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EXECUTIVE SUMMARY

Wireless networking has gone mainstream. Virtually all laptops and notebook computers manufactured today are wireless-enabled. WiFi “hotspots” today are commonplace, both indoors and outdoors, and we are witnessing the emergence of the “wireless city.” Initiatives are underway throughout the United States and abroad to build and deploy municipal-wide WiFi networks. This ubiquitous connectivity is planned for major U.S. metropolitan areas including Chicago, Philadelphia, San Francisco, Denver, Minneapolis and Milwaukee.

The ability to work in the field and stay in touch with the office has transformed the business landscape. The market research firm IDC expects the mobile worker population to increase from 650 million worldwide in 2004, to more than 850 million in 2009, representing more than one-quarter of the global workforce, according to an IDC market research report, “Worldwide Mobile Worker Population 2005 – 2009 Forecast and Analysis.”¹ More than 70 percent of the U.S. workforce will be mobile by 2009, the survey finds. In a summary analysis, IDC reports that today’s businesses recognize that “job functionality can be enhanced by mobility for a significant portion of the workforce.”²

Not surprisingly, a large and growing mobile workforce has spurred market demand for portable communication and business devices. One product category experiencing worldwide growth is wireless projectors.

In its short six-year history, wireless projection technology has made a quantum leap forward in terms of portability, ease of use, performance and functionality. With Panasonic’s latest generation of wireless projectors, real-time collaboration among a roomful of businesspeople or students is a reality. With Panasonic’s flexible wireless environments, up to 16 computers can seamlessly share the same projector: the images from all 16 computer screens can be projected, individually or simultaneously, onto a multi-windowed screen.

Today’s users have unprecedented control over their presentations, from making near real-time edits to computer text or a spreadsheet during a presentation, to cropping in on a section of the PC screen for projection as a full image. Technical barriers to effective wireless projection have been lowered by today’s high-speed wireless networks and Panasonic’s compression technology. Utilizing Panasonic-developed technology, projectors can play video clips at 30 frames per second with audio.

In this white paper, we will trace the evolution of wireless projector technology, which closely parallels the development and widespread adoption of IEEE WiFi standards. We will show how successive generations of wireless projectors achieved gains in speed, functionality and ease of use, while becoming lighter and more compact. Next, we will discuss today's more powerful and function-rich wireless projectors, and how they are transforming business and education.

Before we begin, we first should review key industry terms.

LCD VERSUS DLP® TECHNOLOGIES

The two optical device technologies used in digital projectors today are Liquid Crystal Display (LCD) and Digital Light Processing® (DLP). Based on radically different technologies, the display device technology has a lot to do with image quality, brightness and cost; therefore we need to understand a little about how they work.

LCD PROJECTION

Most LCD projectors contain three liquid crystal display panels (LCDs). Light from the projector lamp is split into the three primary colors of red, green and blue using dichotic mirrors (occasionally more expensive prisms are used, but mirrors are the more common beam-splitting technology in LCD projectors). The three separate colors are then sent through the shutterlike LCD panels, which vary the light passing through them according to variations of the input image. The synthesized color images are then combined and sent through the lens and projected onto the screen as a full-color image.

ONE-CHIP DLP® PROJECTION

DLP® technology is the world's only all-digital display solution. There are two basic types of DLP® projectors, single-chip and three-chip; the names indicate how many of the mirror devices used to create the image are used in the projector. In a single-chip DLP® projector, white light from the projector's lamp passes through a color wheel filter. The projector uses a Digital Micromirror Device, or DMD chip. The color wheel spins, illuminating the DMD chip sequentially with red, green and blue light. With a highly reflective surface consisting of tiny mirrors, the DMD mirrors turn on depending on how much of each color is needed, according to the input video signal. The eye integrates the sequential images, and a full-color image is seen.

An LCD projector with three imaging devices has some advantages over a single-chip DLP® projector. The LCD will have a greater light output per watt of power consumed simply because of the three imagers. DLP® projectors excel in certain applications such as 24-hour, 7-day-a-week operations, and in high-end applications, such as digital cinema. LCD projectors are very well suited to business presentation applications and home theaters.

