

## **Unit 5: Wireless PAN Components**

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### **Objectives**

After studying this unit, you will be able to:

- Explain about the user devices in wireless network
- Discuss the radio NIC
- Explain the wireless USB adapter
- Describe the wireless router
- Discuss about Bluetooth dongle

### **Introduction**

A personal area network – PAN – is a computer network organized around an individual person. Personal area networks typically involve a mobile computer, a cell phone and/or a handheld computing device such as a PDA. You can use these networks to transfer files including email and calendar appointments, digital photos and music.

Personal area networks can be constructed with cables or be wireless. USB and FireWire technologies often link together a wired PAN, while wireless PANs typically use Bluetooth or sometimes infrared connections. Bluetooth PANs are also sometimes called piconets.

Personal area networks generally cover a range of less than 10 meters (about 30 feet). PANs can be viewed as a special type (or subset) of local area network (LAN) that supports one person instead of a group.

Typically, a wireless personal area network uses some technology that permits communication within about 10 meters - in other words, a very short range. One such technology is Bluetooth, which was used as the basis for a new standard, IEEE 802.15.

A WPAN could serve to interconnect all the ordinary computing and communicating devices that many people have on their desk or carry with them today - or it could serve a more specialized purpose such as allowing the surgeon and other team members to communicate during an operation.

## 5.1 User Devices

- **Mobile Phone:** A mobile device (also known as a handheld device, handheld computer or simply handheld) is a small, handheld computing device, typically having a display screen with touch input and/or a miniature keyboard and weighing less than 2 pounds (0.91 kg). Apple, HTC, LG, Research in Motion (RIM) and Motorola Mobility are just a few examples of the many manufacturers that produce these types of devices.

A handheld computing device has an operating system (OS), and can run various types of application software, known as apps. Most handheld devices can also be equipped with Wi-Fi, Bluetooth, and GPS capabilities that can allow connections to the Internet and other Bluetooth-capable devices, such as an automobile or a microphone headset. A camera or media player feature for video or music files can also be typically found on these devices along with a stable battery power source such as a lithium battery.

- **Personal Digital Assistant (PDA):** A personal digital assistant (PDA), also known as a palmtop computer, or personal data assistant, is a mobile device that functions as a personal information manager. PDAs are largely considered obsolete with the widespread adoption of smartphones.

Nearly all current PDAs have the ability to connect to the Internet. A PDA has an electronic visual display, enabling it to include a web browser, all current models also have audio capabilities enabling use as a portable media player, and also enabling most of them to be used as mobile phones. Most PDAs can access the Internet, intranets or extranets via Wi-Fi or Wireless Wide Area Networks. Most PDAs employ touchscreen technology.



*Did u know?* The first PDA was released in 1984 by Psion, the Organizer II. Followed by Psion's Series 3, in 1991, which began to resemble the more familiar PDA style. It also had a full keyboard.

The term PDA was first used on January 7, 1992 by Apple Computer CEO John Sculley at the Consumer Electronics Show in Las Vegas, Nevada, referring to the Apple Newton.

In 1994, IBM introduced the first PDA with full mobile phone functionality, the IBM Simon, which can also be considered the first Smartphone. Then in 1996, Nokia introduced the a PDA with full mobile phone functionality, the 9000 Communicator, which became the world's best-selling PDA. The Communicator spawned a new category of PDAs: the "PDA phone", now called "smartphone". Another early entrant in this market was Palm, with a line of PDA products which began in March 1996.

- **Headset or Headphones:** Headphones are a pair of small loudspeakers that are designed to be held in place close to a user's ears. Headphones either have wires for connection to a signal source such as an audio amplifier, radio, CD player, portable media player or mobile phone, or have a wireless receiver, which is used to pick up signal without using a cable. They are sometimes known as ear speakers or, colloquially, cans. The in-ear versions are also known as earphones or earbuds. In the context of telecommunication, a headset is a combination of headphone and microphone.

