



IT IS INNOVATION

JULY/AUGUST 2021



NEXTGEN TV PROMISES BETTER AUDIO/
VIDEO AND ENHANCED DATA SERVICES.

RISING

nextgen TV

Consumer
Technology
Association™





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Consumer Technology Association™



Coming out of COVID

The economy is humming with industry sales setting records, but our industry also faces challenges. Our nation's economy has record growth with Q1 GDP rising to 6.4% and the Fed expecting 7% growth this year. But this reflects pent up demand and is off the low base during the 2020 economy-stopping pandemic.

The president, Congress and both political parties have approval numbers we have not seen in decades, according to a June Harvard-Harris poll of over 2000 Americans. This makes sense. Americans have been cooped up fearing a deadly disease and just got a vaccine allowing them to be maskless with other humans although this may be changing.

But we should not be delusional. Some of the happiness was bought with borrowed money. Our national economic success is a temporary high fueled by "Uncle Sugar" government lavishing cash on many Americans and businesses. Our children and grandchildren will bear the burden of our national debt soon to hit \$30 trillion.

The economy also faces crosswinds. We are in denial about inflation, the lack of workers and other big changes. We are seeing double-digit price jumps in gas, lumber, PVC and



“When it comes to increasing productivity, our industry shines.”

thousands of products. Inflation is a tax that hits the poor and those on fixed incomes. It slows economies, devalues currencies and angers citizens. We have not had double-digit inflation since 1980, so many Americans do not know its horrors.

Inflation has two known cures: higher interest rates and greater productivity. High interest rates cut inflation by blunting demand, and, thus, pricing pressure. Fewer homes and factories get built. Higher interest rates also cripple our federal government. A 10%

interest rate on a \$30 trillion debt means we must spend \$3 trillion on interest and cut almost every non-discretionary federal program, including the Department of Defense.

When it comes to increasing productivity, our industry shines. We fuel remote work, telemedicine, remote diagnostics and new productivity tools including Zoom, Teams, Salesforce and Slack. Robotics, self-driving vehicles, IoT, 5G and smart cities and homes are enhancing and improving our lives.

Artificial intelligence (AI) is the superhero of productivity—and can help slow inflation. It combines the best of machine learning and human problem solving. However, AI's kryptonite is a government uniquely hostile to the tech industry and unfamiliar with how taxes, overbroad and inconsistent regulations on data collection impact investment.

The March action by the new administration and Congress to "stimulate" the economy with \$1400 checks and \$300 weekly non-taxable payments to unemployed workers expanded our debt and shrunk the workforce. The cash incentivized millions of Americans to avoid work when the economy most needed them.

The disconnect between the Beltway and reality has never

been greater. Ten million jobs are open, yet nine million Americans say they are actively looking for jobs. While certainly regional disparities, skill gaps, childcare and COVID explains some of the disparity, the incentive structure is so perverse that the Chamber of Commerce urged the administration and Congress to immediately halt the payment program. I also raised this with Labor Secretary Scalia over a year ago. The lower unemployment rates in states whose governors cut off federal unemployment aid implies the government made a huge mistake in incentivizing unemployment.

Although, the president and Congress had good intentions to alleviate hardship, they incentivized sloth and dependence over resilience. And they are frustrating millions of Americans who cannot eat at their favorite restaurants, get the repairs and products they need, and face long lines as cashiers are in short supply.

As I write this, a bipartisan infrastructure bill is possible as our No Labels/Problem Solvers friends have a deal which is gathering support. The June Harvard CAPS/Harris poll found that four of five Americans want Congress to pass the smaller compromise infrastructure package. So, although there are challenges ahead, there are also rays of hope.

Gary Shapiro,
President and CEO



Advancing Tech

Whether you're spending time this summer at the beach, the mountains or your favorite city spot — this season always flies by too fast. The best moments for me are soaking up the sun on the beach, enjoying luscious peaches, strawberries and watermelon, and biking, running or kayaking. Although we still have a few lazy days left, soon the pace of business will accelerate for autumn.

In this issue, we look at the power of NEXTGEN TV that is providing new interactive experiences. We also examine how close we are to achieving the goal of self-driving vehicles and the promise they offer in safety, efficiencies and independence for the elderly and disabled. And for an inspiring take on self-driving vehicles, we highlight the first Indy Autonomous Challenge to be held at the Indianapolis Motor Speedway on October 23 that was announced at CES. Thirty student teams from over 40 universities and 11 countries, will race their Dallara AV-21 race cars 20 laps hoping to win and helping to solve "edge case" scenarios like avoiding obstacles at high speeds while maintaining vehicular control.

There have been many lessons learned from the pandemic on the rollout of smart cities. Read some of these observations in *i3*'s C4 column and how the Industry can best move forward. And CTA's Tiffany Moore recently spoke with Intel's CDIO Dawn Jones to discuss the important benefits for companies that advance diversity and inclusion including fast-tracking innovation.

Meanwhile, disrupted supply chains are impacting businesses around the globe, particularly from

COVID-19 related problems. Cesar Remis, head of Mexico's Office for the Implementation of the USMCA, explains how migrating from a cost-efficiency supply chain structure to a more resilient scheme can minimize the risk of future disruptions. He notes that the USMCA are ideal partners to advance the U.S.' nearshoring and onshoring efforts for supply chain resilience.

To wrap up, we take a look at America's favorite products. CTA's 23rd Annual *U.S. Consumer Technology Ownership & Market Potential Study* finds 4K UHD TVs and two-in-one notebook PCs saw the largest gains in home ownership. Other products making significant advances over the past year include smart home and connected fitness equipment. *i3*'s Market Beat column has more details. We want to hear from you, please send comments to cstevens@CTA.tech.

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It's All in the Numbers for Tokyo

With its highly educated talent pool of STEM (science, technology, engineering and math) graduates, Tokyo attracts startups and established companies alike. The city generates a multitude of ideas, patents and new products. In fact, it had the most patent applications — 1.11 million patents applied — among the 20 global cities an Elsevier 2021 report reviewed.



Tokyo 2020: Olympic Medals Recycled from Electronics

Used electronics devices were recycled in a nationwide Japanese effort to produce the Olympic medals for the Tokyo 2020 Games. The two-year effort collected enough recycled material to produce about 5,000 bronze, silver and gold medals with 90% of Japanese cities, towns and villages participating by donating devices. The recycling campaign produced 70 pounds (32 kilograms) of gold, 7,700 pounds of silver and 4,850 pounds of bronze from nearly 80 tons of old phones and laptops, said Tokyo 2020 spokesperson Hitomi Kamizawa. Using a process of dismantling, extracting and refining by contractors, the recycled material was molded into Junichi Kawishi's design concept for the medals — that beat 400 other entries in a Tokyo 2020 competition.

INTERNATIONAL FOCUS

TOKYO



Electric Vehicles Take to the Roads

It's not just auto manufacturers making electric vehicles (EV). Sony is positioning its newest EV to be a "personal internet device," and has been conducting road tests with its concept car, the Vision-S EV. Sony's high-performance image sensors use artificial intelligence (AI) to detect surroundings. The vehicle also has 33 sensors which include radar, lidar and the cameras. The Sony Vision-S Concept Car debuted at CES® 2020. Tokyo's startup **PJP Eye** is offering an alternative to lithium-ion batteries used in electric cars. These carbon batteries could change the EV industry as their dual carbon batteries are made of environmentally-friendly organic materials. The life cycle of the battery is roughly 10 years, instead of the two to three years of lithium-ion batteries. **PJP Eye** also has plans to bring its own charging station to market, that features rapid charging.

INNOVATION AT THE OLYMPICS

The Tokyo Games were a showcase of technology that included robotic trains and taxis for the athletes, instant translation tech and 8K broadcasts. Many Olympians used virtual reality, analytics and AI to train and track their performance. Intel and Alibaba launched 3D Athlete Tracking (3DAT) that uses AI and computer vision to create a 3D mesh to allow analysis of real-time and biomechanical data for athletes and coaches, as well as provide insights to fans on how athletes performed.

And Toyota Motor Corp's AI-powered self-driving field support robots (FSR) equipped with cameras and sensors were used to retrieve items like javelins while a pair of human support robots (HSR) and delivery support robots (DSR) guided spectators and even provided snacks.

Toyota Motor Corp. Tokyo 2020 Olympics mascot Miraitowa. ❤️



Getting the Ball Rolling in Space Tech Tokyo

A collaboration between the Japan Aerospace Exploration Agency (JAXA) and Tokyo-headquartered toy-maker TOMY, has produced a baseball-sized robot to explore the moon surface. The toy company's expertise in small, moveable parts helped produce this ultra-lightweight robot that can hitch a ride on the lunar lander. The bot can easily roam the uneven surface of the moon and also has a camera to capture photos.



C4 TRENDS

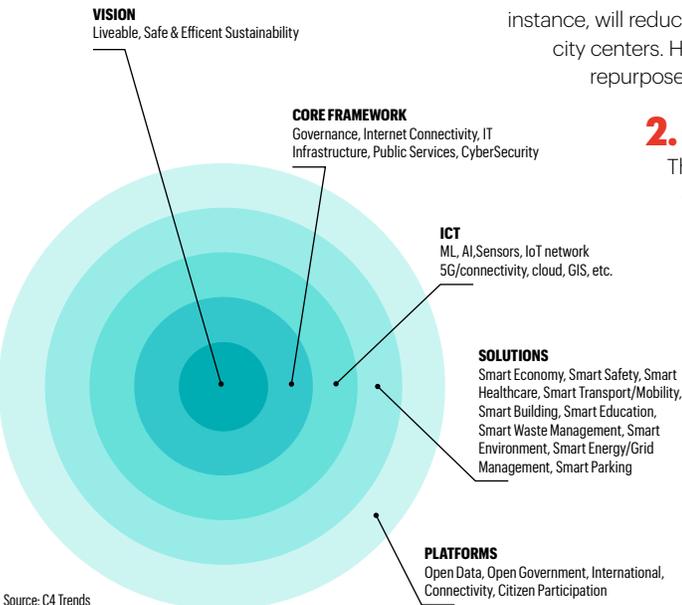
Re-imagining Smart Cities

Smart city initiatives promise to make cities more connected, efficient and sustainable.

C OVID-19 tested the resilience of cities. Over half of the world's population today lives in urban centers, and that is expected to jump to 68% by 2050, per the UN. Smart cities include technologies for scalable implementations such as 5G, artificial intelligence (AI) and blockchain. Working together these technologies can hyper-connect a city for greater efficiencies and sustainability based on data integration and analytics, cybersecurity and citizen engagement.

Post-pandemic, these parameters encompass collecting and contextualizing ICT (Information and Communications Technologies) as well as connecting physical devices using IoT (internet of things) networks and geographical information systems (GIS) — for greater endurance and more equitable communities.

COVID-19 was a wake-up call around the globe. The pandemic accentuated how ill-equipped cities were. Many municipalities barely functioned, lacked agile and efficient infrastructures, datapoints and funding to deal with the situation. The resulting upheaval underscored that communities need to be better prepared for shorter-term catastrophes and other extreme events.



Three Trends for Reimagining Urbanization

Opportunities related to smart city startups worldwide will reach \$39 billion in 2021, according to Statista. AksjeBloggen.com is projecting that smart city startups worldwide will generate \$110.7 billion in revenue by 2025, a trifold increase in five years. Many lessons were learned from the pandemic, here are a few:

1. Rethinking Neighborhoods

With restricted mobility, people stayed within their neighborhoods. This is reigniting interest in the “15-minute city” by urban managers. It’s based on livable and self-sufficient neighborhoods within a city that are pedestrian-friendly. Some cities are developing more car-free thoroughfares. The reduced need to commute to the office and the rise of remote working and online shopping, for instance, will reduce the demand for space in city centers. How will this space be repurposed?

2. Public Space: Redefined

The trend towards greener cities took on new meaning, with a resurging interest in the outdoors. Urban planners are thinking differently about street space and considering the playbook of their European counterparts, focused on squares, gardens, and pedestrian-focused street designs. While some U.S. cities created bike lanes other cities like

New York experimented with pedestrian promenades or slow streets. As a consequence of the pandemic limiting indoor restaurant capacity, cities expanded sidewalks to house parklets or ‘terrace zones’ for outdoor dining reminiscent of Paris bistros.

3. Mobility

There also was an uptake in ‘active transportation’ with walking, biking, e-scooters and other micro-mobility options. Less driving resulted in reduced carbon emissions and improved air quality, accelerating discussions about sustainability, lower emissions and pollutants. Ford recently announced plans to invest \$30 billion in vehicle electrification efforts by 2025, and the company anticipates that 40% of its global sales by 2030 will be fully electric vehicles. Overall, there is a global movement towards increasing the safety and easy flow of transportation — whether for e-mobility, autonomous transport, communications and intelligent transport systems. While reducing car use was trending pre-pandemic – an emerging question is, will shared mobility survive the pandemic?

