

Wireless Networking



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Need help?

- **Have you been wondering when/whether your library should consider adopting wireless technology?**
- **Planning to remodel or build and need to understand the networking options for the future, short- and long-term?**

What we will cover:

- **What is a Wireless Network?**
- **History.**
- **How it works.**
- **Standards & Technologies**
- **Security**
- **Why do it or possible uses?**
- **Myths.**
- **Some Wireless Devices**
- **Considerations.**
- **Planning .**
- **Resources.**
- **The Future.**

What is a Wireless Network?

Enables your device to stay connected to your wired network without a wire or network cable.



A Brief History

- **1894 – Marconi experimented with radio waves.**
- **1901 – signals transmitted across the Atlantic.**
- **1942 – Frequency Hopping Patent.**
- **1939 - broadcast TV started.**
- **1945 – first public mobile telephone.**
- **1971 - first wireless LAN.**
- **1977 – first cellular phone system.**
- **1982 – commercial cellular.**
- **1990s – laptops and PDAs.**
- **1997 – IEEE 802.11 Standard.**

Hedy Lamar Connection

- **Wireless based on an idea patented by Hedy Lamar and composer George Antheil**
- **Frequency hopping or spread-spectrum.**

Wireless Networking -- Bill Drew
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Parts of a WLAN



Access Point (AP):

Wireless LAN transmitter/receiver that acts as a connection between wireless clients and wired networks.

Parts of a WLAN



Network Interface Card (NIC):

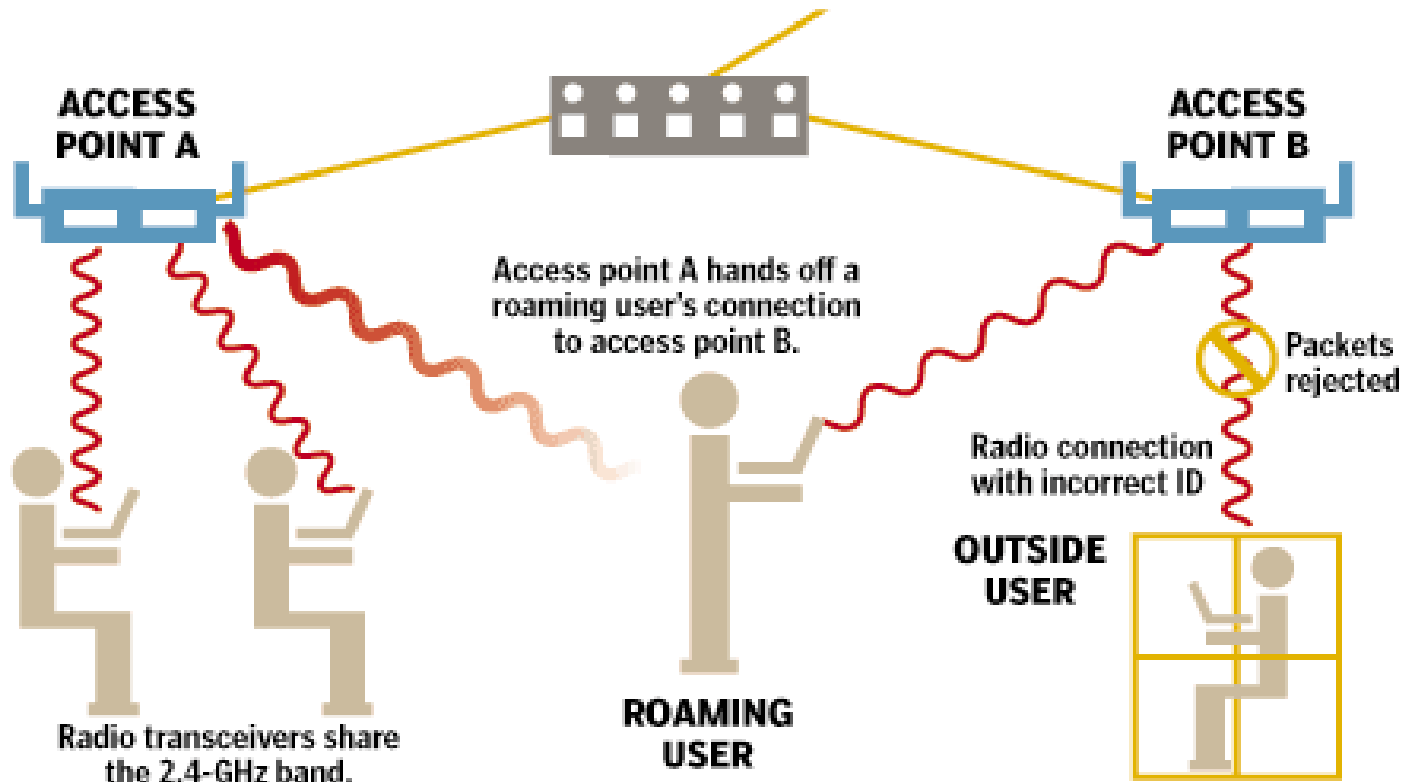
hardware installed in computing device that enables it to communicate on a network.

