

Rugged IT

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A Market in Flux

Compared to its high-volume, nonrugged sibling, rugged computing is a niche market. But it had been a consistent growth market during the past decade until the recession.

Demand for handheld rugged computers, which had been the strongest part of the market, nosedived in 2009, by as much as 30 percent in some segments. Although the large form-factor market was shielded to some extent by procurements budgets that were already in place, the recession's effect began to show in that area, too, with a noticeable dip in demand in 2010.

Industry observers are focusing on how the market recovers and develops going forward, given the budget constraints that organizations face, particularly those in government. The small form-factor market bounced back well in 2010, according to market watcher VDC Research, with 20 percent revenue gains in the overall rugged market. However, the outlook is unsettled.

"In a recent discussion with a utility in Florida, which has been a long-term user of rugged notebooks, it said it was faced with deciding whether or not it really needs fully rugged boxes for its applications or whether it can instead use business rugged machines with flash drives," said David Krebs, director of VDC's mobile and wireless practice. "Or if it even needs a notebook at all and could get away with using a tablet."

Nearly every major procurement of rugged computers is going through the same scrutiny now. A lot of organizations are looking at things such as rugged handheld computers and instead deploying smart phones and trying to live with the failure rates, Krebs said. However, many of them are realizing that those failure rates cause workflow interruptions, which in turn affect productivity and worker morale.

"So it's a fine line," Krebs said.

Based on published solicitations only, rugged procurements in government might be on the rise because more solicitations have the word "rugged" in the specifications, said Tim Collins, director of defense and intelligence sales at Panasonic Corp.'s federal unit. However, when they finally decide on a product, many organizations decide to just go with a cheaper unit, which might not be suitable to users' needs.

"You have to be careful when you deal with customers about what rugged really means," Collins said. "Customs and Border Protection has been ordering quite a few computers to take

out in their trucks, for example, but it needs truly fully rugged because its systems are out in places such as the Mexico/Arizona border, and they're really banging on those things."

Most users understand the level of rugged devices they need to support their mission, he said. The challenge usually comes when the process gets to the contracting phase, which is usually the responsibility of people in a different part of the organization and for whom price is often the major factor in a purchasing decision.

"And that's our challenge, to make sure those folks truly understand the mission that these computers are being purchased for," Collins said.

One catalyst for more rugged systems is organizations' need to move more computing and communications devices to people in the field. That's certainly true of the military, by far the biggest user of rugged systems in government.

That's a major reason why companies such as Crystal Group Inc., which provides rugged servers for military applications, have observed an increase in demand for rugged technology in recent years. The market for such systems has evolved from standard commercial technology to more rugged commercial tech, said Todd Prouty, Crystal's business development manager. As those systems in the field become more prevalent, the need for more reliability becomes more critical.

"The Navy, for example, has had some events that have happened in the past where the regular [commercial] products have not been lasting as long as it needs them to, and that has prodded it to move to more rugged systems at the server level," Prouty said. "We use [commercial] components in the servers themselves, but the chassis that carries them and that we provide is more rugged."

For government, an advantage of the shifting market is a likely drop in the price of rugged systems. More companies have moved into the government rugged market, so there is more competition for the same opportunities. And rugged technology will likely remain a growth market after the effects of the recession wane.

"The growth rates are lower for government than for nongovernment," VDC's Krebs said. "But I'd still put them in the midsingle digit range." ▲



The Smart-Phone Effect

Although no one is claiming that smart phones will take the place of fully rugged handheld computers, the accelerating use of the devices in the enterprise is fueling the rapid overall growth of mobile computing and communications. In addition, smart phones are increasingly influencing mobile users' expectations for functionality and ease of use.

In government, the military has been taking the lead on the potential use of smart phones. Speaking to government contractors in April, Defense Department CIO Teri Takai said a key priority for DOD is the adoption of mobile technologies, adding that there is a growing demand for consumer mobile technologies such as the Apple iPhone and Android-based smart phones.

Also in April, the Army announced it would develop a prototype device, named the Joint Battle Command-Platform Handset, that would run on the Android operating system.

Smart phones and handheld devices will indeed play a more important role in warfighter missions, said Terry Edwards, director of system-of-systems engineering at the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology. However, it's unlikely that regular commercial handsets will suffice. Those can handle a lot of abuse from an average user, Edwards said, but the devices will need to adhere to specific rugged standards for military use.

Other considerations include the devices' performance and ability to run tactical applications.

"Depending on the mission, a commercial rugged smart phone could play a significant role," Edwards said. "A rugged handheld device will be a necessity, and centralized control of applications for interoperability will be essential, as well."

