

CES 2019 Report

The 2019 CES Report is presented by the Entertainment Technology Center at the University of Southern California (ETC), a research center and think tank organized within the School of Cinematic Arts. More Information at etccenter.org, read the latest industry technology news at etccentric.org, and subscribe to our free [Daily News Brief](#).



■ Introduction

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Get ready. The blistering fast speed and low-latency of *5G technology*, rapidly improving applications of *machine learning and artificial intelligence*, and the introduction of *commercial quantum computing* are among the first real products and technology to exemplify the description of *The Fourth Industrial Revolution* by World Economic Forum executive chairman Klaus Schwab.

The implications are significant for media and entertainment companies. Unlike the previous three industrial revolutions, the impact of this fourth one will be faster, broader, and potentially more visible.

Our reporting from CES 2019 presented here, and in a narrative presentation by ETC analysts that becomes available after the completion of a series of live-onsite briefings, highlights products, technologies, companies, issues, and trends important to media, entertainment, and technology companies.

More from the WEF

[Creative Disruption: The Impact of Emerging Technologies on the Creative Economy](#)

[Our Shared Digital Future](#)



Media and Entertainment Play Pivotal Role

It was not that many years ago when CES executive vice-president Karen Chupka convened a meeting at the Four Seasons Hotel in Los Angeles with representatives of the Hollywood studios to pitch CES as a place for entertainment. It was a stretch for some people in the room that day to imagine doing meaningful business there. Cut to CES 2019 and entertainment was everywhere. The enabling power of 5G and AI combined with more powerful processors and beautiful new televisions, had everyone talking about entertainment and experiences.

The full potential of 5G will manifest over time but the best example to illustrate how fast it can be is the under 10 seconds it takes to download a feature film compared to today's 3-4 minutes on a good connection. While Verizon CEO Hans Vestberg said that speed is just one "currency" of 5G and downloading or streaming movies is obvious, for examples of innovation that will create new opportunities he highlighted Disney's StudioLab and the New York Times, which now makes extensive use of video in their storytelling.

AMD introduced their new Threadripper 32 core, 64 thread processors specifically designed for content creators. CEO Lisa Su extolled advantages and cost savings for virtual production and included behind-the-scenes footage and comments from Fox Studio's VFX Lab to back up her claims.

In 2011, CES partnered with *Variety* to produce the Entertainment Matters program mostly to attract media and entertainment executives to what then was still called the Consumer Electronics Show. In 2015, CES introduced C-Space as a conference venue focused entirely on media and entertainment. If its first years drew modest crowds, this year the Aria conference sessions were generally standing-room-only to hear top marketers, content creators, network and studio executives, and marketing tech leaders. The hallways were crowded with media buyers and sellers taking meetings in tony hospitality suites.

The shift away from traditional print and basic broadcast has accelerated. Ad spending in the United States, according to *Statistica*, placed mobile on top at 34% and paid search at 23%, followed by national TV (20%), desktop (18%), and social (14%). Local TV, print, radio, video, and other out of home account for the remainder. Many factors feed into this shift to digital but it is content that entertains that attracts and engages audiences.

CTA celebrated this fact as the CES 2019 week opened. “Consumer spending on music and video streaming services is valued at \$26 billion in revenue, 25 percent higher than last year,” the trade organization reported in their Sales and Forecast Report. “The availability of live TV streaming and exclusive, award-winning content through subscription video streaming services will push consumer spending to \$18 billion in 2019, up 27 percent from 2018. On-demand music services (e.g., Spotify, Pandora or Apple Music) will bring in an expected \$7.7 billion in revenue, up 22 percent as providers race to gain subscribers.”



2019 CTA CONSUMER TECH FORECAST



CTA and ETC Trends To Watch

CTA, the Consumer Technology Association and owner of CES, identified *5 Tech Trends to Watch*:

- Artificial Intelligence
- The Smart Home of the Future

- Digital Health
- eSports and Sports Technology
- Resilience

Perhaps the most notable point made during the CTA pre-show briefing was an observation that we are entering **The Data Age**.

From the information age of the 1990s, The Digital Age defined the first decade of the 2000s, followed by The Connected Age.

“The U.S. is beginning a transformation that will create lucrative business opportunities for many,” CTA president and CEO Gary Shapiro wrote in his [Tech Trends introduction](#). “5G is coming and its rich bandwidth will reduce latency, allow a fast data stream and incentivize new services that cross the borders of all tech sectors.”

“Combined with low cost sensors, deep data analytics and AI, 5G will be the backbone for much of the smart city infrastructure that will help to drive resilience for unforeseen disasters — one of our key topics,” he added. “5G will also fuel the connected home, transform digital healthcare and create immersive experiences for global sports fans. Of course, AI will be at the core of each of these areas supporting them with data to make informed actions.”

ETC Topics and Trends

For ETC@USC, interest in 5G is less about the nascent hardware or services today and much more about the significance three to five years hence when the [GSMA mobile trade association projects](#) that a third of the world’s population will have 5G access and 1.2 billion devices will be connected.

It is against this landscape that ETC frames supplementary trends to see how close we are to a sea change in distribution and personalization.

These trends include:

- **5G**
- **Giants on the Move**
- **Digital Assistants - Google and Alexa Everywhere**
- **IoT**
- **Artificial Intelligence**
- **Augmented Reality and Virtual Reality**

- **Media and Marketing**
- **Hidden Future**

Our report presents ETC reporting throughout CES 2019, video highlights from the floor, keynote presentations, panels, products, and helpful links to "Also Noted" stories, curated from other publications.



CES 2019 Keynotes Reflect Priorities of Industry and Leaders

Highlights from all of the CES Keynote Corporate Presentations and Keynote Panels.

CES 2019 keynotes reflected the priorities of industry leaders and the Consumer Technology Association (CTA) with corporate presentations by IBM, LG, Verizon, AMD, a Smart City focused keynote panel, and a mobile and marketing focused keynote panel with AT&T, Adobe, National Geographic and Magic Leap. Topics ranged from artificial intelligence, display technology, smart products, telecom and transmission to core technology, the future of transportation, 5G, hyper-connectivity and consumer engagement.

IBM chair, president and CEO Ginni Rometty, who last delivered a CES keynote in 2016, brought the IBM theme “Bring Smart to Work” to CES. “IBM is changing the way the world works. At CES 2019, IBM showcased how technologies like AI, quantum computing, blockchain, and IoT enable us to enact that change,” the company notes on its [CES website](#). Rometty, as well as other keynoters, also emphasize responsibility and trust as she presented an “outlook for how technology will significantly improve how businesses operate and people work and live.”

LG Electronics president and CTO Dr. I.P. Park presented the CES pre-show keynote on Monday night. Although LG is regarded as a leader in display technology and the company showed an 88-inch OLED and similar sized LED televisions among its products, it is transforming itself from a product manufacturing company to a lifestyle innovator and pioneering AI development to do so.