How wireless works

HOW A WIRELESS LAN WORKS

— Wired LAN
~ Wireless LAN

Used with permission of TMZDnet PC Magazine, March 28, 2000; ©2001
<http://www.zdnet.com/pcmag/stories/reviews/0,6755,2482910,00.html>



Peer to Peer

- **Two can talk to each other without a formal network**
- **Graphic courtesy of Proxim**



Client and Access Point

- **Connecting to the LAN via WLAN**
- **Graphic courtesy of Proxim**



Multiple Access Points

- **Multiple Access Points and Roaming**
- **Graphic courtesy of Proxim**



Extension Points

Graphic courtesy of Proxim



Standards

- **1997 - IEEE wireless standard : 802.11**
- **Revised in 1999**
 - **802.11a – Not yet widely used – here is why -**
 - **5 GHz range is not available in every country**
 - **segments controlled by military**
 - **segments used for other purposes**
 - **802.11b – widely used**
 - **2.4 GHz range is globally available**
 - **Speeds up to 11 Mbps**

802.11 Standards

- **802.11a - 5GHz- ratified in 1999**
- **802.11b - 11 Mbps, 2.4 GHz, ratified in 1999**
- **802.11d - World Mode and additional regulatory domains - ratified**
- **802.11e - Quality of Service – voice, video**
- **802.11f - Inter-Access Point Protocol - interoperability among different vendors**
- **802.11g - Higher Data rate (>20 Mbps) 2.4GHz – approved in July 2003**
- **802.11h - Dynamic Frequency Selection and Transmit Power Control mechanisms**
- **802.11i - Authentication and security (draft Jan.2004)**

IEEE 802.11 b most widely used in U.S.

- **Ratified as Standard in Sept, 1999.**
- **11 Mbps, 2.4 GHz, Direct Sequence**
- **11 US channels**
- **Virtually approved for world wide use**



IEEE 802.11a

- **Ratified as Standard in Sept, 1999**
- **Provides similar technology to HiperLAN2**
- **Data rates to 54 Mbps defined**
- **Provides 8 indoor WLAN channels**
- **Regulations differ extensively across countries**

IEEE 802.11g – ready for prime time?

- **Approved June 2003 by IEEE**
- **Provides higher data rates @ 2.4 GHz**
- **Similar speeds as 802.11a**
- **Backward compatible with 11 Mbps (802.11b)**
- **Wi-Fi Alliance approved many products**



Other Standards: Hiperlan/1 and /2 - ETSI

- **5 GHz wireless network.**
- **supports ATM and Ethernet.**
- **Compatible with IEEE 802.11a.**
- **Potentially 53 Mbps.**
- **Primarily a European standard.**

Other Standards- Bluetooth

- **2.4 GHz wireless network.**
- **range - about 30 feet and speed - 2 Mbps.**
- **focused on home and personal area networks (HANs and PANs)**
- **Connects all the digital gadgets one has to other digital gadgets.**
- **wireless personal network (wPAN) focusing on the “personal operating space”**
- **good alternative for localized wireless network.**

