

# **Straight-Line Solutions: Wireless Data 101**



## **Building A Wireless Data Network**

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## How to Build A Wireless Data Network

### Why Wireless?



Wireless is becoming increasingly important to businesses seeking to compete in an information age. Real-time data collection will become ubiquitous within competitive American businesses during the next 10 years because there are compelling reasons to invest in wireless technology. Properly implemented typical industry cost savings are as follows:

- Increase On Time Deliveries 10-20%
- Improve Capacity Utilization 5-10%
- Decrease Direct Transportation Spending 5-25%
- Reduce Warehouse Labor Hours 10-30%
- Trim Inventory Write-Offs 5-10%
- Reduce Total Inventory 5%
- Eliminate 80-100% of Shipping Errors
- Cut Management Time by 50%
- Decrease Inventory Counting Hours 80-100%

[Sources: Lilly, Intermec, eSync, and Tompkins]

The issue is speed: having information that drives processes and decisions. Would you rather wait in a drive-thru 5 minutes or 45 seconds? Would you rather wait 4 hours on a closed-loop process to complete - or be able to make the decision now? Quantum leaps in our ability to amass and process vast amounts of information are now feasible to businesses such as yours. Straight-Line Solutions specializes in getting you there.

Having worked in wireless technical support for years I frequently have potential clients calling in with this basic question, "How can I connect to my database with a wireless device?" The answer to this question is surprisingly simple.

Yes, wireless connections can be complex. But the essentials of building a wireless network, and then accessing a small or large database over that network, are relatively straightforward.

First, let's go over some common misunderstandings by way of definitions. You will build your confidence and save yourself some costly mistakes if you know the basic terminology. You cannot imagine how many lost opportunities to automate business data have been made due to misunderstanding these terms.

### Definitions (or "Disambiguation")

**Wireless:** "Wireless" to most listeners today means "cell phone." This white paper, for the most part, does not address cell phone or Wireless **Wide** Area Network (**WWAN**) connections. This



tutorial addresses Wireless **Local Area Network (WLAN)** connections. Most WWAN connections use cell phone towers. Most WLAN connections use "access points." Clarify this early to those you work with.

**Cordless:** Wireless, for our purposes, does not mean "cordless." A cordless connection does not usually involve a Local Area Network (**LAN**). Most databases reside on a LAN, and LANs require wireless access points - not cordless base stations that work with cordless scanners such as Symbol's Phaser series.

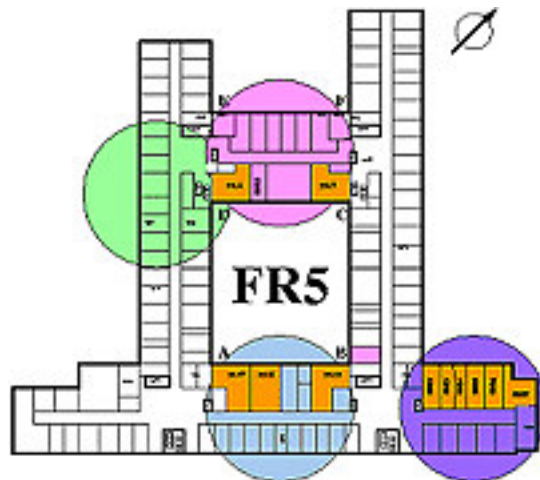
**Is it a "Scanner" or a "Terminal?"** I include this because I have a lot of clients calling a portable data terminal (**PDT**) a "scanner." A "scanner" is used at a Wal-Mart *checkout*. A PDT is used for Wal-Mart *inventory*. A scanner is typically a device that only scans barcodes and transmits the data through a cable. It usually has little memory or processing power and no display. This white paper does not address scanners. Nearly all portable data terminals used for Auto-ID have scanners integrated into them. But a PDT is not a "scanner." A PDT typically has a scanner as one of its components. To put it another way, you don't call your car a "radio." A car has a radio as one of its components – my teens confuse this terminology by practice if not by definition. For them, however, I can understand calling their car a "stereo." They pour more money into the car stereo than the car!

