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## Mobile Devices and Healthcare: What's New, What Fits, and How Do You Decide?

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A Frost & Sullivan  
White Paper

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## INTRODUCTION

It is no secret that U.S. healthcare providers face new and evolving demands from patients, from federal and state governments and from insurance firms. Is it any wonder that successfully addressing this sea change in expectations requires a concurrent transformation in healthcare technologies?

Wireless technology, in particular, holds the promise of enhancing the quality of patient care, helping providers control costs in creative ways and lessening the pounding headache of regulatory compliance.

It all begins with the mobile device, and manufacturers are working diligently to tempt healthcare providers with a broad—and sometimes bewildering—array of choices. The computer on wheels and the laptop with a mobile broadband card are as portable as some institutions and offices get; however, there are additional wireless device types available that deserve serious consideration.

Change is the constant—with smartphones becoming more powerful, personal monitors becoming more sophisticated, and a new generation of tablets bursting on the scene and threatening to upend laptops. Even traditional, push-to-talk devices are being enhanced with exciting new capabilities.

This paper provides an update on each of four major wireless device categories that should be especially relevant to healthcare providers. It also summarizes the current weaknesses and strengths of these device types, predicts best fit, and reminds the reader that there is more to selecting the right device than just running price comparisons.

## THE THREE HEALTHCARE IMPERATIVES

Healthcare is a fiercely competitive sector that is being buffeted by multiple forces, including:

- Our still-struggling economy, with continued high unemployment and financial unease, making healthcare services more of a financial burden in certain patient segments.
- Consumers becoming more educated and choosier about treatment and caregiver alternatives.
- Physician alignment with hospitals, which remains a work-in-progress.
- Ongoing margin pressures.
- Aging patient populations, with a corresponding rise in chronic conditions.
- Unpredictable government programs and funding, making it difficult to plan long term.

Whether it's in a hospital, the doctor's office, or a patient's home, today's healthcare practitioners face the same basic set of challenges: 1) Expanding the availability and quality of patient care, 2) controlling costs, and 3) complying with government and industry regulations.

### ***Patient Care:***

Delivering high-quality, easily accessible patient care—on both an in-patient and out-patient basis—is an ongoing balancing act. Consumers are looking for quality and value. They have done their homework, think they know the answers, and are frustrated with insurance plans

that impose increased limits on their access to providers and care. In the face of this educated customer, the healthcare industry has to compete and survive by demonstrating real value-add.

The new healthcare value proposition to patients is equal parts high-quality medicine, affordability and convenient accessibility. Multiple expert providers are expected to work together to deliver seamless, coordinated medical services. And those services can more often be provided right in the patient's home or in a nearby satellite facility.

#### **Controlling Costs:**

Unpredictable funding, downgraded bond issues and increased competition all expose the ongoing need to keep expenses actively managed. Fixed expenses and labor costs continue to soar. At the same time, ROI (return on investment) remains a somewhat ephemeral metric in the healthcare sector.

Technology's tangible benefits are easy to predict, but can be difficult to actually quantify. CIOs can find it challenging to put a hard, concrete number on staff productivity improvements, increased patient safety, cost-savings, faster response times, improved outcomes, more satisfied and involved patients, reduced medication errors, etc.

In the face of cost increases and ongoing margin pressures, providers must manage expenses by constantly evaluating alternatives and improving efficiency across departments and groups.

#### **Regulatory Compliance:**

Compliance is always a major priority, keeping healthcare executives and IT departments constantly on the alert. HIPAA regulations, adoption of ICD-10 (International Classification of Diseases) and implementation of certified electronic health records are just a few of the industry- and government-imposed mandates that must be satisfied. These requirements cost money and can disrupt work flow, and can even negatively impact patient care if not deployed properly.

### **YES, MOBILE DEVICES CAN TRANSFORM THE HEALTHCARE EXPERIENCE**

The healthcare sector has never been known for being an early adopter of information technology. However, wireless devices—along with wireless broadband data networks and mobile software applications—have to be recognized as fundamental components in the quest to expand and improve patient care, control costs and comply with government and industry mandates.