Urban Retrofitting

Instead of starting from scratch to build new cities — urban retrofitting is emerging as an alternative solution but the path towards smart cities will be manifold. The pandemic underscored the need for public-private partnerships between government and communities with business, academia, the tech industry and fast-moving startups. Smart cities require integrated frameworks, systems and solutions that enable efficient customizable responsiveness to localized context, cultures and communities. Plus, private sector investments are often required by cash-strapped cities.

New infrastructures need to be built with innovative solutions to make cities smarter and responsive to the needs of its citizens in ordinary times and under crisis. ■



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A TECH TO WATCH

Protecting Against Cyberattack

How can you reduce your chances of being a cyber victim?



Insecure devices can compromise your privacy.

Electronic home products — such as smart thermostats, home surveillance cameras, smart refrigerators and lights — offer convenience enabled by internet connectivity. But like phones, tablets and laptops, these connected consumer technology products must be secured against cyberattack.

Insecure devices can compromise your privacy, allow sensitive data to fall into the hands of bad actors or be hijacked and disrupt your use of the internet. In addition, without having the ability to determine which vulnerabilities affect products, device manufacturers can't create a "patch" and update their products to fix these vulnerabilities.

Common Cyberattacks

Malware is a term that describes malicious software, including ransomware and viruses. Malware breaches a network when a user clicks a dangerous link or email attachment that installs risky software. Once inside the system, malware can disrupt components and render the system inoperable or install software to steal the victim's information.

Phishing is the practice of sending fraudulent communications that appear to come from a trusted source, usually through email. The goal is to steal sensitive data like credit card and login information or to install malware on the victim's machine.

Spoofing is when an attacker impersonates an authorized device or user to steal data, spread malware or bypass access control systems.

Eavesdropping occurs when a hacker intercepts, deletes or modifies data transmitted between two devices. A type of man-in-the-middle (MitM) attack, eavesdropping occurs when hackers insert

themselves into a two-party transaction, interrupt the traffic and then steal the data.

Comprehensive Security

This should cover the device, apps and the cloud. Weaknesses associated with the app, and particularly the cloud, is far more damaging. Rather than hacking a specific user's product, manipulating the cloud can simultaneously hack many products of the same type.

Protecting the whole network rather than individual devices is what products like Bitdefender Box, F-Secure Sense, Firewalla and Trend Micro Home Network Security do. Once activated, these protection systems scan all traffic passing in and out of your home network, preventing intrusions, and blocking hacking attempts and web threats.

Some of these solutions simply join the network and do its security work without taking on the tasks of a router. Others can also function as a router. Either way the end result provides insight into what's on your network, along with what your computers and mobile devices are doing, such as:

- Detecting new devices connecting to your network and disabling them if needed.
- Detecting if apps are performing malicious activities in the background.
- Scanning your network to discover open ports on devices.

Additional steps to protect against cyberattack without the assistance of protective software include:

- Use a strong password that makes it harder for cyber criminals to compromise your household devices. Passwords should be at least eight characters long combining upper- and lower-case letters, numbers and symbols.
- Make sure your device automatically locks after a brief period of inactivity. This way, if you misplace your device, you reduce the opportunity for someone to access your personal information.
- Turn off capabilities such as Bluetooth, network connections, mobile wallets and near field communications when they are not needed. These features can provide easy access for a nearby, unauthorized user to retrieve your data.
- Make sure you trust the app provider and download from the Google Play Store, Apple's App Store, or other trusted sources as they proactively remove known malicious apps to protect users.

Firms routinely release security updates for devices such as laptops and smartphones to address software vulnerabilities. The same could be done for consumer technology devices. Some of these updates are automatic, but others require users to install them — worth the effort to avoid being a victim. ■

PIPE LINE

Radar, AI, Deepfakes and More

What happened at the T&S Forum?

Consumer technologists from across the globe gathered virtually May 3-6 to discuss CTA's work on industry standards at the 2021 Technology & Standards (T&S) Spring Forum. A host of new projects were launched, and informative panel sessions held, as CTA explored the subjects it will look at next.

Gesture control was a hot topic. Gestures make something happen with a specific body movement and it is an area ripe for best practices. A "gesture handbook" is under development by a new group formed by CTA's Technology Council. This gesture handbook will describe open air hand gestures for things like, accept/reject, up/down, left/right, forward/backward, increase/decrease, etc. across various use cases including XR (extended reality) and automotive.

Related to gesture control is consumer radar. Consumer radar refers to the use of low power/high frequency radio waves including touchless gesture controls, sleep tracking, sports/fitness tracking, home/office security and remote vital sign measurements. When integrating technology into applications, developers prefer to work with a standardized software interface — an application programming interface or API. CTA's Technology Council formed a group to create an API to define how consumer radar chips interact with their host devices.

The Technology Council also addressed interoperability between Ultra HD video sources and displays. It formed a group to consider a series of consumer facing naming conventions for common functions to provide consistency for end users. It might develop an implementation guide, too, that would result in a setup script through which sources and displays would negotiate for connectivity and optimum viewing arrangement.

Join CTA's standards program at cta.tech/standards. ■

Technology & Standards Fall Forum
Sept. 20-23, 2021 | Digital Event

REGISTER: at cta.tech/Events. The CTA Fall Technology & Standards Forum, a digital event, will bring together engineers, product managers, CTOs and people from technology alliances to hear presentations, network, share information and develop standards.



T&S Forum panelists discuss the role of data in addressing public health emergencies.

SESSIONS OFFERED A GLIMPSE OF THE FUTURE

Future Standards for Digital Therapeutics covered the importance of common terms for digital therapeutics regarding what gets regulated and reimbursed, how the data produced by digital therapeutics can be leveraged to develop new standards, and how COVID-19 has accelerated the use of innovative health care technologies.

Mental Health and the Virtual Care Evolution discussed how technology can make private treatment easier, encouraging people afraid of stigma to get mental health treatment. It also covered how technology can help providers serve more people quickly, even 24 hours a day; and how technology helps patients more easily find doctors similar to them which improves patient outcomes.

Mitigating Bias Through Inclusive Design discussed best practices for avoiding bias in artificial intelligence (AI) systems. Strategies include making combating bias a corporate priority, making sure the team is diverse, and the data used to train an AI is relevant. For example, using the amount of money people spend on something as a proxy for their need for that item can lead to bias, because not everyone who needs it can afford it.

The Role of Data in Addressing Public Health Emergencies covered the importance of gathering accurate data and sharing it quickly when addressing a public health emergency. In a pandemic like COVID-19 one of the challenges is that systems that do not normally communicate must — for example, systems tracking inventories of personal protective equipment in stores communicating with hospital systems tracking these inventories.

Combating Deepfakes covered how technology can detect artifacts in content that indicate the content is fake, and how using AI to create deepfakes can outsmart deepfake detection efforts. Establishing and tracking media provenance is another way to combat deepfakes. There is a race between fakers and those trying to detect them, with each using the latest technology. However, sometimes there are legitimate reasons to create fake content, for example when producing fictitious movies.



NEXTGEN TV promises better audio/video and enhanced data services.

NEXTGEN TV — the go-to-market name for ATSC 3.0 IP-enabled broadcast transmission — provides cleaner audio and video, sharper voice clarity, more uniform volume across channels and 4K Ultra HD and High Dynamic Range (HDR) images. Some NEXTGEN TV broadcasts are also enhanced with interactive internet content to get the most out of live sports, news and events in real time. When it comes to NEXTGEN TV, the numbers look good:

- About 120 TV stations in 30 U.S. cities are transmitting ATSC 3.0 signals, as of July. By Labor Day, 50% of U.S. homes will be within reach of a NEXTGEN TV signal (although only a scant number will be able to see the content they're carrying).
- Nearly five dozen NEXTGEN TV models from LG Electronics, Samsung and Sony are on the market, with more manufacturers expected to add products in coming months.
- More than two million NEXTGEN TV sets will be sold this year (5% of total receiver sales), and those numbers will grow to 20 million sets (47%) within three years, according to the Consumer Technology Association's (CTA) latest *U.S. Consumer Technology Five-Year Industry Forecast*. That would put the new receivers in nearly one-third of American homes by 2024.

Beyond the numbers, the advanced TV community of broadcasters, receiver manufacturers, technology providers, advertisers, automotive companies and others have been hustling to develop services and systems. They are rolling out projects such as cable integration to assure that the 3.0 signals can be viewed via existing cable TV subscribers, interactive pay TV services that compete with cable/satellite video in rural areas, plus an expansive "Motown 3.0 Test Track" project that is using Detroit TV stations to show automakers the data services potential of the broadcast technology.

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Moreover, the TV owners involved in NEXTGEN TV rollouts are buoyed by responses to a Magid research study this spring in which 60% of TV viewers said they'd buy the new 3.0 technology within three years of its availability. And the broadcasters are looking forward to a showcase rollout in Washington, D.C., scheduled for late summer — an “all-encompassing effort” that will include most local stations, the National Association of Broadcasters, Howard University (licensee of a public TV channel) plus the Pearl TV consortium and Sinclair Broadcasting Group — two of the major promoters of NEXTGEN TV.

In short, a lot has happened since the Federal Communications Commission (FCC) authorized broadcasters to voluntarily launch Internet Protocol-based advanced television services in November 2017, which was followed by the Advanced Television Systems Committee's final adoption of its ATSC 3.0 standard in September 2019. The “NEXTGEN TV” brand emerged at the same time.

“Based on early feedback from consumers and from broadcasters' research, viewers are excited about NEXTGEN TV,” says Brian Markwalter, CTA's senior vice president of research and standards. “They particularly like the enhanced and interactive content provided by ATSC 3.0 integration of broadcast and IP services, which gives them additional content information, on-demand video and premium viewing experiences with 4K UHD and HDR.”

Markwalter also cites positive response to the immersive audio and especially “the unique capability called Voice + that lets you hear the dialog very clearly.” He expects that after absorbing the “enhanced live programming” that NEXTGEN TV delivers, consumers will enjoy discovering “the additional benefits of interactivity and upgradeability.”

CTA expects that converter boxes (set-top devices that will enable existing TV sets to receive and display NEXTGEN TV signals) will accelerate adoption, although they will play a different role than the converter boxes did during the transition from analog to digital TV in the early 2000s. This time there will be no government subsidized vouchers and no hard cut-off date for the old technology, so the migration schedule to NEXTGEN TV is still a little fuzzy.



LG has focused on the premium segment, marrying the superior performance of LG OLED and the new features unlocked by ATSC 3.0.”

— John Taylor of LGE



Top: John Taylor, senior vice president at LGE

Above: Nick Colsey, vice president of business development at Sony Electronics.

But the improved all-Internet Protocol signal — including its audio and data flexibility — is strong. Hence companies in the 3.0 ecosystem are counting on rapid adoption. NEXTGEN TV broadcasts can deliver 4K Ultra HD video quality, HDR displays, theater-like sound and expanded mobile reception.

CTA's forecast expects NEXTGEN TV sets will account for 9% of TV sets shipped next year, climbing to 47% by 2024. That equates to four million units in 2022, 11 million in 2023 and 20 million in 2024.

MANUFACTURERS' COMMITMENTS

Sony has plunged into the NEXTGEN TV world wholeheartedly. Almost every TV set (40 models) it sells in the U.S. this year will be able to receive the ATSC 3.0 signal, says Nick Colsey, vice president of business development at Sony Electronics.

In addition to its line of NEXTGEN TV receivers, Sony has been involved in most of the field trials during recent years and its engineers have worked on the technical definitions and test of the standard. Another Sony group makes 3.0 semiconductors that are used in Sony and other brands' TV receivers. Sony is also participating in the “Motown 3.0 Test Track” automotive project in Detroit, using a tuner/demodulator which is optimized for mobile use case, Colsey adds.

LG Electronics USA has been involved throughout the 3.0 evolution. As a co-inventor of the standard, it has been collaborating with broadcasters during the development process and was the first manufacturer to supply equipment for the Phoenix pilot market trial, explains LGE Senior Vice President John Taylor. Since the company has also had mobile and automotive units, it has leveraged its capabilities “as a key technology partner” in the Motown 3.0 Test Track project, he adds, focusing on opportunities for telematics and navigation updates, software upgrades, sensors and infotainment.

Taylor says that LG has “focused on the premium segment, marrying the superior performance of LG OLED and the new features unlocked by ATSC 3.0.” Among its video devices being used in rollouts are 4K and 8K OLED NEXTGEN TVs ranging from 55- to 88-inches. “As the number of stations offering NEXTGEN TV service grows, we anticipate strong growth for ATSC 3.0 receivers,” Taylor says. “Despite the pandemic effect, the uptake of NEXTGEN TV broadcasting in the U.S. over the past year has been nothing short of phenomenal.”

