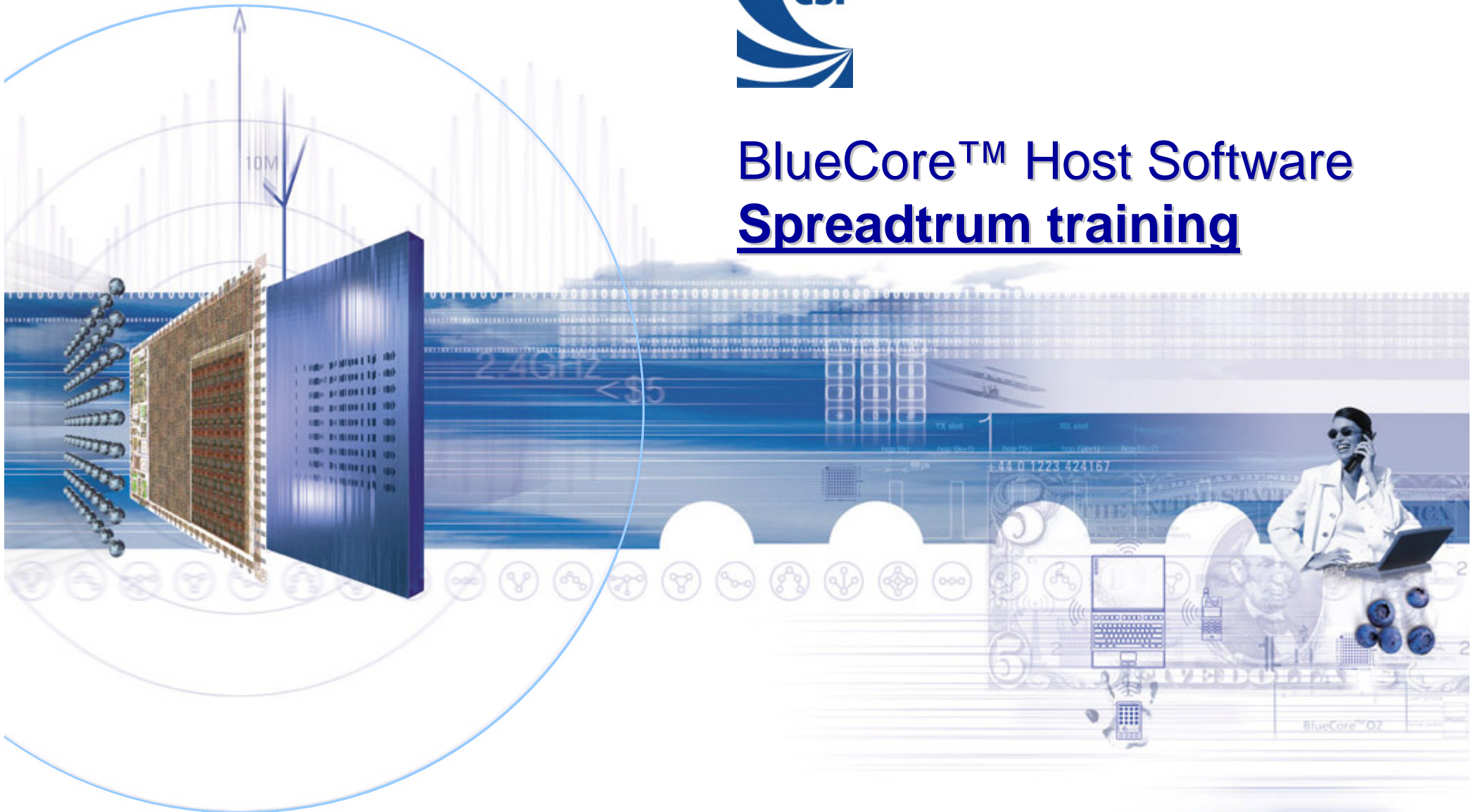**csr**

BlueCore™ Host Software
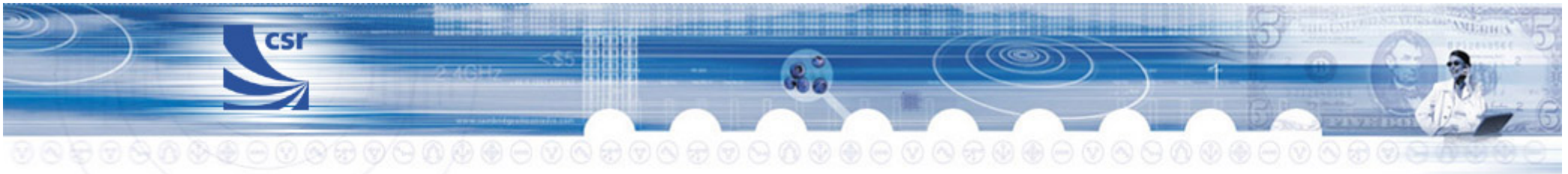## Spreadtrum training

Schedule for training

- **BCHS overview and introduction**

- **Scheduler**

- **Lower layers**

- **Profile Managers**

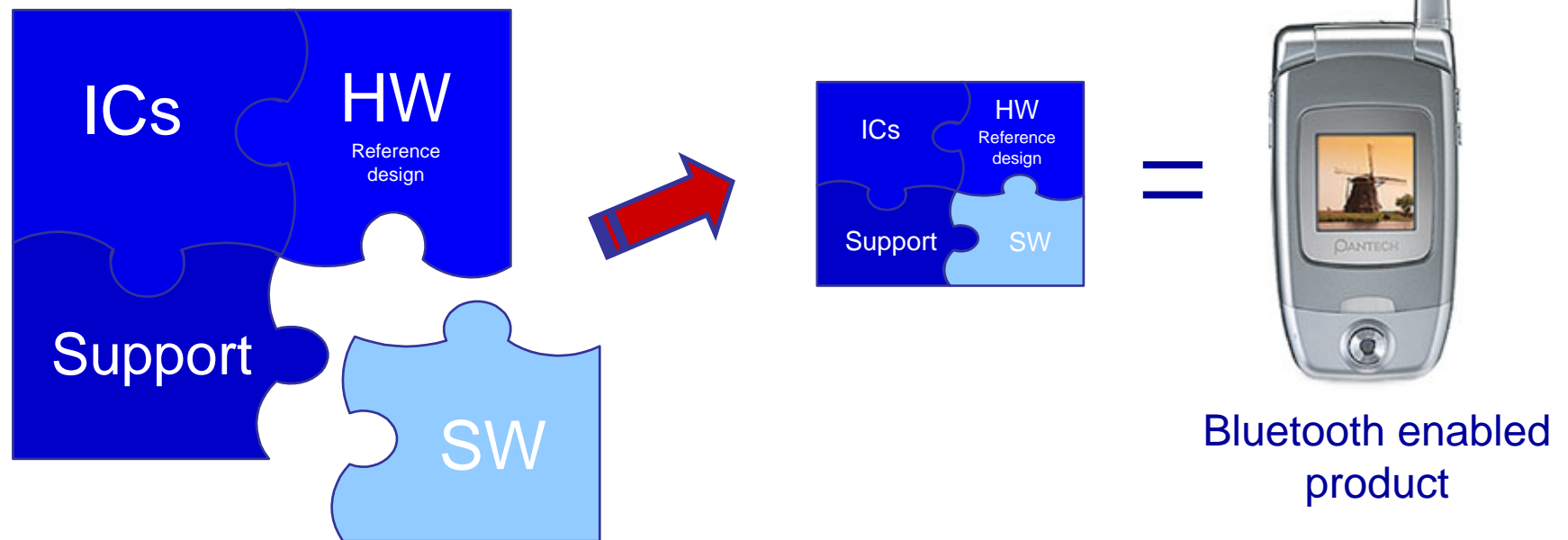- **Customers product issues (ROM, A2DP)**

Contents

- **BCHS overview**

- **BCHS architecture**

- **BCHS porting**

- **BCHS file structure and documentation**

- **Example applications (AG)**

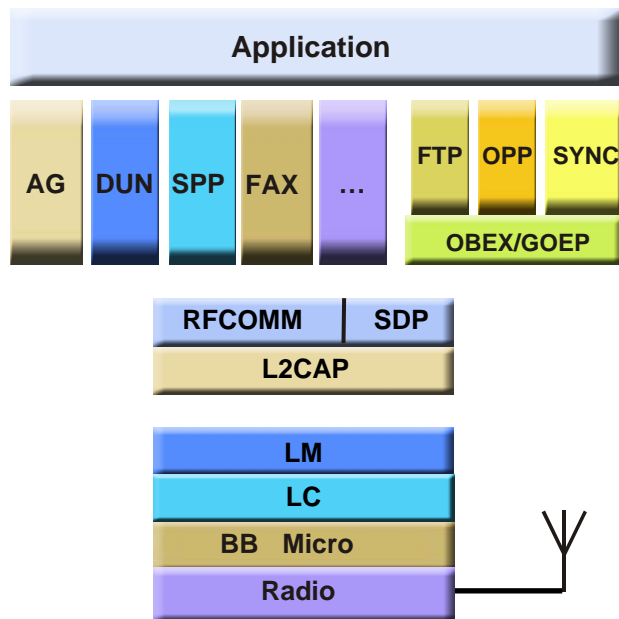BlueCore is a Trade Mark of Cambridge Silicon Radio

What is BlueCore™ Host Software?

BCHS is an embedded Bluetooth® protocol stack developed to function with CSR's BlueCore IC's to provide a
Full Bluetooth® system solution.

BCHS is designed for use in mobile phones

ICs

HW
Reference design

Support

SW

ICs

HW
Reference design

Support

SW

=

Bluetooth enabled product

Flexible Solution

- CSR has developed a full portable protocol stack including profiles
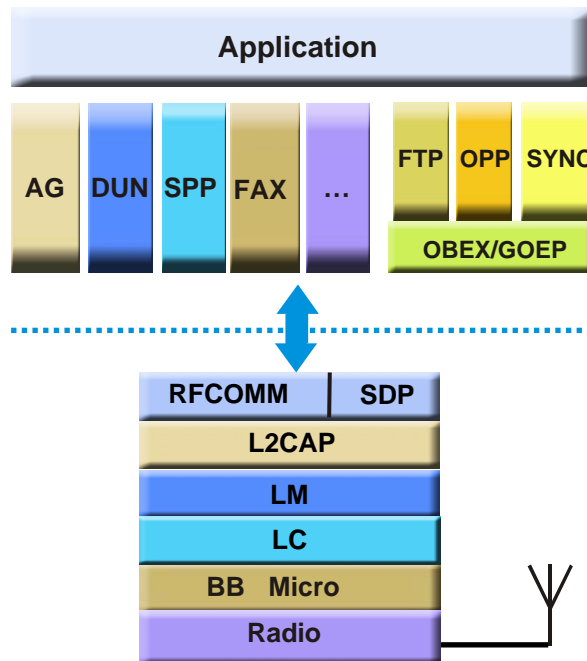- BlueCore™ has extra processor resources on chip

Therefore the split between what is running on host and what is running on chip is flexible.

There are currently two options:
- BCHS - RFCOMM
- BCHS - HCI

All APIs are the same in the two solutions, so it is easy to change from one option to another.
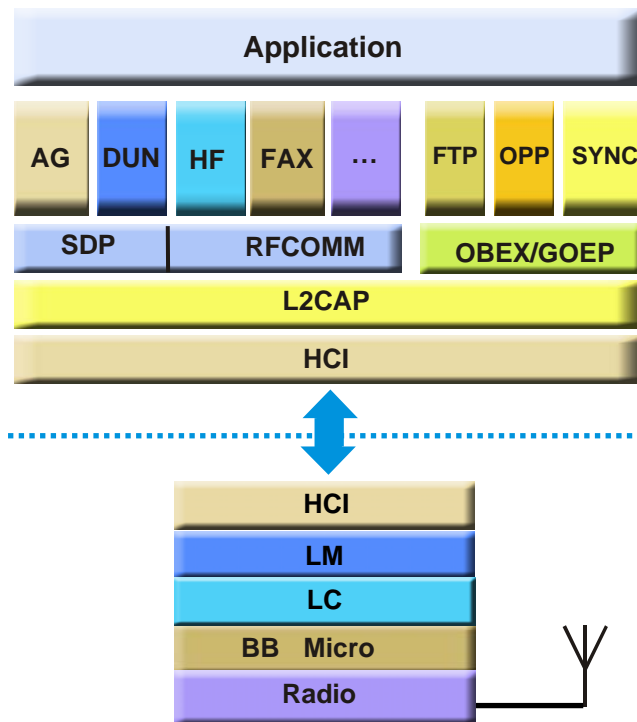
BlueCore is a Trade Mark of Cambridge Silicon Radio

BCHS - RFCOMM

Application

AG | DUN | SPP | FAX | ... | FTP | OPP | SYNC

OBEX/GOEP

RFCOMM | SDP
L2CAP
LM
LC
BB   Micro
Radio

- Simplest and cheapest version
- Saves host resources
  (L2CAP, RFCOMM, and SDP on-chip)
- Maximum data rate with RFCOMM build is 360 kbit/s
- Supports up to 3 slaves
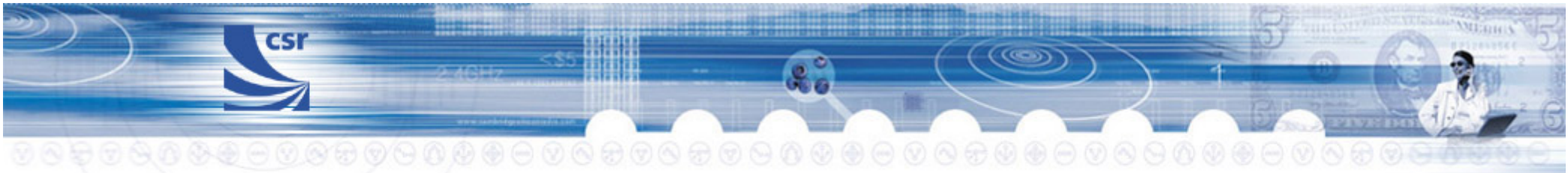
BCHS-RFCOMM is used where the required data rate is less than 360 kbit/s, e.g. mobile phones and access points.

