

# CSR Firmware

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## **Firmware Categories**

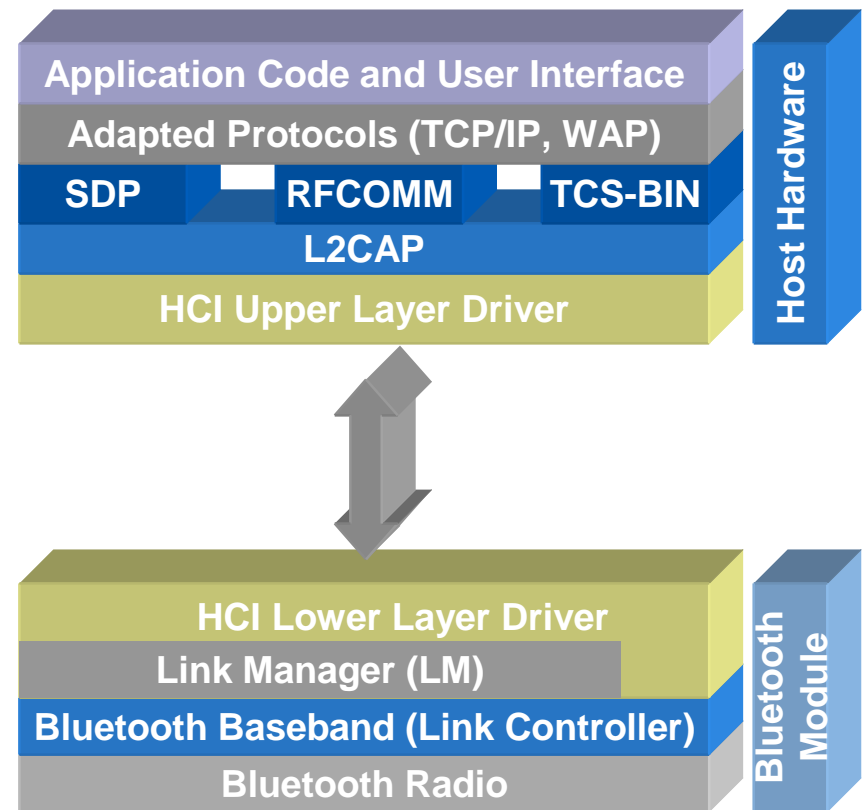
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- Several variants of the BlueCore firmware are available.
- These target different application areas and market segments.
- All the variants are produced from the same source code tree.



## Firmware Categories - HCI Build

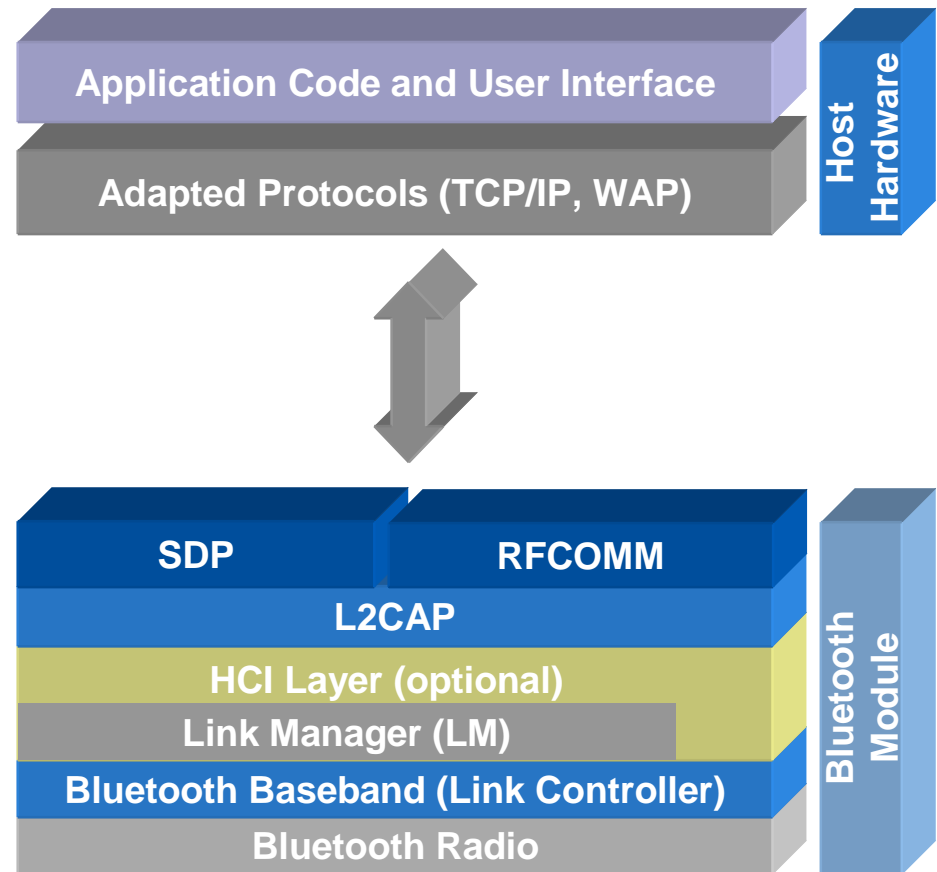
- The traditional architecture splits functionality between the Bluetooth module and a host at the HCI level.
- This offers the most hardware flexibility.
- A separate microprocessor is required to implement



