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The Value of Cisco Compatible Extensions (CCX) for Mobile Computers

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IEEE and industry standards define how a Wi-Fi radio interoperates with a wireless LAN infrastructure, and the Wi-Fi CERTIFIED™ seal ensures interoperability. For many organizations that rely on mobile computers, however, Wi-Fi CERTIFIED is not enough. These organizations need assurance that their mobile computers will interoperate with a Cisco wireless LAN infrastructure and support Cisco wireless LAN innovations for enhanced security, mobility, quality of service, and network management. The Cisco Compatible seal gives organizations the assurance that they seek.

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EXECUTIVE SUMMARY

Organizations of all types and sizes worldwide rely on mobile computers for data collection and information management. When a mobile computer uses a wireless LAN, the Wi-Fi® radio in the mobile computer must provide a reliable network connection. If the connection is not reliable, then the device will be seen as unreliable.

IEEE and industry standards define how a Wi-Fi radio interoperates with a wireless LAN infrastructure, and the Wi-Fi CERTIFIED™ seal ensures interoperability. For many organizations that rely on mobile computers, however, Wi-Fi CERTIFIED is not enough. These organizations need assurance that their mobile computers will interoperate with a Cisco wireless LAN infrastructure and support Cisco wireless LAN innovations for enhanced security, mobility, quality of service, and network management. The Cisco Compatible seal gives organizations the assurance that they seek.

A mobile computer earns the Cisco Compatible seal through a program called Cisco Compatible Extensions, or CCX. Like the Wi-Fi certification program, CCX:

- Includes a specification that defines a set of features that must be implemented in the hardware and software for a Wi-Fi radio or a device that uses a Wi-Fi radio
- Requires compliance testing conducted by an independent lab that is approved by the organization that manages the program
- Requires that a submitted radio or device pass all tests to be approved

The CCX specification is a superset of that used for Wi-Fi certification. In fact, a device cannot be certified for CCX unless it, or the Wi-Fi radio inside it, is Wi-Fi CERTIFIED.

Within the CCX program, a mobile computer is classified as an application-specific device, or ASD. The CCX specification for an ASD is a subset of the specification for general-purpose devices such as laptops. Addressing even the ASD subset of the CCX specification can be a daunting task for a mobile computer maker. An attractive option is to use Wi-Fi solutions from Summit Data Communications, because those solutions already are certified for CCX.

THE IMPORTANCE OF STANDARDS

Wi-Fi involves communication between radios that use a specific type of radio frequency (RF) technology. Many of today's popular portable and mobile computing devices, such as notebook computers and phones, include Wi-Fi radios as standard equipment. Wi-Fi use is widespread in homes, coffee shops, offices, hospitals, airports, and many other types of environments.

The foundation of the Wi-Fi boom is interoperability; this ensures that the Wi-Fi radio in a client device will communicate with the Wi-Fi radio in an infrastructure product such as an access point (AP) or router, regardless of who makes the radios, the client device, or the infrastructure product. Interoperability is possible when two devices support the same standards for communicating with each other. Standards for wireless LAN products are defined and ratified by the 802.11 Committee of the Institute of Electrical and Electronics Engineers, or IEEE. Wireless LAN products often are referred to as 802.11 products.

The IEEE defines standards but has no mechanism for enforcing them. As a result, interoperability of wireless LAN products is ensured not by the IEEE but by the Wi-Fi Alliance®, a non-profit industry association of more than 330 member companies. The primary goal of the Wi-Fi Alliance is to ensure that products implement IEEE 802.11 specifications by running rigorous interoperability tests against products from different vendors. Since the introduction of the Alliance's certification program in March 2000, more than 7,000 products have passed all required tests and been designated as Wi-Fi CERTIFIED.

As an example, to achieve the Enterprise level of Wi-Fi certification, a product with an 802.11g radio must pass a broad range of tests that demonstrate support for:

- 802.11b and 802.11g, including acceptable throughput for both
- The Enterprise version of Wi-Fi Protected Access® 2, or WPA2®-Enterprise, which is equivalent to the ratified wireless LAN security standard of IEEE 802.11i
- At least one Extensible Authentication Protocol (EAP) method in conjunction with WPA2-Enterprise

Organizations that run business-critical applications on mobile devices demand that those devices be Wi-Fi CERTIFIED. For many of these organizations, however, Wi-Fi CERTIFIED is not enough.