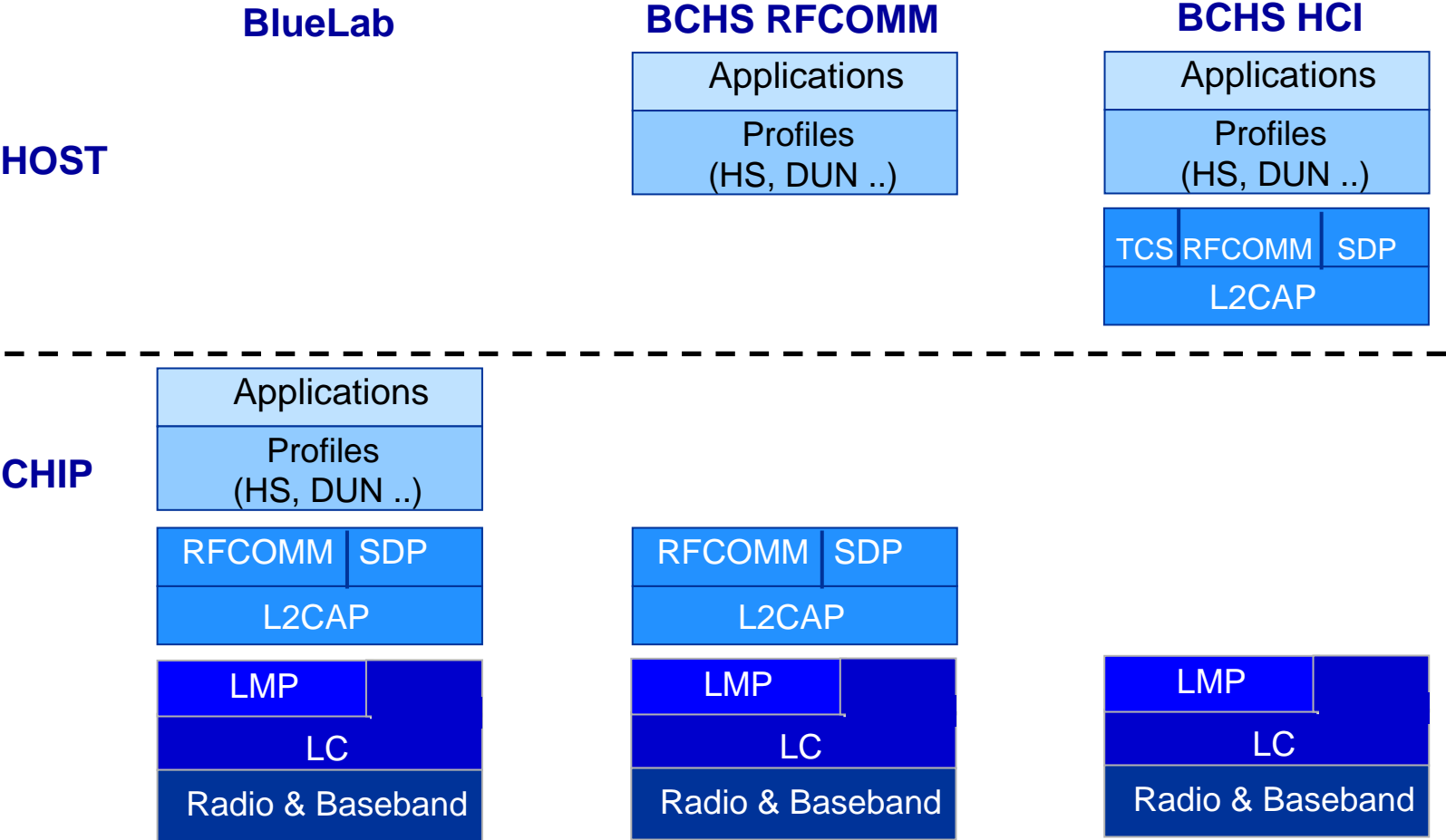BlueCore is a Trade Mark of Cambridge Silicon Radio

BCHS - HCI

- Supports full data rate (720 kbit/s)
- Supports the maximum number of active slaves
  (7 slaves)

BCHS-HCI is used where full data-rate is required.

CSR Bluetooth System Solutions

BlueLab

BCHS RFCOMM

BCHS HCI

HOST

Applications
Profiles (HS, DUN ..)

Applications
Profiles (HS, DUN ..)

TCS	RFCOMM	SDP
L2CAP		

CHIP

Applications
Profiles (HS, DUN ..)

RFCOMM	SDP
L2CAP	

LMP
LC
Radio & Baseband

RFCOMM	SDP
L2CAP	

LMP
LC
Radio & Baseband

LMP
LC
Radio & Baseband

BlueCore is a Trade Mark of Cambridge Silicon Radio

Example Use Cases for BCHS

Internet Bridge

Synchronization of calendar, contacts etc.

Sending a fax

DUN PAN

Sync

Fax

Wireless headset

AG

OPP FTP

Business card & file exchange

BIP

SPP PAN

Multiplayer games

Pictures Exchange

CTP

Hands-free unit
installed in the car

HF

AV

"3 in one phone"

Stereo headset

26 Available Profiles

Dial Up Networking Gateway Profile (DUN)
Headset Profile (AG and headset side)
Serial Port Profile (SPP)
Fax Gateway Profile (FAX)
Hands-free Profile (HF include HF 1.5)
Object Push Profile (OPP)
Synchronisation Server Profile (SYNC)
File Transfer Profile (FTP)
Cordless Telephony Profile (CTP)
Intercom Profile (ICP)
Personal Area Network Profile (PAN)
Basic Imaging profile (BIP)
Advanced Audio Distribution Profile (A2DP)

Generic Object Exchange Profile (GOEP)
Generic Access Profile (GAP)
Service Discovery Application Profile (SDAP)
Generic Audio Video Distribution Profile (GAVDP)
Audio/Video Remote Control Profile (AVRCP)
Basic Printing Profile (BPP)
LAN Access Profile Client (LAP)
SIM Access Profile Client & Server (SAP)
Human Interface Device Profile (HID)
Phone Book Access Profile (PBAP)
Message access profile (MAP) [1]
Video Distribution Profile (VDP) [2]
HCRP printer side

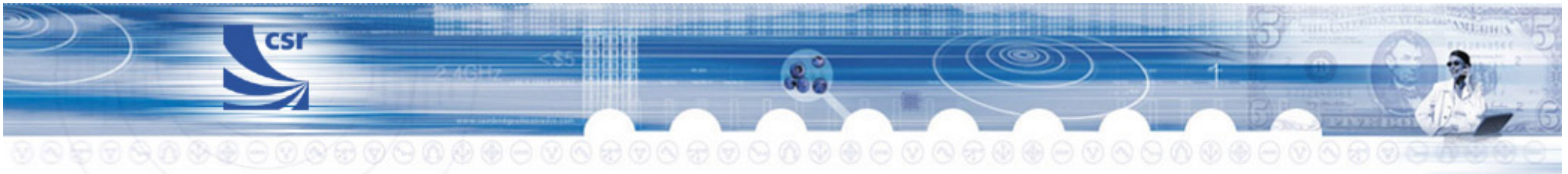## Additionel features
JSR82 support [3]
V2.0 compliant including eSCO and EDR

[1] This profiles is not adopted yet, it is available as engineering releases on request
[2] No codec is included for VDP (mandatory codec is H.263)
[3] Scheduler task for lower layer support of JSR82 (JAVA classes are not included)

BCHS future Plans

BCHS is a mature product including most of the BT profiles. Focus in 2006 will be:
- Making it easier for the customer to integrate BCHS into their platform (BCHS IM)
- Differentiation

New profiles and features are still added to meet the customers' requirements:

Next release (September 2006):
- SyncML server
- Support for text to speech feature in CSR headsets
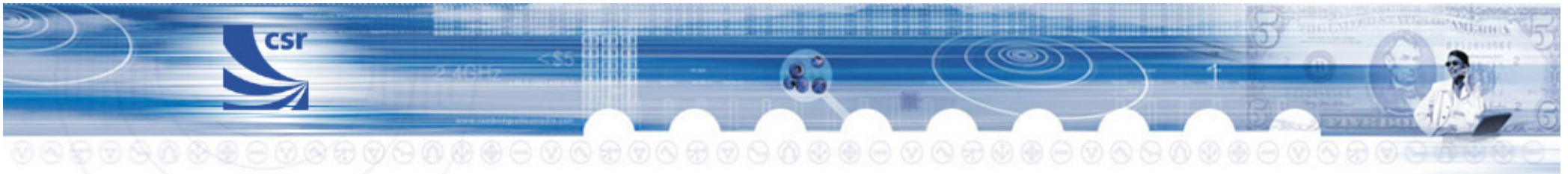- Dual Stereo headsets
- FM API

Features and profiles under consideration for future releases:
- Stream AAC & AAC+
- Simple pairing (v2.1)
- Extended inquiry response (v2.1)
- HCRP device side
- VDP H.263 codec
- MAP
- CTP 1.2
- AMP

CSR offers the most complete set of profiles, with resources to deliver new profiles quickly
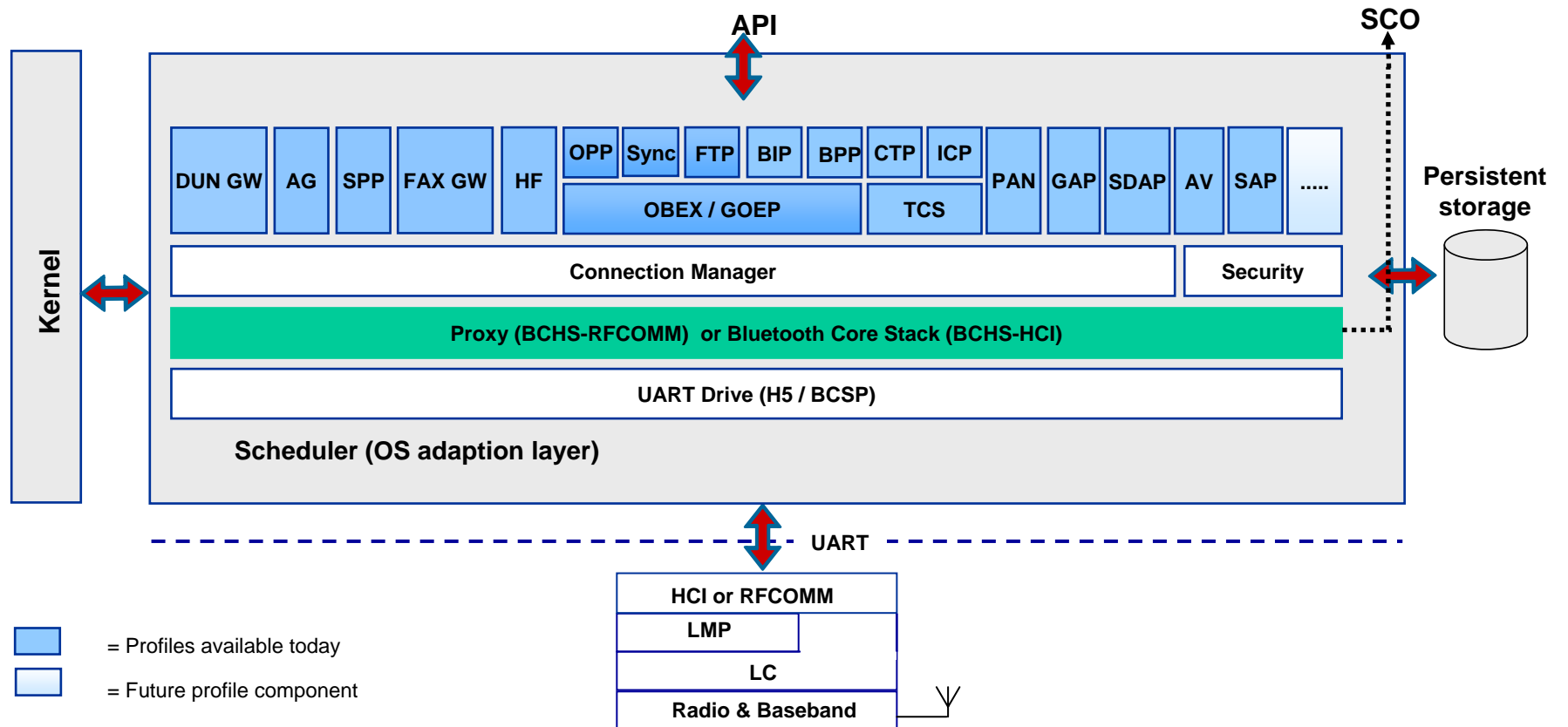
BCHS Package structure

