The CIO's Guide to Wireless in the Enterprise

Executive Overview and Worksheet

This guide provides a basic overview of mobile computing for those who are interested in evaluating a wireless enterprise solution.

Part 1:

Making Sense of the Wireless World

Part 2:

Wireless 101: Take the Test

Wireless Technology Basics

The first concept that we'll cover is the difference between circuits and packets. This will help you understand why there are so many different technologies out there in the industry. When you make a normal phone call, it is a **circuit switch connection**. What happens is that a circuit is opened between your phone on one end through all the various telephone switches, all the way to the switch on the other end and the other person's phone. This circuit connection is established from end to end and is maintained for the entire duration of the call. If at any point a part of the connection—any one of those hops where this circuit is connected—drops, the call is ended and one party has to call the other one back. Each circuit that is dedicated cannot be used for anything else until the circuit is released and a new connection is set up, even if no actual communication is taking place that channel still remains unavailable to other users. For voice conversations where a very short response time is important, a circuit-switch connection works well.

Packet switching is another technology used in wireless and telecommunications. Packet switching is similar in concept in that there are a number of hops between any two points, but instead of it being a switch, a router is used, typically on the Internet. A packet-switch connection (the communication between the two end points) will be broken down into a series of messages called packets. Packet switching does not require a circuit to be established and allows packets to communicate almost simultaneously over the same "wire" channel. Packet switching is used to optimize the bandwidth available in a network, to minimize the transmission latency.

The significance of this is that each packet could take an entirely different path to get from A to B. That means if any one point was to become harmed in the path between point A and B, as long as there are other redundant paths available, the connection will still be maintained. A packet switch connection is much more efficient than a circuit-switch connection because it is not open the entire time. If there's no message to send, the connection is not being utilized. It also offers the capability to do things like load balancing to maximize the speed of the communication.

Specific Wireless Technologies

Following is an overview of specific wireless technologies. Figure 1 covers most common industry buzzwords and puts them into the appropriate categories.

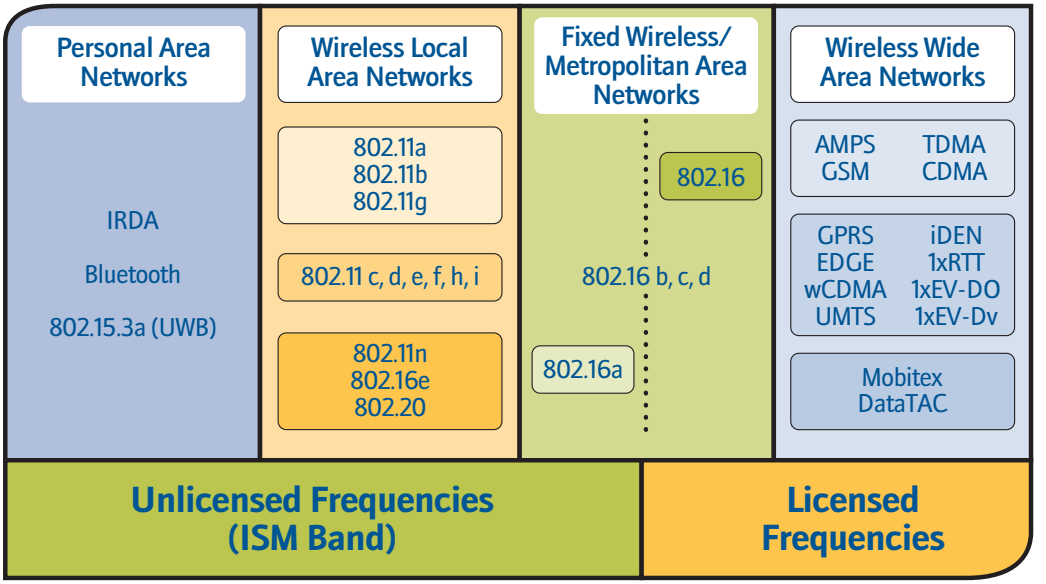


Figure 1: Wireless Technologies

Personal Area Networks

The first term is a **PAN** or a **Personal Area Network**. A Personal Area Network is a wireless point-to-point connection meaning no physical cables are required to connect the two end points. One of the more common PAN technologies is named **IrDA**, for the **Infrared Data Association**. Strictly speaking, it is wireless technology, but it differs from the others mentioned in Figure 1 in that light waves are used as opposed to radio waves. Line of sight therefore is very important—you can't have anything in the way. The IrDA data rate has been increased to 4 Mbps and generally distances of one meter or less are required, for example, the distance required for transferring data between laptops.

The other PAN technology that's generated a high degree of excitement in the industry is **Bluetooth®**. Bluetooth uses radio waves to allow two devices to share data and communicate. Speeds for Bluetooth are up to 2.1 Mbps with the latest version of the specification with a maximum range 30 to 60 feet. Electromagnetic interference (from metal, wires or electricity) will affect the range.

802.15.3a, also referred to as **UltraWideband** is a standards effort underway from the IEEE. It has a range similar to Bluetooth, but would offer a faster bandwidth speed, with theoretical speeds of up to 1 Gbps.

Wireless Local Area Networks

The second technology group in Figure 1 is **WLAN**, or **Wireless Local Area Network**. There's a lot of excitement and growth here, specifically for those in the computer industry, because these technologies are increasingly becoming married to the latest generation of hardware.