Notes

- **PC input devices:** The input unit is formed by the input devices attached to the computer. Ex - Keyboard, Microphone etc. An input unit takes the input & converts it into binary form so that it can be understood by the computer.
- **Global Positioning System (GPS) receiver:** The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver.
- **Dial-up modem:** Dial-up Internet access is a form of Internet access that uses the facilities of the public switched telephone network (PSTN) to establish a dialed connection to an Internet service provider (ISP) via telephone lines. The user's computer or router uses an attached modem to encode and decode Internet Protocol packets and control information into and from analogue audio frequency signals, respectively.
- **Wireless remote control:** A remote control is a component of an electronics device, most commonly a television set, DVD player and home theater systems originally used for operating the device wirelessly from a short line-of-sight distance. Remote control has continually evolved and advanced over recent years to include Bluetooth connectivity, motion sensor-enabled capabilities and voice control.
- **Sensor modem:** Wireless sensor nodes comprises a variety of low power, battery-operated wireless data acquisition devices to which different sensors may be directly connected.

## 5.2 Radio NIC (Network Interface Card)

The hardware required to connect a computer to a network is a network interface card (NIC). Each network interface card has a unique number called a MAC address, which is a six-figure hexadecimal number such as AB:1C:FF:56:4D:33. Most NICs are designed to connect to twisted-pair cable; however, there are NICs that connect to all types of network cable and wireless NICs that send and receive radio waves through an aerial. Wireless ATM networks will provide multimedia information to end users anywhere and anytime. A key technology component in the integration of a wireless ATM (WATM) network is the WATM network interface card (NIC). Similar to ATM NICs, the WATM NIC requires the support of the ATM and AAL layer transfer protocols. But, in order to provide a reliable wireless transmission platform, WATM NICs should also incorporate data link control (DLC), media access control (MAC), and radio physical (RPhy) layer functionality. As a result, the WATM NICs processing requirements are more demanding than that of ATM NICs at equivalent transmission rates. Thus, the design of a high-performance WATM NIC software/hardware low-cost architecture poses a new challenge. This paper presents a new architecture and implementation of a first generation 8 Mb/s WATM NIC developed at NEC Princeton for the WATMnet network.

In the early days of computing, individual computers operated as stand-alone systems. The earliest personal computers did not have an easy way to connect to other computers. In order to transfer files between computers, you had to use a portable storage medium such as a floppy disk; however, in modern day computers, connecting to a network is essential. For example, you need it to use e-mail, access information on the Internet, share documents within a corporate network.

A computer uses a network interface card (NIC) to become part of a network. The NIC contains the electronic circuitry required to communicate using a wired connection (e.g., Ethernet) or a wireless connection (e.g., WiFi).

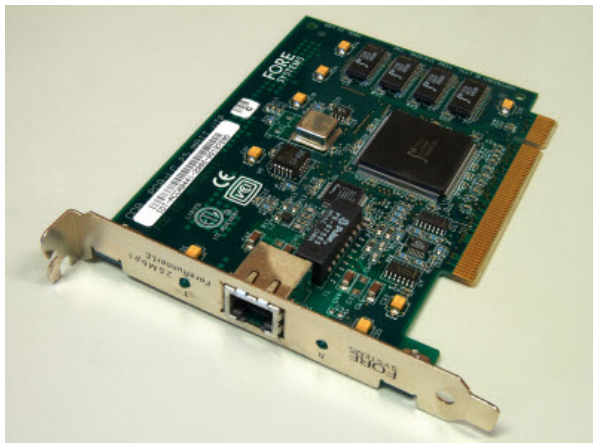


*Notes* A network interface card is also known as a network interface controller, network adapter, or Local Area Network (LAN) adapter.

## Notes

Early NICs typically consisted of an expansion card connected to the motherboard. This separate card contained the electronic circuitry and the physical connectors. The figure 5.1 shows an example of a typical NIC.

**Figure 5.1: Typical Network Interface Card**

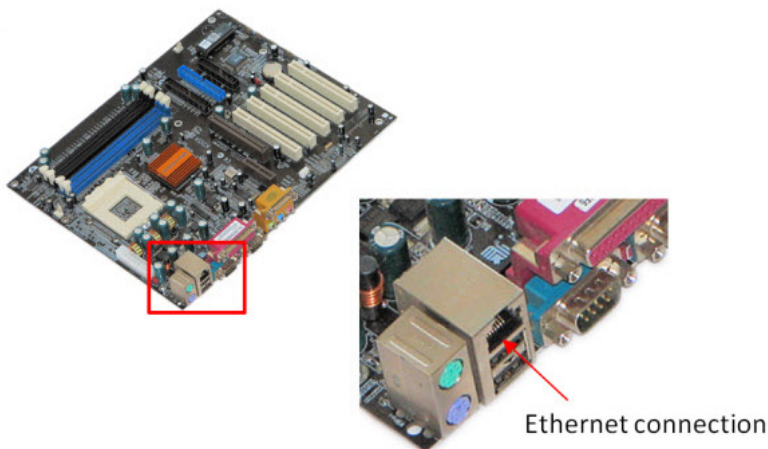


Source: <http://education-portal.com/academy/lesson/network-interface-card-nic-types-function-definition.html>

