Just Another Year in the Consumer Electronics Industry?

By Peter Corcoran

Welcome to another CES show issue of *IEEE Consumer Electronics Magazine*. This issue is aligned with the International CES held in Las Vegas, a global meeting for the consumer electronics (CE) industry where you can view the latest developments in new CE products and associated technologies and services. It is a time to reflect on the year gone by and to look forward to what is to come next in our industry.

CHANGE AND THE CE INDUSTRY

As I have commented before, the CE industry is one where you really need to get used to the constant and rapid pace of change [1]. The driving forces in our sector provide much of the impetus for new technology development and deployment in mass markets. The competition drives us to excel or find an alternative career path.

As I have said before:

…CE engineers not only have to do it better, faster, and more efficiently but also have to figure out how to do it for next to nothing. We ignore the laws of physics and economics; we optimize algorithms beyond the capabilities of mathematics; we reliably compress data until only noise should remain; we improve images beyond the capabilities of any optics. And it all works. It has to, because we serve the most persnickety and fickle of masters—the

common consumer. If it isn't perfect, consumers don't buy, and the business is bust.

…Everything in CE was in a constant state of change and improvement, and it always would be. CE engineers are the sorcerers of change. Change is our raison d'etre; it is why we are here. Ultimately, that is why it is such a compelling field with which to be involved [1].

So what are we going to find at International CES 2016? What new sorcery will be unveiled in our existing technologies, and what new sectors and trends will emerge? In this editorial, let's take a look at some of the more exciting and interesting developments of 2015 and guess at likely developments for 2016.

I cheated a bit here as I recently attended the IEEE International Conference on Consumer Electronics (ICCE)–Berlin conference and had an opportunity to wander the IFA Trade Show—the European equivalent of International CES. Some of my insights are based on new products and technologies I caught during this "wander." However, let's take a quick step through some of what is new in CE for 2015.

TV PANELS—REINVENTING THE HOME ENTERTAINMENT EXPERIENCE

For many years, TV was the backbone of the CE industry. More recently, it lost out through the growth of home computers, followed by the commoditization of the Internet through the web, leading to what I like to call the "consumer ICT"

segment; while most of us still have a TV panel at home, the role of TV has been pushed into the background in recent years through the growth of video streaming and the introduction of tablets.

However, the TV panel industry has been fighting back, and, today, most panels are equipped with Internet connectivity and a range of "smart" functions that take advantage of that connectivity. Much of this development has been "silent," but I have to say that I am impressed by improvements in some of the more recent panels, where the integration of functionality with Internet services is far more refined than it was 12–18 months ago.

The visual quality of the latest 4K panels is also stunning. Again, I was a skeptic until recently, but, if you read this column regularly, you'll know that I recently commented on my own experience with a new 4K panel and was pleasantly surprised. The last requirement for TV panels to reclaim their central role in the living room is to enhance the audio experience to become a wall-mounted home cinematic experience. We are starting to see this happen—among the showstoppers at IFA were the new 4K ultrahigh-definition (UHD) OLED TV panels from Panasonic, but what was really impressive was the integrated audio experience, with full THX certification built in.

UHD BLU-RAY PLAYERS ARRIVE

To match the array of improved panels at IFA, Samsung also delighted home-video buffs by announcing the first 4K UHD Blu-ray player. The new Blu-ray format

will deliver optimal picture quality for 4K TV owners, with high-bit-rate full high-dynamic-range support, and it incorporates up-scaling of standard Blu-ray discs and legacy DVDs.

In a complementary announcement at IFA, 20th Century Fox pledged its full support for 4K UHD, and all of its new-release titles will be available in the new Blu-ray format, while older titles are to be remastered and rereleased over time. Samsung indicated that the new players would appear in Europe in early 2016 and possibly in the United States market in time for the holidays. Clearly, the increasing sales of UHD 4K TV panels have started to catalyze the market for more 4K content, and we'll undoubtedly see further developments throughout 2016.

NEW PANEL TECHNOLOGIES ARE ON THE WAY

I saw some other interesting exhibits—quantum-dot TV panels were also on display from TCL. The company holds a market share of 8.4% in France and ranks fourth in Europe after Samsung, LG, and Philips. Its quantum-dot panels were nothing short of spectacular, but I did wonder at the publicity videos that were running as they showed a sequence of spectacular video imagery highlighting the vivid colors available, but each featured only slowly moving scenes. There were no football matches or action sequences, so it seems that there are still motion rendering issues with quantum-dot technology. However, once these are sorted, we'll all be switching over.

