White paper

New Roles, New Rules: Are Your Smart Phones Tough Enough for Work?

Why Emerging Enterprise Applications Require Ruggedness, Reliability

Intermec

BARCOM 20th Anniversary

Millions of new smart phones continue to ship every month, and many of them find their way into businesses to help workers do their jobs in innovative new ways. Many of these same phones will be replaced within a year because they are not durable enough to work reliably in new enterprise work environments. When smart phones will be used by new categories of users to support new business processes, there are new requirements for phones themselves. Ruggedness is at the top of the list. If phones fail and worker productivity suffers, the cost is much greater than the price of the phone.

Figure 1: Yearly Replacement Rates for Enterprise Handheld Devices

	Year 1	Year 2	Year 3
Non-ruggedized	18.0%	38.5%	82.6%
Ruggedized	3.3%	7.8%	18.2%

Source: VDC Research "Total Cost of Ownership (TCO) Models for Mobile Computing and Communications Platforms," July, 2007.

With smart phones now being used by professionals in fields ranging from field service to customer care, evaluating and selecting the optimal device has become much more challenging. Once enterprises could base their selections mainly on coverage maps, rate plans and the look and feel of the phones themselves, but now they must carefully consider durability, device lifecycles, available enterprise software, support for bar code scanning and much more.

This white paper takes an in-depth look at which smart phone features make work easer for users in emerging enterprise applications and explains why ruggedness is a requirement. It focuses primarily on the needs of workers who will use phones to communicate, run enterprise applications and service customers or equipment in non-office environments. By understanding the work environment and user requirements that impact smart phones for these emerging environments, enterprises can choose devices that will provide the most reliable performance, longest lifecycles and superior return on investment (ROI).

Understanding New Phone Roles & Requirements

Many new smart phone work processes involve frequent data collection. The phone is an essential tool, not an accessory. Emerging use cases include recording survey or inspection data on the touchscreen, scanning bar codes to take inventory or record parts used, and completing transactions such as proof of delivery, guest check-in or payment processing. In these cases the touchscreen and bar code reader are used much more often than in traditional voice- and text-centric deployments, so appropriate components are essential. For example, the touchscreen should be constructed from a durable, scratch-resistant material that will withstand tens of thousands of taps and strokes from the stylus. When bar codes are part of the work process, an integrated bar code scanner or imager is highly advantageous compared to a cell phone camera. While cameras can read bar codes, they are considerably slower, harder to focus and less accurate than bar code scanners and imagers, so camera-based reading will slow workers down. In tests, workers scanned bar codes 10 to 20 times faster with bar code readers than with cameras.

Perhaps the biggest differences between traditional and emerging smart phone deployments are who is using the phones, and where. Smart phones entered the enterprise in the pockets and purses of white collar workers who mostly moved from offices to conference rooms to cars. A device failure often only represented a temporary inconvenience, as the user could access e-mail from a nearby PC, make calls and retrieve voicemail messages from a landline or cell phone borrowed from a colleague. Today smart phones are tools for blue collar and "gray collar" (which is somewhere between white and blue) workers, who often work alone where there is no roof overhead or carpeted floor underfoot. These usage environments raise the requirement for reliability and durability.

For gray and blue collar workers, a device is a necessity, not a convenience. They cannot do their jobs without the ability to collect data, consult with colleagues, access enterprise information and complete transactions. When their phone fails, their productivity plummets. Depending on their jobs, handheld device users lose an average of 50 to 80 minutes of productivity each time the device fails, not counting the time IT or other support staff spend troubleshooting the device[1]. Mobile workers who experience 50 to 80 minutes of downtime will probably have to miss at least one of their sales or service calls that day. Productivity loss – not device purchase price – is by far the largest component of the total cost of ownership for smart phones and other handheld devices[2]. The value of lost productivity accounts for 41 percent of the total cost of ownership (TCO) for commercial grade handheld computers used in the enterprise.

Because downtime is so expensive, there is clear value to keeping these devices functional. Ruggedness is a requirement, not an option, when working extensively outside office and home environments. In the real world, mobile phones will be dropped onto concrete, and they will be rained on. That doesn't mean the phone will stop working. There are product features that protect phones – and preserve productivity – in very challenging environments. The following sections explain how specific features and product characteristics impact reliability in non-office environments.

Understanding Device Ruggedness

1 Total Cost of Ownership Models for Mobile Computing and Communications Platforms Executive Brief. VDC Research, 2010.

2 Ibid.

What Makes a Phone Rugged & Reliable?