The most widely used network connection for personal computers is an Ethernet connection. Ethernet is really a standard for computer network technologies that describes both the hardware and the communication protocols. Ethernet was commercially introduced in 1980 and has largely replaced other wired network technologies.

Since Ethernet is so widely used, most modern computers have a NIC built into the motherboard. A separate network card is not required, unless some other type of network is used. The figure 5.2 shows an Ethernet connection built into a motherboard. Several other connections are located directly adjacent to the Ethernet connection.

**Figure 5.2: Ethernet Connection Integrated on a Motherboard**



Source: <http://education-portal.com/academy/lesson/network-interface-card-nic-types-function-definition.html>

**Notes**

An Ethernet connection uses a standard interface known as a RJ45 connector. RJ stands for registered jack. The figure 5.3 shows an Ethernet cable with a RJ45 connector.

**Figure 5.3: Ethernet Cable using a RJ45 Connector**



Source: <http://education-portal.com/academy/lesson/network-interface-card-nic-types-function-definition.html>

This cable plugs into the Ethernet connection of a computer. Small LED lights built into the connection will show that a connection is active and whether data is being transferred.

While most desktop computers rely on a wired connection, mobile computing devices such as laptops, tablets and smart phones use a wireless connection. The most widely used system for wireless connections is WiFi, which relies on radio signals.

Most laptop computers have both an Ethernet and a WiFi connection, while smaller devices typically only have a WiFi connection. The NIC controls both types of connections, so whether you use an Ethernet or WiFi connection, you can use your computer for the same tasks independent of the type of connection. Wireless connections tend to be slower and are sometimes less secure, but, in a typical network, the two connections are designed to work seamlessly with each other.

### **Self-assessment**

Fill in the blanks:

1. A ..... has an electronic visual display, enabling it to include a web browser
2. The ..... is a space-based satellite navigation system that provides location and time information in all weather conditions,
3. Wireless ..... nodes comprises a variety of low power, battery-operated wireless data acquisition devices to which different sensors may be directly connected.
4. A computer uses a network interface card (NIC) to become part of a .....
5. The most widely used network connection for personal computers is an ..... connection.

## **5.3 USB Adapters**

Most personal computers had a built-in D-sub serial RS232 port, also referred to as a COM port, which could be used for connecting the computer to most types of serial RS232 devices. By the

late 90's many computer manufacturers started to phase out the serial COM port in favor of the USB port. By the mid 2000's some computers had both a serial COM port and a USB port, however many did no longer have a serial COM port by that time; and today almost all modern computers have no serial COM port but only USB ports instead. Since many serial devices with a RS232, RS485 or RS422 port are still in use and even still produced today, the disappearing of the serial COM port from personal computers has created a need for the USB to serial adapter.

A USB adapter is a type of protocol converter which is used for converting USB data signals to and from other communications standards. Commonly, USB adaptors are used to convert USB data to standard serial port data and vice versa.

Most commonly the USB data signals are converted to either RS232, RS485, RS422 or TTL serial data. The older serial RS423 protocol is rarely used anymore, so USB to RS423 adapters are hard to find.

USB to serial RS232 adapters are often used with consumer, commercial and industrial applications and USB to serial RS485/RS422 adapters are usually mainly used only with industrial applications.



**Caution** Adapters for converting USB to other standard or proprietary protocols also exist; however, these are usually not referred to as a serial adapter.

The primary application scenario is to enable USB based computers to access and communicate with serial devices featuring D-Sub (usually DB9 or DB25) connectors or screw terminals, where security of the data transmission is not generally an issue.

USB serial adapters can be isolated or non-isolated. The isolated version has opto-couplers and/or surge suppressors to prevent static electricity or other high-voltage surges to enter the data lines thereby preventing data loss and damage to the adapter and connected serial device. The non-isolated version has no protection against static electricity or voltage surges, which is why this version is usually recommended for only non-critical applications and at short communication ranges.