Dan Schinasi, director of Samsung Product Planning, says Samsung was one of the first TV set makers to participate in Pearl TV's pilot field trial in Phoenix and that the company continues to maintain a lab there. Samsung is also active in the virtual InterOp that the National Association of Broadcasters is facilitating in Santa Barbara, CA, which Schinasi says is different from a typical, face-to-face InterOp. For the ongoing Santa Barbara project, "all resources are secure and online, enabling our engineers around the world to participate 24/7," which he says will assure that receivers are "top quality as broadcasters roll out advanced services for viewers."

Samsung has also been involved in ATSC 3.0 automotive projects since January 2019 when it teamed up with subsidiary Harman plus SK Telecom in Korea and Sinclair Broadcast Group. Schinasi says more details about this mobile broadcast-based project will be revealed in coming months. Schinasi, who chairs the CTA Video Promotions Working Group, expects that the NEXTGEN TV project in Portland, OR, to test the compatibility of broadcast signals over cable TV networks, "will benefit television viewers in that they can see the 4K content and hear higher quality audio that ATSC 3.0 makes possible."

He adds, "Consumers who have invested in top-end displays and audio systems will experience the greatest benefit from distribution of NEXTGEN TV services, whether over-the-air, via broadband, over cable, or from satellites." Samsung will have 20 NEXTGEN TV models by the end of this year in the U.S.

MOBILE DATA IN MOTOWN

Data delivery is another broadcaster opportunity for the ATSC 3.0 bandwidth, and TV stations are going after it aggressively, starting with an automotive courtship. Pearl TV, the consortium of nine broadcast groups which is promoting uses for ATSC 3.0 technology, has organized the "Motown 3.0 Open Test Track" in Detroit, a project that involves the city's five major broadcast channels. The field trial transmits in-vehicle entertainment as well as software programming data updates and is adding services for rental cars, car-sharing fleets, school bus operators and long-haul trucks, including autonomous vehicles.



Top: Dan Schinasi, director of Samsung Product Planning.

Above: Anne Schelle, managing director of Pearl TV

With as many as 60 markets potentially coming online in the U.S. in 2021 according to ATSC, as many as 70% of all American viewers could benefit from ATSC 3.0 services.

Avis, the rental car firm, and its subsidiary Zipcar, the car-sharing service, are among the automotive firms in the trial. Pearl TV is also working with trucking companies to develop a reference design for truck fleets, including for use in self-driving vehicles.

Pearl TV picked Detroit as the test site for the vehicle project because the legacy car makers and their major suppliers are based there. But Anne Schelle, managing director of Pearl TV, has invited non-U.S.-based manufacturers to participate. It is intended to "show automakers what's possible with ATSC 3.0 and to merge automotive applications with NEXTGEN TV," Schelle explains.

The Detroit project builds on "some early testing with Sony in Phoenix," Schelle adds, referring to the Phoenix Model Market, where the Pearl group established a test site in 2017, that was expanded in 2020. Five Detroit TV stations have carved out part of their 3.0 spectrum for exclusive use by the auto industry and its vendors in the hope of introducing them to the affordability and efficiency of the spectrum.

Kerry Oslund, vice president of strategy and business development at E.W. Scripps (which owns two of the participating Detroit TV stations), characterizes the ATSC 3.0 service as "ultra-affordable data for rolling computers." He says the consortium has talked to autonomous trucking companies, big school bus lease operators and rental car fleets.

CABLE COLLABORATION

Pearl TV has also been coordinating a "technical integration" project in Portland, OR, with Comcast cable, to assure that NEXTGEN TV signals pass cleanly through the cable system. Although some cable organizations initially opposed broadcasters' plans to demand retransmission of the 3.0 signals through the cable infrastructure (a long-standing contentious situation), Comcast and others seek to assure that there will be no technical glitches when and if they do carry the 3.0 signals.

“We have to think about this in stages with the cable companies,” Schelle explains. “We’re working through the different technical aspects of integration including ecosystem support.” The results of that process will “allow the business folk to have discussions when the time is right around business issues.”

Schelle says the tests so far have generated valuable information for future technical integration of ATSC 3.0 signals via cable. She adds that Pearl TV is “discussing the technical integration considerations” with CableLabs, Comcast, Cox and other large MSOs for future implementations of NEXTGEN TV via cable.

Among the services that are being evaluated are formatted video and High Dynamic Range (HDR) video, a key feature in 4K Ultra HD television. The seven Portland TV stations will also add data applications to the technical trial.

“There is value in these applications, such as emergency alerts, multilingual service and rich-media alerting,” Schelle says, emphasizing the potential enhancement for cable customers. “As we look at it, there will be applications that are seamless between cable and over-the-air TV, such as sports betting and shopping.” She describes a NEXTGEN platform, now in development, that includes a framework for “enhancing content” for various interactive features.

Schelle says the NEXTGEN platform will enable “opening up layers to applications developers.” This “framework for enhancing content” has not been part of the Portland trial, which has focused until now strictly on technical factors.

Among other new ventures are the “EVOCA” pay TV service for ATSC 3.0, developed by Edge Networks and aimed at offering a rural market alternative to cable



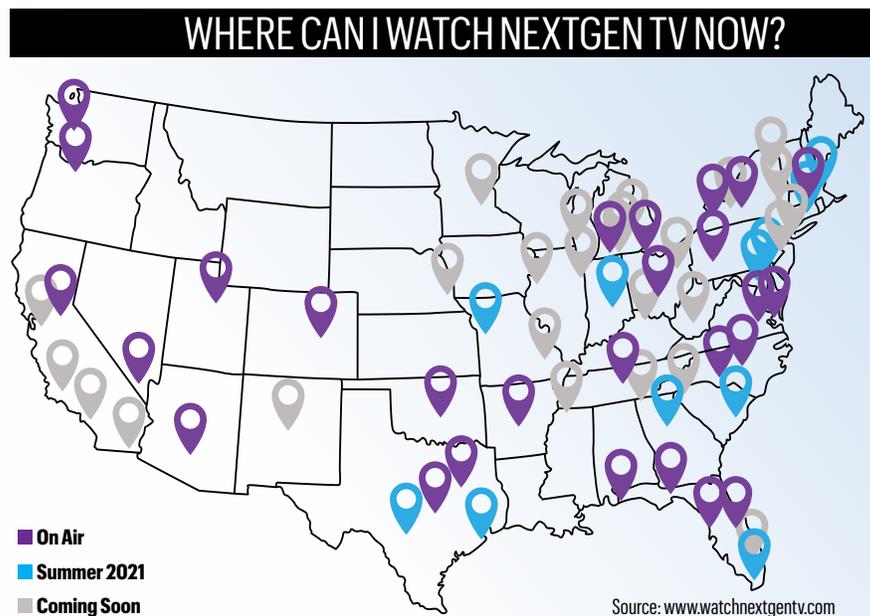
As we look at it, there will be applications that are seamless between cable and over-the-air TV, such as sports betting and shopping.”

– Anne Schelle of Pearl TV

TV and satellite video. Edge Networks CEO Todd Achilles introduced the NEXTGEN TV service in his company’s hometown Boise, ID, last year and is rolling it into Phoenix, AZ. Evoca is already in the market with a receiver that receives “in the clear” ATSC 3.0 signals as well as encrypted channels via broadcast and internet sources.

Evoca TV, which calls itself an “OTA-OTT” [over-the-air/over-the-top] hybrid pay TV service has begun transmitting “Evoca Learn,” a free ATSC 3.0 programming service, and a Basque-language channel to reach the Basque community (about 15,000 people) in Boise, using programming from a Basque channel in Spain. The educational service will feature interactivity, such as quizzes to gauge what they’ve learned and keep them engaged, Achilles explains.

With as many as 60 markets potentially coming online in the U.S. in 2021 according to ATSC, as many as 70% of all American viewers could benefit from ATSC 3.0 services. ■



▶ LOOKING FOR MORE NEXTGEN TV IDEAS?

To keep track of the fast-evolving world of NEXTGEN TV, check out these online resources from major players in the migration to ATSC 3.0.

Advanced Television Systems Committee: atsc.org/

Consumer Technology Association: cta.tech/Membership/Member-Groups/Video-Division/NEXTGEN-TV

Evoca TV: <https://evoca.tv>

Industry Sources (Maintained by Pearl TV): watchnextgentv.com/

Pearl TV Consortium: <https://pearl.tv.com/>

Sinclair Broadcasting Group (ONE Media 3.0 subsidiary): <https://onemediallc.com/>



THE DREAM OF FULLY AUTONOMOUS VEHICLES

How close is the industry to achieving this goal?

By Robert E. Calem

According to past predictions, swarms of fully self-driving cars were supposed to be ferrying passengers around the world by 2021. But alas, while many cars at all price levels offer some level of automated driving assistance, the forecasts have not been realized yet. Drivers still remain in front seats and retain responsibility for their vehicles' actions.

Yet the work underlying those predictions never ceased. Indeed, sages say fully self-driving cars that render everyone a passenger are still en route, just delayed. And the first of these vehicles could be commercialized a few years from now in fleets of robotaxis and industrial vehicles.

SHORT-TERM STATUS QUO, LONG-TERM TRANSFORMATION

"This was meant to be the year we expected a lot of unsupervised autonomous driving to take place, and it isn't," says James Hodgson, principal analyst for smart mobility and automotive at ABI Research in London, UK. Billions of dollars of investments in sensors, processors, networking and software technology for self-driving cars simply is "not being monetized effectively at the moment," he declares, noting that cars now offer only "longitudinal and lateral assistance" with what is known as Level 2+, a reference to levels of driving automation defined in a standard named J3016 by SAE International.

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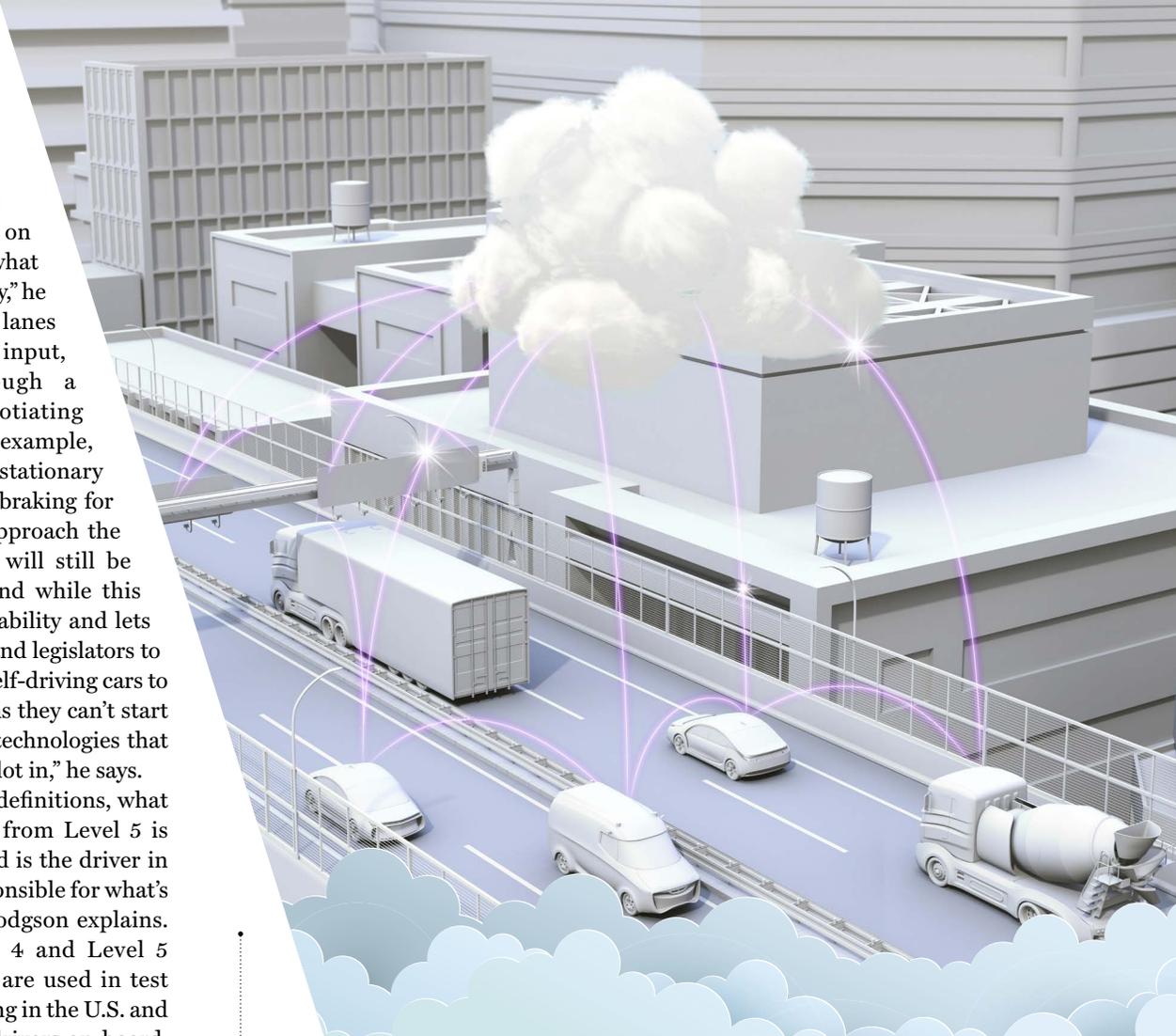
“The car will do a lot on your behalf, far beyond what we think of as Level 2 today,” he says including changing lanes without driver steering input, navigating itself through a highway exit, and negotiating urban scenarios by, for example, moving unaided around stationary vehicles or automatically braking for pedestrians when they approach the vehicle. “But the driver will still be responsible,” he adds. And while this saves automakers from liability and lets them wait for regulators and legislators to act before bringing fully self-driving cars to market, “critically it means they can’t start deploying some of those technologies that they’ve invested an awful lot in,” he says.