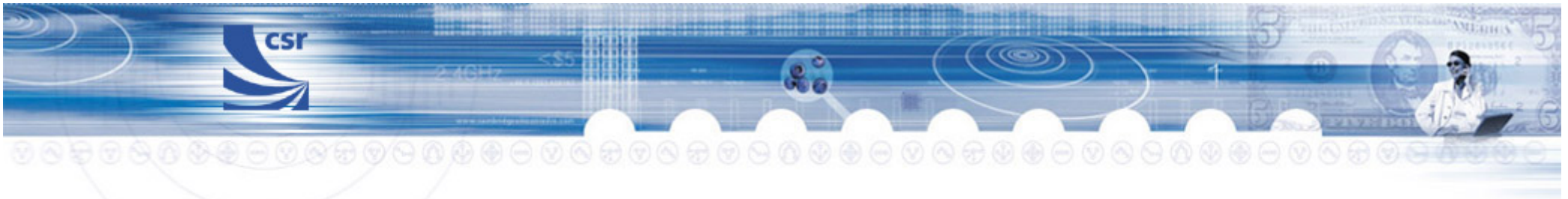


## Firmware Categories - RFCOMM Build

- Additional layers of the Bluetooth protocol stack can be run on the BlueCore.
- This removes some processing load from host.
- The maximum data throughput may be reduced.