Verizon CEO Hans Vestberg explored the future of connectivity through 5G as it fuels new technologies and services that will blend our physical and digital worlds. Verizon Digital Media had a major presence at CES as it looks forward to serving a marketplace where 82 percent of Internet traffic will be video.

AMD president and chief executive Dr. Lisa Su took the keynote stage as the company [continues to grow its market share](#). AMD announced its latest Ryzen and Threadripper processors and new, more powerful graphics cards. Dr. Su’s keynote provided “a view into the diverse applications for new computing technologies ranging from solving some of the world’s toughest challenges to the future of gaming, entertainment and virtual reality with the potential to redefine modern life,” CES wrote.

The marketing and media-oriented C Space continues to grow in size and substance. This year’s C Space keynote, titled “New Frontiers in Mobile,” featured a conversation with AT&T Communications CEO John Donovan and MediaLink chairman and CEO Michael Kassan.

National Geographic CMO Jill Cress; Deloitte Digital CMO Alicia Hatch; Omar Hatch, chief product officer of Magic Leap; Adobe CMO Ann Lewnes; Mark Penn, president and managing partner of The Stagwell Group; and Philip Thomas, chairman of the Cannes Lions discussed how global companies are developing marketing strategies to best engage consumers in this mobile-first, hyper-connected, data-driven world.

These videos include highlights of the CES Keynote sessions described above and all of the major corporate presentations.



To read full stories in the "stack", please click the fullscreen icon

Keynote: IBM CEO Arvind Krishna

Verizon CES Keynote Demonstrates 'Eight Currencies' of 5G

By Don Levy

"5G will change everything," said Verizon CEO Hans Vestberg in the opening statement of his CES keynote. The exponential enabling power of the 5G network relies on what he called "eight currencies" or capabilities that together produce true 5G. They are peak data rate, mobile data volume, mobility, connected devices, energy efficiency, service deployment, reliability

and latency. These “currencies” enable innovation and Vestberg presented initiatives with *The New York Times*, Walt Disney Studios, Verizon-owned drone operator Skyward, and Medivis, in healthcare, as examples. [Read More](#)



Giants on the Move

Facebook, Apple, Amazon, Netflix, & Google

The five companies that comprise the acronym FAANG — Facebook, Apple, Amazon, Netflix, and Google — made an impact at CES whether or not there were actually at the show. Apple had a silent presence, attracting attention with a building-high billboard, and more alliances that suggest an opening in their wall-garden while Facebook pressed beyond privacy controversies. Where Google dominated the central plaza with a two-story exhibit space and experiential ride so big that the structure reportedly required its own

foundation, Amazon spread itself throughout the exhibit spaces, showcasing not only Alexa but Amazon Web Services and a growing position in advertising. Now that Netflix has changed viewing habits around the world, the forecast of 25% increase in streaming service revenue for 2019 reflects expansion in the market and new entrants. One thing that all of these giants have in common are the financial resources and corporate curiosity to invest in enabling technologies and possess deep stores of data necessary for better and more valuable personalization.

Lead Vocalists - Alexa and Google

Voice as the new interface

Judging Current State of Amazon and Google Rivalry at CES

By Debra Kaufman

At CES 2019, in what some are saying has become an annual battle in recent years, Amazon and Google went mano a mano, with the former's Alexa voice assistant in one corner, and the latter's Google Assistant in the other. Since the debut of the voice assistants, this sector's importance has soared, and both companies have been jockeying for dominance. Amazon stated that more than 100 million Alexa devices have been sold, while Google said its Assistant will be built into one billion devices by the end of the month.

[Read More](#)

CES: Voice Assistants Are No Longer Just for Smart Speakers

By Rob Scott

If CES is any indication, 2019 may be the year that voice assistants become more integrated into our daily lives. Amazon and Google went head-to-head in Las Vegas last week with a flood of partnerships touting smart home and CE devices that now support Amazon Alexa and Google Assistant. Among the products featuring voice support included LG's much-hyped rollable OLED TV; Panasonic's new 4K OLED; Samsung's 2019 TV lineup; Vuzix Blade AR glasses; an array of speakers, soundbars and headphones; new smart displays from Lenovo, Archos and KitchenAid; and a collection of home security devices, kitchen and bathroom appliances — even

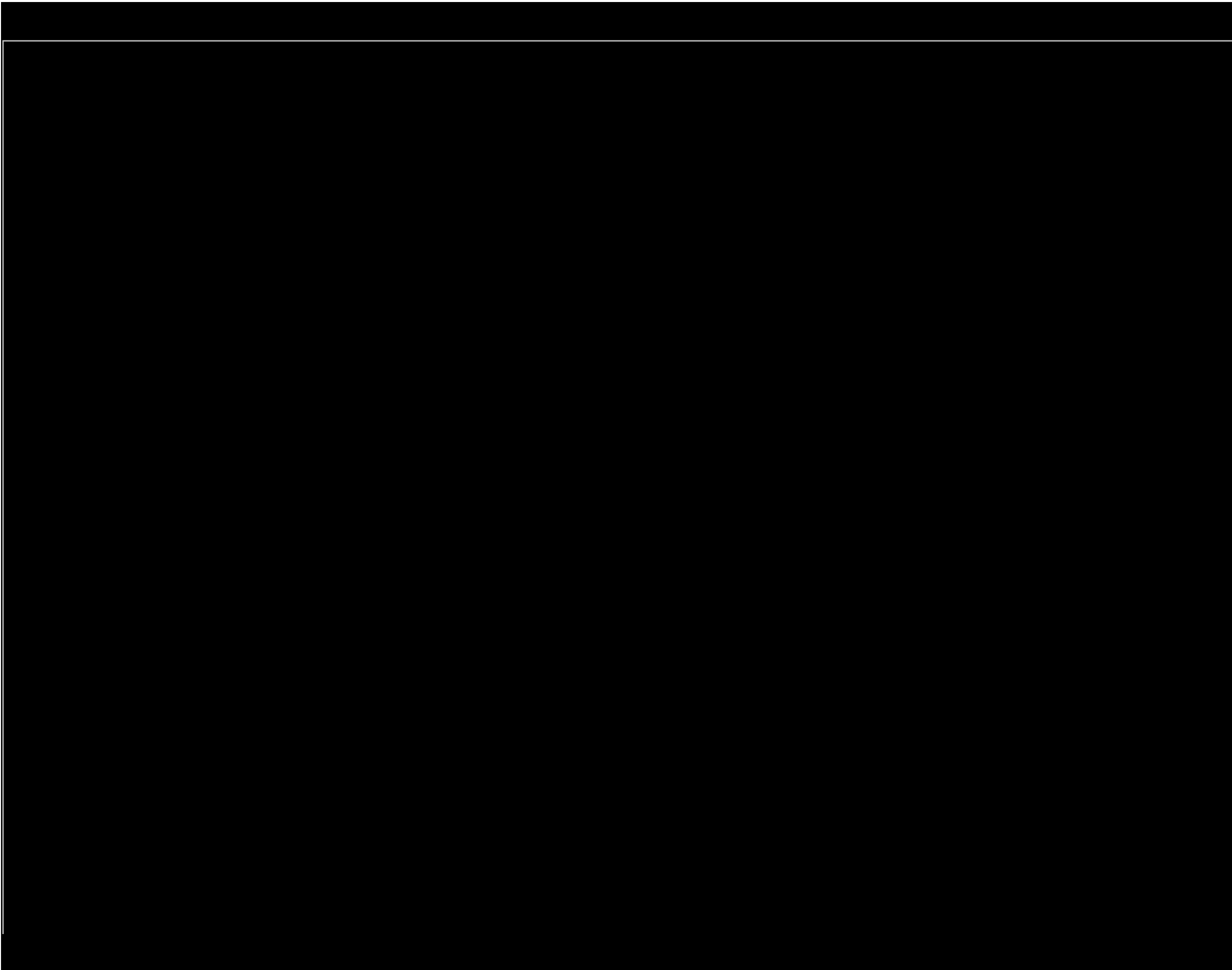
[Read More](#)