BCHS Professional Includes

- Full source code (ANSI C)
- 6 months maintenance and support
- Access to secure website for updates
- Two day training seminar
- Example applications and drivers for ARM7, Nucleus and Windows
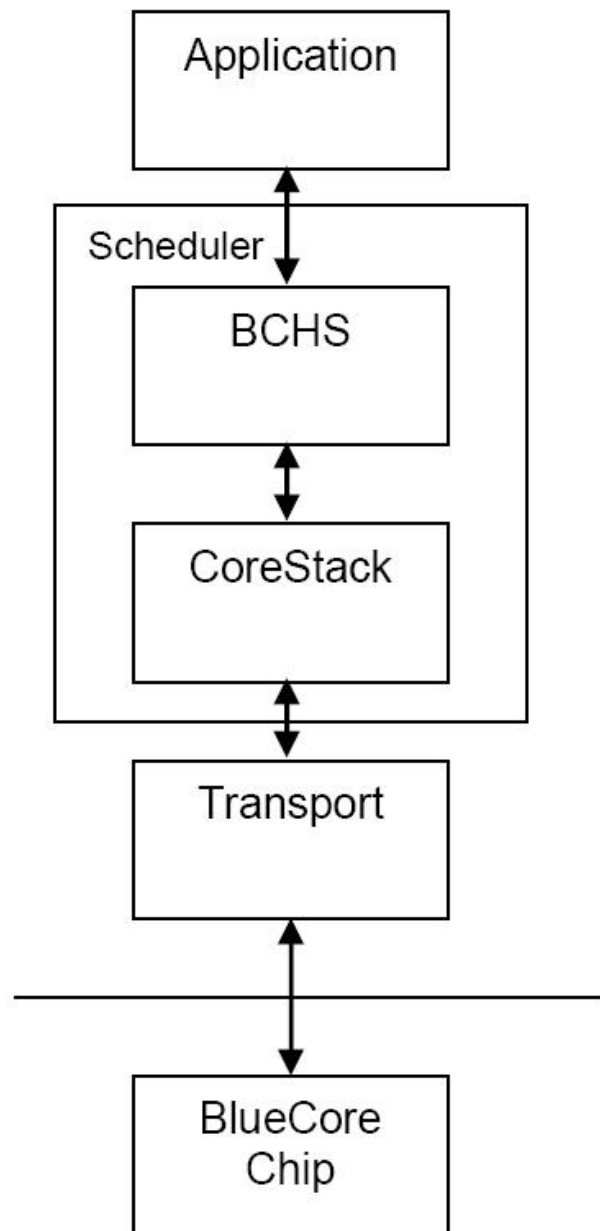- Documentation: user guide, porting guide, APIs, qualification reports

The BCHS licence gives the user the right to use the software in conjunction with BlueCore™ devices.

BCHS - a Flexible Concept

All interfaces for BCHS-HCI and BCHS-RFCOMM are the same. The only difference is one module. Therefore it is easy to "upgrade" from BCHS-RFCOMM to BCHS-HCI and vice versa. It only requires a change of the makefile.
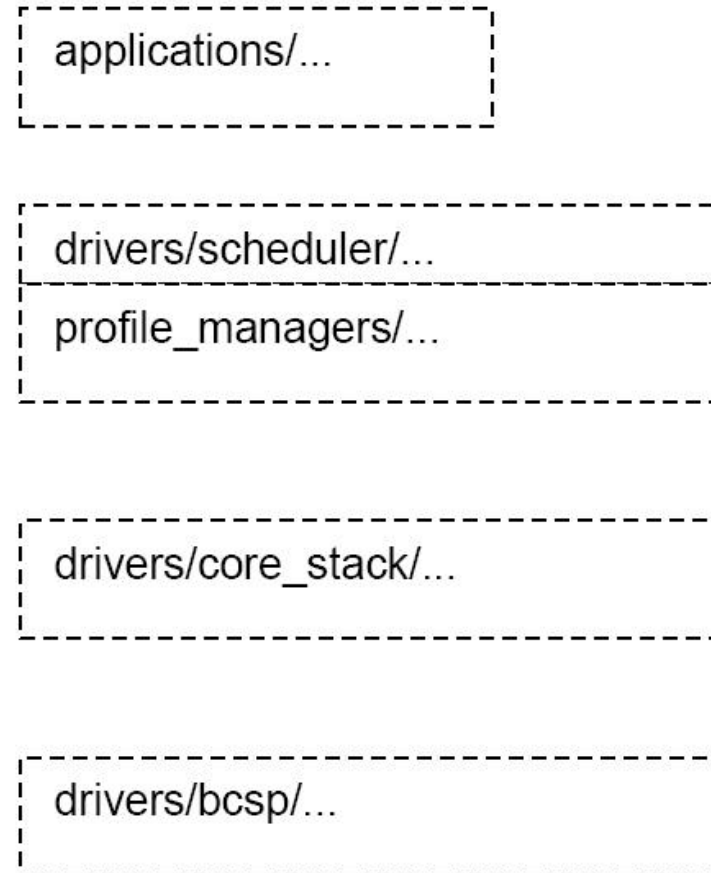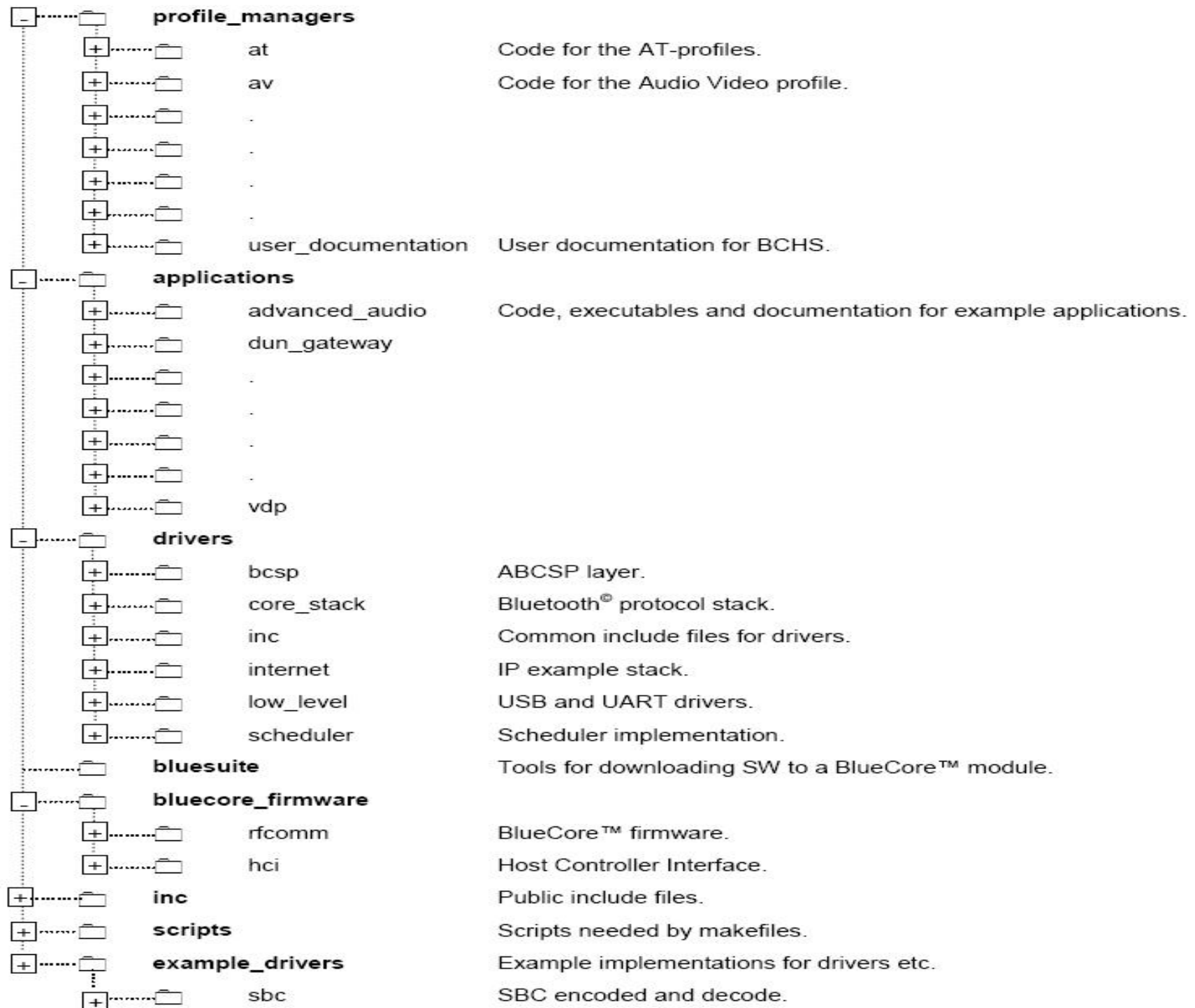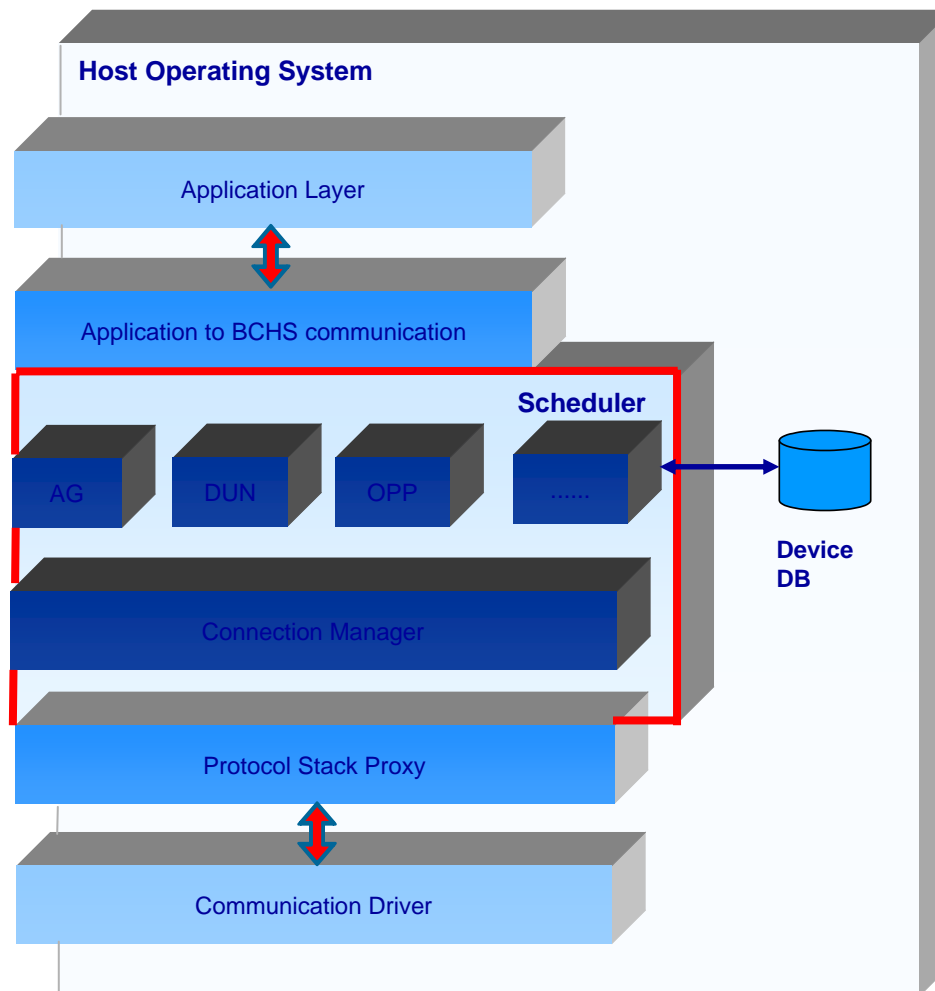

BlueCore is a Trade Mark of Cambridge Silicon Radio

Figure 3: Simplified view of BCHS

```
- ┄┄┄┄ 📁 profile_managers
  + ┄┄┄┄ 📁      at                    Code for the AT-profiles.
  + ┄┄┄┄ 📁      av                    Code for the Audio Video profile.
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      user_documentation    User documentation for BCHS.
- ┄┄┄┄ 📁 applications
  + ┄┄┄┄ 📁      advanced_audio        Code, executables and documentation for example applications.
  + ┄┄┄┄ 📁      dun_gateway
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      .
  + ┄┄┄┄ 📁      vdp
- ┄┄┄┄ 📁 drivers
  + ┄┄┄┄ 📁      bcsp                  ABCSP layer.
  + ┄┄┄┄ 📁      core_stack            Bluetooth© protocol stack.
  + ┄┄┄┄ 📁      inc                   Common include files for drivers.
  + ┄┄┄┄ 📁      internet              IP example stack.
  + ┄┄┄┄ 📁      low_level             USB and UART drivers.
  + ┄┄┄┄ 📁      scheduler             Scheduler implementation.
  ┄┄┄┄ 📁 bluesuite                    Tools for downloading SW to a BlueCore™ module.
- ┄┄┄┄ 📁 bluecore_firmware
  + ┄┄┄┄ 📁      rfcomm                BlueCore™ firmware.
  + ┄┄┄┄ 📁      hci                   Host Controller Interface.
+ ┄┄┄┄ 📁 inc                          Public include files.
+ ┄┄┄┄ 📁 scripts                      Scripts needed by makefiles.
+ ┄┄┄┄ 📁 example_drivers              Example implementations for drivers etc.
  + ┄┄┄┄ 📁      sbc                   SBC encoded and decode.
```

BCHS Porting

Steps to Port BCHS

Host Operating System

- Application Layer
- Application to BCHS communication

Scheduler

AG | DUN | OPP | ......