Lots of smart phones can provide e-mail access, take pictures and run calendar and contact applications. Few can also read a bar code on a rusty motor housing that is exposed to the elements, instantly access the unit's service history, display a schematic, generate a work order, capture the customer's signature electronically on the screen, then use Bluetooth to direct a mobile printer to generate a signed copy. Today smart phones are being used in similar scenarios and are also being used to automate sales, delivery, inspection, contracting, retail operations, home healthcare, professional services and other operations. As applications like these are emerging, the definition of what makes a good smart phone is changing.

General-purpose smart phones have notoriously short life cycles when used for these operations. Annual failure and replacement rates of 50 to 90 percent or higher are common. Plus, device manufacturers frequently introduce new operating systems on current and new models, which creates an ongoing need to port, test and maintain applications. The frequent churn of devices and operating systems makes it difficult to maintain application consistency across the user population as phones are replaced and rollouts are scaled over time.

Enterprises can avoid rapid replacement cycles by selecting the right devices for the work environments. Ruggedized handhelds that are designed for enterprise operations can reasonably be expected to last three to five years, even when frequent handling, data collection and outdoor use are normal business processes. As Figure 1 shows, first-year replacement rates are 5.5 times higher for non-ruggedized handheld devices as ruggedized ones used in enterprise operations. After three years, 82.6 percent of non-ruggedized smart phones and PDAs used in enterprise operations needed to be replaced because of damage or failure, compared to just 18.2 percent of ruggedized models.

Enterprise users need smart phones that are designed to prevent the leading causes of device failure, which include screen damage, antenna problems and lost peripheral functionality. They also need devices that provide a stable operating system and development environment so that software applications and development skills can be leveraged over the lifecycle of the device and subsequent deployments.

As Figure 1 shows, there is a large difference in the duty cycles of ruggedized and commercial grade handheld computers and smart phones, but the difference is the result of many smaller factors. The device housing, screen material, antenna placement and internal components all play a part. The following sections explain what makes smart phones rugged and how to decide what is required for specific work environments.

Temperature Testing

Ruggedness Ratings

Ruggedness is not only desirable for enterprise smart phones, it is measurable. There are several credible, standardized and practical measures of ruggedness that are good indicators of how smart phones can withstand the rigors of enterprise operations. These include Ingress Protection (IP) ratings, MIL standard (MIL-STD) conformance and other certifications. Unfortunately, there are also non-credible, subjective measures that manufacturers use to suggest ruggedness. These include inappropriate drop test and other ratings and claims that are difficult to verify. "Rugged" "durable" and "enterprise" are subjective terms; IP ratings, MIL-STD certifications and UL listings are not.

IP ratings are the most useful and appropriate measures of mobile devices' ability to withstand work environments. Other credible ratings and certifications include MIL standards (MIL-STD) and NEMA ratings.

MIL standards are set by the U.S. Department of Defense for equipment to be used by military agencies. There are numerous MIL standards for resistance to shock, vibration and other conditions. MIL standards are useful, but there are many of them, so it can be difficult to determine which standards are appropriate to the work environment.

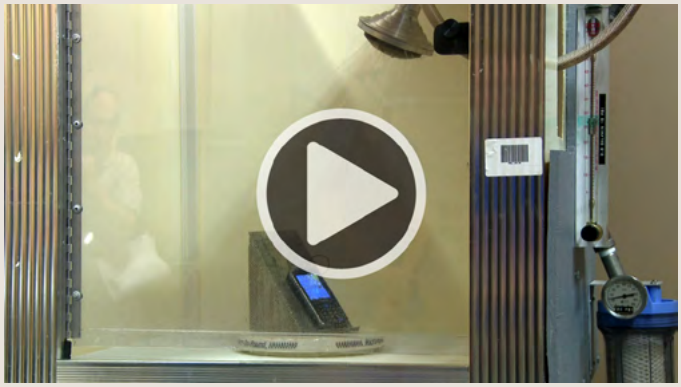
NEMA is an electrical industry trade association that maintains a variety of standards, including enclosure ratings for electrical devices. NEMA enclosure ratings designate how well an electronic product enclosure can withstand exposure to specific conditions and materials in the atmosphere. NEMA ratings are typically used for installed, stationary equipment rather than mobile devices.

IP Ratings

IP ratings are one of the best measures of a devices ruggedness and ability to withstand conditions common to enterprise operations. IP ratings are defined by International Electrotechnical Commission (IEC) standards to provide a measure of how well devices are sealed against dirt and moisture. Ratings are typically expressed by the letters "IP" followed by two numbers. The first digit, which ranges from 0 to 6, indicates the level the device is protected against particles, and the second digit, which ranges from 0 to 8, is the protection against water. For example a mobile computer rated IP42 has level four particle protection, which means it can be penetrated by dirt or other objects up to 1mm wide, and level two water protection, which means the device can function after exposed to dripping water at a 15° angle to the seal. The higher the number, the greater the protection. Smart phones used for enterprise operations should have an IP rating of at least 54, which is considered dust protected and able to withstand splashing water regardless of orientation. Figure 2 below provides a guide to IP code designation.