**Infrastructure:** Wireless "Infrastructure" usually has reference to access points (**AP**) and the components necessary to connect those APs to the network or database. This will become increasingly important for data collection personnel to know because of Metcalf's Law: the value of a data network grows as the square of its connected devices. Wireless is, for the most part, invisible, cost effective, and has an obvious ROI. It is going to be part of all our lives in the near future.

**End Device:** An "end device" in a wireless network typically refers to a device that connects to a computer network or database through a wireless access point. It can be a handheld personal digital assistant (**PDA**), PDT, printer, laptop, or other...well, "end device." Many end devices that are not wireless, such as printers, can be made wireless with some simple modifications. Eventually many more end devices, even the speakers on your home stereo, will become wireless as the technology progresses.

**Site Survey:** When you read specifications on an access point that state, "coverage extends to 1,400 radial feet from the antenna" that is what I would call a "marketing number." A **site survey** is usually needed for wireless installations covering more than 30,000 square feet. Wireless technicians at the customer's location, prior to finalizing the proposed quote, conduct this survey. Everything effects radio range – everything. Without a site survey we can only estimate how many access points will be needed to provide adequate wireless coverage.





Site Survey Map

With these “disambiguations” out of the way we can proceed to the meat of wireless data connectivity.



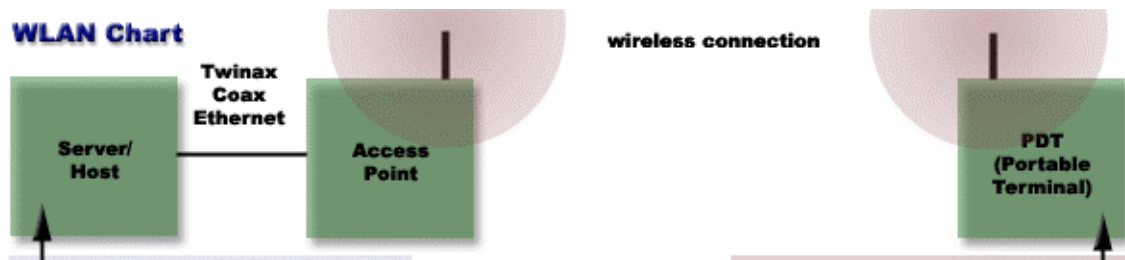
## Module1: Wireless Overview & Introduction

Before we can address the business data connection we need to understand what a basic wireless network entails.

Think of a wireless network as three boxes:

1. A **Server** Box,
2. An **Access Point**(s) Box,
3. A **End Device** Box (e.g. a PDT, printer, laptop, etc.).

Below I've depicted these basic components as three green boxes. They are the core elements of a standard wireless solution. We could also use this chart to explain a **WWAN** (Wireless Wide Area Network, or "cell phone") connection. But let's keep our topic to the more widely adopted form of data collection: the **WLAN** (Wireless Local Area Network).



Below is a brief explanation of what these three boxes are.

### BOX #1: The Server/Host

More disambiguation is necessary on this one. Don't let the term "server" throw you. The server "box" can be any kind of computer: from a laptop to an AS400, or an IBM390, VAX, Unix, Linux, OS/2, or Win/NT PC; it doesn't matter what it is. I promise, we can connect a wireless mobile device to it. Also, it usually doesn't matter what kind of database the server is running. We'll talk about the database later. Further, it doesn't matter if the server is 10 feet or 2,000 miles away. We can connect to it wirelessly. You will see a chart of some typical server connections later.

### BOX #2: The Access Point

An access point is just a box that allows data to be transmitted wirelessly. Once you have an access point **Box #2** connected to the server **Box #1** then wireless devices can access the database. For a WWAN, or Wireless Wide Area Network "cellular" connection, the same concept applies - we simply swap out the access point box for a cell tower "box" and service provider such as T-Mobile, then we use a WWAN radio *instead of* a WLAN radio inside the PDT.

For the WLAN the access point connection is made with a cable called Ethernet or Cat5 cable. Ethernet cable is so prevalent that Wal-Mart carries it. In a real world application there is generally an entire network of devices connected to the server. The access point(s) becomes just another device connected to the network.