Device DB

Connection Manager

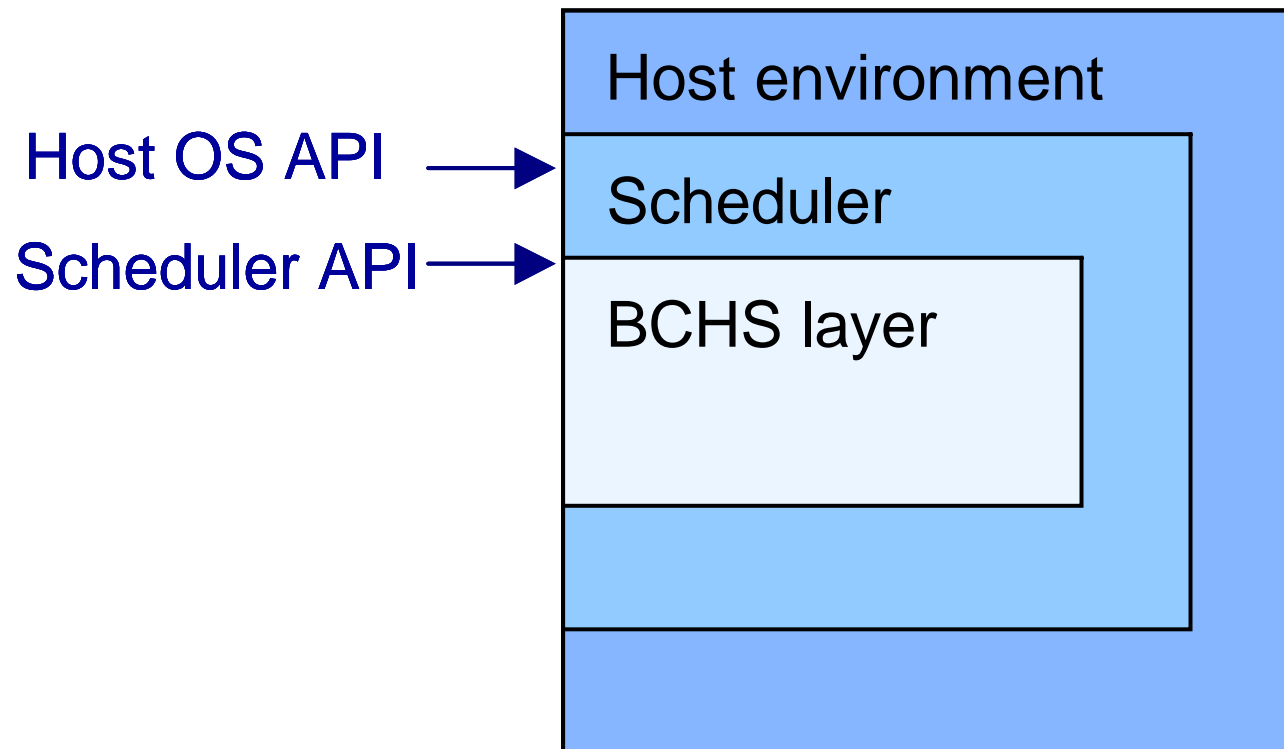Protocol Stack Proxy

Communication Driver

Porting the virtual OS (the Scheduler) to the host OS

Defining low level drivers for the BlueCore communication and interfacing the driver to BCHS

Defining a communication path between the tasks executing in the Scheduler and the tasks executing in the host OS

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Porting BCHS - Models

- Recommend
    - Scheduler port to native OS

- Alternative
    - Provide Scheduler API (using native OS API)

BCHS Scheduler

Host OS API →

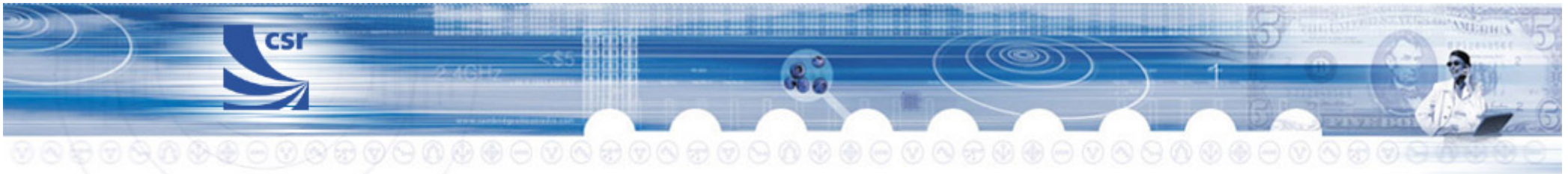Scheduler API →

| Host environment |
| Scheduler |
| BCHS layer |

BCHS Scheduler Tasks

- BCHS is organised as a set of tasks
- Each task is a message driven state machine
- Tasks have no requirements on scheduling (not time critical)
- Each task is a function call + an optional initialisation function
- No global data used (in BCHS tasks)

Example Schedulers

- Current ports: Nucleus, Windows, and ARM stand-alone

- Very simple (500 lines of code)

- All tasks run in a single address space

- Round robin

- Non pre-emptive

- Support for pre-emptive kernel/OS

- No priority of tasks

- Message handling included

- Timer handling included

- Time critical code should be run as interrupts
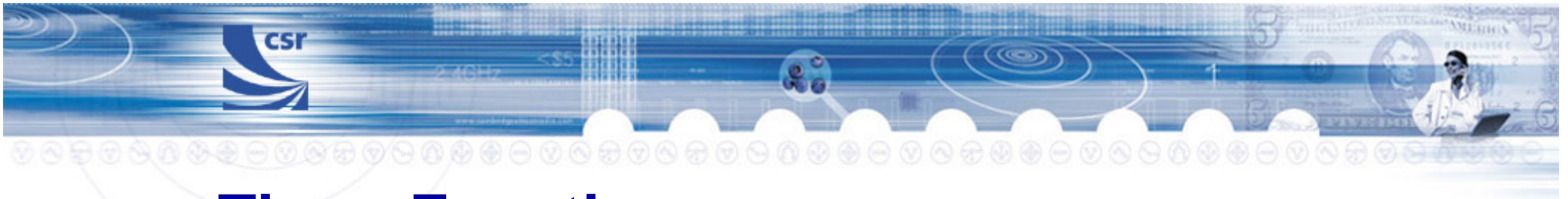
- Supports background interrupts

Scheduler and Memory Manager APIs

- **Message functions** (6 functions)

- **Timer functions** (4 functions)

- **Memory allocation functions** (3 functions)

- **Panic** (1 function)

- **Controlled shutdown** (option)

Message Functions

- bool_t **get_message**(qid q, uint16_t *pmi, void **pmv)

- msgid **put_message**(qid q, uint16_t mi, void *mv)

- bool_t **cancel_message**(qid q, msgid mid, uint16_t *pmi, void **pmv)

- msgid **put_message_at**(TIME when, qid q, uint16_t mi, void *mv)

- msgid **put_message_in**(TIME delay, qid q, uint16_t mi, void *mv)

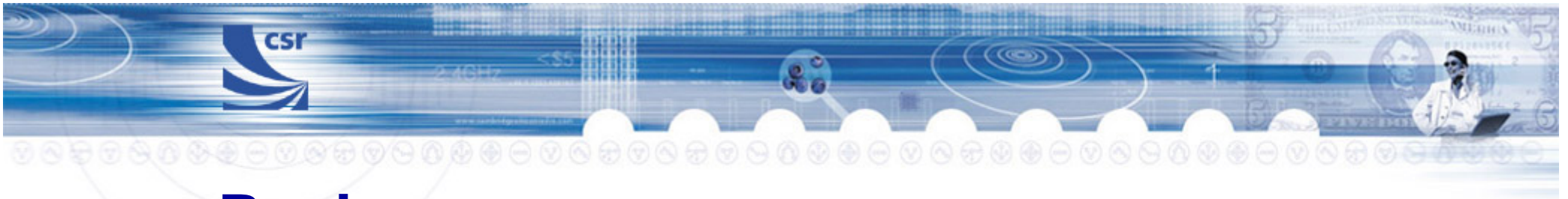- bool_t **cancel_timed_message**(qid q, msgid mid, uint16_t *pmi, void **pmv)

Timer Functions

- tid **timed_event_at**(TIME when, void (*fn) (uint16_t, void *), uint16_t fniarg, void *fnvarg)

- tid **timed_event_in**(TIME delay, void (*fn) (uint16_t, void *), uint16_t fniarg, void *fnvarg)

- bool_t **cancel_timed_event**(tid eventid, uint16_t *pmi, void **pmv)

- TIME get_time(void)

Memory Allocation Functions

- void *pmalloc(uint32_t size)

- void pfree(void *ptr)

- void *zpmalloc(uint32_t size)
  implemented as (memset(pmalloc(size), 0x00, (size_t) size))

Panic

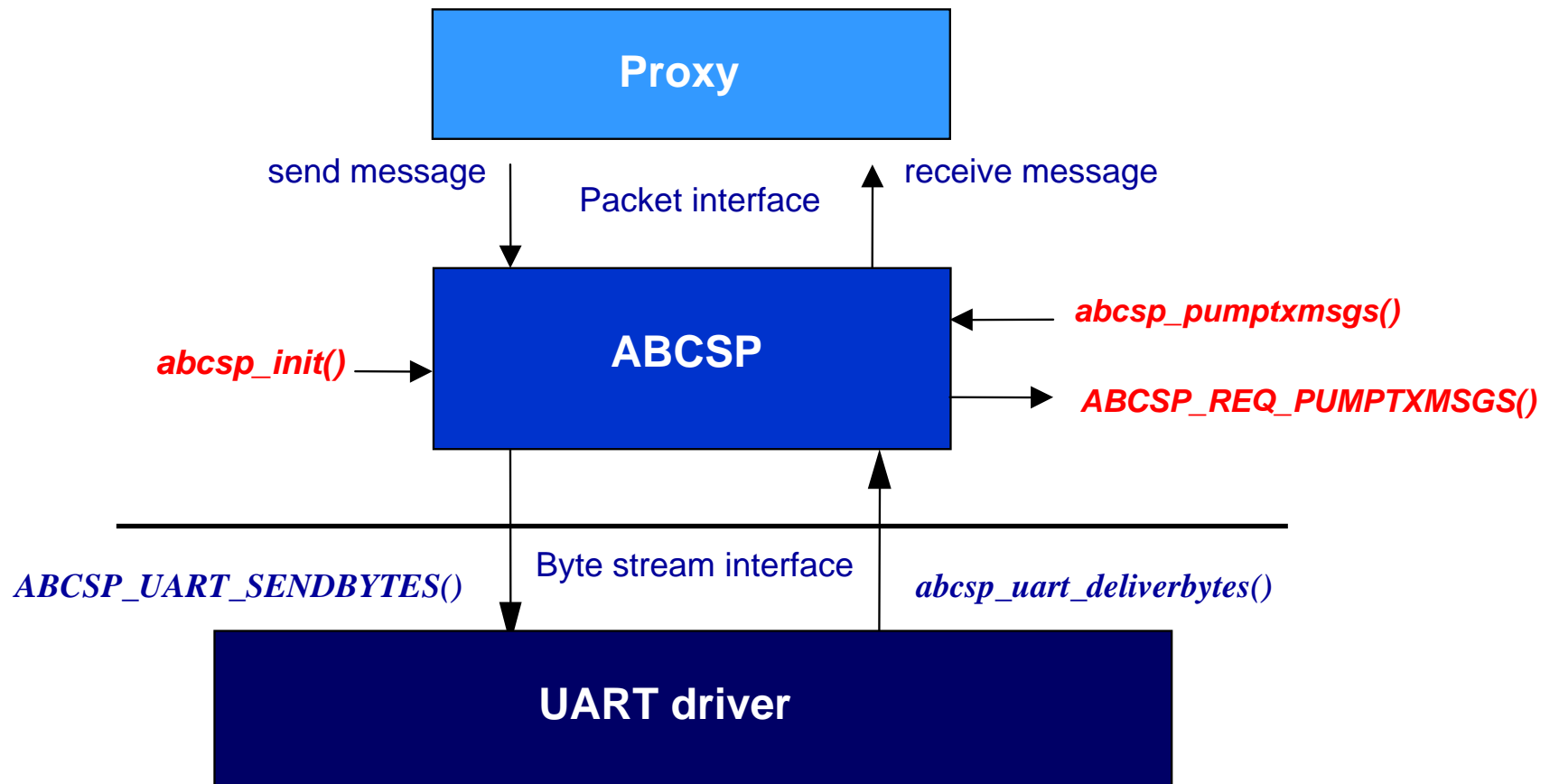- void **sched_panic**(panicid deathbed_confession)

Host interface – UART or USB

SC Data Base and UART Driver APIs

- scDbRead()

- scDbWrite()

- scDbRemove()

- UartDrv_Tx()

- UartDrv_Rx() – functionality must be implemented

- UartDrv_RegisterHandlers() – functionality must be implemented

- UartDrv_Configure() – in case of ROM bootstrap

- UartDrv_Start() – in case of ROM bootstrap

Low Level Interface BCSP - UART

Proxy

send message → Packet interface ← receive message

abcsp_pumptxmsgs()

abcsp_init() → **ABCSP** → ABCSP_REQ_PUMPTXMSGS()

Byte stream interface

ABCSP_UART_SENDBYTES()   abcsp_uart_deliverbytes()

UART driver

USB Driver APIs

- UsbDrv_Start()

- UsbDrv_Stop()

- UsbDrv_Reset()

- UsbDrv_Tx()

- UsbDrv_Rx()

A ported USB interface for the Windows (win32) platform is provided as an example with BCHS

Documentation

This is the general information in how to use BCHS:

File-name	Description
bchs-gu-001_user_guide.pdf	This document
bchs-gu-002_port_guide.pdf	Guidelines in how to port BCHS to the user's platform and operating system
bchs-srn-001_release_notes.pdf	Supported features, test evidence, qualification status and known issues

Each profile has a document describing the Application Programming Interface (API). The API document includes message definition and simple use case sequences of utilisation of the API.