Drop Ratings

Drop ratings are very useful measures for determining a device's ability to keep functioning and whether the seal will maintain integrity after the device is dropped – providing the drop testing is appropriate and objective. The height of the drop rating is very important and is a big differentiator among products. A three-foot drop may simulate a fall from a pocket or belt clip, but because devices are often used at chest height when reading the screen or entering data, four-foot drop ratings are much more appropriate for real-world conditions. It is important to read product spec sheets carefully, because some manufacturers rate their products to drop to a carpeted or vinyl floor or plywood, while others set a higher standard and measure drops to concrete. Also note if the device is rated to withstand a drop when landing on any side or a corner. Corners and seams are most vulnerable to impact. Some tests are conducted so the device falls flat and/or only lands on reinforced areas.



IP Ratings

It is important for organizations to test devices at actual working temperatures. In drop tests, devices that are used at consistent temperatures (e.g. inside or outside most of the time) perform differently than devices that frequently transition among indoors, outdoors and vehicles. Transition testing also reveals whether the display will fog and become unreadable when the device moves between warm and cool environments.

Component Considerations

Leading sources of failure for smart phones include their antennae, screens and radios. Therefore it is advantageous to choose models in which these components have been ruggedized and designed for higher performance. It is generally advantageous for antennas and other components to be integrated within the device housing, rather than protruding from the device or connecting through an I/O port. Integrated antenna and other components are protected, and internal construction can also make the device easier to use.

Figure 2: IP Code Designations

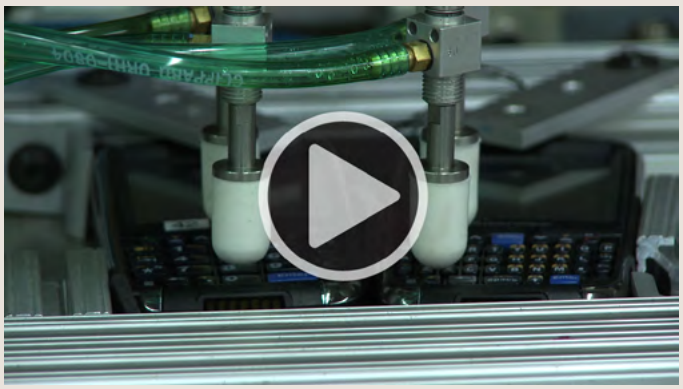
1st digit – particle protection level	2nd digit – moisture protection level
0 Not protected	0 Not protected
1 Protected against penetration by objects larger than 50 mm	1 Protected against dripping water
2 Protected against objects greater than 12mm	2 Protected against dripping water when tilted up to 15N
3 Protected against objects greater than 2.5mm	3 Protected against spraying water
4 Protected against objects greater than 1.0mm	4 Protected against splashing water
5 Dust protected	5 Protected against water jets
6 Dust tight	6 Protected against heavy seas
	7 Protected against the effects of immersion
	8 Protected against submersion

Source: Underwriters Laboratories.

Screen & Keypad Keys
As noted, when smart phones are deployed for enterprise operations, the screen is used differently and more harshly than when the devices function primarily as phones. Low-cost, entry-level screens should not be used in operations that feature repeated electronic form data entry and signature capture via stylus. A tethered stylus is advisable, because it helps prevent the stylus from being lost, and a plain pen used in its place will cause damage to touch panels. Screens are also prone to cracking when dropped, so hardened, crack- and scratch-resistant models are beneficial. Similarly, keypads and control buttons should be sealed to prevent particles and moisture from reaching internal components, and wear resistant so the key is still readable after a month of use.

Peripheral Issues
Integrating bar code scanners, RFID readers, GPS and other functionality into the smart phone helps reliability and worker productivity by eliminating potential points of failure represented by multiple, additional peripheral devices. Because failure rates for peripherals are generally higher than failure rates of ruggedized enterprise smart phones and handheld computers, devices with integrated functionality are generally more cost effective over the deployment lifecycle. Cables and connectors are especially prone to damage, and can become expensive to replace when supporting a population of mobile users. When external peripherals must be used, Bluetooth provides an effective, low-maintenance connectivity option (for more background see Intermec's white paper Benefiting from Bluetooth in Enterprise Mobile Computing Environments).

Most mobile devices engineered for enterprise operations have bar code readers and other commonly used peripherals built directly into the device. The integrated functionality contributes to the purchase-price difference between enterprise and commercial grade smart phones. When comparing costs, it is important to make apples-to-apples comparisons. For example, if operations require bar code scanning and a commercial smart phone doesn't offer it, the cost of purchasing peripheral scanners should be factored into the total device cost. An interface and device controls may also need to be developed, because many mainstream smart phones and PDAs do not have native support for scanners, printers and other peripherals.