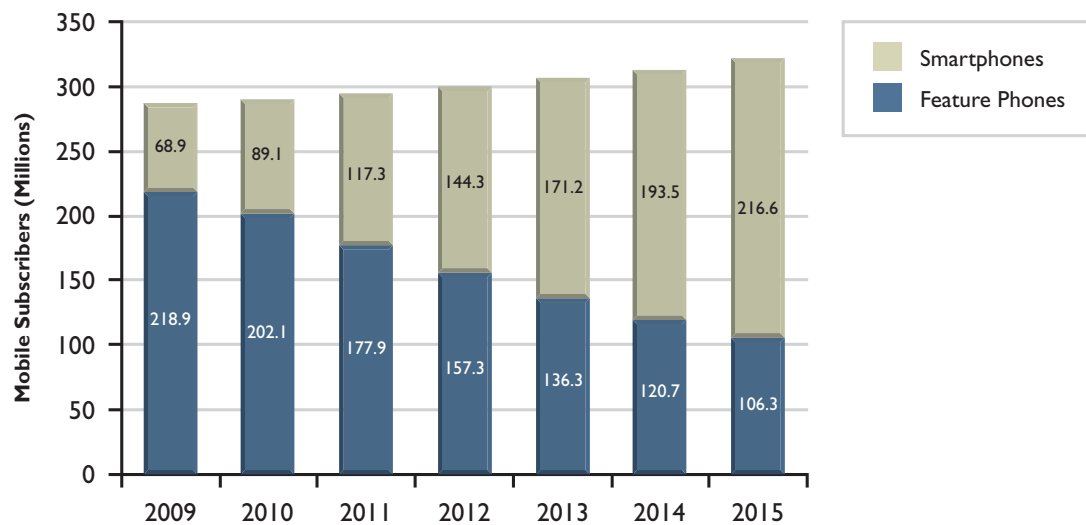
For some hospitals, the computer on wheels (COW) is as mobile as it gets—simply because no one is motivated to search for better alternatives. Often, a lack of funding or technology personnel serves as a key barrier to transitioning to wireless. Sometimes IT staffs are paralyzed at the thought of supporting more than one type of mobile device and therefore refuse to support anything. Data security and patient privacy are also concerns. However, whatever the objections to mobility have been in the past, they are falling away as everything wireless becomes more powerful, more affordable and more user-friendly.

Today's home healthcare providers, physician offices and hospitals have an array of mobile devices to choose from. Smartphones, wireless laptops and push-to-talk devices are familiar to most. Tablets and patient-connected telehealth devices are assuming higher profiles. Which form factor is appropriate in which setting?

**Smartphones:**

Smartphone penetration in North America is forecasted by Frost & Sullivan to surge from 23.9 percent as of EOY 2009 to 67.1 percent by 2015. Doctors report being even higher adopters. These popular devices are equal parts handheld computer and mobile phone, and come in six major flavors. Today's operating systems include Google's Android™, Apple's iOS, RIM's BlackBerry®, HP's webOS, Nokia's Symbian/MeeGo™, and Microsoft's Windows® Phone 7 (successor to Windows Mobile 6.x). Despite some differences in approach, each OS sets the stage for intuitive, user-friendly devices and applications.

**Smartphone Market: Mobile Device Connections Forecast (North America), 2009–2015**



Note: All figures are rounded; the base year is 2009.

Source: Frost & Sullivan

Touch screens, increasingly powerful processors, GPS location awareness, crisp graphics and animation, rapid Web browsers, and accelerometers are just a few smartphone capabilities that help deliver a convenient user experience to healthcare providers. Smartphone-based mobile health applications range from drug and clinical references to diagnostic tools to real-time patient record keeping. Specific examples that have found their home on the smartphone form factor include:

- **Mobile reference libraries**—Caregivers can stay current on medical advances, advice and news by tapping into medical apps, such as anatomy references (ex: Netter's Anatomy) and drug guides (ex: Davis's Drug Guide for Nurses).