Tests conducted at the Rochester Institute of Technology's Munsell Color Science Laboratory pointed to DLP®'s winning combination of performance, longevity and

LCD VERSUS DLP® TECHNOLOGIES

reliability. The two DLP® projectors used in the 2002 study “delivered stable contrast and color balance that remained relatively unchanged for over 4,000 hours of continuous operation.”³ DLP® also minimizes any “screen door” effect because pixels are much closer together; Panasonic has developed a special optical filter which is added to LCD projectors to reduce this screen door effect to the point that it is no longer a serious impediment to LCD projector use in most applications.

Consensus among industry experts is that LCD and DLP® projectors each have unique advantages. Well-designed LCD projectors can produce good color fidelity, color saturation and brightness. The LCD architecture is more light-efficient at the same lamp wattage, and lowers energy consumption and preserves lamp life in comparison to a single-chip DLP® projector, but is slightly less efficient than a three-chip DLP® projector.

WIFI NETWORKS SPUR DEMAND FOR WIRELESS PROJECTORS

The first wireless projectors debuted in 2000. While hinting at the promise of wireless projection, these Bluetooth-enabled projectors were of limited practical use.

Developed in 1994, Bluetooth technology is a short-range (30 feet) wireless networking specification designed for a Personal Area Network (PAN). Intended as a replacement for cable, it is primarily used to create a wireless, point-to-point connection between two Bluetooth-enabled devices, such as a notebook and mobile phone. Bluetooth offered a maximum bandwidth of 720Kbps (kilobytes per second).

A more expansive technology for wireless networking is Wide Fidelity, or "WiFi." The standard "802.11" refers to a family of standard specifications developed by the Institute of Electrical and Electronics Engineers (IEEE) for Wireless Local Area Network (WLAN) facilitation.

WiFi took off in 1999 with the introduction of 802.11b. Not only is 802.11b ten times faster than Bluetooth, it was designed for use with Ethernet local area networks. Up to that point, equipment interoperability was an issue when trying to connect different vendor products. By using traditional networking protocols and standards, 802.11b provided a way to connect computers and other wireless products to each other and to the Internet without any wiring and at low cost.

The market demand for wireless products grew, prompting the formation of a new industry group, the Wireless Ethernet Compatibility Alliance (WECA), dedicated to certifying products for interoperability. Airports, hotels and office buildings began rapidly installing WiFi networks. The rapid proliferation of WLANs, and the adoption of the 802.11b standard by notebook manufacturers, underscored the need for a wireless-enabled portable projector.

The next significant WiFi breakthrough occurred in 2003, with the introduction of the IEEE 802.11g standard, which defined the way WLAN equipment communicates at up to 54 megabits per second (Mbps), while remaining backward-compatible with 11-Mbps 802.11b. This important breakthrough will enable streaming media, video downloads and a greater concentration of users per WLAN network.

WIRELESS PROJECTORS ADOPT 802.11 STANDARDS

In 2002, Panasonic and other leading audiovisual (AV) network product manufacturers introduced the first wireless peer-to-peer network projectors based on 802.11b technology. This marked the beginning of true wireless connectivity between projectors, PCs and PDAs. Over the next four years, wireless projectors became increasingly lightweight, compact and powerful.

Peer-to-peer is a wireless configuration in which one or more computers can share a projector equipped with the same wireless capability. Since no cable is involved, the equipment can be set up anywhere in the room. Peer-to-peer is also known as Ad Hoc, from the Latin phrase meaning “for this purpose only.” Another common application of networking technology is called “infrastructure.” This mode of operation is the type of networking that uses hubs and access points, and has many users; common office networks are infrastructure mode networks because they connect many users over wide areas. The gains in projector performance and functionality were significant with the new WiFi models, but the first-generation projectors were heavy and unwieldy to transport, and relatively expensive.

Panasonic made several significant advances on the wireless front in 2003, when it introduced the PT-L735NT. This wireless projector featured a new “live” mode for projecting animated Microsoft® PowerPoint® content and web pages. The compact model offered 2,600 lumens of brightness and built-in stereo speakers. It introduced a new level of operating ease with time-saving features, such as speed start, One-Touch Auto Setup, automatic input signal detector and Direct Power Off. An SD Memory Card slot enabled PC-free presentations.