To my mind, 2015 was definitely the year the TV panel industry started to find its feet again. There was much improved connectivity, responsive switching between input sources and the network, and improved user interfaces, coupled with the growth of over-the-top services like Netflix—we now begin to see TV panels learn how to take advantage of the Internet and move seamlessly between display modes with functionality that consumers really need. Nobody is talking about "smart TV" anymore because that smartness has become intuitive and invisible to the user—as it

Wearable cameras are everywhere and getting smaller and more connected as I write.

should be. However, the truth is that the user experience is back where it needs to be, and I expect the panel industry to go from strength to strength during 2016.

SMARTPHONES—THE FIGHT FOR MARKET SHARE!

We can't really avoid talking about them, can we? The smartphone is everyone's favorite CE device and boasts the fastest-ever market growth for a CE product, but market saturation is rapidly coming upon us. And the competition is something else. I have heard that there are several hundred companies now in China that manufacture smartphones, and, naturally, most of them will go out of business over the next couple of years.

The fiercest competition is not visible to us in Europe or the United States because the key markets are in India, China, Latin America, Africa, and the Middle East. And here, it is not the US$100 smartphone that is the winner—no, the new target is the US$50 smartphone. Yes, many companies are managing to squeeze a profit—assuming they can get production levels high enough to achieve volume discounting on key components like screens, application processors, and wireless subsystems. Profitability only comes after 12–18 months as these discounts kick in, but many companies will not survive long enough to reach profitability.

However, there is competition at the high end as well. Apple continues to dominate, but when you compare the iPhone to the latest models from other manufacturers, you have to wonder. Sony recently released (at IFA) a new phone with 4K display and 23-megapixel camera. And both the LG G4 and the Samsung S6 feature higher-resolution

displays than the iPhone 6 and higher specification main cameras. There are arguments that more pixels won't improve image quality, but comparisons between the images from these devices shows that they certainly don't hurt image quality. The iPhone 6S has brought Apple back into the game with 12 megapixels, but the screen pixel density still lags behind the competition.

Table 1 shows the comparative specifications, and it is clear that there is a tooth-and-nail fight going on here as well, but note that it is no longer around the traditional elements of RAM and CPU: with smartphones, the focus now is on the camera, the display, and the battery capacity—everything else is a commodity. No one really cares if you have six or eight cores in the applications processor. While Apple still commands a premium and holds sway over the high end of the market, it is clear from Table 1 that it won't be easy to hold onto that lead. We can question the utility of having a 4K resolution display on a handheld smartphone, but I had an opportunity to see this display in action at IFA, and it was impressive.

This market is going to be very interesting to observe throughout 2016. Will Cupertino continue to rule, or can the challengers start to upset things? The introduction of a new subscription model for iPhone ownership from Apple shows that innovations will not be confined to technical improvements. It is clear that smartphones are the gateway to a consumer's life, and many device manufacturers are prepared to take significant business risks to keep skin in this game. What will unfold throughout 2016 is anyone's guess, but we do live in interesting times!

AUTOMOTIVE—A SMARTPHONE ON WHEELS?

Over the last few years, the automobile industry has been moving to aggressively adopt CE into its vehicles. Today, it is difficult to buy a car that does not feature a touch-panel display with a myriad of in-car information and entertainment electronics. Today's high-end models are a hive of electronics technologies—many vehicles now provide 4G connectivity

Table 1. Specifications of the latest high-end smartphones (adapted from http://www.cnet.com/news/ apple-iphone-6s-vs-samsung-galaxy-s6-lg-g4-sony-xperia-z5-premium/).

	Apple iPhone 6S	Samsung Galaxy S6	LG G4	Sony Xperia Z5 Premium
Display	4.7 in with 1,334 × 750-pixel resolution	5.1 in with 2,560 × 1,440-pixel resolution	5.5 in with 2,560 × 1,440-pixel resolution	5.5 in with 3,840 × 2,160-pixel resolution
Pixel density	326 ppi	557 ppi	534 ppi	806 ppi
Dimensions	138.3 × 67.1 × 7.1 mm	143.4 × 70.5 × 6.8 mm	149.1 × 75.3 × 8.9 mm	154.4 × 76.0 × 7.8 mm
Weight	5.04 oz (143 g)	4.8 oz (138 g)	5.4 oz (152 g)	6.34 oz (180 g)
Mobile OS	Apple iOS 9	Android 5.0 Lollipop	Android 5.1 Lollipop	Android 5.1 Lollipop
NFC	Yes	Yes	Yes	Yes
Camera	12 megapixel	16 megapixel	16 megapixel	23 megapixel
Video	UHD video (4K)	UHD video (4K)	UHD video (4K)	UHD video (4K)
Front Camera	5 megapixel	5 megapixel	8 megapixel	5 megapixel
Processor	64-b A9 chip with M9 motion processor	Octacore Exynos 7420	1.8-GHz hexacore Snapdragon 808	Octacore Snapdragon 810
Storage	16–128 GB	32–128 GB	32 GB	32 GB
Expandable storage	No	No	Up to 2 TB	Up to 200 GB
Battery	1,715 mAh	2,550 mAh	3,000 mAh (removable)	3,430 mAh