You can see a large selection of access points and wireless switches on our web site at the following address: <http://www.4sls.com/products/wireless/index.html>.



### Box #3: The End Device with Matching Radios (PDT)

The mobile or portable device can be a laptop, Personal Digital Assistant (PDA), or any device that has a radio in it. The radio in Box #3 must be compatible with the radio in Box #2 – the access point.

Here is a good place to introduce you to radio types. Again, the type of radio that is in our access point must be the same radio type in our mobile device or PDT (some exceptions).

Here is a simple table showing common radio type matches:

	Access Point (BOX #2)	Mobile Device (BOX #3)
Compatible Solution #1	802.11b	802.11b
Compatible Solution #2	802.11g	802.11g
Compatible Solution #3	802.11a	802.11a

What about older radios? I often have clients calling who have older radios in their portable device and they want to connect to newer access points. In most cases this cannot be done. What about other radios not listed? There are many more types of radios than those listed in this simple chart. The good news is that these three are commonly used for newer wireless installations. An even newer radio type, 802.11n, is being ratified by the [IEEE](#) and should be rolling out in the next few years. 802.11n may provide a great deal of backward compatibility with older radios. Presently, however, very few backward compatible radio types exist.

You can see a large selection of end device PDTs on our web site at the following address:  
<http://www.4sls.com/products/mobile/index.html>.

### Overview Summary

That's all there is to building a basic wireless data solution. It's just that simple. In many installations this is all the hardware that is necessary to get connectivity to the server's database.

As an example, if the database has a browser front-end, like Internet Explorer, then any CE mobile device or laptop with a browser is ready to do business.

To the right is an example of a real-time MySQL database Straight-Line Solutions built using a browser as a front-end. With a wireless terminal that runs a browser (e.g. Pocket Explorer) just put in the Internet address of your database input page and enter your data. Anyone with access to the Internet can view this data real-time - whether they are in Chicago, Antarctica, or over the New Hebrides in the Space Shuttle. Naturally, you can do this with a private intranet or Virtual Private Network (VPN).

What if your business is not using a browser or similar tool found on newer mobile operating systems? What if you have an older database that you must use? The next module discusses this common, but more advanced, solution.



There is much more involved with wireless connections: encryption, power over Ethernet, bridging, tunneling between subnets, etc. For the most part, however, this is sufficient to get us moving rapidly. You now understand the basics to building a complete solution for many, if not most, wireless networks.

We're now going to move on to understand the more advanced data connections!



## Module 2: Advanced Wireless Data Connections (Telnet)

In the **Module 1** I mentioned that building a wireless solution could be complex. For example, many companies have older servers. These servers, sometimes called "legacy" boxes, do not use browsers for data entry. They may still use text-based, dumb terminals for data entry. What if you want to use this same legacy system for real-time, wireless database updates? No problem! We will add software to the portable device that allows connections to these older servers.