Chinese Compete on Quality Technology

Chinese Compete on Quality, Technology,

AND Price

Chinese companies with lower prices and significant quality are helping to drive adoption of 4K and beyond displays. Acquisition of major consumer appliance companies make them major competitors in the digital home.



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If 5G Begins The Next Industrial Revolution, **what is 5G?**

At CES 2019, 5G – the next generation cellular network – was a central focus. And no wonder, since many new technologies introduced and touted previously at CES, from fitness bands to self-driving vehicles, smart doorbells to smart speakers, get a huge boost from the dramatic speed and latency improvements promised by 5G.

Much of the discussion drilled down into what 5G is and isn't, the future of 4G and the stumbling blocks to implementing the next generation networks. Experts took pains to explain that the arrival of 5G will not signal the end of 4G LTE, which is likely to continue to evolve, even reaching gigabit speeds. Networks, therefore, need to be backwards compatible with 4G even as they enable 5G.

How fast is 5G? Various experts and publications have cited speeds of four to 100 times that of 4G. “The answer,” says *The New York Times*, “depends on where you live, which wireless services you use and when you decide to take the 5G plunge.” It also notes that Qualcomm “demonstrated peak 5G download speeds of 4.5 gigabits a second, but predicts initial median speeds of about 1.4 gigabits,” which “translates to roughly 20 times faster than the current 4G experience.” But the benefits of 5G aren't limited to speed – it's also about latency. *NYT* again notes that, currently, latency of 50 to “several hundred milliseconds is common, whereas 5G promises to shave that down to “a few milliseconds.” Low latency will enable everything from virtual reality to remote surgery and haptic features.

In addition to speed and latency, 5G could also potentially increase coverage with many more small cell installations. 5G needs more base stations than 4G because the signal doesn't carry as far and can be blocked by walls or trees. But the backpack-sized 5G small cells are easily installed. Speaking of signal, 5G isn't monolithic but is actually made up of three types of spectrum, says *Digital Trends*. Low-band spectrum is “sub 1GHz,” which offers “great coverage area and penetration” but speeds top out at 100Mbps. T-Mobile is the big player in this spectrum, having bought “a massive amount of 600MHz spectrum” at the 2017 FCC auction.

Mid-band spectrum, which offers speeds up to 1Gbps, provides faster coverage and lower latency but its waves have difficulty making their way into buildings. *Digital Trends* reports that Sprint has “the majority of unused mid-band spectrum,” and is using Massive MIMO – which “groups multiple antennas onto a single box, and at a single tower for simultaneous beams to a single user” – to improve penetration and coverage area. Much of the buzz around 5G refers to high-band spectrum, also called millimeter wave or mmWave with peak speeds of 10Gbps. The challenges here again, are limited coverage and poor building penetration. AT&T and Verizon are rolling out their 5G services via this spectrum.

The use cases for 5G were also discussed at CES 2019, for everything from Deere tractors (which are already connected to 4G services) to the many permutations of smart cities. In fact, 5G unlocks the power of the smart city, which is why so many of the panelists, including Los Angeles manager of the Department of Transportation Seleta Reynolds, described plans for utilizing 5G-enabled sensors to streamline and improve city life. Edge computing, which makes the processing local to the device rather than in the cloud, combined with 5G was also compelling to some CES speakers, who noted that that will shave off another millisecond or two of latency.

In the wake of CES, a few pundits have spoken up with observations and warnings. In this *NYT* piece, former FCC chair Tom Wheeler decries the fact that the threat of 5G networks being hacked to disastrous effect is real and not being discussed at the highest levels of government. “The Trump F.C.C. also canceled a formal inquiry seeking input from the country's best technical minds about 5G security, retracted an Obama-era F.C.C. white

country's best technical minds about 5G security, extracted an Obama-era NSAC [white paper](#) about reducing cyberthreats, and questioned whether the agency had any responsibility for the cybersecurity of the networks they are entrusted with overseeing," he added.

How far will 5G evolve in 2019? *Tom's Guide* suggests that, "after years of hype about gigabit speeds ... 5G is finally becoming a reality." He summarizes now and the near future: Verizon demonstrated 5G service; AT&T started its 5G mobile network in December and began selectively offering a mobile 5G hotspot; Qualcomm and Intel are working on 5G modems for phones, cars and other devices; and that, according to Qualcomm, 20 operators around the world will unveil 5G this year. Still, it predicts that, "2020 is when the fifth generation of wireless connectivity will really start to take off."

2019, meanwhile, will show progress, uncover bugs and pain points and, one hopes, gin up excitement for what 5G will soon bring as it evolves into real products and services.

- <https://www.digitaltrends.com/mobile/what-is-5g/>
- <https://www.nytimes.com/2019/01/21/opinion/5g-cybersecurity-china.html>
- <https://www.tomsguide.com/us/5g-release-date,review-5063.html>

According to *MarketWatch*, Moor Insights & Strategy, which said the evolution to 5G will produce mobile phones 100 times as fast as their 4G counterparts, estimated that infrastructure spending on 5G will exceed \$326 billion by 2025.

Manufacturers are first looking at data centers (AMD, Broadcom, Nvidia, Qualcomm and Samsung); network transformation to help telecom and other communication companies to upgrade their networks to 5G and modems and/or supply intellectual property that contributes to the 5G standard (Ericsson, Huawei, Intel, Nokia and Samsung); and operators to deliver mobile services (AT&T, China Mobile, Orange, Singtel, Sprint, T-Mobile, Verizon, Vodafone).

Reuters notes that, according to global wireless trade group GSMA, "deals to start building mass-market 5G networks are still largely a year away, but by 2025, 1.2 billion people are set to have access to 5G networks," one-third of which will be in China. Qualcomm, it says, makes half of all core baseband radio chips in smartphones, with Taiwan's MediaTek providing one-quarter of the market and Huawei and Samsung Electronics developing chips for their own devices.