“When you look at the definitions, what really separates Level 2 from Level 5 is supervision: how involved is the driver in the process and how responsible for what’s actually taking place,” Hodgson explains. To be sure, some Level 4 and Level 5 vehicles exist today and are used in test fleets of robotaxis operating in the U.S. and elsewhere, with backup drivers on-board. Next will come full commercial rollouts of robotaxis without backup drivers on a small scale, Hodgson foresees. Fully self-driving, Level 5 cars for private use won’t emerge before 2026, and then only as expensive options for high-end vehicles like a Mercedes S-Class, he predicts.

“We’re looking at 2030 as that inflection point now” for mass market deployment of self-driving cars, says Mark Fitzgerald, director of autonomous vehicle research at Strategy Analytics in Newton, MA. By contrast, in 2025 there will be only a few thousand Level 4 vehicles and no Level 5 vehicles deployed, Fitzgerald predicts. These will be robotaxis and high-end personal vehicles, he says, adding luxury brands like Mercedes-Benz will then have to incorporate Level 4 automation to distinguish themselves from mass-market brands that already deployed Level 3 automation in cars for common folk.

“As our nation struggled with COVID-19, self-driving vehicles really helped our population with a number of tests that wouldn’t have been possible before.”

—Mitchell Kominsky



“CTA views self-driving technology as transformative,” says Mitchell Kominsky, director of CTA government affairs. It will improve people’s lives by enabling driverless deliveries, providing new transit options for non-drivers, and making roads safer. Kominsky adds, “CTA is looking at how we can advance the safe deployment of self-driving vehicles,” through a self-driving vehicle working group. Its goal is to help federal and state governments shape policies that propel companies active in the space, and its roughly 160 member-companies vary widely “across the ecosystem,” he says.

Policies for which CTA advocates would encourage technology neutrality, open roads for testing, and update and modernize the Federal Motor Vehicle Safety Standards (FMVSS) process to not conflict with the concept of a self-driving vehicle. On a state level, for example, CTA is working with the California Transportation Agency to develop its autonomous vehicle guidance framework.

Kominsky points out, to help educate the public about self-driving cars, CTA is working with Partners for Automated Vehicle Education (PAVE), a non-profit organization backed by the automotive and technology industries that was launched at CES 2019.

“It’s hard to predict when we will see mass deployment of self-driving vehicles on our roads,” Kominsky proclaims. A substantial number of self-driving vehicles are being tested on public roads right now, “and with the pandemic we saw a lot of new applications” of the technology, including deliveries of groceries and medicines to consumers, as well as transport of COVID-19 test specimens by self-driving vehicles, he notes.

“For better or worse, a lot of the AV (autonomous vehicle) space is in the [realm] of perception right now because the technology is still developing,” says Ed Niedermayer, director of communications at PAVE, which is headquartered in Washington, D.C. “But it’s important to remember that perceptions of AVs have always been at odds with the reality.” According to the results of a PAVE consumer survey published in February 2020, the people who are most pessimistic about self-driving cars are also the ones who know the least about them. “The more you know about AVs, the more comfortable you are with them,” however, “for most people, AVs are just this abstract idea,” Niedermayer says.

Conversely, there’s also a correlation between experience with the advanced driver assistance systems (ADAS) integrated into many cars now and comfort with the concept of self-driving cars. But this could be due to the misconception that a vehicle with ADAS is a self-driving car, and PAVE is working to reverse that, too, so people don’t over trust ADAS and “actually make

driving less safe,” Niedermayer exclaims.

Reality is that the development of self-driving cars is more about the learnings and challenges of the “human-less customer service experience” — such as determining the best place for a robotaxi to drop off or pick up a passenger in an urban environment — and less about the driving task, he says.

Moreover, public transit systems are likely to adopt self-driving buses before robotaxi fleets are widely deployed, Niedermayer suggests. But rather than merely replacing the driver, he adds, self-driving technology will allow the transit system employee to remain on-board and focus on customers.

“Five years ago at CES, the car companies were saying that within five years we’re going to have fully-self-driving vehicles available. I think there’s been a clarification of that now, to recognize that there’s going to be a continuum of progress made over one or more decades to get to that point, and it’s going to come through ADAS,” says John Verboncoeur, associate dean for research and graduate studies in the college of engineering at Michigan State University, in East Lansing, MI. Full automation of functions like parking or freeway driving will be first to proliferate after driver assistance because those could be most precisely tuned for accuracy and safe operation. Verboncoeur predicts, “I think you can expect that self-driving vehicles will have a higher bar than manually driven vehicles in terms of safety statistics.”

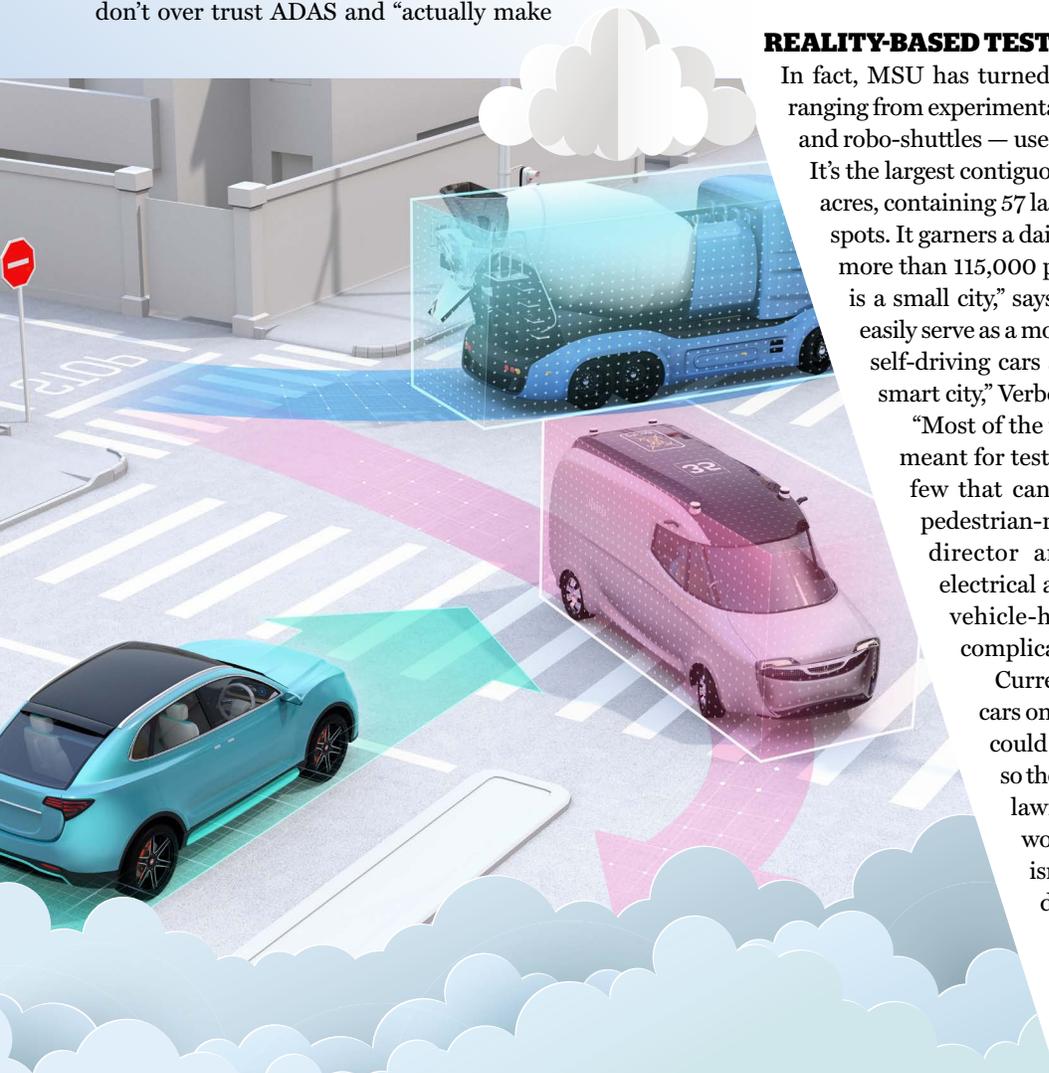
To be sure, one reason for that higher bar will be passengers’ comfort needs, and MSU has a “socio-mobility group” of 30 to 40 faculty outside the engineering department that is studying the “sociological and psychological aspects of vehicles,” Verboncoeur notes.

REALITY-BASED TESTING AND TRAINING ARE DECISIVE

In fact, MSU has turned its entire campus into a testbed for AVs — ranging from experimental self-driving cars to autonomous lawnmowers and robo-shuttles — used by a wide swath of the university community. It’s the largest contiguous college campus in the U.S., spanning 5,200 acres, containing 57 lane miles, 30 traffic signals, and 11,000 parking spots. It garners a daily population of about 70,000, which grows to more than 115,000 persons when a sporting event is hosted. “So it is a small city,” says Verboncoeur. Thus, what’s done there could easily serve as a model for a municipality looking to accommodate self-driving cars and other AVs, and MSU’s goal “is to build a smart city,” Verboncoeur affirms.

“Most of the test beds that you see around the country are meant for testing vehicles at high speeds. This is one of the few that can be used for first-mile, last-mile testing in pedestrian-rich environments,” says Satish Upda, mobility director and university distinguished professor of electrical and computer engineering at MSU. “It is that vehicle-human being interaction that is the most complicated to deal with.”

Currently, there are two self-driving development cars on campus used to test, for example, systems that could predict a pedestrian’s or bicyclist’s next move so the car is prepared to react. There are autonomous lawnmowers and snowblowers programmed to work when classes aren’t in session, so their noise isn’t a distraction. And the university’s first self-driving campus shuttle is expected to start serving the campus community this fall. MSU also boasts the largest carport solar array in North America, which powers the campus’s buildings and can also be used to charge electric vehicles (EVs).



“The reality is that (self-driving cars) is a problem that is much more challenging” than was initially thought, says Danny Shapiro, senior director of automotive at NVIDIA Corp. in Santa Clara, CA. “It requires a massive amount of computing. You can’t afford to make a mistake. In a car, there’s no second chance. You can’t not protect pedestrians.”

Therefore, Shapiro adds, much more training and data collection is required, with more sensors and redundancies adding complexity to the self-driving systems and making TOPS “the new horsepower.” TOPS is a chip industry acronym referencing trillions of operations per second that a computer processor can perform. DRIVE Orin — the latest generation of NVIDIA’s “system-on-a-chip” (SOC) for self-driving cars, used by automakers including Mercedes-Benz and Volvo — is rated at 254 TOPS. But DRIVE Atlan, the successor SOC that was announced at NVIDIA’s GTC conference in April, jumps up to more than 1,000 TOPS. It will be available in 2025 car models, “and we’ll probably have customers that will use multiple of those,” incorporated in “deep neural networks” within vehicles, Shapiro says.

Nevertheless, training the AI that runs in the car happens first outside the car, in data centers, using both real and simulated data. DRIVE Sim, a simulation software suite that resembles technology used by Hollywood studios can generate a nearly infinite range of real-world scenarios for AV development and validation, as well as managing fleets of self-driving cars. It was accompanied by DRIVE Hyperion, NVIDIA’s eighth-generation AV development platform that streamlines data collection and testing.

Of course, making cars smarter through simulation is inevitably insufficient, says Artur Seidel, vice president of Americas, at Elektrobit, an independently-operated subsidiary of Continental AG that is a global supplier of embedded and connected software products and services for the auto industry. What’s best is for the vehicle to learn as it goes and then report back to the automaker, which can improve its fleet of vehicles on the road with higher intelligence through over-the-air updates, Seidel says. This requires a total overhaul of the vehicle’s electronics architecture, including

“We believe that an automated vehicle needs to be fully situationally aware and be able to navigate any reasonably foreseeable scenario.”

