PhonexChange™ 3.6 FAQ

110X_111X_119X-FAQ104-R

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REVISION HISTORY

Revision	*Date*	*Change Description*

110X_111X_119X-FAQ104-R	10/15/08	**Updated:**
		• Section 1: “Introduction”
		• Section 2: Frequently Asked Questions:
		  • Ethernet, “Using the Switch as a Router” on page 32
		  • File System, “Supported Devices” on page 36
		  • Peripherals, “Watchdog Timer” on page 53
		• Appendix A, “Glossary and Acronyms”, on page 91

110X_111X_119X-FAQ103-R	06/10/08	**Updated:** • Version information throughout the document • “References” on page 1 • “BCM1101 Family” on page 3 • “BCM1190 Family” on page 5 • “Broadcom Customer Support Portal Product Cases” on page 6 • “Build Environment” on page 9 • “Endpoint” on page 14 • “Ethernet” on page 30 • “File System” on page 36 • “H.323 Call Control” on page 38 • “Peripherals” on page 47 • “Protocol” on page 64 • “Enabling IGMP” on page 65 • “Tools” on page 70 • “Security” on page 82 • “SIP Call Control” on page 84 • “Broadcom Profiling Tools” on page 80 • “DNS SRV Queries” on page 85

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Revision	*Date*	*Change Description*
110X_111X_119X-FAQ102-R	10/18/07	**Updated:** • "Building a Newly Added Library (Folder)" on page 10 • "Controlling Behavior of Adaptive Jitter Buffer" on page 13 • "Adaptive Jitter Buffer Statistics" on page 14 • "Increasing the Size of NOR Flash" on page 38 Added: • "SRTP" on page 21
110X_111X_119X-FAQ101-R	4/11/07	**Added:** • "Platform CD 3.3 Installation" on page 10 • "JTAG Tool Cannot Communicate With Device" on page 72 Updated: • "Cover Title" on page i • PhonexChange version from 3.3 to 3.4 • "References" on page 1 • "Build Aborted for No Apparent Reason" on page 10 • "Creating a New Platform Profile Procedure" on page 10 • "Building a Newly Added Library (Folder)" on page 12 • "Wind River PCD3.3 Compatibility" on page 13 • "Supporting Port Mirroring" on page 33 • "Adding NOR Memory Device Types" on page 36 • "Convert a Platform from NAND flash to NOR flash" on page 37 • "Modifying RAM Memory Mapping" on page 38 • "Modifying Flash Memory Mapping" on page 38 • "Changing Flash Size" on page 39 • "Changing SDRAM Size" on page 42 • "Using Different Flash and SDRAM Chips" on page 42 • "Network Cluster Pool" on page 43 • "Adding Serial Ports" on page 46 • "Testing the USB" on page 56 • "LCD Attributes" on page 57 • "Keyboard Mapping" on page 58 • "External LEDs" on page 60
110X_111X_119X-FAQ101-R (continued)	4/11/07	• "Enabling IGMP" on page 63 • "udpSend Errors" on page 63 • "Soft Resets" on page 67 • "PhonexChange 2.x Boot Image" on page 68 • "Using the Workbench Debugger Through the Network Interface" on page 74

Revision	*Date*	*Change Description*
110X_111X_119X-FAQ104-R	10/15/08	• "Using the Workbench Debugger Through the Serial Interface" on page 75"Wind River System Viewer Application Support" on page 78 (formerly Windview Application Support) • "802.1x in PhonexChange" on page 80 • "OpenSSL Source Files" on page 81 • "SDP Formation" on page 82 • "SIP and IP Destination Addresses" on page 84 • "Registration" on page 85 • "Setting WAN IP Address" on page 85 • "Unsubscribing" on page 86 • "Vocoder Negotiation" on page 87 **Removed:** • "Reference Design Summary" on page 8 • "Build Environment" on page 13 • "Inability to Link to PhonexChange Build Environment using PCD2.0" on page 14 • "Building PhonexChange Using Toronado IDE" on page 19 • Failed Booting of Chip on page 91
110X_111X_119X-FAQ100-R	09/12/06	Initial release

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Section 1: Introduction

This document provides answers to many of the questions frequently asked regarding the use of PhonexChange™ software.

This document applies to PhonexChange 3.6.

The following phone platforms are supported:

- BCM91101 (Version 2)
- BCM91103
- BCM91103MP
- BCM91103SP
- BCM91104
- BCM91104MP
- BCM91104SP
- BCM91190LB

REFERENCES

- *PhonexChange* Software Development Guide
- *Resources for DHCP*, Droms, R. Nov. 22, 2003. May 27, 2005 http://www.dhcp.org
- *DHCP FAQ,* Droms, R. and T. Lemon. Oct. 26, 1998. May 27, 2005 http://www.dhcp-handbook.com/dhcp_faq.html
- *BCM1103 Gigabit IP Phone Chip* Data Sheet
- *BCM1100/BCM1101/BCM113(R) Ethernet IP Phone Chips* Data Sheet
- *BCM1190 VoIP Phone Chip* Data Sheet
- *PhonexChange VxWorks Board Support Package*
- *VxWorks® Application* Programmer's Guide 6.6
- *VxWorks Kernel* Programmer's Guide 6.6
- *Wind River® Network Stack for VxWorks 6* Programmer's Guide 6.6
- *VxWorks BSP Developer's Guide 6.6*
- *PhonexChange Endpoint Module* Technical Reference Manual
- *PhonexChange Ethernet Driver* Technical Reference Manual
- *PhonexChange™ 802.1X Broadcom Supplicant Wrapper (BSW)*
- *Broadcom Call Control SIP Protocol Abstraction Layer 1.10*
- *PhonexChange Porting Guide*

Section 2: Frequently Asked Questions

The information in this section is structured as follows:

- Heading - Describes topic category.
- The question and answer use the following Q and A format

Q: Describes the question.

A: Presents the answer.

APPTEST

KEY FEATURES

Q: What key features are available in the ippConsole of the apptest application?

A: Table 1 lists some of the more frequently used commands/features of the ippConsole.

Table 1: List of ippConsole Commands

Command	*Description*
?	List commands
help	List commands
chip	Prints chip information
ver	Prints the IPP version
reset	Resets board
cv	Call and Voice menu

COMMANDS AND CALL CONNECTIONS

Q: How can I use apptest console commands to make a call connection, modify gains, play a tone, etc.?

A: Refer to "Section 5: Test Call Client Application - Running the Test Call Client" in the PhonexChange Reference Design Development Platform document.

BCM1101 FAMILY

BCM1101 FAMILY FEATURE DIFFERENCES

The following table summarizes the differences in the BCM110X/BCM111X silicon family.

Table 2: Feature Differences in the BCM110X/BCM111X Silicon Family

BCM1101	***BCM1113***	***BCM1115***
150 MHz RISC	100 MHz RISC	150 MHz RISC
108 MHz DSP	108 MHz DSP	108 MHz DSP
3 (APM) CODECS	3 (APM) CODECS	2 (APM) CODECS
2 Ethernet ports	2 Ethernet ports	1 Ethernet port
1 Ethernet switch	1 Ethernet switch	No Ethernet switch
BCM1113R	***BCM1115R***	
87 MHz RISC	87 MHz RISC	
87 MHz DSP	87 MHz DSP	
3 (APM) CODECS	2 (APM) CODECS	
2 Ethernet ports	1 Ethernet port	
1 Ethernet switch	No Ethernet switch	

BDSL FILE FOR THE BCM1113 AND BCM1115

Q: Where can I locate the BSDL file for the BCM1113 and BCM1115?

A: The BCM1101 BSDL file is applicable to the BCM1113 and BCM1115 products, and is available in docSAFE on Broadcom's Customer Support Portal (CSP).

BCM1103 FAMILY

BCM1103 FAMILY FEATURE DIFFERENCES

The features listed in Table 3 summarize the differences between products in the BCM1103 silicon family.

Table 3: Feature Differences in the BCM1103 Silicon Family

BCM1103	*BCM1104*
275 MHz RISC	275 MHz RISC
125 MHz MHz DSP	*NO DSP*
2 (APM) CODECS	2 (APM) CODECS
2 10/100 Ethernet PHYs	2 10/100 Ethernet PHYs
1 Gigabit Ethernet switch	1 Gigabit Ethernet switch

BDSL FILES FOR THE BCM91104XX PLATFORMS

Q: Where can I locate the BSDL files for the BCM91104xx platforms?

A: The BCM1103 BSDL file is applicable to the BCM1104 device and is available in docSAFE Broadcom's Customer Support Portal (CSP).

BCM1103/1104 MIPS CORE

Q: What MIPS® core is used in the BCM1103/1104?

A: The BCM1103 and BCM1104 use the MIPS32® 4KC core with Broadcom DSP instruction extensions.

BCM1190 FAMILY

BCM1190 FAMILY FEATURES

Features of the BCM1190 silicon family include:

- 275 MHz RISC
- NO DSP
- 1 (APM) CODECS
- 2 10/100 Ethernet PHYs
- Software Switch on MIPS core

BCM1190 MIPS CORE

Q: What MIPS® core is used in the BCM1190?

A: The BCM1190 use the MIPS32® 4KC core with Broadcom DSP instruction extensions.: the same MIPS core as on the BCM1103 and BCM1104 devices.

BROADCOM CUSTOMER SUPPORT PORTAL PRODUCT CASES

Broadcom's Customer Support Portal (CSP) product cases are presented in this section.

PRODUCT CASE NOTIFICATION

Q: How do I notify my colleagues about a problem submitted to Product Cases?

A: Include your colleagues' e-mail addresses in the Requester CC list field. The field is located under the Additional Info tab of any case. When using this feature, an e-mail is sent to each e-mail address included in the list.

DOWNLOADING CASES

Q: Is there a method to download all the cases to a local drive in case an Internet connection is lost?

A: Presently, no download utility is available. However, the Query link can be used to build a query and specify Excel as the output format. The query can then be issued at any time, and the output can be saved to an Excel spreadsheet. The Query link is found under the Product Cases tab alongside the Submit Case, My Cases links.

SENDING QUESTIONS TO SUPPORT ENGINEERS

Q: How do I send information, questions or discussions to support engineers in addition to the original question?

A: Use the Requester Notes field under the General tab in the product case. When the field is updated, an e-mail is sent to recipients involved in this case: requester, assignee, and individuals on the Requester CC list.

Q: What kind of information should be included in the original question?

A: In addition to the Project, Product, and Item fields, complete the following fields:

- **Software Version:** The version number (e.g., PhonexChange 3.2.1.0) can be read from the \phonex\build\config\release.h file.
- **Chip Revision:** (e.g., BCM1103KPB) Provide the chip number marked on the chip.
- Make sure to provide the following information in your original Case Description.
  - **Reproducible:** If you are reporting a bug, please let us know if the bug occurs intermittently, once, randomly or is easily reproducible. If it is easily reproducible, provide the steps to reproduce the issue.
  - **Triggering API Function:** If PhonexChange API function that triggers the error is known, let us know.

If the question is related to an existing CSP case, link the case number to the question through the Related tab. The Related tab accessible in the Modify mode.

Q: In addition to the Case Description, should logs be provided? If so, what kind of logs should be sent?

A: Provide the debug printout from the serial port for all questions. In addition, it is recommended that the following logs be provided for each type of issue listed below.

Flash Related Issues (e.g., problems writing and/or erasing certain sectors in the flash) The recommended log is the serial port printout with the following extra setup:

- At compile time, make sure CFI_DEBUG is defined in \phonex\bsp\vxWorks\common\bcm911xx\cfiamd.c.
- At runtime, query the problematic flash sector by entering the "d" command in the VxWorks Console. Below is a screenshot of the command.

```
-> d 0x800f0000
800f0000: 27b5 0010 3c04 8022 2484 43a9 0016 2840 *'...<.."$.C...(@*
800f0010: 3c06 8022 0c03 68a0 24c6 43ae 0016 2840 *<.."..h.$.C...(@*
800f0020: 02a0 2025 0c04 49a9 2406 0020 8eee 0004 *.. %..I.$.. ....*
800f0030: 27de 0001 31ce 000f 01d6 001a 0000 0812 *'...1...........*
800f0040: 16c0 0002 0020 7021 0007 000d 2401 ffff *..... p!....$...*
800f0050: 16c1 0004 3c01 8000 15c1 0002 0000 0000 *....<...........*
800f0060: 0006 000d 03ce 082a 1420 ffe6 02b6 a821 *.......*. .....!*
800f0070: 1000 0066 0000 0000 0000 0000 0316 001a *...f............*
800f0080: 0000 0812 16c0 0002 0020 c021 0007 000d *......... .!....*
800f0090: 2401 ffff 16c1 0004 3c01 8000 1701 0002 *$.......<.......*
800f00a0: 0000 0000 0006 000d 171e 000c 2694 ffff *............&...*
800f00b0: 3c04 8022 2484 43b0 27a5 0010 3c06 8022 *<.."$.C.'...<.."*
800f00c0: 0c03 68a0 8cc6 30f4 27a4 0010 2405 0010 *..h...0.'...$...*
800f00d0: 0c04 49a9 2406 002e 0000 f025 3401 0002 *..I.$......%4...*
800f00e0: 12c1 0009 3c04 8022 3401 0004 12c1 000d *....<.."4.......*
800f00f0: 3c17 8022 3401 0008 12c1 0011 3c17 8022 *<.."4.......<.."*
```

- **Network or Protocol Related Issues** (e.g., problems with SIP, ICMP or RTP packets) The recommended log is the network packet analyzer log, such as Wireshark or Ethereal® log (you will need to connect your device to the PC through a Hub in order to obtain the log through Wireshark or Ethereal).
- **Sound Quality or Endpoint related Issues** (e.g., noisy output at the handset/headset) The recommended log is a *.WAV file recording of the device output.
  - You may need to acquire a recording device, such as THAT-2, in order to make a recording.
  - You may also use the IORW utility for recording. See "How do I use the IO utility for audio debugging?" on page 26.
- **All kinds of Assertion**. You can identify an assertion when the following error messages are printed on the Serial Port.

```
Tlb load exception
Exception program counter: 0x00000000
Status register: 0x1000ff01
Cause register: 0x00000008
Access address: 0x00000000
Task: 0x80eb8db0 "hwtk"
```

  The recommended logs are the serial port log with all of the Debug messages before the above error messages, and the the Memory Map file (app*.map) for your application which can be found in `\phonex\bin\<Config Profile>` directory.

- **Ethernet Switch related issues**, e.g., packet forwarding, routing-related issues, 802.1pQ Configuration, etc. The recommended log is the serial port log with END Driver Verbose turned on.
- Turn on END Driver Verbose by typing the following commands in the VxWorks console.

```
- endFilter =1
- endRxVerbose=1
- endTxVerbose=1
```

- You will see the following printout in the serial port if these commands are executed successfully.

```
-> endFilter=1
endFilter = 0x8067b200: value = 1 = 0x1
> endRxVerbose=1
endRxVerbose = 0x8067b060: value = 1 = 0x1
-> endTxVerbose=1
endTxVerbose = 0x805ce680: value = 1 = 0x1
```

CAN PROPRIETARY INFORMATION BE POSTED ON THE WEB INTERFACE?

Q: Can I post proprietary information on the web interface and will the information be sent to people that I am not aware of?

A: Information exchanged in the case is only viewable by members of your company working on the same project, other authorized users provided by your company, and the Broadcom Customer Support team members. E-mail notices generated from the information exchange only go to the requester and the members on the Request CC list.

CAN E-MAIL GENERATED BY PRODUCT CASES BE REPLIED TO DIRECTLY?

Q: When receiving e-mail generated by product cases, can I reply to the e-mail directly instead of going through the web interface?

Q: What are the implications?

A: Yes, the e-mail can be responded to directly. And, either way, information is logged into the Product Cases system. However, when replying through e-mail, delete the content of the notification e-mail to avoid cluttering the system.

WHAT HAPPENS WHEN REPLIED-TO E-MAIL IS NOT RECEIVED BY THE SYSTEM?

Q: When I replied to the e-mail directly, according to procedure, the e-mail was never received by the system. Why did that happen?

A: You may be replying to CSP with a user e-mail address that has not been registered with the system. Please contact Broadcom to register the user for CSP usage.

BSP

CHANGING THE END DEVICE NAME

Q: How do I change the end device name from the default bcm?

A: You can change the end device name by modifying the define END_DEVICE_NAME in `\phonex\bsp\vxWorks\<BSP profile>\config.h`

BUILD ENVIRONMENT

PLATFORM CD 3.6 INSTALLATION

Q: How do I install PCD 3.6?

A: Refer to the "Platform CD 3.6 Installation" section in the *PhonexChange Software Development Guide* and the *Release Notes for PCD 3.6 patches.*

CLEAN BUILDS

Q: What is a clean build?

A: A clean build removes the object files and libraries associated with the target. For more information on a clean build, refer to the section "PhonexChange™ Build Environment" of the *PhonexChange Software Development Guide*.

BUILD ABORTED FOR NO APPARENT REASON

Q: The build aborts for no apparent reason, and the following error messages appear in the shell window. What should I do?

A: The compiler may leave intermediate files in a temporary folder when a previous build was stopped by pressing **<CTRL-C>**. You need to manually remove all files from the temporary folder to resolve this issue. You can locate the temporary folder by querying the environment variable—TEMP with the Set command.

CREATING A NEW PLATFORM PROFILE

Q: Why should we create a new platform profile?

A: The IP Phone build environment includes support for configuration profiles that can be used to define a specific IP Phone configuration. A new configuration profile can be used to store build information for a specific platform. The profile is stored in the folder `\phonex\build\config\<config profile>`, where <config profile> is the name of the configuration profile.

CREATING A NEW PLATFORM PROFILE PROCEDURE

Q: How can I create a new platform profile?

A: You can create a new profile by following the procedures in PhonexChange Build Environment - Configuration Profiles of the *PhonexChange Software Development Guide*.

BUILDING A NEWLY ADDED FILE

Q: How can I build a newly added file in our boot code?

A: You can add the file to phonex/bsp/vxWorks/<platform> (eg. custom.c) and modify the file Makefile within the directory as follows:

```
# Additional source code that resides in the BSP directory
MACH_EXTRA = \
bcmIPHalEnd.o \
bcmBoard.o \
bcmCache.o \
bcmBsp.o \
custom.o
```

Q: How can I build a newly added file in our application code?

A: Modify the makefile within the folder that contains the newly added file. For example, if you want to add ccUser.c to the folder `\phonex\mcu\cc\test`, you need to update the makefile located in the same directory of your source file. Since `libcctest.mk` is the makefile located in the `\phonex\mcu\cc\test` directory, you need to add `ccUser.c` to the list of source files. The following illustrates the example.

```
#############################################################################
#
# This makefile is used to build libcctest.a library and the library is
# located at \phonex\lib\<BSP Profile>
#
#############################################################################

# ---------------------------------------------------------------------------
# This should match the target name.
#
XCHG_LIB_BASE  := libcctest

CCTEST_ROOT    := $(IPP_XBE_DIR_$(XCHG_LIB_BASE))

# ---------------------------------------------------------------------------
# List of all source files. Do not specify directories, we use vpath below.
#
XCHG_SRC_FILES_$(XCHG_LIB_BASE) := \
   kbdprv.c \
   ccData.c \
   cctest.c \
   ccstore.c \
   ccUser.c \
   htmlTest.c \
   ccPhoneCfg.c

XCHG_SRC_FILES += $(XCHG_SRC_FILES_$(XCHG_LIB_BASE))

# We use vpath so that the object files don't wind up in nested subdirectories.
# These must be absolute paths in order to support non-recursive makefiles.
#
vpath %.c $(CCTEST_ROOT) $(CCTEST_ROOT)/..

# ---------------------------------------------------------------------------
# Add in private directories that are only needed when compiling this library.
# These must be absolute paths in order to support non-recursive makefiles.
#
XCHG_C_LOCAL_INCLUDE_$(XCHG_LIB_BASE) := ${CCTEST_ROOT}/..

# ---------------------------------------------------------------------------
# Add in private defs that are only needed when compiling this library.
#
XCHG_C_LOCAL_DEFS_$(XCHG_LIB_BASE) :=

# ---------------------------------------------------------------------------
# Add in private compile options that are only needed when compiling this library.
#
XCHG_C_LOCAL_COMPILER_OPTS_$(XCHG_LIB_BASE) :=

# ---------------------------------------------------------------------------
```

```
# To set a module specific compiler option, create a target specific make
# variable which sets the option and depends on the module target name.
# For example, to enable compiler optimizations for this module:
#
#     $(XCHG_LIB_BASE): XCHG_C_OPTIMIZE_OPT = $(XCHG_C_OPTIMIZE_OPT_ENABLE)
#
# or, to disable optimizations:
#
#     $(XCHG_LIB_BASE): XCHG_C_OPTIMIZE_OPT = $(XCHG_C_OPTIMIZE_OPT_DISABLE)
```

BUILDING A NEWLY ADDED LIBRARY (FOLDER)

Q: How can I build a newly added library (folder)?

A: **1.** Add the software module under the phonex directory by creating its own subdirectory "<NEW_MODULE>" and by adding a new "lib<NEW_MODULE>.mk" file in the subdirectory with the following lines:

```
XCHG_LIB_BASE := lib<NEW_MODULE>

<NEW_MODULE>_ROOT := $(IPP_XBE_DIR_$(XCHG_LIB_BASE))
```

2. Modify \phonex\ipp_xbe_targets.mk.

a. Add new library to the list of all targets, IPP_XBE_ALL_TARGETS.

```
IPP_XBE_ALL_TARGETS := \
…
lib<NEW_MODULE> \
…
```

b. Add an entry for the new module's directory.

```
IPP_XBE_DIR_lib<NEW_MODULE> := $(IPP_XBE_ROOT)/###/<NEW_MODULE>
```

where ### is the parent directory of the new module.

c. Add an entry for the new module's public includes.

```
IPP_XBE_PUBLIC_INC_<NEW_MCU_MODULE> := $(IPP_XBE_ROOT)/###/inc
```

where ### is the parent directory of the new module.