Component	File name
Audio Gateway	bchs-api-001_audio_gw_api.pdf
Dial-Up Gateway	bchs-api-002_dun_gw_api.pdf

BCHS is Configurable

- Only the modules (profiles) used are included

  - Projectfile configuration (e.g. EXCLUDE_AG_MODULE)

Audio configuration

Audio configuration

- ## Audio over PCM

set MAP_SCO_PCM PSKey to TRUE.

- ## Audio over BCSP (UART) or USB

MAP_SCO_PCM PSKey must be set to FALSE

AND

the application must register a SCO service function.

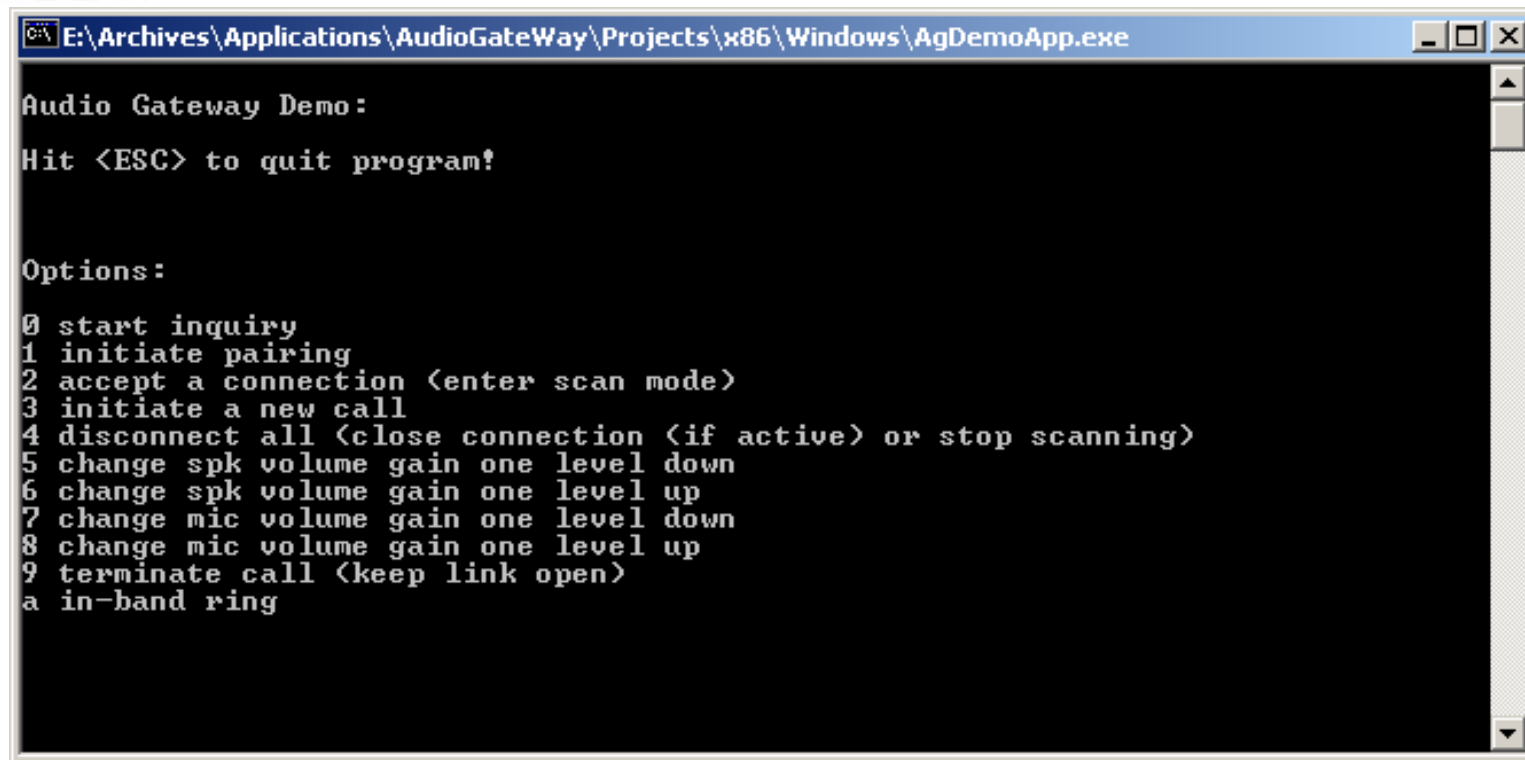bool_t RegisterScoHandle(uint16_t theScoHandle, ScoHandlerFuncType theFunctionPtr)

Example Applications

- To make it easy to understand a specific profile, each profile has a separate example

- The Windows examples are "console" (POSIX) based to make them more readable (no Windows programming required)

- The examples are used to qualify the profiles and will as such contain command options that are not necessary or awkward in real life applications

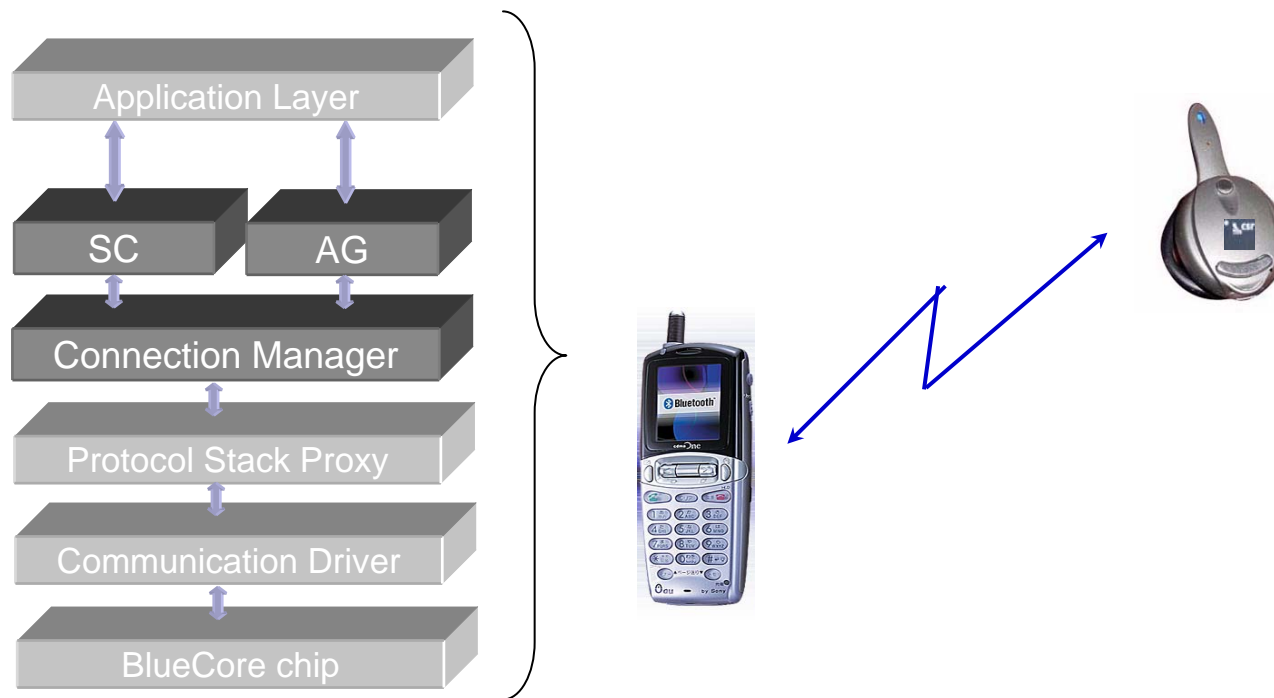- The example applications are an easy way to get started with BCHS (Microsoft Visual C project and an .exe file)