and remote monitoring, and one vehicle manufacturer recently introduced the technology to allow courier deliveries to a car trunk, unlocking the trunk remotely when the courier arrives to make the delivery. The connected vehicle is already here. The industry continues to invest heavily in autonomous vehicles and myriad enhanced sensing and navigational technologies.

GETTING THE USER INTERFACE RIGHT

I can understand this impetus to turn our vehicles into smartphones on wheels—the automotive industry has a five- to ten-year product turnover cycle and is envious of the two-year cycles of the smartphone manufacturers. However, to my mind, the integration of electronics into our vehicles is still lacking. Smartphones are very attention-grabbing devices, and integrating their use modalities into an environment that requires high levels of user focus is challenging. Adding complex touch panels that attempt to mimic the smartphone/tablet interface serves as a distraction to the

driver rather than an enhancement of the driving experience.

Recently, there has been a trend toward new user-interface modalities, but they are typically unintuitive and awkward to use. Gestures and eye gaze are even more challenging to integrate with driver ergonomics than a touch panel. Voice interfaces can be effective but take time and effort to train and, to date, have been limited to high-end vehicles.

DISRUPTION AHEAD?

To my mind, the automotive sector has made great advances in terms of connected vehicles and safety-enhancing technologies such as electronic stability systems that watch for conditions that might lead to loss of control of the vehicle. However, these are "invisible" technologies for the majority of vehicle owners. It is the electronics that are in front of you that remain awkward, often unintuitive, and, for the most part, fail to enhance the driving experience.

In a sense, the automotive industry is in the same place that smart TV was two to three years ago, and I have seen little in the last couple of years to indicate new trends here. However, changes often come from new players, and I feel that we are already seeing this trend in the automotive industry. In this issue, we have an interesting piece from Bob Frankston about his experiences with hiring the "most programmable" car he could find to test out over his vacation. It is an interesting read, and I think it

Is the automobile turning into a smartphone on wheels?

shows that we can expect some new disruptive experiences coming soon to a vehicle near you—I expect to see some of this coming disruption appear at International CES 2016!

INTERNET OF THINGS—BUT WHERE ARE THE CUSTOMERS?

I recently gave a webinar for the IEEE Internet of Things (IoT) Initiative, and, as a long-time IoT skeptic, I explained my changed viewpoint about the IoT in the presentation. I reworked the presentation into an article for this issue, summarizing my views that maybe the conditions are ripe for a broader adoption of the IoT. However, we must also consider that, despite all the hype, there has not been enough effort to consolidate industry standards.

Last year, we saw a strong IoT presence at CES, but the industry has yet to unveil breakthrough products that can genuinely catalyze this emerging market. To paraphrase the old saying, one thermostat does not a smart-home industry make. There are, however, some interesting subsegments of the IoT that seem to be moving in intriguing directions, so let's take some examples and see if we can identify some broader trends from these niches.

CAMERAS EVERYWHERE

One sector that showed interesting developments in 2015 is that of wireless security cameras. The leader in this segment has been Dropcam (now owned by Nest Labs/Google). In 2015, however, the Simplicam (https://www.simplicam. com/) gained some improved features, including an easy set-up process that works directly from your smartphone by generating and presenting a quick-response code, customized for your local network, to the camera. It features a wider field of view than the Dropcam, although video quality is only 720 p. Advanced notification features include face- and sound-based alerts—yes, this camera can recognize faces and alert you when a stranger is detected. It signals the future evolution of home security, where you will be able to find out in real time when an unauthorized person has entered your home. It is not too

Watch out—fashion and style is the next step for wearable technology!

much of a stretch to think that you will soon be able to alert local law enforcement of a break-in directly from your lounger on the beach—and send mug shots of the intruder.