3. Modify \phonex\build\app_ipphone_libsgroup.mk. Add the new library to the group to which it belongs.

a. Add "lib<NEW_MODULE>.a" under LIBS_###, where ### is the group.

4. Modify \phonex\build\phonex_xbe_rules.mk to include directories for the new module. The following is an example of included directories:

```
export lib<NEW_MODULE>_cinc = \
        ${IPP_XBE_ROOT}/util/inc \
        ${IPP_XBE_ROOT}/build/config/${CONFIG} \
        ${IPP_XBE_ROOT}/build/config \
        ${IPP_XBE_ROOT}/bsp/bcm/bcmBoard/inc \
        ${IPP_XBE_ROOT}/bsp/${IPPCFG_BSP_COMMON}
```

WIND RIVER PCD3.6 COMPATIBILITY

Q: Is Wind River's PCD3.6 compatible with previous versions of Tornado®?

A: Wind River's PCD3.6 is not compatible with previous versions of Tornado. All source files need to be recompiled (conduct a clean build before recompile).

MAKEFILE FORMAT

Q: What is the format of a makefile?

A: A simple makefile consists of rules with the following format:

```
target ... : dependencies ...
     command
     ...
     ...
```

A target is usually the name of a file generated by a program. Examples of targets are executables or object files. Dependencies are files that are used as input to create the target. A target often depends on several files. A command is an action that make performs. A rule may have more than one command, each on its own line.

ADDING CUSTOM DEFINES TO MAKEFILE

Q: How can I add custom defines to makefiles?

A: To add a custom define to your build, refer to “PhonexChange Build Environment - Configuration Profiles” in the *PhonexChange Software Development Guide* . To add a custom define within your library, add the custom define in the following way:

```
CFLAGS += -D<custom_define>
```

ENDPOINT

ADAPTIVE JITTER BUFFER

Q: What is an adaptive jitter buffer?

A: An adaptive jitter buffer dynamically adapts to network conditions to ensure smoothness during playback. For a detailed description, refer to "Appendix E. Adaptive Jitter Buffer" in the PhonexChange Endpoint Module Technical Reference Manual.

JITTER BUFFER RECOMMENDED SETTINGS

Q: What are the recommended settings for the jitter buffer?

A: We strongly recommend using the default settings for the jitter buffer. To use the default settings, set useDefaults to TRUE in the jitter buffer configuration structure (see the previous question). The rest of the parameters are "don't care" (they will be ignored if useDefaults is set to TRUE). The default settings are:

- jitterMin = 0 ms
- jitterMax = 0 ms
- jitterTarget = 0 ms

However, if there is a known non-zero minimum network jitter, you can set the jitterTarget to that value to prevent underflow.

In addition, since the default jitterMax is 0, the jitter buffer will adapt to the maximum allowable holding time, which is limited by the available jitter buffer memory allocation.

When the default values are used and the network doesn't produce any jitter, the adaptive jitter buffer may produce odd results in the case of high clock drift (about 200 ppm). With no jitter, it finds no reason to hold packets before they are played, and therefore, plays out packets whenever they are received. However, if the two systems' clocks are different (clock drift), the adaptive jitter buffer may sometimes under-run because one clock is slower than the other. As a result, you may encounter odd performance results (again, only when clock drift is high, around 200 ppm).

CONTROLLING BEHAVIOR OF ADAPTIVE JITTER BUFFER

Q: How do I control the behavior of the adaptive jitter buffer?

A: It is highly recommended that the user always use the default jitter buffer settings. The endpoint module can control the behavior of the adaptive jitter buffer through the data structure `EPTJITTERBUF`. However, we strongly recommend default jitter buffer settings be used.

Refer to "Appendix E. Defining the Adaptive Jitter Buffer Configuration" of the PhonexChange Endpoint Module Technical Reference Manual for more information on the EPTJITTERBUF data structure.

ADAPTIVE JITTER BUFFER STATISTICS

Q: How can we obtain the adaptive jitter buffer statistics?

A: Refer to Appendix E. Obtaining the Adaptive Jitter Buffer Statistics of the *PhonexChange Endpoint Module Technical Reference Manual.*

ADAPTIVE JITTER BUFFER STATISTICS INTERVAL

Q: How do I change the jitter buffer statistics generation interval?

A: You can change the jitter buffer statistics generation interval at run-time through the serial port by:

1. Starting the BRCM console by typing the following command at the prompt:

   > console

2. Starting the Voice Over IP Menu by typing the following command at the prompt:

   > voip

3. Entering the desirable internal <n> in milliseconds (ms).

   > interval <n>

RTP STATISTICS AND JITTER REPORTS

Q: What is the limitation in retrieving the jitter report in the RTP Statistics?

A: The RTP statistics are updated internally once every 200 ms in the endpoint module. The interval of the query is defined by the symbolic constant `EPT_HAPIGET_INTERVAL` in `\phonex\mcu\inc\ept.h`. If you query statistics more frequently than the internal updates, the statistics reported may not have been updated since the last query and will be stale. For more information regarding to RTP/RTCP statistics, refer to “RTP/RTCP Packets” under the “Examples” section in the latest *PhonexChange Endpoint Module Technical Reference Manual*.

ACCESSING THE IOM2 AUDIO CHANNEL

Q: How do I access the IOM2 audio channel?

A: IOM-2 is no longer supported by PhonexChange.

BROADCOM ECAN TAIL LENGTH

Q: What are the tail lengths for the Broadcom ECAN and AEC? How can we change them?

A: The tail lengths are set to 16 ms (32 ms for the BCM1103) and 96 ms for Broadcom ECAN and Broadcom AEC respectively. You must not change these settings because these values are optimized for Broadcom IP Phone applications.

DEFAULT PLC MODE

Q: What is the default PLC mode? Can we change it at run-time?

A: Different default PLC modes are set up for different vocoders. Details of each of these PLC modes are covered in "Appendix B: Packet Loss Concealment" in the *PhonexChange Endpoint Module Technical Reference Manual*.

You can change the PLC mode at run-time through the function: `eptModifyStream()`. Refer to the *Endpoint Module Technical Reference Manual* for more information.

VAD VALUES

Q: What does each level value do when I turn on the VAD?

A: The level range of VAD (or silence suppression) is from `EPTSILSUP_LEVEL_MIN` to `EPTSILSUP_LEVEL_MAX`, with a larger value corresponding to a more aggressive setting. The level does not matter if the mode field of the `EPTSILSUP` structure is set to "`EPTSILSUP_OFF`".

EQUALIZATION FILTER

Q: How do I use the Equalization Filter?

A: Refer to "Equalizer Filter" in "Signal Generation" under "Examples" in the *PhonexChange Endpoint Module Technical Reference Manual.*

HIGH-PASS FILTER

Q: What are the properties of the high-pass filter inside Endpoint that conditions audio signals to and from codecs? Can I disable the filter?

A: The digital high-pass filter implements the follow difference equation:

```
y[i] = (1-alpha) * y[i-1] +  ( x[i] - x[i-1] )*(1-alpha/2)
where alpha = 2^5
```

This filter has no gain in the pass-band, and a 3 dB point at about 40 Hz.

The high-pass filter should never be disabled; otherwise; it leads to unpredictable behavior.

CUSTOMIZING TONES AND RINGS

Q: How can I create a customized tone/ring?

A: Refer to "Signal Generation" in the section "Signal Generation" under "Examples" in the *PhonexChange Endpoint Module Technical Reference Manual*.

GENERATING TONES AND RINGS (INGRESS)

Q: How can I generate a tone/ring into the network (ingress)?

A: You can generate a tone/ring into the network by following the example for generating a tone/ring shown in the "Signal Generation" section under Examples in the *PhonexChange Endpoint Module Technical Reference Manual.*

GENERATING TONES AND RINGS (EGRESS)

Q: How can I generate a tone/ring locally (egress)?

A: You can generate a tone/ring locally by following the example for generating a tone/ring provided in “Signal Generation” under “Examples” in the *PhonexChange Endpoint Module Technical Reference Manual.*

GENERATING TONES AND RINGS (EGRESS AND INGRESS)

Q: How do I generate a tone/ring locally (egress) and into the network (ingress)?

A: To do this, follow the example for generating a tone/ring provided in “Signal Generation” under “Examples” in the *PhonexChange Endpoint Module Technical Reference Manual.*

CHANGING VOICE VOLUME WITHOUT CHANGING TONE VOLUME

Q: I am playing voice and tone locally (egress) at the same time. How can I change the voice volume without changing the tone volume?

A: Use `eptModifyStream()` to modify the Voice Volume gain block setting. This is done by changing the `voice.egressVoiceLevelDb` element in the parameter set passed to `eptModifyStream()`. Changing the Voice Volume gain block only changes the voice volume; it will not change the tone volume. See “Volume and Gain Control” under “Examples” in the *PhonexChange Endpoint Module Technical Reference Manual.*

RESTARTING TONE GENERATION

Q: Do I need to restart the tone generation in a stream when I attach the stream to another device?

A: No. The tone should be heard at the second device once the stream is attached to the other device. There is no need to regenerate the tone.

ATTENUATING TONE

Q: The tone volume level in `EPTSIGTONEPARM` ranges from 0 to -95 dB. Does this mean that I can only attenuate the tone?

A: Yes, it means that you can only attenuate the tone volume level and cannot boost the tone level. The maximum level is 0 dB.

DB LEVEL

Q: When the direction field in `EPTSIGTONEPARM` is `EGRESS_AND_INGRESS`, does the dB level affect the gain of both egress and ingress signals?

A: No, the dB level is set up separately by using the parameters `ingressSignalLevelDb` and `egressSignalLevelDb`. For more information, see “Signal Generation” under “Examples” in the *PhonexChange Endpoint Module Technical Reference Manual.*

GENERATING AN RFC2833 DTMF TONE

Q: How do I generate an RFC2833 DTMF tone?

A: Refer to “Tone Relay of Signal Generation” under “Examples” in the *PhonexChange Endpoint Module Technical Reference Manual* for examples on generating an RFC2833 DTMF tone.

VERIFYING RFC2833 DTMF TONES

Q: How do I know RFC2833 DTMF tones are actually generated?

A: When the user enables tone relay and presses a digit during a call, packets with the following RTP payload are sent into the network. For more information about the payload, refer to:

http://www.ietf.org/rfc/rfc2833.txt.

```
0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     event     |E|R| volume    |          duration             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

DETERMINING RTP PAYLOAD TYPES

Q: How is the RTP payload type determined when generating DTMF tones according to the RFC2833 standard?

A: According to the RFC2833 standard, the RTP payload type is determined dynamically.

INTERFACING RTP/RTCP PACKETS FROM ENDPOINT TO NETWORK

Q: How are RTP/RTCP packets passed between Endpoint and network?

A: The RTPT (RTP Transport) module is used to interface Endpoint with the network. This module is implemented in (`\phonex\mcu\rtpt`).

This requires first initializing the RTPT module by calling `rtptInit()` with a pointer to a user-supplied callback function. The callback function is used by RTPT to pass egress packets to an egress packet handler.

Next open RTP ports using `rtptOpen()`.

The next task is to initialize the Endpoint module by calling `eptStartup()` with a pointer to a user-supplied callback function. The callback function is used by Endpoint to pass ingress packets to an ingress packet handler.

After RTPT is initialized and ports are opened, the RTPT module starts the "RTPT" task to receive egress packets. Each time an egress packet is received by the RTPT module, the egress packet callback function is called. The egress packet handler should pass the packet into Endpoint by calling `eptPacket()`.

When an ingress packet is produced by Endpoint, Endpoint invokes the ingress packet callback. The callback function should call `rtptSend()` to forward the packet into the network via the RTPT module.

For an example, refer to `egressPktCb()` in `\phonex\mcu\cc\test\cctest.c` and `ingressPktCb()` in `\phonex\mcu\cc\test\cctest.c`.

Refer to "Endpoint Module Context" under "Introduction" in the *PhonexChange Endpoint Module Technical Reference Manual* for information on Endpoint context.

CHANGING RTP PORTS

Q: How can I change the RTP port?

A: To change the RTP port, call the function `rtptClose()` to close the unused port. Then, call the function `rtptOpen()` to open the new port. The following function is an example from `\phonex\mcu\cc\test\cctest.c`.

```
int ccTestMulticast( BOOL join, EPTSTREAMID streamId, UINT32 mcast_ip )
{
   int rc;
   RTPTCFG rtptCfg;

   if ( ! streamIdValid( streamId ) )
   {
      rc = FALSE;
   }
   else
   {
      rtptCfgGet( cnxParm[streamId].rtptHandle, &rtptCfg );

      /* close the RTPT port then reopen it */
      rtptClose( cnxParm[streamId].rtptHandle );
      if ( join )
      {
         rtptCfg.srcAddr = mcast_ip;
      }
      else
      {
         rtptCfg.srcAddr = 0;
      }
      rc = (int)rtptOpen( &cnxParm[streamId].rtptHandle, &rtptCfg );
   }

   return ( rc );
}
```

SUPPORTED VOCODERS

Q: Which wideband and narrowband vocoders are supported?

A: Refer to the “PhonexChange Components and Licensing Restrictions” section in the software release report for an up-to-date list of supported vocoders.

TROUBLESHOOTING AUDIO HANDSET

Q: There is no audio in the handset after I bind the EPT device `EPTDEV_NLP_1` from APM handset to an external HSS device. Why does that happen?

A: There are only 3 EPT DEVICES in the EPT software. Binding binds an `EPT DEVICE` to an APM or HSS interface. Since we have only 3 EPT DEVICES, there can only be three working devices at one time.

```
EPTDEV_NLP_1      for handset
EPTDEV_NLP_2      for headset
EPTDEV_FDS        for handsfree
```

If `EPTDEV_NLP_1` is rebound from the APM handset to HSS, then the APM handset loses the binding with `EPTDEV_NLP_1`. As the result, the handset no longer has audio.

NOISE AND SATURATION

Q: I am hearing noise/saturation. Where are the gain blocks? What are their default values?

A: The gain blocks of the BCM1100/BCM1101 and BCM1103 chips are covered in the "Gains and Sidetone in the Signal Path" section of the *PhonexChange Software Development Guide*.

RESETTING RTP STATISTICS COUNTERS

Q: Why does it appear that `egressRtpCumLostPkt` counter is not reset after I call `eptModifyStream()` with resetStats flag set to TRUE?

A: The `egressRtpCumLostPkt` counter specifies the cumulative packet loss of the RTP/RTCP session. This field is updated whenever an egress RTCP packet is received. If you reset the counter, and an RTCP packet arrives BEFORE you poll the counter, the counter becomes non-zero and appears as if the reset had no effect.

UNITS FOR RTP STATISTICS

Q: What are the units for `ingressRtpLatency` and `egressRtpJitter` in `EPTRTPSTAT` structure?

A: When using narrowband codecs, they are both in units of 125us. When using wideband codecs, `ingressRtpLatency` is still in units of 125us, but `egressRtpJitter` is in units of 62.5us.

STATISTICS INCREMENTING CONDITIONS

Q: Under what conditions is the `egressRtpDiscardPkt` field in `EPTRTPSTAT` structure incremented?

A: The `egressRtpDiscardPkt` is incremented when egress RTP and RTCP packets are dropped by Endpoint. They are dropped under the following situations when:

- There is error in RTP/RTCP header (i.e. invalid length, version, padding, and so forth.)
- The size of the packet does not match the type of vocoder used.
- The specified vocoder is not supported.
- The NTE (named telephone event) event range is not supported
- The RTCP type is not defined (i.e. not SR, RR, SDES, BYE, and APP, as defined in RFC3550).

RTP Statistics Differences

Q: What is the difference between `egressRtpDiscardPkt` and `egressRtpCumLostPkt` fields in the `EPTRTPSTAT` structure?

A: `egressRtpDiscardPkt` indicates the number of packets dropped by Endpoint. `egressRtpCumLostPkt` indicates the packets lost in the network.

SRTP

Q: How do I set up SRTP?

A: SRTP parameters are contained as a part of the stream parameters. These values can be sent to endpoint using eptCreateStream() or eptModifyStream(). An example of configuring SRTP can be found in phonex\mcu\cc\test\cctest.c in the function ccTestSetSrtp(). The ingress and egress settings are configured independently.

Q: Is the code supplied for SRTP and SRTCP certified?

A: Based on the FIPS140-2 standard, our SMAPI-SRTP SW stack is compliant with the "FIPS 140-2, Level-1" requirements, though it has not gone through formal certification. If certification is required, it should be made the part of the software development process.

Maximum Packetization Values

Q: I have seen a maximum value of 90 ms packetization period in the ept.h file. Can I use this value on any vocoder when I create or modify a stream? Can I use a value greater then 90 ms?

A: The range of packetization period that is supported on each vocoder is listed in the PhonexChange software release report. You can set the packetization period to any value that is within the range, with the restriction that the period must be a multiple of the vocoder's base packetization period.

The maximum packetization period for each vocoder is also defined in `\phonex\mcu\inc\ept.h` as `EPT_MAX_PKTPRD_xxx`.

Note: If the packetization period is set outside of the range the DSP will return a HAPI error. Below is an example:

```
hdspEvntCb: NetVHD handle 80. Error evt =
HAPI_CODEC_EXCEPTION_EVT(PVEEXCEPTION_SUPERINTERVAL). max packet size = 640 bytes
```

Mapping Endpoint Devices to APM Codecs

Q: How do I map endpoint devices to APM codecs?

A: The procedure to map endpoint devices is in “Appendix C: Defining Platform Specific Audio Configuration” of the *PhonexChange Endpoint Module section of the Technical Reference Manual.*

CONTROLLING APM AND PGA GAINS

Q: How do I control the APM PGA gains on BCM1103/BCM1104?

A: Instructions on how to control the APM gains are in the “Appendix C: Defining Platform Specific Audio Configuration” section of the *PhonexChange Endpoint Module Technical Reference Manual.*

SIDETONE DELAY

Q: What is the sidetone delay?

A: For the BCM1101/BCM1100, sidetone is generated in the DSP software, so the delay includes the media queue buffering time in the DSP software. A 2.5 ms delay is introduced during ingress sampling and an additional 2.5 ms delay is introduced during egress sampling. The total sidetone delay is therefore 5 ms.

For the BCM1103/BCM1104/BCM1190, the sidetone is implemented in hardware inside the APM block. The estimated sidetone delay is in the order of 10's of μsec. The sidetone delay is mainly introduced from the Y-filter of the APM, where the sidetone is generated at 100 kHz sampling frequency. A negligible delay is also introduced from the rest of the sidetone pathway through the CIC filter and the analog path. The block diagram of the APM path is shown in the “APM Block Diagram” of the applicable data sheet.

APM LOOPBACKS ON THE BCM1103, 1104, AND 1190

Q: How can I do APM loopback on the 1103 or 1104

A: There are two different APM loopbacks that can be performed:

- Loopback from the ADC to the DAC, which skips most of the APM blocks
- Loopback just after the CIC

These loopbacks are illustrated in the *BCM1103 Data Sheet (1103-DS10x-R)* in "Section 10: Audio Processor Module". Refer to adc_dac_lpbk and tx_rx_100k_lpbk respectively in "Figure 10-7: Audio Channel Processor (ACP) Block Diagram".

For example, to set up a handset loopback from the VxWorks console (assuming it is connected to CODEC 0, channel A):

1. Set the RX gain of Codec 0, channel A since it defaults to 0, which is mute.

You must also set the VRX_PGA field in the Codec Configuration-5 register (0xBAFE4114). This example sets the gain to 0 dB:

```
-> m 0xbafe4114
bafe4114:  0000-
bafe4116:  0000-1500
bafe4118:  0000-q

value = 1 = 0x1
```

2. Set the loopback bit for CODEC 0.

For ADC-DAC loopback, you must set the ADC_DAC_LPBK bit to 1 in the Test Configuration Register for Channel A:

```
-> m 0xbafe4018
bafe4018:  0000-
bafe401a:  4448-4548
bafe401c:  0000-q
```

For the CIC loopback, you must set the TX_RX_100K_LPBK bit to 1 in the same register:

```
-> m 0xbafe4018
bafe4018:  0000-
bafe401a:  4448-4468
bafe401c:  0000-q
```

These steps assume that your code has not changed the mux to use channel B, i.e., VTX_PGA_MUX of CODEC Configuration-3 Register is set to input A (0xBAFE410c).

Q: How can I do APM loopback on the 1190?

A: There are two different APM loopbacks that can be performed:

- Loopback from the ADC to the DAC, which skips most of the APM blocks
- Loopback just after the CIC

These loopbacks are illustrated in the *BCM1190 Data Sheet (1190-DS10x-R)* in “Section 10: Audio Processor Module”. Refer to adc_dac_lpbk and tx_rx_100k_lpbk respectively in “Figure 10-4: Audio Channel Processor Block Diagram”.

For example, to set up a handset loopback from the VxWorks console (assuming it is connected to CODEC 0, channel A):

1. Set the RX gain of Codec 0, channel A since it defaults to 0, which is mute.

You also need to set the VRX_PGA field in the Codec Configuration-5 register (0xBAFE4114). This example setsthe gain to 0 dB:

```
-> m 0xbafe4114
bafe4114:  0000-
bafe4116:  00a4-15a4
bafe4118:  dead-
```

2. Set the loopback bit for CODEC 0.

For ADC-DAC loopback, you need to set the ADC_DAC_LPBK bit to 1 in the Test Configuration Register for Channel A:

```
-> m 0xbafe4018
bafe4018:  0000-
bafe401a:  4040-4140
bafe401c:  dead-.
```

For the CIC loopback, you need to set the TX_RX_100K_LPBK bit to 1 in the same register:

```
-> m 0xbafe4018
bafe4018:  0000-
bafe401a:  4040-4060
bafe401c:  dead-.
```

These steps assume that your code has not changed the mux to use channel B, i.e., VTX_PGA_MUX of CODEC Configuration-3 Register is set to input A (0xBAFE410c).

AEC

Q: Where are the AEC parameters defined?

A: The AEC parameters are defined in the `\phonex\build\config\<config profile>\spkrphonecfg.h` file. Once the AEC parameters are determined from tuning, `spkrphonecfg.h` should be modified.

Q: How do I use the IO utility for audio debugging?

A: The "io" utility is a feature to record/inject a signal before and after the AEC block. This utility can help debug most audio issues users encounter. The "io" utility is a command in the AEC console menu.

The utility can record at three locations:

- r1 = BOS receive record - signal after the AEC block in egress direction, right before the signal is played out to the speaker.
- r2 = BOS send record - signal before the AEC block in ingress direction, right after the signal is recorded by the microphone.
- r3 = PVE send record - signal after the AEC block in ingress direction. This is only supported in 1104 and 1190.

The utility can also inject signal at two locations:

- i1 = PVE receive inject - a signal can be injected before the AEC block in egress direction. This is only supported in 1104 and 1190.
- i2 = BOS send inject - a signal can be injected before the AEC block in ingress direction.

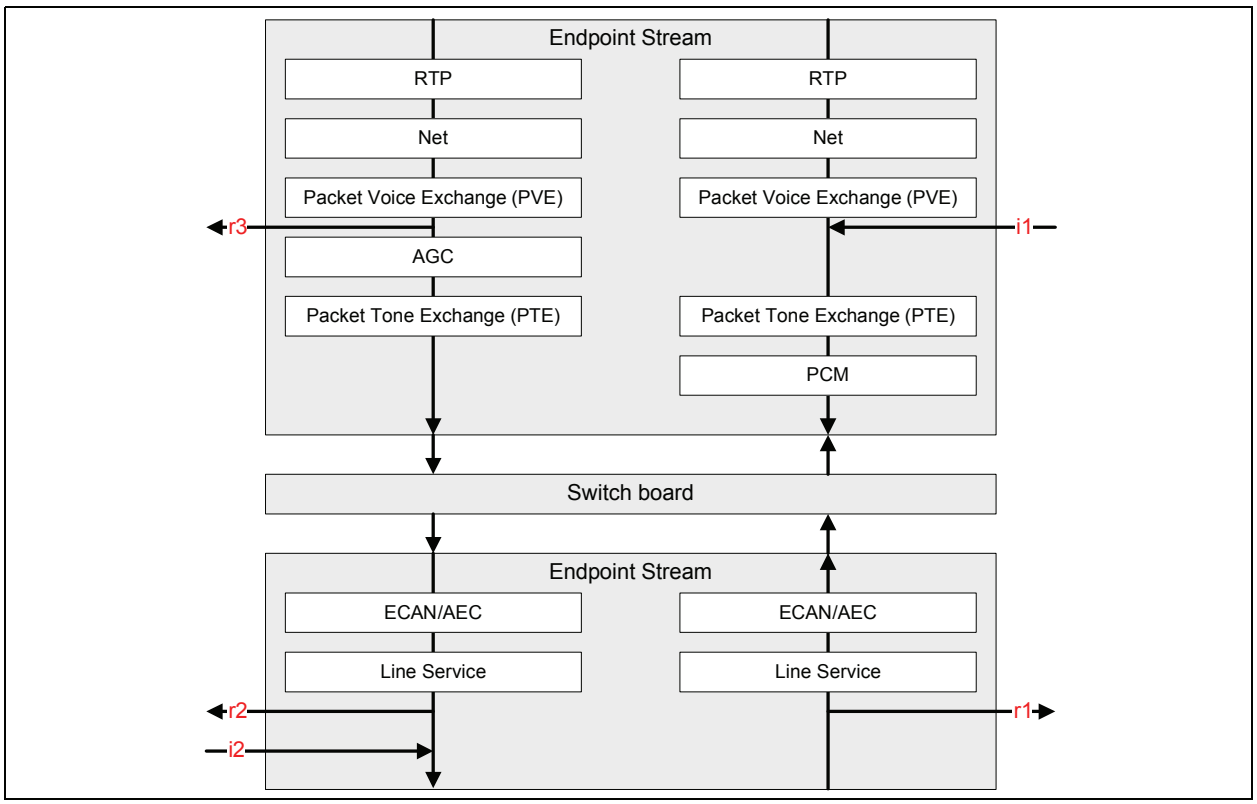


Figure 1: Debugging with the I/O Utility, Record or Inject a Signal

For both inject locations, the utility can either over-write the signal or add the signal on top of the existing signal (prefix i1 or i2 with a '+' sign). The inject signal must be in 16kHz sampling rate, mono channel, and 16-bit Intel PCM format. `ev` is used for logging AEC events. If you don't wish to record/inject at any point, replace the parameter with a '`-`' sign. chan determines which codec channel you are recording from. In our reference design, codec 0 is hooked up to the handset device, and codec 1 is hooked up to a handsfree device. time indicates how long you want the record/inject to be in seconds. The utility uses the FTP clients to download the to-be-injected signals onto the phone and upload the recorded signals once recording is completed. An FTP server is needed for this utility to transfer files to the host PC. Here is the step-by-step operation for setting up FTP and ensuring that the phone is ready to use the io utility:

1. Open the FTP server provided by Wind River (`$(WIND_BASE)host\x86-win32\wftpd32.exe`).
   a. Click Security > Users/rights... to configure the user name and password allowed from the FTP clients.
   b. Click New User... and enter the user name "user" and the password as "password".
   c. Enter "C:\" for the Home Directory text book, and select "Restricted to home".
   d. Click Rights >> and enter "c:\rdata\" for the Directory textbox.
   e. Click Done to save the setting.
2. On the phone:
   a. Enter the command "`hostShow`" to ensure the host IP address is under the hostname "host".
   Example: (the host has the IP address of 192.168.0.100)

```
-> hostShow
hostname    inet address     aliases
--------    ------------     -------
localhost   127.0.0.1
target      192.168.0.130
host        192.168.0.100
value = 0 = 0x0
->
```

   b. If the host is not listed, add it to the list using the command `hostAdd`.

   Example: (the host have the IP address of 192.168.0.100)

```
-> hostShow
hostname         inet address    aliases
--------         ------------    -------
localhost        127.0.0.1
target           192.168.0.130
value = 0 = 0x0
-> hostAdd "host","192.168.0.100"
value = 0 = 0x0
-> hostShow
hostname         inet address    aliases
--------         ------------    -------
localhost        127.0.0.1
target           192.168.0.130
host             192.168.0.100
value = 0 = 0x0
->
```

Go back to the `AEC` console, and the `io` utility is ready to go.

For apptest:

1. From the IP Phone Console, type `cv` to get into the Call/Voice menu
2. Type `aec` to get into the AEC console. Type `help` to see all commands available.

Use the following commands to get to the AEC console:

```
IPP > cv
[CALL/VOICE]# aec
aec
ioSampleFreq=16000
aec.hf >
```

For appsip or apph323:

1. From the VxWorks prompt, type `console` to get to Broadcom console
2. From the Broadcom console, type `aec` to get into the AEC menu

```
[BRCM]> aec
ioSampleFreq=16000
aec.hf >
```

Q: I tried doing tests according to the *PhonexChange Acoustic Echo Canceler and Line Echo Canceler Hardware Preparation Checklist*, but nothing seems to work?

A: Please make sure a G.711-ulaw-VAD off voice call MUST be established between two phone terminals.

Q: How do I turn on/off AGC (Automatic Gain Control) in ECAN or AEC?

A: Refer to the *PhonexChange Acoustic Echo Canceler Tuning Guide* for turning the AGC on and off for AEC. The same parameters apply to ECAN.

Q: How do I turn on/off CNG (Comfort Noise Generator) in ECAN or AEC?

A: Please refer to *PhonexChange Acoustic Echo Canceler Tuning Guide* for turning the CNG on and off for AEC. The same parameters applied to ECAN.

HANDSET ECHO WHEN ECAN IS ENABLED

Q: Why do I hear echo from my handset when ECAN is enabled?

A: The echo that you are hearing has nothing to do with the ECAN in the local phone. The echo is being generated by the far end phone. The ECAN in the far end phone is responsible for removing this echo and is not operating properly. You need to debug the ECAN in the far end phone.

DSP ASSERTION

Q: What should I do when the DSP asserts?

A: DSP asserts are fatal and indicate a programming bug. You should capture all the information in the serial port from start-up to the point when DSP asserts and report it through the Broadcom Customer Support Portal - Product Case.

Q: I see the following errors continuously printed out in the serial log. What do they mean?

```
lhapiOsSemTake FAIL: pSem: 0x80a54864 bosStatus 0x1 timeOut: 500
**********************************************************************
hapiIOctl ERROR: Command response Sema4Take failed
Command: 0x44b4   handle 0x53  op1: 0x0 , op2: 0x2100, status 0xffffffff
lhapiOsSemTake FAIL: pSem: 0x80a54860 bosStatus 0x1 timeOut: 500
**********************************************************************
hapiIOctl ERROR: Command response Sema4Take failed
Command: 0x6b5   handle 0x52  op1: 0x0 , op2: 0x0, status 0xffffffff
lhapiOsSemTake FAIL: pSem: 0x80a54864 bosStatus 0x1 timeOut: 500
**********************************************************************
hapiIOctl ERROR: Command response Sema4Take failed
Command: 0x43b0   handle 0x54  op1: 0x0 , op2: 0x0, status 0xffffffff
```

A: The errors indicate that the hausware task (hwtk) stopped running. Specifically, the errors are the hausware commands failing because they time out. When a command is sent to hausware, a response is expected within 500 ms. When there is no response, the command fails and the messages above are printed out.

hwtk usually stops because the DSP asserted, hwtk hit an exception, or hwtk is being blocked by a higher priority task. To debug further, look for prior logs that indicate a DSP assert or hwtk exception. If there are none, check for a higher priority task that could be blocking hwtk.

ENABLING DSP FEATURES

Q: Can DSP features be enabled by changing #defines in the DSP header files?

A: No, DSP features cannot be enabled by changing the #defines in DSP header.

IP PHONE FAILS TO GENERATE TONES

Q: The IP Phone cannot generate any tones when I am trying to complete the *PhonexChange Acoustic Echo Canceler and Line Echo Canceler Hardware Preparation Checklist*; why does that happen?

A: You must make a connection to another phone before you can perform any of the commands listed in the *PhonexChange Acoustic Echo Canceler and Line Echo Canceler Hardware Preparation Checklist*. Otherwise, the expected tone from the IP phone cannot be heard.

iLBC AUDIO CODEC SUPPORT

Q: Is iLBC audio codec supported?

A: We have no plans to support iLBC. Instead, we are promoting our BroadVoice16 (narrowband) and BroadVoice32 (wideband) vocoders. The BroadVoice vocoders are lower in delay, higher in quality, and lower in complexity than the iLBC vocoder and are available without royalty payment on our Broadcom IP phone chips.

ETHERNET

Q: Issuing network commands, such as "ping", on the VxWorks shell prompt takes a long time to respond. How can we reduce the delay?

A: The delay is caused by host lookup when the DNS resolver is enabled and the DNS server is unreachable and not returning host names.

To bypass host lookup, issue the command with the '-n' option:

```
ping "-n 192.168.1.25"
```

DENIAL OF SERVICE

Q: What is DoS?

A: The Denial of Service (DoS) module monitors unicast, broadcast, and multicast packet reception rates and instructs the Ethernet switch to filter out packets if the reception rates exceed the user-defined thresholds.

The DOS task disables the reception of broadcast, multicast, and unicast packets at the SMP port based on the rate at which those packets are received. Details are as follows:

- The DOS task compares the number of broadcast, multicast, and unicast packets received every 100 ms to their respective high thresholds.
- For broadcast and multicast packets, if the packet type's high threshold is exceeded, the task disables the receipt of those packets at the SMP port.
- For unicast packets, if the packet type's high threshold is exceeded, the task disables the receipt of all packets at the SMP port.
- For broadcast packets, after a holdoff period, if the number of packets is below the low threshold, the SMP is re-enabled to receive broadcast packets again.
- For multicast and unicast packets, the task re-enables the SMP after the holdoff period and checks if the high threshold has been exceeded. If the number of multicast or unicast packets received during the next 100 ms is below the high threshold, the SMP is re-enabled to receive packets.
- The difference in treatment between broadcast and multicast/unicast packets is due to the fact that the packet counters for multicast and unicast packets are based on software counters in the Ethernet driver, which are not incremented when the packet rx is denied.
- All parameters are configurable for each packet type: the high and low thresholds, the holdoff period, and the condition where DOS is enabled.

The default settings are:

- Broadcast packets:
  - DOS enabled
  - high and low thresholds = 50 packets/100 ms
  - holdoff period = 100 ms
- Multicast packets:
  - DOS enabled
  - high threshold = 50 packets/100 ms
  - holdoff period = 100 ms
- Unicast packets:
  - DOS enabled
  - high threshold = 150 packets/100 ms
  - holdoff period = 100 ms

Detailed DOS information is covered in the *BCM110X_111X PhonexChange Ethernet Driver Technical Reference Manual*. The DOS code is in /`xchg_drivers/upper/eth/dos.c`. The task that calls the DOS code is in `/phonex/bsp/vxWorks/common/bcmIPHalEnd.c` (dosTask).

DETECTING CABLE DISCONNECTION

Q: How can I detect an Ethernet cable disconnection?

A: You can detect Ethernet cable link state by reading the link status registers - Link Status Summary, Link Status Change, and Port Speed Summary. You can use the "`linkget`" command in the `ETH` menu in the `BRCM` console to access all these link status.

For more information on these registers, refer to the following data sheets:

- BCM1101 chip: see the *BCM1100/BCM1101/BCM113(R) Ethernet IP Phone Chips Data Sheet*
- BCM1103/BCM1104 chips: see the *BCM1103 Gigabit IP Phone Chip Data Sheet*
- BCM1190 chip: see the *BCM1190 VoIP Phone Chip Data Shee*t

ENABLING LOOPBACK MODE

Q: How can I enable loopback mode on an Ethernet port?

A: To enable loopback mode on an Ethernet port, you have to write to the following register through the ioctl () function with the ETH_IOCTL_MII_SET command.

- Write a 1 to bit 14 and 8 of MII Control Register
- Write a 0 to bit 12 of MII Control Register

You also have to perform the following register write.

- Write a 1 to bit 14 of the Auxiliary Control Status Register

When transmitting packets for testing, you can use the `txegr` command from the `ETH` menu in the IPP console to specify the port to which you are sending the loopback packets.

For more information on these registers, refer to the following data sheets:

- BCM1101 chip: see the *BCM1100/BCM1101/BCM113 Ethernet IP Phone Chips Data Sheet*
- BCM1103/BCM1104 chips: see the *BCM1103 Gigabit IP Phone Chip Data Sheet*
- BCM1190 chip: see the *BCM1190 VoIP Phone Chip Data Sheet*

USING THE SWITCH AS A ROUTER

Q: How can I configure the switch for router applications?

A: Refer to Section 4: Ethernet Driver Features, Using the Switch as a Router in the *BCM110X_111X_119X PhonexChange Ethernet Driver Technical Reference Manual*.

NAT support is also required for router functionality. Wind River® NAT may available for integration. For Wind River NAT details, check Wind River support.

For more information on the switch, refer to the sections “Ethernet 3-Port Functional Description” and “Ethernet 3-Port Switch Register Definitions” in the *BCM1100/BCM110/BCM1113 Ethernet IP Phone Chips Data Sheet* and the *BCM1103 Gigabit IP Phone Chip Data Sheet*.

The functional description of the switch in the BCM1103 data sheet is also applicable to the BCM1190. However, the 3-port switch register definitions are not applicable because the switch on the BCM1190 is implemented in software.

SUPPORTING PORT MIRRORING

Q: How can I configure the switch to support port mirroring?

A: Refer to Port Mirroring in the Ethernet Driver Features section of the *BCM110X_111X_119X PhonexChange Ethernet Driver* Technical Reference Manual.

For more general information on the switch, refer to sections “Ethernet 3-Port Functional Description”, and Ethernet “3-Port Switch Register Definitions” in the *BCM1100/BCM110/BCM1113 Ethernet IP Phone Chips Data Sheet* and the *BCM1103 Gigabit IP Phone chip Data Sheet.*The functional description of the switch in the BCM1103 data sheet also applies to the BCM1190. However, the 3-port switch register definitions are not applicable because the switch on the BCM1190 is implemented in software.

PORT MIRRORING AND 802.1P PRIORITY RETAGGING

Q: If we enable 802.1p priority retagging and 802.1Q VLAN features, do the frames mirror as they are received without modification?

A: The setting in the VLAN configuration registers changes the ingress or egress tagging rules for frames at that port. For egress frames, the rules at the port receiving the frames are applied before the frame is mirrored, so the modified frame is what is mirrored. Similarly, ingress rules are applied to the mirrored frames before they are sent out.

VLAN ID TAGS

Q: How do I remove/insert a VLAN ID?

A: For an example on how to remove/insert a VLAN tag, refer to the “Virtual LAN” example in “Section 4: Ethernet Driver Features” in the BCM110X_111X_11*9X PhonexChange Ethernet Driver Technical Reference Manual.*

For more general information on the switch, refer to sections “Ethernet 3-Port Functional Description” and “Ethernet 3-Port Switch Register Definitions” in the *BCM1100/BCM110/BCM1113 Ethernet IP Phone Chips Data Sheet* and the *BCM1103 Gigabit IP Phone Chip Data Sheet.*

The functional description of the switch in the BCM1103 data sheet is also applicable for BCM1190. However, the 3-port switch register definitions are not applicable because the switch on BCM1190 is implemented in software.

802.1P TAGS AND INCOMING FRAMES

Q: How do I program the Ethernet switch to modify 802.1p tags on incoming frames via the external Ethernet ports?

A: The priority of each external port can be changed by calling `ethIoctl()` with the `ETH_IOCTL_802_1PQ_SET` command, and a pointer to a `ETH_802_1PQ` structure as the argument. The current priority settings of each port can be retrieved with the `ETH_IOCTL_802_1PQ_GET` command. For example, to replace priority to priority 5 to every VLAN-tagged packet received on port 0:

```
ETH_802_1PQ pq;
// Get current 802.1pQ setting for port 0
pq.port = ETH_PORT_0;

// Configure port 0
pq.enable = 1;            // Enable 80231pQ feature
pq.priority = 5;          // Change port priority to 5
pq.vlan.replaceTag = 1;   // Enable replace tag on port
ioctl( endEthFd, ETH_IOCTL_802_1PQ_SET, (int)&pq );
```

For more general information on the switch, refer to sections “Ethernet 3-Port Functional Description” and “Ethernet 3-Port Switch Register Definitions” in the *BCM1100/BCM110/BCM1113 Ethernet IP Phone Chips Data Sheet* and the *BCM1103 Gigabit IP Phone Chip Data Sheet.*

The functional description of the switch in the BCM1103 data sheet also applies to the BCM1190. However, the 3-port switch register definitions are not applicable because the switch on BCM1190 is implemented in software.

SETTING PRIORITY LEVELS

Q: What is the difference between the `priority` field of the `ETH_802_1PQ` data structure and `priorityLevel` field of the `UTIL_ETH_STATUS` data structure?

A: The '`priorityLevel`' field in UTIL_ETH_STATUS is used to specify how the 802.1p tag software applies to ingress packets before transmitting out to the SMP port.

'`priority`' field in ETH_802_1PQ programs the 802.1p tagging/replacement feature for packets received at external Ethernet ports 0 and 1. For more information on the 802.1p tagging/replacement feature, refer to section “IEEE 802.1P Priority” in the *BCM1100/BCM110/BCM1113 Ethernet IP Phone Chips Data Sheet* and the *BCM1103 Gigabit IP Phone Chip Data Sheet*.

The functional description of the switch in the BCM1103 data sheet also applies to the BCM1190. However, the 3-port switch register definitions are not applicable because the switch on the BCM1190 is implemented in software.

ENABLING PHY INTERRUPTS

Q: How can I enable the PHY Interrupts?

A: You can install an interrupt handler function for PHY interrupts and then enable interrupts in the MII Interrupt register. You'll also need to read this register to clear the interrupt and check the link state. The interrupt handler function prototype looks like:

```
static void isrPhy( int fd );
```

Then, you can install it with the code:

```
#include <intc.h>
intcIsrSet( INTC_IRQ_EPHY, (INTC_ISRP)isrPhy, 0, 0, 0 );
intcIrqEnable( INTC_IRQ_EPHY );
```

You can obtain a working example by looking at the lower DMA driver in /`xchg_drivers/upper/dma/dma.c`.

Note: This solution does not work on the BCM1103A1 device with an external PHY due to a hardware bug that prevents proper access to MII registers.

THE L2 SWITCH AND EAPOL PACKETS

Q: How can I configure the L2 switch to forward EAPOL packets?

A: The L2 switch does not automatically forward EAPOL packets. EAPOL packets are instead forwarded to the MIPS processor via the SMP port. Software then automatically forwards EAPOL packets to the LAN port when it receives a packet with the special destination address of 01-80-c2-00-00-03. There is no API to disable EAPOL packet forwarding. The software that performs forwarding is in `/phonex/bsp/vxWorks/common/bcmIPHalEnd.c`. In the function `txFilter802_1x()`, it will check for the special EAPOL destination address and forward matching packets to the LAN port.

FILTER LOOP INPUT PORTS

Q: While auto MDIX is running on the BCM1101, is the filter loop input port recognized from both sides of EPHY0 and EPHY1 of the Ethernet Transceiver Interface?

A: The BCM1101 cannot support auto MDIX when using the filter loop. This changes the termination characteristics of the path and there are resultant performance problems. The port without the filter loop can support auto MDIX at all times though. Note that the filter loop only goes to EPHY0, not EPHY1.

FILE SYSTEM

SUPPORTED DEVICES

Q: What devices are supported in the file system?

A: Different phones contain different devices for the file system. The default devices in the BCM91101 phone file system are shown in Table 4.

Table 4: File System Devices on BCM91101 Phones

Name in File System	*File System Type*	*Device Type*
flash0	TFFS	NOR Flash
flash1	TFFS	NOR Flash
ram	DOSFS	RAM

The default devices on the BCM1103, BCM1103MP, BCM1103SP, BCM1104, BCM1104MP, and BCM1104SP phone file systems are shown in Table 5.

Table 5: File System Devices on BCM91103, BCM91103MP, BCM91103SP, BCM91104, BCM91104MP, and BCM91104SP Phones

Name in File System	*File System Type*	*Device Type*
nflash	YAFFS	NAND Flash
ram	DOSFS	RAM

Table 6: File System Devices on BCM91190 Phones

Name in File System	*File System Type*	*Device Type*
sflash	TFFS	serial flash
ram	DOSFS	RAM

For more information, refer to “File System” in the section titled “Host Software Modules” in the *PhonexChange Software Development Guide.*

FILE SYSTEM DEVICE MODIFICATION

Q: How do I modify the size of each file system device?

A: Refer to “Set Up the Flash - Customize the Flash Size” and “Set Up the SDRAM - Customize the SDRAM Size” in the PhonexChange Porting Guide for details.

ADDING NOR MEMORY DEVICE TYPES

Q: How can I add more NOR memory device types?

A: New NOR memory devices can be added by writing their respective drivers with a standard MTD interface. You can add more AMD devices by editing the `cfiamd.c` file. Refer to the *VxWorks Kernel Programmer's Guide 6.3* for more details.

ADDING FLASH MEMORY DEVICE TYPES

Q: For the BCM1103, can I add any NAND flash memory device types that are not identified in the list of supported NAND devices in the "Supported NAND Devices" section of the *BCM1103 Gigabit IP Phone Chip Datasheet*?

A: No, you cannot add any NAND flash memory devices that are not listed in the table.

CONVERT A PLATFORM FROM NAND FLASH TO NOR FLASH

Q: How do I convert a platform which uses NAND flash to use NOR flash?

A: Refer to “Set Up the Flash - Change a Platform to use NOR Flash Instead of NAND Flash” in the *PhonexChange Porting Guide*.

H.323 CALL CONTROL

GENERATING IN-BAND AND OUT-OF-BAND DTMF TONES

Q: How do I generate in-band and out-of-band DTMF tones for the H323 application?

A: To send in-band DTMF tones for the H323 application, you must disable RFC2833 Tone Relay. Use Endpoint API `eptModifyStream()` to disable Tone Relay. Then, you can send in-band DTMF tones with the `eptSignalStream` function.

To send out-of-band DTMF tones, two methods are available:

- Call the `callSendDTMF()` function in the Call Control interface. This function is specific to H.323 only, and invokes the H.245 service to send DTMF digits between two parties.
- Use Endpoint API to enable the RFC2833 DTMF tone relay with the same procedure used to disable Tone Relay. Then, you can send DTMF tones with the `eptSignalStream` function.

Note: To enable/disable Tone Relay, refer to the "Tone Relay of the Signal Generation" subsection in the "Examples" section of the *BCM110X/BCM111X PhonexChange Endpoint Module Technical Reference Manual* for examples on generating an RFC2833 DTMF tone.

Note: To send DTMF tones with the eptSignalStream function, refer to the "Generating an Ingress Tone" example in "Section 3: Examples" of the *BCM110X/BCM111X PhonexChange Endpoint Module Technical Reference Manual*.

MEMORY

MAPPING OF FLASH AND RAM

Q: By default, where is each section of flash and RAM mapped to?

A: The SDRAM memory map is shown in the “SDRAM Memory Map” section of the *PhonexChange Software Development Guide*.

All of the constants for the RAM memory maps are defined in `\phonex\bsp\vxWorks\<BSP Profile>\config.h`.

Note: The boot code for the BCM91104xx platforms are identical to that of the BCM91103xx platforms. Therefore, they share the same sets of BCM91103xx BSP files.

Note: `LOCAL_MEM_SIZE` is defined to be `BCM_CONFIG_RAM_SIZE` in `\phonex\bsp\vxWorks\common\bcmConfigLegacy.h`.

Note: `BCM_CONFIG_RAM_SIZE` for each platform is defined in `\phonex\bsp\bcm\<BSP profile>\bcmBoard_def.h`.

For the flash memory maps, refer to the "Flash Memory Map" section of the *PhonexChange Software Development Guide*.

For the flash memory maps, refer to the "Flash Memory Map" section of the *PhonexChange Software Development Guide*.

LOCATING THE RAM DISK

Q: I cannot find the RAM disk anymore. Where is the RAM disk?

A: The RAM Disk is controlled by `RAM_DISK_SIZE` in `\phonex\bsp\vxWorks\<BSP profile>\bcmBsp_fs.c`. It is only available in the boot, bootnand, and bootburner. It is not available in the application.

MODIFYING RAM MEMORY MAPPING

Q: How do I modify the RAM memory mapping?

A: Refer to “Set Up the SDRAM - Customize the SDRAM Memory Mapping” in the *PhonexChange Porting Guide*.

MODIFYING FLASH MEMORY MAPPING

Q: How do I modify the NOR memory mapping for the BCM91101 phone?

A: Refer to “Set Up The Flash - Customize the Flash Map” in the *PhonexChange Porting Guide*.

Q: How do I modify NAND memory mapping for the BMC91103xx/BCM91104xx?

A: Refer to “Set Up The Flash - Customize the Flash Map” in the *PhonexChange Porting Guide*.

Q: How do I modify the serial flash memory mapping for BCM91190 phone?

A: Refer to “Set Up The Flash - Customize the Flash Map” in the *PhonexChange Porting Guide*.

REBUILDING THE BOOT IMAGE

Q: Why is it necessary to rebuild the boot image if `RAM_LOW_ADRS` is changed in the application code?

A: When the symbolic constant `RAM_LOW_ADRS` is changed, the boot has to know where to decompress the application.

CHANGING FLASH SIZE

Q: What are the default flash sizes in Broadcom's reference phones?

A: Refer to “Set Up the Flash - Customize the Flash Size” in the *PhonexChange Porting Guide*.

Q: How can I change the flash size of NOR devices?

A: Refer to “Set Up the Flash - Customize the Flash Size” in the *PhonexChange Porting Guide*.

Q: How can I change the flash size of NAND devices?

A: Refer to “Set Up the Flash - Customize the Flash Size” in the *PhonexChange Porting Guide*.

INCREASING THE SIZE OF NOR FLASH

Q: How do I port PhonexChange to a platform with greater than 4MB of NOR flash?

A: All PhonexChange platforms with NOR flash support can support NOR flash sizes beyond 4MB on the External Bus Interface (EBI) bus. However, the MIPS limits the boot vector table to start at 0xBFC0 0000 and kernel virtual address space 1(kseg1) ends at 0xBFFF FFFF, the devices in NOR flash can only use up to 4 MB without the following changes:

The figure uses 8-MB flash as an example. Conceptually, we can support the 8-MB flash by spoofing the software into believing the memory is contiguous. But physically in flash, the memory wraps the upper 4 MB around the lower 4 MB as shown below. (For 16-MB flash, the upper 12 MB wraps around the lower 4 MB).

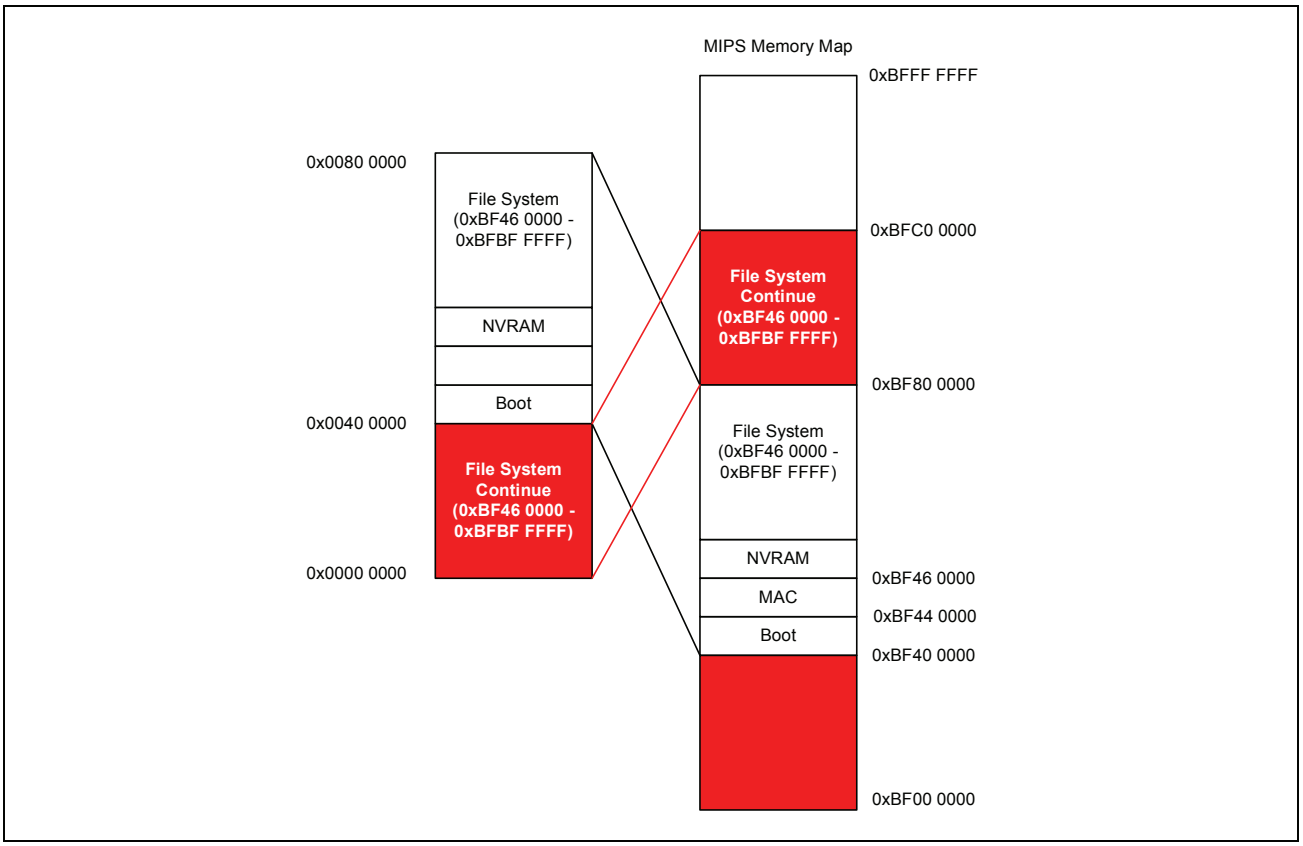


Figure 2: Physical Mapping of a NOR Flash Device When Flash Exceeds 4 MB

1. From the perspective of physical Flash, the device is segmented. From the perspective of the MIPS, the Flash is a contiguous segment of memory.
2. Because 0xBF40 0000 is physically the same as 0xBFC0 0000, when we boot, the boot device is at the correct location.
3. The base address of CS0 needs to be changed to 0xBF40 0000 or any other addresses with bit 22, not 22nd bit (22nd bit is bit 21) = 1 so that the address will wrap at 4 MB. i.e. 0xBFC0 0000, 0xBF40 0000, and so forth.
4. The size of CS0 must be set to 16 MB, or double the actual memory, because when the size is set to 8 MB, the MIPS automatically sets the addressable memory at segment 0xBF00 0000 to 0xBF80 0000, even though the base address is set at 0xBF40 0000. Or, in another example, the MIPS is set to the addressable memory at segment 0xBE80 0000 to 0xBF00 0000, even though the base address is set at 0xBFC0 0000. Again, for 16-MB Flash, the size should be 32 MB.

Note: We support uniform flash that is greater than 4MB. The flash driver is provided by Wind River, and they do not support wraparound when it comes to non-uniform flash. To support the non-uniform flash that is greater than 4MB, the flash driver must be modified to support the wraparound mentioned in the previous question. For example, when the user uses an 8MB bottom-boot device, the first block is the boot block and the rest of the blocks will be uniformly sectored; this is the configuration that Wind River flash drivers support. However, due to the MIPS limitation, we must implement the wraparound solution to fully utilize the whole flash. With the wraparound, the boot block will now be somewhere in the middle. The flash will start with uniform blocks, followed by the boot block, and then the rest of the uniform blocks. It is the user's responsibility to implement this in Wind River's flash driver.

An example is provided below for the BCM1101 platform for software modification to increases supported NOR flash size beyond. This example assumes that the NOR device will be changed is NOR0. The changes that need to be made are:

- `BCM_BOARD_NOR0_SIZE` in `phonex/bsp/bcm/bcmBoard/bcm91101v2/bcmBoard_def.h` needs to be set to 8MB (actual flash size).
- The chip select size should be doubled

  `"BCM_BOARD_NOR0_SIZE * 2, /* Chip select size */" (shown in bold in the code below)`
- In the following NOR device structure, the base address must be set to **0xBF40 0000**, as shown in bold .

```
static BCM_MEM_DEV NAMESPACE( memTable )[] =
{
   /* Flash configuration */
   {                                    /* Index 0 */
      BCM_MEM_TYPE_FLASH_NOR,           /* Memory type */
      BCM_BOARD_NOR0_SIZE,              /* Size */
      BCM_MEM_CONFIG_NOR(               /* NOR flash configuration */
         0xbf400000,                    /*    Base address */
         0,                             /*    Chip select */
         BCM_BOARD_NOR0_SIZE *2,        /*    Chip select size */
         4,                             /*    Wait states */
         BCM_BOARD_NOR0_WIDTH           /*    Bus width */
      )
   },
   {                                    /* Index 1 */
      BCM_MEM_TYPE_FLASH_NOR,           /* Memory type */
      BCM_BOARD_NOR1_SIZE,              /* Size */
      BCM_MEM_CONFIG_NOR(               /* NOR flash configuration */
         0xba000000,                    /*    Base address */
         1,                             /*    Chip select */
         BCM_BOARD_NOR1_SIZE,           /*    Chip select size */
         4,                             /*    Wait states */
         BCM_BOARD_NOR1_WIDTH           /*    Bus width */
      )
   },
   /* RAM configuration */
   {                                    /* Index 2 */
      BCM_MEM_TYPE_RAM,                 /* Memory Type */
      BCM_BOARD_RAM_SIZE,               /* Size */
      BCM_MEM_CONFIG_RAM(               /* RAM configuration */
         3                              /*    CAS */
      )
   }
};
```

NOR Flash Memory and Addressing

Q: What happens when you have a NOR Flash memory map that uses addresses beyond the physical memory boundary?

A: If the software NOR Flash memory map is greater than the actual physical NOR Flash memory boundary, the additional memory segment wraps around the actual physical memory space and maps to the initial segments of the physical flash memory, which is the boot segment by default.

Therefore, if one maps the memory addresses beyond the physical memory boundary, anything that is in the wrapped segment can be overwritten.

Changing SDRAM Size

Q: How do I change the SDRAM size?

A: Refer to “Set Up the SDRAM - Customize the SDRAM Size” in the *PhonexChange Porting Guide.*

USING DIFFERENT FLASH AND SDRAM CHIPS

Q: We want to use different flash and SDRAM chips from the reference design. Are they supported by the current PhonexChange drivers?

A: We do not maintain a list of recommended parts for the 1101. Refer to "Set Up The Flash - Customize the Flash Size" in the *PhonexChange Porting Guide* for the supported sizes of flash. Refer to the *BCM1100/BCM1101/BCM1113 Ethernet IP Phone Chips Data Sheet* for detailed information about the supported sizes of flash and SDRAM. Check with Wind River for information on the NOR flashes that are supported by their drivers.

We do not maintain a list of recommended DDR SDRAM and NOR flashes for the 1103/1104 phones. But we do maintain a list of recommended NAND Flash and a list of unsupported NAND flashes. These lists can be found in the Parallel NAND Flash section of the *BCM1103 Gigabit IP Phone Chip Data Sheet.*

We do not maintain a list of recommended serial flash for BCM1190. Refer to the *BCM1190 VoIP Phone Chip Data Sheet* for serial flash requirements. The Serial Flash Boot option will only work with memory devices that expect a read instruction opcode of 0x03 or 0x0b. In order for the state machine to generate a read instruction opcode of 0x0b, the spi_fast_read strap will need to be low.

Note: We do not support auto-detection of SDRAMs and flash in PhonexChange software.

REDUCING MEMORY USAGE

Q: How do I reduce memory usage?

A: You can reduce memory usage by building without debug symbols or by using the optimizer.

To build without debug symbols, set the constant `IPPCFG_SYMTBL` to 0 in `\phonex\build\config\<config profile>\ippcfg.mk`. Then, undefine the constant `INCLUDE_SYM_TBL` in `\phonex\bsp\<BSP Profile>\config.h`.

To use the optimizer, set the constant `IPPCFG_OPTIMIZE_LEVEL` to a value between 0 and 3 inclusive in `\phonex\build\config\<config profile>\ippcfg.mk`. Refer to the GNU compiler user manual for the definitions of the different optimization levels.

NETWORK CLUSTER POOL

Q: How do I adjust the network cluster pool sizes?

A: Changing the network cluster pool sizes is not recommended. For information on network cluster pool sizes, refer to the "Memory Pool Configuration" chapter in the *Wind River Network Stack for VxWorks 6 Programmer's Guide 3.1.*

INTERFACING TO SERIAL EPROM

Q: How do I interface to a serial EPROM (EEPROM)?

A: You can interface to a serial EPROM with the Master Serial Port Interface (MSPI) on the BCM110X/BCM111X/119X. Refer to the following documents for hardware information:

- "Master SPI" in the *BCM1100/BCM1101/BCM1113 Data Sheet* for BCM1100/BCM1101/BCM1113/BCM1115 chips
- "Master Interface" in the *BCM1103 Gigabit IP Phone Chip Data Sheet* for the BCM1103 and BCM1104 chips
- "SPI Master/Slave Interface" in the *VoIP Phone Chip Data Sheet* for the BCM1190 chip.

NVRAM LOCATION

Q: Where is the NVRAM?

A: The NVRAM is physically mapped in Flash memory. See "Mapping of Flash and RAM" on page 39.

SDRAM CONTROLLER AND PHYSICAL ADDRESSES

Q: How does the SDRAM controller in the BCM1103 translate physical addresses to bank/row/column addresses?

A: The SDRAM controller in the BCM1103 uses a 32-bit address to specify the bank select, row address, and column address for the SDRAM. Column addressing occupies the least significant bits, then row addressing, and lastly bank select. For the 32 MB (4M x 16 x 4 banks) SDRAM, the column address would occupy A[1:9], the row address would occupy A[22:10], and bank select would occupy A[24:23]. The addresses are shifted by 1 bit because it's a 16-bit SDRAM.

OS CONFIGURATION

INCREASING THE NUMBER OF SEMAPHORES

Q: How do I increase the number of semaphores in the system?

A: By default, the maximum number of semaphores allowed in VxWorks is 60. To increase the default value, insert the following two lines in `\phonex\bsp\config.h`. The following example sets up 80 semaphores in the system.

```
#undef SM_OBJ_MAX_SEM
#define SM_OBJ_MAX_SEM 80
```

DEFAULT TASK PRIORITIES

Q: Can I change the default task priorities in the system?

A: By default, the task priorities are set as below in `\phonex\build\config\config_common\pxcTaskCfg.h`.

```
#define PXC_TASK_PRTY_RTPT            BOS_TASK_CLASS_MED_HIGH
#define PXC_TASK_PRTY_DIS             BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_KBD             BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_KPD_CB          BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_IND             BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_DS              BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_CCLI            BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_PROF            BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_EPT             BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_CDNC            BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_SIGT            BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_PROVIS          BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_HAPIGET         BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_SND             BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_WAV             BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_IPPCON          BOS_TASK_CLASS_MED
#define PXC_TASK_PRTY_HSM             BOS_TASK_CLASS_MED_LOW
#define PXC_TASK_PRTY_HTTP_REQ        BOS_TASK_CLASS_LOW
#define PXC_TASK_PRTY_HTTP_SERVER     BOS_TASK_CLASS_LOW
```

You can change the default task priorities by modifying the above symbolic defines.

PERIPHERALS

CHANGING UART BAUD RATES

Q: How can I change the baud rate of the UART/Debug port?

A: You can change the baud rate at compile time or at run-time. To change the baud rate at compile time, you must modify the symbolic constant `CONSOLE_BAUD_RATE` in `\phonex\bsp\vxWorks\<BSP Profile>\config.h`.

```
/* Console support
** ---------------
*/
   #undef CONSOLE_BAUD_RATE
   #define CONSOLE_BAUD_RATE        115200   /* console baud rate */
```

To change the baud rate from the VxWorks shell at run-time, call the following VxWorks function as a command:

```
ioctl <FILE_DESCRIPTOR>, <IOCTRL_CMD>, <BAUD_RATE>
```

Below is the description of each field of this command.

- FILE_DESCRIPTOR: this field is an integer. You can determine the file descriptor of the UART by calling the VxWorks function `ioGlobalStdGet()`.
- IOCTRL_CMD: This is the code that corresponds to the actual command. You have to set this field to 4 (FIOBAUDRATE) to set the UART Baud Rate.
- BAUD_RATE: The Baud rate represented as an integer value. The default Baud rate is 115200.

An example to change the baud rate to 57600 in the VxWorks shell at run time is illustrated below.