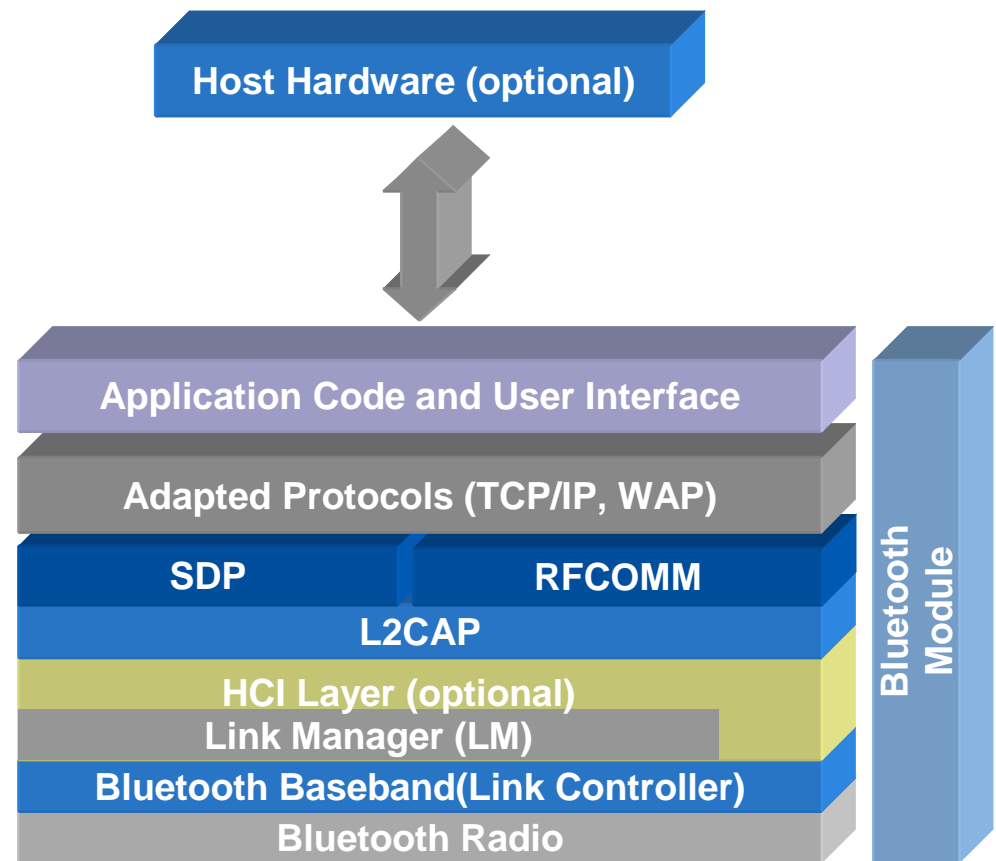


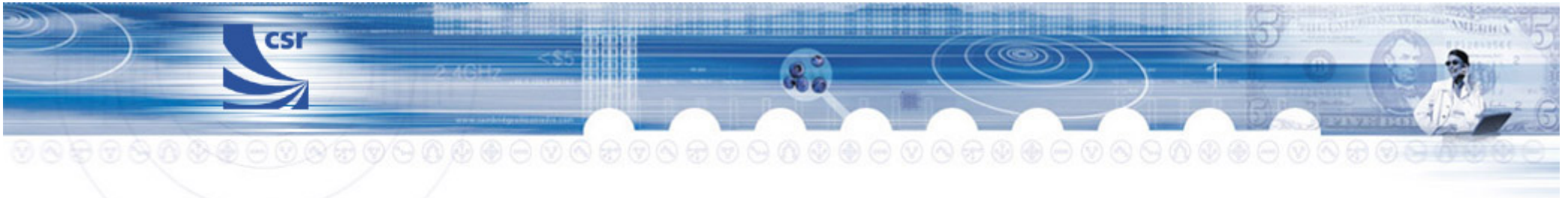




## Firmware Categories - RFCOMM Build

- The BlueCore firmware incorporates a virtual machine (VM).
- The complete application can run on the BlueCore, without requiring an external host processor.
- Suitable for small applications such as mobile phone headsets and audio gateways.
- The VM is also present in HCI-only builds.





## **Firmware Categories - Application Specific**

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- Special build variants are produced for some applications, where the VM does not provide sufficient flexibility or performance:
  - HID (mouse etc.)
  - HID proxy (presents a USB HID interface to the PC)
  - DUN server
- Additional variants are being developed:
  - BNEP (IPv4 or IPv6)
- Some of these may revert to using a custom application with a standard firmware build once the VM has been enhanced sufficiently.



## **Firmware Categories - Host Transport**

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- BlueCore supports several transports between itself and the host:
  - H:2 (HCI USB Transport Layer)
  - H:4 (HCI UART Transport Layer)
  - BCSP (BlueCore Serial Protocol)
  - Raw UART (enables custom protocols from VM applications)
- Combining support for all of these transports with RFCOMM requires more than 4Mbit of program memory.
- Hence, some firmware builds only contain support for a single host transport.
- Support for self-test in production may be omitted from some builds for the same reason.

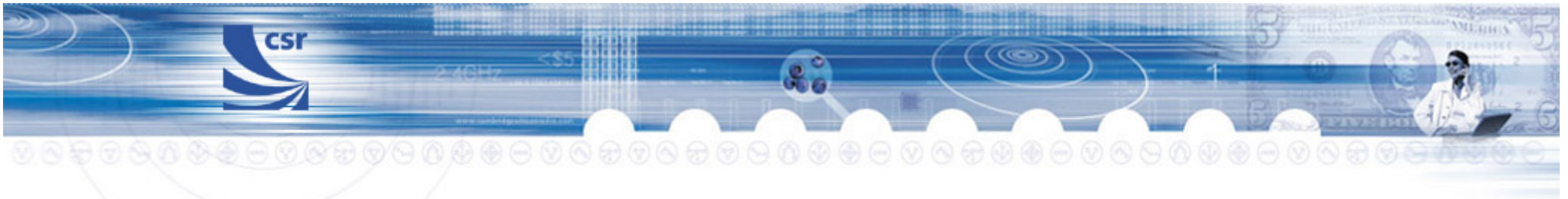


## **Firmware Categories - BlueCore Variant**

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- Separate firmware builds are required for different members of the BlueCore family.
- Currently two variants are supported:
  - BlueCore01b
  - BlueCore2-External
- Additional build variants will be produced as required.