Another exciting development is the Arlo camera from Netgear—it is 100% wire-free, weatherproof, and provides a full-HD wide-field-of-view video stream with three to four months of battery life. Yes, it is a genuine wire-free camera! How can that be managed on battery power alone? Arlo hints at another smart development—it only processes video when it detects movement. The data from the image sensor are analyzed and, if there are no significant changes frame-to-frame, then nothing is processed or transmitted to the base station. As you can imagine, Arlo is engineered to use very low power during normal "scan" mode, using only a fraction of the main sensor pixels for motion detection and working at low frame rates. However, once motion is detected, it quickly ramps up to 30 frames/s and full-HD resolution, compressing the video with a state-of-art MPEG codec and transmitting to the wireless base station, where the video stream is uploaded to a cloud storage service.

If the smart energy efficiency of Arlo could be combined with the face-recognition capabilities of Simplicam, we would have a real killer IoT product. Something to look forward to in 2016 perhaps?

HEATH, WELLNESS, AND LIFESTYLE

The march of the smart watch continues, with Apple announcing record preorders for its entry models. Samsung's new Gear S2 smart watch was officially launched at IFA in September 2015, and it is very impressive. Based on the Android Wear ecosystem, it is the first real competition for the Apple Watch. On the wrist, the Gear S2 feels stylish and slick. It is lightweight as it is made from stainless steel, which is sturdier than aluminum. The dial feels precise and easy to navigate. There are home and back buttons—pretty standard for Android—and these are very easy to find with your off hand. The vast majority of navigation is done with the dial, followed up by a tap on the touch screen to confirm the selection.

With these new devices, we see a trend to bring out devices into more intimate contact with our bodies. This enables more detailed measurement of our physiological parameters, with the potential to gauge not only our immediate body state but also to measure and learn about our responses to our environment and, eventually, to determine our likely state of mind in real time.

While the ability to monitor and analyze the state and health of the body is valuable, it is important to be aware of and provide safeguards against more extensive monitoring and analysis of the individual. I will touch on this topic in more detail, but, for now, consider if you really want Apple or Samsung to instantly measure and track your physiological responses and stresses. Imagine the potential to direct advertising and real-time services to the consumer. On a summer day, if you are hot and bothered, a cloud service could send you locations of nearby cafés where you can get a relaxing drink—but is that going a step too far?

SMART HOMES AHOY, CAPTAIN?

Back in the early 1990s, I authored an article for a magazine called *Technology Ireland* titled "Smart Homes Head for the Highway"—it was about the integration of the IEEE CEBus home networking technology with the Internet. In the article, I was optimistic about the commercialization of smart-home technology—you can read a bit more in my IoT article in this issue. However, over the intervening 25 years, I have grown to feel a bit like Captain Ahab, with the smart home being my personal Moby Dick.

However, smart homes are tantalizingly closer today. Apple's HomeKit looks like a good step in the right direction, and its emphasis on security protocols for compliant products and subsystems is encouraging. HomeKit products with Apple's MFi ("Made for iPhone") certification have an authentication chip built in and have undergone rigorous testing to get this seal of approval, including compliance with the iCloud keychain. Apple TV will be the main gateway for Home-Kit devices, but industry-wide adoption is still slow. As a (semi)eternal optimist, I have hopes to see the smart home take off, and perhaps 2016 will become the year that happens. (I still keep that harpoon sharpened and ready in the garage.)

REMOTE CONTROL, ANYONE?
It is easy to overlook the obvious, but at IFA, Logitech announced new additions to its Harmony remote-control lineup, including the Harmony Elite. So maybe the best home gateway for the IoT is the remote-control system in your living room? Who doesn't long for "one remote to control them all" (apologies to *Lord of the Rings* fans!)?

The Harmony Elite works with Logitech's Harmony Hub to control not only your entire entertainment system but also smart-home devices such as lighting, thermostats, door locks, and window shades. You can program so-called Harmony activities, which will sequence several commands at once. Could this remote-control approach be the killer product that brings the IoT into our homes (and helps your editor catch his whale)? Only time will tell.

AND EVERYTHING I LEFT OUT…
I think I have probably rambled on enough; there are many new things I have not touched on. Drones were one example of an emerging CE sector at IFA, even if most of them were kept in cages. There was also a surprising emphasis on new food-preparation technologies, many with hands-on demonstration areas where you could test the new gadgets. There were double-load washing machines with Wi-Fi connectivity. There was even a "connected" microbrewery system that could mash

grain and prepare must for fermenting your own beer—definitely a novel IoT technology that was getting a lot of attention! It's not quite free beer but definitely a way to get high-quality, cheap beer made from natural ingredients.