As significant as more than a billion and a half 5G devices and a market of more than 20 billion IoT devices is, according to [Ericsson](#), these devices will connect to a projected universe of 14 billion sensors.

The 5G standard is not a single monolithic technology. *PC Magazine* explains that "5G primarily runs in two kinds of airwaves: below and above 6GHz," and reports that Verizon launched the first "5G" home service — although not based on the global 5G standard — on October 1 to a handful of U.S. cities. AT&T began its launch of networks based on the global 5G standard in the last quarter of 2018; Verizon will upgrade its network to the standard in 2019.

PC Magazine adds that, "all 5G devices, initially, will need 4G ... to make initial connections before trading up to 5G," which explains why mass-market penetration is an evolution, not a revolution.

T-Mobile exec Karri Kuoppamaki notes that the low-frequency (below 6GHz) networks use existing cellular and Wi-Fi bands and cell sites to achieve "speeds 25 to 50 percent better than LTE." *Fast Company* reports that it's the second, higher frequency 5G that "will enable

than LTE. *Fast Company* reports that it's the second, higher frequency 5G that will enable services well beyond phones." The so-called millimeter wave frequencies offer challenges; "they can't travel as far as Wi-Fi signals and can be blocked by obstacles as small as tree leaves."

"The core foundation of 5G is, you build a system that can evolve and adapt to various requirements and new market opportunities through the lifetime of the system," said Qualcomm engineer/senior vice president Serge Willenegger, who helped develop the 5G standard.

To get a jump on things, companies like Audi are testing out private 5G networks to replace wireless, says *Engadget*, which adds that, "BMW, Daimler and Volkswagen also seem interested in 5G, as are utilities and shipping ports, along with manufacturing, oil, gas and chemical companies."

Related Links:

<https://www.nytimes.com/2018/12/31/technology/personaltech/5g-what-you-need-to-know.html>

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CES Research Summit: Experts Consider 5G Tech, Use Cases

By Debra Kaufman

The advent of 5G doesn't mean that 4G is going away any time soon, explained industry leaders at CES. "It's not a light switch," suggested AT&T Mobility vice president, IoT solutions Joe Mosele. "There's still room for 4G LTE to grow, and it will continue to be a complement to 5G." Boingo Wireless chief technology officer Derek Peterson added that, "we'll see gigabit speeds on LTE." "You'll see continuous advancements with Wi-Fi as a component as well as unlicensed spectrum and near-band IoT," he said. an evolutionary cycle." [Read More](#)

Artificial Intelligence and Machine Learning

AI was in almost everything but it is the AI that is built into the streaming services and the latest generation of televisions that is beginning to deliver an increasingly accurate and personalized experience for the audience. The marketing tracks and Digital Hollywood sessions were all over it but so was first-time CES exhibitor John Deere showing AI on the modern farm. It certainly was a main focus for IBM's Chair, CEO and president Ginni Rometty in her keynote. Among the work showed was an advancement in Project Debater, an AI project that debates humans on complex topics. ETC consultant Yves Berquist noted that "this is impressive because it can semantically process the meaning of languages, which is a bit of a holy grail in AI." <https://www.research.ibm.com/artificial-intelligence/project-debater/>

By Yves Berquist

AI has earned "grown-up" status": buzz down, more and more applied Deep Learning beyond just voice assistants, some really smart choices by some autonomous vehicle players (Aptiv, John Deere), and the very first appearance of truly semantic Machine Understanding (IBM's Debater).

This reflects a fundamental trend in AI today: Deep Neural Nets, which have been at the center of the "AI hype" for the past 3-4 years (even though they are not AI but machine learning), have really shown their limits in 2018, forcing researchers and companies to creatively extend their AI/ML architectures to other domains like knowledge bases and good-old-fashioned if/then programming.

2018 was a pivotal year in machine learning, especially in the lab. All throughout last year, the research community went wild with deep reinforcement learning (where AI agents — generally in video game environments — learn autonomously through reward and trial and error), creating above human-level AI gameplay.

Lots of progress was also made in natural language processing through the application of deep learning. Most importantly, AI researchers started looking pragmatically beyond deep neural net infrastructures (too narrow and data-hungry) to experiment with hybrid models using probabilistic reasoning on graph data structures.

Overall, there's a pervasive sense throughout the AI community that, to get out of the lab and into people's lives, AI applications will need to scale down to narrower domains, or pivot towards more complex hybrid architectures mixing methods (deep learning and probabilistic reasoning) that were once considered antagonistic to one another.

Cool trends:

1. More hybrid and realistic autonomous vehicle architectures: the Aptiv/Lyft autonomous

vehicle, which I did a blog post on, is a hybrid application which receives real-time data from sensors embedded in the infrastructure, and has a mix of neural network machine perception and expert system programming. Interestingly, Aptiv isn’t a pure AI company but the ML affiliate of an old auto parts company.

Meanwhile, Waymo was making a lot of noise about their “Waymo One” self-driving service, apparently “about to roll out”, but it’s clear Waymo is running against some real issues (only works in sunny weather, only in certain types of roadways, and only between neighborhoods it knows extremely well). Waymo doesn’t seem to be very confident in its own ability to handle complex and large domains. As a result, it’s not clear when Waymo One will roll out, if at all. Waymo has put a lot more stock in Deep Learning than Aptiv.

The most impressive rollout of autonomous driving in the world is John Deere, which fleet is 90% "self-driving capable". This is incredible, but also normal: fields are a much smaller and less complex domain than roadways.

2. Some cool computer vision using Deep Learning: Cambridge Associates’ DeepRay and LG’s ThinQ AI TVs with image and sound upscaling. This is interesting in the context of the old debate between content creators and TV manufacturers: Tom Cruise came out publicly a couple months ago giving fans some instructions on how to tune their TV to watch the latest M:I optimally. I think we’re going to see a lot more DL for upscaling, including in the QA process in post-production and restoration.

3. Some really impressive stuff: IBM Debater, which can create debate arguments on the fly, shows that IBM has made substantial headways in Natural Language Processing, and has built a tech that is capable of handling deep semantic representation of language (machine understanding).

CES Panel: AI Poised to Change the Entertainment Ecosystem

By Debra Kaufman

CTA senior director of publications Cindy Stevens looked at the various ways — from scriptwriting to production — that artificial intelligence can be integrated into entertainment. “Some people are afraid their creative talents could be replaced by machines,” she said. Comcast senior vice president of digital home, devices and AI Fraser Stirling, who noted that he prefers to use the term “machine learning,” is using it for deep search among other tasks. One project is to turn a three-hour NFL game into snackable pieces. [Read More](#)

■ **Almost Real:** Augment Reality, Virtual Reality, and Mixed Reality

Immersive Media is Almost Upon Us

Real Applications

Even as some important prior-generation IM (Immersive Media) players are exiting the market or restructuring their businesses (ex. ODG, Meta, Blippar), new entrants are working to offer more complete immersive experiences that meet audience expectations and

address experience shortcomings.