```
-> ioGlobalStdGet
value = 3 = 0x3
-> ioctl 3,4,57600
```

Note: Make sure that the terminal program's baud rate matches the updated baud rate in the IP Phone.

ENABLING AND USING UART1

Q: How can I enable UART1?

A: The UART 1 pins are shared with GPIO lines. To use UART1, define `USE_BT_UART` in the file `\phonex\bsp\vxWorks\common\sysSerial.c`.

On the BCM91101 platform, UART1 shares its pins with the display, the application no longer detects the display when UART1 is enabled. Therefore, you must disable the display driver when using UART1. To disable the display driver, change the `IPPPLAT_DIS` constant value in the file `\phonex\build\config\<config profile>\ippplat.h` from `IPPPLAT_BCM9110x` to `IPPPLAT_NULL`.

To initialize UART1, use `open()` function to enable the port in the driver.

```
#define UART1_DEV     /tyCo/1
int    consoleFd;       /* fd of initial console device */

consoleFd = open (UART1_DEV, O_RDWR, 0);
```

Once opened, use `ioctl()` to set the baud rate, mode. UART options include word length, stop bit, and parity. Below are the default UART options that are used.

- Baudrate: 115200
- Mode: interrupt mode (BCM_UART_MODE_INT)
- Word length: 8
- Stop bit: 1
- Parity: 0

Below is an example of how you can configure UART1 with the above options.

```
(void) ioctl (consoleFd, FIOBAUDRATE, 115200);
(void) ioctl (consoleFd, FIOSETOPTIONS,
       OPT_ECHO | OPT_CRMOD | OPT_TANDEM | OPT_7_BIT);
```

To write data to UART1, you can call the function below.

```
write(consoleFd, &key, 1);
```

To read data from UART1 by polling the port, you can call the function below.

```
read(consoleFd, &key, 1);
```

ADDING SERIAL PORTS

Q: How do I support more than two serial ports?

A: This requires setting up an additional serial device driver for the additional port. Instructions on how to set up an additional device are located in the “Serial Drivers” section of the *VxWorks 5.5 BSP Developer's Guide*. You can use the implementation of the device driver for UART1 as a reference design. The UART1 device is implemented in the `\phonex\bsp\vxWorks\common\bcm110xSio.c`.

USING THE SPI TO READ AND WRITE

Q: How can I use the SPI to read and write to a peripheral module?

A: The following is a sample code for opening an SPI interface:

```
static int spiFd;
spiFd = open( /spi0, 0, 0 );

if( spiFd < 0 )
{
   printf( "ERROR (%i)\n", errno );
}
// Setup the Clk Rate
if( ioctl( spiFd, SPI_IOCTL_CLK_SET, (int) SPI_CLK_03125_KHZ ) != 0 )
{
   printf( "ERROR \n" );
}

// Setup IRQ on the SPI Interface
if( ioctl( spiFd, SPI_IOCTL_IRQ_MODE_SET, 1 ) != 0 )
{
   printf( "ERROR \n");
}

if( ioctl( spiFd, SPI_IOCTL_INIT, 0 ) != 0 )
{
   printf( "ERROR \n");
}


if( ioctl( spiFd, SPI_IOCTL_START_SET, 1 ) != 0 )
{
   printf( "ERROR \n" );
}
```

You can then write to the SPI device directly with the write() function.

```
static XDRV_UINT16 spiTxData[4] =
{
   0xbabe,
   0x0001,
   0x0002,
   0x0003
};

write( spiFd, (void *) &(spiTxData[spiIdx]), 4);
```

You can read from the SPI device directly with the read() function.

```
static XDRV_UINT16 spiRxData[4];
read( spiFd, (void *) &(spiTxData[0]), 4);
```

STATUS OF THE HSS

Q: Is there a status register that shows whether the RxClk of HSS interface is active?

A: There is no register that is dedicated to the RxClk status. However, you can obtain some information on the HSS mode through bits [31:29] of the HSS Control register. You can then deduce the clock behavior from the HSS Serial Port Mode information.

For more information on the HSS Serial Port, refer to the following data sheets:

- BCM1101 chip: Section 13 of the *BCM1100/BCM1101/BCM1113 Ethernet IP Phone Chips Data Sheet*
- BCM1103/BCM1104 chips: Section 17 of the *BCM1103 Gigabit IP Phone Chip Data Sheet.*
- BCM1190 chips: Section 10 of the *BCM1190 VoIP Phone Chip Data Sheet*

DETERMINING HSS CONNECTIONS

Q: How can I determine whether the HSS is attached to an external device?

A: The HSS port does not change its mode when connected to an external device.

EXTERNAL INTERRUPTS

Q: How can I set up an external interrupt?

A: You need to set the interrupt service routine (ISR) and the IRQ triggering event before you can enable the external interrupt. For example, you can set up an external interrupt using `IRQ_EXT3` as shown below.

First, you need to set the interrupt service routine. Below is the function structure of the ISR.

```
typedef void (*INTC_ISRP)( int arg0, int arg1, int arg2 );
```

Below is the prototype that is used to set up the ISR for the external interrupt.

```
int intcIsrSet( INTC_IRQ irq,  /* The IRQ number */
                INTC_ISRP isr, /* Pointer to the Interrupt service routine */
                int arg0, int arg1, int arg2
                              /* The arguments to be passed to the ISR, which is called
                                   when the interrupt starts */
              );
```

Assuming that testIsr3 has been defined as the ISR below, you can setup the ISR for `IRQ_EXT3`.

```
intcIsrSet( INTC_IRQ_EXT3, (INTC_ISRP)testIsr3, 0, 0, 0 );
```

You can also set the triggering event with the following function:

```
int intcIrqTrigSet( INTC_IRQ irq, INTC_TRIG trig );
```

You can then configure the interrupt trigger with one of the below settings.

```
typedef enum
{
   INTC_TRIG_EDGE_BOTH = 0,   /**< Both rising and falling edges */
   INTC_TRIG_EDGE_RISE,       /**< Rising edge only */
   INTC_TRIG_EDGE_FALL,       /**< Falling edge only */
   INTC_TRIG_LEVEL_HIGH,      /**< High level */
   INTC_TRIG_LEVEL_LOW        /**< Low level */
} INTC_TRIG;
```

Below is an example of how you can setup `INTC_IRQ_EXT3` to rising edge trigger only.

```
   intcIrqTrigSet(INTC_IRQ_EXT3, INTC_TRIG_EDGE_RISE );
```

Finally, you can enable the interrupt with the function below.

```
   extern int intcIrqEnable( INTC_IRQ irq );
```

Below is an example of how you can enable `INTC_IRQ_EXT3`.

```
   intcIrqEnable(INTC_IRQ_EXT3);
```

You can also disable the IRQ with the function: `int intcIrqDisable( INTC_IRQ irq )`.

Assuming that testIsr3 has been defined as the ISR below, you can setup the ISR for IRQ_EXT3.

```
intcIsrSet( INTC_IRQ_EXT3, (INTC_ISRP)testIsr3, 0, 0, 0 );
```

You can also set the triggering event with the following function:

```
int intcIrqTrigSet( INTC_IRQ irq, INTC_TRIG trig );
```

You can then configure the interrupt trigger with one of the below settings.

```
typedef enum
{
   INTC_TRIG_EDGE_BOTH = 0,   /**< Both rising and falling edges */
   INTC_TRIG_EDGE_RISE,       /**< Rising edge only */
   INTC_TRIG_EDGE_FALL,       /**< Falling edge only */
   INTC_TRIG_LEVEL_HIGH,      /**< High level */
   INTC_TRIG_LEVEL_LOW        /**< Low level */
} INTC_TRIG;
```

Below is an example of how you can setup INTC_IRQ_EXT3 to rising edge trigger only.

```
   intcIrqTrigSet(INTC_IRQ_EXT3, INTC_TRIG_EDGE_RISE );
```

Finally, you can enable the interrupt with the function below.

```
   extern int intcIrqEnable( INTC_IRQ irq );
```

Below is an example of how you can enable INTC_IRQ_EXT3.

```
   intcIrqEnable(INTC_IRQ_EXT3);
```

You can also disable the IRQ with the function: `int intcIrqDisable( INTC_IRQ irq )`.

DETECTING CHIP REVISION

Q: How can I identify the chip revision that I am using?

A: You can identify the chip revision by calling the function `chipCpuRevGet()` in the VxWorks Shell.

MODIFYING THE SIZE AND NUMBER OF BRCM BUFFERS

Q: How can I modify the size of the BRCM buffers?

A: First, the buffer management module must be initialized by the root application (the protocol-specific Call Client) prior to starting the other software modules. Initialization is done in the function `bmMgrInit()`. The function creates two buffer pools: one containing large-sized buffers and one containing small-sized buffers. The size of each pool and the number of buffers each pool contains can be compile-time configured in `\phonex\util\inc\bmmgr.h`, as shown below. The size and number of the large-sized buffers are defined as follows.

```
   #define BMLGPSIZE 512   /* in number of words */
   #define BMLGPNUM 40
```

The size and number of the small-sized buffers are defined as follows:

```
   #define BMSMPSIZE 32    /* in number of words */
   #define BMSMPNUM 100
```

For more information, refer to the section “Host Software Modules - Buffer Management” in the *PhonexChange Software Development Guide.*

WATCHDOG TIMER

Q: How do I use the watchdog timer for my application?

A: Broadcom uses the VxWorks API for the watchdog timer. The following function is an example on how to enable the watchdog timer.

```
/* OS specific includes */
#include <iosLib.h>
#include <stdio.h>

/* Driver specific includes */
#include <wd.h>
#include <drvFs.h>

/* Watchdog driver handle */
int wdHandle;

/* Watchdog defines */
#define WD_DEV          DRV_FS_PATH_WD /* watchdog device */
#define WD_TIMEOUT              10000 /* Watchdog timeout */
#define WD_CONTROL_REG      0xBAFE0220 /* Address of Watchdog control register */
#define WD_CONTROL_ENABLE_CMD1  0xFF00 /* Enable Cmd 1 */
#define WD_CONTROL_ENABLE_CMD2  0x00FF /* Enable Cmd 2 */


/* Watchdog callbacks */
int testWdCallbackPass( void );
int testWdCallbackFail( void );


/* Tests watchdog */
void testWd( int wd )
{
   int fd;
   char device_name[16];
   int status;

   sprintf(device_name, WD_DEV"%d",wd);

   /* Open watchdog device
   */
   printf( "Opening %s ... ", device_name );

   fd = open( device_name, O_RDONLY, 0 );

   if( fd > 0 )
{
      printf( "OK\n" );
      wdHandle = fd;
   }
   else
   {
```

```
 printf( "ERROR (%i)\n", errno );
      return;
   }
   /* Set watchdog timeout */
   status = ioctl( wdHandle, WD_IOCTL_TIMEOUT_SET, WD_TIMEOUT );

   printf( "IOctl WD_IOCTL_TIMEOUT_SET %d ... ", WD_TIMEOUT );

   if( status == 0 )
   {
      printf( "OK\n" );
   }
   else
   {
      printf( "ERROR (%i)\n", errno );
   }

   /* Set watchdog callback */
   status = ioctl( wdHandle, WD_IOCTL_CALLBACK_SET, (int)testWdCallbackPass );

   printf( "IOctl WD_IOCTL_CALLBACK_SET ... " );

   if( status == 0 )
   {
      printf( "OK\n" );
   }
   else
   {
      printf( "ERROR (%i)\n", errno );
   }

   /* Enable watchdog */
   {
      volatile int *WdControl = (volatile int *)WD_CONTROL_REG;
      *WdControl = WD_CONTROL_ENABLE_CMD1;
      *WdControl = WD_CONTROL_ENABLE_CMD2;
   }
}
/* Callback that returns 1, preventing the watchdog from resetting */
int testWdCallbackPass( void )
{
   printf( "testWdCallbackPass...\n" );

/*   testWdClose( 0 ); */

   return( 1 );
}
/* Callback that returns 0, causing a watchdog reset */
int testWdCallbackFail( void )
{
   printf( "testWdCallbackFail...\n" );

/*   testWdClose( 0 ); */

   return( 0 );
```

```
}
/* Disables watchdog */
int testWdDisable( void )
{
   ioctl( wdHandle, WD_IOCTL_DISABLE, 0 );

   return( 0 );
}
```

To use the code:

1. Call testWd() in the VxWorks shell.
   - The printfs from testWdCallbackPass() should be printed every 5 seconds, as that is the halfway point of the watchdog interval.
2. Call testWdDisable() to disable the watchdog.
   - The printfs should stop.

If desired, the callback configured in the call to WD_IOCTL_CALLBACK_SET can be changed to testWdCallbackFail(). In this case, the watchdog reset should kick in after 10 seconds.

PERIPHERAL TIMER

Q: How can I use the peripheral timer in my application?

A: An API for the general timer is included in the standard PhonexChange software. Below is example code that illustrates how you can use the peripheral timer:

The following code is required for the subsequent timer commands.

```
#include <tmr.h>
#define TMR_DEV   /tmr

int tmrHandles[4];

void testTmrCallback( int interval, int count )
{
   (void)interval;
   (void)count;
   printf("testTmrCallback %d, %d \n",interval,count);
}
```

The following function is an example on how to initialize and set up a peripheral timer:

```
void testTmrSet( int tmr, int usec )
{
   int fd;
   char device_name[10];
   int status;

   sprintf(device_name, "TMR_DEV%d",tmr);
   /* Open timer device */
   printf( "Opening %s ... ", device_name );
   fd = open( device_name, O_RDONLY, 0 );
   if( fd > 0 )
   {
      printf( "OK\n" );
      tmrHandles[tmr] = fd;
   }
   else
   {
      printf( "ERROR (%i)\n", errno );
      return;
   }

   status = ioctl( tmrHandles[tmr], TMR_IOCTL_INTERVAL_SET, usec );
   printf( "IOctl TMR_IOCTL_INTERVAL_SET %d ..." , usec );
   if( status == 0 )
   {
      printf( "OK\n" );
   }
   else
```

```
    {
       printf( "ERROR (%i)\n", errno );
    }

    status = ioctl( tmrHandles[tmr], TMR_IOCTL_CALLBACK_SET, (int)testTmrCallback );
    printf( "IOctl TMR_IOCTL_CALLBACK_SET ..." );
    if( status == 0 )
    {
       printf( "OK\n" );
    }
    else
    {
       printf( "ERROR (%i)\n", errno );
    }

    status = ioctl( tmrHandles[tmr], TMR_IOCTL_MODE_SET, TMR_MODE_PERIODIC );
    printf( "IOctl TMR_IOCTL_MODE_SET TMR_MODE_PERIODIC ..." );
    if( status == 0 )
    {
       printf( "OK\n" );
    }
    else
    {
       printf( "ERROR (%i)\n", errno );
    }

    status = ioctl( tmrHandles[tmr], TMR_IOCTL_STATE_SET, TMR_STATE_ENABLED );
    printf( "IOctl TMR_IOCTL_STATE_SET DRV_STATE_ENABLE ..." );
    if( status == 0 )
    {
       printf( "OK\n" );
    }
    else
    {
       printf( "ERROR (%i)\n", errno );
    }
}
```

The following function is an example on how to start the general timer.

```
void testTmrStart( int tmr )
{
   int status;

   if ( tmrHandles[tmr] )
   {
      printf( "Starting %d ..." , tmrHandles[tmr] );
      status = ioctl( tmrHandles[tmr], TMR_IOCTL_STATE_SET, TMR_STATE_ENABLED );
      if( status == 0 )
      {
         printf( "OK\n" );
      }
      else
      {
         printf( "ERROR (%i)\n", errno );
      }
   }
   else
   {
      printf("Handle for %d not opened\n",tmr);
   }
}
```

The following function is an example on how to stop the general timer.

```
void testTmrStop( int tmr )
{
   int status;

   if ( tmrHandles[tmr] )
   {
      printf( "Stopping %d ..." , tmrHandles[tmr] );
      status = ioctl( tmrHandles[tmr], TMR_IOCTL_STATE_SET, TMR_STATE_DISABLED );
      if( status == 0 )
      {
         printf( "OK\n" );
      }
      else
      {
         printf( "ERROR (%i)\n", errno );
      }
   }
   else
   {
      printf("Handle for %d not opened\n",tmr);
   }

}
```

The following function illustrates how to get the miscellaneous options of a timer.

```
void testTmrGet( int tmr )
{
   int status;
   int val;

   if ( tmrHandles[tmr] )
   {
      status = ioctl( tmrHandles[tmr], TMR_IOCTL_CALLBACK_GET,  (int)&val);
      if( status == 0 )
      {
         printf( "Got callback %x ... \n" , val );
      }
      else
      {
         printf( "TMR_IOCTL_CALLBACK_GET ERROR (%i)\n", errno );
      }

      status = ioctl( tmrHandles[tmr], TMR_IOCTL_INTERVAL_GET,  (int)&val);
      if( status == 0 )
      {
         printf( "Got interval %d ... \n" , val );
      }
      else
      {
         printf( "TMR_IOCTL_INTERVAL_GET ERROR (%i)\n", errno );
      }

      status = ioctl( tmrHandles[tmr], TMR_IOCTL_STATE_GET,  (int)&val);
      if( status == 0 )
      {
         printf( "Got state %d ... \n" , val );
      }
      else
      {
         printf( "TMR_IOCTL_STATE_GET ERROR (%i)\n", errno );
      }

      status = ioctl( tmrHandles[tmr], TMR_IOCTL_MODE_GET,  (int)&val);
      if( status == 0 )
      {
         printf( "Got mode %d ... \n" , val );
      }
      else
      {
         printf( "TMR_IOCTL_MODE_GET ERROR (%i)\n", errno );
      }

   }
```

```
else
   {
      printf("Handle for %d not opened\n",tmr);
   }
}
```

The following function illustrates how to read the time that remains in a timer.

```
void testTmrRead( int tmr )
{
   int status;
   int buffer[1];

   if ( tmrHandles[tmr] )
   {
      status = read( tmrHandles[tmr], (char*)buffer, 4 );
      printf( "Reading %d: %d usec remaining..." , tmr, buffer[0] );
      if( status == 4 )
      {
         printf( "OK\n" );
      }
      else
      {
         printf( "ERROR (%i)\n", errno );
      }
   }
   else
   {
      printf("Handle for %d not opened\n",tmr);
   }
}
```

TESTING THE USB

Q: How can I test the USB?

A: USB test code is included with VxWorks. VxWorks has a command line utility, usbTool, that can be used to exercise the USB stack. You need to make some changes to the code to enable USB and usbTool. Below are the required changes.

In the \phonex\bsp\vxWorks\<BSP Profile>\config.h file, you will need to make the following changes:

- Change the line `#if FALSE /* set TRUE to include USB support */` to `#if 1`
- Change the line `#undef INCLUDE_USBTOOL` to `#define INCLUDE_USBTOOL`

You can find more details on the above changes in the comment block, which contains the title: `/* USB Host Components */` in `config.h`.

After you make the above changes, rebuild your application. Then, you can test USB by calling the following commands from the VxWorks shell:

1. `usbTool` to enter the tool shell
2. `usbInit` to initialize the USB
3. attach ohci to initialize an OCHI controller
4. `usbEnum` to see what devices are detected. If you have a hub attached, you should see this along with other devices that may be attached to the hub.

These commands provide a good indication of whether your USB is working.

Detailed information about the USB tool can be found in the *Wind River USB for VxWorks 6 Programmer's Guide 2.3* (wr_usb_vxworks_6_programmers_guide_2.3.pdf), available on the Wind River website.

Note: `mouseTest` can be used to verify movement and button states, but this test hangs upon exit. We have notified Wind River about the issue.

Note: The stack objects to USB 1.1 devices that identify themselves using an encoding of 0x0101 for the revision. Most devices use the encoding 0x0110. The USB 1.1 spec can be misinterpreted on this subject; however, it is made clear in 2.0. We have notified WR about this issue as well.

SERIAL PORT TROUBLESHOOTING

Q: I do not detect anything from the serial port after reset. Why?

A: There are several possible reasons that cause the serial port not to work. Below are some of the common reasons:

- Incorrect terminal port settings. Below are the correct settings that should be configured in the Terminal Port
  - 115200 baud rate
  - 8 bit data
  - No parity
  - 1 stop bit
  - No flow control
- The serial port is connected to a null-modem type cable. Make sure that you do not connect to a null-modem type cable.

LCD ATTRIBUTES

Q: How do I add LCD attributes?

A: Refer to "Port and Bring Up the Broadcom Test Application (apptest) - Set Up the Display" in the *PhonexChange Porting Guide*.

KEYBOARD MAPPING

Q: How do I modify keyboard mapping?

A: The hardware-specific files are located in the `\phonex\bsp\bcm\bcmBoard\<BSP profile>\` directory. Keyboard mapping is defined in the `bcmBoard_key.c` file.

Refer to "Port and Bring Up the Broadcom Test Application (apptest) - Set Up the Keypad" in the *PhonexChange Porting Guide*.

KEYPAD MULTI-KEY FILTERING

The APIs mentioned in this section can be found in the Keyboard module, `\phonex\mcu\kbd\`, defined in `\phonex\mcu\inc\kbd.h`.

Q: How does the multi-key filter work?

A: The Keyboard (KBD) module uses the multi-key filter to determine if key presses and releases should be sent to the Call Client.

The current Keyboard multi-key filter feature has three possible settings:

1. Custom multi-key filter
2. Broadcom default multi-key filter
3. Disable the multi-key filter

Q: How do I setup a custom multi-key filter?

A: Use `kbdKeyFilterCBSet( )` to set the custom multi-key filter callback function.

Setting the filter should only be done after the keypad service, `kbdStartup( )`, has been invoked.

The custom callback function has to be of the following form as defined in `\phonex\mcu\inc\kbd.h`:

```
/*********************************************************************
** FUNCTION:   (*KBDKEYFILTERFUNC)
** PURPOSE:    Callback function provided by client for filtering of
**             keypad input.  When invoked by KBD, the callback
**             function determines if keypad event should be sent to
**             the Call Client application.
**
** PARAMETERS:
**    key      - [IN] key index
**    event    - [IN] key event
**    downTime - [IN] key press down time (0, for key down event)
**
** RETURNS:    TRUE  - Send keypad event to client application
**             FALSE - Ignore and keypad event NOT sent
**
** NOTE:       KBD determines sending of events for current keypad activities
**             by checking the return value from the key filtering callback
**             function.
**
*********************************************************************/
typedef BOOL ( *KBDKEYFILTERCBP )( int key, int event, BOS_TIME_MS downTime );
```

Q: How do I enable custom multi-key filtering?

A: To enable custom multi-key filter, use `kbdSetKeyFilter( KBD_FILTER_USER )`. Note that no multi-key filter will be used (same as disabled multi-key filter) when custom multi-key filtering is enabled and no custom multi-key filter has been set.

Q: How do I enable Broadcom default multi-key filtering?

A: To enable Broadcom default multi-key filter, use `kbdSetKeyFilter( KBD_FILTER_ENABLED_DFLT )`.

Q: How do I disable multi-key filtering?

A: To disable multi-key filtering, use `kbdSetKeyFilter( KBD_FILTER_DISABLE )`.

Q: What is the behavior for the Broadcom default multi-key filter?

A: The Broadcom default multi-key filter has the following behavior:

- Hold down key 1, release key 1
  - Key down is registered as soon as key 1 is depressed
  - Key 1 up is registered as soon as key 1 is released
- Press and hold key 1, press and hold key 2, release key 2, release key 1
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 2 up\down is never registered
  - Key 1 up is registered as soon as key 1 is released
- Press and hold key 1, press and hold key 2, release key 1, release key 2
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 1 up is registered when key 1 is released
  - Key 2 down is registered when key 1 is released
  - Key 2 up is registered when key 2 is released
- Press and hold key 1, press and hold key 2, press and hold key 3, release key 1, release key 2, release key 3
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 1 up is registered only when key 2 is released
  - Key 3 down is registered only when key 2 is released
  - Key 2 up\down is never registered

Q: What is the behavior when there is no multi-key filter?

A: If there is no multi-key filter or when multi-key filtering is disabled, the KBD module will report detected key events to the Call Client immediately without any filter processing.

Examples:

- Hold down key 1, release key 1
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 1 up is registered as soon as key 1 is released
- Press and hold key 1, press and hold key 2, release key 2, release key 1
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 2 down is registered as soon as key 2 is depressed
  - Key 2 up is registered as soon as key 2 is released
  - Key 1 up is registered as soon as key 1 is released
- Press and hold key 1, press and hold key 2, release key 1, release key 2
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 2 down is registered as soon as key 2 is depressed
  - Key 1 up is registered as soon as key 1 is released
  - Key 2 up is registered as soon as key 2 is released
- Press and hold key 1, press and hold key 2, press and hold key 3, release key 1, release key 2, release key 3
  - Key 1 down is registered as soon as key 1 is depressed
  - Key 2 down is registered as soon as key 2 is depressed
  - Key 3 down is registered as soon as key 3 is depressed
  - Key 1 up is registered as soon as key 1 is released
  - Key 2 up is registered as soon as key 2 is released
  - Key 3 up is registered as soon as key 3 is released

KEYSCAN PRESCALE VALUES

Q: When programming the keyscan prescale value to 25 kHz, we saw that the chip samples each row at approximately 2.7 kHz. Why?

A: The prescale register sets the frequency of the row sampling (i.e., how frequent all Keyout[8:0] values are changed). The keypad scan frequency is defined as follows:

```
Keypad scan frequency = rowScan / rows
```

In other words, with the prescale setting of 25 kHz, we would expect the frequency with which we cycle through all the rows to be 25 kHz. Because an individual row is only sampled every 9 times, the keypad scan frequency for each row is nine times less than the pre-scale frequency (approximately 2.7 kHz).

EXTERNAL LEDS

Q: How do I interface to an external LED?

A: Refer to "Port and Bring Up the Broadcom Test Application (apptest) - Set Up the LEDs" in the *PhonexChange Porting Guide*.

PERIPHERAL SUPPORT ON EBI BUS

Q: How do I support extra peripherals on the EBI bus?

A: The purpose of the EBI bus is to support the connection of external SRAMs, flash memories, and EPROMs, and to interface with additional external peripherals.

For the BCM1101 device family, see the “External Bus Interface” section in the *BCM1100/BCM1101/BCM1113 Ethernet IP Phone Chips Data Sheet*. This contains detailed information on how the EBI bus works, including bus signal descriptions and timing diagrams.

For the BCM1103 family, the EBI is part of the Multi-Peripheral Interface (MPI). Some changes have been made to the EBI. For more information, refer to the “EBI” section and the “EBI Mode Operation” section in the *BCM1103 Gigabit IP Phone Chip Data Sheet.*

The BCM1190 family does not support EBI or MPI.

MIPS VIRTUAL ADDRESSES

Q: How do the MPI/EBI base address/size settings map the MIPS virtual addresses through to the EBI actual address lines and chip selects?

A: The EBI base address/size settings determine the chip select and the address mask. Depending on the specified size, the number of address bits are masked with the specified base field. For example, if you define the size to 0xA (which corresponds to 8 MB) and base address to 0xBFC00000, the address bits A[31:23] will be [1011 1111 1]. Even though the bit 22 (or the 23rd bit) is set in the base address field, it will be ignored. The bit 22 does not have to be set, because MIPS behaves identically, whether set or not.

PROTOCOL

DYNAMIC HOST CONFIGURATION PROTOCOL

Q: What is DHCP?

A: The purpose of the Dynamic Host Configuration Protocol (DHCP) is to enable each computer on an IP network to extract its configuration from a DHCP server. The server has no exact information about individual computers until each computer sends a configuration request. Ultimately, DHCP reduces the work required to administer a larger IP network. For reference, see the following two DHCP resources:

http://www.dhcp.org
and
DHCP FAQ:
http://www.dhcp-handbook.com/dhcp_faq.html

REQUESTING DHCP INFORMATION

Q: How do I request more information from the DHCP server on top of the standard options?

A: To request more information from the DHCP server, you must add entries to the DHCP table. The table contains mapping between the DHCP options and the corresponding provisioning item IDs. By default, the following options are defined in `\phonex\mcu\provis\provisDhcp.c`:

```
static PROVIS_DHCP_MAPPING_T ProvisDhcpMappingTable[] = {
    /* DhcpOptionNumber, dataID */
     { 1,                 PROVIS_BASICIP_SUBMASK },
     { 3,                 PROVIS_BASICIP_DEFRTR },
     { 66,                PROVIS_EXTTFTP_ADDR }
};
```

ENABLING DHCP

Q: How do I enable DHCP and how do I know DHCP is used?

A: To enable DHCP, you have to connect the IP phone to a LAN with an enabled DHCP server. You then need to run an application such SIP or H323 on the IP phone, and initialize the phone's IP to 0.0.0.0. During the IP phone's startup, it automatically attempts to locate the DHCP server to obtain its IP and other information.

You can sniff packets to verify whether DHCP packets are sent to the network. If DHCP is set up successfully, you should be able to see the DHCP Discover, Offer, Request, and ACK packets.

DNS PHONEXCHANGE SUPPORT

Q: Is DNS client supported in PhonexChange?

A: Yes, DNS client is supported in PhonexChange software.

ENABLING IGMP

Q: How can I enable IGMP?

A: By default, IGMP is enabled.

IGMP is enabled by defining the symbolic constant `INCLUDE_IGMP` in `\phonex\bsp\vxWorks\<BSP Profile>\config.h` file. The following line defines the symbolic constant.

```
#define INCLUDE_IPMCP_USE_IGMP /* include igmp code */
```

UDPSEND ERRORS

Q: Why do I see ERROR udpSend messages?

A: The error message is one of the error messages displayed for network related errors. You should be able to see an error code in this error log as well. The following is a typical error message:

```
ERROR udpSend: errno: 0x43
```

These error codes are defined in the `$WIND_BASE\target\h\errno.h` file. The following table shows error codes and descriptions.

Table 7: List of Wind River Network-Related Error Codes

Error	*ERR Code (decimal)*	*Description*
Argument Error		
EDESTADDRREQ	40	Destination address required. Additional Description: No default destination address was set for the socket. This occurs when you try to transmit data over a connectionless socket, without first specifying a destination for the data.
EPROTOTYPE	41	Protocol wrong type for socket. The socket type does not support the requested communications protocol.
ENOPROTOOPT	42	Protocol not available. You specified a socket option that does not translate for the particular protocol being used by the socket. See Socket Options section.
EPROTONOSUPPORT	43	Protocol not supported. The socket domain does not support the requested communications protocol (perhaps because the requested protocol is completely invalid). See Creating a Socket section.
ESOCKTNOSUPPORT	44	The Socket Type is not supported.
EOPNOTSUPP	45	Operation not supported on socket. The operation you requested is not supported. Some socket functions do not make sense for all types of sockets, and others may not be implemented for all communications protocols.
EPFNOSUPPORT	46	Protocol family not supported. The socket communications protocol family you requested is not supported.
EAFNOSUPPORT	47	Address family not supported. The address family specified for a socket is not supported; it is inconsistent with the protocol being used on the socket. See the Sockets section.
EADDRINUSE	48	Address already in use. The requested socket address is already in use. See the Socket Address section.

Table 7: List of Wind River Network-Related Error Codes (Cont.)

Error	*ERR Code (decimal)*	*Description*
EADDRNOTAVAIL	49	Cannot assign requested address. The requested socket address is not available; for example, you attempted to provide a socket name that does not match the local host name. See the Socket Addresses section.
ENOTSOCK	50	Socket operation on non-socket. A file that isn't a socket was specified when a socket is required
Operational Error		
ENETUNREACH	51	Network is unreachable. A socket operation failed because the subnet containing the remote host was unreachable.
ENETRESET	52	Network dropped connection on reset. A network connection was reset because the remote host crashed.
ECONNABORTED	53	Software caused connection abort. A network connection was aborted locally.
ECONNRESET	54	Connection reset by peer. A network connection was closed for reasons outside the control of the local host, such as the remote machine rebooting or an unrecoverable protocol violation.
ENOBUFS	55	No buffer space available. The kernel's buffers for I/O operations are all in use.
EISCONN	56	Socket is already connected. You tried to connect a socket that is already connected. See Making a Connection section.
ENOTCONN	57	Socket is not connected to anything. This error occurs when you attempt to transfer data over a socket, without first specifying a data destination. For a connectionless socket (datagram protocols such as UDP), EDESTADDRREQ occurs instead.
ESHUTDOWN	58	Cannot send after socket shutdown. The socket has already been shut down.
ETOOMANYREFS	59	Too many references: can't splice.
ETIMEDOUT	60	Connection timed out. A socket operation with a specified timeout received no response during the timed-out period.
ECONNREFUSED	61	Connection refused. A remote host refused to allow the network connection (typically because it is not running the requested service).
ENETDOWN	62	Network is down and a socket operation failed as a result.
ETXTBSY	63	Text file busy. An attempt has been made to execute a file that is currently open for writing, or write to a file that is currently being executed. Often, using a debugger to run a program creates a file-open condition, causing an inability to write and an error. (The name stands for text file busy.)
ELOOP	64	Too many levels of symbolic links were encountered in looking up a file name. This often indicates a cycle of symbolic links.
EHOSTUNREACH	65	No route to host. The remote host for a requested network connection is not reachable,
ENOTBLK	66	Block device required. A file that is not a block special file was presented in a situation that requires one. For example, trying to mount an ordinary file as a file system in Unix creates this error.
EHOSTDOWN	67	Host is down. The remote host for a requested network connection is down. The status information received by the client host from the underlying communication services indicates that the net or the remote host is down.

TFTP FAILURE

Q: TFTP failed. Why did that happen?

A: There are several possible causes of TFTP failure. Usually, the configuration of the IP phone is incorrect. Ensure that the following parameters are configured correctly:

- TFTP server (i.e,. The directory is pointing at the right folder.)
- Host IP address

For more information on how to start up the Broadcom reference design platform, refer to "Loading and Running Code (Without Tornado)" section in the *PhonexChange Software Development Guide*.

Note: If using the Broadcom boot, once the host IP address is changed, enter bootsave to save the changes and reset the phone.

UDP SOCKETS

Q: How do I increase the number of UDP sockets that can be opened simultaneously in VxWorks?

A: To increase the number of UDP sockets that can be opened simultaneously in VxWorks, increase the maximum number of file descriptors. By default, the maximum number of file descriptors allowed is 50. To increase the default value, insert the following two lines in `\phonex\bsp\vxWorks\<BSP Profile>\config.h`. For example, if you want to allow 60 file descriptors simultaneously:

```
#undef NUM_FILES
#define NUM_FILES 60
```

RESETTING AND BOOT

BOOT SEQUENCE OF PHONEXCHANGE

Q: What is the boot sequence of PhonexChange on a MIPS32 CPU?

A: Refer to the Boot Overview section - Boot Initialization in the *PhonexChange VxWorks Board Support Package Technical Reference Manual.*

BOOT SEQUENCE OF ZSP SOFTWARE

Q: What is the boot sequence of the ZSP software?

A: The boot sequence is identical for all phones. Refer to the PhonexChange System Overview - ZSP Startup Procedure" section in the *PhonexChange Software Development Guide*.

PC TRAFFIC DISRUPTION

Q: The Ethernet traffic between the PC and LAN is disrupted for 7-10 seconds when the IP phone performs a hard reset or a watchdog reset. Is there any way to reduce this disruption period?

A: Since the Ethernet Port is initialized in the application code, the 7-10 seconds disruption is actually the time required for starting the application. This delay includes the time required for powering and booting up the device and decompressing the application image file.

We can reduce this disruption time to 2-3 seconds by initializing the Ethernet port in the boot.

To initialize the Ethernet Port in the boot, the following code must be added to the file:

```
\phonex\bsp\vxWorks\common\romInit_1101.s for the BCM91101 phone,
\phonex\bsp\vxWorks\common\romInit_1103.s for all BCM91103xx or BCM91104xx phones,
\phonex\bsp\vxWorks\common\romInit_1190.s for all BCM91190xx phones
```

Q: Is the Ethernet traffic between the PC and LAN affected when the IP phone performs a soft reset?

A: PC traffic is not affected by a soft reset on all platforms except for 1190. BCM1103/BCM1104 has a SoftReset register that allows the user to reset the chip without resetting the Ethernet Switch. Refer to the "SoftReset" register in the "Chip Control Block" section of the *BCM1103 Gigabit IP Phone Chip Data Sheet* for more details on this feature. This SoftReset register is not available on the BCM1101.

Soft reset on this chip is done in the software. The system will gracefully shut down the APM and Ethernet DMAs before restarting the boot code. Note that shutting down the Ethernet DMAs does not affect traffic between the PC and LAN port. The Ethernet DMAs only affect Ethernet traffic to the MIPS core. BCM1190 has a software switch in the MIPS core. Since a soft reset will reset the MIPS core, traffic will be interrupted. However, the Ethernet link on 1190 will not be affected by soft reset.

SOFT RESETS

Q: How can I perform a soft reset?

A: A soft reset has been implemented in the release for all platforms. Use the `reboot()` function provided by VxWorks to issue a soft reset. See the function `sysSoftReset()` in `\phonex\bsp\vxWorks\common\sysLib.c` for details.

BCM1103/BCM1104 Devices:

BCM1103 and BCM1104 devices support a soft reset feature that resets all blocks except for SDRAM controller, AltExcCtrl register in peripheral block, and Ethernet switch.

BCM1101 Devices:

Soft reset on the BCM1101 device is done through software. The system will gracefully shut down the APM and Ethernet DMAs before restarting the boot code. Note that shutting down the Ethernet DMAs do not affect traffic between the PC and LAN port.

BCM1190 Devices:

When the BCM1190 is soft reset, the Ethernet link state will remain unchanged; however, Ethernet traffic through the software switch will be interrupted.

BOOT LINE FLAGS

Q: Where can I find the definitions of the boot line flags?

A: The boot line flags or system configuration flags are defined in `$(WIND_BASE)\target\h\sysLib.h`.

TOOLS

PHONEXCHANGE 2.X BOOT IMAGE

Q: I am using the PhonexChange 2.x boot image. How do I upgrade the boot image?

A: For the 91103 phone, you need to reload the image via the WRS VisionProbe/VisionICE/VisionClick or UART0 Loader. Refer to the corresponding procedures in the "Loading and Running Code (Without Tornado)" section of the *PhonexChange Software Development Guide.*

For the 91101 phone, you need to upgrade the image through Corelis ScanICE or WRS VisionProbe/VisionICE/ VisionClick JTAGs. Refer to the "Loading and Running Code (Without Tornado) - Loading and Running Boot Code Via VisionClick" and "VisionProbe" section in *PhonexChange Software Development Guide.*

Note: If the phone has an existing PhonexChange boot image version earlier than PhonexChange 3.4, the flash on the phone must be erased prior to loading with the latest boot image.

UPGRADING BOOT CODE USING WRS VISIONPROBE/VISIONICE/VISIONCLICK

Q: How can I upgrade boot code using WRS VisionProbe/VisionICE/VisionClick?

A: Follow the procedures in "Loading and Running Boot Code via VisionClick and Vision Probe" under the "Loading and Running Code (Without Tornado)" section in the *PhonexChange Software Development Guide.*

Note: There is a known problem with VisionProbe. If you are using VisionProbe for the first time, you need to load the register set to the VisionProbe by doing the following:

1. Open the active project by selecting **Open Project Files** from the **File** menu.
2. Right-click **Emulator Register Configuration File**, and select **Load Registers Configuration**.
3. Click **No** when a window appears pointing to the path for the register file.
4. Repeat steps 2--3 three times.

Note: Hardware connections for VisionProbe and VisionICE is different, refer to the Wind River documentation.

MODIFYING THE WRS REGISTER FILE

Q: How can I modify the register file for WRS VisionProbe/VisionICE/VisionClick?

A: An example register file is included in the official release of PhonexChange Software. The `*.reg` file for each profile can be found under its corresponding folder in the `\phonex\bsp\vxWorks\` directory. You should change this file only when you are using a different SDRAM.

Refer to the listed documents for information on how the registers should be set for your hardware on each of the following chipsets.

- BCM1101 family: Section 11 of the *BCM1100/BCM1101/BCM1113 Ethernet IP Phone Chips Data Sheet*
- BCM1103/BCM1104 devices: Section 6 of the *BCM1103 Gigabit IP Phone Chip Data Sheet*
- BCM1190 devices: Section 6 of the *BCM1190 VoIP Phone Chip Data Sheet*

The following code is a sample register file (BCM9110x.reg) (very similar to the file included in the PhonexChange release) for a single 16 MB SDRAM.

Note: Bold lines are different from the file in the official release. These lines are **`MBR, INIT, and MODEREGCMD0.`**

```
REM   ********************************************************
REM   visionPROBE REGISTER CONFIGURATION CAPTURE FILE
REM   Captured On:  08-28-2001 : 19:12:26
REM   from visionPROBE Firmware:  VP1.8F
REM   visionCLICK 7.80A version:  Rev. 7.80A (7.80.0006) Created On: 6/28/01 2:36:34 PM
REM   ComDll version:  6.0C - DRIVERX Created On:  6/29/01 3:28:14 PM
REM   ********************************************************

REM ****************************************
REM CF CONFIGURATION
REM ****************************************
CF TAR                          BCM1100
CF SB                           SB
CF VECTOR                       NORMAL
CF RST                          YES
CF CLK                          16
CF LENDIAN                      NO
CF MODE                         32
CF DLD                          NORMAL
CF DLDHSHG                      NO
CF HRESET                       DISABLE
CF SIDS                         YES
CF WSPACE                       a0000000 ffff
CF STACK                        00000000 ffffffff
CF INVCA                        YES
CF TGTCONS                      BDM
CF TRESET                       ACTIVE
CF TRGIN                        OFF
CF TRGOUTMODE                   OFF
CF TRGOUT                       LEVELHI
CF TCBDR                        9600
CF USEERL                       NO
CF TRPEXP                       YES
CF DRST                         200
CF RPER                         YES
CF RPL                          1
REM ****************************************
REM SC CONFIGURATION
REM ****************************************
SC GRP ERASE
SCGA EBI              EBIBADDR0        FFFE2000  1F00000B EBI
SCGA EBI              EBIBADDR1        FFFE2008  1A000008 EBI
SCGA EBI              EBIBADDR2        FFFE2010  00000000 EBI
SCGA EBI              EBIBADDR3        FFFE2018  00000000 EBI
SCGA EBI              EBIBADDR4        FFFE2020  00000000 EBI
SCGA EBI              EBIBADDR5        FFFE2028  00000000 EBI
SCGA EBI              EBICSCTRL0       FFFE2004  00000019 EBI
SCGA EBI              EBICSCTRL1       FFFE200C  00000019 EBI
SCGA EBI              EBICSCTRL2       FFFE2014  00000000 EBI
SCGA EBI              EBICSCTRL3       FFFE201C  00000000 EBI
SCGA EBI              EBICSCTRL4       FFFE2024  00000000 EBI
SCGA EBI              EBICSCTRL5       FFFE202C  00000000 EBI
SCGA EBI              EBIECR           FFFE2040  08000400 EBI
SCGA EBI              EBIDMACTRL       FFFE2044  00000100 EBI
```