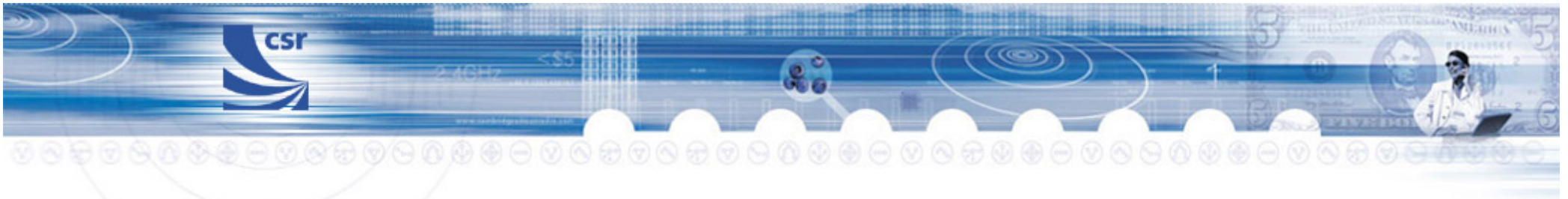




## **Firmware Categories - Encryption**

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- Some countries place restrictions on the length of keys that may be used for encryption.
- To comply with these restrictions, the BlueCore firmware can be supplied with a limit of either 56bits or 128bits on the maximum length of encryption keys.
- This limit is absolute; it overrides any settings in persistent store.



## Firmware Categories - Matrix of Builds

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- The basic firmware build variants are currently:

	HCI	RFCOMM	HID	HID Proxy
H:2 (USB)	✓ (single build)	✗	n/a	✓
H:4		✓	n/a	n/a
BCSP		✓	n/a	n/a
DFU	✓	✗	✗	✗

- All of these can be combined with the following:
  - BlueCore01b or BlueCore2-External
  - 56bit or 128bit encryption

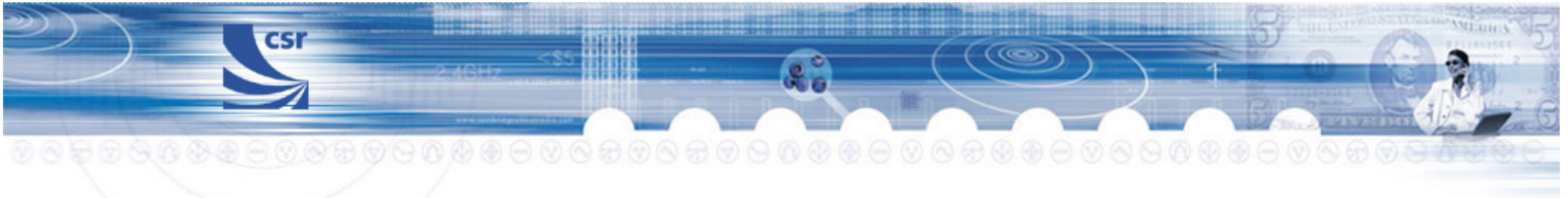


## Firmware Categories - Current Combinations

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The following firmware build combinations are currently produced:

- |                |                  |                    |      |
|----------------|------------------|--------------------|------|
| - HCI with DFU | for BC01b        | 56bit encryption   |      |
| - HCI with DFU | for BC01b        | 128bit encryption  |      |
| - HCI with DFU | for BC2-External | 56bit encryption   |      |
| - HCI with DFU | for BC2-External | 128bit encryption  |      |
| - RFCOMM only  | for BC01b        | 56bit encryption   | BCSP |
| - RFCOMM only  | for BC2-External | 56bit encryption   | BCSP |
| - RFCOMM only  | for BC01b        | 56bit encryption   | H4   |
| - RFCOMM only  | for BC2-External | 56bit encryption   | H4   |
| - HID          | for BC01b        | (56bit encryption) |      |