- **Diagnostic tools**—This is a burgeoning category, including both prepackaged and customized solutions. Lab results can be delivered directly to a physician. Electrocardiogram results and guidance can be accessed. Patient vitals (for recovering patients or those with chronic conditions) can be monitored long distance using a combination of smartphones and sensors. Remote consults can take place with rural or distant patients and colleagues.
- **Patient record keeping**—Electronic health records can be accessed via smartphone, allowing caregivers to diagnose and communicate virtually anywhere, anytime, including at the point of care. Home healthcare providers can enter patient data once on site.
- **Worker monitoring**—Home healthcare aide location and workflow can be monitored via GPS to ensure timely arrivals and departures and optimal productivity.

Smartphones present certain strengths and weaknesses as a form factor in the healthcare field:

#### Device Category: Smartphones

PRO	CON	BEST FIT
<ul style="list-style-type: none"> <li>▪ Inexpensive</li> <li>▪ Easy to carry in pocket</li> <li>▪ Decent-sized screens</li> <li>▪ Location awareness (with GPS)</li> <li>▪ Rapidly expanding portfolio of medical applications</li> <li>▪ Can be ruggedized with third-party casing</li> </ul>	<ul style="list-style-type: none"> <li>▪ Limited displays and lower processing power can result in incomplete or unclear information, time-consuming paging through multiple screens</li> <li>▪ Potential security vulnerabilities</li> <li>▪ Easy to lose</li> <li>▪ Battery life less than 10–12 hours (a full shift)</li> </ul>	<p>Hospitals Physician's Office Home Healthcare</p> <p>High Applicability      Low Applicability</p>

Source: Frost & Sullivan

#### Tablets:

Ruggedized, special-purpose, tablet-type computers have been around since the 1980s; however, a slimmer, less expensive, more feature-packed version is now taking the mobile device industry by storm. These new iterations, launched by a growing list of top-tier vendors, have significant potential in the healthcare sector.

Frost & Sullivan predicts rapid growth in world units shipped—from 38.6 million in 2011 to more than 142 million in 2016. At the same time, prices are expected to drop from an average of \$565 to \$362.

Tablets can satisfy the clinician's growing demand for information and data right at the point of care. Weighing about 1 pound, less than half an inch thick, and offering 7- to 10-inch touch screen displays, these devices are eminently portable, with the 7-inch models being compact enough to tote around in a lab coat pocket. With 1 GHz dual-core processors, they deliver the speed and performance that are absolutely crucial for medical applications. And high-resolution displays (1024 x 600 pixels) can provide clear, crisp views of medical images (X-rays, CT scans, etc.).

Dual cameras (front and back) on certain models make these devices even more productive in three important ways: 1) By allowing caregivers to supplement patient records with valuable images of the current medical condition, 2) by providing an image that the caregiver can quickly share with his or her colleagues for feedback and collaboration purposes, and 3) by allowing videoconferencing—virtual consultations—with patients and other healthcare providers.

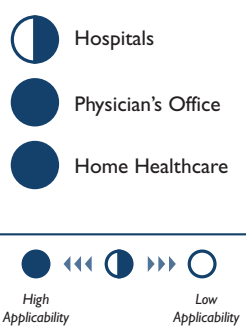
Tablets also allow caregivers to share images and data directly with the patient, resulting in more interaction and engagement and, hopefully, a more satisfied healthcare customer.

Tablet applications will focus on providing diagnostic imaging and video, quick access to educational and reference resources, and on-the-spot access to electronic patient records. In addition to the capabilities discussed, software vendors are challenged to leverage additional features such as pen input, GPS, accelerometer, gyroscope and multiple network connectivity options. Both custom and prepackaged applications will be common.