At CES 2019 we saw VR headsets with sensors that help you avoid running into furniture and that track your hands so you have a greater sense of presence in the virtual world. A number of vendors showed AR glasses with wider (but still inadequate) fields of view and hand gesture-control user interfaces that worked consistently and comfortably. 6 DOF (six degrees of freedom) movement with spatial audio tracking is becoming the baseline for an acceptable IM experience. Some vendors, such as Bose and North, have focused on delivering products that do a few things really well in a form factor that consumers would be comfortable wearing in public (ex. Bose is audio-only, North is line-of-sight image display). Others, like Pimax, Xtal by VRgineers, ThirdEye, RealMax, and Vuzix, offer more features and a higher quality experience in a headset designed for industrial and business use-cases (e.g. a headset that screams ‘computer on face’).

Ultimately, IM beyond ‘magic window’ on flat screen devices will be real when the head mounted displays deliver experiences in a value-added way via UX/UI (User Experience / User Interface) designs that are intuitive and engaging.

Gaming, which operates at the intersection of technology and art, continues to be the touchstone for stories assessing the state of IM at CES. HTC Vive and others showed advances in consumer-market headsets and handheld controller design that made game play more comfortable and intuitive.

Beyond gaming, vendors demonstrated VR and AR applications for industrial and architectural design, remote and in-store retail experiences, virtual auto showroom and virtual car test drive experiences, and other business use cases.

It was commonly accepted at CES that LBE (Location Based Entertainment), which lies at the interception of gaming and storytelling, has become the surrogate consumer-market test bed for new product ideas, feature sets and ruggedization testing.

We are seeing rapid advances in the technologies that will make UX/UI design more intuitive. Personal assistants driven by voice commands and natural language processing are moving into the HMD space and becoming a platform for the UI. Inside-out tracking built into an increasing number of HMDs for free-roaming IM experiences are being leveraged for hand gesture UIs. Eye tracking built into some HMDs for backchannel data gathering is being adapted as a UI option – often paired with some other action such as a button push to trigger a ‘click’ at the gaze point. Head motion tracking necessary to anchor virtual objects in a physical space is also being used for UI. For example some HMDs are programmed to recognize and accept ‘yes’ and ‘no’ head shakes.

In short, over the next year we will see a lot of experimentation and field-testing of UX/UI design as part of the evolution and improvement of the multi-sensory VR and AR equipment, language, and experiences. Look to industrial and business applications to prove out the ROI of IM resources. Look to LBE to guide mass market UX/UI design as well as help ruggedize and idiot-proof the hardware.

AR Is PRACTICALLY Here

It Works and People Are Using It for Practical Apps.

Feature sets and quality went up, and price points came down (or were not offered) for AR

equipment that got media buzz at CES.

Nreal got significant news coverage for their Light AR glasses. The China-based startup offered stylish tethered AR glasses with 52 degree FOV, 1080p display resolution, stereo speakers for spatial audio, environment mapping from two cameras plus other sensors, and dual microphones for a voice command UI. Unlike Magic Leap, the Light glasses can be plugged into any mobile or desktop processor via a USB-C connector, potentially making them a far more developer- and market-friendly HMD (Head Mounted Display).

The Vuzix Blade untethered monoscopic AR glasses replaced ODG as the leading US start-up AR company to cover. The Blade has a similar audio, video and head-tracking feature set to the Nreal, and a remote control app for both Android and iOS devices. Connectivity can be via Wi-Fi, Bluetooth, or micro-USB.

North's Focus AR glasses do one thing extremely well: they look like regular eye glasses. North is pursuing the hipster techie market with showrooms in Brooklyn and Toronto where every purchase is custom fitted to the buyer. The kit includes the glasses, a Loop ring with an x/y plus push joystick, and a charging carry case. At \$999 they are a bit pricey, but as industry strategist Jay Samit says, "people are already paying \$200-\$400 for glasses that only do one thing – focus." North's Focus glasses do much more at only twice the price.

Other AR glasses that were covered by ETC in stories from CES include the MAD Gaze, ThirdEye, and Lumus.

Highlights From the AR/VR Think Tank Sessions at CES 2019

By Phil Lelyveld

During the AR/VR Think Tank panel and subsequent panels on gaming and LBE (Location-Based Entertainment) at CES this week, representatives of production and tool companies put the current state of the medium in a broader context. We are past the initial "everything should be shot in 360" stage, and are now asking "what are you trying to say?" Ultimately the experience must be purpose-driven. Game developer Don Daglow noted that killer apps usually happen by accident when someone's passion taps into an unrecognized mass market demand. He noted that VisiCalc was a killer app for the PC, for example. [Read More](#)

Science at CES

Commentary by Erick Moen, PhD

Near-eye Displays for VR and AR

Three directions we took note of at the show for augmented reality displays were diffractive waveguides (currently employed by the majority of manufacturers - Hololens, Magic Leap, ODG), something called "pin mirrors" from our friends at LetinAR, and laser beam scanning with holographic optical elements (HOEs) (North's Focals).

Diffractive waveguides have become the go to for AR hardware because they are thin, light, and provide a good mix of "real" and "augmented" light. However, because of the way they "bend" light (often several times depending on the form factor), they can suffer from poor image quality - distortion, sharpness, and chromatic aberrations.

LetinAR, a startup out of South Korea, is attacking the problem a bit differently with what they call "pin mirrors." These small mirrors are embedded at regular intervals in the glass and redirect images from an OLED microdisplay back to the eye. Using mirrors instead of diffractive or holographic elements allows for reduced chromatic dispersion with increased depth of field. The small diameters of the mirrors allows each one to act like a point source (a pinhole camera in reverse) while allowing the user to "see around" to the outside world. While each mirror only provides roughly a 15 degree FOV the system is designed as an array to provide roughly a 70 degree FOV total. The concern with a design like this would be the brightness as the small diameter mirrors would struggle with efficiency, though this wasn't overly apparent in our experience with the demonstration.

Laser beam scanning is a compelling way of providing AR in a very compact form factor. North is using it, along with holographic optical elements embedded in the lenses, to deliver full color images. The difficulty with these systems is the need for tailored manufacturing and providing an adequately large eye box with sufficient resolution. To get over the first hurdle, North currently requires consumers to travel to a retail outlet to be fitted. To enlarge the eye-box, however, one would have to track the eye and provide multiple optical paths. The company gets around this by utilizing the holographic element embedded in the lens to provide the image as well as eye tracking.

Quantum Computing

From science fiction to satellites and data centers near you, quantum computing is rapidly accelerating toward widespread adoption. Intel spent part of its keynote last year to detail developments on its quantum computer. This year IBM took to the show floor to announce the first commercial quantum computer, IBM Q System One. While it won't be mass produced, it is available for scientific and commercial use now. The rig will be used as a test

platform to investigate and optimize programming in this new paradigm. Quantum computers are intriguing for their ability to explore an exponentially larger solution space than classical systems in a fraction of the time. **This enhanced compute ability presents challenges to traditional cryptography.**

Interestingly, CES had that base covered this year as well as Fraunhofer IOF debuted a new security device also based on quantum physics. Fraunhofer's key announcement was a new entangled photon source that will enable a new type of encryption for satellite-based communication. As the name implies, entangled photons are photons that share information, regardless of the distance between them. Based on this principle, keys can be generated between transmitters and receivers to verify the integrity and privacy of communication between them. The value add here is physical encryption that is robust against increasingly sophisticated (and powerful) "computational" attacks.