—Jack Weast

high-performance computers on-board that can do real-time analysis of sensor data, as well as connectivity — which in turn necessitates new software underpinnings. Hence, Elektrobit last November introduced EB xelr, an industry-first software platform that enables automakers and suppliers to do that overhaul around a handful of high-performance computers in a vehicle, instead of a traditional architecture of many small electronics control units (ECUs).

But connectivity must not be fundamental to the safe operation of a self-driving car, contends Jack Weast, vice president of automated vehicle standards at Mobileye, and an Intel Fellow, based in Phoenix, AZ. “We believe that an automated vehicle needs to be fully situationally aware and be able to navigate any reasonably foreseeable scenario, fully within its own capabilities. And the reason for that frankly is safety,” he says. “From a safety standpoint, if your ability to keep the people inside the vehicle safe, or people outside the vehicle safe from the vehicle, is dependent upon the ability to send or receive a message over a shared untrusted medium, by definition your safety case is flawed. So while we see lots of value in connectivity for value-added services, as a safety pillar, we think that’s a flawed approach.”

For that reason, Weast says, upon examining their architectures, “you don’t see the leading automated vehicle companies talking about V2X or infrastructure.

What a self-driving car needs ultimately is a software-based “responsibility-based safety model” that enables it to use reasonable assumptions about other road users as the basis for its own driving decisions to ensure a vehicle operates safely and avoids causing a collision, he argues. But, this relies upon agreement by the auto industry, governments and societies about what it means to drive safely. And different places in the world will set the goalposts differently, he adds. Not everything can be solved with AI, Weast insists.

“This whole process of training, testing, validating, deploying, it’s a continuous cycle,” says NVIDIA’s Shapiro. “A car will get better and better over time,” he asserts — but don’t expect to buy one without a steering wheel anytime soon. ■



Chesky/Shutterstock



Cesar Remis

GUEST BLOG

USMCA: A Regional Partnership Towards Supply Chain Resilience

Mexico, the United States and Canada are friends, partners and allies. There is no other relationship between neighboring countries as complete and cooperative as ours, as we not only share a common productive platform that allows us to compete globally, but we also share the values of freedom and democracy.

As part of the North American region, we have always worked together to face common threats. A clear example of this happened during the first months of the COVID-19 pandemic, when, in a coordinated effort, Mexico, the U.S. and Canada agreed to take joint measures to guarantee essential trade flows through our borders.

In this sense, the COVID-19 pandemic brought important lessons for governments, which are now rethinking their industrial policy, and for businesses, which are migrating from a cost-efficiency supply chain structure to a more resilient scheme to minimize the risk of future disruptions. According to a report published by McKinsey, companies can now expect supply chain disruptions lasting a month or longer to occur every 3.7 years on average, which has reinforced the idea of locating closer to consumption centers through near-shoring and ally-shoring strategies.

This challenge also brings an historic opportunity to enhance the integration of supply chains in North America, making Mexico an ideal destination to attract complementary segments of the supply chains in a large number of industries, particularly those in which we have competitive advantages. In that regard, the USMCA is a key instrument to boost the economic recovery from the COVID-19 global crisis, enabling North America to become the most dynamic and prosperous region of the world.

In July 2021, the Biden Administration published the 100-day review of the



The USMCA partners are the ideal allies to advance the U.S. nearshoring and onshoring efforts.

relevant actions and policies needed to make more resilient critical supply chains, which covers strategic sectors like semiconductors, large capacity batteries, pharmaceuticals and critical minerals. Mexico welcomes the U.S. willingness to work with allies to strengthen supply chains and we are convinced that building resilience from a regional perspective would boost economic recovery, create jobs and make North American products more competitive globally.

The semiconductor supply chain disruptions caused by the economic downturn, forced production shutdowns in companies across the electronic and

automotive sectors and exposed the high concentration of strategic segments of the supply chain. Currently, Mexico supplies some of the key components for the manufacture of semiconductors to the U.S., such as 21% of the total U.S. imports of capacitors and resistors, as well as 30% of all electronic connectors imports, but in order to achieve resilience, the North American partners need to work together to promote further integration in critical high-tech sectors such as the semiconductor industry.

Although North America participates in the semiconductor supply chain, the more complex and capital-intensive segments are concentrated in Asia. This makes the U.S. dependent and therefore less resilient. For example, in 2020, 63% of all U.S. imports of semiconductors and related devices, as well as 73% of printed circuits imports came from Asia, though, this opens a window of opportunity for North America to attract and generate new investments and create jobs.

The numbers above illustrate where we can deepen our North American ties and find opportunity for growth in regional markets. This opens opportunities for North America to attract and generate new investments and create jobs. To prevent future disruption to the supply chain, we should avoid excessive dependence on a single market, and rather seek to ensure availability within the region. North America shares a common production platform built through more than 27 years of integration. The USMCA partners are the ideal allies to advance the U.S.' nearshoring and onshoring efforts.

To learn more about Mexico's technology sector and supply capabilities, please visit: trade.gov/usmca ■

Cesar Remis is the head of Mexico's Office for the Implementation of the USMCA.

POLICY NEWS

The Indy Autonomous Challenge

The fastest autonomous racecar is coming to CES 2022.

The Indy Autonomous Challenge (IAC) Dallara AV-21 was virtually introduced to a global audience at CES 2021 seeking technologies that will change the world.

Inspiration for the IAC was the 2004-2005 DARPA Grand Challenge, which led to the advancement of new technologies and invigorated the prize challenge model of promoting innovation. The IAC is a \$1.5 million prize competition designed to engage worldwide university teams to program autonomous-modified racecars and compete in the first autonomous racing event at the famed Indianapolis Motor Speedway (IMS) — the Racing Capital of the World.

The IAC taps into the power of science, technology, engineering and math (STEM) and prize competitions to advance technologies to speed the commercialization of fully autonomous vehicles. The goal is to improve vehicle safety and performance, and increase public awareness of the transformational impact that automation has in our lives.

The primary organizers of the IAC are Energy Systems Network (ESN) and the IMS, supported by a consortium of public and private partners and sponsors. CISCO is the IAC presenting sponsor, and contributing companies include: ADLINK, Ansys, Aptiv, AutonomouStuff/Hexagon, Bridgestone, Clemson University's International Center for Automotive Research (CU-ICAR), Luminar, Microsoft, New Eagle, PWR, RTI, Schaeffler and Valvoline, in addition to the Indiana Economic Development Corp., Juncos Racing and Dallara USA, producer of the IAC AV-21, the base IAC racecar for each team.

Since 1909, the IMS has been an incubator and proving ground for automotive innovation. The IMS oval will

push the limits of performance and safety for this autonomous race event scheduled for October 23, 2021.

University Teams

More than 40 universities, representing 11 countries on four continents, including 14 U.S. states, registered for the Indy Autonomous Challenge. The 30 teams will race their Dallara AV-21 racecars 20 laps hoping to win. The IAC advances autonomous vehicle commercialization by helping to solve “edge case” scenarios — problems that occur in extreme operating environments, such as avoiding obstacles at high speeds while maintaining vehicular control. Importantly, the competition is normalized around software. Teams do not develop or produce the racecar or any of the automated vehicle computers, sensors and hardware. Instead, the IAC teams focus on developing software using artificial intelligence (AI) to ensure precision control of vehicles at high speeds during the competition, hoping one day to also reduce fatalities on roadways.

Team Training and Simulation

Key to the success of preparing the university teams for the October 2021 IAC race is a series of hackathons and workshops, organized by ESN, its collaborators and sponsors, that began in May 2020. These simulations are orchestrated by Ansys, which has created a unique simulation platform based on its industry-leading VRXPERIENCE Driving Simulator, powered by SCANer™. On June 30, Ansys ran its final simulation

race and awarded \$100,000 to the first-place winner, PoliMOVE, and \$50,000 to TUM Autonomous Motorsport, the runner-up, in this critical simulation race milestone.

The Racecar: The IAC Dallara AV-21

The official vehicle the teams use is the IAC Dallara AV-21, which has been retrofitted with hardware and controls to enable automation. Since 2001, Dallara has been the sole supplier of racecar chassis for the Indy Lights Series, which prepares young drivers for the NTT INDYCAR SERIES.

The IAC Dallara AV-21 is the most technologically advanced, fastest autonomous racecar with a bullet-proof package of equipment including a modified-for-autonomy Indy Lights chassis from Speedway's Dallara USA, a four-cylinder turbocharged beast of an engine, and Lidar, radar and optical cameras sensors. This equipment converges with screamingly quick on-board rugged-edge computing and communications, coupled with cutting-edge AI algorithms.

These advanced hardware and next generation software systems are synthesized to create the most optimized and powerful platform for safety, precision control and performance — the Dallara AV-21, a \$1 million technical marvel. ■



The Indy Autonomous Challenge Dallara AV-21 Racecar

GO ONLINE: Visit the IAC website and follow the teams: @IndyAChallenge on LinkedIn, Twitter, Instagram, Facebook, YouTube and Reddit/hashtag #IAC2021. The IAC will take place on October 23, 2021.

CDO SPOTLIGHT

Intel's Dawn Jones



Dawn Jones is a 24-year veteran at Intel with a remarkable track record. On April 14, she was named chief diversity and inclusion officer (CDIO) and vice president of social impact. She is leading the company's global diversity and inclusion strategy as well as Intel's investments and programs driving positive global impact. This includes prioritizing cross-company and industrywide initiatives to achieve Intel's 10-year 2030 RISE Strategy. She has served as acting CDIO since January 2021 and prior to that was global director of policy, strategy and partnerships. She joined *i3* to discuss the importance of diversity.

How has making D&I a business imperative made your company stronger?

Intel is committed to advancing diversity and inclusion at every level of our company and in our industry. Our point of view is that when everyone is given the opportunity to share their ideas and unique perspectives, we can accelerate innovation and business results in the pursuit of our purpose of creating world changing technology for all. As a global business leader, we also have a corporate responsibility to lead the industry by raising the bar for ourselves, and, as a result, raising it for others. This is based on a strong belief that people with diverse backgrounds and perspectives enable better decisions and create technology that addresses the breadth of opportunities and challenges we face worldwide.

How are you working with others to advance D&I?

We recently launched the Alliance for Global Inclusion in partnership with Dell, Nasdaq, NTT DATA and Snap Inc. The Alliance for Global Inclusion is a global coalition of companies who have publicly pledged their commitment to developing and aligning on shared metrics that track progress in D&I. The Alliance for Global Inclusion and Inclusion Index will provide a consistent system of measurement to better track progress and identify areas of improvement. We invite others to join us in using our collective strengths and capabilities to create positive change within corporations, our communities and society at large. The coalition was formed based on a guiding principle that the best way to accelerate the adoption of inclusive business practices is through data transparency and collaboration, rather than organizations trying to address the issue in isolation. The coalition has committed to working

“
Our point of view is that when everyone is given the opportunity to share their ideas and unique perspectives, we can accelerate innovation and business results in the pursuit of our purpose of creating world changing technology for all.
”

—Dawn Jones

together to create a set of shared metrics and goals that we will collectively work toward. As part of these efforts, each member will create employee-led working groups within their companies that will play a vital role in helping the Alliance achieve its goals. The index will be updated twice a year and is a great resource for companies. To learn more, visit allianceforglobalinclusion.com.

What are some key lessons learned?

We've learned that some of the biggest challenges we face as a society can't be solved individually. It will take all of us coming together with shared responsibility. From our point of view, addressing these challenges is not a one-size fits all proposition, it requires an end-to-end approach. That is why we continue to invest in several key areas including our own workforce and supply chain to drive greater representation; technology and STEM programs to make technology more inclusive and expand digital readiness for everyone, including under-resourced communities; and collaboration with customers, partners, communities, NGOs and governments to address critical social issues through public-private partnerships, innovative programs and public policy.