As a simplified example a typical standard USB to serial adapter consists of a USB processor chip which processes the USB signals. The USB processor sends the processed USB signals to a serial driver chip which applies the correct voltages and sends the processed data signals to the serial output. For the computer to be able to detect and process the data signals drivers must be installed on the computer. When the USB to serial adapter is connected to the computer via the USB port the drivers on the computer creates a virtual COM port which shows up in Device Manager. This virtual COM port can be accessed and used as if it was a built-in serial COM port. However, the characteristics of the virtual COM port are not exactly the same as a real internal COM port, mainly due to data latency; which means that if very sensitive and precise data transfer is required, the USB to serial adapter might be unreliable and not a desired solution. Virtual COM drivers are usually available for Windows, Linux and MAC only.

## 5.4 Wireless Routers

A wireless router is a device that performs the functions of a router but also includes the functions of a wireless access point. It is commonly used to provide access to the Internet or a computer network. It does not require a wired link, as the connection is made wirelessly, via radio waves. It can function in a wired LAN (local area network), in a wireless-only LAN (WLAN), or in a mixed wired/wireless network, depending on the manufacturer and model.

Most current wireless routers have the following characteristics:

- One or multiple NICs supporting Fast Ethernet or Gigabit Ethernet integrated into the main SoC



Notes

- One or multiple WNICs supporting a part of the IEEE 802.11-standard family also integrated into the main SoC or as separate chips on the Printed circuit board. It also can be a distinct card connected over a MiniPCI or MiniPCIe interface.
  - ❖ So far the PHY-Chips for the WNICs are generally distinct chips on the PCB. Dependent on the mode the WNIC supports, i.e. 1T1R, 2T2R or 3T3R, one WNIC have up to 3 PHY-Chips connected to it. Each PHY-Chip is connected to a Hirose U.FL-connector on the PCB. A so called pigtail cable connects the Hirose U.FL either to a RF connector, in which case the antenna can be changed or directly to the antenna, in which case it is integrated into the casing. Common are single-band (i.e. only for 2.4GHz or only for 5GHz) and dual-band (i.e. for 2.4 and 5GHz) antennas.
- Often an Ethernet Switch supporting Gigabit Ethernet or Fast Ethernet, with support for IEEE 802.1Q, integrated into the main SoC (MediaTek SoCs) or as separate Chip on the PCB.
- Some wireless routers are also include a xDSL-, DOCSIS- oder a LTE-modem in addition to the other components.

Figure 5.4: Linksys-Wireless-G-Router



Source: <http://en.wikipedia.org/wiki/File:Linksys-Wireless-G-Router.jpg>

If you don't have an ADSL connection, but have a cable broadband connection, then don't buy an ADSL wireless router. You want one that you can plug your modem in to. Look for any wireless router that DOESN'T have the words ADSL in the title.

The modem you got from your ISP will probably be connected to your computer via an ethernet cable. Unfortunately, you can't just plug this in to your shiny new wireless router and expect it to work! When you plug your Ethernet cable in to your computer, you're plugging it in to an ethernet card. Your ethernet card has a unique address called a MAC address. Cable providers connect you via the MAC address of your ethernet card. Your new router will have a different MAC address. So if you plug your ethernet cable in to this, your provider won't know where you are, and you won't get any web pages!

The good news is that there's something called MAC address spoofing. This is when the router pretends to be your ethernet card. If you get a wireless router like the Buffalo AirStation G54 High Power then the install process will take care of this for you. The process will be fairly painless. The bad news is that some routers expect you to do all this for yourself! The manual will then explain how to get the MAC address of your ethernet card, and how to enter this information in to the router. The wireless cable routers we've chosen on our recommended pages all have easy setup options for MAC address spoofing

## 5.5 Bluetooth Dongles

Bluetooth technology is a wireless technology that allows devices like computers, cell phones, headsets and PDAs to communicate with each other. This communication facilitates data transfers quite easily, and has heralded a new age in wireless computer and cell phone accessories. If you have a computer and you want to use Bluetooth accessories with it (such as a printer, keyboard, headset or mouse) then you will first need a Bluetooth adapter.