AG Demo Application


```
E:\Archives\Applications\AudioGateWay\Projects\x86\Windows\AgDemoApp.exe

Audio Gateway Demo:

Hit <ESC> to quit program!


Options:

0 start inquiry
1 initiate pairing
2 accept a connection (enter scan mode)
3 initiate a new call
4 disconnect all (close connection (if active) or stop scanning)
5 change spk volume gain one level down
6 change spk volume gain one level up
7 change mic volume gain one level down
8 change mic volume gain one level up
9 terminate call (keep link open)
a in-band ring
```
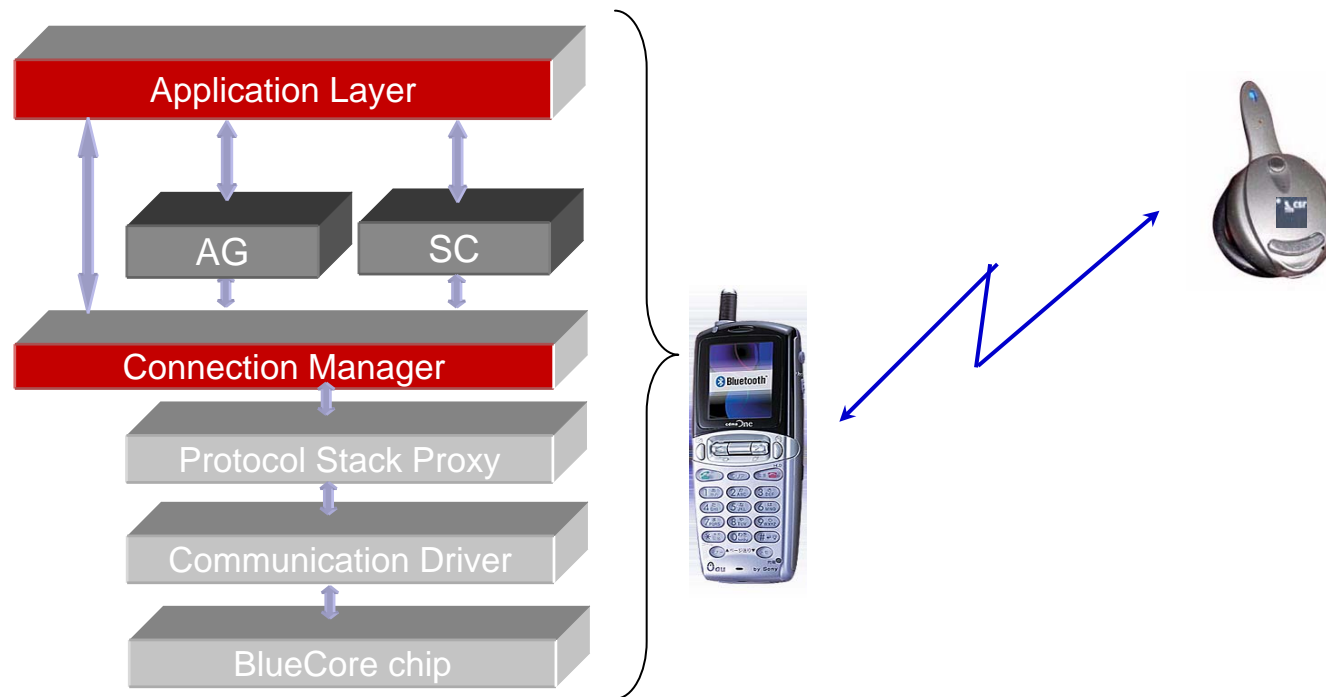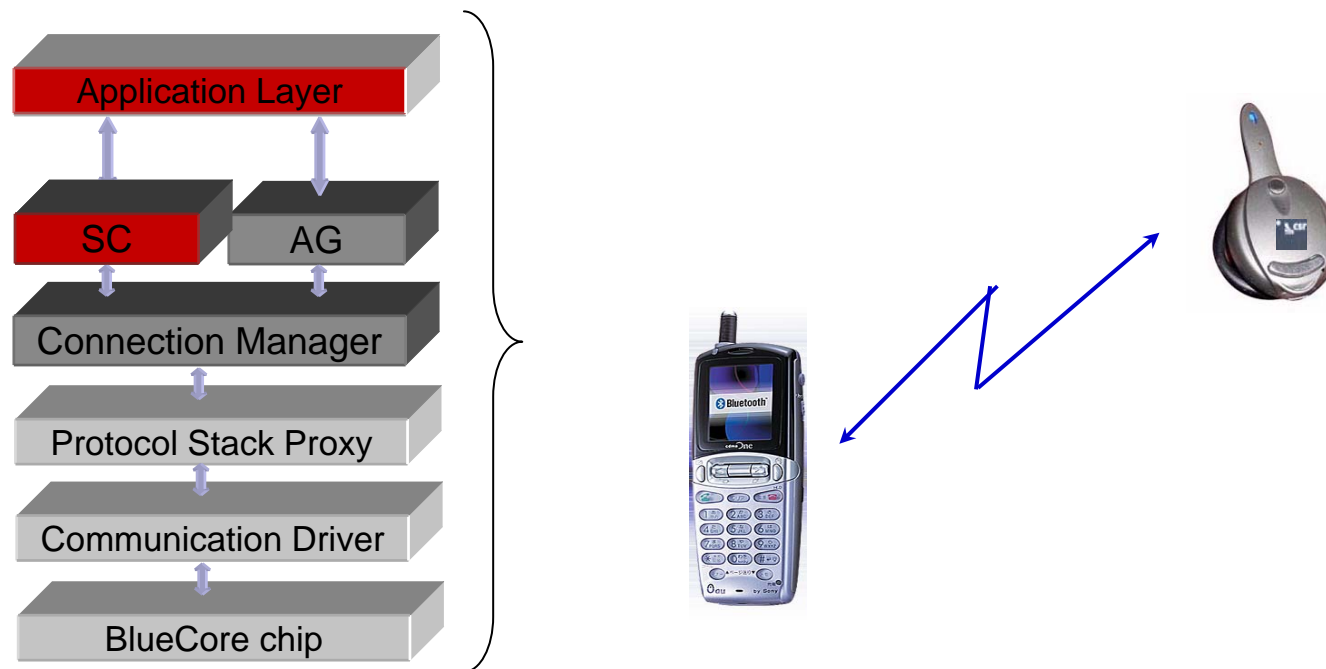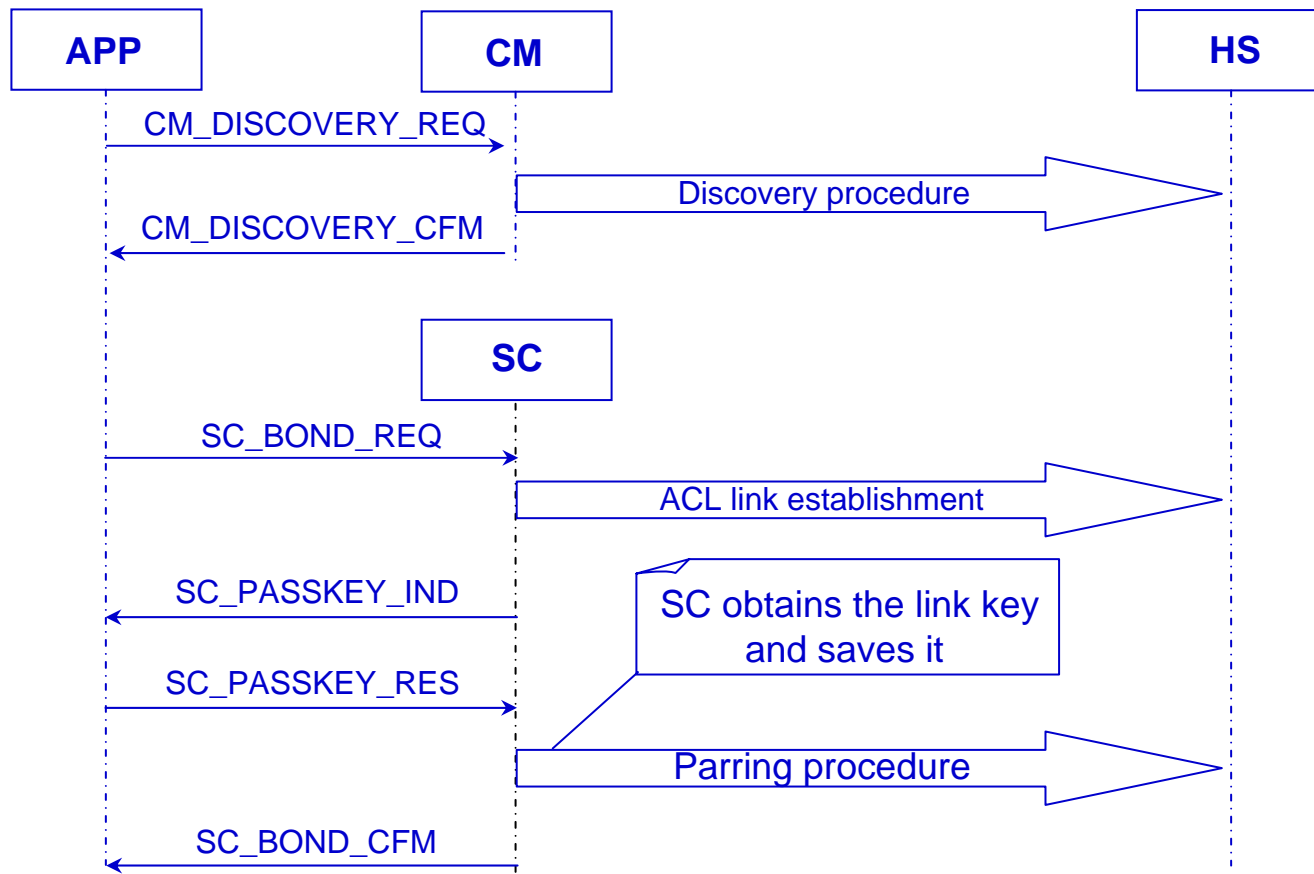
AG Example

Application Layer

SC AG

Connection Manager

Protocol Stack Proxy

Communication Driver

BlueCore chip

AG Example

Application Layer

AG   SC

Connection Manager

Protocol Stack Proxy

Communication Driver

BlueCore chip

How to discover headsets from the phone?

AG Example

Application Layer

SC | AG

Connection Manager

Protocol Stack Proxy

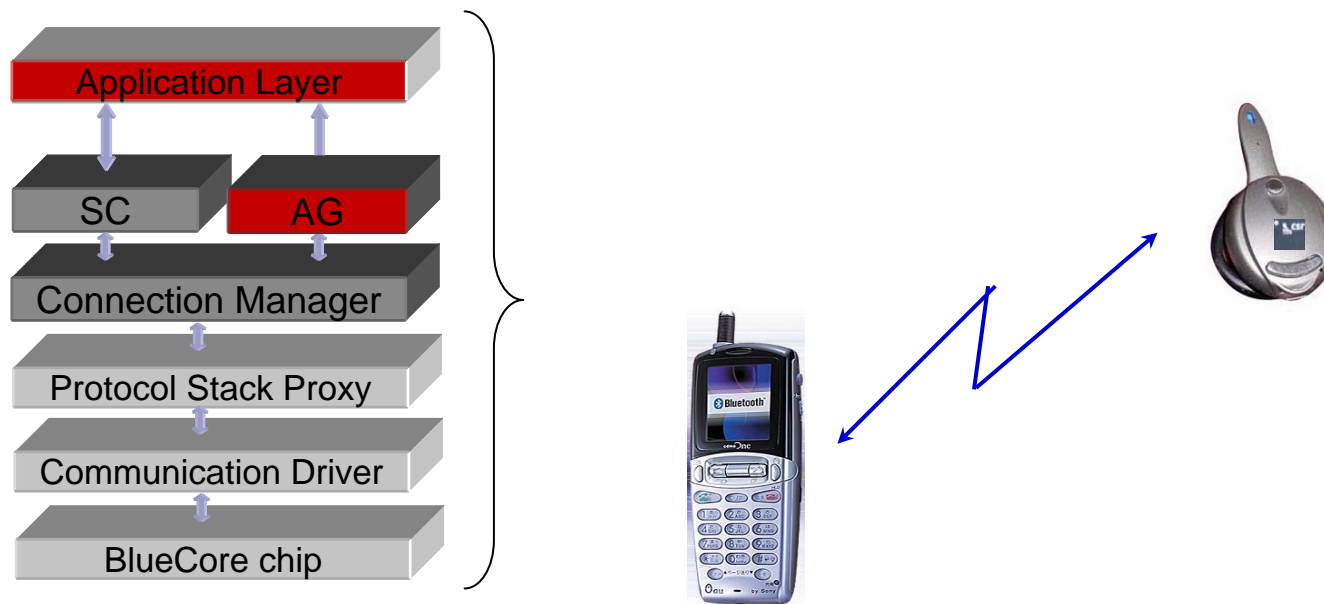Communication Driver

BlueCore chip

How to initiate bonding from the phone?

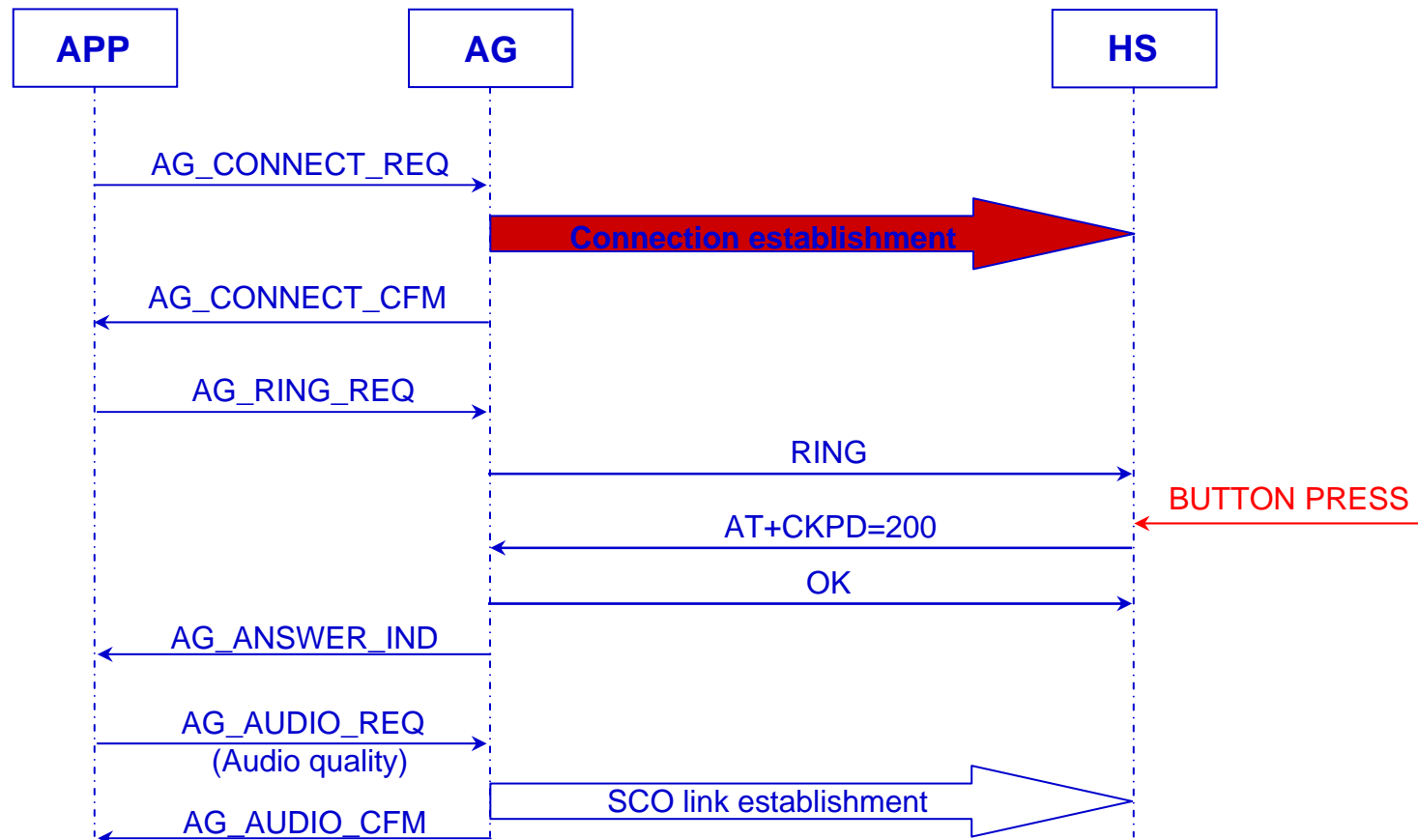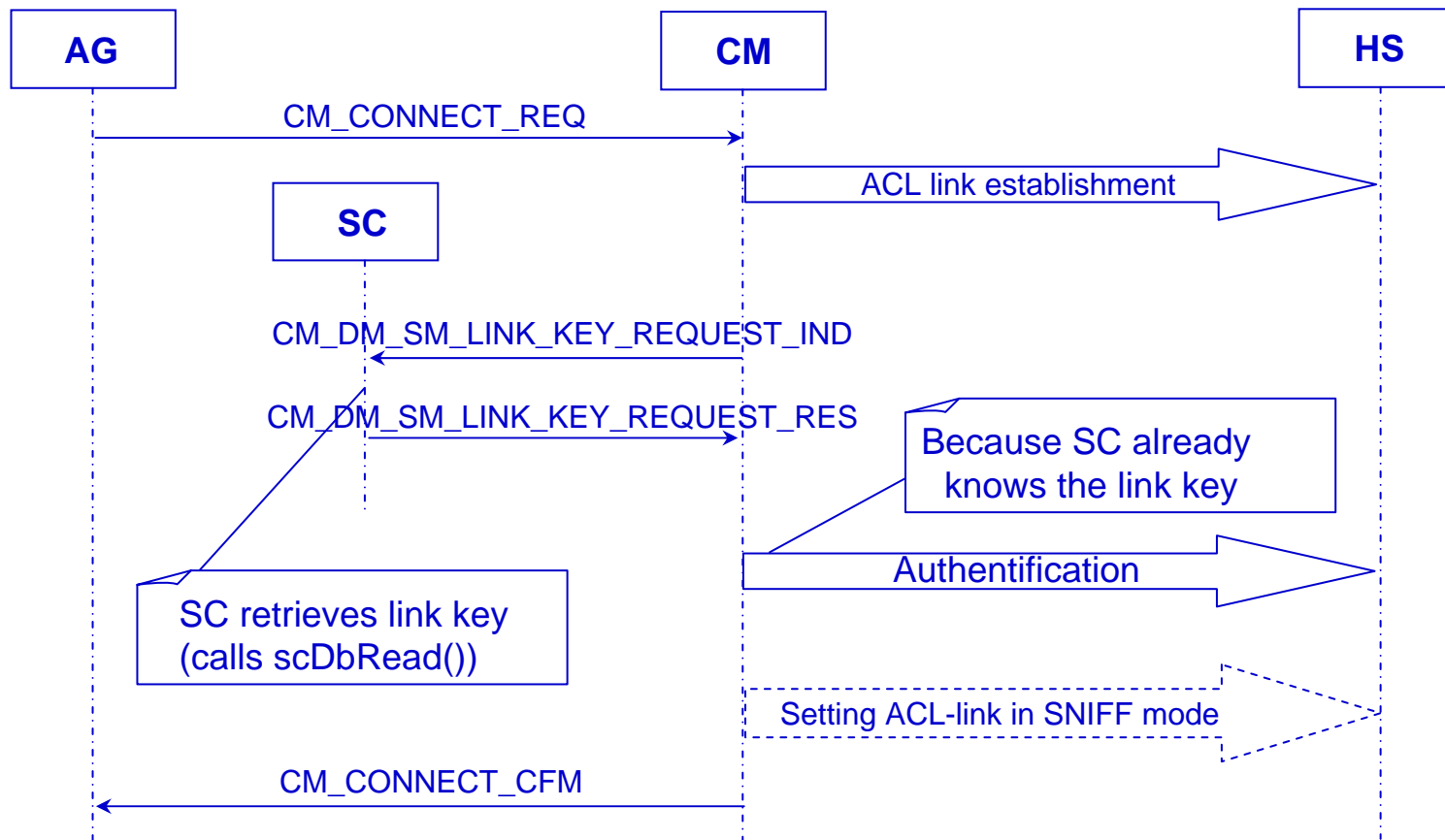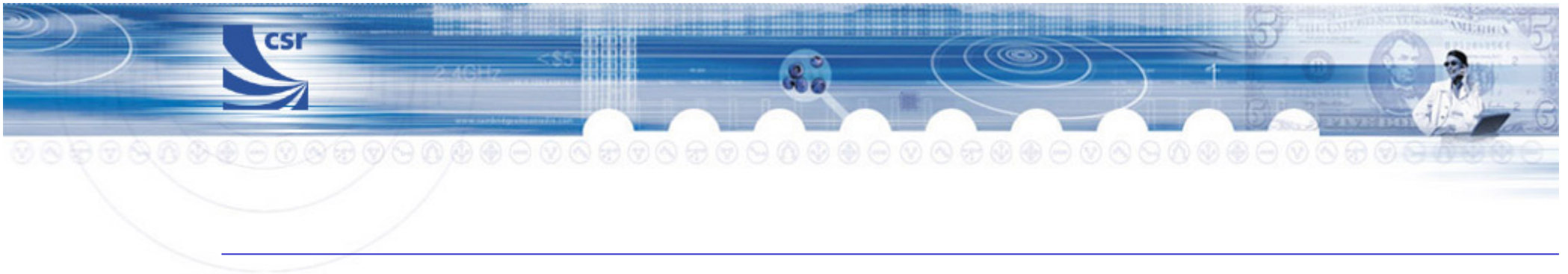# How to Initiate Bonding from the Phone

