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The Risks of Sticking with Legacy Technology

By Daniel Burrus, CEO of Burrus Research

It's akin to that pair of blue jeans you continued to wear as a teenager, despite your mother's protests.

"How in the world can you go out in public like that?" she'd exclaim. "There are holes in the knees that are bigger than your head!" "Mom," you'd reply with a noncommittal shrug. "They're comfortable."

Move that anecdote onto a larger stage and you have a fairly accurate picture of how many organizations look at legacy technology—systems, software and other tools for which the best, most productive days are well in the past. Why do organizations stick with such outdated technology?

"They're what we're used to," comes the reply, with the corporate equivalent of an indifferent shrug.

> *Continuing to use outdated technology can be exceedingly costly*

In a world characterized by exponential change, that can prove a serious miscalculation. Continuing to use outdated technology of all sorts—particularly when suitable upgrades can readily be found—can be exceedingly costly. Moreover, the cost to your organization may not be limited to mere finances.

Legacy Technology Defined

One online definition of legacy technology describes the term as referring to "an old method, technology, computer system or application program, of, relating to, or being a previous or outdated computer system."

As it happens, this particular definition goes on to point out that legacy technology is often framed in a negative light, meaning that the system is rather outdated and, in fact, would greatly benefit from an upgrade or replacement.

That may sound like a bit of editorializing, but there's no getting around the fact that legacy technology is pervasive. An article by Saca Technology titled "Top Five Most Impactful Legacy Techs" details some of the most troubling suspects:

• **Mainframes.** As the article notes, even newly manufactured mainframes are often saddled with running applications written with out-of-date programming languages.

• **COBOL.** The common business-oriented language created in 1959 is still used widely by both the federal government and business.

• **OS/2.** Although the last official version of OS/2 was released in 2001, the system is reportedly still being used by various ATM companies around the world as well as several major metropolitan mass transit systems.

That may come off as a bit abstract but as several recent news items can attest, organizations of all

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TECHNOLOGY NEWS HIGHLIGHTS

Smart Socks

It has been reported that every year, in the U.S. alone, 1.5 million people with diabetes will develop a foot ulcer. Of those ulcers, 25 percent don't fully heal, leading to 100,000 amputations. But with early detection, more than 70 percent of them could be prevented, which is what has prompted the development of Smart Socks—wearable technology that can monitor changes in foot temperature that may signal the onset of a potentially life-threatening infection.

Foot ulcers develop as a result of injury that goes untreated. They occur more commonly in diabetics because of slower healing rates due to poor circulation, as well as reduced sensation from nerve damage due to prolonged high glucose levels.

One of the earliest signs is skin inflammation, which is generally accompanied by a rise in skin temperature. Smart Socks are designed to monitor changes continuously over time rather than simply taking periodic measurements in order to better distinguish normal variations (e.g., from environmental factors) from sustained temperature changes.

Multiple sensors in each sock are connected to a transmitter that relays information to a smartphone app. The goal is to give patients the tools they need to spot anomalies early.

The socks are machine washable and require no charging. The company is currently accepting pre-orders at a discounted price of $120 for a pack of seven pairs.

For information: Siren Care, 814 Mission Street, 6th floor, San Francisco, CA 94103; phone: 628-444-9603; website: https://siren.care/

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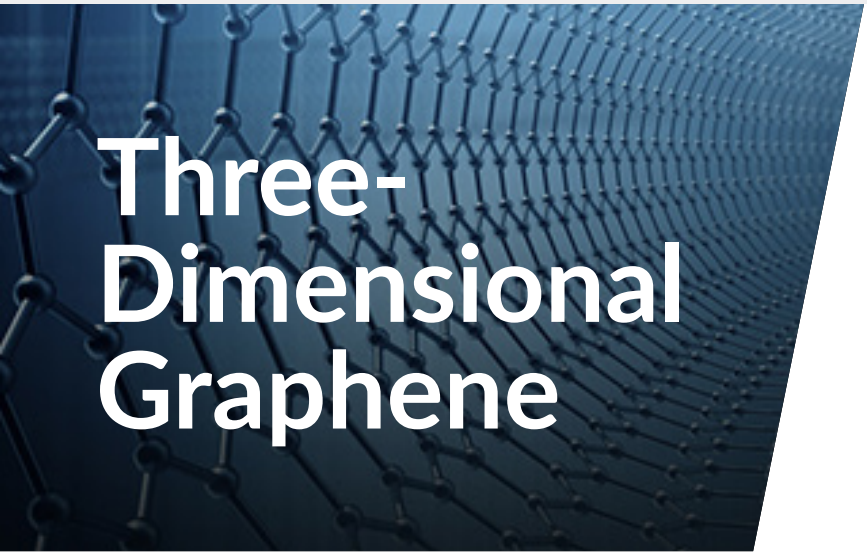
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Three-Dimensional Graphene

Graphene—a two-dimensional form of carbon that's only one atom thick—is considered to be the strongest, thinnest and most conductive material known to man. At the same time, it's incredibly flexible, transparent and a perfect barrier that even helium cannot pass through. It's no wonder that for more than a decade now, finding potential applications for this revolutionary material has been one of the fastest-growing areas of research.