CCX

About two thirds of the wireless LAN infrastructure systems in today's businesses use products from Cisco Systems, Inc. As a result, most organizations with business-critical mobile devices want to ensure that their devices interoperate with a Cisco wireless LAN infrastructure and support Cisco wireless LAN innovations for enhanced security, mobility, quality of service, and network management.

Nearly all mobile computer vendors claim that their devices work well with a Cisco wireless LAN infrastructure. Fortunately, you don't have to take a vendor's word for it. Since 2003, Cisco has managed a program by which Wi-Fi radios and mobile devices with those radios can earn the Cisco Compatible logo. The logo signifies that a radio or device interoperates with a Cisco wireless LAN infrastructure and supports Cisco innovations. The program is called the Cisco Compatible Extensions (CCX) program.

Within CCX, Cisco licenses a specification of IEEE standards and Cisco innovations. A licensee, typically a firm that offers wireless LAN radios for client devices, implements support for all required elements of the specification in the software for a Wi-Fi radio. The licensee then submits the radio, or a client device that uses the radio, to an independent lab for rigorous testing. Only by passing all tests does the radio or device earn the Cisco Compatible seal.

CCX AND STANDARDS

The CCX program has a structure that is similar to that of the Wi-Fi certification program. With both programs:

- One or more specifications define what features must be implemented in the hardware and software for a Wi-Fi radio or a device that uses a Wi-Fi radio.
- Compliance testing is conducted by an independent lab that is approved by the organization that manages the program.
- A device must pass all tests to be certified.

The primary differences between the programs are:

- Who manages the program
- What type of devices are eligible for certification testing
- What is in the specification

CCX is part of the Cisco Developer Network (CDN) and is managed by Cisco. The Wi-Fi certification program is managed by the Wi-Fi Alliance.

CCX is for client devices that interact with Cisco's enterprise-class wireless LAN infrastructure products, which are used by businesses and other organizations. The Wi-Fi certification program, on the other hand, is for any type of product that uses Wi-Fi technology. Table 1 shows the types of devices that can be Wi-Fi CERTIFIED:

Table 1: Wi-Fi CERTIFIED Devices

Device Type	Description	Examples
Infrastructure device: Home	Links client devices to broadband (DSL or cable) modem	▪ Access points (APs) ▪ Routers
Gateway: Home	Combines AP/router with broadband modem	▪ Cable gateways ▪ DSL gateways
Infrastructure device: Business	Links client devices to business networks	▪ Enterprise APs with associated switches/controllers ▪ Enterprise routers
Radio	Wi-Fi radio in client device	Internal and external
Consumer electronics device	Home electronics device that benefits from Wi-Fi	▪ Cameras: Still, portable, networked ▪ Audio devices: Stationary, portable ▪ Video devices: Set-top box, display device ▪ Gaming devices: Console, portable ▪ Servers and storage devices
General computing device	Computer used for general applications	▪ Ultra-mobile PCs ▪ Laptops, notebooks, desktops ▪ PDAs
Printer	Prints; may also scan, fax	Printers, print servers
Voice ASD	ASD where primary application is voice	▪ Dual-mode phones, smartphones ▪ Single-mode phones, smartphones
Data ASD	ASD where primary applications are data applications	▪ Mobile computers ▪ Medical devices

CCX targets business client devices and nothing else. The Wi-Fi certification program is much broader, and its specification includes fewer elements than the CCX specification.

The CCX specification is, in fact, a superset of the specification used for Wi-Fi compliance. A device cannot be certified as Cisco Compatible unless that device or the wireless LAN radio that it uses is Wi-Fi CERTIFIED.

In addition to Wi-Fi interoperability elements, the CCX specification includes Cisco-defined technologies and features. Some of these technologies and features have been proposed as IEEE standards so that they are not limited to Cisco infrastructures but available on infrastructures from any vendor. CCX features have been proposed for the following IEEE standards (and potential standards):

- 802.11h and 802.11k: Radio measurements
- 802.11r: Fast roaming
- 802.11u: Expedited bandwidth request
- 802.11v: Real-time reporting and client diagnostics
- 802.11w: Management frame protection

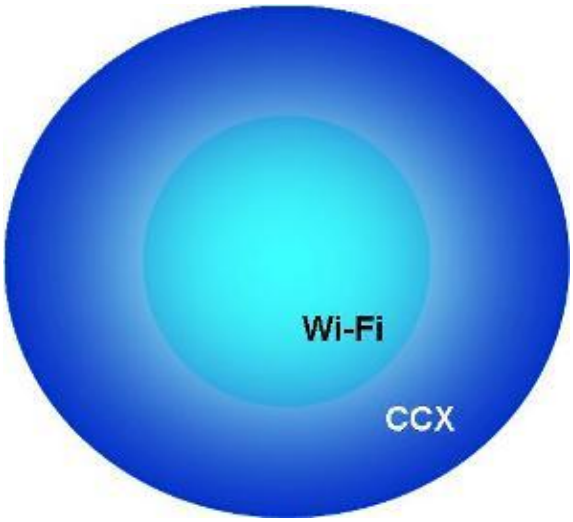

Figure 1: The CCX specification is a superset of the Wi-Fi specification.