Keypad Key Testing

The Case Against Cases
Some organizations try to "ruggedize" their smart phones by using protective cases. Cases provide some protection, but will not bring smart phones up to the IP54 level recommended for use in enterprise operations. There can also be drawbacks to using cases. The case encloses the device, often blocking access to the screen or function keys needed for scanning and other features, without significantly increasing protection against drops and moisture. In fact, cases can collect moisture, leading to condensation and increased humidity that may fog the device screen and otherwise interfere with its use. Cases are best issued to supplement device protection. A case can enhance a phone's durability, but it is no substitute for rugged design.

Ruggedness Provides a Return
The more rugged a device is, the longer it will last in enterprise environments. Research into actual implementations has consistently found that ruggedized handheld devices have significantly longer lifecycles than their commercial- and consumer-grade counterparts. As a result, the average annual TCO for a ruggedized handheld device used for enterprise operations is $2,355, which is 34 percent less than the average annual TCO for commercial grade models used in the same environments. (Source: Total Cost of Ownership Models for Mobile Computing and Communications Platforms Executive Brief. VDC Research, 2010.)

Superior uptime means ruggedized devices enable superior productivity. They also result in lower repair and replacement costs than non-ruggedized models. That is why the documented TCO for ruggedized devices is lower than for commercial and consumer models, even though ruggedized units usually cost more to purchase.

For more data and details about how ruggedness and other issues relate to value, see Intermec's white paper How Ruggedness Reduces TCO for Mobile Computers.

Conclusion

In emerging use cases the smart phone's role is changing, from primarily a communications device to a computer that is used to enter data, access enterprise systems, verify information, complete transactions and document activity. Field professionals need to access the same information as their colleagues in the office, but work in environments where office-appropriate equipment would not survive. Smart phones need to satisfy environmental needs as well as information needs. Ruggedness and reliability are essential.

Consumer-oriented smart phones are inappropriate for many emerging enterprise applications ruggedness and reliability limitations. If smart phones cannot be used reliably and conveniently, worker productivity will plummet, and customer service, revenues and operating efficiency will plummet along with it. The value of a mobile deployment depends heavily on the ruggedness of the devices used, including how well they are sealed against the environment and can withstand drops. In bar code applications, productivity will suffer without an integrated, high-speed reader. Components, ratings and specifications make a big difference in how devices perform and the productivity they will support.

Size, weight and cost have traditionally been the leading smart phone selection criteria, but they are not the most important for emerging enterprise deployments. To maximize value from such deployments it is essential to match the right product to the right work requirement. To make the project a success, device ruggedness, integrated functionality, software compatibility and ease of use must all be evaluated. Failure rates are high for devices that are not engineered for field professionals. Beware of unsubstantiated ruggedness and performance claims, and cost-benefit analyses that do not realistically account for device support, repair and replacement.

The considerations and details presented in this paper will help enterprises quickly sort the hundreds of smart phone options to a few devices that are truly appropriate for their operations. The process may seem daunting, but many organizations have successfully navigated the enterprise smart phone selection process and implemented productivity-enhancing solutions that provide both rapid ROI and long lifecycles.

About Intermec

Intermec offers a complete range of ruggedized computing, communication and data collection devices to meet enterprise needs. We have been developing ruggedized mobile computers and data collection equipment for more than 40 years and have successfully integrated hundreds of thousands of devices into demanding industrial, field service, healthcare, delivery, logistics, retail and other environments. The Intermec CS40 combines mobile phone, bar code imaging, digital camera and Windows Mobile computing capability into an IP54-certified handheld that is the smallest rugged Universal Mobile Telephone System (UMTS) device on the market. The CS40 is rated to withstand multiple four-foot drops to concrete, has an accelerometer, internal antenna, GPS and 2D bar code imager, strengthened touch panel and durable keypad, but weighs just 196 grams. The CS40 was engineered for the enterprise. It runs the Windows Mobile 6.5 operating system, is Cisco CCX 4 certified and has native support for remote device management. It was designed specifically for use in challenging enterprise environments, where Intermec has years of experience and thousands of successful installations.

Intermec Inc. (NYSE:IN) develops and integrates products, services and technologies that identify, track and manage supply chain assets and information. Core technologies include rugged mobile computing and data collection systems, bar code printers, label media, and RFID. The company's products and services are used by customers in many industries worldwide to improve the productivity, quality and responsiveness of business operations. For more information about Intermec, visit http://www.intermec.com or call 800-347-2636.

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