There are two main differences between a Personal Area Network and a Wireless Local Area Network. The first is the distance over which it operates and the second and even larger difference is bandwidth, or how much data you can move per unit of time. Here's an example of why Wireless Local Area Networks are so useful. If you go to a meeting room, you might want to take along your laptop and have it stay connected as if you're on the network so during that meeting you can take notes or check email. It's a wireless way to stay connected as a fully functioning node on your Local Area Network.

HomeRF is a Radio Frequency transmission of packet data between HomeRF enabled devices and wireless access points. It has speeds up to 1.6 Mpbs with distances of 160 feet. HomeRF did not gain much market share and in January 2003 the working group was disbanded to be replaced by other standards (mainly WiFi).

WiFi is also a radio frequency transmission of packet data. There are currently three flavors of WiFi; b, a, and g. **802.11b** is the first standard that took off and has gained steam. By contrast, Bluetooth operates at distances of 30 to 60 feet and a maximum bandwidth of 720Kbps. WiFi, on the other hand, has a maximum theoretical distance of 300 feet, but typically works best around 100 feet, at speeds up to 11Mbps. So that's quite a difference in terms of speed. As soon as the first iteration of 802.11 came out, the market demanded greater bandwidth. This is where **802.11a** was born. 802.11a works at different frequencies than b does. It uses the 5GHz frequency band as opposed to the 2.4GHz frequency band. Both of these are unlicensed, which means that you don't need a carrier involved in order to exchange signals. The distances are smaller for 802.11a—typically around 50 to 75 feet. The dramatic difference here is speed—802.11a operates at 54Mbps as opposed to 11 Mbps.

The latest development in this field is **802.11g**. Since 802.11a is completely new and different, 802.11b equipment will not interoperate with it unless it's been specifically designed to do so. By contrast, 802.11g is also a radio frequency-based system, but it is meant to offer an upgrade path to companies that may already have a fairly large investment in 802.11b.

Other standards that you sometimes hear about are **802.11 d, e, f, h and i**. They define different components of the wireless networking puzzle, such as MAC (Media Access Control Layer), QOS (Quality of Service), etc.

Future developments in wireless include:

- **802.11n**, which will dramatically increase transmission speeds (over 10 times those of 802.11a and 802.11g) and will offer better distances.
- **802.16e** or **WiMAX** is Worldwide Interoperability for Microwave Access which is extending fixed wireless aspects of 802.16 to mobile devices.
- **802.20** or **Mobile Wireless Broadband Access**, which is a current IEEE standards effort for all IP-based high speed wireless transmissions.

Wireless Wide Area Networks

The final wireless technology is the **Wireless Wide Area Network**. Not many people are familiar with this term. But if you've used a cell phone, you've used a Wireless Wide Area Network. Here, distances are measured in kilometers and miles as opposed to feet or meters. Figure 2 shows the technologies you're most likely to hear about under the heading of Wireless Wide Area Network.

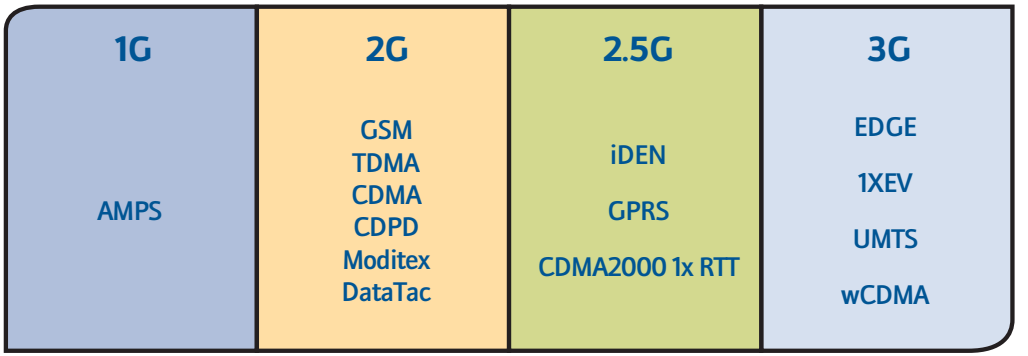


Figure 2: Wireless Wide Area Technologies

The first, **AMPS**, stands for the Analog Mobile Phone system. First-generation cell phones were AMPS. This is a circuit switch technology used for making voice calls, and it was analog-based. Moving down the list, we have **CDPD**, which stands for Cellular Digital Packet Data. This was the first attempt to leverage all those cell towers that were out there and deploy a good data solution, which is what CDPD was intended to do.

Today, the circuit-switching digital cellular technologies that are primarily in use in the world today include **GSM**™ and **TDMA**, which is becoming less common as most TDMA carriers are moving to GSM. The other major standard is Co- Division Multiple Access, or **CDMA**. GSM is currently the most widely adopted cell phone standard in the world. Over 70% of the world is using GSM. Throughout North America and in pockets of Asia, CDMA (which is again a circuit switch but digital cellular technology) is fairly widely used as well.