## **Version Number - Structure and Release Status**

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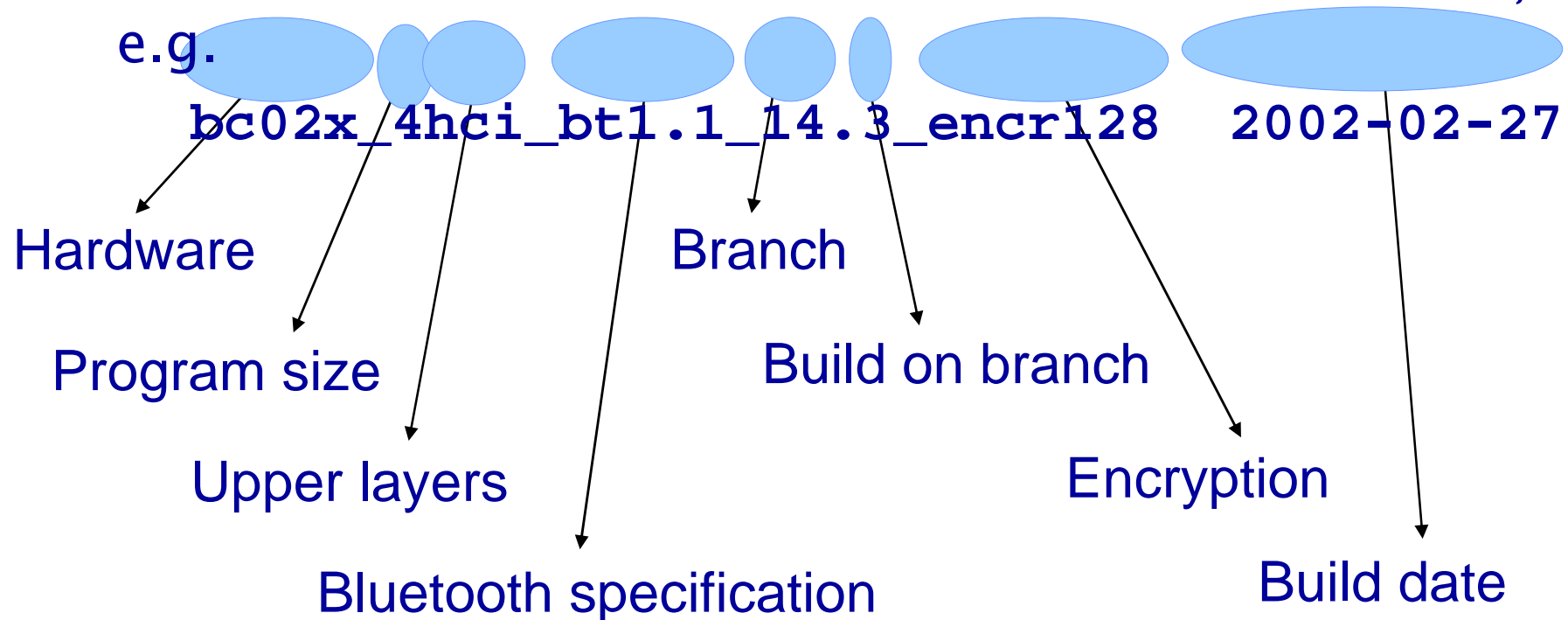
- BlueCore firmware builds are assigned both a structured textual identifier and numeric build identifier.
- The textual build identifier encodes the following information:
  - Firmware version number
  - Release status
  - Firmware category
  - Bluetooth specification version
  - Build date
- The numeric build identifier is unique for each release and build variant.



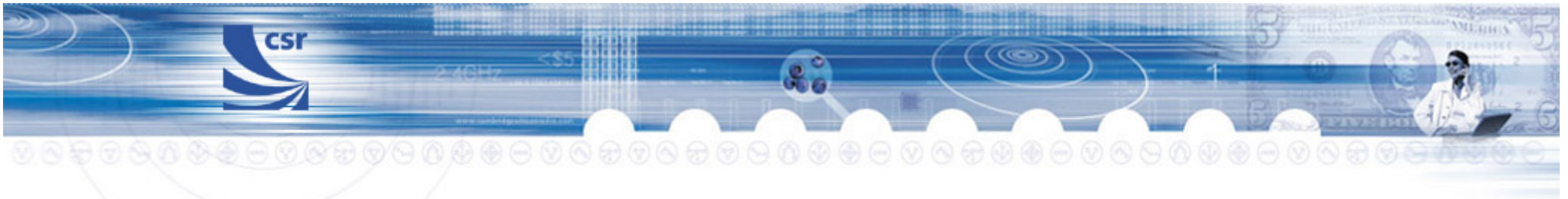
## Version Number - Textual Identifier

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- The textual build identifier is comprised of several fields that indicate the nature of the firmware build, e.g.







