

Transforming Small Mobile Devices into Full-Featured Wi-Fi Access Points

Bart Giordano

Product Marketing Manager

Emerging and Embedded Business Unit, Marvell Semiconductor, Inc.

December 2009

Introduction

*“Someday, we’ll tell our grandchildren how we had to drive around town looking for a coffee shop when we needed to get online, and they’ll laugh their heads off.”
--David Pogue, New York Times ¹*

Indeed, as Pogue wrote on May 6, 2009, the emergence of new technology is enabling consumers to jump online from anywhere they like—in a taxi, on a beach, in a hotel—much more quickly and cost-effectively than previous attempts at mobile wireless Internet solutions.

Specifically, Pogue was referring to the recently released Novatel[®] MiFi 2200 personal hotspot device, powered by Marvell Mobile Hotspot (MMH) technology and designed with one function in mind: to grab an Internet connection from the air and share it with multiple devices via Wi-Fi, essentially serving as a wireless router on the go.

Got Constant Connectivity?

The rapid penetration of social media in the lives of consumers around the world has spawned greater need for constant connectivity. Users on the wildly popular Facebook[®] network, just to cite one example, share billions of images and videos daily with their “friends”—and not just from personal computers, but more and more so from mobile devices. In fact, the number of mobile handsets worldwide is closing in on 6 billion, with many consumers owning more than one device.

Without question, people are consuming and sharing digital content at a staggering rate. And as they increasingly live their personal and professional lives online, constant connectivity has become imperative.

The Rise—and Risk—of Public Wi-Fi

As a result, there has been a spike in the number of public venues offering Wi-Fi connections—from airports and coffee shops to bookstores and RV parks. Global retail chains such as Starbucks[®] and Borders[®], among countless other gathering spots, offer havens where people can tap into wireless networks.

These access points, however, are limited, keeping users confined to a designated area and becoming sluggish with a high volume of users. Often the target of hackers seeking sensitive data, they also can present severe security risks. What’s more, misleading “free” networks are becoming widespread, drawing in users only to charge additional, associated service fees.

Enter Marvell Mobile Hotspot (MMH) Technology

Launched in February 2009, the Marvell[®] Mobile Hotspot (MMH) is a groundbreaking technology that transforms any consumer electronics (CE) device with an Internet connection into a wireless hotspot. For the first time in history, portable devices such as smartphones, digital cameras, personal media players and personal navigation systems can now operate as full-featured Wi-Fi access points.

Technically, the MMH bridges a cellular broadband data connection over the Wi-Fi access point network. With MMH technology built into their devices, users can carry their Wi-Fi hotspot with them wherever they go. In addition, the MMH fosters a new set of applications, usage options and product categories for cellular devices with integrated 802.11. Moreover, the MMH consumes the least power and has the smallest memory footprint of any 802.11 access point available today.

As a result, people are no longer relegated to getting Internet access via cumbersome public hotspots. Instead, they can enjoy the benefits of Wi-Fi connectivity anywhere a cellular data connection is available. With MMH technology, people can use a single portable device to browse websites, access email, play online games, etc. Furthermore, they can make hands-free, voice-activated calls at home, at the office and on city streets. MMH provides users with ultimate mobility, delivering a virtually limitless array of applications for both work and play.

For the first time in history, portable devices such as smartphones, digital cameras, personal media players and personal navigation systems can now operate as full-featured Wi-Fi access points.

Design Considerations for OEMs and ODMs

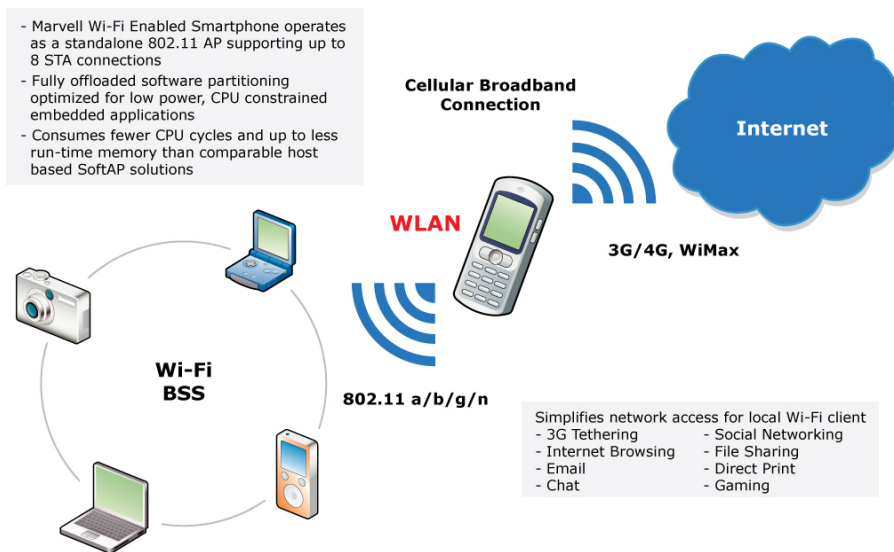
The emergence of mobile hotspot technology presents original equipment manufacturers (OEMs) and original design manufacturers (ODMs) a significant opportunity to increase market share and revenue through new product development.