Courtesy of ABA Legal
Technology Resource Center

Technologies

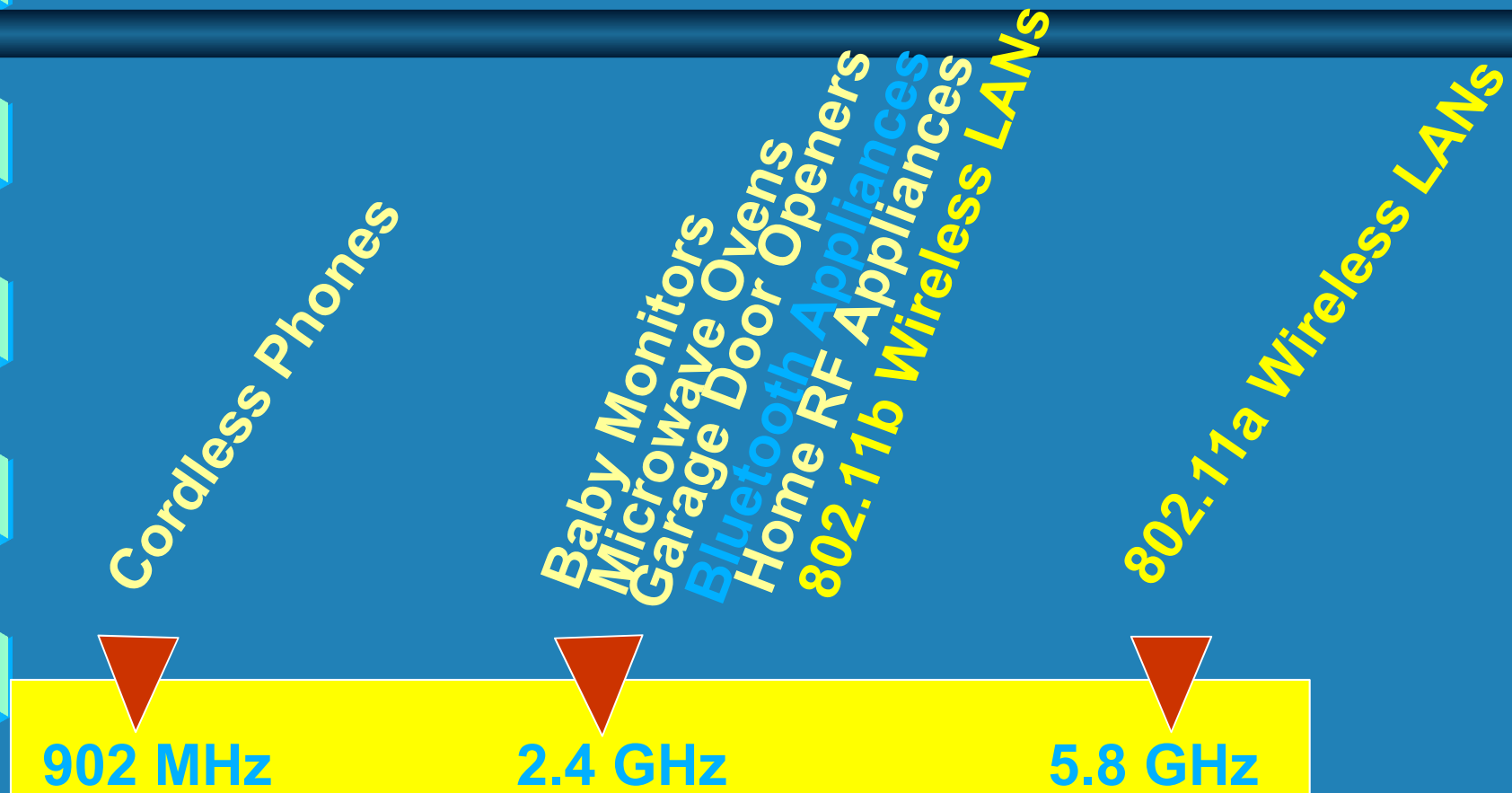
- **Infrared**
 - **line of site only**
 - **3 feet to 20 feet**
 - **Usually limited to single room**
- **Radio Frequency**
 - **Pass through most obstacles**
 - **150-300 feet from access point**
 - **Indoors, outdoors and building-to-building**