In 2004, Panasonic launched the PT-LB10NTU, a wireless LCD projector weighing less than five pounds. Despite its diminutive size, the PT-LB10NTU offered native XGA resolution (1,024 x 768), nearly universal 802.11b support and “multi-live” presentational support. A ProjectorCentral.com review of the PT-LB10NTU noted: “Panasonic takes wireless to a new level with broad support and fast and easy connection of up to four PCs, user-friendly features and high brightness in a slim 4.9-pound package at a great price.”⁴

Innovations continued to accrue at an accelerated rate. In 2005, Panasonic introduced the PT-LB20NTU, the first wireless projector to leverage the image-enhancing Daylight View Technology. With this sensor-controlled feature, the 2,000-lumen PT-LB20NTU achieved a level of image performance equal to many 3,000-lumen projectors. By

WIRELESS PROJECTORS ADOPT 802.11 STANDARDS

building the wireless function into the projector, Panasonic eliminated the need for a wireless card and slimmed down the profile. That same year, Panasonic brought out the PT-LB30NTU, which at 5.7 pounds was the world's lightest projector to offer 3,000 lumens of brightness.

By 2006, Panasonic wireless data speeds increased fivefold, and the new-generation model projectors would support full motion video and the simultaneous projection of 16 computer screens as one indexed image. We will now examine the amazing functionality and performance enhancements in today's 802.11b/g wireless projectors, and how they are transforming business meetings and classrooms.

The *2006 InfoComm Market Forecast Survey*, conducted by AWP Research, found that the audiovisual industry in both North America and Europe was expected to grow dramatically between 2005 and 2006 – a trend sustained over the past four consecutive years.⁵ The survey points to the increased market demand for networked AV products due to the integration of IT and audiovisual technology. Specifically, the two largest markets, business and education, are looking for wireless applications, streaming media, webcasting, digital signal processing and AV-related software.

The latest generation of Panasonic wireless projectors - the PT-F200NTU, PT-LB80NT, PT-LB75NT and the widescreen counterpart, PT-LW80NT - leverage a confluence of networking, AV and proprietary technologies to deliver on this promise. All of these models offer unrivalled high-speed data transfer rates that support moving picture files and sound streaming. They also incorporate the fourth generation of Panasonic's exclusive Daylight View Technology. Each features a fast, simple, highly automated startup and operation; they are also ultra-lightweight for easy travel.

In the next section, we will examine key areas and discuss what you can expect today from a wireless projector.

Wireless projectors keep getting easier to use. Many of today's wireless projectors have plug-and-play setup capabilities. Since there are no cables to connect other than the power cord, the setup is quick and easy, and you have full layout flexibility. Panasonic's "Auto Everything" approach is designed for use by mobile professionals and instructors, not IT staff. Setup is a breeze, and you don't have to power down.

The PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT projectors automatically detect what type of power source is being used. This allows a two to three second startup time. As we will discuss in more detail, brightness levels are adjusted automatically in accordance with ambient light conditions. Similarly, the projectors automatically sense whenever the viewing angle changes vertically, and instantly makes keystone corrections to optimize viewing.

Presenters can take advantage of a host of operational options using simple screen menus. Picture mode includes Dynamic (the brightest), Natural and Standard settings. The lamp can be run on full power or "eco-mode." From the menu, you also can set the second computer port to function either as a computer input or as a monitor output.

Once the presentation is over, you can instantly disconnect the power cable and move the projector because the cooling fan keeps operating until the lamp is cooled.

INSTALLATION-FREE SOFTWARE SETUP

The settings for wireless connection can be made quickly and easily using the Wireless Manager. The wireless operating software application can be loaded onto a computer via a simple CD-ROM installation. Presentation software can also be copied onto a removable medium, such as an SD (Secure Digital) memory card, and accessed via the Internet at a website for PC-free presentations. However, bear in mind that with a pre-recorded presentation, you lose the dynamic editing and image customization features offered in the PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT models.

Wireless Manager reads the computer screen, compresses the data and transmits it to the projector. With early models, there was a perceptible time delay between the transmission of the screen data and the projection of the image. With Panasonic's exclusive compression technology, and the transmission speeds of 800.11g, the PC-to-projector transmission now is nearly synchronous. In fact, in "Live Mode" and "Multi-Live Mode," the content on the PC screen is projected with the same smooth image as you get with a wired connection. Another Wireless Manager feature occurs at the end of the presentation: the PC default settings are automatically restored so the computer can reconnect to the corporate LAN.