In its two-dimensional form, graphene has been considered impractical for building purposes, but a team of scientists recently developed a method for creating a three-dimensional geometry out of graphene using a combination of heat and pressure. The resulting material, although porous and lightweight, was shown to be 10 times stronger than steel, with only 5 percent of the density. Used in construction, lightweight, three-dimensional graphene could dramatically reduce labor and shipping costs. It could also be used as a filter for water or air to create greener buildings. And since carbon is mechanically and chemically stable, the material is environmentally friendly as well.

One big drawback is that graphene is prohibitively expensive for use in large-scale construction. However, other organic molecules like proteins, cellulose and silk may also be designed with a similar porous geometry.

Perhaps the most exciting application is in space. A structure of three-dimensional graphene could conceivably extend beyond the earth's atmosphere, bringing the idea of a space elevator for shipping supplies to build space stations and even space colonies one step closer to reality.

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Self-Driving Platform for Cars, Trucks and Factories

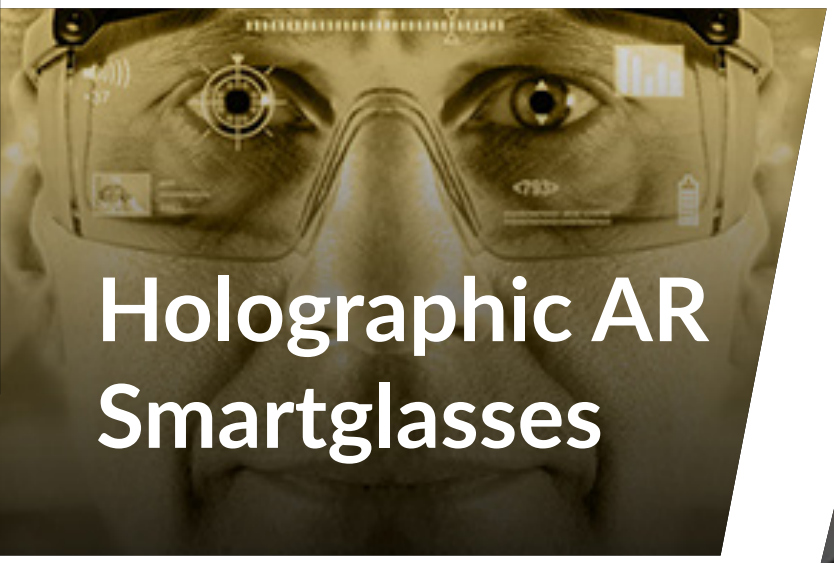
One year ago, we reported on the release of the NVIDIA DRIVE™ PX 2 Self-Driving System for the automotive industry. Now, a leading tier-one supplier has announced a new system, based on the NVIDIA computing platform, that will bring the same deep learning capabilities to a wider range of industries.

The ZF ProAI platform takes autonomous driving systems beyond self-driving cars to trucks, buses and even industrial applications such as forklifts and material-handling vehicles. It processes inputs from multiple cameras, lidar (light detection and ranging), radar and ultrasonic sensors using a process they have dubbed "sensor fusion." This enables the vehicle to construct a 360-degree view of its surroundings and locate

itself on a high-definition map so it can navigate safely through traffic. It also includes applications that allow vehicles to communicate with each other in a form of "swarm intelligence" so that multiple vehicles learn from each other faster than any one vehicle can on its own.

Just as AI promises to reduce accidents and congestion in traffic, technologies such as this will undoubtedly help businesses overcome these same challenges while improving safety and efficiency.

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Holographic AR Smartglasses

For decades, companies have been working on developing holographic eyepieces to address the augmented reality (AR) market, which is expected to grow to $90 billion by 2020. Most of the solutions to date are bulky and expensive with unexceptional picture quality. But recently, a leading supplier of materials and systems for holography decided to repurpose its patented holographic data storage technology to develop prototype displays that provide good performance at a reasonable cost.