### 5.5.1 Use

The function of a Bluetooth adapter is to allow you to create a Bluetooth network for your computer if it is not already Bluetooth-enabled. Once this network has been created, your computer will be compatible with all Bluetooth-enabled wireless devices. Other uses of a Bluetooth dongle include:

- **Listening to Music:** Bluetooth can be used to stream audio to headphones or even speakers. These speakers or headphones will typically be battery-powered. By using such devices, you can play music on your computer and listen in from another room.
- **Transferring Files:** A Bluetooth connection between computers can be used to stream files. By pairing two computers together, a shared folder can be established, allowing multiple users access to a database. This makes it convenient to work on files that are frequently updated.
- **Customizing your Phone:** Unless your phone has had its usability crippled by your carrier, you can send ringtones and wallpapers to your phone. This gives you the option to take your own collection of pictures and music, and transfer them to your phone using the software that is included and activated with your dongle.
- **Streaming Media:** If you have the proper hardware, such as a TV that can interface with a laptop or a Bluetooth-enabled TV receiver, you can activate a connection between your main computer, with a dongle installed, and your TV or laptop. You can use this connection to stream movies or pictures to your TV from your now Bluetooth-enabled computer.
- **Controlling Mechanical Devices:** If you're tech-savvy, it is possible to take advantage of a Bluetooth receiver to engage physical switches. With the proper set-up, you can use a Bluetooth dongle on your home computer to activate lights, sprinklers, cameras or other such devices within a range of about 100 meters. Such a set up may require some technical know-how and a good bit of solder.

### 5.5.2 Applications

Bluetooth dongle namely Bluetooth adaptor is a supernatural gadget. Wow, it is bad when you want to transfer music files from your PC to your Bluetooth mobile phone, however, the data cable is lost and your PC does not have Bluetooth port, what should you do now? Please do not worry, Bluetooth dongle will solve it, please plug one Bluetooth adaptor into the USB port of your PC, and turn on it, now, your PC has been transformed a Bluetooth PC, you can transfer files at ease. How marvelous the Bluetooth dongle it is. And you may ask is it very expensive? "No!", onTheSource.com would like gladly to answer you it is not dear at all. Bluetooth adaptor from onTheSource.com is not only good but also at very featured prices.

### 5.5.3 Features

There are several benefits to having a Bluetooth adapter. If you like using wireless devices, then installing a Bluetooth adapter to create a Bluetooth network is essential. Instead of your wireless devices all working on their own small network, a Bluetooth adapter enables them to all work together, which will increase productivity. It will also prevent problems caused by competing networks.



## Notes

**5.5.4 Reliability**

The internal antenna in a dongle is used to deliver interference-free reception under optimal conditions. The passwords and user names provide the user-level authentication.

**Self-assessment**

Fill in the blanks:

6. The internal antenna in a dongle is used to deliver ..... reception under optimal conditions
7. The function of a Bluetooth ..... is to allow you to create a Bluetooth network for your computer if it is not already Bluetooth-enabled.
8. A ..... adapter is a type of protocol converter which is used for converting USB data signals to and from other communications standards.
9. A wireless ..... is commonly used to provide access to the Internet or a computer network.
10. The USB processor sends the processed USB signals to a serial driver chip which applies the correct ..... and sends the processed data signals to the serial output
11. The internal ..... in a dongle is used to deliver interference-free reception under optimal conditions



*Task* Compare the major Bluetooth dongles available in the market.

**Case Study How Cisco Upgraded Its Wireless Infrastructure**

In 2000, Cisco® IT designed and deployed a global WLAN infrastructure that serves all Cisco offices. Originally designed as a secondary network for intermittent data usage, the WLAN proved very popular with Cisco's highly mobile workforce. Within two years, nearly 25 percent of Cisco employees were using the WLAN as their primary network access medium, and many were also using a variety of wireless voice services.

By 2005, it was clear that an upgrade of the WLAN infrastructure was necessary as user adoption continued to increase. What was originally a secondary network was now deemed business-critical by the majority of Cisco employees, with 81 percent of users describing the WLAN as "critical" or "extremely important" for their day-to-day productivity. The original infrastructure was reaching the end of its useful lifetime, and many components were no longer sold or supported. Additionally, Cisco business managers were calling for improvements in service availability and operations; business objectives for the upgraded infrastructure included reduced support costs, enhanced stability and security, and an increased Service Level Agreement. Perhaps most importantly in today's business environment, the existing WLAN could not offer the performance and stability required for high levels of wireless voice and video traffic.