All of these Wireless Wide Area Network technologies are ideally suited to voice. They are not ideally suited for data connections because they keep that channel open too long which results in possible low-bandwidth situations. Each of these different technologies is constantly evolving. **GPRS** is a packet-switched data overlay that runs on top of a GSM network. It allows the network carrier to provide a world-class data service from the same basic infrastructure. GPRS does not require a completely new and different network, as was the case with the evolution from AMPS to GSM or CPDP to TDMA. Another option is **CDMA 2000 1X or 1XRTT**. This is a digital, packet-switched data overlay for the existing CDMA voice network. Now, there are a couple differences here because of how these two networks use bandwidth. GPRS has a theoretical maximum downlink speed of 115Kbps and CDMA 2000 has a theoretical maximum of 150Kbps. The third technology in this group is called **iDEN**™. This is a proprietary technology invented by Motorola. It came from a packet radio world, but a few major North American carriers have deployed the technology. iDEN provides the capability to transfer data. Figure 3 shows which WWAN technologies are voice versus data and the migration path of these technologies.

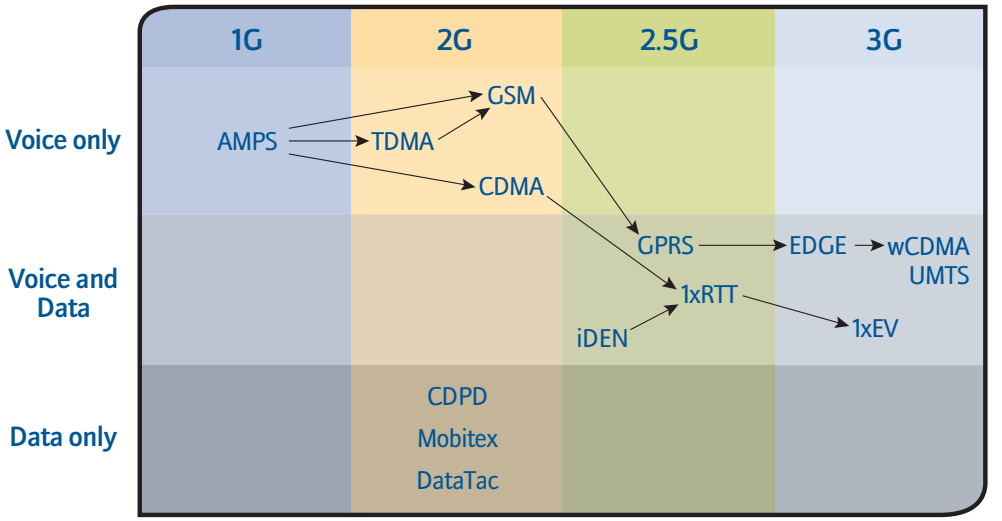


Figure 3: Migration of Wireless Technologies through the G's

Through the generations with the 'Gs'

If you've heard people refer to "the Gs", they stand for "generations." The definition for **1G** is a mobile connection (such as any analog cell phone system). Second generation, or **2G**, systems are digital, which allowed for a significant improvement in voice quality. Most cell phones and PDAs today use **2.5G**, and the three technologies we just described, **iDEN**, **GPRS**, and **CDMA 2000** are in use here. What defines 2.5G is the implementation of a packet switched domain (data) in addition to the circuit switched domain (voice). For example on the BlackBerry 7290 you see that the signal is GSM/GPRS. This means that the device is using the GSM for the phone and the GPRS for the data connection. Older BlackBerry devices, such as the BlackBerry 950 were 2G designed for data use only using the Mobitex network. Similarly many 2G cell phones were designed for voice only. The future will hold **3G** technologies such as **EDGE**, **1XEV**, **UMTS**, and **wCDMA**.

With 2.5G, the new packet switching over the existing 2G networks enabled the carriers to get faster speeds out of existing infrastructure and base station technologies. **EDGE** (Enhanced Data GSM Environment) technology is an enhancement to the GSM/GPRS providing higher data rates. Although it does not require a hardware change to the GSM network, base stations still need to be modified to gain speeds of 237 Kbps (with theoretical maximums up to 474 Kbps).

1xEV technology also provides higher speeds implemented in two phases: 1xEV-DO and 1xEV-DV. Phase 1 is 1xEV-DO (Evolution-Data Only), which increases the downlink peak data rate to 2.4 Mbps. The average rate a user experiences is between 300 and 600 Kbps. 1xEV-DO Revision A supports IP packets, increases the downlink to 3.1 Mbps and boosts uplink dramatically to 1.2 Mbps. Phase 2 is 1xEV-DV (Evolution-Data Voice), which integrates voice and data on the same carrier with rates up to 4.8 Mbps.

The evolution to true **3G** will require the carriers to change their base station infrastructure. This technology will give dramatically higher bandwidth compared to the current generation. If we recall from both CDMA and from GPRS, we can expect somewhere between 115 and 150 theoretical maximum kilobits per second, whereas the range for 3G is 384Kbps to a theoretical maximum of 2Mbps. Some GSM operators have opted to upgrade to EDGE, while others view **UMTS** (**U**niversal **M**obile **T**elecommunication **S**ystem), a broadband digital packet-switched network that will deliver information at speeds of up to 2Mbps, as the ultimate upgrade path. However, due to the higher costs associated (of replacing base stations) UMTS has been slower to see adoption.

With true 3G, even a voice call has the possibility of being a packet. So when you're speaking on the phone, you could be using a technology like Voice over IP (VoIP) or one of its equivalents. If your voice is traveling around the world as a packet, long-distance phone calls would likely be a thing of the past. The concept of 3G is that you can call anybody anywhere in the world, and it's just the same as a local call. In theory you will only pay based on the number of packets you use. 3G is likely to have a very promising future. Most of the carriers today have transitioned from either GSM or CDMA into GPRS, EDGE, 1XRTT, 1XEV or iDEN. It is important to ensure any product claiming to be 3G fits that criterion. Figure 4 shows the relative speeds of the Gs and the types of mobile applications that they will enable.