Because it requires program participants to implement support for both established and emerging IEEE and industry standards, CCX encourages support for standards in the market.

THE VALUE OF CCX FOR MOBILE COMPUTERS

Today, a client device can be certified at version 4 of the CCX specification (CCX V4) or version 5 of the CCX specification (CCX V5). In CCX V4 and CCX V5, some features are classified as optional for ASDs such as mobile computers because ASDs may lack the computing power or operating system foundation required to support those features. Here are the primary features of CCX V4 for ASDs:

- Wi-Fi certification for the device or the radio in the device
- WPA-Enterprise and WPA2-Enterprise with at least one of the following EAP types: LEAP, EAP-FAST, and EAP-TLS
- Wi-Fi Multimedia (WMM), an industry standard for quality of service (QoS)
- Cisco roaming enhancements, such as AP-assisted roaming and fast 802.1X re-authentication via the Cisco Centralized Key Management (CCKM) protocol
- Improved client and network management through support for multiple SSIDs and VLANs on an AP, AP-specified client transmit power, and client-based RF scanning and reporting
- Voice features:
  - Call Admission Control (CAC): The ability to reserve and control bandwidth for voice, improving the quality of voice calls
  - Unscheduled Automatic Power Save Delivery (U-APSD), also called reverse polling: Allows synchronization of send/receive in one atomic operation to improve battery life, increase capacity per AP, and reduce congestion
  - Voice metrics: Provides information to predict and tune networks for optimum voice over wireless LAN performance

Not every CCX feature may be essential for every mobile computer, but in the aggregate CCX features ensure that every mobile computer has a secure, reliable network connection. For a network administrator, the Cisco Compatible seal reduces the complexity and cost of establishing and maintaining those network connections.

By using CCX devices, an administrator has the assurance that the devices will interoperate with a Cisco wireless LAN infrastructure. Because Wi-Fi certification is a prerequisite for CCX certification, the Cisco Compatible seal provides the assurance of interoperability with a non-Cisco wireless LAN infrastructure, too.

When only CCX-certified devices are permitted to connect to an organization's wireless LAN, the infrastructure can have a single configuration that supports a rich set of capabilities in key areas such as security and mobility. On the security front, the network can require the use of WPA2-Enterprise with the organization's preferred choice of an EAP type. To ensure application persistence on mobile devices, the network can require the use of CCKM for fast EAP re-authentication.

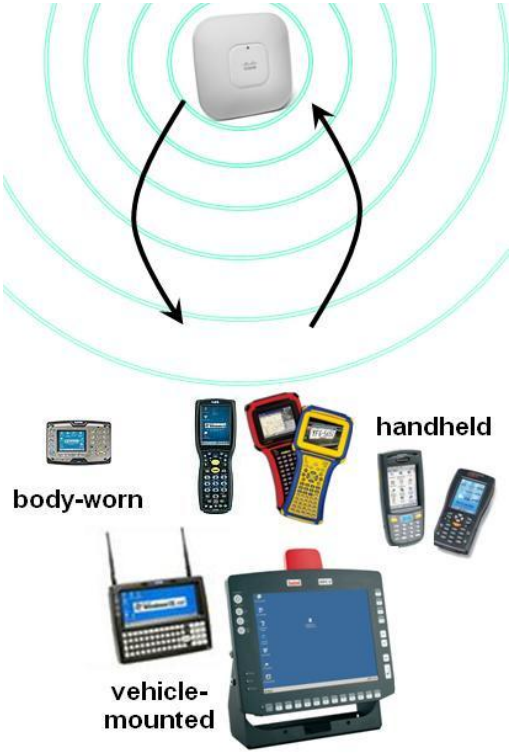

Figure 2: Mobile computers require secure, reliable wireless LAN connections

In contrast, when an organization's wireless LAN must accommodate devices that lack support for some CCX features, network administrators must do one or more of the following:

- Introduce security risks by using weaker security schemes for devices not certified for CCX
- Increase network complexity and costs by creating additional wireless LANs for non-CCX devices and tying those wireless LANs to network VLANs to protect sensitive data on the network
- Deploy additional software to maintain network connections on devices with inferior mobility

Because CCX brings key benefits to network administrators, those administrators want the assurance that all of their devices, including mobile computers, support CCX. While many device vendors claim support for CCX, the only guarantee that a device is *certified* for CCX is the use of the Cisco Compatible seal with that device. Given that Cisco has a large share of the market for wireless LAN infrastructure in environments where mobile computers are used, mobile computer vendors that fail to earn the Cisco Compatible seal may find themselves losing deals to competitors that do.