Designs should incorporate a full-featured, completely functional, standards-compliant 802.11 (a/b/g/n) access point on a single wireless chip. This provides numerous benefits for both OEMs and consumers, including:

- **Secure Wi-Fi connectivity with ease of provisioning.** This is accomplished by providing standard 802.11 WPA2 authentication and data protection mechanisms, as well as MAC address filtering and Wi-Fi Protected Setup (WPS).
- **Extended battery life of devices connected to mobile hotspot.** By utilizing standard IEEE-based 802.11 power saving mechanisms and offloading the entire implementation onto the wireless SoC, the mobile hotspot technology consumes less power with small memory footprint and application processor utilization. Additionally, advanced device power management techniques are employed to maximize the battery life of products leveraging MMH technology.
- **Wireless Quality of Service (QoS) via Wireless Multimedia (WMM) protocol.** This enhances the experience of using voice and multimedia applications over the Wi-Fi mobile hotspot network via industry-accepted traffic prioritization and management schemes.
- **Intelligent radio co-existence architecture to accommodate multiple wireless connectivity solutions** (e.g., Wi-Fi and Bluetooth). Co-existence technology can dynamically synchronize and adjust radio behavior to maximize performance and eliminate interference between radios operating on the same unlicensed frequency band.
- **Support for concurrent users connected to the Internet via a cellular broadband connection.** Integrated "Layer 2" bridging capability enables multiple users to communicate directly with each other through the mobile hotspot-enabled wireless system-on-a-chip (SoC). Therefore, the access point can participate in and host a 802.11 network, supporting a variety of peer-to-peer use cases.

Key Features of Marvell Mobile Hotspot (MMH)

Figure 1: Marvell Mobile Hotspot (MMH)



- **Low cost single-chip device as a standard 802.11 access point and wireless station**
 - Access point (AP) and station (STA) implemented in firmware on top of Marvell's "Thick" MAC 802.11 stack
 - Same hardware configuration for both AP and STA modes
- **Simplified integration of access point functionality in low-cost, low-power consumer electronic devices**
 - Implemented on standard reference designs (i.e., no special hardware configuration required)
 - No additional MIPS consumed on the host for uAP mode when compared with STA mode (i.e., uAP implemented entirely in firmware on the WLAN SoC)
 - Thinnest available AP driver results in simplified porting effort and, ultimately, quicker time-to-market
- **Fully offloaded access point implementation**
 - All AP software implemented on WLAN SoC
 - Fewer MIPS consumed on central processing unit (CPU) than with traditional host-based SoftAP implementations
 - Least amount of host memory consumed compared with traditional host-based SoftAP implementations
 - "Layer 2" station-to-station bridging implemented on the device further reduces host CPU utilization (no host interaction for STA-to-STA communication)
- **Wi-Fi Protected Setup (WPS) protocol**
 - WPS integrated into MMH to simplify the secure setup of Wi-Fi networks
 - Enables users to easily access network and share connection by pushing button or entering PIN code

Target Usage and Availability

Devices equipped with Marvell Mobile Hotspot technology provide users—both business travelers and consumers on the go—with an "always-on, always-available" Internet connection for laptop computers and other clients enabled with Wi-Fi.

By simplifying network access, MMH technology lets mobile users perform a range of activities from just about anywhere, including:

- 3G tethering
- Internet browsing
- Email access
- Online chat
- Social networking
- File sharing
- Direct print
- Gaming

The patented MMH technology, is available for Marvell's entire suite of Avastar™ embedded Wi-Fi SoCs. The Marvell Avastar™ family of wireless devices integrates single-function and multi-function radios for the entire spectrum of always-on consumer electronics products such as smartphones, personal media players, digital cameras, portable gaming devices, printers and even automobile telematic head units.

MMH technology is also available across a broad spectrum of mobile operating systems including Linux, Android®, ThreadX®, Rex®, Windows® Mobile, and WinCE®. Furthermore, it is a standard feature across Marvell's complete line of application and communication processor handset platforms, as well as a variety of commercially available products.

And as Pogue from the New York Times® wrote about, MMH technology also has spawned an entirely new class of data card products used for wireless tethering over a cellular data network. These products are gaining broad carrier acceptance throughout the world, and OEMs and ODMs alike are beginning to implement solutions based on the pioneering MMH technology.

This also has opened up new revenue streams for service providers, enabling them to monetize network access with MMH-enabled data cards and devices—and new business models for monthly and bandwidth usage-based data plans

Conclusion

The Marvell Mobile Hotspot has revolutionized the way people access the Internet. Prior to this technology, most people relied on public hot spots hosted by service providers or other proprietors for Internet connectivity when away from the home or workplace. The interfaces and mechanisms by which a user accesses these networks vary considerably across service providers and can be confusing, unsafe and expensive.

Today, users with MMH-equipped devices are freed from the complexity of public hotspot access and, instead, can carry their own mobile hotspot wherever they go. And because configuration of the MMH interface is simple and intuitive, OEMs and ODMs can rapidly develop devices and applications that extend this technology to their consumers.

Footnotes:

1. "Wi-Fi to Go, No Café Needed," New York Times, May 6, 2009, David Pogue

Bart Giordano

*Product Marketing Manager,
Emerging and Embedded Business Unit, Marvell Semiconductor, Inc.*

Bart Giordano is a technology professional with more than 10 years experience across the network security, wireless and fabless semiconductor industries. After receiving his Bachelor of Science in Computer Engineering from California Polytechnic State University, San Luis Obispo, Bart worked for six years at Cisco Systems, where he was a senior engineer focused on the implementation of advanced security technologies for virtual private network (VPN) routers and switches. Currently, as product marketing manager at Marvell, Bart is responsible for the definition of technologies, product management and business development across Marvell's complimentary wireless product line.

www.marvell.com



Copyright © 2009. Marvell International Ltd. All rights reserved. Marvell, Moving Forward Faster, and the Marvell logo are registered trademarks of Marvell or its affiliates. Armada, Avastar, Sheeva, and Qdeo are trademarks of Marvell or its affiliates. Other names and brands may be claimed as the property of others.

Marvell Mobile Hotspot_whitepaper-002 2/2010