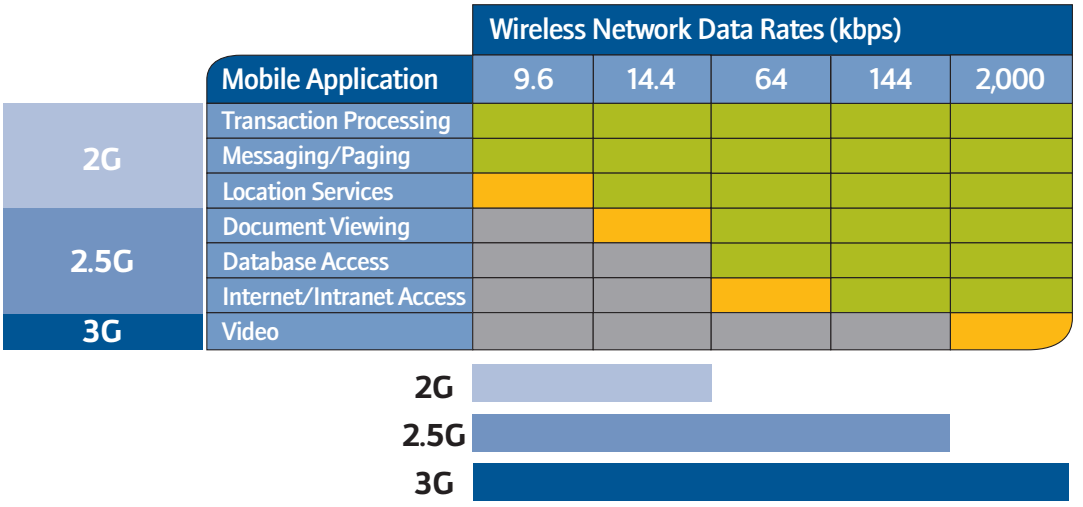


Figure 4: Wireless Network Speeds and Network Generations

Sorting out the options

What do the different types of wireless technology mean for you? First, 2.5G technologies are real and practical today, whereas you've got to be careful with 3G. 3G requires a very large investment on the part of global carriers—in the hundreds of billions of dollars—because they not only have to buy new radio spectrum, they have to buy entirely new equipment in most cases. So, while we're starting to see the beginnings of 3G, it is probably going to take longer than the hype would indicate. If your users are looking for mobile access, you should be thinking seriously at this point about IXEV and EDGE technologies. These networks provide the capability to get a converged handheld that will do both voice and data. In this space you've got a choice of network technologies and nearly 10 carriers in North America from which to choose. Remember, too, to heed the AN, the Area Network. You must use the right technology to meet the appropriate user's needs. Many people assume they will be able to use 802.11 speeds and have access everywhere they go just the same as if they were using EDGE or IXEV. For a long time, that is not likely going to be the case. Simple economics and physics will govern.

Wireless is just a bunch of technology solutions if you can't drive value with it. What matters is what you do with it. You've got to think about how you can advance your own productivity—as well as your company's.

Lessons learned

With mobile devices popping up everywhere in corporations and government organizations today, its not just executives that want to connect their device to the corporate email server. Wireless email is spreading fast as more and more people discover personal and organizational benefits that stem from being connected. However, need for connectivity isn't just about email anymore. Salespeople need access to the customer and order information held within their CRM systems. Field technicians need to be able to receive and interact with their service information. Managers are looking for constant access to critical business data from their business intelligence system. And the list goes on. So, how does IT accommodate its internal users, while still putting standards in place to ensure corporate manageability, flexibility, scalability and, most importantly, security? Also, how do you help ensure a proper return on investment? BlackBerry® enterprise customers have developed a variety of best practices culled from their wireless experiences over the past few years. Following are highlights from their experiences.

Given the increase in mobile workers and users wanting to do more than just email, scalability should be a concern. Verify that the architecture and infrastructure can scale and that the vendor has an enterprise-wide focus. Consider the ramifications of going from a 30 device pilot to more than 300 or even 3000. You'll also want an architecture that enables secure, efficient access to your existing business applications. For example, a widely-used trouble ticket or sales management tool should be accessible from the wireless device, either by writing the integration or purchasing available software.

To accommodate users, you may need to support devices from different manufacturers (for example, BlackBerry, Nokia, or Palm) running on different network technology (for example, CDMA, GPRS, iDEN, 802.11b, etc.). For this reason, it's important to have a middleware solution that will support a variety of devices, operating systems, and network technologies. Even if an organization decides on one device as its standard, there will often be exceptions for a variety of reasons. Many companies will require multiple carrier partnerships in countries around the world. Having a solution that is supported by leading carriers will ensure that users have the coverage they require throughout the United States and the rest of the world.

Keep in mind that users will be users. So, if they have devices, they're going to lose them, they're going to forget passwords and more. Having a solution that gives IT a high-level of manageability will make life easier for both the IT department and the users. For instance, when users call in because they have forgotten their password, make sure the wireless system has the settings to allow IT to change passwords over the air.

A high level of manageability also means giving IT control over which functions users have. For example, IT settings should be able to prevent unauthorized users from downloading an executive dashboard application or accessing restricted enterprise systems. These IT settings could also restrict phone or internet use for certain groups of users, or be used to mandate passwords.