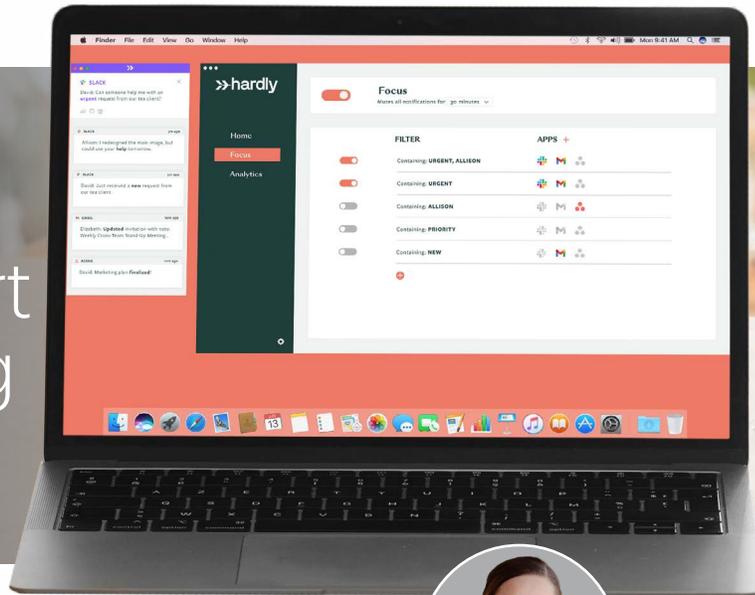
What is your advice for companies beginning their D&I strategy?

The first piece of advice I would give when building out your D&I strategy is to go back to the basics: listen for understanding and start with respect. We work with people and to drive real change we need to do it through people. The second is making sure the D&I strategy is fully integrated into systems, leadership expectations, and annual performance bonus metrics. For your strategy to be successful, it needs to play a central role in everything your company does from hiring practices to how you build products and services. ■

FUTURE OF WORK

Innovative Technologies Support New Ways of Working

Tech is providing solutions to help employees stay productive, efficient and connected.



With many companies planning for a hybrid work environment, new technologies are emerging to support both in-office and remote work. From new software to help employees manage notifications, screen sharing features to enhance virtual presentations, and hardware tools to improve video conference calls, here are some examples of CTA members who are providing solutions for this new work environment.

Hardly Tackles “Notification Fatigue”

Hardly developed software to prioritize and organize notifications to reduce distractions. “Too many alerts lead to stress and missing important information. We need apps to consider people’s changing priorities and needs for work and life,” says CEO of Hardly Allison Braund-Harris.

Research shows notifications are a big issue for workers. In his latest book, *A World Without Email*, Cal Newport cites research that found workers checked a communication application every six minutes or less. More than two-thirds of the users never had more than an hour of uninterrupted time. Hardly connects notifications from various apps, allowing users to prioritize topics and senders. This feature permits relevant notifications while holding all others. When users want a break, they can choose to release the other notifications and browse their social media, news articles, personal emails and other potentially distracting content that was muted.

“Many people use notifications for collaboration and communication, so turning on do-not-disturb is not an option,” says Braund-Harris. “As we begin

to return to work and implement hybrid models, ensuring easy communication between in-person and remote workers will be crucial.”

Microsoft Fosters Interactive Presentations

Microsoft recently announced plans to revamp PowerPoint sharing on Microsoft Teams. Reliance on video conferences has increased the need to seamlessly present slideshows, while maintaining control of the call and chat features. PowerPoint Live improves the presenting experience where the audience can navigate the slideshow at their own pace and interact with live links. Presenters can see their notes, the attendees, and the chat, while sharing slides. And Presenter Modes provides different ways to share video and presentations simultaneously. The presenter also has the option to silhouette their video in front of the presentation, display it next to them or share it as a visual aid above their shoulder like a televised news report.

Google Creates Immersive Meetings

In September 2020, Google introduced the Google Meet Series One Hardware in partnership with Lenovo. The Google



Many people use notifications for collaboration and communication, so turning on do-not-disturb is not an option.

Allison Braund-Harris, Hardly



Meet hardware was created with hybrid workplaces in mind to create immersive meetings. Features include an audio bar, smart camera, mic pod, computing system and remotes. The Smart Audio Bar integrates TrueVoice® which uses AI to remove background noise and focus on human voices. The Smart Camera also uses AI to automatically adjust to ensure all participants are in frame.

In early 2020, companies were forced to quickly shift to a remote environment. Employers and employees discovered the many benefits and new challenges of remote work. These challenges may heighten as organizations navigate hybrid work models without proper solutions. Technology is playing a critical role in supporting new ways of working and providing solutions to help employees stay productive, efficient and connected. ■

SUSTAINABLE TECH

Companies Need to Know What's in Their Products

Manufacturers must develop robust chemical management systems which can rapidly respond to an evolving regulatory landscape.

The beginning of 2021 was a whirlwind for many reasons. But in the chemical management world, industry was unexpectedly caught up in the Environmental Protection Agency's (EPA) Final Rules on five persistent, bioaccumulative and toxic chemicals pursuant to the Toxic Substances Control Act (TSCA). After publication of the Final Rules, one of those five chemicals — phenol, isopropylated phosphate (3:1) (PIP (3:1)) — was found to play a critical role in internal and external cables, insulation covers and other components in many consumer technology products. PIP (3:1) is a halogen-free flame retardant that operates at a high level of efficiency while also exhibiting plasticizer qualities. It provides fire safety protection for some components and accessories of consumer technology products.

Many of CTA's members have robust chemical management programs, but a multitude of factors led to industry being caught up by EPA's new regulations. First, PIP (3:1) is not regulated in any jurisdiction around the world. Second, it doesn't appear on industry-wide declarable substances lists. As a result, many manufacturers' chemical management tracking systems failed to flag this chemical.

The limited industry engagement with EPA in the development of the Final Rule resulted in an EPA assuming that PIP (3:1) was not widely used in commerce and thus established a 60-day compliance timeframe to phase it out of commerce. This placed both product manufacturers and retailers in an untenable position. Companies and retailers were faced with the real possibility of having to pull products from shelves at a significant financial loss.

In collaboration with several other industry trade associations, CTA petitioned EPA to revisit the Final Rule for PIP (3:1) and, in March 2021, EPA issued a 180 day No Action Assurance indicating the agency would exercise "enforcement discretion" with companies. CTA recently submitted comments to the Final Rule requesting a compliance timeframe extension.

Lessons Learned

There are several lessons to be learned from our experience with PIP (3:1). First is a policy lesson. Although EPA has regulated chemicals under TSCA since the 1970s, a 2016 bipartisan effort updated TSCA through the Frank R. Lautenberg Chemical Safety for the 21st Century Act. With the updated law now being implemented, TSCA no longer primarily impacts chemical manufacturers. Brand

Investing in transparent supply chains can stave off challenging situations.

owners and retailers are now on notice that the use of chemicals in articles, a term that encompasses parts, components and finished goods, may be regulated.

Second is a process lesson. The experience with PIP (3:1) has been a stark and painful reminder that EPA may establish rules that are untenable for industry unless we proactively engage. Without such engagement, the risk of unreasonable compliance timeframes or bans of a needed chemical for which no alternatives exist is now very high.

EPA's PIP (3:1) regulation is likely to be the first of many in the coming years at the federal and state level that impacts chemicals used in consumer technology products. This demonstrates the urgent need for manufacturers to develop robust chemical management systems which can rapidly respond to an evolving regulatory landscape. Investing in transparent supply chains can stave off challenging situations like this one and ensure that the industry is positioned to advocate for the establishment of reasonable rules under which industry can continue to innovate. ■



FACES OF INNOVATION

Robin Liss of Suvie

The future of smart appliances is here — innovation in gourmet cooking



Move over Rosie (from the Jetsons), meet Suvie, the first fully automated countertop robot that can cool and cook your food in minutes. Think of Suvie as a sleek refrigerated oven that saves you time and prepares delicious home cooked healthy meals for you and your family.

This isn't your mother's crockpot; this is the future of smart kitchen appliances. It's a new vision and technology for the most used and yet tech neglected space in the house — your kitchen countertop. Looking through a tech lens, founders Robin Liss and Kevin Incorvia realized they had an opportunity and started Suvie in 2015. At the company's headquarters in Cambridge, MA, you will find experts on the leading edge of innovation in gourmet cooking, product design, safety and engineering.

"If you look around the world, American appliances are significantly different than everywhere else in the world. American ovens were designed for two days; Christmas and Thanksgiving," says Liss. She also points out how in other countries, ovens are different sizes and food is a rapidly evolving, cultural thing. Sharing a meal is the easiest way to connect with someone, even if you don't speak the same language.

Making it Smart

Kitchen appliances revolutionized automation in the home, and at times do not get the credit they deserve for their time saving capabilities. Appliances are meant to help save time on chores, and with technology advancing at a rapid pace, expect the smart home to include smart appliances.

Suvie is called a robot for good reasons — it intelligently cooks a meal to perfection. The newly released Suvie 2.0 kitchen robot has two independent cooking zones and can be paired with additional inserts to prepare accompanying sauces and starches. The Suvie contains a mini-compressor and water jacketed tech to safely cool, cook and keep food warm until it's time to serve.

Suvie's patented water jacketed technology gently thaws food from frozen

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If you look around the world, American appliances are significantly different than everywhere else in the world. American ovens were designed for two days; Christmas and Thanksgiving.
”

to fully cooked in as little as 25 minutes. With 15 cooking functions, home chefs can load a frozen tray of food into Suvie and schedule it to finish cooking later in the day. The system automatically defrosts frozen food and takes it through the thawing cycle to fully cooked without the hassle of using multiple kitchen appliances.

The company has a comprehensive list of Suvie Smart Meals and recipes available. Cooks simply scan the label on the package or the recipe card, and Suvie will get to work, knowing the precise times and temperatures so cooks don't have to bother. Suvie goes from steaming, to baking, roasting or broiling, with no extra time needed in the kitchen, or having to stand around waiting to flip your food over or tend to it. Instead, Suvie encourages families to spend the time connecting.

The kitchen was designed to be the center of our home and health. Suvie and Suvie Smart Meals makes it easier for families serving up “fast food” in healthy ways. To find out more about Suvie, visit: suvie.com. ■

The Changing Entertainment Ecosystem

Platform changes impact distribution and advertising.

When HBO Max introduced its ad-supported, subscription tier in June, the digital entertainment world absorbed a tradition-shattering blow. For decades, HBO — the premium cable channel — wouldn't even allow advertising in its printed program guide, let alone on its channels.

But now HBO's streaming service is offering ad-supported viewing for \$100 annually or a commercial-free package for \$150. Both versions include a deep catalog of content from HBO, Warner Bros., Turner Classic Movies and the Cartoon Network. Ads will be limited to four minutes per hour, with no ads run during HBO programs. About 35 brands are in the first wave of HBO Max advertisers.

But there are caveats, such as ad-supported subscribers can't download content for offline viewing, and streaming video quality will be capped at 1080p.

This all comes while Hollywood and the media world are preparing for a post-pandemic overhaul that reaches from theatrical revisionism to platform permutations. Warner Bros. drew heat last year when it adopted a "streaming-first" release pattern. What worked for some films during the pandemic may become a permanent feature, but it's not being universally embraced, especially by the theater-based infrastructure.

Meanwhile Amazon's \$8.45 billion acquisition of MGM moved a historic film library to the giant's entertainment warehouse, and also created new licensing and distribution possibilities. Since MGM produces series such as "Handmaid's Tale" for Hulu and " Fargo" for FX, the studio will provide new content for Amazon Prime and potentially others.

These structural revisions come during tremendous media industry upheaval, aided by the pandemic's effect on viewing patterns. For example, *IndieWire*, a trade publication, ran the headline "This Was the Week That Movie Studios Finally Lost Control of the Industry." It characterized the situation as one in which "movie studios are no longer in charge of Hollywood."

Robert Tercek, founder and CEO of General Creativity, a Los Angeles consultancy, cited the changes as proof that "TV is just another app that runs on somebody else's platform." Tercek, whose book "Vaporized" explores the reinvention of legacy industries including the overhaul of entertainment and media, contends that "content is king" is no longer accurate.

"Today it's all about the platform and the marketplace plus application programming interfaces and monetization," Tercek says. "Internet and mobile are now the most important channels; theatrical release is not as significant as it was pre-pandemic." He says traditional filmmakers want to open their movies in theaters and that the new platform moguls can "indulge that."

Tercek explains Netflix has a stake in such prestigious movie theaters as the Egyptian Theater on Hollywood Boulevard and the Paris Theatre in Manhattan, which enable the streaming

“
Internet and mobile are now the most important channels.

— Robert Tercek

”
behemoth to guarantee a glamorous opening night for its films and qualify them for Oscar consideration.

What's Next for OTT Subscriptions?

Another unknown in the distribution formula is the dominance of streaming video subscriptions. A *Parks Associates survey* in June 2021 found that 82% of U.S. broadband households subscribed to at least one OTT (over-the-top) video service, up from 76% in 2020 and way above the 64% level in 2018.

Cynics are seeing a decline in streaming revenues. An *Antennas Direct study* found most subscribers expect to cut back on the services they buy because of the "strain on household budgets." The survey found that 21% of homes pay more than \$100 per month for streaming subscriptions, and another 25% spend more than \$130 monthly. The report indicates most respondents spend less than \$50 per month.