Examples of native apps currently being developed for tablets include MRI viewers, mobile film readers and mobile medical calculators. Developers are still discovering the benefits of the tablet’s increased size. For example, tablets are large enough for easy addition of a biometric reader, which could single-handedly trump the need for other security protocols—thereby saving valuable clinician time and effort.

While there are distinct advantages to the tablet form factor, there also remain vulnerabilities—at least for the time being:

**Device Category: Tablets**

PRO	CON	BEST FIT
<ul style="list-style-type: none"> <li>Highly portable—7” models fit into lab coat pocket</li> <li>Large, bright, sharp screens and images</li> <li>Rapid web browsing</li> <li>Digital pen for notes</li> <li>Enterprise-grade security with certain vendors</li> <li>Price point that encourages laptop computer replacement</li> </ul>	<ul style="list-style-type: none"> <li>Centralized device management, strong authentication and encryption, and remote wipe capabilities are often lacking</li> <li>Battery life less than 10–12 hours (a full shift)</li> <li>Water resistance may not be sufficient to withstand required disinfectant wipe-downs</li> <li>Requires after-market casing to protect from drops</li> </ul>	 <ul style="list-style-type: none"> <li>Hospitals</li> <li>Physician’s Office</li> <li>Home Healthcare</li> </ul>

Source: Frost & Sullivan

**Push-to-Talk:**

Push-to-talk communication devices are often described as “walkie-talkies on mobile phones.” Nextel Communications introduced mobile push-to-talk service on its iDEN network in 1993. Push-to-talk provides instant communications, usually taking less than a second to connect the caller with the targeted recipient(s).

This service is still fairly utilitarian, enabling instant, short, focused voice calls. With half-duplex communications, only one person at a time can transmit. Communications can be one-to-one or with groups.







A variety of mobile handset types can be used as push-to-talk devices, including ruggedized devices, flip phones, etc. Additional push-to-talk service capabilities can include:

- Call alerts
- Repeating text with alerts
- Photo capture
- Maps
- GPS location of sender and/or recipients
- Live chats
- Message history with playback and storage
- Offline communications in case of a network outage or if outside network coverage area

Push-to-talk devices are often marketed for field service workers; however, they can also be ideal in the healthcare industry, especially for hospital support staff in patient transport, campus security and facilities management. Push-to-talk handhelds can provide needed functionality in the emergency room and in natural disaster situations, where temporary care locations have to be created and stressed communications networks need to be maintained. In many medical settings, push-to-talk devices are also positioned as an ideal replacement for the ubiquitous pager.

Push-to-talk devices present a clear set of benefits in the right user segment:

**Device Category: Push-to-Talk**

PRO	CON	BEST FIT
<ul style="list-style-type: none"> <li>▪ Dependable, focused voice communications</li> <li>▪ Increased efficiency and reduced costs due to quicker communications and response times (especially compared to pagers)</li> <li>▪ Closed-loop system ensures only authorized users</li> <li>▪ Fewer mobile devices to carry if pager is jettisoned</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ideal for communicating only the most basic of information</li> <li>▪ Primarily a voice instrument</li> <li>▪ Can have limited data capacity, resulting in limited apps on devices</li> </ul>	<div style="display: flex; flex-direction: column; align-items: center;"> <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="text-align: center;">  Hospitals         </div> <div style="text-align: center;">  Physician's Office         </div> <div style="text-align: center;">  Home Healthcare         </div> </div> <hr style="width: 100%;"/> <div style="display: flex; justify-content: space-between; width: 100%; align-items: center;"> <div style="text-align: center;">   High Applicability         </div> <div style="text-align: center;">  </div> <div style="text-align: center;">   Low Applicability         </div> </div> </div>

Source: Frost & Sullivan

**M2M/Connected Devices:**

Often, geography, expense or health conditions make it difficult for patients and healthcare providers to be in direct, in-person contact as often as they would prefer. Machine-to-machine (M2M) medical monitoring devices have been developed to bridge this gap. These solutions are designed for in-home use and are at an early adoption stage in North America.