In terms of image quality, brightness now comes in small packages. Owing to a high-performance optical system and high-efficiency 250-W UHM™ lamp, the PT-F200NTU, one of the brightest projectors available in its class, delivers at 3,500 lumens of brightness. While the PT-LB80NT's 220-W UHM™ lamp offers 3,200 lumens, the PT-LW80NT and PT-LB75NT, with a similar lamp offering, provide 2,600 lumens of brightness each.

That only begins to tell the story. All four projectors offer Daylight View Technology, a unique Panasonic innovation that makes images crisp and easy to see, even in brightly lit rooms. Here's how it works: a built-in sensor measures ambient light and adjusts the halftone colors and brightness levels automatically in real-time. The Daylight View mode also provides white balance adjustment settings for fluorescent and incandescent lamps to match the room lighting.

One of the notable performance gains in Panasonic's newest wireless projectors is the ability to stream full-motion video and sound. With 802.11b projectors, video quality tended to be a little jerky. The higher bandwidth and transmission speeds of 802.11g have solved this problem.

Leveraging the WiFi "g" bandwidth, the PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT models can transmit motion video at 30 frames per second (fps). More impressive still, they enable moving motion files with audio. With variable audio output, presenters and instructors can use the projector remote to control external speakers hooked up to the projector.

Instead of a static, flat presentation, teachers and business professionals now can create PowerPoint® presentations embedded with video clips, animation and sound effects. Panasonic's latest-generation wireless projectors offer faster transmission standards (802.11g) to help eliminate issues with bandwidth. The 802.11g standard is two to five times faster (from 11 Mbps to 54 Mbps) than the popular 802.11b standard. Smoother transitions and the ability to edit text or spreadsheets can now be accomplished in near real-time.

The PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT all keep audio and video in sync. When clicking on the launcher, you can blank the projector screen, and if there is sound output, the sound goes off as well.

The advances made in wireless projection are abundantly clear when reviewing the flexible user options:

MULTI-LIVE MODE

This mode supports three different screen arrangements:

- Four-Window Style – Four computers use the same projector simultaneously. The projection screen is divided into four quadrants – one for each computer.
- Index Style: Four Thumbnails – Images from up to four PCs are displayed as small windows along the bottom of the projection screen.
- Extended Index Style: 16 Thumbnails – The projector screen is divided into 16 equally sized windows (four columns by four rows), and the screen images from up to 16 PCs can be projected simultaneously. Using the projector's remote control, you can select any one of the index windows and display it on the main window, or on a full screen.

MULTIPLE SOURCE LIVE MODE

With this mode, you can project a single computer's screen on up to eight projectors at a time. It optimizes audience viewing in large conference rooms, or when the same presentation is being given, concurrently, in several conference rooms. The PT-LB60NTU and PT-LB50NTU were the first Panasonic wireless projectors to offer Multiple Source Multi-live Mode. Now, the latest generation of wireless projectors - PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT - all bring the window and index style options to presentations with multiple projectors in use.

There are also new and improved user image control options.

- Selective Area Transmission

A continued feature in the PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT model projectors is the Selective Area Transmission mode.

You can project just a section of an image, using an on-screen tool to set the parameters. For instance, with a photograph of a Greek temple on your computer screen, you might choose to highlight a section of a frieze, and that delineated section detail will fill the projection screen. This works for all data transmissions except streaming video.

- Wireless Prompter Function

Wireless Prompter Function, also known as Secondary Display Transmission, enables the transmission of content to the projector that is different from what is displayed on the PC. For instance, a presenter can read notes off the PC screen, while only projecting the PowerPoint® slides. While Secondary Display Transmission was available in earlier models (PT-LB10NTU, PT-LB20NTU and PT-LB30NTU) for Live mode, Multi-live and Multiple Source Live mode, it is now available in the new Multiple Source Multi-live mode with the PT-F200NTU, PT-LW80NT, PT-LB80NT, and PT-LB75NT.

- Dual Screen Images

Using the PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT remote controls, you can place two images side-by-side. A static, indexed image can occupy half of the screen, while the other half of the screen is in Live Mode. For instance, the fixed image could be an artist's rendering of a new building, and the live half could display walk-through floor plans to show different rooms and amenities.

SECURITY

As a deterrent to theft, the PT-F200NTU, PT-LW80NT, PT-LB80NT, and PT-LB75NT can be password-protected so their operation is predicated on supplying the password. To safeguard the wireless transmissions, these models support Advanced Encryption Standard (AES) at the application level. As a result, all data transfers between the projector and computer are encrypted.