CHALLENGE: ACHIEVING CCX ON MOBILE COMPUTERS

A relatively small percentage of the mobile computers on the market are certified for CCX. Why? It's not because CCX features offer little value on mobile computers. Security features are important on all types of devices, and features that enhance mobility, such as CCKM for fast 802.1X re-authentication, offer *more* value on mobile computers than on general-computing devices such as laptops because a mobile computer often runs applications that can fail if the device does not maintain a constant network connection.

Support for CCX features is implemented primarily in the Wi-Fi radio software that runs on the device. The primary software components are a device driver, a security supplicant, and an administrative utility. Supporting CCX requires the following software development tasks:

- Modify the radio device driver to add support for driver-based CCX features
- Integrate a security supplicant that offers support for CCX security features
- Create an administrative utility for configuring settings required for various CCX features

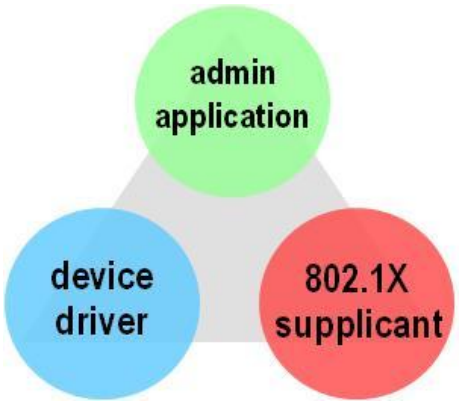

Figure 3: CCX features are implemented in three Wi-Fi radio software components

In the laptop world, the required software development is done not by laptop vendors but by silicon providers. These firms provide reference designs for Wi-Fi radios in specific form factors, such as PCI Express, that fit into laptops. A reference design is not just the radio hardware but also the software that makes the radio work on the laptop operating system, which is "big" Windows. The reference design includes a device driver, an integrated security supplicant, and an administrative utility (which may appear to be part of the native Windows administrative facility). Once a silicon provider implements CCX support in a PCI Express reference design and has that reference design certified for CCX, a laptop vendor can achieve the same level of CCX compliance by simply including the reference design in the laptop. The laptop vendor makes no hardware modifications or software modifications.

The mobile computer market is a challenging one for silicon providers, for reasons that include:

- Device volumes are far lower than for laptops.
- The percentage of the market addressed by a single reference design is reduced by the fact that different mobile computers use different radio form factors and run different operating systems.
- Implementing CCX features requires software modifications for every reference design.

No silicon provider offers a CCX-certified reference design for mobile computers. A mobile computer manufacturer must take Wi-Fi radio reference-design software and do the following:

- Port the device driver to the operating system that runs on the mobile computer.
- Modify the radio device driver to add support for CCX features not supported in the reference-design driver.
- Integrate a security supplicant with support for security features not supported in the operating system.
- Create an administrative utility for configuring settings required for various CCX features.
- Test the resulting software set on the mobile computer and make modifications as necessary.

The challenge is too great for most mobile computer makers.

SUMMIT: ADDRESSING THE CHALLENGE

Fortunately, a viable alternative exists for many mobile computers: Wi-Fi solutions from Summit Data Communications. Each Summit solution is certified for CCX on a range of operating systems. By using a Summit solution on a mobile computer that runs one of those operating systems, the device manufacturer is assured that the mobile computer will earn the Cisco Compatible seal.

Summit designs its Wi-Fi solutions for business-critical mobile devices, not consumer devices. Summit solutions provide secure, reliable connections in the most challenging environments in the world. From its start, Summit has recognized that mobile device users place a high value on CCX, and so Summit has engineered CCX support into every one of its solutions.

Summit Data Communications provides Wi-Fi solutions for mobile computers and other business-critical mobile devices. Summit solutions provide secure, reliable connections in the challenging environments in which mobile computers operate. Every Summit solution is Wi-Fi CERTIFIED and certified for CCX.
