home Menu, the Video label appears in the source control area; video feeding the composite video input connector on the rear of the Cygnus STB will appear in the scaled video window as shown in shown in Figure 5:



Figure 5- Home Menu with Video Selected

There are no controls required for the Video source. Nothing will appear in the source control area.

Overview When the user selects the S-Video video source from the Home Menu, the S-Video label appears in the source control area; video feeding the Y/C video input connector on the rear of the Cygnus STB will appear in the scaled video window as shown in shown in Figure 6:



Figure 6 - Home Menu with S-Video Selected

There are no controls required for the S-Video source. Nothing will appear in the source control area.

DVD Player

Overview When the user selects the DVD Player video source from the Home Menu, the DVD label appears in the source control area along with rewind, stop, pause, play, and fast-forward buttons. The scaled video window will show the output from the DVD. Above the row of controls is a single line that will either display the title of the DVD found in the drive or an indicator that there is no disc. There is room below the controls for another line for additional text information. The DVD selection is shown in Figure 7:



Figure 7 - Home Menu with DVD Selected

Program AutoPlay When a DVD disc is placed in the DVD drive and the tray is closed, the DVD will load and immediately begin playing. No user interaction is required to start the program.

Eject There is no button to eject the DVD disc, so after the DVD is stopped, the user must depress the eject button on the front panel of the STB. If the user depresses the eject button before the DVD is stopped, the operation and logic is TBD.

Stop When the user selects Stop, the DVD will stop playing and the video will blank (black). Selecting Stop automatically resets the program logic; a subsequent Play operation will start the program at the beginning.

| | |
|---------------------|---|
| Pause | When the user selects Pause, the DVD program will freeze where it is. The current frame of the program will be displayed until subsequent user selections. |
| Play | When the user selects Play, the program will begin playing(at regular forward speed) from the beginning, unless the last user operation was Pause, in which case the program will begin playing where it was last paused. DVD audio is only available when Play has been selected. |
| Rewind | When the user selects Rewind, the program runs in the reverse direction at a rate of approximately 10X normal speed. Audio output is disabled when the user has selected Rewind. If the DVD is allowed to Rewind to the beginning, an automatic Stop operation is executed. |
| Fast Forward | When the user selects Fast Forward, the program runs in the forward direction at a rate of approximately 10X normal speed. Audio output is disabled when the user has selected Fast Forward. If the DVD is allowed to Fast Forward to the end, an automatic Stop operation is executed. |

This version of the STB suite does not support forward or reverse searching of the DVD by chapter.

This version of the STB suite does not support DVD menus, extra features, scripting, alternate language selection, or interactivity.

This version of the STB suite does not support the detection or enforcement of international DVD “playzones”.

This version of the STB suite does not support the detection or enforcement of any media copy protection (i.e. MacroVision, digital watermarking, etc.).

This version of the STB does not support the text information line below the DVD controls, and will be blanked.

Overview The “Zones” area on the Home Menu is designed to display informational bulletins to the user. These bulletins can include financial, health, or entertainment information, and many other kinds of topics. In addition to traditional “newswire” stories, this area can also be used to display information about the user’s account, spending limits, and other types of data.

Subscription Services Some customers may prefer to provide this information as a no-cost feature; it is also possible to allow users to subscribe to timely information such as real-time stock quotes or late-breaking news using the Zones area as a display.

The methods and technologies for delivering this information to the STB is **TBD**.

This version of the STB will include a number of static topics that will rotate through the display automatically. This is designed as a demonstration of how this technology might be used.

Remote Shortcuts

The following table shows the shortcuts supported for the handheld remote and wireless keyboard.

| Operation | Handheld Remote | Wireless Keyboard |
|------------------------------------|---|---|
| Video Source Selection | | |
| Display Tuner video source | Depress TV button | Repeatedly depress input key until tuner video is displayed |
| Display DVD video source | Depress DVD button | Repeatedly depress input key until DVD video is displayed |
| Display Video video source | Depress VCR button | Repeatedly depress input key until Video video is displayed |
| Display S-Video video source | Depress SAT/CABLE button | Repeatedly depress input key until S-Video video is displayed |
| Display web browser | Depress TV/NET button | Depress TV/NET key |
| Display STB Home Menu | Depress menu button | Depress menu key |
| Menu and Browser Navigation | | |
| Move highlight left | Depress left navigation button | Depress left arrow key |
| Move highlight right | Depress right navigation button | Depress right arrow key |
| Move highlight up | Depress up navigation button | Depress up arrow key |
| Move highlight down | Depress down navigation button | Depress down arrow key |
| Click/Select highlight | Depress OK navigation button | Depress enter key |
| Scroll web page down | Depress page dn button | Depress page down key |
| Scroll web page up | Depress page up button | Depress page up key |
| Show web browser home page | Depress home button | Depress home key |
| Show previous web page | Depress back button | Depress back key |
| Channel Selection | | |
| Tuner channel down | Depress CH- button | Depress CH- key |
| Tuner channel up | Depress CH+ button | Depress CH+ key |
| Enter channel | Enter channel using numeric buttons, followed by OK button. | Enter channel number using numeric keys, followed by Enter key. |
| DVD Operation | | |
| Stop | Depress stop button | Depress stop key |
| Play | Depress play button | Depress play key |
| Pause | Depress pause button | Depress pause key |
| Fast Reverse | Depress reverse button | Depress rew key |
| Fast Forward | Depress forward button | Depress ff key |

Reference Documents

The following documents are included here for reference only, and are not a part of the functional specification.

Geode SC1210 Advanced Multimedia Device on a Chip
National Semiconductor – Draft

REALmagic EM8400 DVD/MPEG-2 Audio/Video Decoder Databook
Sigma Designs – Version 1.0a

Guide to the Use of the ATSC Digital Television Standard
Advanced Television Systems Committee – Doc. A/54, 04 Oct 95

Video Middleware API Specification Programmers Reference
National Semiconductor – Version 1.0

Graphics Adaptation Layer (GAL) Document
National Semiconductor – (no version)

NSC Linux API Implementation Specification (DVB Subsystem)
National Semiconductor – Version .66

NSC Linux API Middleware Implementation Specification (DVD/MPEG2 subsystem)
National Semiconductor – Version .01

Linux Kernel DVB Demux Driver Specification
National Semiconductor – Version 0.1

Linux DVB API
Convergence Integrated Media – 26 October 2000