Panasonic hardware security has been expanded in the current models. Early wireless models supported IEEE Wired Equivalent Privacy (WEP) encryption/authentication network security protocol for 802.11 WLANs. Now, current wireless models additionally support the WiFi Protected Access (WPA) security systems based on Pre-Shared Key (or personal) mode: WPA-PSK and WPA2-PSK. With this added security layer, a projector user must enter a password to access the network.

AD HOC MODE

Ad hoc mode (also called peer-to-peer) enables wireless devices to communicate directly with one another without connecting through a network. This mode creates a wireless network where a wireless infrastructure does not exist, or where access to the network is prohibited to all but authorized network users. Most corporate and university wireless LANs (WLANs) operate in infrastructure mode because they require access to the wired LAN in order to access file servers and printers. Therefore, security is a major concern, and WLAN access is restricted to authenticated users who have been issued network IDs and user passwords. Because of these heavily fortified WLANs, most business consultants and trainers at a client site will use the ad hoc mode to create a temporary wireless connection between notebook(s) and wireless-enabled projector(s).

In this mode, the computer browser can access the projector menus and control the projector in the same way as the projector's remote control. This mode outputs the computer screen to the projector, and the presentation can be controlled from either the projector or the computer.

INFRASTRUCTURE MODE

In infrastructure mode, wireless devices communicate with each other via an Access Point (AP) or gateway to the wired network infrastructure, typically an Ethernet LAN. A wireless computing device can access wired network resources and services, such as file servers, printers and Internet connections. This configuration is called a Basic Service Set (BSS). An Extended Service Set (ESS) is a set of two or more BSSs that form a single subnetwork.

Infrastructure mode is not used to deliver content centrally stored on the network to a projector. Projectors do not have the information processing and storage capabilities of computers, and therefore, they cannot download content directly from the LAN or Internet. In fact, a business presentation stored on the network should be downloaded, prior to the meeting, to the computer that will drive the projector. While infrastructure mode is required for Internet access, the projector cannot project a dynamic Web feed directly. The companion computer must receive and transmit the real-time online content to the projector.

Infrastructure mode is primarily an asset management tool for IT administrators. This mode is used in-house to connect equipment to the wired network for operational purposes. When connected to the wired LAN, the Web browser on any computer in the network can be used to perform operations, such as switching its input source, or checking its status. This remote operation does not require the installation of any special software. For example, if wireless projectors are mounted in multiple conference rooms or lecture halls, the IT staff can remotely check the status of each device and troubleshoot. For business presenters and instructors, this means having IT support “on tap.” Rather than waiting for an A/V person to physically come to a meeting room to examine a projector, diagnostics begin online. Many standard problems, such as adjusting brightness or contrast, or choosing the right keystone setting, can be handled remotely.

INFRASTRUCTURE MODE SETUP

It should be emphasized that infrastructure mode is not a “do-it-yourself” process. It requires the technical assistance of an IT administrator. Because each network varies in terms of its security protocols, firewalls and encryption schemes, there is no universal set of steps to follow to configure and deploy a wireless device to a wired network.

Furthermore, the computer operating system often needs adjustment before a wireless connection can be made, such as disabling the firewall in Microsoft Windows XP™.

The following technical information must be provided to establish a wireless connection:

- **IP Address:** The wireless device needs an Internet Protocol (IP) address to be recognized as a unique destination by the network. An IP address is a protocol for distributing data, and the address corresponding to the data distribution destination is called the IP address. All devices connected to the WLAN use an IP address with the same Network ID, so they all stay within the same IP network. The Access Point (AP) serves as a bridge for the wireless devices connecting to the IP network.
- **Dynamic Host Configuration Protocol (DHCP):** Network function that automatically assigns IP addresses to the connected equipment. If a device with the DHCP server function is present within a LAN, it automatically

assigns IP addresses to the connected equipment. If a DHCP server does not exist in the network, a unique IP address must be manually inputted, along with the Gateway, defined as the relay point for connecting different networks; and the Subnetmask, which limits the range of the IP addresses assigned to computers to divide the network into distinct sections.