It's a wide open field now. The only rugged devices that come close to the smart phone's capability are those such as Panasonic Corp.'s Toughbook U1 Ultra, which, with a 7.2-inch by 5.9-inch footprint, is smaller than any computer or tablet, but at just more than 2 inches thick, it's still a good deal bigger and chunkier than a smart phone. That device won't slip easily into someone's jacket pocket.

However, its display comes with a 1,024 x 600 resolution, and it contains an Intel Atom processor, which means it can run a complete Windows 7 operating system and not a cut-down derivative, such as Windows CE.

Those details are important when defining the characteristics of a rugged smart phone, said Tim Collins, Panasonic's director of defense and intelligence sales. The magic goal would be something like Dick Tracy's wristwatch, but the question is what you can pack into a phone, because as you reduce the real estate, you also reduce the capabilities of the device.

"Everyone is certainly driving to that form factor," Collins said. "But we've taken the decision that we won't produce products that can't fit into the rugged area."

However, it depends on how rugged you need your device to be. For example, the Motorola ES400 looks more like a regular smart phone and, though not fully rugged, is rated as exceeding Mil-Std 810G for rain and IP42 standards for water ingress. Other similar durable products span the commercial smart-phone and fully rugged worlds.

The military is looking to use smart phones for a variety of functions, said David Krebs, director of VDC Research's mobile and wireless practice. At the high end, dominated by fully rugged technology, troops would use them with specialized applications such as sniper bullet location, call for fire, two-way translations for talking to locals, and situational awareness applications.

But smart phones also are useful for tasks such as access to training and maintenance manuals, recordkeeping, medical records, and approval of leave passes, which don't require high-end rugged devices. In other words, it will be a matter of choosing the right horse for the course.

"I think with the miniaturization of some of the components that will go into these phones and what they're doing in terms of leveraging new kinds of composites for the casings, they'll be able to deliver a device that meets the rugged spec in a much more ergonomic product," Krebs said. "I mean, just look at the evolution of these rugged handheld products over the past 10 years. It's gone from something that looked like a brick to where, today, they are quasi-pocketable."

What it will also do is expand the overall rugged device market because these phones are not displacing anything, he said. Yes, troops carry tactical radios and use head-mounted displays, "but for the most part, it's not as if these guys are running around with a rugged tablet that these phones will replace," he said. "So it's a net new opportunity." ▲



COTS and the Dismounted Soldier

The history of computing and IT in the military has been one of large systems, located well away from the battlefield, that gathered intelligence, analyzed the data and then funneled information as needed to the fighter on the battlefield. The focus on the future will be to put as much of that capability as possible at the tip of the spear.

“An important focus [is to provide] more intelligence to the dismounted warfighter, [and] this will change the face of the current ruggedized systems,” said Terry Edwards, director of system-of-systems engineering at the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology. “Rugged commercial hardware today is beginning to withstand more and more of the environmental and tactical mission requirements. The trends are expected to continue.”

The Army’s tactical systems are a mix of mostly commercial off-the-shelf (COTS) rugged solutions. Both semirugged and COTS equipment are mounted in specialized operational transit cases that provide stabilization and cooling for use in a mobile environment, as well as some fully rugged systems.

Future rugged IT will be driven by the need to deliver services and applications through a cloud environment to smart phones and handheld devices so that soldiers can perform critical tactical command and control functions, Edwards said. To do that, “devices will need to be smaller, faster and lightweight [and] will need to be wearable or fit within the warfighter’s cargo pockets,” all of which puts added emphasis on reduced size, weight and power requirements.

It’s a major switch in the way that systems will be designed and deployed, said Todd Prouty, business development manager at Crystal Group Inc. What used to be compute power contained in an IT shelter that was static and environmentally controlled is now going almost completely out to dismounted soldiers and their handheld devices.

That kind of compute capability used to require a hangar’s worth of servers and other equipment. But all those servers are being virtualized and consolidated so that just a few physical servers contained in portable integration racks can be transported and set up quickly to establish a command post in the field.

“And you need docking stations to charge those handhelds, you need systems to support them and to get the data on and off those forward deployed systems and to uplink them,” he said. “We are now seeing distributed processing with reach back capabilities as a key driver for how our rugged systems are being deployed today, compared to the way they were being used five or 10 years ago.”

Also, it’s not just the classic computer or server that’s in demand, he said, but increasingly its integrated systems such as a server with 80T of Redundant Array of Independent Disks storage that users want to be portable and rugged.

A major contract under which the military gets its rugged systems is the Army-led Common Hardware/Software-3 (CHS-3), the latest in a line of similar contracts that stretches back to 1988. The 10-year CHS-3 had a \$2 billion ceiling when it was awarded in May 2003, but that was last raised in 2010 to close to \$2.7 billion, with a \$187 million contract modification to prime contractor General Dynamics C4 Systems Inc.