**Challenge**

The challenge for Cisco IT was to continue providing a global wireless LAN that could serve as a primary access medium and deliver more bandwidth and coverage to more

*Contd...*

users, while satisfying the company's business requirements. The next-generation WLAN would also need to provide native support for wireless voice and video, with high levels of accessibility, availability, and security to reduce service-impacting incidents.

Our goal was to deploy an enterprise-class, on-demand wireless network that is suitable as a primary access medium," says Oisín Mac Alasdair, Cisco IT program manager for wireless strategy and architecture. "In the short term, we want to support at least 50 percent of our users adopting wireless as their regular network access method. Over the longer term, that percentage should continue to rise."

### Solution

The Cisco Next-Generation WLAN program, which began in May 2006, will evolve Cisco IT's existing indoor wireless network infrastructure into a more available, stable, and secure network. Cisco IT will increase the number of access points - from 3100 to more than 6000 - in more than 300 Cisco locations worldwide and deploy the latest intelligent and fully integrated Cisco wireless products.

The next-generation WLAN is based on the Cisco Unified Wireless Network solution, which combines centralized Cisco Wireless LAN Controllers with Lightweight Access Point Protocol (LWAPP)-enabled access points, and distributed, autonomous access points based on Cisco IOS Software. (Figure 1)

Campus sites. At main campuses, the new WLAN design uses 100 or more Cisco Aironet® 1130AG Series access points. The Cisco Aironet 1130AG Series is an ideal choice for these large sites, because it offers enterprise-class features such as high-performance 802.11a and 802.11g radios, integrated antennas, and 802.11i security compliance.

Campus buildings are served by two or more Cisco Catalyst® 6500 Series switches with Wireless Services Modules (WiSMs). Authorized user traffic is carried over LWAPP tunnels, while guest traffic is carried in a generic routing encapsulation (GRE) tunnel.

The WLAN is managed with internal systems and the Cisco Wireless Control System (WCS), which provides comprehensive tools for planning, monitoring, and control. (Figure 2) Location servers installed in a Cisco data center enable delivery and management of location-based services for users.

Large and midsize field sales offices. Large and midsize field offices will also use a centralized WLAN solution, with up to 98 Cisco Aironet 1130AG Series access points that are controlled by dual Cisco 4400 Series Wireless LAN Controller appliances and managed by the Cisco WCS. (Figure 3) The Cisco 4400 Series controllers manage office-wide WLAN functions such as security policies, intrusion prevention, Auto RF, QoS, and mobility.

Small field sales offices. The smallest offices will use up to four Cisco Aironet 1200 Series access points running Cisco IOS Software. No local WLAN controller is required because a dedicated access point provides wireless domain services. These small office WLANs will be managed with the Cisco Wireless LAN Solution Engine (WLSE). (Figure 4)

Wireless clients. In conjunction with the global upgrade of the WLAN architecture, the Cisco Secure Services Client will be supported on all client endpoints. The adoption of a single authentication framework allows Cisco IT to standardize on a single client for all devices, which simplifies support and reduces the company's total cost of ownership for wireless networking. The Cisco Secure Services Client is also compatible with a wide range of wireless adaptors that support the Cisco Certified Extensions (CCX) program.

New capabilities. The new WLAN architecture supports enhanced capabilities such as location-based services; improved guest access; enhanced wireless voice services for dual-band phones and other user devices; and outdoor coverage on campus sites. The architecture also enables security through an integrated wireless intrusion detection

*Contd...*

**Notes**

system (IDS), improved detection of rogue access points, as well as the security features Wi-Fi Protected Access (WPA2) and wireless network admission control (NAC).

**Result**

As of late 2006, the WLAN upgrade was complete for the Cisco headquarters campus in San Jose, California, and deployment was under way in other locations. With nearly 40 percent of Cisco employees working at the headquarters site, the early results achieved at this campus indicate the value to be obtained from the remaining deployments.

With the next-generation WLAN and Cisco Unified Wireless Network solutions, Cisco employees will experience a better wireless network. In addition, Cisco will gain the benefits of cost savings, greater network stability, and continued productivity gains.

**Lessons Learned**

Cisco customers can benefit from the lessons learned by Cisco IT during the initial WLAN deployment and the next-generation upgrade.