Courtesy of ABA Legal
Technology Resource Center

Technologies

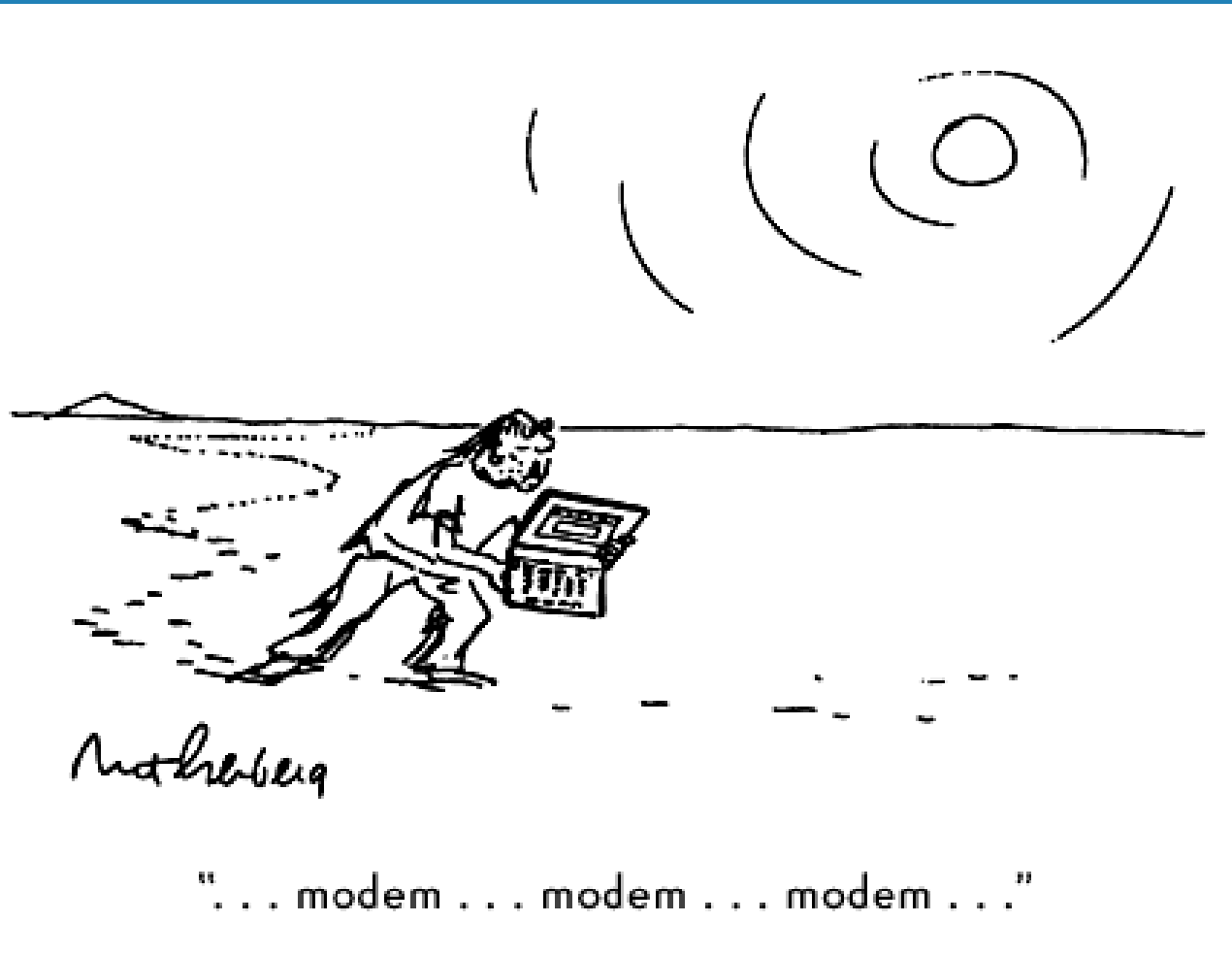
- **Frequency Hopping v. Direct Sequence**
 - **DSSS transmits data faster**
 - **FHSS limited to 2 Mbps**
 - **DSSS more resistant to interference**
 - **DSSS has higher potential bandwidth**
 - **DSSS now best option for 802.11b**

Wireless Spectrum



Instrumentation Scientific Medical (ISM) Bands of Radio Spectrum

Why do it?



Why do it or Possible Uses (Part 1)?

- **Flexible configuration of rooms using laptops.**
- **Allow users to bring in their own wireless devices.**
- **Can be cheaper than wired.**
- **Fast installation.**
- **Greater productivity and service.**
- **U.S. – twice as many wireless devices as PCs (Forrester Research).**

Why do it or Possible Uses (Part 2)?

- **Access networked resources at meetings.**
- **Extend virtual reference desk to all users .**
- **Allow myLibrary service users to keep their myLibrary on their own device.**
- **Enhance experience of users in study groups.**
- **Provide printing from anywhere in the library.**
- **Place computers where needed not just where there is wire.**

Why do it or Possible Uses (Part 3)?