Between 60 percent and 70 percent of the delivered CHS-3 products have been rugged systems, and the popularity of those systems means the ceiling on the current contract might be raised even higher before the new CHS-4 contract is in place. That contract was expected to be awarded by the middle of 2011.

It’s not all smooth sailing, and there are ongoing issues with the development of rugged systems. There’s continual pressure to reduce size, weight and power requirements, which raises technical questions. For example, existing computing systems use multiple high-speed cores that are hard enough to cool in a regular office environment.

That will change in the future as lower-power processors evolve, but for now, in a forward-deployed environment, rugged systems need some fairly innovative and unique solutions, such as built-in water cooled radiators.

The main problem for Edwards is the short technical life cycle of rugged IT systems that, based as they are on commercial technologies, have to follow the life cycles of the various commercial components, processors, chips and

memory that go on a motherboard. By the time a system is developed, tested and fielded, at least one year of its life is gone.

It's a problem that the Army has tackled on the back end by a critical support strategy in CHS-3 with significant warranties, in-theater quick turnaround support and repair, Edwards said.

Availability and customization are also significant problems, he said.

"COTS rugged IT equipment takes a significant amount of time to develop, evaluate and test to meet mission requirements," he said. "And they are not readily available at your local consumer computer store. These rugged IT products take a substantial time to procure, further impacting the usable life cycle of COTS-based technologies."

Vendors are having to learn that these are the new facts

for doing business in rugged systems with the government, Prouty said. Given the kind of budgets people have to keep up with the pace of technology change, he said, Crystal will be putting at least a near-term focus on taking advantage of some these more rapid deployment needs.

In the past, the military services have settled for going to a large contractor for these systems and having them develop a custom piece of gear to do that, he said. Then they'd wait for as long as three or four years for the product to be ready.

"What we're seeing now is that organizations wanting to use COTS equipment in that rugged environment don't want to wait, they want something in as little as two weeks sometimes," he said. "Well, if it's off-the-shelf, we will supply it that quickly."

Customization takes a little longer, he said, but only a few months. Multiyear development horizons are no longer tolerated. ▲



Technology Drivers of Rugged IT

As the trend toward more forward deployment of high-end computing and communications develops and users increasingly turn to commercial products to provide those capabilities, the future of rugged computing is clearer. Reduced size, weight and power requirements and the push to outfit troops on the ground with more powerful systems point to the need for certain technologies.

Solid-state memory, for example, would seem to be an ideal fit for the smaller and lighter future rugged systems. Just a few years ago, that wouldn't have been the case because solid-state drives had much lower storage capacity than spinning hard drives and were many times more expensive.

That's not the case today. You can buy 120G 2.5-inch internal solid-state drives for less than \$300, and their reliability is well known. That's still more expensive than spinning hard drives, which go for about \$100 per terabyte, but given their inherent shock resistance and durability because they have no moving parts, they fit the rugged movement perfectly.

A lot of the past failures associated with computing systems, such as notebooks – even the rugged variety – can be attributed to failure of hard drives, said David Krebs, director of VDC Research's mobile and wireless practice.

"If you can eliminate that or reduce it significantly through introducing a solid-state solution and you can do it in a packaging that is slightly less rugged and therefore slightly less expensive, then that's certainly something that can open doors that may not have been so welcoming before," he said.

It's not always that clear cut, said Tim Collins, director of defense and intelligence sales at Panasonic Corp.'s federal unit. Although he claimed Panasonic's failure rate for its spinning drives is very low, he said that other manufacturers couldn't get their drives to the point where they could be certified as rugged.

Although solid-state drives have advantages, they're not infallible. They don't have the susceptibility to movement and vibration that spinning drives do, Collins said, but they are more susceptible to other elements, such as heat and cold. But it's a customer-driven business.

"Because customers have asked for it, we are now offering solid state as an option on almost all of our products," he said. "It's obvious that the customer believes there is a value to it."

Screens that are more readable – particularly in direct sunlight – lighter and more energy-efficient are also a requirement for future rugged systems. Because the assumption is that units with these displays will be wearable and in the field, displays will need much higher nits, Collins said.

A nit is a measure of light expressed in candelas per square meter. Notebooks used in office-lit conditions generally need displays that measure in the 200- to 250-nit range. Displays used in direct sunlight outdoors will need to register 1,000 nits or more.