- **SSID:** To communicate amongst themselves, all wireless devices must be configured with the same SSID (Service Set Identifier), a sequence of case-sensitive alphanumeric characters (letters or numbers). In ad hoc mode, the projector uses the SSID set on the computer. In infrastructure mode, you would enter the SSID registered at the Access Point.
- **Authentication:** You must employ the user authentication method used by the network. Following are three options:
 - **Open System/OPEN:** This is an authentication of wireless signals employing a public key cryptosystem.
 - **Shared Key/SHARED:** This is a secret key cryptosystem for wireless signals, in which authentication is performed with a key pre-set in the Wired Equivalent Privacy (WEP), in which the encryption key is created and notified only to the communicating user, so the communication data cannot be decrypted by a third party.
 - **WPA-PSK:** This is a standard covering encryption method used in wireless LAN. It provides greater security than WEP, and has functions such as a user authentication function and also Temporal Key Integrity Protocol (TKIP), which automatically changes the encryption key at fixed intervals.
- **Encryption:** You must select the encryption method to be used for communications between the projector and the network. The choices are WEP, TKIP and AES. The latter are the U.S. government's next-generation standard encryption methods, which are performed by the National Institute of Standards and Technology (NIST). You also can choose none if the transmission will not be encrypted.

PANASONIC PT-F200NTU, PT-LW80NT, PT-LB80NT, AND PT-LB75NT DEFAULT SETTINGS

The following is set as [USER1]-[USER3] in the wireless menu before the projector leaves the factory.

SSID: Panasonic Projector DHCP: OFF

IP ADDRESS: 192.168.10.100 SUBNETMASK: 255.255.255.0

GATEWAY: 192.168.10.1 MODE: AD HOC

AUTHENTICATION: OPEN ENCRYPTION: NONE

CONNECTIVITY

The latest Panasonic projectors support both ad hoc mode and infrastructure mode. Panasonic includes both a Quick Start guide and a CD with documentation and software. The Wireless Manager software is easy to install, and if you need documentation, a PDF is located in the “network” folder on the CD. When you close the Wireless Manager, the projector’s wireless connection is also closed, and you’ll be able to restore connection to your network.

- **AD HOC MODE**

With ad hoc configurations, the network setting is completely automatic using Panasonic technology. The projector’s mobile operating system is Wireless Manager 3, which can be loaded onto a computer via a simple CD-ROM installation. The third-generation Wireless Manager now offers a motion-streaming mode. Moving-image files can be sent wirelessly, along with the audio track, from the hard disk of a computer. This eliminates the need for connecting an external video source.

- **INFRASTRUCTURE MODE**

The infrastructure mode is used to connect the projector to the wired LAN, and by extension, the Internet. You have the ability to control the projector over the internal network Ethernet or Intranet, through the projector’s “command and control” networking functions. Using the browser-controlled Web screen, the presenter can control input select, lamp power, picture mode, shutter, sound volume, picture position and picture quality. Another important function is monitoring the equipment while online, such as selected input, lamp power, status of lamp temperature and lamp run time.

Moreover, if there is no router between PC and projector, the mode can connect from another building. Audio and video streaming to the projector is not available in many projectors when using the infrastructure mode; only control and monitoring of the projector is possible. In this case, a separate connection for video input to the projector is required. Panasonic, however, can stream audio and video in either ad-hoc or infrastructure mode. An IT professional should be consulted if you intend to build an infrastructure network.

Making a wireless connection while using the Internet depends on your network configuration:

- If you have a wireless LAN environment, which allows an Internet connection, placing the projector on that network will allow you to use the Internet and the wireless connection at the same time.
- If you use a simple connection with two wireless LAN cards, since which card to be used for the projector will not be clear, you must make the connection between the computer and the projector through the manual user settings.
- If you have a wired Internet connection (Ethernet), the PT-F200NTU, PT-LW80NT, PT-LB80NT and PT-LB75NT permit wireless use with a simultaneous wired connection to the Internet.

The PT-F200NTU (with the new 2x zoom lens) can project a 4:3 aspect ratio image in sizes ranging from 33 to 300 inches diagonal, with a throw range of about 4 to 60 feet.

The PT-LB80NT and PT-LB75NT (with the 1.2x zoom lens) can fill a 33 to 300-inch diagonal 4:3 screen with a throw range of about 4 to 35 feet.

The widescreen PT-LW80NT can similarly fill anywhere from a 33 to 300-inch diagonal, but with a 16:10 aspect ratio.