AG Example

How to initiate a call setup from the phone?

How to use the supported power savings modes?
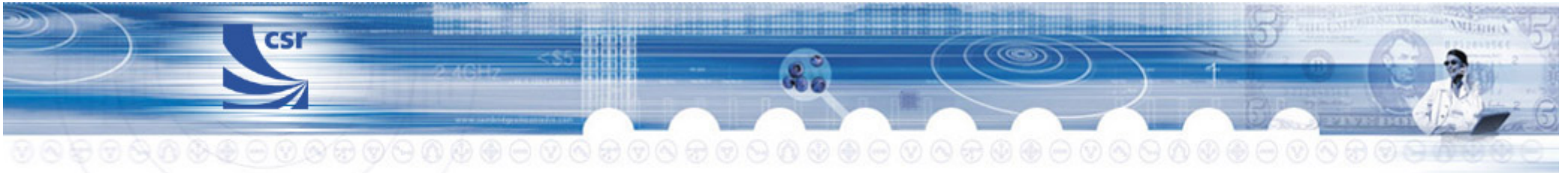
How to Initiate a Call Setup from the Phone

BlueCore is a Trade Mark of Cambridge Silicon Radio

Connection Establishment

AG   CM   HS

CM_CONNECT_REQ

ACL link establishment

SC

CM_DM_SM_LINK_KEY_REQUEST_IND

CM_DM_SM_LINK_KEY_REQUEST_RES

Because SC already knows the link key

Authentification

SC retrieves link key (calls scDbRead())

Setting ACL-link in SNIFF mode
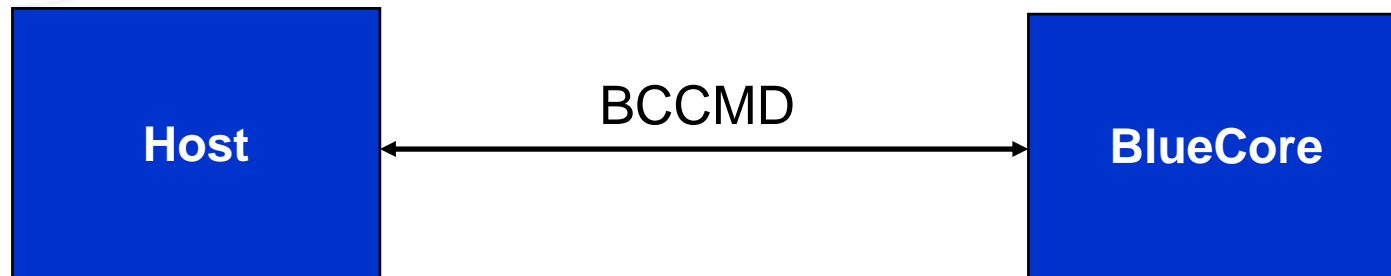
CM_CONNECT_CFM

ROM chips

Case of ROM chips

- Design may not have an e2prom

- ROM chips needs to be configured at boot-up

- The host must provide configuration data:

  1. needs to modify Pskeys

  2. send pskeys write commands over UART

  3. these commands are encapsulated in a BCCMD packet

  4. BCCMD packets are sent directly to the BCSP channel number 2

  5. confirmation packet received on the same channel

$\Rightarrow$ It is the boostrap code

$\Rightarrow$ Good news! Already implemented in BCHS

Basic BCCMD Commands

```
┌─────────────┐          BCCMD          ┌─────────────┐
│    Host     │ ◄─────────────────────► │  BlueCore   │
└─────────────┘                          └─────────────┘
```
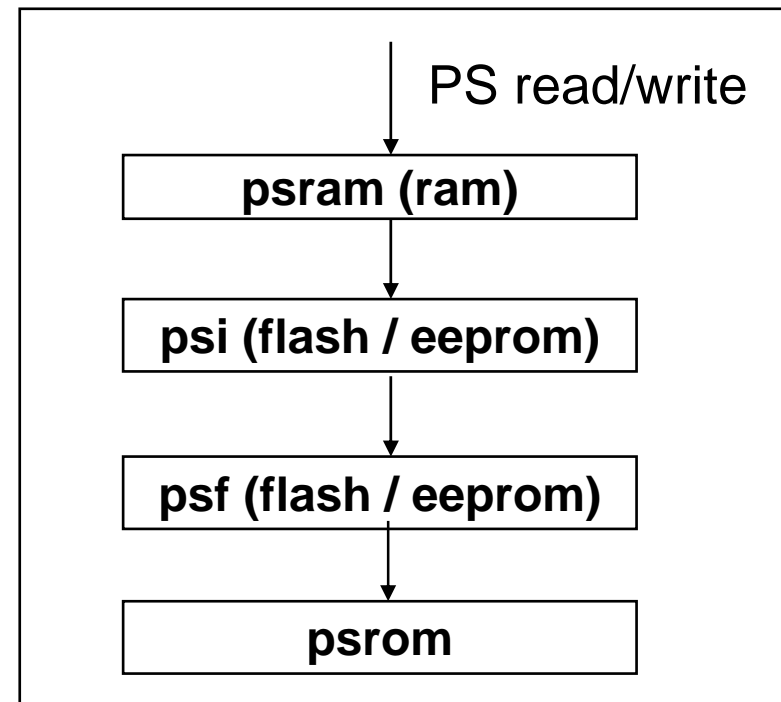
System Control cmds:

Config_UART

Bypass_UART

Map_SCO_PCM

PIO ctrl

Warm reset

Persistent Store (PS cmds)

PS read/write

psram (ram)

psi (flash / eeprom)

psf (flash / eeprom)

psrom

BlueCore is a Trade Mark of Cambridge Silicon Radio
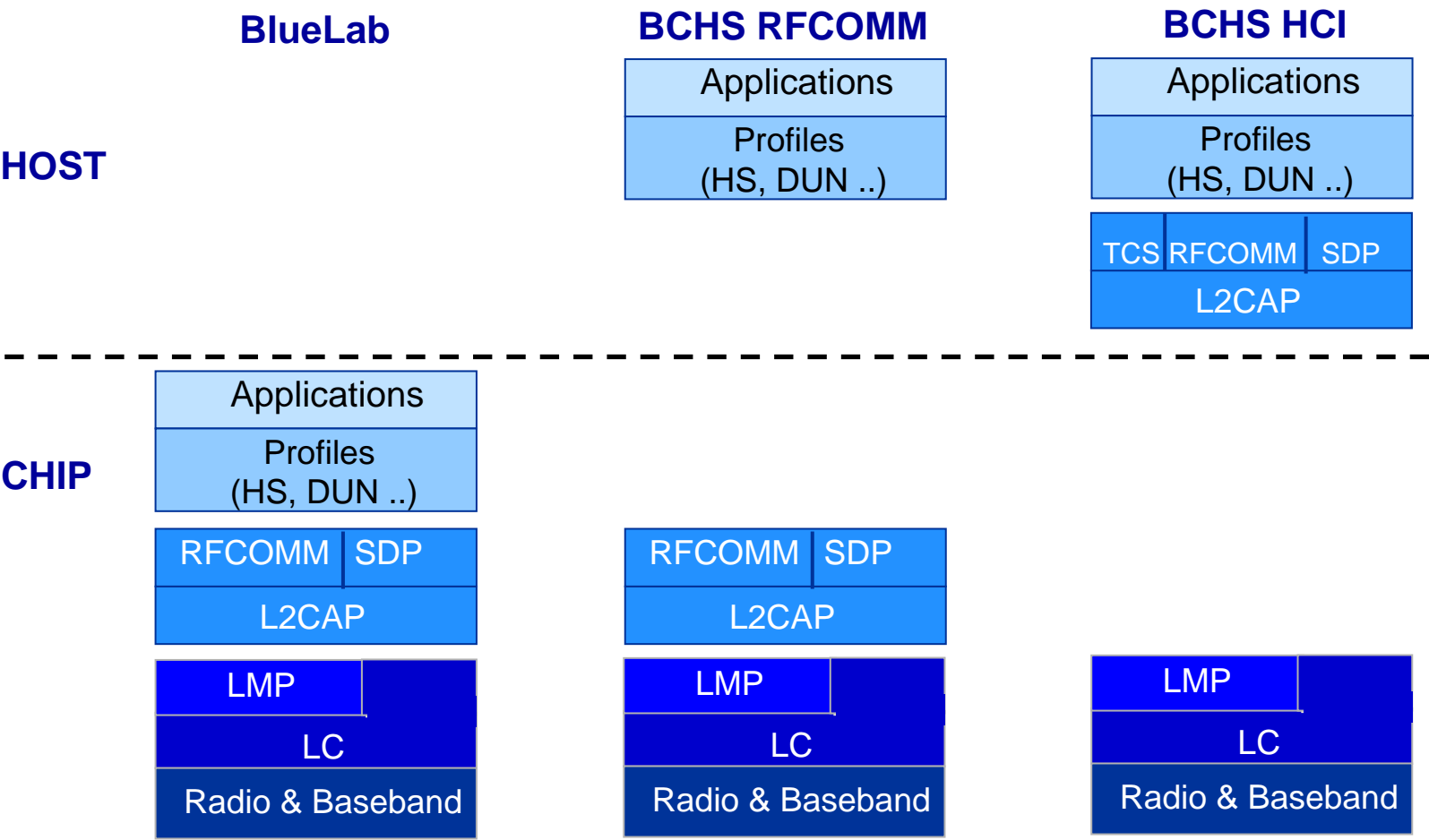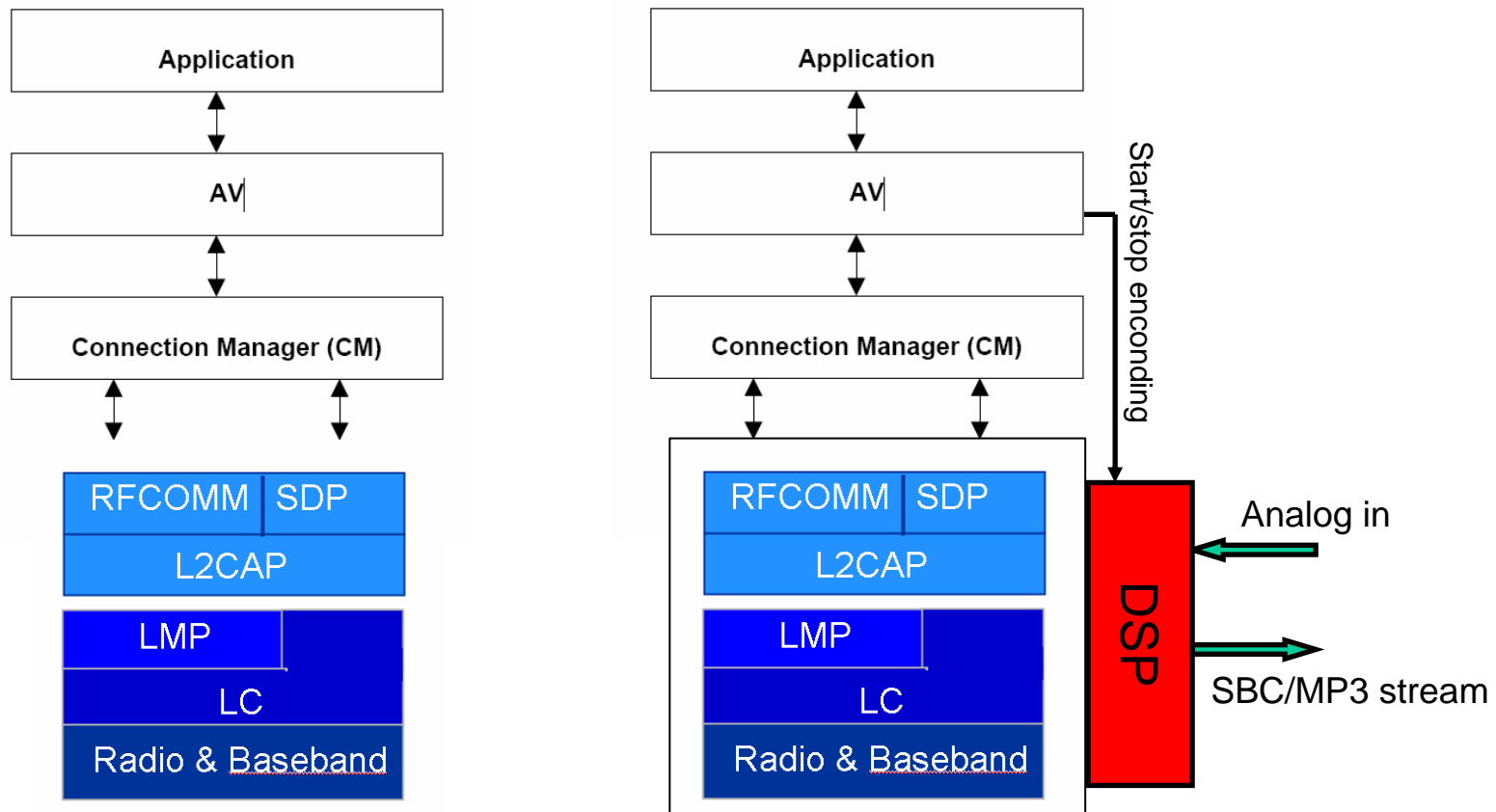
Low cost platform and AV profiles