Over the past two decades, HoloMirror technology has been developed and refined to produce complex holographic recording systems, but along the way, the company gained unique insights into the use of holography to create the most elusive component of AR—the display. Utilizing high-performance polymers, and combining a multitude of holograms in a single layer, the method enables better control of the quality and size of the images to optimize performance. The result is a more vivid color spectrum and a wider field of view (the goal is 60 degrees) than has ever been achieved. Best of all, the headset itself will consist of a thin, transparent eyepiece to combine a seamless view of the outside world with a computer display.

The company hopes to have prototypes available for testing by summer of this year.

For information: Akonia Holographics, 2021 Miller Drive, Longmont, CO 80501; phone: 303-776-1968; email: info@akoniaholographics.com; website: http://akoniaholographics.com/



Remote Rehab Monitoring

Dutch researchers are working on a high-tech suit that would help clinicians monitor stroke patients in their homes, a major advance that could revolutionize rehabilitation regimens. The project is yet another example of how a myriad of new technologies—small sensors, smart fabrics and advanced data collection—can come together to improve lifestyles as well as patient outcomes.

The suit is designed to be worn underneath the clothing for up to several months. A total of 41 sensors track a variety of variables, including strength, flexibility and gait as the patient performs "real-world" tasks like getting out of bed, navigating around the house and cooking a meal. The sensors are connected wirelessly to servers where the data is filtered and processed to provide therapists with relevant metrics. The system represents a growing trend toward acquiring a more complete picture of patient progress by collecting information relating to daily life activities around the clock, rather than relying on intermittent clinic visits.

Although the research is currently focused on stroke patients, future systems could be adapted for other forms of physical therapy as well.

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Watson the Robot

The future of IBM's cognitive computing technology was the topic of a recent World of Watson conference. Among the areas being explored is the idea of "embodied cognition"—in other words, putting Watson artificial intelligence (AI) into robots, avatars and even "smart" spaces. The goal is to bring Watson's ability to reason and understand closer to the ways in which humans interact.

While it's not too difficult to envision what this would mean in terms of a physical device such as a robot, applying a neural network to an avatar (which is basically a model of the musculature of a human face) takes things to a whole new level by giving it the ability to express realistic emotions and reactions.

And IBM has already been experimenting for years with a smart boardroom—a technology that the company refers to as "Watson in the Walls." Sensors and actuators throughout the room are connected in a way that allows Watson to interact with the occupants. Using a technology called Debater, it could even go so far as to carry on a debate by assimilating and summarizing information faster than humans ever could.

The possibilities are pretty much unlimited, with smart spaces being anything from a car to a cockpit to a patient's hospital room.

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Software That's Truly Creative

Google's latest artificial intelligence project—known as Magenta—is aimed at developing

software capable of generating ideas. Drawing on Google's recent research into artificial neural networks, the goal is to help professionals such as artists, musicians, architects and writers by offering creative suggestions.

For example, Google has developed prototype software that can take a handful of musical notes and extrapolate them into a short song based on an analysis of 4,500 pop-music tunes. The next step may be to augment this capability with an approach Google has already incorporated into its AlphaGo software (which beat one of the world's top Go players earlier this year). Known as reinforcement learning, the software acquires new skills by maximizing rewards, similar to the way you would train a puppy. Such a technique could make the software capable of more complex works.

Whether or not software will ever achieve artistic autonomy is still debatable. Only time will tell if neural networks are capable of moving from imitation mode to becoming purely creative.

For information: Google, Inc., 1600 Amphitheatre Way, Mountain View, CA 94043; phone: 650-253-0000; website: https://www.google.com/about/



Predicting Criminal Behavior

Although it has not been officially published, a recent study on the use of facial recognition to distinguish criminals from law-abiding citizens is fueling controversy over appropriate applications for machine learning.

The report, which appeared in an online, open-sourced journal, claims that the software was able to correctly identify criminals from photos with 90 percent accuracy by analyzing three facial features: upper lip curvature, inner eye corner distance and nose-to-mouth angle.

The artificial intelligence system was first trained with 1,670 pictures of Chinese men, half of whom were convicted criminals.

It was then presented with an additional 186 photos and asked to identify criminals and non-criminals.

Based on this, the researchers determined that criminals have a greater degree of dissimilarity in facial features than non-criminals. In addition (supposedly), on average, the nose-to-mouth angle is 19.6 percent smaller, lip curvature is 23.4 percent larger and inner eye corner distance is 5.6 percent shorter in criminals.

As with previous attempts to judge a person's character from appearance alone (e.g., physiognomy in ancient Greece and craniometry in 19th-century Britain), the results of this study are dubious, and the danger of using such technologies for "predictive policing" may far outweigh the benefits.

More research is needed before tools like this are widely deployed.

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The Risks of Sticking with Legacy Technology

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sorts know all too well the risks that out-of-date technology can pose:

• In July 2016, Southwest Airlines canceled 2,300 flights when a router failed, delaying hundreds of thousands of passengers. A few weeks later, Delta Air Lines grounded 451 flights in a single morning.