These remote monitoring devices currently fall into three general-use categories:

- **Remote patient monitoring**—Managing chronic conditions (such as diabetes, cardiac disease, asthma) by wirelessly transmitting a variety of data (e.g., blood pressure, glucose levels, weight, heart rate, oxygen level) to the patient’s care team.
- **Personal wellness**—Typically focused on gathering data on a person’s fitness, nutrition and general well-being.
- **Assisted living**—Helping the elderly or at-risk individual to live independently by monitoring their condition and safety. This includes real-time location awareness of Alzheimer’s patients.

Given that many prospects for these types of solutions are older, infirm or fragile, the user interface on these devices must be very simple and easy to use. Fortunately, vendors realize this. Medical M2M monitoring devices continue to become smaller and simpler. They currently include glucose meters, pulse and blood pressure monitors, spirometers, body weight scales, fingertip pulse oximeters, etc.

Using a Personal Area Network (PAN) interface/gateway such as Wi-Fi, BlueTooth® or ZigBee, a subset of these devices can wirelessly capture and communicate data to the patient’s healthcare provider(s). This enables health professionals to intervene early should abnormal data appear. It also allows the information to be added to the patient’s electronic medical record.

By monitoring patients at home, physicians and hospitals can better manage their patient load, patients do not need to travel, and measurements are constant and less prone to error. In elder care situations, these M2M/connected solutions allow healthcare providers to better track the patient’s physical condition and give family members (who can live far away) additional peace of mind.

In the case of chronic condition monitoring, vendors are finding that the enhanced level of disease management and patient participation can produce a reduction in:

- The number of physicians’ office visits.
- Hospitalization risk.
- Patient mortality.
- The length and quantity of hospital stays.

As a nascent technology, healthcare's M2M/connected solutions offer both risk and reward:

**Device Category: M2M/Connected Devices**

PRO	CON	BEST FIT
<ul style="list-style-type: none"> <li>▪ Cost savings from early diagnosis/treatment, shorter hospital stays, and reduced physician time and office visits</li> <li>▪ Increased patient compliance with self-care behaviors</li> <li>▪ Enhanced patient safety, convenience, independence</li> <li>▪ Better disease management</li> <li>▪ Increased data accuracy and record-keeping</li> </ul>	<ul style="list-style-type: none"> <li>▪ Low awareness on part of prospective patients and the healthcare community</li> <li>▪ Insurance may not cover cost</li> <li>▪ Still-emerging category with FDA approval requirements possibly slowing new product introductions</li> <li>▪ Data security concerns</li> </ul>	<p>Hospitals</p> <p>Physician's Office</p> <p>Home Healthcare</p> <p>High Applicability ← → Low Applicability</p>

Source: Frost & Sullivan

**CRITERIA FOR CHOOSING THE RIGHT MOBILE DEVICE(S)**

Let's agree upfront that larger healthcare entities (including hospitals and physicians' offices) will have to support a diverse array of wireless devices. Today, it is unreasonable to expect a completely homogeneous environment in which one type of device is universally accepted by all medical staff. First, different types of workers have different communications needs. One size definitely does not fit all. Second, an increasing number of doctors expect to be able to use their own personal devices as needed, typically smartphones from a variety of vendors and operating on a variety of platforms.

The correct wireless device is the cornerstone to creating an effective and successful mobility strategy no matter what the healthcare environment—hospital, physicians' office or home care. Criteria to consider when selecting a device should include:

**Functionality**—From quick, basic voice communications to sophisticated data software applications, there's a wireless device that can meet your needs. The challenge is to clearly define your mobile communications requirements, projecting out over the next three to five years if possible. This is not an isolated exercise, but one that necessitates involvement and analysis from IT staff and all impacted user groups. Their inputs will dictate the optimal mix of capabilities and features, including requirements around screen size, touch navigation, battery life, processing power, sensors and various forms of information capture and display (writing/signature, photo, video, barcode, Flash animation, etc.).