CSR Bluetooth System Solutions

BlueLab

BCHS RFCOMM

BCHS HCI

HOST

BCHS RFCOMM
Applications
Profiles (HS, DUN ..)

BCHS HCI
Applications
Profiles (HS, DUN ..)

TCS	RFCOMM	SDP
L2CAP		

CHIP

Applications
Profiles (HS, DUN ..)

RFCOMM	SDP
L2CAP	

LMP
LC
Radio & Baseband

RFCOMM	SDP
L2CAP	

LMP
LC
Radio & Baseband

LMP
LC
Radio & Baseband

BlueCore is a Trade Mark of Cambridge Silicon Radio

CSR Bluetooth System Solutions

AV Profile System Chooser

BlueCore-ROM

BlueCore-Multimedia

BlueCore is a Trade Mark of Cambridge Silicon Radio
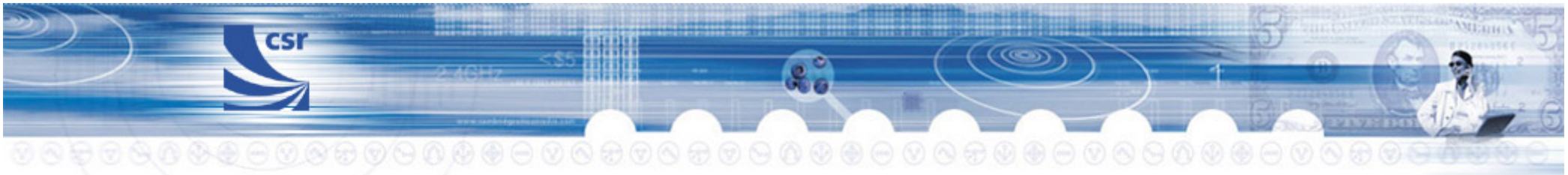
AV Profile System Chooser

When choosing how to implement the AV profile in a mobile phone,

CSR has two approaches depending on the resources available.

A normal HCI split using the Bluecore-ROM devices where the host processor has enough MIPS to do the transcoding to the SIG defined CODEC (SBC)

A RFC split where due to resource limitations and transcoding encoding is done by the BlueCore3-Multimedia devices DSP engine
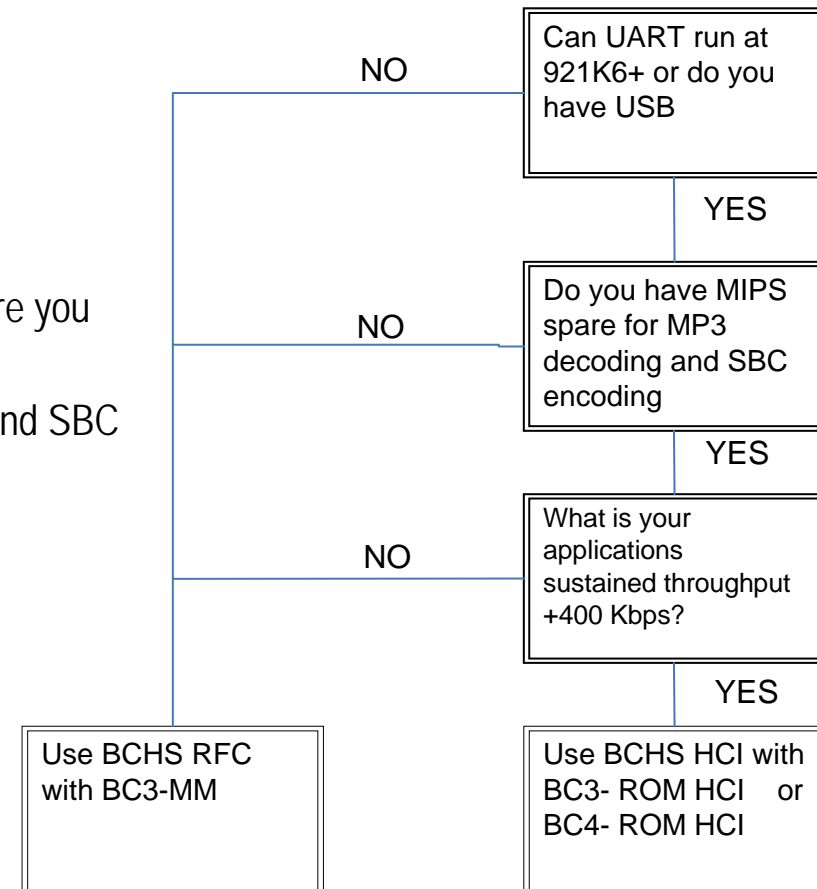
Questions to Ask

This chart is designed with questions which

let you choose which option is right for your

system architecture

Do you have an UART which runs at 921K6 baud or are you
connecting with USB?

Do you have spare MIPS capacity for MP3 decoding and SBC
re-encoding?

Can your application sustain >400Kbps throughput?

NO

Can UART run at
921K6+ or do you
have USB

YES

NO

Do you have MIPS
spare for MP3
decoding and SBC
encoding

YES

NO

What is your
applications
sustained throughput
+400 Kbps?

YES

Use BCHS RFC
with BC3-MM

Use BCHS HCI with
BC3- ROM HCI   or
BC4- ROM HCI

BlueCore is a Trade Mark of Cambridge Silicon Radio

Questions?

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射 频 和 天 线 设 计 培 训 课 程 推 荐

易迪拓培训(www.edatop.com)由数名来自于研发第一线的资深工程师发起成立，致力并专注于微波、射频、天线设计研发人才的培养；我们于 2006 年整合合并微波 EDA 网(www.mweda.com)，现已发展成为国内最大的微波射频和天线设计人才培养基地，成功推出多套微波射频以及天线设计经典培训课程和 ADS、HFSS 等专业软件使用培训课程，广受客户好评；并先后与人民邮电出版社、电子工业出版社合作出版了多本专业图书，帮助数万名工程师提升了专业技术能力。客户遍布中兴通讯、研通高频、埃威航电、国人通信等多家国内知名公司，以及台湾工业技术研究院、永业科技、全一电子等多家台湾地区企业。

易迪拓培训推荐课程列表： http://www.edatop.com/peixun/tuijian/

射频工程师养成培训课程套装

该套装精选了射频专业基础培训课程、射频仿真设计培训课程和射频电路测量培训课程三个类别共 30 门视频培训课程和 3 本图书教材；旨在引领学员全面学习一个射频工程师需要熟悉、理解和掌握的专业知识和研发设计能力。通过套装的学习，能够让学员完全达到和胜任一个合格的射频工程师的要求…

课程网址：http://www.edatop.com/peixun/rfe/110.html

手机天线设计培训视频课程

该套课程全面讲授了当前手机天线相关设计技术，内容涵盖了早期的外置螺旋手机天线设计，最常用的几种手机内置天线类型——如 monopole 天线、PIFA 天线、Loop 天线和 FICA 天线的设计，以及当前高端智能手机中较常用的金属边框和全金属外壳手机天线的设计；通过该套课程的学习，可以帮助您快速、全面、系统地学习、了解和掌握各种类型的手机天线设计，以及天线及其匹配电路的设计和调试…

课程网址： http://www.edatop.com/peixun/antenna/133.html

WiFi 和蓝牙天线设计培训课程

该套课程是李明洋老师应邀给惠普 (HP)公司工程师讲授的 3 天员工内训课程录像，课程内容是李明洋老师十多年工作经验积累和总结，主要讲解了 WiFi 天线设计、HFSS 天线设计软件的使用，匹配电路设计调试、矢量网络分析仪的使用操作、WiFi 射频电路和 PCB Layout 知识，以及 EMC 问题的分析解决思路等内容。对于正在从事射频设计和天线设计领域工作的您，绝对值得拥有和学习！…

课程网址：http://www.edatop.com/peixun/antenna/134.html

CST 学习培训课程套装

该培训套装由易迪拓培训联合微波 EDA 网共同推出，是最全面、系统、专业的 CST 微波工作室培训课程套装，所有课程都由经验丰富的专家授课，视频教学，可以帮助您从零开始，全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装，还可超值赠送 3 个月免费学习答疑…

课程网址：http://www.edatop.com/peixun/cst/24.html

HFSS 学习培训课程套装

该套课程套装包含了本站全部 HFSS 培训课程，是迄今国内最全面、最专业的 HFSS 培训教程套装，可以帮助您从零开始，全面深入学习 HFSS 的各项功能和在多个方面的工程应用。购买套装，更可超值赠送 3 个月免费学习答疑，随时解答您学习过程中遇到的棘手问题，让您的 HFSS 学习更加轻松顺畅…

课程网址：http://www.edatop.com/peixun/hfss/11.html

ADS 学习培训课程套装

该套装是迄今国内最全面、最权威的 ADS 培训教程，共包含 10 门 ADS 学习培训课程。课程是由具有多年 ADS 使用经验的微波射频与通信系统设计领域资深专家讲解，并多结合设计实例，由浅入深、详细而又全面地讲解了 ADS 在微波射频电路设计、通信系统设计和电磁仿真设计方面的内容。能让您在最短的时间内学会使用 ADS，迅速提升个人技术能力，把 ADS 真正应用到实际研发工作中去，成为 ADS 设计专家...

课程网址： http://www.edatop.com/peixun/ads/13.html

我们的课程优势：

※ 成立于 2004 年，10 多年丰富的行业经验，

※ 一直致力并专注于微波射频和天线设计工程师的培养，更了解该行业对人才的要求

※ 经验丰富的一线资深工程师讲授，结合实际工程案例，直观、实用、易学

联系我们：

※ 易迪拓培训官网：http://www.edatop.com

※ 微波 EDA 网：http://www.mweda.com

※ 官方淘宝店：http://shop36920890.taobao.com