When considering a wireless solution, there are standard upfront costs such as devices, server software, and service plans. However, from a complete TCO perspective, you will also want to consider:

- efficiency of connectivity and data transfer (and its impact on wireless fees)
- ongoing user training and education
- infrastructure and scaling costs as more mobile users are added
- technical support
- administration

When looking at savings, consider both the hard savings (for example, fewer laptops or reduced long distance and remote dial-in charges) and the softer savings (for example, increased customer and employee satisfaction, productivity gains and improved workflow).

Wireless security

Wireless security is critically important. If the VP of Sales' device slipped out of his briefcase while in a taxi cab, all of your sales opportunities and statistics could be exposed.

With wireless security, a single point of control is needed so IT can manage how users interact with your systems. This point of control must sit behind the corporate firewall. Make sure you have the ability to mandate passwords for users, the ability to wipe data from the device remotely, as well as the ability to lock the device remotely. Being able to establish settings through policies or parameters and providing robust control across all devices is extremely important to corporate security.

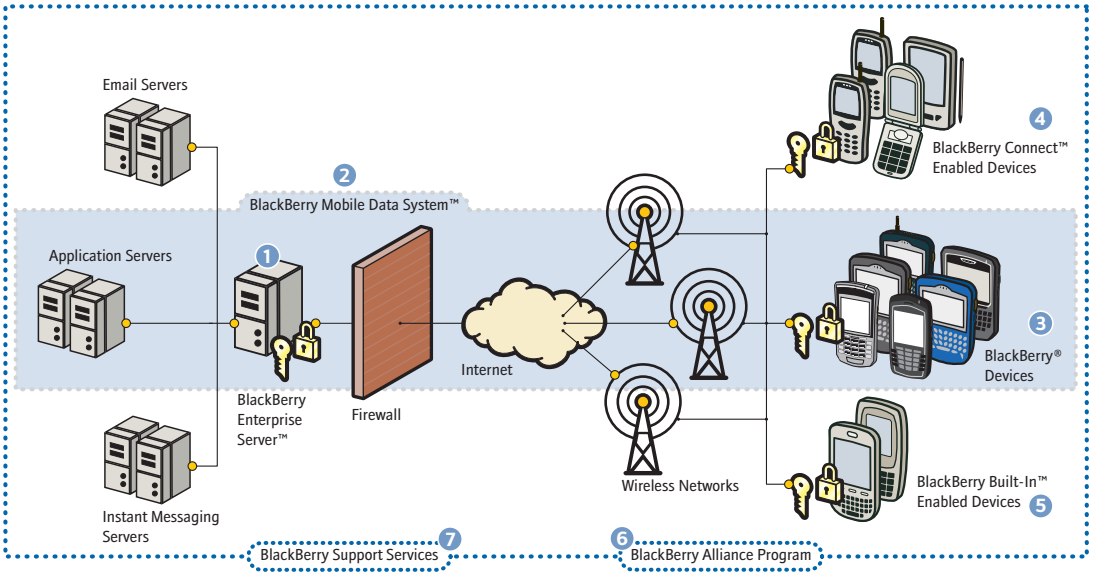
End-to-end security is a top priority for most companies and government organizations. IT departments also need to be concerned about exposure to viruses, denial of service attacks and malware. Organizations need to ensure that their wireless platform meets appropriate standards to protect their corporate systems and data.

All transmissions from the wireless device to servers behind the corporate firewall should be secure from end to end. Think about confidentiality, integrity and authenticity. Confidentiality is typically achieved using advanced encryption. Integrity ensures a message has not been tampered within transit. Authenticity allows the recipient to identify the sender and trust that the sender actually sent the message.

For additional application security, features such as code-signing can ensure that every application loaded onto a device is tied to an author, which locks out potentially malicious or unauthorized applications. System administrators, once again, should be able to maintain control by setting an IT policy that blocks third-party applications from being loaded on the handheld.

The BlackBerry Enterprise Solution

The BlackBerry Enterprise Solution™ is a flexible, IT friendly solution that provides organizations with a secure, open platform for wireless access to enterprise email and business critical applications.



Key elements of the BlackBerry Enterprise Solution architecture are:

1. **BlackBerry Enterprise Server**™ is robust software that acts as the administrative control point behind the corporate firewall that allows you to control what your users can do and what they may access. It communications with the wireless world through your firewall using an authenticated outbound-initiated connection on something called port 3101, which is a communications port. The server integrates with standard systems to provide users with wireless access to email, enterprise instant messaging and personal information management tools, including:
   - IBM® Lotus® Domino® and IBM Lotus Sametime™
   - Microsoft® Exchange and Microsoft Live Communication Server™
   - Novell® GroupWise® and Novell GroupWise Messenger™

2. **BlackBerry Mobile Data System**™ (BlackBerry MDS™) is an optimized framework for developing, deploying and managing applications for the BlackBerry Enterprise Solution. It includes development environments, administrative services and BlackBerry device software. Accessing corporate data uses the same proven BlackBerry push delivery model and advanced security features used for BlackBerry email.

3. **BlackBerry devices** are integrated wireless voice and data devices that are optimized to work with the BlackBerry Enterprise Solution. The various BlackBerry devices are designed to work globally, including Australia, Asia-Pacific, Europe, North America and South America on a variety of different network technologies including CDMA, 1XEV, iDEN, GSM, GPRS, and EDGE. When connected with the BlackBerry Enterprise Server, they provide secure push-based access to email and data from enterprise applications and systems in addition to web, MMS, SMS and organizer applications.