## **Version Number - Firmware Type - Hardware**

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- The first part of the textual build identifier indicates the target BlueCore type.
- These are currently:

bc01b	BlueCore01b
bc2x	BlueCore2-External



## **Version Number - Firmware Type - Program Size**

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- All firmware builds currently fit within 4Mbit (the limit of external program memory on BlueCore01).
- BlueCore2 can address up to 8Mbit of external program memory. This is likely to be used by some future firmware builds, e.g. RFCOMM with support for DFU.
- The required program memory size is included in the textual build identifier after the BlueCore variant:

4	4Mbit
8	8Mbit



## **Version Number - Firmware Type - Upper Layers**

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- One of the most important differences between different firmware builds is the nature of the higher protocol layers, if any, that are included.
- The textual build identifier indicates the type of build:

<code>hci</code>	Only protocol layers below HCI included
<code>rfcomm</code>	RFCOMM and SDP included
<code>hid</code>	HID device
<code>hidproxy</code>	USB HID interface presented to PC



## **Version Number - Firmware Type - BT Spec.**

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- All current BlueCore firmware is based on version 1.1 of the Bluetooth specification.
- This is indicated in the textual build identifier after the firmware category:

bt1.1

Bluetooth specification version 1.1



## **Version Number - Branch Name**

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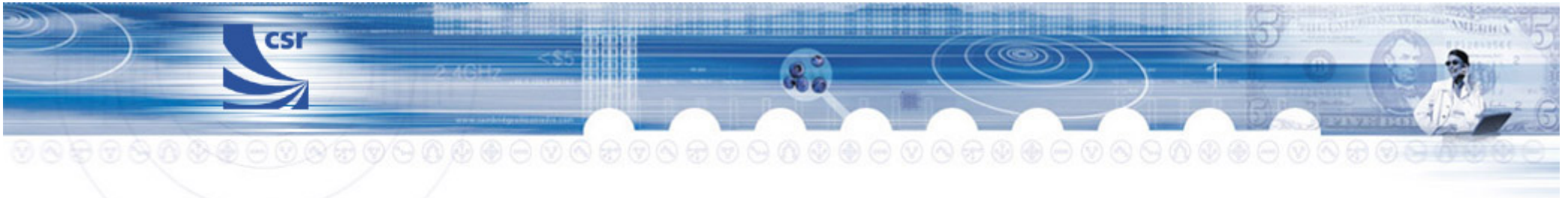
- A new branch is created within the revision control system (CVS) for each release that contains significant new functionality.
- Only bug fixes are applied on a branch.
- Branches are usually given numeric names:

14

The first firmware branch for BlueCore2







## Version Number - Release Status

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- Two qualities of release are produced:
  - Production quality
  - Beta quality
- Production quality releases have been subject to, and have passed, formal testing.
- Beta quality releases are intended for development use only; they are not suitable for production use.
- Beta releases are marked by “**dev**” in the textual build identifier:

dev-75

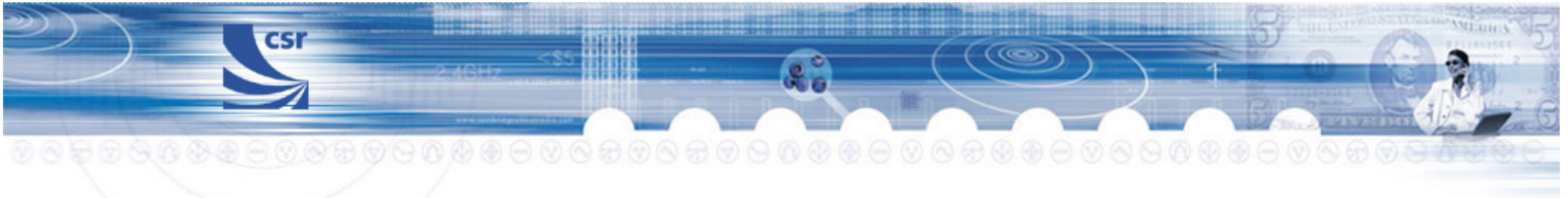
Beta quality build number 75



## **Version Number - Firmware Type - Encryption**

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- The limit on length of encryption keys is incorporated into the textual build identifier after the version number:
  - `encr56`      Encryption keys limited to 56bits or less
  - `encr128`      Encryption keys limited to 128bits or less



## **Version Number - Firmware Type - Transports**

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- Some firmware builds only include support for a single host transport.
- Restrictions on the host transport are appended to the end of the textual build identifier:

bcsp                      BCSP (BlueCore Serial Protocol) only

h4                              H:4 (HCI UART Transport Layer) only

- Lack of a transport specification in the build identifier indicates that all host transports are supported.