**Usability**—The device can provide all the functionality you need; however, if your care providers and staff don't find it easy and natural to use and carry, the device has no value. The simplicity of push-to-talk. The pocket-size portability and light weight of smartphones and the 7-inch tablets. The automatic capture and communication capabilities of small, compact M2M/connected devices. Ergonomics done well result in devices that even your most technophobic personnel will find acceptable and—dare we hope—desirable.

**Security**—Government and industry regulations concerning the privacy and security of patient information dictate enterprise-level security mechanisms. Centralized device management should be possible, along with over-the-air lock/wipe and robust data encryption and authentication capabilities. Devices that can be easily integrated with an existing enterprise IT infrastructure are ideal.

**Network Connectivity**—Define the type of wireless networks your users will have available to them. What type of network connectivity must the wireless device be able to provide—cellular, Wi-Fi, Bluetooth, mobile broadband? Test the device across a wide range of locations and signal strengths in order to identify any vulnerabilities.

**Durability**—It is a fact of life: In healthcare environments, devices are going to inevitably be dropped, are going to fall off surfaces, and are going to be regularly disinfected. If your wireless device is not already ruggedized, an aftermarket casing may suffice. For example, vendors such as Otterbox® provide rugged cases that protect all types of mobile devices from drops, dust and shock. However, include the incremental cost in your TCO (total cost of ownership) calculations. And check carefully to identify any device mechanisms, buttons, camera lens, etc., that may be blocked by the additional casing. Water resistance is another necessity in hospital settings (while not as applicable in individual doctors' offices or in patients' homes). Devices at the point of care are going to be wiped down with strong disinfectants on a frequent basis. Can your device withstand this treatment over time?

**Applications Availability**—If there are few prepackaged software applications available for a particular form factor or operating system—or an inordinate amount of approval barriers through which in-house developers must jump—you will not be able to optimize the value of your device. And, worst case, the device may end up being prematurely discontinued for lack of viability. For newer device types, such as the emerging tablet market, healthcare apps remain a work in progress, so one must become familiar with the operating systems and their level of application development friendliness. Certain OS systems are closed and tightly controlled, erecting various approval gateways. The objective is to ensure a high level of quality; however, this can also slow down and limit the availability of high-value, healthcare-specific solutions. Other OS are decidedly open source, allowing anyone to build applications, but also injecting a higher level of risk regarding quality, security, etc.

**Price**—Cost remains a major barrier to implementation. Often, however, the purchaser of a wireless device can obtain a better price by signing up for a long-term service contract. Actual device price points are only one input to the solution purchase analysis, which should include a detailed definition of all hard and soft costs (including user training, application software, data plans, upgrades, device management services, etc.).

Using these criteria to finalize device selection can result in choices that help address three of healthcare's greatest challenges: controlling costs, delivering high-quality and easily-accessible patient care, and complying with government and industry regulations.

## HOW SPRINT CAN HELP

In a recent hospital CIO focus group conducted by Frost & Sullivan, the preference for end-to-end mobile solution providers was pronounced. The reasons given focused on ease of integration, sustainability and lower cost of ownership. Sprint has done the due diligence and partnered with top-tier vendors to assemble a wide range of effective communications and data access solutions for healthcare providers:

### **Wireless Devices:**

Whether it is smartphones, tablets, push-to-talk devices or M2M/connected solutions, Sprint offers a robust device portfolio that just keeps expanding as new, top-tier manufacturer partners are vetted, approved and presented to customers. The carrier's current device lineup includes:

**Smartphones**—Sprint's current stable of manufacturers include RIM®, HTC, Motorola, Samsung, and Sanyo. Operating systems include Android, BlackBerry, WebOS, and Windows Phone. In addition to a comprehensive selection of 3G devices, the carrier is rapidly building a portfolio of 4G smartphones that are designed to take full advantage of its powerful and growing 4G network (reaching more than 70 markets and counting). Sprint has also partnered with Otterbox to provide rugged casings for those devices that will be used in more challenging environments, such as certain healthcare settings.