Flexible displays demonstrated at the 2010 Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance On-the-Move (C4ISR OTM) exercises held at the New Jersey Joint Base showed that users could successfully display video from UAVs and the user interface from a battle command software system on an ultra-rugged mobile PC worn in a land warrior vest, said Terry Edwards, director of system-of-systems engineering at the Office of the Assistant Secretary of the Army for Acquisition, Logistics and Technology.

"The success of this demonstration has led to plans for a more powerful, flexible display prototype with the capability to insert a smart phone" for use in missions, Edwards said. "In the end, it's all about providing the warfighter with the best possible equipment for accomplishing a successful mission."

And rugged systems are increasingly taking advantage of general-purpose computing on graphics processing units technology, a hybrid, multicore architecture that allows for much faster processing of the kinds of data used in C4ISR applications.

You can put many of those multicore processors into a single card and then fit multiples of those cards into a rugged chassis, essentially providing supercomputer performance in a relatively small, rugged system. The Lawrence Livermore



National Laboratory recently partnered with Crystal Group to develop an advanced, rugged signal-processing system that could process 3-D sensor data in real time.

It's a trend that will definitely continue, said Crystal's Todd Prouty, but those systems come with certain challenges, such as how to cool them.

"When you have that many cores on cards that are densely packaged, it's very hard to cool even in a normal office

environment let alone in a forward-deployed situation, where the operating temperature can be anywhere between -20 degrees Celsius and 55 degrees Celsius," he said. "And one thing the warfighter doesn't like to see is his IED detection systems slowing down because it's getting hot."

But given the demands for the kinds of computing power that agencies want to provide to the ultimate end user, rugged systems vendors will need to find a way to incorporate these and other technologies into their products. ▲



The Growing Allure of Business Rugged

Talk all you want about the advantages of rugged systems, but organizations have only so much money to spend — and budget constraints are getting tighter.

Purchasing decisions will mostly depend on the intended uses for the rugged equipment. Mission-critical applications need a level of assurance that only fully rugged systems can guarantee, though some organizations have tried to accomplish the same tasks with less than fully rugged products.

“We see the same mindset in government as we do in the commercial sector, where people say they have to equip a thousand users, this is our budget, and this is how we are going to go about doing it,” said David Krebs, director of VDC Research’s mobile and wireless practice. “Obviously, some people are pushing the envelope too far and are failing as a result.”

However, a growing class of equipment, known as business rugged systems, is available to organizations that are figuring out what rugged means and what it can do for them.

None of the recognized standards for ruggedness, such as Mil-Std 810G or the Ingress Protection (IP) ratings, covers anything called business rugged. Roger Kay, president of consulting firm Endpoint Technologies Associates, tried his hand several years ago at defining a scale of ruggedness that included systems such as business rugged and even durable, but it never caught on.

According to his definition, business rugged would meet certain standards for drops, vibration and ingress tests, but those results wouldn’t necessarily need to be independently verified by a certified testing laboratory, as those for fully rugged or semirugged systems need to be.

Even as the perceived need for rugged systems increases, it’s still a challenge to get some people to understand why certain products are designed for battlefield use versus less-taxing applications, such as emergency medical care or border patrol duty, said Panasonic Corp.’s Tim Collins.

Then there are people such as field insurance adjusters who investigate accidents and want something that is somewhat durable and can withstand water because they’ll sometimes

carry it in the rain and then throw it in the back of a truck, he said.

“They are looking for an administrative product that’s going to be used in a more clean environment, and they just want it to be impervious to water, 4-foot drops and those kinds of things,” Collins said. “They are looking into what kind of rugged mobile system will work for them, and for those kinds of applications we are seeing the growth of business rugged in various places in government.”

It could also be that organizations’ attempts to cut costs during the past few years by stepping away from rugged and going with commercial products such as smart phones could lead to more use of business rugged, as a partial step toward the superior total cost of ownership (TCO) presented by rugged systems.

VDC, for example, said it tracked an increase in average failure rates for enterprise-deployed devices leading into 2010, driving TCO once again to the top of their IT investment criteria. And in various studies, VDC has found that the annual TCO performance for rugged devices is some 40 percent better than for nonrugged.

It won’t impact those organizations that regularly use fully rugged systems for their mission-critical capabilities, said Collins, because they tend to be well aware of the value of them for their mission. If budget is an issue, they opt to buy less of the rugged units rather than turn to the cheaper devices.

But for others, there are options.

“Things that we do with our systems [include adding] handles that help protect them from drops, using magnesium casings and waterproof membranes,” he said. “If they don’t need their systems to be impervious to the kind of dust you get in Afghanistan, and don’t need them to be protected against driving rain, then many people can use what we are calling the business rugged standard.”

Given the people who are now looking for rugged and durable systems in certain price areas, he said, business rugged is definitely an expanding niche market in government. ▲



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