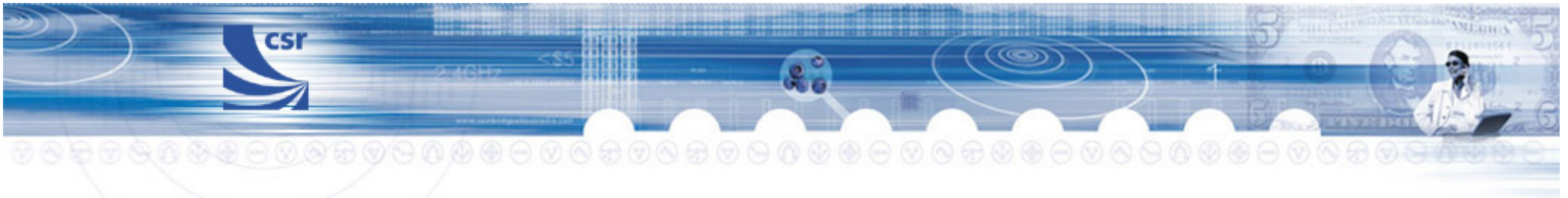
## **Version Number - Build Date**

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- The date on which the firmware build was made is included at the end of the textual build identifier.
- The date is formatted as YYYY-MM-DD, i.e. the reverse of the normal (European) order.
- For example:

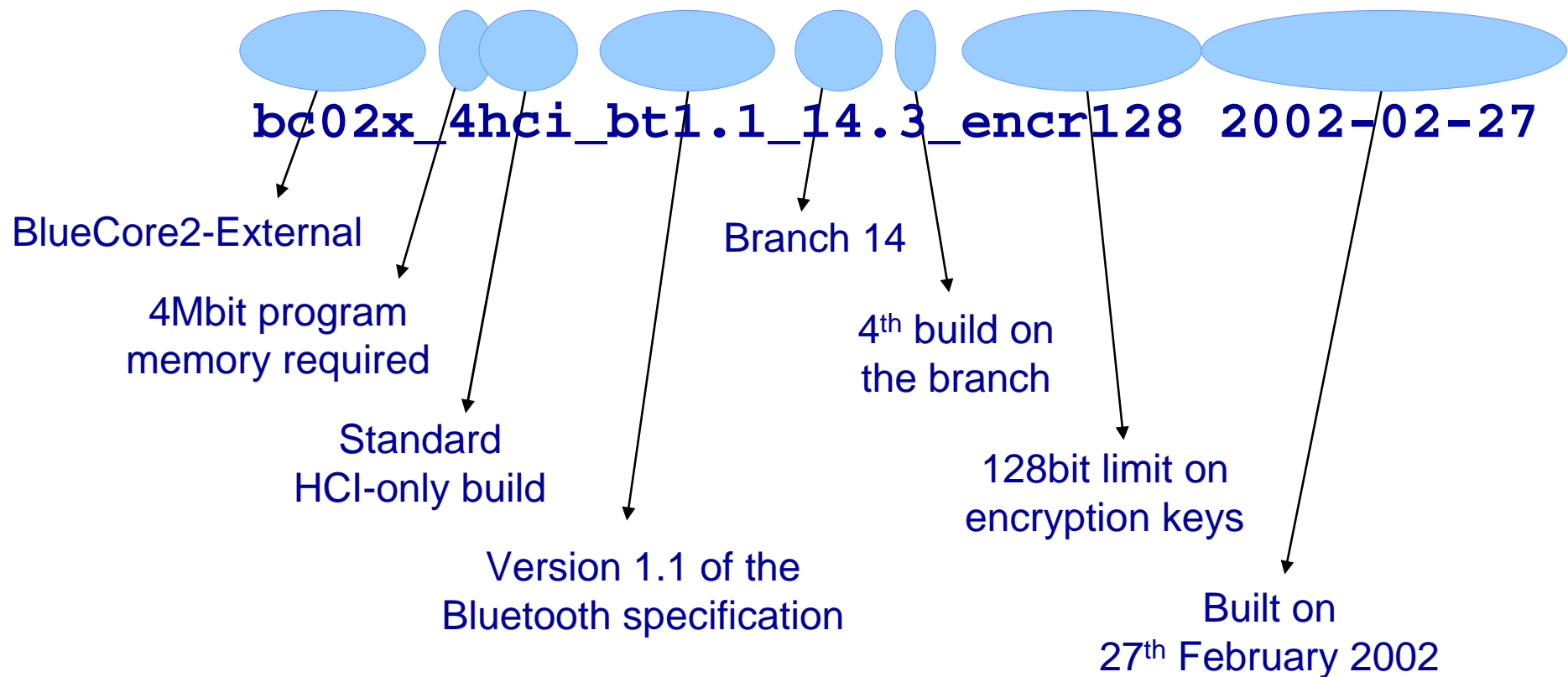
2002-02-27    27<sup>th</sup> February 2002