MARKET APPLICATIONS: EDUCATION

Now that you are familiar with the new performance and functionality available from wireless projectors, we will look at the impact of the technology on the two largest projector markets: education and business.

EDUCATION

Acclaro Growth Partners, an independent strategic research firm, conducted a study, “AV Technology in Higher Education,” on behalf of InfoComm International, the international trade association representing the professional audiovisual industry.⁶ Released in November 2005, the study suggests that by 2010, half of all higher education classrooms will be equipped with AV technology. The study finds that AV equipment in colleges and universities has doubled every year for the past years, and is expected to double annually through 2010.

Commenting on the study, Randal A. Lemke, Ph.D., Executive Director of InfoComm International, said, “It is encouraging to see colleges and universities looking at AV as a long-term investment that is enhancing the quality of education, while reducing its cost, eliminating academic bottlenecks and assisting recruitment efforts.”⁷

Miami University is exemplifies of this trend. In 2004, the university, located in Oxford, Ohio, formulated a sweeping Information Technology Tactical Plan to empower and enhance learning and research, and upgrade IT resources campus-wide. One of the goals was to improve technology in the classroom, and in doing so, the school chose to standardize its equipment usage. Panasonic projectors were chosen both for performance and service quality, according to Randy Mikesell, coordinator of Classroom Facilities, Information Technology Services.

To upgrade classroom instruction, Kent State University has installed dedicated projectors in more than 130 classrooms to date; the majority of these projectors are Panasonic. Robert Minno, Manager of Audio Visual Services at Kent State, said that for today’s students, “the visual medium is their medium of choice.” He said they are discerning, and expect high-quality images in the classroom.

Northeast Wisconsin Tech College embarked on a program three years ago to build-in multimedia classroom capabilities for instructors. In a webcast on the Panasonic website, John Siemering, the head of Media Services, characterized the Panasonic projectors as “the heart” of the more than 150 smart classrooms, underscoring

MARKET APPLICATIONS: EDUCATION

how the ability to project images from multiple digital sources is central to modern classroom instruction.

The growth is also noted in the American public school system. A recent article in EdTech: Focus on K-12 (September/October 2006), reports that an estimated 200,000 projectors were sold to K-12 schools in the United States, and that by 2010, annual sales to classrooms across the country are expected to grow to more than 400,000 units.⁸ The trend is attributed to improvements in projector usability, brightness and affordability over the past five years.

Panasonic beta tested the PT-LB50NTU in 20 Japanese middle schools. The response of the teachers was enthusiastic. They found the new lightweight wireless projectors to be considerably easier to set up and operate, especially in a large gymnasium that once required an extra-long signal cable. They also reported that the wireless option was safer, because they no longer had to worry about children tripping over the wires.

Since teachers and lecturers now can set up the projector and the computer anywhere, they can pick the best location for conducting the lesson. With a wired arrangement, their position was fixed, and they often had their backs to the class. Now, they can move around and both oversee and interact with students while teaching the lesson.

Using AV equipment in classrooms used to be a problem, since the rooms tend to have many windows, and the lighting conditions are bad for projection. With Daylight View 4 Technology, the image can be clearly viewed, and the adjustment to the ambient light occurs automatically.

The most notable difference teachers reported, however, was in student participation. Having a projector in a classroom promotes greater collaboration and information sharing. Asking students to come to the front of the class and write on the blackboard creates a disruption. Live and Multi-live modes incorporated in the latest generation of wireless projectors allow students to work as groups, or work on the same exercise at the same time.

With the ability to project 16 students' work on the screen at the same time, teachers said they could oversee many students' work simultaneously. As a result of having their work projected on the screen, the Japanese teachers found that their students came to class better prepared, and paid closer attention during exercises. They also could now solve problems collectively, which made the assignments more interactive and fun.

MARKET APPLICATIONS: EDUCATION

Several teachers said the Multi-live mode engendered a healthy spirit of competition, especially when using the four-window style.

Showing a film in a classroom is no longer a chore. Before, an AV person or the teacher would wheel in the projector on a cart, and manually adjust the controls and lens angle to get a viewable image. With the streaming video mode, teachers can now set up the ultra-lightweight equipment and show instructional films with the audio track.

Access to the Internet adds an exciting new dimension to classroom instruction. Using the Infrastructure mode, a teacher can go online from his or her laptop, and the students can follow the real-time action on the projector screen. The projector becomes a window for Internet-based learning.