- **Web based camera to send video back over network for security.**
- **Wireless devices for OPAC queries and other access.**
- **Bar coding and other scanning (shelf reading, inventory).**
- **Allow reference staff to roam with access to network and library resources.**
- **Circulate laptops / PDAs with wireless.**

Security: Look out for Pirates



- **Current protocol uses Wired Equivalent Privacy algorithm, or WEP**
- **Weaknesses of WEP:**
 - **Signals not encrypted.**
 - **Anyone walking by with proper equipment could use the network.**

Source: Zdnet News:

<http://zdnet.com.com/2100-11-527906.html?legacy=zdn>

Security – what to do?

From Secure your WLAN by Chris Kozup, Zdnet Tech Update, Dec. 28, 2001;
<http://techupdate.zdnet.com/techupdate/stories/main/0,14179,2835133,00.html>

- 1. Audit: know location of all access points.**
- 2. Authentication: require all users to log in. Treat same as physical network. Can use Kerberos, LDAP, RADIUS, etc.**
- 3. Confidentiality: encrypt your data . Can be done using VPNs (virtual private networks).**

Security Solutions



- **802.11i- new security standard**
 - Provides new encryption and authentication schemes.
 - Available late 2002 according to Zdnet Tech Update.
- **Third party solutions available now** – see The best way to secure wireless access by Lee Schlesinger, Zdnet Tech Update, Feb. 7, 2002;
<http://techupdate.zdnet.com/techupdate/stories/main/0,14179,2845902,00.html>

Selected Recommendations from NIST

1. Develop a security program.
2. Have a complete inventory of all access points.
3. Change default settings on access points.
4. Enable all security features of your WLAN.
5. Use encrypted authentication and VPNs.
6. Consider using a firewall between WLAN and rest of network.

W.E.P. ? - Wired Equivalent Privacy

Uses 10 or 26 character key password

- Difficult to set up
- Most equipment requires entering hexadecimal codes:
 - 64A7BFCFC3104A0B98841C3545
- Must be entered on every computer & access point on the network

W.P.A.? - Wi-Fi Protected Access

- Uses password (pre-shared key) – can use regular text to enter it. Use 12 characters or more!
- Uses the key to generate new keys on other devices on the network.
- Part of Wi-Fi certification of equipment since Sept. 2003. All equipment on network should meet that certification. Older equipment may require software update.
- Set up for WPA may be hidden. Look for it!



Myths (from Larry Glover – with permission)

- **It won't work.**
- **It costs too much.**
- **I don't know how to hook up a wireless network.**
- **Anybody can read my data or hook into my network.**
- **Planes, trains, truckers on their CBs, and storms will cause my network signal to break up.**



Myths

- **Only works in metal free buildings.**
- **Unreliable.**
- **Too slow to surf the web.**
- **?**

Some Wireless Devices



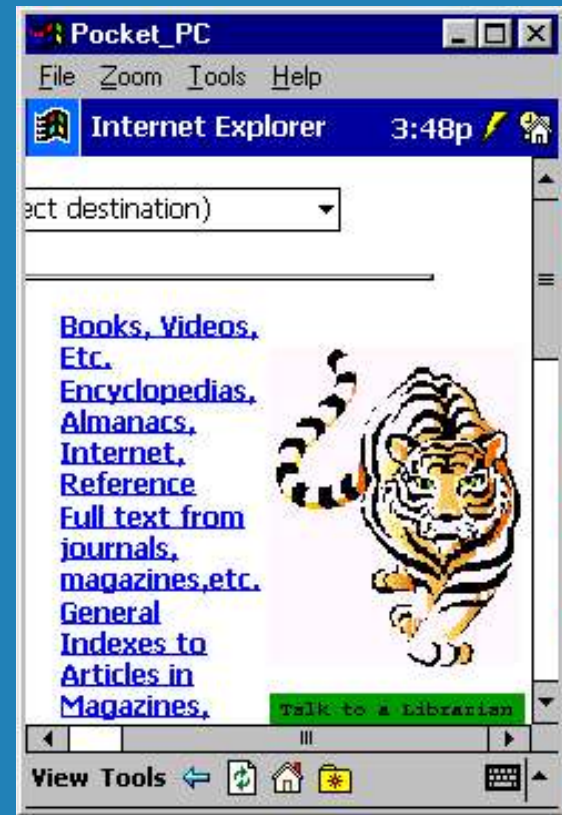
Compaq
iPAQ 3650

- Thin, lightweight, design with brilliant color screen.
- Audio record and playback – Audio programs from the Web, MP3 music, or voice notations
- Rechargeable battery that gives up to 12 hours of battery life
- Ethernet wireless card optional.
- 32 MB RAM.