While still a few years off from being commonplace or even consumer grade, the presence of these devices on the show floor is an exciting development.

Artificial Intelligence - AI

A word on nomenclature - AI is a broad term for any algorithm that can optimize a result. Machine learning is a set of algorithms under this umbrella. One type of machine learning algorithm is a neural network. These networks can be built in layers. When there are enough layers, we call it deep learning. How much is enough? Excellent question. It is sufficient to say that most AI algorithms today employ deep learning in some fashion.

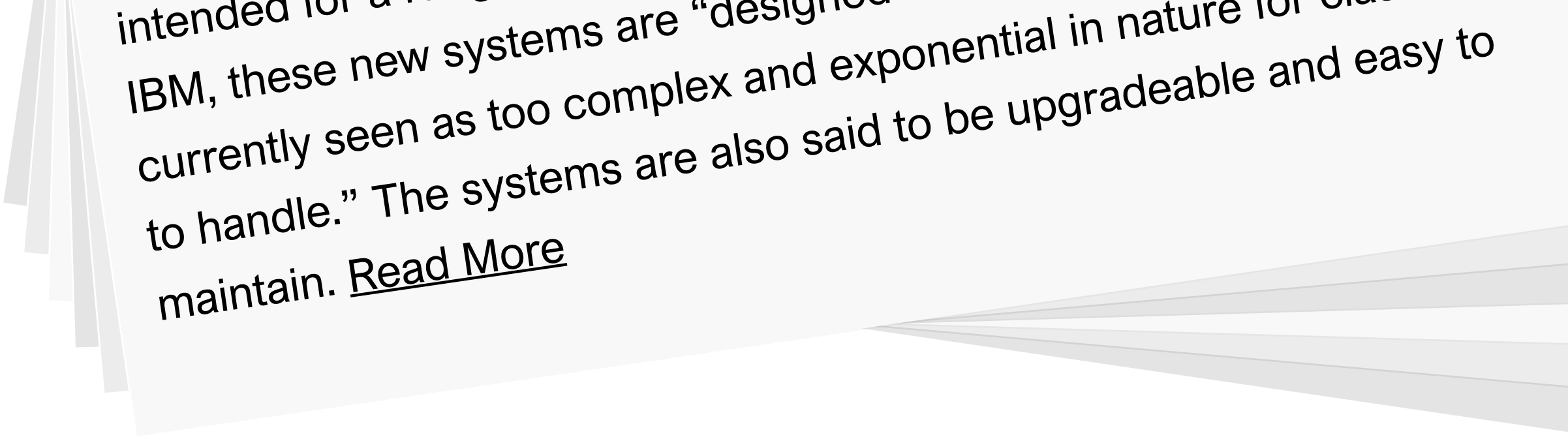
Training deep learning models takes time and processing horsepower (usually on GPUs but these can be subbed with proprietary multi-core architectures like TPUs). Running the models once they've been trained can be very easy and these predictions are usually computationally lightweight. That's one reason I was intrigued by LG's ThinQ TVs and its Alpha9 Intelligent Processor. This type of computational fire power could allow for models to be trained "online," or with new data it gathers from room layout, lighting conditions, or even content.

Cambridge Consultant's DeepRay was also intriguing for its use of multiple GANs (generative adversarial networks - multiple deep learning models working against one another to improve the overall result - think "iron sharpens iron"). By using one network to try to "clean up" an image (this could be to restore a video, correct for aberrations, or reproduce a style) and another to critique its result (by comparing it to clean images for example) the system attempts to reconstruct footage from obscured frames in real time.

IBM Rolls Out Its First Commercial Quantum Computer at CES

By Rob Scott

During CES last week, IBM announced the IBM Q System One, the company's first foray into commercial quantum computing outside of the lab. The 20-qubit IBM Q system combines quantum and classical computing for a range of business and research applications. According to IBM, the system is designed to one day tackle problems that are intractable for classical systems.



intended for a more personal world. IBM, these new systems are “designed currently seen as too complex and exponential in nature for old to handle.” The systems are also said to be upgradeable and easy to maintain. [Read More](#)



A More Personal World

CES Panel: CMOs Discuss Top Priorities, Trends and Change

By Don Levy

Growth priorities, game-changing technology, engaging customers, building brands, and the trends and challenges that keep marketing execs awake at night were among the topics discussed by three of Forbes Top 50 CMOs during a C Space panel at CES, moderated by editor of the CMO Network at Forbes, Jenny Rooney. Aimée Lopic of Pandora, Susan Vobejda of The Trade Desk, and Deborah Wahl of Cadillac work in different markets but face similar challenges as they break through old models, explore new ways of reaching and engaging audiences, and balance the potential of personalization with privacy.

Vobejda of The Trade Desk, which has become the fastest growing demand-side platform in the industry by offering agencies, aggregators and their advertisers best-in-class technology to manage display, social, mobile, and video advertising campaigns, keeps the fundamentals at the top.

“Brand, brand campaigns, value proposition — the core fundamentals still have to get done,” she said. “Start with the strategy for what you want to achieve and what you hope will be the customer experience. We get smarter and optimize as we go. We build and we do. Can’t spend six months figuring out the problem.”

At Pandora, Aimée Lopic said the goal is “to give their customers another reason to stay on Pandora.” In December 2018, the company launched its Podcast Genome Project, a spoken-word variation of its Music Genome technology. According to the company, it uses a combination of machine learning algorithms, natural language processing, and collaborative filtering methods to determine listener preferences.

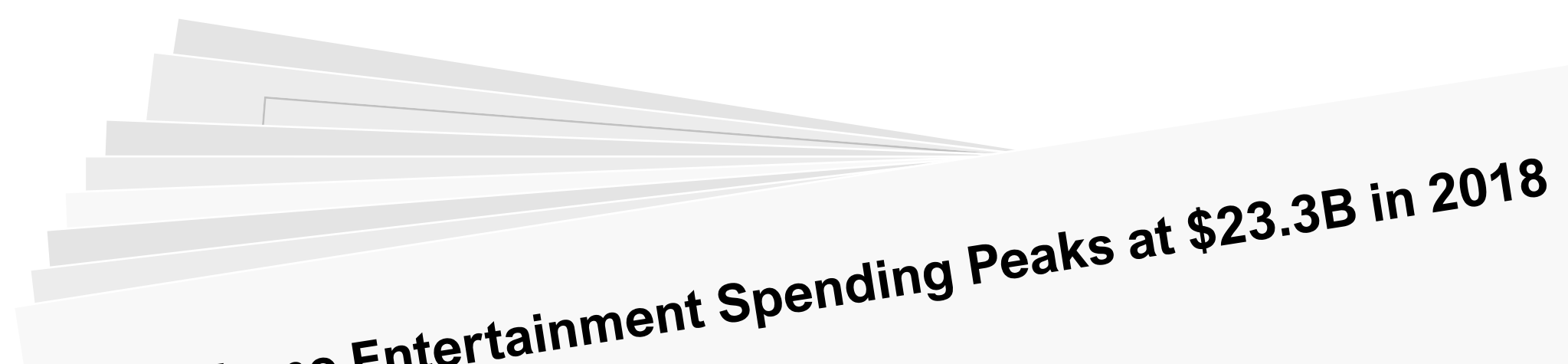
“Pandora invested in a platform that allows us to be super personal across platforms and outside Pandora,” she said, noting that they have thousands of targetable audience segments.