In the Antennas Direct study, of those who plan to reduce their monthly plan, 86% of viewers said they'll travel with their savings, 66% said they'll dine out and 71% cited a "wedding or life event." However, "Going to a movie theater" didn't show up as significant. ■

FORWARD STRATEGIES

Rethinking Your Operating Strategy

How flexwork and distance collaboration are reshaping work.

With recovery from the pandemic top of mind, businesses are asking: Should employees be allowed to continue working remotely? Two thirds of professionals are concerned about returning to the office, while nearly half only want to work part-time onsite, according to a survey by workplace safety tool maker Envoy. What's more, roughly one in three say they will quit if they can't work remotely, per job search service LiveCareer.



Ironically, with virtual roles having quickly become the standard, and rising flexibility in scheduling, work assignments and management models now established as operating reality, it may be a moot question. With many of the world's largest firms having shifted to at-home operations and embraced the idea of flexwork (flexible working) and its more malleable workweeks and workplans, hybrid and remote options are here to stay.

Companies must fundamentally rethink their operating models to accommodate unexpected events and give employees greater latitude in how they perform their work. Firms also must place priority on employee satisfaction, and offer more flexibility in terms of individual perks, professional development, training and benefits, and HR policies to attract and retain top talent. There are several key areas of flexwork that organizations are embracing. Among them are:

Workplace Solutions

To promote safety and social distancing, many employers are bringing fewer employees into the office and staggering workers' schedules to minimize the employees that are physically onsite. They are offering more choices in terms of days, times and hours during which work can be performed. Many are rethinking the role of the traditional office in driving productivity and communication, and reserving physical gatherings for collaboration, cross-functional meetings or teamwork activities. Workspaces are being redesigned with greater spacing between individuals, more contactless and

touchless solutions, and more frequent cleaning. Many employers are also letting their employees work from home offices and furnishing workers with laptops, videocameras and high-speed Wi-Fi routers to facilitate remote connections.

Flexible, remote and virtualized working models are here to stay, and in an age of digital transformation, will soon be the new norm.

To promote greater speed and convenience as well as safety, many firms are employing cost-affordable tech tools and structural redesigns to reimagine interpersonal exchanges, meetings, and everyday business exchanges. For example: Many tech retailers are using online apps and curbside pickups to facilitate transactions; hospitality providers are implementing solutions such as app-based tickets and registrations in lieu of manual check-ins; and videoconferencing and live streaming tools. Organizations are rethinking basic business processes to include more connected and virtual solutions.

Professional Development

To keep up with changes in working models, companies are providing staff with more training and professional development. They are finding new ways to upskill their workforces and provide more opportunities for employees to

connect, communicate, and boost distance leadership and management capabilities as well as regularly briefing teams on emerging events. More personalized mentoring and professional development paths tailored to the needs of the individual worker are becoming common. Customizable and on-demand educational platforms let workers retrieve learning modules when they desire.

Job Perks

Flexwork-friendly employers are also offering more accommodating benefits programs such as a financial allowance that an employee can spend on a menu of benefit choices that best suit their individual scenario. Perks can range from babysitting and tutoring to gym memberships. These perks help to promote well-being and professional development and give staffers the custom support required to give their best efforts at work.

The traditional 9-to-5 workday and one-size-fits-all approach to business is outdated. Ongoing concerns related to COVID-19, fundamental shifts in the marketplace, and sociocultural changes are putting pressure on companies to rethink their operating models. New shifts in the workplace — more flexible, remote and virtualized working models (like personalized perks and scheduling) are here to stay, and in an age of digital transformation, will soon be the new norm. ■

Contact professional speaker Scott Steinberg at FuturistsSpeakers.com.

TECH TACTICS

Plummeting Price of Solar Power

Inexpensive solar disrupts traditional power producers.

Solar power is the cheapest source of new electricity globally. In April 2021, the world record low bid of 1.0¢ per kWh of solar power was announced for 600MW of solar power in Saudi Arabia — that is enough energy to power 100,000 homes. Power Purchase Agreements (PPA) are for 20 or more years and include both capital and operating costs.

This is bad news for traditional power producers globally. It costs more than a cent to run an existing gas, coal or nuclear power plant. In other words, the combined capital (CAPEX) and operating (OPEX) expense of some solar is now cheaper than the operating expenses of traditional power plants. According to the International Energy Agency (IEA), the cost to operate nuclear power plants are two to five cents per kWh; for coal it is two

to four cents; and for natural gas it is between four and ten cents.

Solar and wind power are the cheapest source of electricity for two thirds of the world's population, according to Bloomberg New Energy Finance (BNEF). The economies in these countries represent 72% of the world's GDP and 85% of global power demand.

Looking back, the price of solar power has plummeted from \$77 per Watt in 1977 to just 12¢/Watt in 2020. This stunning decline of 640X is head spinning. Solar power has been declining in cost 18% annually since 2010.

Most traditional electricity utilities have been slow to embrace solar. In 2000, the IEA predicted that the world would have installed a total of 18 Gigawatts (GW) of solar capacity by 2020. The IEA is the body that advises world governments and electric utilities on future trends. By the end of 2020, the world had installed just shy of 900 GW of solar power. The decline in solar prices has driven cumulative solar installations surpassing what the IEA predicted.



Wright's Law

Wright's Law states that for every cumulative doubling of units produced, costs will fall by a constant percentage. Think of it as the law of learning, or the experience curve. For solar power it works out to a 30% decline in cost for each doubling of cumulative production. As solar installations continue to be built, costs will decline, resulting in even more solar installations.

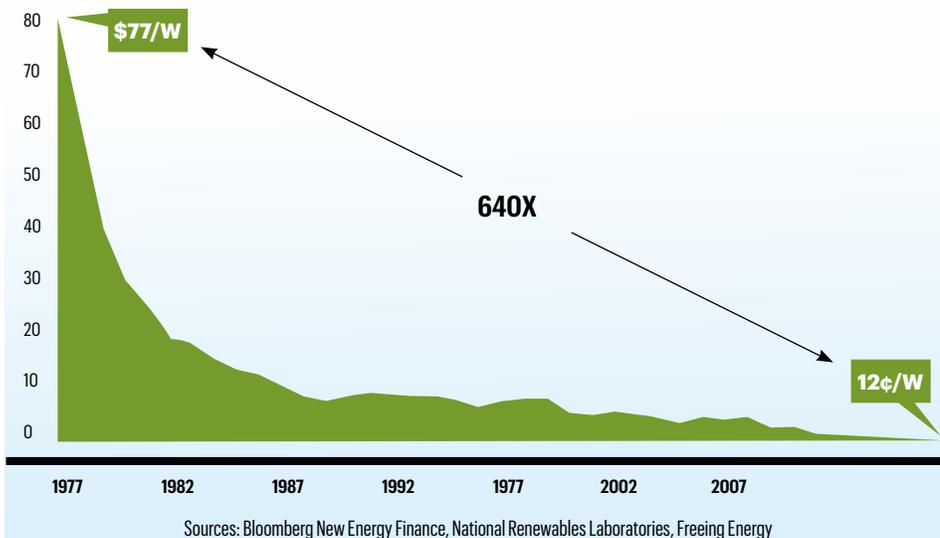
Here is a staggering statistic: more energy falls on the earth from the sun in a single hour than all energy used in all countries in an entire year.

According to a new report released by Carbon Tracker in April of 2021, by the mid 2030s, solar and wind power will have pushed fossil fuels (coal, oil, and gas) completely out of the electricity sector. Given the rapid rise in electrification of the \$10 trillion transportation market, fossil fuels will be pushed out of transportation as well.

It appears the decade of disruption for electric utilities will be between 2020 to 2030. ■

Jim Harris is the author of Blindsided. Follow him at @JimHarris or email jim@jimharris.com.

PLUMMETING PRICE OF SOLAR POWER
640X CHEAPER OVER 43 YEARS (\$/WATT)



BY THE NUMBERS

The Post-Pandemic Computing Landscape

2021 looks like it will be another stellar year for laptops.

The year 2020 proved to be lucrative for laptop sales as much of the U.S. population was pushed to work from home and into remote learning models. This shift forced many Americans to focus on upgrading their offices and the technologies within those offices to stay productive. And 2021 looks like it will be another stellar year for laptops. According to CTA's *Dynamic Forecast for Laptops (April 2021)*, mobile PCs saw an all-time high in the survey with 27% of participants intending to purchase a laptop within the next six months.

Mobile PCs, classified as notebooks, netbooks and convertible PCs, are one of the largest categories within the forecast. In 2020, CTA estimated that mobile PCs alone generated just over \$40 billion in shipment revenues which accounted for almost 15% of hardware shipment revenues for all tech products in the forecast.

Outfitting the Home Office

Mobile PCs are the main influencers for other home office tech products. As consumers continue to purchase mobile PCs for working at home, the need for computing peripherals remains as well. Peripherals like PC monitors, mesh networks (so people can work wherever they want at home), docking stations, mice, keyboards and headsets are all expected to see increased sales and will have excellent momentum in 2021.

In the January 2021 version of the five-year outlook, early data implied that unit shipments were much

Peripherals like PC monitors, mesh networks, docking stations, mice, keyboards and headsets are expected to see increased sales and will have excellent momentum in 2021.

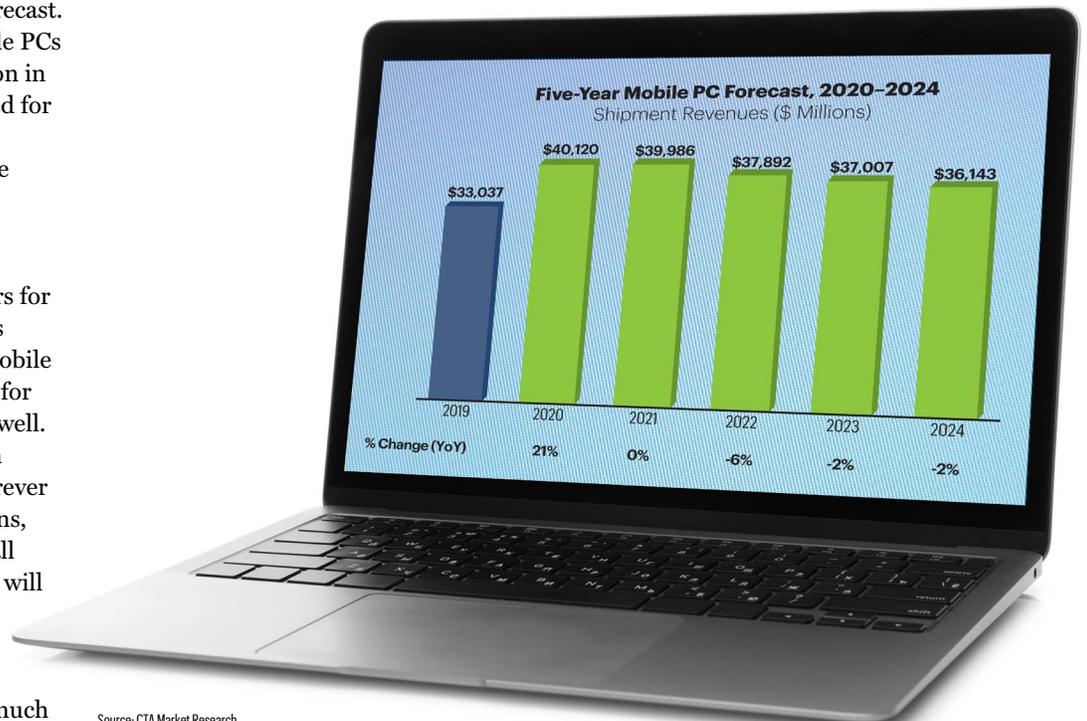
higher than first expected, so CTA's estimate was raised to account for a better 2020 market for laptops. CTA now estimates that just under 70 million units of netbooks and notebooks shipped in 2020, which was an increase of over two million units from the previous estimate. This increase is attributed to the increased reliance on teleworking and the efficient adoption of remote working and learning by students studying at home.

Keeping Steady

After an all-time profitable year in sales, CTA is forecasting demand to remain relatively stable in 2021, believing that repeating last year's record growth is unrealistic under normal market conditions. Market resistance factors are beginning to creep into forecast estimates, notably the global chip shortage and consumer saturation. Realistically, consumers cannot keep adding to their stock of home computing devices. On the flip side, businesses are expected to pick-up some of the slack, resulting in a strong year-end unit shipment number.

Amid the chip shortage and supply constraints, CTA is projecting that unit shipments of mobile PCs will decline in 2021 to just under 68 million units shipped. However, rising prices will keep revenues steady generating just under \$40 billion in shipment revenues for the year. For the five-year outlook CTA projects unit sales and revenues will continue to drop but will remain higher than 2019 for the entire five-year forecast window.