4. **BlackBerry Connect™ devices** from leading manufacturers integrate BlackBerry email and select PIM applications on other operating systems and hardware. These integrated BlackBerry applications feature the BlackBerry push delivery technology and connect to BlackBerry Enterprise Server*.

5. **BlackBerry Built-In™ devices** from leading manufacturers integrate the BlackBerry operating system providing the BlackBerry experience including email, calendar, contacts, browser, tasks and memo pad* on other hardware. BlackBerry Built-In devices also offer proven BlackBerry push delivery technology and the ability to connect to BlackBerry Enterprise Server.

6. **BlackBerry Alliance Program** brings together a large community of independent software vendors, system integrators and solution providers that offer applications, services and solutions for the BlackBerry Enterprise Solution. It is designed to help organizations make the most of the BlackBerry Enterprise Solution when mobilizing their enterprises.

7. **BlackBerry Support Services** available include: Technical Knowledge Center, TSupport, Corporate Development Program and RIM Professional Services. These tools and programs are designed to help organizations deploy, manage and extend their wireless solution.

* Features and functionality of BlackBerry Connect and BlackBerry Built-In devices may vary from device to device.

Summary

Wireless technology gives an organization the potential to realize a clear competitive advantage through improved communication, responsiveness and productivity. Make sure you choose a solution that was built for the enterprise – taking into account scalability, security and seamless integration into corporate systems and workflow. Having a solution with this high level of manageability will reduce TCO and enable a quicker return on your investment.

For more information

RIM offers a number of different resources to learn more about wireless solutions in general and BlackBerry in particular. The web site www.BlackBerry.com is a good first place to start. The site features a developer's forum www.blackberry.com/developers/forum/index.jsp and is used by application developers around the world. RIM also offers BlackBerry reference documents on a variety of topics.

The Technical Knowledge Center www.blackberry.com/support on the site can help you get answers to particular questions.

The network provider web sites are another good resource for information on what the carriers offer for BlackBerry and what their coverage is. It is a good idea to speak to a carrier sales representative. All carrier sales teams have access to additional RIM resources. They can come to your site and help you answer any of your questions about BlackBerry. There is also an archive of BlackBerry web seminars on the web site at http://www.resourcecenter.blackberry.com.

Part 2: Wireless 101 – Take the Test

Understanding the different wireless technologies is important for any company planning to invest in wireless solutions. Not all solutions run on multiple standards, and choosing a solution means choosing a technology. The BlackBerry® wireless devices provide a solution for multiple technologies, including devices with Bluetooth® capability, WiFi® (802.11b) and WWAN. In addition, BlackBerry supports all of the major network technologies in use today, including GPRS, CDMA, iDEN™, Mobitex®, Datatac and more. Use this document to test your knowledge of the wireless technologies.

Questions:

Q1: What are the differences between circuit switched connections and packet switched connections?

Circle either a C for Circuit-Switched Connections, or a P for Packet Switched Connections, or both for each statement below:

Normal phone call	C	P
BlackBerry data and the Internet	C	P
Multiple hops between two points	C	P
Connection points between hops must be available the entire time of transmission	C	P
Data is transmitted in packets	C	P
Information can take different paths to get from A to B	C	P

Q2: Why are there monthly service fees associated with some wireless technologies and not with others?

Circle all answers that apply.

A) Some frequencies are licensed, while others enable anyone to transmit within certain ranges

B) Carriers don't pay for the frequencies, but charge consumers to cover their costs of operations

C) Carriers purchase the right to transmit, for this reason there is a cost associated

D) Free wireless technologies can only transmit over limited distances and are paid for by manufacturers

E) Unlicensed frequencies have no transmission costs but the transmission distances are limited

Q3: What are the differences between Wireless Wide Area Networks (WWAN), Wireless Local Area Networks (WLAN) and Personal Area Networks?

Place the following beside their description: WWANs, WLANs and PANs.

_____ Allow everyday devices to be connected wirelessly over very short distances; for example, digital cameras to printers, or handheld devices to wireless earpieces.Maximum range is approximately 30 to 60 feet.

_____ Act as cable replacements for specific locations, such as a campus, and are often referred to as WiFi or 802.11. Operate at distances up to 300 feet, but typically operate best at approximately 100 feet.

_____ Enable access through a wireless link that is regional, national or global. These networks are not restricted to a specific physical location, and distances are measured in miles or kilometres.

Q4: What are the differences between the 802.11 standards?

Place the following beside their description: 802.11b (WiFi), 802.11a, 802.11g, Other 802.11 (d, e, f, h, i, etc.).

_____ Radio Frequency transmission of packet data between _____ -enabled devices and wireless access points (not point to point) – operates at the 2.4 GHz unlicensed frequency band. Speeds up to 11 Mbps with distance to 300 feet. Most broadly deployed WLAN technology in use today.

_____ Radio Frequency transmission of packet data between _____ -enabled devices and wireless access points (not point to point) – operates at the 5 GHz frequency band. Speeds up to 54 Mbps – at smaller distances.

_____ A Radio Frequency transmission standard for packet data being developed that is meant to evolve 802.11b capabilities into capability similar to 802.11a while maintaining compatibility.