### Connecting Databases to Mobile Devices Using Add-On Software

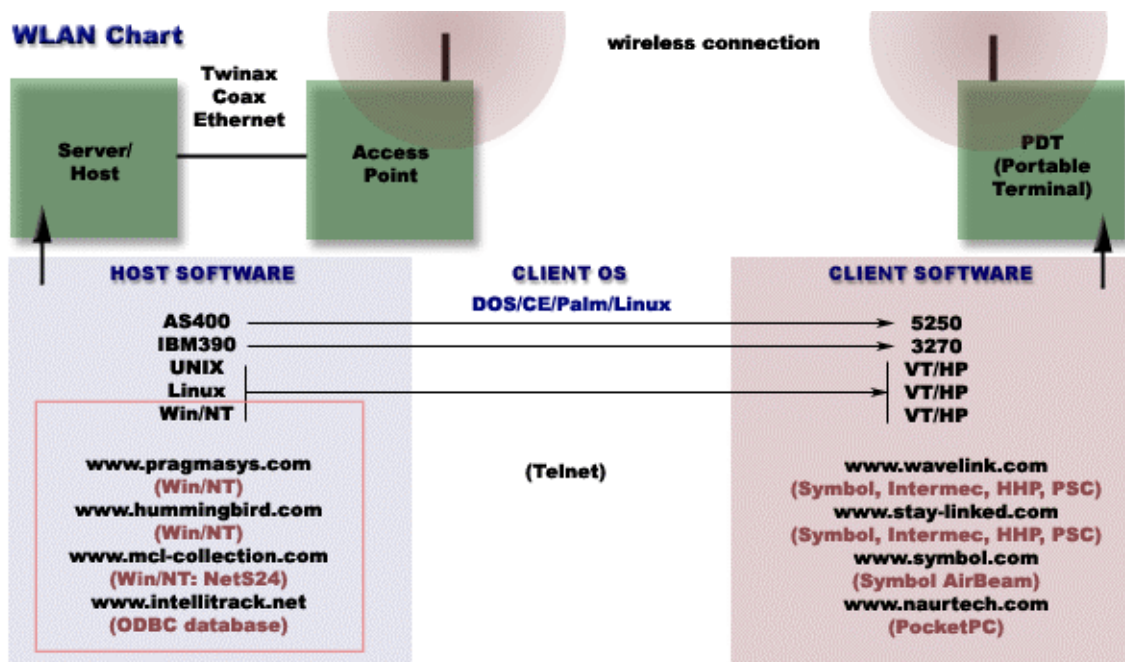
Software is a means to bridge the gap between databases that are not friendly to mobile wireless devices. Here are a few reasons why this is so.

- Quite a few businesses are going to be strapped to a budget. They cannot afford to implement the hardware or software needed to support browser-based data transfer.
- Older server databases have been used in your company for many years and cannot be replaced without large outlays of resources and lost time.
- Further, your business may gulp hard at the price of ruggedized retail or industrial wireless devices. Significant costs above those of the initial hardware purchase would potentially derail the solution.

### Telnet Software

To resolve these dilemmas there is a basic, low-cost software package that provides a solution. In many cases this software technology is already employed in older servers and can work to your advantage. It's called "telnet" software.

The chart below contains what you already know about the three basic elements of a wireless connection. To this we need to add telnet software components. Take a minute to study this chart before proceeding.



Telnet software provides a simple, text-based screen for data entry on the portable terminal. So, we are going to add a “telnet client” software piece to **Box #3**, the PDT.

### Telnet Emulation Types

There are three basic types of telnet clients or “emulations.” Each of them refers to the type of server they connect to. These break down into two main types:

1. **5250, 3270** emulation for use with AS400s and IBM 390 servers respectively, and...
2. **VT/HP** emulation for use with servers running Windows/NT, VAX, Unix, and the Unix “stepchild” we call Linux.

You can see on the [HOST SOFTWARE](#) side of the connection chart which operating systems these emulations typically work with.

### Telnet Client Software

Can we install telnet software on any wireless device? Telnet software can run on nearly all older DOS wireless PDTs as well as most of the newer CE, Palm, and Linux wireless hardware. Specific part numbers are ordered for each PDT client and are normally licensed per terminal.

### Telnet Server Software

Do all servers have telnet software already on them? Many older legacy servers do. AS400s, IBM 390 mid-frames, and UNIX normally have telnet server software as part of their operating systems. Some Linux distributions do as well.

But note that there is a **red box** around the Win/NT [HOST SOFTWARE](#) section. The reason for this is that Windows/NT operating systems do not have native telnet server software installed on them. If your business does not already have telnet server installed on your host you will not be able to connect to the telnet clients on the portable terminals.

The solution to this problem for Win/NT servers is to purchase telnet server software. Pragmasys is an example of one third-party software provider who carries this solution. You can use telnet server software, such as Pragmasys, to connect to an ODBC compatible database on that server while, at the same time, providing access to the server’s database on the mobile terminal via a telnet session.

### Advanced Wireless Data Connection (Telnet) Review

To review, telnet server software accomplishes three things:

- Host software connects to the back-end server database.
- Host software also hosts a “telnet session” with remote devices that wish to connect to this database.
- Client software on the wireless mobile devices facilitates the telnet session.

Telnet is still widely used among manufacturing and distribution warehousing operations and is a relatively inexpensive solution to connecting wireless devices to databases.