Some Wireless Devices



Compaq
iPAQ 3650



Some Wireless Devices



WebDT 380

- Windows CE 3.0 device
- aimed at original equipment manufacturers sell it under their own brand.
- built-in wireless local area network support.

Some Wireless Devices



**IBM ThinkPad
with Raylink
Ethernet card**



Some Wireless Devices



- **Palm VIIx**
- **6.7 oz.**
- **8 MB.**



Considerations

- **Cost - Per seat cost can be lower.**
- **Speed - slower than some Ethernet wired LANs (<100 Mbps); Potential of 802.11a is over 100 Mbps.**
- **Wireless bandwidth is less than wired.**
- **Reliability - limited points of failure.**
- **Security – encryption. need to use same care as with wired network.**



Considerations

- **Mobility - allows a user to move from access point to access point through a building without losing connectivity**
- **Compatibility - Products are PC focused and may not include Apple support.**
- **Interoperability - Wi-Fi certified (will work with other WiFi certified equipment).**

Planning – some qualifiers

- **Few libraries willing to share planning experiences.**
- **Few planning resources available.**
- **Small libraries do not need formal planning documents(?).**
- **Many libraries part of larger institutions and piggy backed on their efforts.**

Planning : LAN Requirements

- **Coverage/Mobility**
- **Application Requirements**
- **Number of Users**
- **End-User Device Types**
- **Battery Longevity**
- **System Interfaces**
- **Information Security**
- **Environment**
- **Schedule**
- **Budget**

From : http://searchnetworking.techtarget.com/tip/1,289483,sid7_gci509511,00.html



Planning – 10 Step Program

- **From:** “Look Ma, No Wires! or The 10 Steps of Wireless Networking”
by James L. "Larry" Glover ,
Computers in Libraries, Vol. 21, No. 3
March 2001
- **Used with permission of Larry Glover and Computers in Libraries**

Planning – 10 Step Program

- Step 1. Measure the building.
- Step 2. Map out your stationary computer stations (i.e., four-top tables and such).
- Step 3. Compute your distances vs. bandwidth needs (and remember to find out what's in your wall construction).
- Step 4. Check with your software vendors for any known "issues" regarding wireless transmission of their data. (This is not really a problem with anything in the last 3 years.)



Planning – 10 Step Program

- Step 5. Order hardware and assorted supplies. (Remember the *assorted* part.)
- Step 6. Pray to the gods of nerds and paychecks.
- Step 7. Install.
- Step 8. See step 6 again.
- Step 9. Turn it on.
- Step 10. Accept the praise of your colleagues and patrons and that nice big new pay raise.



Resources: Discussion Groups (LibWireless)

**To subscribe, use the web
form at:**

**[http://people.morrisville.edu/~drewwe/
wireless/libwireless.html](http://people.morrisville.edu/~drewwe/wireless/libwireless.html)**

Resources: Wireless Librarian Website

- <http://people.morrisville.edu/~drewwe/wireless/>
- **Contains:**
 - **Article bibliography; links to full text for some.**
 - **Book bibliography**
 - **Useful links**
 - **List of libraries with wireless networks with links.**
 - **Vendors with links**
 - **More to come.**

<http://people.morrisville.edu/~drewwe/wireless/>



Wireless Librarian

Home Page

[\[Wireless Librarian\]](#) [\[Bill Drew's Homepage\]](#) [\[E-mail:Drewwe@Morrisville.edu\]](mailto:Drewwe@Morrisville.edu) [\[LibWireless Discussion Group\]](#)
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[\[Planning\]](#) [\[Glossary\]](#) [\[How it Works\]](#) [\[WLAN Security\]](#) [\[Wireless in Libraries\]](#) [\[Links of Interest\]](#)
[\[Latest Wireless News\]](#)

Search Wireless Librarian

The purpose of this page is to provide a space for documenting my experiences using wireless and to provide resources for other libraries and librarians going through the wireless experience. This site so far concentrates on Wireless LANs in libraries but will be expanded if other wireless technologies start to make their way into libraries. This site does not cover cellular phone use or using cellular phones to access library resources. I will also include links to sites of interest. Images are used with permission of their owners.