Deborah Wahl faces not only a changing media landscape, but an automotive industry and a legacy brand undergoing enormous disruption and change. “This year we will see a new inflection point,” she said. “We have to go back to the customer and the human element. Let’s get rid of all of the extra stuff that is not delivering good experience.”

A big question for the traditionally big spender in broadcast is “how much of our media spend should be general when we have the ability to be direct?” When the car being sold is able to interact with its driver “sort of like your companion,” it becomes even more essential that content and creative helps you tell your story across platforms. “How to tailor a message that resonates takes magic,” she said.

Of the challenges, Vobejda added that “Marketing has a marketing problem. The organization did not fully understand what marketing could do for the company.” Strong imagery and an imaginative campaign turned into a rallying cry.

The panelists reflected that even as the value and scope of marketing grows, very few CMOs have a seat on executive committees of major corporations.



U.S. Home Ent

By Debra Kaufman

According to DEG (The Digital Entertainment Group), U.S. consumer spending on home entertainment during 2018 reached an estimated \$23.3 billion, a new record. During CES, DEG revealed that subscription streaming and “transactional video-on-demand” (TVOD) boosted the amount spent, which was up 11.5 percent from 2017. DEG noted that the numbers are preliminary and that final numbers will be revealed in early February. The biggest growth came from subscription streaming mainly via Netflix, Amazon Prime Video and Hulu. [Read More](#)

Hidden Futures

Enhanced compute ability of quantum computing also presents challenges to traditional cryptography

Blockchain at CES 2019 – What a Difference a Year Can Make

By Seth Levenson

Blockchain sessions and projects still abound at CES this year, but the bloom is definitely off the rose. At last year’s sessions it was standing room only, but this year it was no problem finding a seat. Given that cryptocurrencies are down 82 percent since last year at this time, I guess it’s no surprise. The good news, however, is that with a lot of the hype and “quick buck” mentality deflated, there’s a lot of good work and investing still being done. Unlike last

back to reality, there's a lot of good work and investing still being done. Unlike last year, which was one ICO announcement after another, this year was much more subdued and focused on products that address real business needs.

Companies could no longer capitalize their business on token sales, and instead, needed to show real business value to get VC funding. And VC companies continue to invest in blockchain companies.

VC luminaries such as Tim Draper (Draper Associates) and Jonathan Johnson (Medici Ventures) couldn't be more bullish on the ability for blockchain to have a huge impact on almost every aspect of our lives. They're investing in a broad spectrum of companies and services from banking to healthcare to identity to supply chain.

One of the most exciting announcements was from Devvio, which brands itself "*THE* Enterprise Blockchain" and claims to have solved all of blockchain's current implementation issues. These include: stability, scalability, security and privacy. The company claims its Devv blockchain tech can support 8 million transactions per second (compared to Bitcoin's 7 transaction per second average). Further, Devvio states that its transaction cost is 1/100,000th the cost of an Ethereum transaction.

Obviously, all of this still needs to be tested and proven. But, at that rate and cost, direct-to-consumer implementations for content become possible and cost effective. This could have significant implications for Media & Entertainment, and open up new distribution models.

Another interesting company is Pundi X. Based in Singapore with offices in Jakarta, London, São Paulo, Seoul, Tokyo and Shenzhen, it has an ambitious strategy that includes both hardware and software. The company provides point-of-sale XPOS devices for retailers that allows them to both sell and accept cryptocurrencies from their stores.

Pundi X also announced a blockchain cell phone (the XPhone, below), that provides secure voice, text and web browsing functionality using blockchain. Their software (including a modified version of Android OS for their phone) has a digital wallet (XWallet) application for both Android and iOS, as well as all the backend infrastructure to support their ecosystem.

Ultimately, they hope to be able to use an installed base of PoS and phones to provide a truly distributed blockchain infrastructure that uses the compute power on those devices and doesn't rely on a centralized set of servers to provide that functionality.

Finally, there was a session — "Cities Flirt with Blockchain" — that discussed the implications for blockchain in that environment. For local governments, blockchain offers a number of potential benefits, including: identity, e-voting, homeless/refugee management, improved efficiencies and access to IoT devices and city data.

As cities become "smarter," so must the ways in which they provide services and interact with their residents. Blockchain, while not a silver bullet, provides unique capabilities that could improve the way in which all of us interact with agencies and services that cities provide.

Despite the lack of media attention it once received, the future looks bright for blockchain and its ability to fulfill its promise to change the world.

Click fullscreen icon to view stories



With 6G, Intention

CES Panel: Building the Quantum Internet With 5G

By Debra Kaufman

What is edge computing and what can it bring when married with 5G, asked *TechRepublic* editor-in-chief Jason Hiner, who moderated a CES panel on the topic. AT&T vice president Alicia Abella described edge computing in historical context, as the pendulum has swung back and forth from centralized computing (in the 1960s to 1980s) to compute power on the desktop (with the advent of the desktop PC), back again to a centralized notion with the cloud, and now back to a distributed model with edge computing. [Read More](#)

■
Just For Fun

A Look Into the CES Show Floor

LG OLED TV With Rollable Screen Impresses CES Attendees

By Rob Scott

While MicroLED, 8K QLED and some impressively large quality displays have been generating the most TV buzz this week in Las Vegas, LG has been showcasing a concept that's taken different forms at CES in the past, but not with this level of sophistication. Rather than introducing a foldable or bendable screen that retracts, LG debuted a 65-inch OLED TV with rollable screen at this year's confab. The LG Signature OLED TV R "rolls" into a base to the point that the flexible screen is no longer visible. The 3-millimeter OLED panel then rises from its base for easy viewing. Users can also play music through the base since it's a 100W Dolby Atmos soundbar. [Read More](#)

CES Unveiled: A Look at This Year's Innovation Award Winners

By Debra Kaufman

On Sunday, CES "unveiled" its Innovation Award winners for the year, in a room also crowded with numerous startups eager to showcase their technologies. This year was, again, a plethora of self-care, health-oriented products as well as many related to smart homes and home security. The 31 companies/products honored this year for "best of innovation" fell into the categories of digital imaging/photography, smart home, smart energy, wearable technologies, computer hardware, virtual reality and video displays among others. [Read More](#)