There is no doubt that there was a lot going on in the CE industry in 2015. We are going to see a lot of continuing developments during 2016, many of which will shape the development of this industry over the next decade. I hope this review of the past year has built up your enthusiasm to sally forth at International CES and see what new developments are here to kick off the next year in CE. And may 2016 be an even more interesting

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years for our industry and for the consumers who fuel this cauldron of change that we live and work in. Now, back to more immediate concerns: next is my summary of this latest issue of *IEEE Consumer Electronics Magazine*.

IN THIS ISSUE

CE SOCIETY NEWS
This is a busy time for the CE Society. Here, we provide news and stories of the activities and initiatives undertaken by the Society Board of Governors and by the local Chapters and relating to conferences, workshops, and other activities such as standards that may be of interest to our members. Here, you can see that your interests as a member are being looked after by those elected to the Society board. If you have voted for a candidate, you should be able to note their contributions here!

CE SOCIETY PRESIDENT'S VISIT TO ENGINEERS IRELAND
CE Society President Sharon Peng and Joe Lillie recently visited Ireland on the

way back to the United States from ICCE–Berlin and met with senior executives of Engineers Ireland (EI). Joe Lillie, who is our current treasurer, is also the principal IEEE liaison with national engineering bodies, so the visit represented a formal meeting between IEEE and EI. You can read more about this visit and some of planned collaborations between IEEE and EI in this news item.

CHAPTER EVENTS—BATTLE ROYALE
Thanks to Wahab Almuhtadi for this fascinating news article on Canada's answer to the classic film. And I thought all those young engineers would be out enjoying the summer sunshine after the hard Canadian winter!

CONFERENCE REPORTS

THE IEEE PANEL OF CONFERENCE ORGANIZERS 2015
The Panel of Conference Organizers (POCO) is an internal IEEE conference run by MGA with a view to training and informing conference organizers and administrators of current best practices. There are also many panel and break-out sessions where delegates have opportunities to share and exchange their individual experiences. POCO 2015 was held in Glasgow, Scotland, and there was a definite Scottish flavor to the proceedings, including sword fights, whiskey tasting, and a fabulous venue for the "multisensory" conference banquet.

ICCE–BERLIN
We have an overview article on ICCE–Berlin, which is now five years old. This has become the CE Society's main European conference, and it attracts participants from across Europe—from Spain, Ireland, the United Kingdom, and Germany in the west of Europe and from Serbia, Greece, Romania, and other Eastern European nations. There was also a strong presence from Russia (St. Petersburg Chapter) and quite a few Korean participants, so while this is a European conference, it remains very much an international one in the spirit of ICCE.

YOUNG PROFESSIONALS ACTIVITIES AT ICCE–BERLIN

The CE Society's annual European conference is ICCE–Berlin, held in conjunction with the IFA trade show. This year, the Society's young professionals went kayaking in the rivers around Berlin. You can read all about it here.

PUBLICATIONS ROUND-UP

Stu Lipoff's column puts the focus on *IEEE Transactions on Cloud Computing* and *IEEE Transactions on Computational Intelligence and AI in Gaming*—two more of the IEEE journals for which CE Society members are entitled to discounted subscriptions.

FUTURE DIRECTIONS

One of the more active people within our Society is Tom Coughlin, who manages and chairs the CE Society Future Directions (FD) Committee. In this issue, Tom has a detailed report gathered from the chairs of some of the FD subcommittees. Here you can read about conference participation by the FD groups across all of the Society's conferences and some of the articles submitted by FD participants during the year to the magazine and future plans for 2016. FD spans a range of emerging fields of interest across the IEEE, including transportation and electrification, cloud computing, IoT [2], [3], augmented reality, consumer privacy and security [4], [5], safe advanced mobile power [6], [7], and the future of making. All of these areas have an affinity with the CE sector, and, if you have an interest in some of them, then Tom Coughlin is the person to direct you to the relevant chair of your interest group.

FD IoT ACTIVITIES—2015 AND 2016

Let's not forget Soumya Kanti Datta, who is chair of the FD IoT interest group. Soumya was very active this year running IoT-related panels at the International Symposium on Consumer Electronics, ICCE–Berlin, and again at ICCE 2016 in Las Vegas. Here, he gives details of both successfully completed activities during 2015 and planned events for next year. If you are interested in or working on IoT-related technology—and I know

that many of you are!—then Soumya is the person to contact to get involved as a volunteer. Feel free to contact him at Soumya-Kanti.Datta@eurecom.fr.