BUSINESS

A widely reported survey by Strategic Analytics, released in October 2006 found that Wireless Local Area Network (WLAN) is the dominant remote connectivity choice for U.S. mobile professionals.⁹ According to the survey, WiFi outranked dial-up as the number one mode of remote access; four out of every five notebooks in this country have WiFi capability. More than one in three (35%) business professionals identified WLAN as their primary means of remote connectivity.

The mobile workforce's preference for high-speed WiFi connections over the dial-up connection, and the high number of WiFi-enabled notebooks, are spurring demand for a new breed of ultra-light wireless projectors that are both easy to use and powerful.

Little steals the thunder from a business conference or presentation faster than an equipment failure. Before the advent of wireless projectors, business presenters and instructors had no choice other than to use the projector at the client site. Setup was hit or miss. The presenter would arrive only to learn that the round data cable didn't fit into a square data port, or the cable was too short. Even if the wiring went smoothly, there was always the problem of fiddling with controls to get the image right. Presenters often required technical assistance to select the right input source, set keystone settings from the lens and adjust the projector's contrast and brightness.

Today's wireless projectors are so lightweight and compact that they slip into a briefcase or tote bag, and can be carried along with a laptop. As a result, mobile professionals are no longer at the mercy of unfamiliar equipment, or the ever-present risk of encountering incompatibility or connectivity issues. Using their own projector and laptop, business presenters and instructors are in control of their presentation, and can incorporate all of the advanced features, including streaming video, sound, animation and the web, to enliven and enrich their presentations.

It is hard to overstate the impact of having a collaborative meeting without having to physically connect every computer and PDA. In a group presentation, the pass off of the projector can be accomplished with seamless segues. For internal meetings, such as brainstorming sessions, the ability to project multiple PC screens at the same time gives new meaning to teambuilding. The projector lets participants switch between modes, so up to 16 laptop users can work through an idea on the same screen, and possibly one solution will be clicked on for full-screen viewing.

Another advantage is mobility. Instead of being rooted to one spot, the presenter can move freely around the room, since the computer or PDA can operate from within 150 feet of the projector. As a result, the presenter can interact with the audience and hold their attention better.

The advantages of going wireless today are multifold:

- The new lightweight projectors are easy to transport and setup is largely automatic
- Multiple PC sources and multiple projectors can be used singularly or simultaneously without cables
- Presenters can move about the room, using a handheld remote device to control the PC presentation
- Panasonic's new 802.11b/g models offer 30 frame-per-second video streaming with synchronized audio output
- Wireless projectors display the source image in near real-time, getting rid of the jerkiness associated with old transmission speeds and performance
- Projectors are brighter, and Panasonic's Daylight View 4 Technology makes it easy to see an image in a brightly lit room
- Color fidelity and color saturation is first-rate with Panasonic LCD wireless projectors
- Security has been beefed up to incorporate the latest WiFi network protocols

1. IDC Press Release, "IDC Finds Global Mobile Worker Population Will Increase by more than 200 Million Users Between 2004-2009," October 12, 2005
2. IDC Press Release, "IDC Finds Global Mobile Worker Population Will Increase by more than 200 million users between 2004-2009," October 12, 2005
3. ProjectorCentral.com, "Texas Instruments' Test Results: DLP® vs. LCD," by Evan Powell, July 2, 2003 (www.projectorcentral.com)
4. ProjectorCentral.com, "PT-LB10NTU: Wireless projecting just got easier," by Elizabeth Jeffery's, June 25, 2004 (www.projectorcentral.com)
5. InfoComm International press release, "AV technology use growing and revenues rising," February 8, 2006 (www.infocomm.org)
6. InfoComm International press release, "New Study Released: AV use in higher education growing," November 16, 2005 press release, (www.infocomm.org)
7. InfoComm International, "New Study Released: AV use in higher education growing," November 16, 2005 press release, November 16, 2005 (www.infocomm.org)
8. *K-12 EdTech*, "Projector Power," by Jane Soung, September/October 2006 issue
9. *DigiTimes Daily IT News*, "Strategic Analytics: WLAN the dominant remote connectivity choice for mobile US professional," by Rodney Chain, October 10, 2006 (www.digitimes.com/print/a20061012PR204.html)