**Tablets**—The formally announced components of Sprint's tablet portfolio include the BlackBerry® PlayBook™, Motorola Xoom™, and HTC Evo View 4G. This initial selection offers healthcare providers a selection of sizes (7 inch and 10 inch), network connectivity (Wi-Fi, EVDO Rev A, and WiMAX), features (dual cameras, digital pen, video capture, GPS, accelerometer, Adobe® Flash®, advanced security) and robust development environments.

**Push-to-Talk**—A pioneer in the push-to-talk field, Sprint has announced plans to launch new, next-generation push-to-talk capabilities on its powerful CDMA network. The new Sprint Direct Connect® brand will encompass an initial portfolio of rugged devices from Motorola Mobility and Kyocera®. These devices will provide not only push-to-talk capabilities, but also high-speed data access, high-resolution cameras and Bluetooth connectivity.

**M2M/Connected Devices**—Sprint is steadily building an array of solutions that will utilize its machine-to-machine (M2M) platform to transmit patient medical data from home to healthcare provider. Current solutions include American TeleCare, Inc.'s live audio and video communication with integrated electronic peripherals, the Reflection Solutions wristwatch monitor (that sends alerts for exits, falls, and selected vital signs), the Omnilink ComfortZone™ solution (tracking Alzheimer's patients) and the IDEAL LIFE product portfolio, which transmits medical data that can include a patient's glucose, blood pressure, weight, heart rate and oxygen level.

### **Wireless Data Networks:**

The backbone for running any sort of wireless applications within a healthcare facility is the

wireless network. If there's no connectivity, then wireless communication is not possible. Whether caregivers are trying to access patient data on a tablet or just need a reliable voice capability, dependable wireless connectivity is mission-critical.

Sprint's Custom Network Solutions (CNS) unites multiple network technologies (Wi-Fi, cellular, land-mobile radio, paging, etc.) and designs a cohesive network that enhances wireless coverage and capacity. This is an outsourced solution that includes a thorough analysis of site requirements, custom network design, full equipment installation, and ongoing management and support. GE Healthcare is a valued partner in this effort, leveraging GE CARESCAPE™ Enterprise Access, a single, universal wireless platform.

#### **Healthcare Software Application Solutions:**

Sprint has partnered with leading application developers, such as CellTrak, TeleNav, and Xora®, to provide home healthcare providers with software solutions that track the time and travel of their mobile caregivers. These apps also include workflow software that pushes task lists to the caregiver, which are noted and synchronized with the home healthcare provider's backend systems.

Other Sprint partners include mVisum and its mobile phone-based EKG app, AirStrip Technologies with its fetal monitor (waveform) solution, and Calgary Scientific and its ResolutionMD™ Mobile application that provides advanced visualization of medical images.

Sprint's healthcare expertise, powerful wireless networks, and growing ecosystem of mobile device and application partners can help healthcare providers at every level—delivering high-quality, accessible patient care, controlling costs and supporting regulatory compliance.

To learn more about how Sprint's mobility solutions can help get the job done, please visit [sprint.com/healthcare](http://sprint.com/healthcare).

Sprint 4G network reaches over 70 markets and counting, on select devices. Sprint 3G network reaches over 274 million people. Nationwide Sprint Network reaches over 278 million people. **GPS:** Requires GPS & Java-enabled device. GPS reliability varies by environment. Use without a plan that includes data is 3¢/kb). **Custom Network Solutions:** Coverage not available everywhere. Wireless coverage may be impacted by environmental and other factors. To utilize Custom Network Solutions services, Customers will need to sign a Custom Network Solutions Agreement with applicable terms and conditions. Restrictions apply. See store or Sprint.com for details.

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