What if your database is part of a Citrix, SAP, ERP, SQL or other enterprise level back-end? Fortunately many of these same providers have developed their own clients for wireless mobile devices. We’ll discuss those in **Module 3: Advanced Enterprise Wireless Connections**.



## Module 3: Advanced Enterprise Wireless Data Connections

### Enterprise Client Software

The list of [enterprise](#) business and data systems, along with their associated processes and methodologies, reads like acronym heaven: SQL, MySql, SAP, mySAP, DB2, ODBC, ERP, ORACLE, R/3, Citrix, CRM, J2EE, Seibel, Sybase...whew! It'll make you head spin.

The good news is that there are many well-known system providers who support their own wireless or mobile client software products. Third-party software developers also have a suite of tools. Database solutions such as [Citrix](#), [SAP](#), [ERP](#), [Baan ERP](#), and [SQL](#) can connect wirelessly to portable terminals using their own software. They do this because it is always good business to follow the trend to mobility.

It is usually best to allow these enterprise-level software providers sell and support their software. These packages typically come with support licenses to free your from the burden of maintaining them.

So, in these instances, you merely put the ball back into the Enterprise Data court by letting them know the above: i.e. that your back-end Enterprise Data system (e.g. SAP) already has their own clients that run on mobile CE, Palm, and DOS terminals. I am certain that many large enterprise wide solutions have been lost because a business was not aware of this!

### Custom Software

Suppose your server's database is more complex than a simple part-bin-quantity type of data collection. You don't have an enterprise system that supports mobile clients, nor do you want to implement an enterprise solution such as a Citrix server.

For example, you may be required to compare a database on **Server A** with another database on **Server B** then perform a mathematical analysis of the results on the portable device. Needless to say telnet server software probably doesn't cut the mustard here.

More good news: a plethora of software is available for these types of applications. But you need to keep in mind a basic premise:

- When the problem is complex the solution tends to be a custom solution, or...
- When more variables are in a problem this often necessitates more variables in a solution, i.e. a custom program.

In these cases you can either...

1. **Sub it out.** Contract out the solution to software developers such as [AppForge](#) or...
2. **Purchase Development Software.** You can purchase the software that allows you to build your own custom solution.

If you opt to purchase development software then we need to learn a little about what is out there. Below is a list of tools for building a custom wireless or batch solution for your business's mobile terminal. These tools break down into three categories of user-friendliness.

1. An **OOB**, or Out Of Box software, is the user-friendliest, usually uses a back-end tool like Microsoft Access, and is feature rich. But OOB software is usually not as customizable as



- other tools and licensing is sometimes required for each server and each mobile device employed. Sometimes this is expensive.
2. A **GUI**, or Graphical User Interface, tool is user-friendly, allows you more control over the creation process, and usually requires no programming experience. They are also called "RAD" software (Rapid Application Development). But GUI tools, like OOB tools, can be expensive in that they usually require licenses to install and use the program on both the server and mobile device.
  3. A **Code** level tool allows you the most flexibility in customization and integration but requires knowledge of common programming languages such as C, C#, .Net, Java or a similar programming language. However, this solution tends to be less expensive in the long run because you are not required to pay per terminal license fees to install your program.

Software shaded in yellow is what we carry directly.

Custom Software Tool	Mobile Operating System	Type
<a href="#">Microsoft Visual Studio .NET</a>	PPC/Mobile 2003/.NET (= CE) Smartphone/Web/Server	Code Level C++, VB.NET, C#
Microsoft Embedded Visual Tools	PPC/PPC2002 ("legacy" CE)	Code Level C,VB
<a href="#">Code Warrior</a>	CE/Palm/Smartphone/Web/Server/Linux	Code Level C++
<a href="#">Intellisync</a> Data Synchronization	CE/Palm/Web/Server/	GUI, XML
<a href="#">MCL Designer</a>	CE, Palm, DOS, Linux	GUI
<a href="#">Syware</a>	CE	GUI
<a href="#">AppForge</a>	<a href="#">CE</a>	GUI or Code
<a href="#">Intellitrack DMS RF</a> Small-Mid-Tier	DOS, CE	GUI/OOB
<a href="#">Intellitrack WMS</a> Enterprise	DOS, CE	GUI/OOB
<a href="#">Steven's Creek</a>	Palm	GUI/OOB
<a href="#">Pocket Gear</a>	CE	OOB

### Advanced Enterprise Wireless Connections Summary

In these three modules I've covered about 90% of the issues involved in building a basic wireless data network. Newer wireless, and network hardware and software, can be added to automate and simplify larger wireless installations. But the same principles we've discussed here are involved in those installations as well: the three-box diagram makes the concept easier to understand.