• It's not just the airline carriers themselves that are vulnerable to the risks of legacy technology. In November 2015, Orly Airport in Paris was forced to ground planes for several hours, stranding thousands of passengers. The cause: the airport's weather data management system, which was running on Windows 3.1, crashed in bad weather. At the time, the system was 23 years old.

• In a more recent episode, British bank Tesco shut down online banking in early November after 40,000 accounts were compromised. Additionally, roughly half of those accounts were compromised by hackers committing fraudulent transactions. Andrew Tschonev, technical specialist at security firm Darktrace, was blunt in his assessment that outdated security measures were a primary reason for the breach: "With attackers targeting everyone and anyone, today's businesses cannot safely assume that it won't happen to them," he said.

Bad PR? Yes, but Much More Than That

Obviously, high-profile incidents like these don't make for the most glowing headlines. And reputation is naturally imperative for most any organization. But there are even more reasons not to turn a blind eye to outdated, potentially destructive legacy technology:

• **The potential for data breaches.** As Tesco learned to its chagrin, legacy technology is extremely open to cybercrime. For one thing, vendor support is often spotty or completely nonexistent, which can limit valuable upgrades. Further, old technology can't take as much advantage of improvements in security measures as newer systems can. That only furthers overall security risks.

• **It's more expensive than you might assume.** No one will argue that revamping outdated technology can be an expensive proposition. But so, too, can sticking with systems whose best days have come and gone. No matter the particular use, running outdated technology increases operating costs—not only do old hardware versions lack modern power-saving technology, but the systems are also inefficient and cost more to maintain. Here's evidence: A study several years ago by Unisys and MeriTalk reported that the federal government spends more than $35 billion trying to maintain legacy systems—and even with that amount of money, efforts at modernization were still running behind.

• **You may run up against compliance issues.** This can depend on the particular industry you're in but, in many cases, continuing to use legacy technology may make you vulnerable to compliance guidelines. Once a legacy technology becomes unsupported, the vast majority will fail to meet industry compliance standards such as the Health Insurance Portability and Accountability Act (HIPPA). That can result in severe financial penalties.

• **You run the risk of losing customers.** No matter

what industry your organization may be in, offering outdated solutions and ideas that derive from equally outdated technology may only prompt customers to look to someone else with better answers.

• **You run the risk of unreliability.** Many organizations that hold onto legacy systems attribute the decision to the "fact" that the systems still work. That may or may not be the case, but consider what may happen if or when something goes wrong. For one thing, as the airline example underscores, having outdated technology in place only boosts the risk that something eventually is going to misfire (in the case of Delta's shutdown, it was discovered that some 300 of its 7,000 data center components had not been configured correctly). And should something go amiss, older technology may simply not be bolstered by adequate vendor support as manufacturers turn their attention to newer products.

• **It can also be an internal perception issue.** Of course, no organization wants the public image of being saddled with problematic, outdated technology. But in working with organizations of all sizes and types, I emphasize that leaders also need to be aware of the message they're sending to every one of their employees. Consider how an employee—particularly a younger one who's comfortable with technology—might react to having to cope with the limitations and headaches that outdated systems and networks can foster. That's not only an issue of lost productivity, but a possible reason to begin looking for a new employer who's more willing to invest in adequate, up-to-date infrastructure.

"No" Can Be More Costly Than "Yes"

Updating or replacing legacy technology is not entirely devoid of downsides. A potentially steep price tag is perhaps the most obvious concern, but there are others as well.

For one thing, legacy replacement projects can fail or take longer than expected. That can damage credibility on any number of levels, from organizational leadership to IT. Add to that the time and cost involved in system testing, not to mention the time and expense of widespread end-user retraining.

But it begs the question: Are you and your organization rolling the dice with aging technology, or are you identifying the Hard Trends that are shaping the future, including mobility, cloud services, data analytics and virtualization? Further, are you anticipating the need to invest and upgrade before widespread problems occur?

Look back at any of the real-life examples I cited earlier—there's not one organization that wouldn't want to go back and address the issue of legacy technology instead of waiting for something to break down.

That said, before making any decisions, taking into account both Hard and Soft Trends that affect your organization and your industry, assess the overall impact that replacing legacy systems may carry, both positive and negative.

Consider the impact on your customers as well as people within your organization. Be certain that every element for the resulting new system serves a well-defined business goal—both current as well as those in the future.

As I emphasize in my Anticipatory Organization™ Model, saying yes can be expensive. But saying no to updating outdated technology can be even more costly—in any number of damaging ways.

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