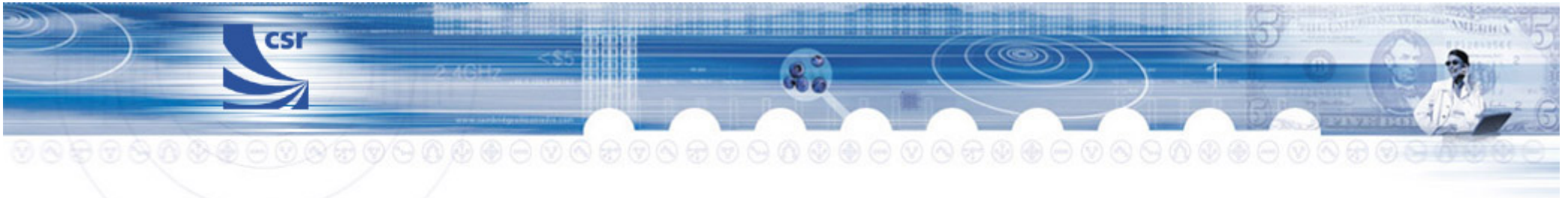




## Version Number - Textual Identifier Decoded

- The textual build identifier shown earlier can now be decoded:





## **Version Number - Reading Textual Identifier**

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- There are two techniques for reading the textual build identifier from the firmware:
  - The firmware includes a symbol look-up table that can be used to find information, such as the textual build identifier, either direct from the flash (over SPI) or from a firmware file
  - The firmware can be uploaded to a PC using DFU, with the textual build identifier included as a comment



## **Version Number - Numeric Identifier**

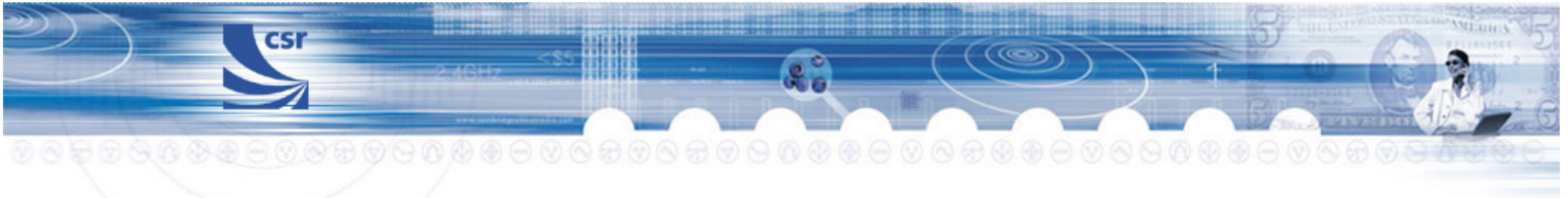
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- All firmware builds are allocated a unique numeric identifier, allocated in the order that builds are made.

- Ordering of the numeric identifiers may not be correlated with the branch names:

272	Branch 14, build 3, 56bit encryption
273	Branch 14, build 3, 128bit encryption
274	Branch 13, build 8, 56bit encryption
275	Branch 13, build 8, 128bit encryption

- Builds prior to branch 13 used the same numeric identifier for the 56bit and 128bit encryption versions.



## **Version Number - Reading Numeric Identifier**

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- There are several techniques for reading the numeric build identifier from the firmware:
  - The symbol look-up table can be used to find the numeric build identifier, either direct from the flash (over SPI) or from a firmware file
  - A BCCMD command is provided to read the numeric build identifier over the host transport
  - USB devices present the numeric build identifier in the bcdDevice field of the device descriptor
  - The firmware can be uploaded to a PC using DFU, with the numeric build identifier included in bcdDevice field of the standard DFU suffix

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