Celebrating CES 2019 Once Again With Last Gadget Standing

By Debra Kaufman

Last Gadget Standing, presented by *Living in Digital Times* — a raucous event at the tail end of CES — has been a tradition for 19 years, when journalist/editor/author Robin Raskin founded it. The event features a showgirl in skimpy red spangles and feathered headdress, loads of swag thrown out to the audience, and music with a powerful beat. Having featured *New York Times* writer David Pogue for several years, this year's event was hosted by the first woman ever, consumer electronics journalist Jennifer Jolly, who wore a top hat with a video screen embedded in the front. [Read More](#)

AI Firm Shows Multilingual Translator That Fits in Your Pocket

By Phil Lelyveld

The iFLYTEK Translator 2.0 is a handheld spoken language translator developed with Chinese AI technology and training. The size of a mobile phone, it can translate between any two of 63 languages and is trained in a number of "professional vocabularies." The device touts a 5-hour battery life, and at \$450, would be a useful and affordable business and personal tool. This Chinese tech also raises some interesting privacy and geopolitical issues. In addition to the upgraded Translator 2.0, the company also announced its iFLYREC Series voice-to-text products, AI Note for recording and transcription, and iFLYOS voice-interaction system at CES. [Read More](#)

Samsung Prototype Debut May Help Kickstart Foldable Trend

By Rob Scott

Samsung chose its San Francisco developer conference to unveil the anticipated prototype

of its foldable two-screen smartphone. The Infinity Flex Display touts a 7.3-inch screen that can be folded to easily fit in a user's pocket. The device also includes what the company calls a "multi active window" feature that enables running up to three apps simultaneously. Google will support the phones with its Android operating system and is working with Samsung on next year's planned launch. Meanwhile, foldable tech is becoming an emerging trend, with products in various stages from Huawei, Lenovo, Royole, Xiaomi and LG, some of which we may see at CES in January. [Read More](#)

French Firm Shows a Robot Stylus That Demos Screen Apps

By Phil Lelyveld

Key Infuser is demonstrating a cellphone-sized robot stylus called KiOne that can demo touch displays and the apps behind them. The full system includes a robotic arm, a video display screen, and a base containing the hardware and code to drive the demo. The entire unit is the size of a toaster oven and fits comfortably on a counter top. Retailers can use it to continuously demonstrate new products with touchscreen UIs, freeing up staff time for higher value customer service activities. Companies could use the technology to provide on-demand training of touchscreen-based applications to visual learners. [Read More](#)

Remo Technology Presents Auto-Director AI Camera at CES

By Rob Scott

China-based camera company Remo Technology showcased a compelling AI camera at CES that should be of interest to YouTubers and prosumer videographers looking for an affordable gesture control solution. The OBSBOT Tail camera combines artificial intelligence tech and its built-in three-axis gimbal in order to automatically track specific subjects with smooth camera motion. Users can even live stream while easily keeping themselves in the camera shot. The new camera — which can record up to 4K video at 60 fps with support for HDR10 — is expected to launch later this month. The early-bird pre-order special is listed at \$469. [Read More](#)

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engages with next generation consumers to understand the impact of emerging technology on all aspects of the media and entertainment industry, especially technology development and implementation, the creative process, business models, and future trends. ETC acts as a convener and accelerator for entertainment technology and commerce through Research, Publications, Events, Collaborative Projects and Shared Exploratory Labs and Demonstrations.

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Appendix

Here you will find articles from other publications curated throughout the show. They are arranged here by general topics

• **5G**

Verizon’s 5G Keynote at CES Spotlights Media, Drone Flight, and Health Partnerships

<https://venturebeat.com/2019/01/08/verizons-5g-keynote-at-ces-spotlights-media-drone-flights-and-health-partnerships/>

Verizon Shows Real-World 5G Speeds at CES 2019

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<https://venturebeat.com/2019/01/09/qualcomm-and-intel-have-5g-devices-at-ces-2019-but-huaweis-are-mia/>

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At CES 2019, 5G Is Even More of a Confusing Mess Than Ever

<https://www.cnet.com/news/after-ces-2019-5g-is-even-more-of-a-confusing-mess-than-ever/>

Beware the 5G Hype: Wireless Rivals Fuel Confusion

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Ignore 5G, For Now

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AT&T Promises Nationwide 5G in Early 2020 – Using Sub-6GHz Spectrum

<https://venturebeat.com/2019/01/09/att-promises-nationwide-5g-in-early-2020-using-sub-6-ghz-spectrum/>

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<https://venturebeat.com/2019/01/02/sk-telecom-uses-5g-for-first-2019-tv-broadcast-plans-live-phone-and-drone-videos/>

Disney StudioLab and Verizon Partner to Explore 5G Innovations

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Cable Operators Will Fight Off 5G With 10-Gigabit Cable Modems

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CES 2019: Sprint Pairs Curiosity IoT With 5G to Power Smart Cities, Autonomous Vehicles

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Netgear Debuts Orbi Wifi With Built-In Cable Modem and Nighthawk 5G Mobile Hotspot

<https://venturebeat.com/2019/01/07/netgear-debuts-orbi-wifi-with-built-in-cable-modem-and-nighthawk-5g-mobile-hotspot/>

- **FAANG**
- **FACEBOOK, APPLE, AMAZON, NETFLIX, GOOGLE**

Amazon Wants to Get Alexa Into Your Car

<https://www.usatoday.com/story/tech/talkingtech/2018/11/29/amazon-wants-get-alexa-into-your-car/2139120002/>

Google Is Primed to Go Big at CES Again

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Amazon Says 100 Million Alexa Devices Have Been Sold – What’s Next?

<https://www.theverge.com/2019/1/4/18168565/amazon-alexa-devices-how-many-sold-number-100-million-dave-limp>

Google Aims to Dominate CES This Year, Triples Its Floor Space From 2018

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Google Assistant Coming to Dish Hopper DVR, Lenovo Smart Clock

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CES 2019: Amazon and Google Assistant Carve Up Tech Expo

<https://www.bbc.com/news/technology-46818797+->

CES 2019: Alexa vs. Google, Foldable TVs and 5G to Take Center Stage in Las Vegas

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Google Says Assistant Will Be on a Billion Devices By the End of the Month

<https://techcrunch.com/2019/01/07/google-says-assistant-will-be-on-a-billion-devices-by-the-end-of-the-month/>

Amazon Is Getting More Serious About Alexa in the Car With Telenav Deal

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Alexa Is Everywhere: Kohler's Smart Toilet Brings Voice Assistant into Bathroom

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German Giants Cruise Into Robotaxi Era

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• **AUGMENTED REALITY AND VIRTUAL REALITY**

Get Ready to Hear a Lot More About 'XR'

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HTC's Next Consumer Virtual Reality Headset Is the First PC VR Hybrid

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These Slick New AR Glasses Project Shockingly High-Quality Visuals

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