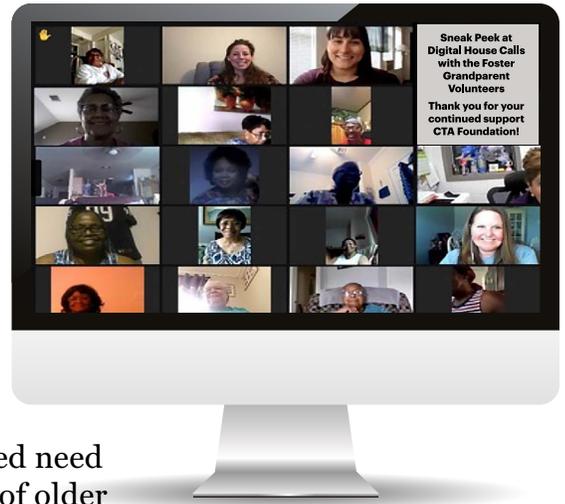
Last year proved to be a historic year for sales of mobile PCs and with demand still at an all-time high, 2021 could be on par with 2020, even when challenged with the chip shortage and supply chain constraints. ■



Source: CTA Market Research

CT REPORTS

Announcing the 2021 CTA Foundation Grant Recipients



The CTA Foundation is thrilled to announce the 2021 class of grant recipients. In a year that saw an increased need and interest in using technology to address the needs of older adults and people with disabilities, the CTA Foundation is committed to getting resources to a wide range of organizations across the country on behalf of the consumer technology industry.

Telehealth was a hot topic this year. Organizations such as the Front Porch Center for Innovation and Wellbeing will be using mobile solutions to provide tele-mental health services to residents in their communities. BridgingApps, a program of Easter Seals of Greater Houston, is expanding the coverage of telehealth solutions through its app database and training programs. And the Code of Support Foundation's PATRIOTlink system continues to build on its platform to match military service members, veterans, families and caregivers with the services they are eligible to receive.

Virtual and augmented reality also jumped to the forefront in providing resources to caregivers. The Council on Aging of Southwestern Ohio is developing a virtual reality-based caregiver trainer and Lutheran Services in America is using augmented reality glasses to support caregivers in its pilot program.

Other groups receiving first-time grants include the Ablegamers Charity, which uses a large scale 3D printer to prototype individually customized solutions for people with disabilities to get the social benefits of accessible gaming. Access Hears in Baltimore is providing access to affordable hearing devices to low-income communities. Avenidas provides technology training

programs to low-income Vietnamese and Mandarin-speaking seniors in Santa Clara County, CA. Second Sense is taking an innovative approach to supporting people who are blind or low vision through a remote technology solution. And St. Barnabas Senior Services is undertaking a new initiative with USC's Leonard Davis School of Gerontology to

address the technology needs of low-income, ethnically diverse seniors.

A complete list of the 2021 class of grant recipients is below. ■



CONTACT: If you are interested in getting involved with any of these organizations, contact sewell@CTAFoundation.tech.

ORGANIZATION	First Time Grant Recipient	Headquarters	Region Served by Grant
<u>Ablegamers Charity</u>	Yes	Kerneysville, WV	National
<u>Access HEARS</u>	Yes	Phoenix, MD	Baltimore and Montgomery County, MD
<u>Avenidas</u>	Yes	Palo Alto, CA	Santa Clara County, CA
<u>Byte Back</u>	No	Washington, DC	Washington, DC and Baltimore, MD
<u>Code of Support Foundation</u>	No	Alexandria, VA	National
<u>Community Tech Network</u>	No	San Francisco, CA	Austin, TX and surrounding counties
<u>Council on Aging of Southwestern Ohio</u>	Yes	Cincinnati, OH	Cincinnati, OH
<u>Easter Seals of Greater Houston</u>	No	Houston, TX	Houston and online
<u>Front Porch Center for Innovation and Wellbeing</u>	No	Glendale, CA	California
<u>Gallaudet University</u>	No	Washington, DC	National
<u>Helen Keller National Center</u>	No	Sands Point, NY	National
<u>Institute on Human Centered Design</u>	No	Boston, MA	Washington, DC
<u>ITNAmerica</u>	No	Westbrook, ME	National
<u>Lighthouse for the Blind and Visually Impaired</u>	No	San Francisco, CA	California
<u>Lutheran Services in America</u>	No	Washington, DC	Michigan and Kansas
<u>Older Adults Technology Services</u>	No	Brooklyn, NY	National
<u>Second Sense</u>	Yes	Chicago, IL	Chicago, IL and surrounding counties
<u>St. Barnabas Senior Services</u>	Yes	Los Angeles, CA	Los Angeles, CA

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MARKET BEAT

Consumer Technology Ownership Hits New Highs

What is the latest tech consumers are buying?

New research from CTA sets the benchmark for technology ownership in North America and provides fresh perspective on engagement with digital services. CTA's analysis reveals rising levels of technology ownership among households over the past year in multiple categories; echoing historic unit shipment volumes tracked by CTA in 2020. The research also shows purchase intentions remain elevated across U.S. households and Canada, portending another banner year for the industry. A deeper dive into the data reveals several key trends driving business opportunities.

Let's start by looking at the fastest growing technology products in terms of household ownership. CTA's *23rd Annual U.S. Consumer Technology Ownership & Market Potential Study* (May 2021) found among the 83 products measured, household ownership of 4K UHD TVs and two-in-one notebook PCs saw the largest gains. Self-reported ownership of 4K UHD TVs grew the fastest, leaping 16 points to land at 52% of households. Ownership of two-in-one notebook PCs grew 14 points to 46% of U.S. households. Other products making significant advances in ownership levels over the past year included smart home products and connected fitness equipment. The imprint of the health crisis on these gains is obvious.

TVs and Smartphones Vie for Dominance

TVs remain the flagship device in American homes, with 91% reporting they own at least one TV. However, household ownership of smartphones is nearly congruent at 90%. Likewise, ownership density of TVs and smartphones is similar with 2.3 and 2.1 products owned, in turn.

Purchase intentions for both products remain strong, inspired by new technologies like 5G smartphones and 8K UHD TVs. In terms of computing products, 81% of households own at least one notebook PC.

Smart home technologies are another category where ownership levels are gaining momentum. Ownership grew robustly across the nine smart home products included in CTA's survey — from smart speakers to smart door locks. 2021 should bring even more ownership gains as purchase intentions over the next 12 months continue to climb across all devices, including robotic vacuums. This is especially true among repeat purchasers as they seek to expand their connected home environments by adding more smart home products such as doorbells, locks, lights and/or centralized control through smart speakers.

Another product category on the rise is wireless personal audio — particularly wireless earbuds, which were popular even before the era of Zoom calls. Today, U.S. household ownership of wireless earbuds (47%) surpasses wired earbuds (45%). Expect wireless personal audio products,

TVs remain the flagship device in American homes, with 91% reporting they own at least one TV. However, household ownership of smartphones is nearly congruent at 90%.

including earbuds and headphones, to remain popular as one-third (33%) of households intend to purchase one of these products within the next 12 months.

Lifted by end demand for more entertainment options and innovative new models, the home video game console market is yet another category seeing substantial gains in household ownership. Today, more than half (53%) of U.S. households report owning at least one home video game console including 26% that own a 'next-gen' model such as Sony's Playstation 5 or Microsoft's Series X. Purchase plans are strong with 33% of U.S. households looking to buy a home video game console over the next year, with one in five planning to buy a next-gen game console.

More technology ownership trends plus a look at engagement with digital services like streaming video and online health care are contained in CTA's U.S. research report. And many of these same trends can be found in CTA's *6th Annual Canadian Consumer Technology Ownership & Market Potential Study*. Connect with these studies and more at CTA.tech/Research. ■

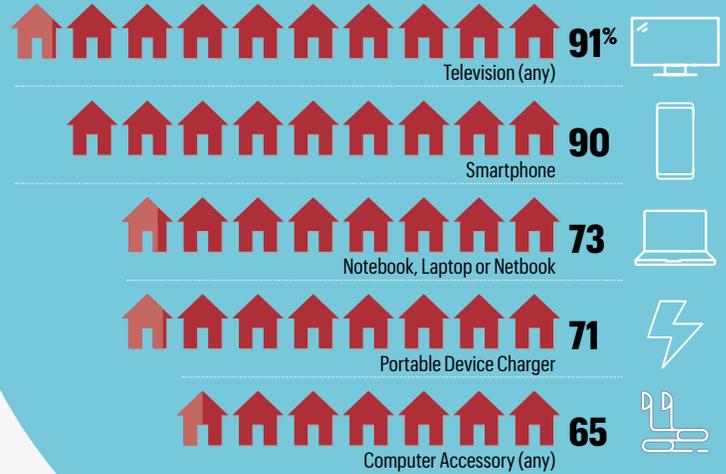
STATS AND FACTS

The Top Five Tech Products Consumers Own

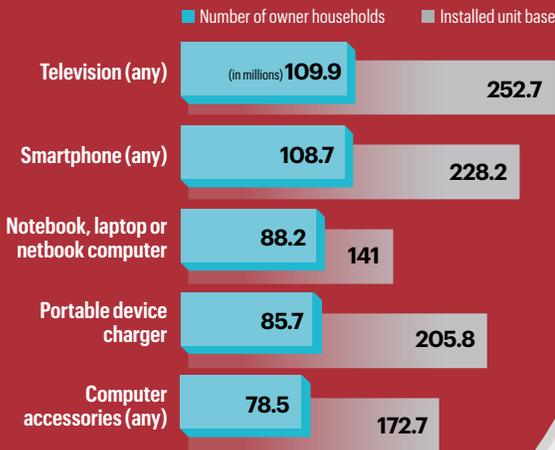
CTA's 23rd Annual U.S. Consumer Technology Ownership & Market Potential Study (May 2021) evaluated 83 products and found the top two tech products that saw the largest growth in ownership during 2020 to 2021 are 4K UHD TVs and two-in-one notebook PCs. Smart home products and connected sports or fitness equipment also made significant advances into U.S. homes in 2021.

While more than nine in 10 households own televisions and/or smartphones, televisions still lead the market with more TVs installed in homes than any other consumer tech product. Consumers report owning 2.3 units, which accounts for nearly 253 million televisions installed in U.S. homes. Following are the leading tech products consumers own:

TOP FIVE MOST OWNED CONSUMER TECHNOLOGY PRODUCTS

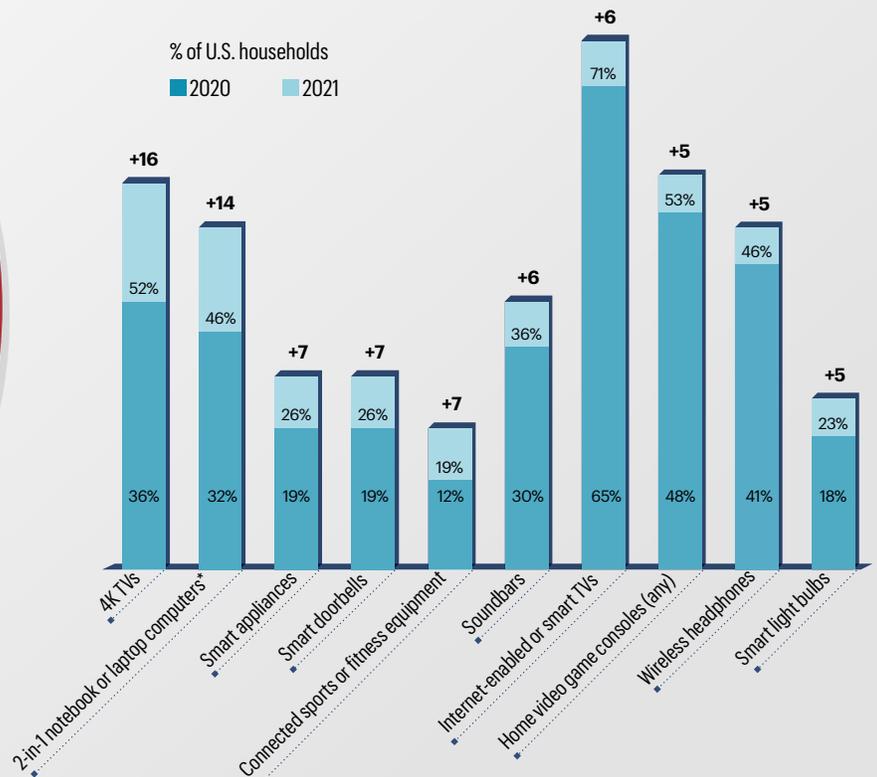


TOP FIVE MOST INSTALLED* CONSUMER TECHNOLOGY PRODUCTS



*Installed base is an estimate of the number of units owned in the United States

LARGEST GROWTH IN OWNERSHIP FROM 2020 TO 2021



*Among U.S. adults owning a notebook, laptop or netbook computer or tablet