In closing, remember this important point: if the software the mobile device comes with, or that you carry, does not fit the problem then you can still capture the data solution by referring to the software providers - such as those listed above. Most of these providers are quite happy to work with you. Further, all of these providers are interested in promoting their software and generally do not get involved in packaging hardware with their solution. Software providers look to Straight-Line for your businesses hardware requirements. It's a win-win proposition.



### Putting It All Together

Knowing how wireless components work together now qualifies you to use the tools already available to build your own wireless quote complete with access points, PDTs, and all related accessories. I am now going to put what you know about wireless hardware and associated connectivity with databases to work. I am going to show you where to go to get specifications on these various components as well as where to go to put all these components together – even down to the correct cables, batteries, and other necessary peripherals.

### Wireless Hardware Chart

What about hardware? Where can you go to view the available hardware for a wireless solution? Use our handy-dandy Straight-Line Solutions web site ([www.4sls.com](http://www.4sls.com)). Not everything that we carry is listed in the wireless and mobile product sections, but most common devices are there.

You can copy these charts and paste them into Outlook then email them throughout your organization. Let your people make the device selection. It's perfectly acceptable to be lazy in this instance. Your people know best what kind of keyboard and operating system they would like. They should know whether they need a Cisco wireless backbone or a Symbol. When in doubt Symbol and Intermec are usually the default choice. Reasons for this are covered at the following link: <http://www.4sls.com/products/wireless/10reasons.html>.

### Wireless Hardware Configurator

Okay, if you have seen our site then you know those are real nice Wireless & Mobile Device Charts. They have pictures of the devices, an overview of their specifications, and even links to PDFs where you can learn more about them.

Suppose, now, you made your choice about which terminal you want and which access points you are interested in (hopefully). But where do you go to build a quote? Where can you select the specific manufacturer, the kind of radios your client wants in their PDT, the AP quantities (based on square footage of area that needs to be covered), the accessories you need, as well as the list price and client cost?

That, my friend, is what "SLS *SpeedParts*" is for. On all our products pages this button gives you detailed descriptions of the hardware and related accessories you may need. Call us for assistance and your special pricing. We're here to help you. We will do whatever it takes to get you up and running within your budget.

### Almost Done – But Not Quite

These are excellent tools available 24/7 to you and your organization. But these tools have their limitations. If you've ever used the SLS *SpeedParts* you will notice that it bases the number of access points in your quote on the square footage that needs to be covered. However, this number may not be sufficient. It is only an estimate. Without a site survey by a qualified wireless technician we will not know exactly how many access points are needed. But that's okay because all we are interested in, at this point, is giving your business an idea of the costs for budgeting purposes.



There are other salient points about the online *SpeedParts* tool. You cannot choose the precise kind of scanner or imager you may require installed on your PDT. The *SpeedParts* tool gives you a “vanilla wrapper” selection. It is usually best in these cases to call Straight-Line to get the specific model your solution requires.

**Pricing:** we provide the retail price on your devices but are willing to work with your budget needs whenever possible. You are wise to do some comparison-shopping. Where price is an issue Straight-Line Solutions can always pull some of our added services to compete. But Straight-Line is not simply a “box pusher.”

When your business aims for the lowest price you are usually dealing with a reseller who is not structured to support you after your purchase even though they state they will. Typically these resellers depend on 3<sup>rd</sup> party technical call-centers - some of whom are not native English speakers.

Straight-Line fields support calls from installations completed years ago. We support what we sell and are technical, hand-on people. Many times the same Straight-Line personnel who sold the equipment to you is the same fine fellow who will install and configures it. Low price resellers sub this work out or don't support installations at all.

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