

Enabling Wi-Fi Connectivity in Feature Phones

Add a SDIO Host Controller to Your Mobile Processor

Wi-Fi Integration in Handsets

The growing demand for mobile web browsing is driving the need for high-performing mobile processors. At the same time, the expense of data streaming creates greater demand for Wi-Fi integration.

The use of Wi-Fi can be a good alternative to using a service provider's network for web browsing, downloading content and video streaming, as many service providers move away from offering unlimited data usage plans. Consumers with Wi-Fi can also utilize free public Wi-Fi hot spots, make VoIP calls and more.

Wi-Fi Integration Challenges

Many baseband processors primarily designed for feature phones lack a true SDIO host controller. Most entry-level feature phones have at minimum a simple WAP browser or sometimes a full web browser. While high-end feature phones are usually equipped with a full web browser, user internet demand is creating the need to integrate Wi-Fi capability. Figure 1 shows WAP (left) and the full web browser (right).

Most feature phone baseband processors offer a 1x SD interface ideal for SD/MMC memory cards, but can't be used for SDIO based devices like Wi-Fi or mobile TV chipsets. While Wi-Fi chipsets can be attached through the SPI port, performance is usually limited.



Figure 1: WAP enabled cellular phone (left) and smartphone with full web browsing capability (right)

Wireless Local Area Network Standards						
Technology	Downlink	Uplink	Frequency	Modulation	Release Date	Standards
WiMax 802.16e	70	70	2.3, 2.5, 3.5, 3.7 and 5.8	OFDM	2005	IEEE 802.16e
WiFi 802.11	2	2	2.4	DSSS	Jun-97	IEEE 802.11 (Legacy Mode)
WiFi 802.11a	54	54	5	OFDM	Sep-99	IEEE 802.11a
WiFi 802.11b	11	11	2.4	DSSS	Sep-99	IEEE 802.11b
WiFi 802.11g	54	54	2.4	OFDM	Jun-03	IEEE 802.11g
WiFi 802.11n	200	200	2.4, 5	OFDM	Nov-09	IEEE 802.11n

Figure 2: Wi-Fi standards and details.

Wi-Fi Standards

Wi-Fi technology built on IEEE 802.11 standards has many variants. See figure 2 for details.

802.11a/b were initially introduced in 1999. In 2003, 802.11g was added with downlink and uplink performance of 54Mbps. Later 802.11b/g combination chipset became the preferred choice of Wi-Fi chipset used in consumer products. However, with the introduction of 802.11n, the market has changed again. With maximum throughput of 200Mbps, 802.11n quickly became the primary choice for high-end smartphones.

Wi-Fi Interface Choices for Handsets

With 802.11n running at 200Mbps, it is clear that interfaces like SPI, UART, and I²C are not sufficient enough to keep up with the bandwidth requirement. It needs a faster yet efficient interface and fewer protocol signal lines to handle 802.11n connection in the handset. SDIO is the best candidate for this purpose. First, it runs with 6 signals (4 data, 1 command and 1 clock). Fewer signals means easier PCB routing which is ideal for handsets. Second, the SDIO2.0 specification is defined with a clock frequency of 50MHz. Multiply this by four data lines, then 200Mbps is the throughput needed for 802.11n. Last, Wi-Fi modules typically support two interfaces: PCI and SDIO. PCI is built primarily for the PC industry while SDIO is the Wi-Fi interface choice for the handset industry.

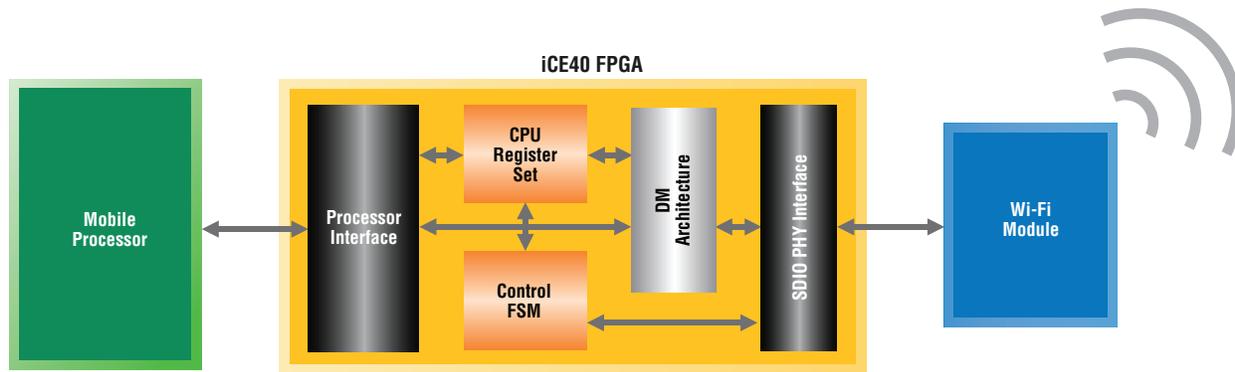


Figure 3: SDIO Host Controller using the iCE40 FPGA

Lattice Solution

Lattice offers a true SDIO host controller in the iCE40™ ultra-low density FPGA to solve the Wi-Fi connectivity challenge. The Lattice SDIO host controller has a pre-defined processor interface which can be used “as-is” or modified to match the user’s needs. Similarly, the SDIO host controller can be customized to support either the version 2.0 fully compliant SDIO host controller or only selections of SDIO commands for Wi-Fi communication to further reduce the size for cost saving purposes. With the flexible iCE40 FPGA architecture, additional functional blocks such as GPIO expansion as well as additional peripherals (UART, SPI, I²C and others) can be added easily.

The SDIO host controller is also offered through the Lattice iCEcube2™ software as an encrypted IP. To evaluate the encrypted version of this IP, download iCEcube2 software from the Lattice website at www.latticesemi.com and request a license.

■ Features supported by the SDIO host controller IP:

- Meets SDIO standard specification version 2.0
- Auto card detect and SDIO card detection
- Forced initialization from the processor
- Supports SD 1-bit, SD 4-bit, and SPI modes
- Operates at the normal mode of 25MHz and high-speed mode of 50MHz
- Features an 8kbit read/write buffer for processor-initiated writes and reads
- Single and multi-byte read/write for SDIO cards
- Supports SDIO card interrupts

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