_____ Define different components of the wireless networking puzzle (i.e. MAC – Media Access Control Layer, QOS – Quality of Service, Global Harmonization, Bridge Operations Procedures, etc.).

Q5: What type of wireless network technology is Bluetooth?

1. Personal Area Network technology
2. Wireless Local Area Network technology
3. Wireless Wide Area Network technology

Q6: What are the differences between 2G and 2.5G?

_____

_____

_____

Q7: What are the three major 2.5G wireless technologies available today?

1. _____

2. _____

3. _____

Q8: What are the four major wireless technologies beyond 2.5G, including 3G?

1. _____

2. _____

3. _____

4. _____

Q9: What does the "G" stand for in 1G, 2G, 2.5G and 3G?

_____

Place the following beside each statement: 1G, 2G, 2.5G and 3G.

_____ Mobitex and DataTAC digital packet networks

_____ AMPS

_____ 1XEV, UMTS, wCDMA

_____ GSM™, TDMA, CDMA

_____ GPRS, 1XRTT, iDEN

_____ A significant step towards 3G

_____ Everything as packets – voice and data

_____ Wireless analog transmission of signals over a wide area

_____ Mobile connection (such as any analog phone system)

_____ The addition of data to existing voice networks (therefore circuit-switched for voice and packet-switched for data). For example, GPRS is a packet overlay for GSM, and 1XRTT is a packet overlay for CDMA

_____ Represents an evolution of the network with theoretical maximum processing speeds between 115 Kbps and 150 Kbps

_____ Real benefits will include much higher bandwidth transmission speeds (ranging from 384Kbps to 2Mbps theoretical)

Q10: When developing applications for any wireless device, which of the following is not true?

A) A 2.5G wireless handheld has about the same usable bandwidth as a 14.4 KPS modem or lower.

B) The amount of information is being sent and how efficiently the data is sent will affect the speed at which it is transported over the wireless network.

C) The more data that is sent over the wireless network, the quicker the battery in a wireless device will drain.

D) Developers building applications for the BlackBerry Enterprise Solution™ have to customize and test their application on each wireless network that they wish to run it on.

Answers:

Q1: What are the differences between circuit switched connections and packet switched connections?

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Normal phone call	C	
BlackBerry data and the Internet		P
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Information can take different paths to get from A to B		P

Q2: Why are there monthly service fees associated with some wireless technologies and not with others?

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~~B) Carriers don't pay for the frequencies, but charge consumers to cover their costs of operations~~

C) Carriers purchase the right to transmit, for this reason there is a cost associated

~~D) Free wireless technologies can only transmit over limited distances and are paid for by manufacturers~~

E) Unlicensed frequencies have no costs to transmit on but the transmission distances are limited

With licensed frequencies, Carriers purchase the right to transmit on certain sets of frequencies across distinct geographies (for example, GSM on 900 Mhz, or CDMA on 1900 MHz). For this reason, there is a cost associated per minute with voice calls and per kB for data transmission.

With unlicensed frequencies, anyone can transmit on the band within certain specific ranges (for example the Industrial, Scientific and Medical (ISM) bands). In North America there are 3 bands of unlicensed frequencies: 902 – 928 MHz, 2.4 – 2.4835 GHz, and 5.725 – 5.850 GHz. There is not cost to transmit but the transmission distances are limited.

Q3: What are the differences between Wireless Wide Area Networks (WWAN), Wireless Local Area Networks (WLAN) and Personal Area Networks?

Place the following beside their description: WWANs, WLANs and PANs.

PANs ____ Allow everyday devices to be connected wirelessly over very short distances; for example, digital cameras to printers, or handheld devices to wireless earpieces. Maximum range is theoretically up to 60 feet, but typically under 30 feet.

WLANs ____ Act as cable replacements for specific locations, such as a campus, and are often referred to as WiFi or 802.11. Operate at distances up to 300 feet, but typically operate best at approximately 100 feet.

WWANs ____ Enable access through a wireless link that is regional, national, or global. These networks are not restricted to a specific physical location, and distances are measured in miles or kilometres.

Q4: What are the differences between the 802.11 standards?

Place the following beside their description: 802.11b (WiFi), 802.11a, 802.11g, Other 802.11 (d, e, f, h, i, etc.).

802.11b (WiFi) ____ Radio Frequency transmission of packet data between 802.11b-enabled devices and wireless access points (not point to point) – operates at the 2.4 GHz unlicensed frequency band. Speeds up to 11 Mbps – Distance to 300 feet (usually around 100 feet or less). Most broadly deployed WLAN technology in use today.

802.11a ____ Radio Frequency transmission of packet data between 802.11a-enabled devices and wireless access points (not point to point) – operates at the 5 GHz frequency band. Speeds up to 54 Mbps – at smaller distances.

802.11g ____ A Radio Frequency transmission standard for packet data being developed that is meant to evolve 802.11b capabilities into capability similar to 802.11a while maintaining compatibility.

Other 802.11 ____ Define different components of the wireless networking puzzle (I.e. MAC – Media Access Control Layer, QOS – Quality of Service, Global Harmonization, Bridge Operations Procedures, etc.).

Q5: What type of wireless network technology is Bluetooth?

1. Personal Area Network technology
2. Wireless Local Area Network technology
3. Wireless Wide Area Network technology

Bluetooth is a PAN technology that's generated a high degree of excitement in the industry. It uses radio waves for short distance two-way transmission (works through walls) – omni directional. Devices "advertise" their capabilities to others (one device can be connected to up to seven other devices at a time). It has speeds up to 720 kbps with a range of 30 to 60 feet.