Regulatory issues. Different access points and wireless interface cards are required in certain parts of the world because the 802.11a standard may not be approved in some countries, or not yet approved in its most recent version. Particularly in emerging market countries, regulatory requirements are more complex, and wireless standards are more controlled. As a result of these issues, Cisco has not been able to use the same access point model in every country. This difference has not significantly affected the support requirements or benefits achievable from the new WLAN.

Transition resources. Certain operational and support resources were required during the deployment of the new WLAN solutions. During the architecture and design phases of the project, several network design engineers created and tested the design, and all required documentation using local and remote labs. In addition, several network operations engineers implemented the proposed design at pilot sites for limited-duration tests and Cisco network management personnel created the interface to Cisco IT's internal network management systems. Additional Cisco IT staff created technical documentation and conducted training globally for the implementation and support engineers.

During the implementation phase, several project managers monitored the implementation schedule and activity. The installation of the new wireless equipment was performed by both Cisco employees and outsourcers.

Indoor and outdoor deployments. Cisco IT developed separate deployment plans for indoor and outdoor coverage, reflecting differences in scope, architecture design, and user needs and expectations for service levels. Upgrading indoor coverage was given a higher priority than installing new outdoor access.

**Questions:**

1. Study and analyse the case.
2. Write down the case facts.
3. What do you infer from it?

Source: [http://www.cisco.com/web/about/ciscoitnetwork/mobility/ngwlan\\_web.html](http://www.cisco.com/web/about/ciscoitnetwork/mobility/ngwlan_web.html)

## **5.6 Summary**

A personal area network - PAN - is a computer network organized around an individual person.

Personal area networks generally cover a range of less than 10 meters (about 30 feet).

A WPAN (wireless personal area network) is a personal area network - a network for interconnecting devices centered around an individual person's workspace - in which the connections are wireless.

A key concept in WPAN technology is known as plugging in

The hardware required to connect a computer to a network is a network interface card (NIC).

Each network interface card has a unique number called a MAC address, which is a six-figure hexadecimal number such as AB:1C:FF:56:4D:33.

A wireless router is a device that performs the functions of a router but also includes the functions of a wireless access point.

It is commonly used to provide access to the Internet or a computer network.

## **5.7 Keywords**

**WPAN (wireless personal area network):** is a personal area network - a network for interconnecting devices centered around an individual person's workspace

**Mobile device:** (also known as a handheld device, handheld computer or simply handheld) is a small, handheld computing device

**Personal digital assistant (PDA):** also known as a palmtop computer, or personal data assistant, is a mobile device that functions as a personal information manager.

**Headphones:** are a pair of small loudspeakers that are designed to be held in place close to a user's ears.

**Global Positioning System (GPS):** is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

**Dial-up Internet access:** is a form of Internet access that uses the facilities of the public switched telephone network (PSTN) to establish a dialed connection to an Internet service provider (ISP) via telephone lines.

**Remote control:** is a component of an electronics device, most commonly a television set, DVD player and home theater systems originally used for operating the device wirelessly from a short line-of-sight distance.

**USB adapter:** is a type of protocol converter which is used for converting USB data signals to and from other communications standards.

**Wireless router:** is a device that performs the functions of a router but also includes the functions of a wireless access point.

## **5.8 Review Questions**

1. Discuss the characteristics of wireless routers
2. What are the uses of a Bluetooth dongle?
3. What is RJ45 connector
4. Explain Network Interface Card

Notes

**Answers: Self-Assessment**

- |             |                                    |
|-------------|------------------------------------|
| 1. PDA      | 2. Global Positioning System (GPS) |
| 3. Sensor   | 4. Network                         |
| 5. Ethernet | 6. interference-free               |
| 7. adapter  | 8. USB                             |
| 9. Router   | 10. Voltages                       |
| 11. Antenna |                                    |

**5.9 Further Readings**



*Books*

802.11 Wireless Networks: The Definitive Guide, Second Edition, Matthew Gast

Introduction to wireless networks, John Ross

Wireless Communications & Networking, Vijay Garg

Wireless Communications: Principles and Practice, Theodore S. Rappaport



*Online links*

<http://education-portal.com/academy/lesson/network-interface-card-nic-types-function-definition.html>

<http://www.homeandlearn.co.uk/bc/bcs6p3.html>

<http://en.wikipedia.org/wiki/Modem>

[http://www.ehow.com/about\\_5112558\\_bluetooth-adapter.html](http://www.ehow.com/about_5112558_bluetooth-adapter.html)