[LISNews.com: Wireless](#)
3.3.2004, 21:43 GMT

[New on Wireless Librarian Website](#)

JiWire



[Wi-Fi Networking News](#)
3.3.2004, 18:53 GMT

[Simplifi Offers Prepaid Access to iPass Network](#)



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wireless.lisnews.com

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Why not give [Meta Moderating](#) a try?
You have **5 Moderator Points!** Use 'em or lose 'em!
This page was generated by a Gang of Pink Friends of the Library for [Bill Drew \(149\)](#).

Wireless News You can Use

posted by [Bill Drew](#) on Wednesday October 22, @08:16AM -25 hits  
from the [Google-News](#) dept.

WLAN Smart Card Consortium Releases Wlan-Sim Specification V1.0 ...
The Scotsman, UK
PARIS – (BUSINESS WIRE) – Oct. 21, 2003 – WLAN-SIM V1.0 Specification Provides a Clear “Go To Market” Path. WLAN Smart ...
<<http://www.news.scotsman.com/latest.cfm?id=2076362>>

WLAN Switches: Time to Add-on
802.11 Planet, CT
... founder and vice president of product management marketing Keerti Melkote, include a lower cost (\$2,995) than the existing modular Aruba 5000, and a new WLAN ...
<<http://www.wi-fiplanet.com/news/article.php/3095651>>

BELAIR Networks Introduces First Cellular LAN Architecture; ...
Business Wire (press release)
... solution by BelAir Networks. The BelAir Networks cellular LAN solution combines the best of WLAN and cellular technologies. It is built ...
Chantry Networks' Brian Collie Explains Wireless Virtualization
... - Business Wire (press release) BelAir Networks Looks to Calysto

Resources:

Organizations -- Vendors, Standards & Trade

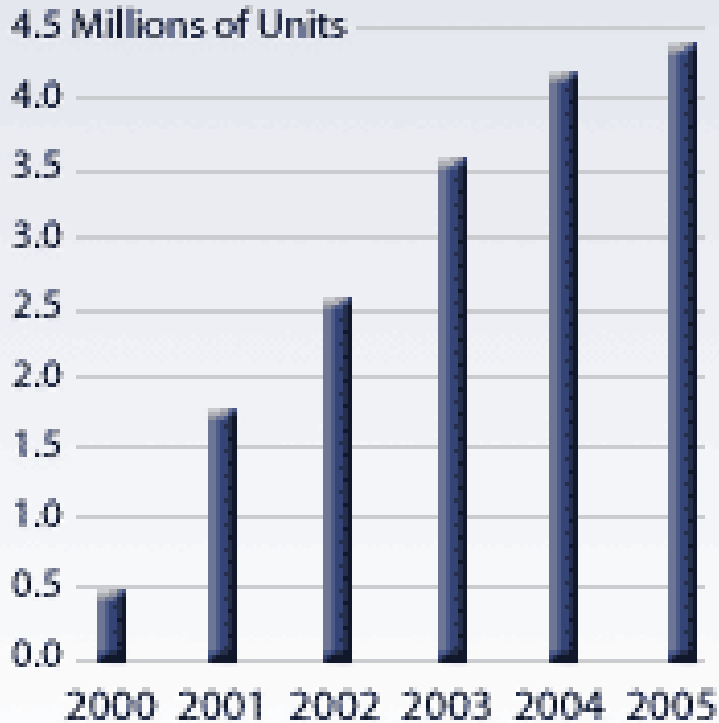
- **WLANA (Wireless LAN Association) – www.wlana.org**
- **WECA (Wireless Ethernet Compatibility Alliance) – www.wirelessethernet.org**
- **Wireless LAN Interoperability Forum (WLIF) – www.wlif.com (?)**
- **More at: www.wlana.org/direct/matrix.htm**

The Future

- **Wireless devices as the ultimate thin client.**
- **Devices talking to each other.**
- **Costs coming way down below wired**
- **Librarians using laptops and wireless.**
- **Carry instruction to the user; not just in the library any more.**
- **Use the new technology ourselves.**
- **Look at Bluetooth and other new things on the horizon.**

Future Growth

WLAN access point shipments to triple by 2005



.....
Source: Gartner Dataquest

Is this the
future of
wireless?