Q6: What are the differences between 2G and 2.5G?

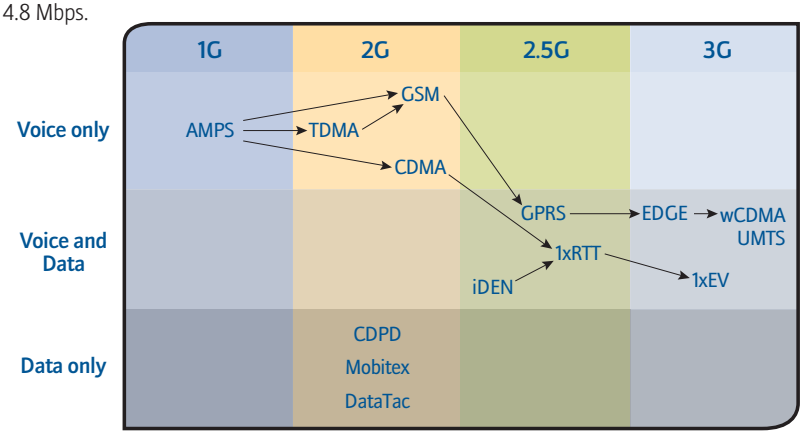
2G technologies are either voice or data, while 2.5G involves the overlay of data on voice resulting in a technology that covers both.

Q7: What are the three major 2.5G wireless technologies available today?

1. GPRS: Packet-switched data overlay for the GSM network - up to 115 kbps.
2. CDMA 2000 1X or 1XRTT: Digital packet-switched data overlay for CDMA networks - up to 150 kbps.
3. iDEN (Integrated Dispatch Enhanced Network): Packet-switched digital cellular technology using TDMA and proprietary Motorola technology – operates in the 800 MHz frequency band. Data, voice, group addressing and two-way radio communications

Q8: What are the four major wireless technologies beyond 2.5G, including 3G

1. EDGE (Enhanced Data GSM Environment): A digital packet-switched network overlay for TDMA and GPRS networks offering higher speed transmissions (in theory up to 384 kbps). Is meant to be the convergence of TDMA and GSM into one global standard providing higher data rates. Some people consider EDGE 3G technology, while others classify it as in-between 2.5G and 3G.
2. UMTS (Universal Mobile Telecommunication System): A broadband digital packet-switched network that will deliver information at speeds of up to 2Mbps. Is meant to be a widely-adopted worldwide standard.
3. wCDMA (Wideband CDMA): A high speed digital packet-switched network that has the capacity to offer higher data speeds than CDMA (speeds up to 2 Mbps). Seen as a potential migration path for GPRS.
4. 1xEV technology provides higher speeds implemented in two phases: 1xEV-DO and 1xEV-DV. Phase 1 is 1xEV-DO (Evolution-Data Only), which increases the downlink peak data rate to 2.4 Mbps. The average rate a user experiences is between 300 and 600 Kbps. 1xEV-DO Revision A supports IP packets, increases the downlink to 3.1 Mbps and boosts uplink dramatically to 1.2 Mbps. Phase 2 is 1xEV-DV (Evolution-Data Voice), which integrates voice and data on the same carrier with rates up to 4.8 Mbps.



Summary of the current wireless technologies and potential migration paths to 3G technologies

Q9: What does the "G" stand for in 1G, 2G, 2.5G and 3G? Place the following beside each statement: 1G, 2G, 2.5G and 3G.

"G" stands for "generation" of technology.

2G _____Mobitex and DataTAC digital packet networks

1G _____AMPS

3G _____1XEV, UMTS, wCDMA

2G _____GSM, TDMA, CDMA

2.5G _____GPRS, 1XRTT, iDEN

2.5G _____A significant step towards 3G

3G _____Everything as packets – voice and data

1G _____Wireless analog transmission of signals over a wide area

1G _____Mobile connection (such as any analog phone system)

2.5G _____The addition of data to existing voice networks (therefore circuit-switched for voice and packet-switched for data). For example, GPRS is a packet overlay for GSM, and 1XRTT is a packet overlay for CDMA

2.5G _____Represents an evolution of the network with processing speeds between 115 Kbps and 150 Kbps theoretical maximum

3G _____Real benefits will include much higher bandwidth transmission speeds (ranging from 384Kbps to 2Mbps theoretical)

Q10: When developing applications for any wireless device, which of the following is not true?

A) A 2.5G wireless handheld has about the same usable bandwidth as a 14.4 KPS modem or lower.

B) The amount of information is being sent and how efficiently the data is sent will affect the speed at which it is transported over the wireless network.

C) The more data that is sent over the wireless network, the quicker the battery in a wireless device will drain.

D) **Developers building applications for the BlackBerry Enterprise Solution have to customize and test their application on each wireless network that they wish to run it on. NOT TRUE**

The BlackBerry Enterprise Solution provides application developers with a consistent, secure and network-independent transport model across all wireless networks. Applications that leverage the Mobile Data Service feature of the BlackBerry Enterprise Solution can be deployed on BlackBerry devices on a variety of networks anywhere in the world without having to worry about how or if the application will be able to connect over the wireless network. Applications will continue to work as users roam from one network to another without any additional configuration by the user or application.