```
SCGA EBI              EBIDMARXADDR     FFFE2048  00000000 EBI
SCGA EBI              EBIDMARXSIZE     FFFE204C  00000000 EBI
SCGA EBI              EBIDMATXADDR     FFFE2050  00000000 EBI
SCGA EBI              EBIDMATXSIZE     FFFE2054  00000000 EBI
SCGA EBI              EBIDMASTATUS     FFFE2058  00000000 EBI
SCGA PER              P_REVID          FFFE0000  110000A0 PER          /r
SCGA PER              P_CHIPCTRL       FFFE0004  0000000F PER
SCGA PER              P_CHIPDIAGCTRL   FFFE0008  70700000 PER
SCGA PER              P_INTMASK        FFFE000C  FFFFFFFF PER
SCGA PER              P_INTSTATUS      FFFE0010  00000000 PER
SCGA PER              P_EXTINTCFG      FFFE0014  000000F0 PER
SCGA PER              P_BRIDGESTATUS   FFFE0100  0000007F PER          /r
SCGA PER              P_BRIDGECTRL     FFFE0104  00000000 PER
SCGA PER              P_POSTRDADDR     FFFE0108  00000000 PER
SCGA PER              P_POSTRDDATA     FFFE010C  00000000 PER
SCGA PER              P_TIMINTSTATUS   FFFE0200  00000000 PER
SCGA PER              P_TIMCTRL0       FFFE0204  00000000 PER
SCGA PER              P_TIMCTRL1       FFFE0208  00000000 PER
SCGA PER              P_TIMCTRL2       FFFE020C  00000000 PER
SCGA PER              P_TIMSTAT0       FFFE0210  00000000 PER
SCGA PER              P_TIMSTAT1       FFFE0214  00000000 PER
SCGA PER              P_TIMSTAT2       FFFE0218  00000000 PER
SCGA PER              P_WDDEFCOUNT     FFFE021C  00000000 PER
SCGA PER              P_WDCTRL         FFFE0220  00000000 PER          /w
SCGA PER              P_WDRESETLEN     FFFE0224  02FFFFFF PER
SCGA PER              P_UART0CTRL      FFFE0300  00E53705 PER
SCGA PER              P_UART0BAUD      FFFE0304  0000000D PER
SCGA PER              P_UART0MISCCTRL  FFFE0308  00004400 PER
SCGA PER              P_UART0EXTINCFG  FFFE030C  00000000 PER
SCGA PER              P_UART0INTMASK   FFFE0310  00000078 PER
SCGA PER              P_UART0FIFO      FFFE0314  0000000D PER
SCGA PER              P_UART1CTRL      FFFE0320  00003704 PER
SCGA PER              P_UART1BAUD      FFFE0324  00000000 PER
SCGA PER              P_UART1MISCCTRL  FFFE0328  00008800 PER
SCGA PER              P_UART1EXTINCFG  FFFE032C  00000000 PER
SCGA PER              P_UART1INTMASK   FFFE0330  00000068 PER
SCGA PER              P_UART1FIFO      FFFE0334  000000BA PER
SCGA PER              P_GPIOCTRL       FFFE0404  00000000 PER
SCGA PER              P_GPIODATA       FFFE0408  0002C018 PER
SCGA PER              P_UARTPINCTRL    FFFE040C  00000000 PER
SCGA SDRAM            MBR              FFFE230C  00000002 SDRAM        /wo /w
SCGA SDRAM            CFG              FFFE2304  00000000 SDRAM        /wo /w
SCGA SDRAM            INIT             FFFE2300  0000082A SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD0   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD1   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD2   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD3   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD4   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD5   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD6   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            CBRREFRESHCMD7   FFFE2300  00000009 SDRAM        /wo /w
SCGA SDRAM            MODEREGCMD0      FFFE2300  0000041C SDRAM        /wo /w
```

```
SCGA SDRAM             CSEL_PARK        FFFE2308  00008040 SDRAM            /wo /w
SCGA SDRAM            DUMWR0           A0000000  AA55CC33 SDRAM           /wo /lendian
/r_endian /w
SCGA SDRAM            DUMWR1           A0000004  00000000 SDRAM           /wo /lendian
/r_endian /w
SCGA SDRAM             MODEREGCMD1      FFFE2300  0000082C SDRAM            /wo /w
REM ****************************************
REM CF GROUP CONFIGURATION
REM ****************************************
CF GRP                  EBI ENABLED
CF GRP                  PER ENABLED
CF GRP                  SDRAM ENABLED
REM ****************************************
REM TF CONFIGURATION
REM ****************************************
tf conf NONE A0000000 0 FFFFFFFF
```

UPGRADING BOOT CODE USING CORELIS-SCANICE

Q: How can I upgrade boot code using Corelis-ScanICE?

A: Follow the procedures in “Loading and Running Boot Code via Corelis ScanICE” in the section “Loading and Running Code (Without Tornado)” in the *PhonexChange Software Development Guide.* Corelis-ScanICE is supported in the BCM1101 family only. This tool is not supported for BCM1103\BCM1104 devices.

JTAG TOOL CANNOT COMMUNICATE WITH DEVICE

Q: What should I do when the BCM1101 is unable to respond to the JTAG beacuse the boot device is empty (0xFF)?

Note: This behavior only occurs in BCM1101Cx chips.

A: When the boot device is empty (filled with undefined instructions, 0xFF), undefined instruction exceptions are generated. The MIPS will invoke the undefined instruction exception handler to process an undefined instruction exception. Since the boot device (which includes the undefined instruction exception handler) is empty, undefined instruction exception will occur on every available clock cycle.

A BCM1101 silicon bug blocks the handling of the debug exception (generated by the EJTAG) during normal exception (which includes undefined instruction exception). Since the debug exception is not handled, the MIPS is unable to respond to and communicate with the JTAG debugger.

The minimum requirement to cause this problem is when the undefined instruction exception handler is made of undefined instructions. The MIPS will then not respond to the debug exception.

This does not affect the EJTAG probe during normal operation, or when there are undefined instructions in the code because the MIPS will eventually get to a point where it is executing defined instructions and the debug exception will occur.

Refer “Definition 14” in *Product Stepping Errata for the BCM1100/1101*.

As a work around, one solution is to use the external programmer to write no-operations (NOP) to flash. Another solution is to use Corelis ScanPlus to fill flash with NOP instructions.

To do this, you will need the following files:

- A BSDL file for the BCM1100/BCM1101 chip.
- A Telesis Net-list file created from the schematics of the board hardware.
- A Flash device file. You should be able to select the correct flash device type from the library provided by Corelis.

These files tell the flash programmer how to control the BCM1100/BCM1101, how the PCB is laid out, and how to access the flash.

Following the instructions in the *Corelis ScanPlus User's Manual*, you should be able to compile an FPI file (*.fpi extension). The FPI file allows you to download the code image over JTAG by having the BCM91100/ BCM91101 drive all lines—address, data, chip selects, etc. See the *.fpi file specifications and your code image.

To build and load NOP instructions to boot the flash, use the following code image (which should be saved as C0flashinit.exo).

```
S315000000000000000000000000000000000000000000EA
S315000000100000000000000000000000000000000000DA
S315000000200000000000000000000000000000000000CA
S315000000300000000000000000000000000000000000BA
S315000000400000000000000000000000000000000000AA
S315000000500000000000000000000000000000000000009A
S315000000600000000000000000000000000000000000008A
S315000000700000000000000000000000000000000000007A
S315000000800000000000000000000000000000000000006A
S315000000900000000000000000000000000000000000005A
S315000000A00000000000000000000000000000000000004A
S315000000B00000000000000000000000000000000000003A
S315000000C00000000000000000000000000000000000002A
S315000000D00000000000000000000000000000000000001A
S315000000E00000000000000000000000000000000000000A
S315000000F000000000000000000000000000000000000FA
S3150000010000000000000000000000000000000000000E9
S3150000011000000000000000000000000000000000000D9
S3150000012000000000000000000000000000000000000C9
S3150000013000000000000000000000000000000000000B9
S3150000014000000000000000000000000000000000000A9
S315000001500000000000000000000000000000000000099
S315000001600000000000000000000000000000000000089
S315000001700000000000000000000000000000000000079
S315000001800000000000000000000000000000000000069
S315000001900000000000000000000000000000000000059
S315000001A00000000000000000000000000000000000049
S315000001B00000000000000000000000000000000000039
S315000001C00000000000000000000000000000000000029
S315000001D00000000000000000000000000000000000019
S315000001E00000000000000000000000000000000000009
S315000001F000000000000000000000000000000000000F9
S3150000020000000000000000000000000000000000000E8
S3150000021000000000000000000000000000000000000D8
S3150000022000000000000000000000000000000000000C8
S3150000023000000000000000000000000000000000000B8
S3150000024000000000000000000000000000000000000A8
S315000002500000000000000000000000000000000000098
S315000002600000000000000000000000000000000000088
S315000002700000000000000000000000000000000000078
S315000002800000000000000000000000000000000000068
S315000002900000000000000000000000000000000000058
S315000002A00000000000000000000000000000000000048
S315000002B00000000000000000000000000000000000038
S315000002C00000000000000000000000000000000000028
S315000002D00000000000000000000000000000000000018
S315000002E00000000000000000000000000000000000008
S315000002F000000000000000000000000000000000000F8
S3150000030000000000000000000000000000000000000E7
S3150000031000000000000000000000000000000000000D7
S3150000032000000000000000000000000000000000000C7
S3150000033000000000000000000000000000000000000B7
```

```
S3150000034000000000000000000000000000000000A7
S3150000035000000000000000000000000000000000097
S3150000036000000000000000000000000000000000087
S3150000037000000000000000000000000000000000077
S3150000038000000000000000000000000000000000067
S3150000039000000000000000000000000000000000057
S315000003A000000000000000000000000000000000047
S315000003B000000000000000000000000000000000037
S315000003C000000000000000000000000000000000027
S315000003D000000000000000000000000000000000017
S315000003E000000000000000000000000000000000007
S315000003F000000000000000000000001000FF00F7
S307000004000000F4
S70500000000FA
```

USING THE WORKBENCH DEBUGGER THROUGH THE NETWORK INTERFACE

Q: How can I use the Tornado debugger through the network interface?

A: To use the Tornado debugger through the network interface, complete these steps:

Note: Using Workbench debugger to connect to the target through the network interface has not been tested.

To use the Workbench debugger through the network interface, build the target application with DEBUG_OVER_NETWORK to 1 in the \phonex\bsp\vxWorks\<BSP Profile>\config.h file. Then, complete the following steps to start using Tornado debugger through a network interface. Make sure the platform is up and running and connection to the network.

1 In the \phonex\bsp\vxWorks\<BSP Profile>\config.h file, set the define DEBUG_OVER_NETWORK constant to **1**.

2 From the Target menu, select **New Connection**.

3 Select **Wind River VxWorks 6.x Target Server Connection**.

4 Click **Next** to start a new configuration and open the New Connection window.

5 In Backend settings:

- Set Backend: Select **wdbrpc**.
- Select the Cpu type.
- Type the phone's IP address in the Target Name/IP Address field.

6 In Kernel image, set File to the path of your *.elf file running on the phone.

7 Click **Finish**. Workbench will attempt to connect the Target with the Target Server, automatically. If it does not connect automatically, from the Target menu, select **Connect XX**, where XX is the Target Connection.

USING THE WORKBENCH DEBUGGER THROUGH THE SERIAL INTERFACE

Q: How can I use the Tornado debugger through the serial interface?

A: To use the Tornado debugger through the serial interface, fcomplete these steps:

Note: Using Workbench debugger to connect to the target through the serial interface has not been tested.

To use the Workbench debugger through the serial interface, build the target application with the DEBUG_OVER_NETWORK to 0 in the \phonex\bsp\vxWorks\<BSP Profile>\config.h file. Then, complete the followign steps to start using Tornado debugger through a serial interface. Make sure the platform is up and running and connected to the serial port.

1 In the \phonex\bsp\vxWorks\<BSP Profile>\config.h file, set the define DEBUG_OVER_NETWORK constant to **0**.

2 From the Target menu, select **New Connection**.

3 Select **Wind River VxWorks 6.x Target Server Connection**.

4 Click **Next** to start a new configuration and open the New Connection window.

5 In Backend settings:

- Set Backend: Select **wdbserial**.
- Select the Cpu type.
- Select the Host serial device.
- Set the Serial device speed (bit/s) to **115200**.

6 In Kernel image, set File to the path of your *.elf file running on the phone.

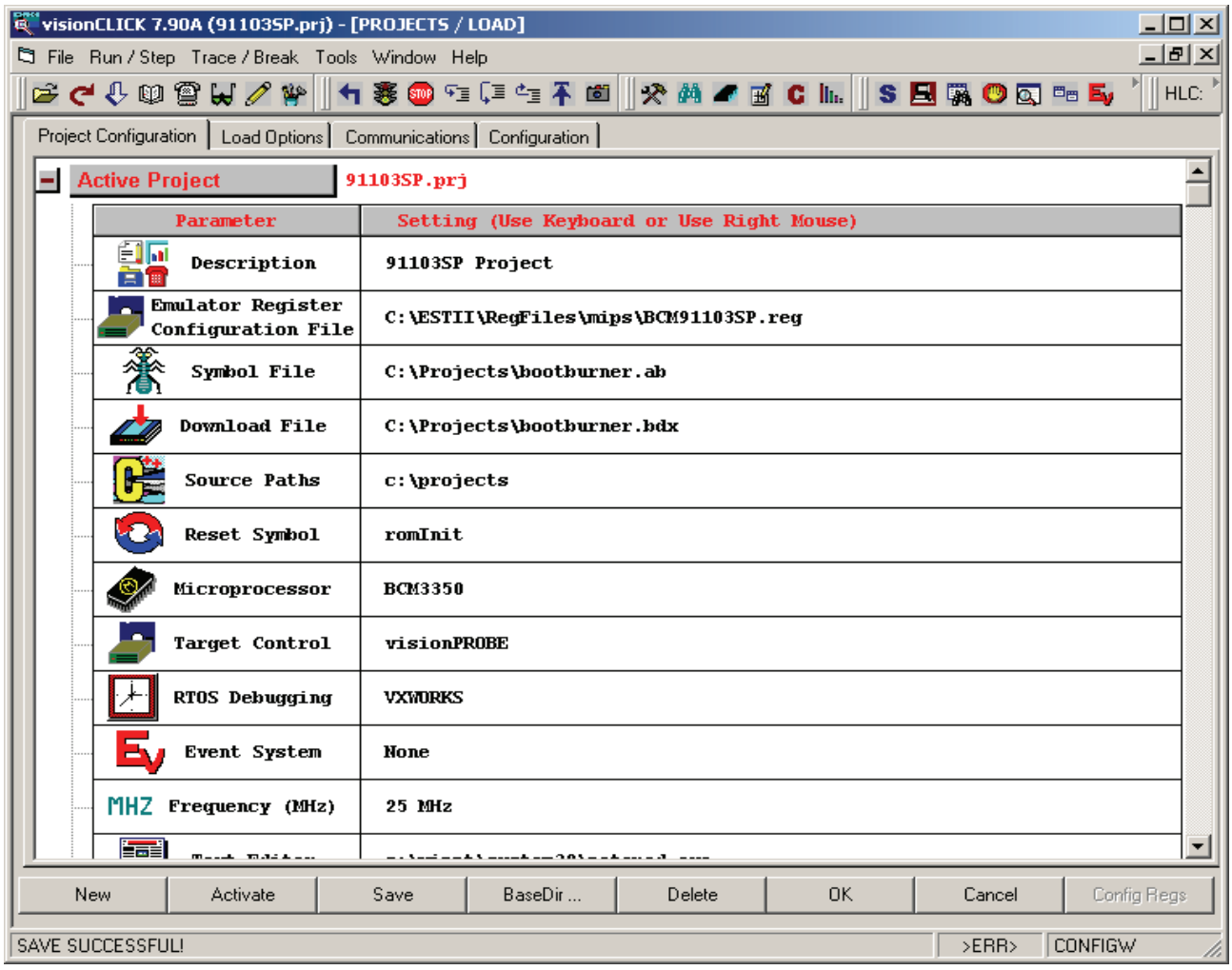
7 Click **Finish**. Workbench will attempt to connect the Target with the Target Server, automatically. If it does not connect automatically, from the Target menu, select **Connect XX**, where XX is the Target Connection.

VISIONCLICK DEBUGGING

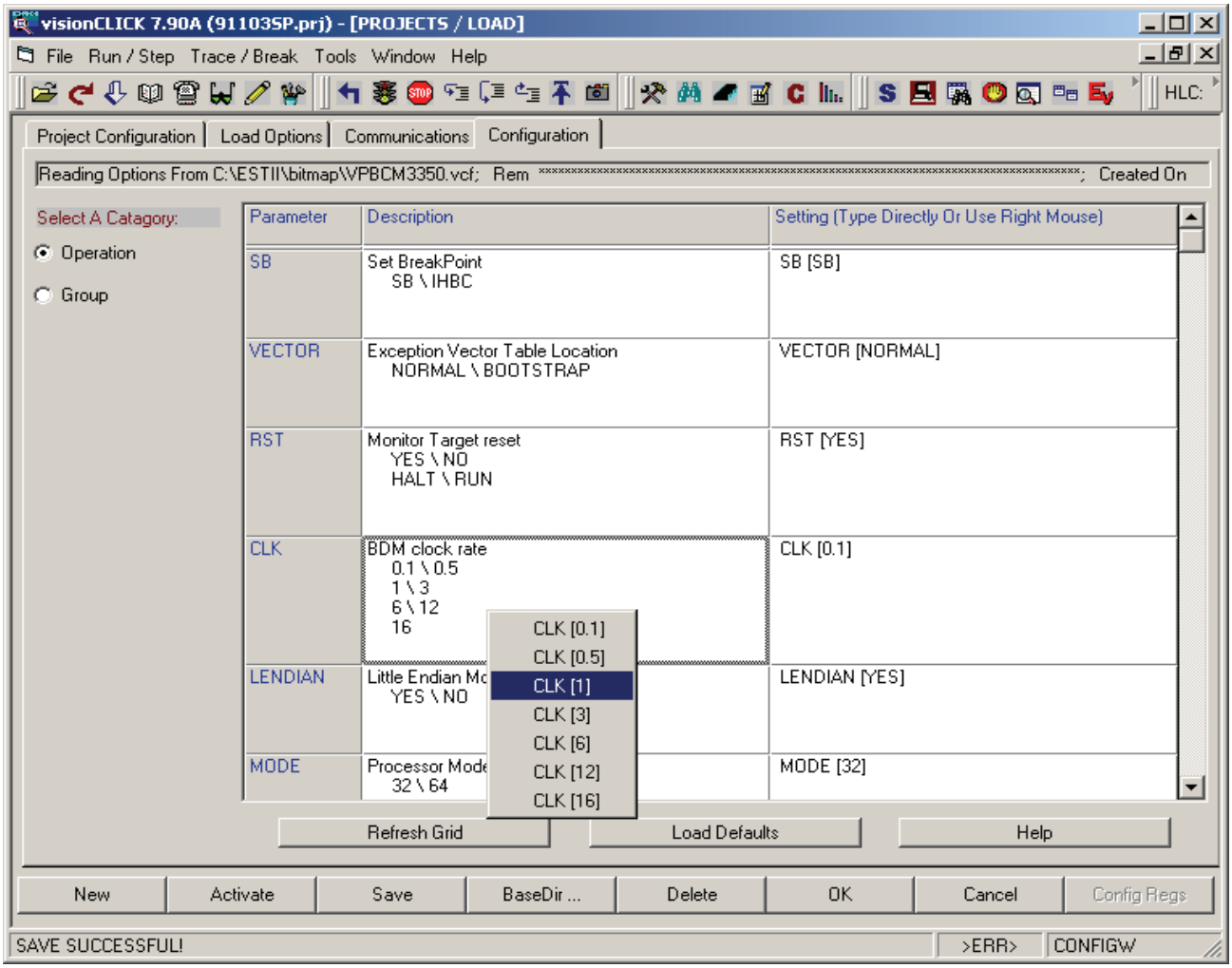
Q: How can I debug with VisionClick?

A: Complete the following instructions for debugging with VisionClick.

1. Open the Project/Load window.



2. In the Symbol File field, type the names of the symbol (.ab) file.
3. In the Download File field, type the names of the executable (.bdx) file.
4. In the Source Paths field, type the path to the C source file that contains the functions to be debugged.
5. In the JTAG field, type **4 MHz**.
6. Click the **Configuration** tab.



7. Click the CLK Description cell and select **CLK [1]** from the menu.
8. Click **Save** .
9. When the phone completely boots, click **Activate**.
10. Select the **config Tab load symbol** file, and then click the **Symbol Explorer** icon.
11. Double-click the preferred function. If the path for the functions source file is included, then the Cfile displays in a background window.
12. Right-click the line numbers in the C file, and select **Set Internal Hardware Break Point**.
13. Click the **Run** icon (traffic light). When the phone completely boots again, a breakpoint triggers when the function is called.
14. Optional: To see the variables values, right-click the variables and place them in the Watch window.

BROADCOM PROFILING TOOLS

Q: How can I use Broadcom profiling tools?

A: Broadcom profiling tools provide information on the resources used in either the MIPS32 or the ZSP CPU, as well as CPU consumption of each task running on the MIPS32 processor. For more information on the profiling tools, refer to the “Host and DSP Profiling” section in the *PhonexChange Software Development Guide.*

Complete the following steps to start the Broadcom profiling tool.

1. Repeatedly type **quit** until the VxWorks shell appears.
2. Type **console** to access the **Broadcom** menu. The menu displays as **[BRCM]>**.
3. Type **prof** to enter the **Profiler** menu. The menu displays as **[PROF]>**.
   a. For the Task Level profiler, type:
      - hosttl <seconds> to start the profiler, where <seconds> is the amount of time, in seconds, the profiler conducts its measurement.
   b. For the DSP profiler, type:
      - **dsp start** to start the profiler
      - **dsp stop** to stop the profiler and retrieve resource usage.
   c. For the Host profiler, type:
      - **host start** to start the profiler
      - **host stop** to stop the profiler and retrieve resource usage.
   d. For the VxWorks profiler or task profiler, type:
      - **hostvx start** to start the profiler. The resource usage by each task is displayed every five seconds.
      - **hostvx stop** to stop the profiler.

WIND RIVER SYSTEM VIEWER APPLICATION SUPPORT

Q: How can I set up the application to support Wind River System Viewer (previously known as WindView®)?

A: A time stamp driver is required to support Wind River System Viewer.To add the time stamp driver, add the following symbolic constants to `\phonex\bsp\vxWorks\<BSP Profile>\config.h`:

```
#define INCLUDE_WINDVIEW /* WindView target facilities */
#define INCLUDE_TIMESTAMP /* WindView target facilities */
```

Refer to the *Wind River System Viewer* manual for information on initiating Wind River System Viewer.

Note: Using Wind River System Viewer with this version of PhonexChange has not been tested.

PROTOS SIP TEST SUITE

Q: How do I run the PROTOS SIP Test Suite?

A: The test environment must be set up as follows before any test can be performed.

- Make sure the latest Java version is installed from http://java.sun.com/j2se/index.jsp. Otherwise, the test will not work.
- The test suite can be found at http://www.ee.oulu.fi/research/ouspg/protos/testing/c07/sip/.

For example, issue the following simple test command:

```
Java -jar c07-sip-r2.jar -touri mailto:1131@10.136.64.131 -teardown -validcase -start
120 -stop 150
```

This command sends packets from test cases 120 ~ 150 to the sip phone at extension 1131/IP 10.136.64.131. The options for the test suite are:

```
(help by command line argument: -help)
single-valued 'java.class.path', using it's value for jar file name
reading data from jar file: c07-sip-r2.jar
Usage java -jar <jarfile>.jar [ [OPTIONS] | -touri <SIP-URI> ]
    -touri  <addr>      Recipient of the request
                        Example: <addr> : you@there.com
    -fromuri <addr>     Initiator of the request
                        Default: user@PCRMNA-JHU
    -sendto <domain>    Send packets to <domain> instead of
                        domainname of -touri
    -callid <callid>    Call id to start test-case call ids from
                        Default: 0
    -dport <port>       Portnumber to send packets on host.
                        Default: 5060
    -lport <port>       Local portnumber to send packets from
                        Default: 5060
    -delay <ms>         Time to wait before sending new test-case
                        Defaults to 100 ms (milliseconds)
    -replywait <ms>     Maximum time to wait for host to reply
                        Defaults to 100 ms (milliseconds)
    -file <file>        Send file <file> instead of test-case(s)
    -help               Display this help
    -jarfile <file>     Get data from an alternate bugcat
                        JAR-file <file>
    -showreply          Show received packets
      -showsent         Show sent packets
      -teardown         Send CANCEL/ACK
      -single <index>   Inject a single test-case <index>
      -start <index>    Inject test-cases starting from <index>
      -stop <index>     Stop test-case injection to <index>
      -maxpdusize <int> Maximum PDU size
Default to 65507 bytes
    -validcase          Send valid case (case #0) after each
                        test-case and wait for a response. May
                        be used to check if the target is still
                        responding. Default: off
```

SECURITY

802.1X IN PHONEXCHANGE

Q: Is 802.1x supported in PhonexChange software?

A: Yes, an 802.1x supplicant is supported. The 802.1x authenticator is not supported. For documentation, refer to the technical reference manual *PhonexChange 802.1X Broadcom Supplicant Wrapper (BSW)* and the *Wind River Wireless Security for VxWorks 6 User's Guide 2.4.*

AUTHENTICATION METHODS

Q: What 802.1x authentication methods are supported in PhonexChange?

A: The 802.1x supplicant with EAP-MD5, PEAP, EAP-TTLS, and EAP-TLS authentication methods are supported in PhonexChange.

Table 8 on page 83 shows the supported 802.1x features, with reference to Tables A.5 - A.7 of the PICS Proforma (Annex A) of the 802.1X standard.

Table 8: Supported 802.1x Features

Reference	*Item*	*Feature*
A.5	supp	Supports the operation of the Port Access Entity (PAE) over the uncontrolled port, as a Supplicant PAE.
A.5	sysm	Supports the system configuration functions.
A.5	suppM1	Supports the system configuration functions.
A.5	suppM2	Supports the ability to maintain and retrieve supplicant statistics.
A.5	ether	Supports EAPOL encapsulation over 802.3/Ethernet MACs.
A.6	eapol	The EAPOL encapsulation used between Authenticator and Supplicant PAEs.
A.6	vtag	EAPOL frames shall not be VLAN-tagged.
A.6	ptag1	Support the reception of priority-tagged EAPOL frames.
A.6	petype	PAE Ethernet Type field in transmitted EAPOL frames is as defined.
A.6	pvalid	Frames shall be processed and interpreted according to the validation rules.
A.6	padd2	Group MAC address used as a destination address in EAPOL frames as specified.
A.6	padd3	Individual MAC address values used as a source address in EAPOL frames.
A.7	mach	The implementation supports the required set of state machines on each port, in accordance with the PAE role(s) that each port supports.
A.7	timers	The Port Timers state machine is supported as defined.
A.7	spsm	The Supplicant PAE state machine is supported as defined.

ADDITIONAL MEMORY REQUIRED BY 802.1X

Q: How much additional memory is required for enabling 802.1X features?

A: With 802.1X included, an additional 200 KB of SDRAM is used. If 802.1X is enabled with either of the supplicants (i.e., EAP-MD5, EAP-TLS, PEAP, or EAP-TTLS), an additional 582 KB is used. The total additional memory usage is 782 KB (200 KB + 582 KB).

Note: 802.1X is enabled in the file `\phonex\build\config\<config profile>\ippcfg.mk` by setting `IPPCFG_8021XSUPP_ENABLE` to 1. TLS is enabled by setting `IPPCFG_8021XSUPPTLS_ENABLE` to 1.

OPENSSL SOURCE FILES

Q: Does Broadcom provide OpenSSL source files?

A: No, the SSL library is provided by VxWorks. If required, the user would have to obtained the source files from VxWorks.

EAP-TLS PRIVATE KEY

Q: Where does the EAP-TLS private key come from?

A: Broadcom does not define where the key comes from. You have to implement the actual key exchange and distribution on the user end. Broadcom simply provides an API for the required keys to be passed to our security protocols. 802.1x EAP-TLS can use AES for encrypting the authentication messages.

IPSEC SUPPORT

Q: Is IPSec supported?

A: No, IPSec is not supported.

3DES ENCRYPTION

Q: Is 3DES encryption supported? I have seen 3DES block inside uHSM block. What is the purpose of the 3DES block?

A: Broadcom supports AES, but not DES. The 3DES block inside uHSM cannot be used for bulk encryption. The 3DES block is not accessible outside the uHSM block. It is intended to be used by other internal blocks inside uHSM for BroadSafe.

SIP CALL CONTROL

SUPPORTED RFC PROTOCOLS

Q: Which RFC protocols are supported by SIP Call Control?

A: See Section 2: "IETF RFC and Draft Support" in the *PhonexChange™ SIP Feature Set* application note for a list of RFC protocols and/or IEFT drafts supported in the current revision of SIP Call Control.

SDP FORMATION

Q: How is SDP formed?

A: SDP is formed in the SIP stack, which is embedded under the Call Control module of the PhonexChange software. The CCSDP structure is designed for Call Clients who need more control over the SDP parameters. For more information, refer to “CCSDP” Usage under the section “SIP User Application Notes” in the *Broadcom Call Control SIP Protocol Abstraction Layer 1.10 Technical Reference Manual*.

GENERATING IN-BAND AND OUT-OF-BAND DTMF TONES

Q: How do I generate in-band and out-of-band DTMF tones for SIP applications?

A: The tone relay capability is defined in `cmCfgCodec` in `cmStream.c`. Tone relay would be used if the line with parameter CCEC_NTE is defined, such that:

```
{ CCEC_NTE, CCRTPC_NEGOTIATED },
```

Note that inserting this line in this location ensures that a tone relay is proposed and that RFC 2833 / telephone-event is proposed in the SDP. If the remote party does not support a tone relay, DTMF would still be sent in-band. To disable tone relay, simply remove the line.

Refer to Tone Relay of Signal Generation under the Examples section in the *BCM110X/BCM111X PhonexChange Endpoint Module Technical Reference Manual* for an example on generating an RFC2833 DTMF tone.

GENERATING DTMF TONES DURING SIP CALLS

Q: How do I know if out-of-band DTMF tones are generated when performing SIP calls?

A: You can verify this by sniffing the RFC2833 packets when calling between the two phones participating in the call.

Complete the following steps to sniff network traffic.

1. Connect the IP phone to the LAN through a hub.
2. Connect a PC to the hub (this is used for sniffing the network traffic).
3. Run a network protocol analyzer (such as Ethereal) to sniff all of the packet data from the network. The RFC2833 packets in the sniffed data should display if the RFC 2833 packets are being sent.

TURNING OFF SILENCE SUPPRESSION

Q: We've noticed that when we turn off silence suppression on the vocoder, the IP Phone no longer sends RFC 2833 messages. Is there anything wrong with this?

A: Switching silence suppression off through the cmCfgCodec structure may trigger the SDP offer to be broken into multiple m= lines. Our software generates multiple m= lines when it finds any one of the following transitions between codec settings.

1. Packetization Rate Changes (Voice Codecs only, NTE does not affect number of m= lines generated). For example, the following contains a packetization rate transition in between Codecs, hence an extra m= line is generated.

```
{ CCEC_PCMU,    20,       TRUE,     CCRTPC_NEGOTIATED },
{ CCEC_G729A,   40,       TRUE,     CCRTPC_NEGOTIATED },
```

2. Vad setting changes (i.e., Off -> on, or on -> off). For example, the following contains a vad setting transition in between Codecs, hence an extra m= line is generated.

```
{ CCEC_PCMU,    20,       TRUE,     CCRTPC_NEGOTIATED },
{ CCEC_G729A,   20,       FALSE,    CCRTPC_NEGOTIATED },
```

3. From NTE to any other Codecs. For example, the following contains a transition from NTE to other Codecs, hence an extra m= line is generated.

```
{ CCEC_NTE,     20,       TRUE,     CCRTPC_NEGOTIATED },
{ CCEC_PCMA,    20,       TRUE,     CCRTPC_NEGOTIATED },
```

Based on our previous experiences with SIPit interop, multiple m= lines are not welcomed by many third-party implementations as multiple m= lines imply multiple parallel streams. Some implementations simply accept only the first m= line, which may not have included the 2833 proposal.

The user can organize the cmCfgCodec structure in such a way that all Codecs are sent in a single m= line by keeping all the silence suppression options and the packetization rate the same, and leaving NTE as the last entry.

DNS SRV QUERIES

Q: Where are DNS SRV queries generated?

A: The SIP stack is responsible for initiating all SIP-related DNS queries (including DNS SRV) using M5T's Portable Resolver module (the SIP stack assumes that the DNS server is configured properly when FQDN is used). In our SIP reference design, the DNS server is configured through keypad provisioning, as well as HTTP provisioning, at start up.

CONFIGURING SIP STACK FOR DIFFERENT UDP PORTS

Q: Can we configure the SIP stack to use different UDP ports for transmitting and receiving?

A: Call Control has no API to configure transmission and receipt of SIP packets on different UDP ports. However, it is possible to separate the transmit and receive ports by altering Call Control. In `\prot_callctrl\stacks\callctrl\sip_mx\CSipEngine.cpp`, change the line:

```
*pRes = m_pTransMgr->Listen(MX_TRANSPORT_UDP, 0.0.0.0,
                uListeningPort, true);
```

to

```
*pRes = m_pTransMgr->Listen(MX_TRANSPORT_UDP, 0.0.0.0,
                uListeningPort, false);
```

causing a transmit port to be allocated (by the OS) at random. It is, however, recommended that the same port be used for sending and receiving, as this is useful for a NAT scenario.

CONFIGURING SIP STACK FOR NON-DEFAULT UDP PORTS

Q: How can we configure the SIP stack to transmit and receive on ports other than the default?

A: The listening/SIP port can be configured with the callConfig function through the `sipport` field of the `CCUSERCFG` structure. Note that you can set the `sipport` as the default port (5060) if the field is set to zero.

CHANGING THE REGISTER PORT

Q: How do I change the register port (regPort) at the SIP Call Control layer?

A: The listening/SIP port can be configured with the callConfig function through the registrar port field of the CCSIPUSER structure.

INITIATING PHONE CALLS

Q: Can the SIP Call Control initiate phone calls without enabling the SIP Registrar and the SIP Proxy server?

Q: Is it possible to set the IP phones to make calls based on any SIP-URI?

A: Yes, it is possible to make phone calls based on any SIP-URI. Carefully examine how function cm`SetCalledParty()` forms the complete URI when no proxy is configured. You may need to modify `cmSetCalledParty()` so that the host part is not populated from `cmCfgBlk.localaddr`. Since one cannot specify alphabets using our reference design phone, the function `cmSetCalledParty()` only accepts a numeric user id as part of the SIP URI. Call Control itself accepts SIP-URI in any form, however.

SIP AND IP DESTINATION ADDRESSES

Q: In the SIP application, how do I specify the IP destination address instead of using the address provided by the DNS resolver?

A: Since Call Control 1.6, we have removed a backdoor method to bypass the DNS SRV lookup. Currently, the official method to specify a destination IP address, instead of using DNS look-up, is to configure the outbound proxy. Refer to the *Broadcom Call Control SIP Protocol Abstraction Layer 1.10 Technical Reference Manual* for more information.

DEFAULT REGISTRATION INTERVAL

Q: What is the default registration interval used in the SIP Call Control block?

A: The default registration interval is 3600 seconds (1 hour).

REGISTRATION

Q: Why does the client register to the server every 1 second when the SIP proxy expire value is set to 30sec?

A: To overcome network delay, the sip stack maintains a registration refresh timer threshold. The default timer threshold value is 1 min. Whenever the expire value becomes less than the timer threshold, a registration occurs. Therefore, when the SIP proxy expire value is set to 30 seconds, which is less than the default 1 minute timer threshold, the registration occurs more frequently.

To avoid frequent registration, the timer threshold should be lowered. If the timer threshold is set to 2 seconds, and expire value is set to 30 seconds, then the registration only happens when the expire value is decremented to 2 seconds, which takes 28 seconds.

To change the default timer threshold value, you have to perform the update through the regthreshold field of the CCTIMERCFG. Detailed information for configuring this value can be found under the “CallConfig” section of “Call Control Protocol Abstraction Layer Commands” in the *Broadcom Call Control SIP Protocol Abstraction Layer 1.10 Technical Reference Manual*.

UPDATING SDP CONNECTION INFORMATION

Q: How do I update SDP connection information (RTP IP address) during an SIP session?

A: In call manager (Callmgr), you can call the following function to set the RTP IP address to local or WAN IP address.

```
cmFillLocalSDP( cnxId, cmVocoderListGet(), &(cx->locSdp) );
callSetParm( cid, CCPARM_LOCAL_SDP, &(cx->locSdp) );
```

SETTING WAN IP ADDRESS

Q: How do I set the IP address (and port) of the WAN when the IP Phone is behind a NAT?

A: See Network Address Transversal (NAT) Support under the section “SIP User Application Notes” of the *Broadcom Call Control SIP Protocol Abstraction Layer 1.10 Technical Reference Manua*l.

SIPS SUPPORT IN PHONEXCHANGE SOFTWARE

Q: Is SIPS supported in PhonexChange SIP software?

A: SIPS is currently supported in the Call Control software, but not in the application.

PHONEXCHANGE SESSION TIMER

Q: Does PhonexChange support the session-timer?

A: Yes, you can set the session time by setting the sessiontmr field of the `CCTIMERCFG` through the callConfig function.

UNSUBSCRIBING

Q: I want to unsubscribe after receiving failed basic requests. Does PhonexChange have any code that sends an event to handle this message?

A: A callback function can be set up to handle the failed basic request message. The basic requests, commands, and events are implemented as `callSendBasicXXX()` and `CCBASXXX` respectively. Refer to the *Broadcom Call Control Protocol SIP Abstraction Layer 1.10 Technical Reference Manual* for more details.

PARSING AND COMPOSING HEADERS

Q: How do I parse or compose headers that are unknown to the stack?

A: Call Control has no API to parse or compose unknown headers. However, it is possible to modify Call Control to handle unknown headers.

To parse headers, which are unknown to the stack:

- Each of the unknown headers is stored in class `CHdrUnknown`.
- Packet headers can be found from class `CPacket` (e.g. from in `InternalEvSesInvited()` in `CSipEngine.cpp`).
- The number of unknown headers can be found by calling:

```
numUnknownHdrs = pPacket->GetNumUnknown();
```

To retrieve headers with the `GetName()` and `GetValue()` API:

```
UINT32 numUnknownHdrs = pPacket->GetNumUnknown();

for (UINT32 i = 0; i < numUnknownHdrs; i++)
{
   printf(SIP header %s received with value %s\n,
      pPacket->GetUnknown(i).GetName(),
      pPacket->pPacket->GetUnknown(i).GetValue());
}
```

An example can be found in `GetAlertInfo()` function in `ccevt.cpp`.

To compose headers that are unknown to the stack.

- Each API sending request/response has a parameter field `pExtraHeaders`. E.g. in `CSipEngine.cpp`:
  `*pError = pSvcMgr->SendRequest(method, pContent, pExtraHeaders);`

The new unknown header can be added like this:

```
CSipExtraHeaders* pExtraHeaders;
   CHdrUnknown* pUnknown = new CHdrUnknown;

   pUnknown->SetName(x-new-header);
   pUnknown->SetValue(value-of-the-header);
   pExtraHeaders->AddHeader(pUnknown);
```

An example can be found in the `InternalSendBasicRequestA()` function in `CSipEngine.cpp`.

VOCODER NEGOTIATION

Q: How does the IP Phone decide which vocoder to use in Sip Call Control?

A: Call Client A must set up the list of vocoders supported by the IP Phone A by calling `cmFillLocalSDP( cnxId, cmVocoderListGet(), &(cx->locSdp) )` and `callSetParm( cid, CCPARM_LOCAL_SDP, &(cx->locSdp) )`;. When Call Control A sends an `INVITE` to the called party B with `callOriginate()`, the list of voice codecs supported by phone A is encoded in SDP in the `INVITE` (as an SDP offer).

Upon the reception of the `INVITE` from IP Phone A (through event `CCEVT_SETUP`), an event type `CCEVT_STATUS` of reason `CCRSN_REMOTECODEC` indicates the availability of the codec information that the remote party can receive. This is sent to Call Client B by Call Control B. At this point, Call Client B is responsible for choosing which encoder to use. Once decided, Call Client B must call `callSetParm(CCPARM_TXCODEC)` to set the codec used.

For more information, refer to `SDP OFFER-ANSWER` Model in Relation to Call Control API and Parameters, which is located in the “SIP User Application Notes” of the *Broadcom Call Control SIP Protocol Abstraction Layer 1.10 Technical Reference Manual*.

Appendix A: Glossary and Acronyms

Table 9: Glossary and Acronyms

Acronym	*Description*
AEC	Acoustic echo canceller
AES	Advanced encryption standard
API	Application program(ming) interface
APM	Audio processor module
BRCM	Broadcom Corporation
BSP	Board support package
BSP Profile	Board Support Packages supported by PhonexChange. Profiles supported in PhonexChange include bcm91101v2, bcm91103, bcm91103mp, bcm91103sp, bcm91190, and bcm91190lb.
Config Profile	Build configuration profiles supported by PhonexChange. Profiles supported in PhonexChange include: phone_91103, phone_91103mp, phone_91103sp, phone_91103svg, phone_91103svp, phone_91104, phone_91104mp, phone_91104sp, phone_91104svp, phone_91190, and phone_91190lb
CFI	Common flash memory interface
DIS	Display
DMA	Direct memory access
DOSFS	DOS file system
DSP	Digital signal processor
DTMF	Dual-tone multifrequency
ECAN	Echo canceller
END	Enhanced network driver
EPT	Endpoint. A component within PhonexChange™.
FAQ	Frequently asked questions
FDS	Full-duplex speakerphone
GPIO	General purpose inputs and outputs
HAPI	HausWare API
HausWare®	The PhonexChange signal processing application component.
HSS	High speed serial port
IND	Indicator
IP	Internet protocol
ISR	Interrupt service routine
KBD	Keyboard
LCD	Liquid crystal display
MIPS	The MIPS Technologies corporation, where the microprocessor core of the BCM110X/BCM111X is derived. This term is usually used to reference the microprocessor core of the BCM11XX, and is not to be confused with the million instructions per second acronym.
NVRAM	Non-volatile RAM
OS	Operating system
PLC	Packet loss concealment
QoS	Quality of service

Table 9: Glossary and Acronyms (Cont.)

Acronym	*Description*
RISC	Reduced instruction set computer
RTCP	Real-time transport control protocol
RTP	Real-time transport protocol
SIP	Session initiation protocol
SMP	Simple Management Protocol
TFFS	True flash memory file system
VAD	Voice activity detector
VHD	Virtual HausWare device driver.
VxWorks Console	The root console menu of the serial port for the application. When running "apptest", type "quit" to exit the "ippConsole".
$(WIND_BASE)	Base directory of the Wind River toolchain
WRS	Wind River Systems
YaFFS	Yet another flash memory file system
ZSP	The name of the DSP within the BCM110X/BCM111X.

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