SOAPBOX

In the last issue, we had our first "Soapbox" column in a while, with Kyle Wiens sounding off about the "right to repair." This issue features Steve Mann writing about the need for transparency and ethical standards in our consumer devices. More specifically, modern devices spend more time spying on and learning about their owners than ever before. Steve is famous for his contributions to wearable technology and has pioneered the concept of sousveillance, which empowers the individual consumer to "spy back" on big brother. Here, he explores these themes in the context of connected CE devices and explains the need for standards or a code of conduct governing the "veillance integrity" of our electronic devices and their associated products and services.

FEATURE ARTICLES

In this issue, we have a special section on Internet of Things and smart homes in addition to our regular "Social Impacts" section. We also have our regular "Soapbox" and "Champions of CE" spots as well as a range of interesting feature articles. Let's start with the main features.

MAIN FEATURES

GAME-ON 2—THE ATARI PCS 400

Joe Decuir is a regular contributor, and here he describes the background and technical history of one of the classic home gaming consoles, the Atari 400. Joe was part of the team that designed and built this system, so he can tell it as it was. And if you like this article, you will be delighted to know that Joe has a full book in the works with even more details, anecdotes, and insights into the early days of the console industry.

STATE OF THE ART IN LIFE-CYCLE ANALYSIS

Our next feature article turns to a more serious topic. These days, we keep hearing about sustainability and the

importance of our energy usage and the environmental consequences of our industrial society. One key challenge for the CE industry is to measure the impact of our products, and this is achieved through a methodology known as life-cycle assessment (LCA). Some of you will already be aware of LCA, but, in this issue, we have a leading LCA researcher who provides a summary of the current state of art in this emerging field.

Anders Andrae works with Huawei in Sweden and has been involved in several recent major collaborative studies working with researchers from other mobile device manufacturers to compare and understand their individual methodologies and reach consensus on best practice in this emerging field. Here, we share some of the current state of art and provide some insight into where LCA is headed over the next few years. There is no doubt that its importance in the CE sector can only increase over this time, and I hope you find these insights of value in your own work activities.

IP CORE SECURITY

I can still remember the time when expensive software came with a hardware dongle to plug into the printer port so you couldn't get it to work on another computer. Since those days, software has become largely commoditized, and, if it does need to be secured, we have server-side licensing engines that remove the need for the dongle. But we are seeing a new frontier for theft of our precious engineering work—the potential to steal the designs and layout details of the IP cores from system-on-chip (SoC) designs.

This problem becomes more relevant as many smaller suppliers of specialized IP core subsystems try to build specialized expertise in a particular aspect of SoC data processing, transcoding, or interfacing—from USB hubs to MIPI peripherals, HDMI interfaces, and specialized audio or video processing subsystems. These small companies sell their IP core designs, often representing many man-years of design work, into larger SoC platforms and rely on licensing royalties to generate their revenues.

They need to be able to secure these designs and prevent unauthorized usage by larger companies operating in highly competitive CE markets.

One of our new associate editors, Dr. Anirban Sengupta, will introduce and review the state of art in IP core protection techniques and will provide a useful summary of current research directions in this field. If you are involved in IP core design work, you will likely be interested in this article.

EVOLUTION OF THE DIGITAL WATCH

Ken Steck and Hansheng Tan provide an overview of the evolution of the digital watch and how it is transitioning to become the smart watch. Can this be the next success for an emerging CE product category, or has too much been promised by the industry? You'll get some interesting insights, and I guess this is another question to be answered as we progress through 2016.

CHAMPIONS OF CE: STEVE WOZNIAK

Our champion this issue is Steve Wozniak who recently joined our Society. To celebrate his achievements, Tom Coughlin has provided an article on the Mac II, and your trusty editor has embellished this with excerpts from an old *Practical Computing* interview with Steve conducted by another venerable CE Society member, Robin Bradbeer. I hope you enjoy the article, and maybe you'll even catch up with "the Woz" at one of our conferences in 2016.

SPECIAL FEATURE—IoT AND SMART HOMES

We have featured a few recent articles on the IoT, but, in this issue, I have an interesting selection for you—different perspectives from different people.

IoT BUBBLE

Pablo Valerio is an analyst who has worked in the IT industry for more than 25 years. Primarily based in Spain, he has also lived in Germany, The Netherlands, and Denmark. His knowledge of the European IT business and his interest in European Union

(EU) technology initiatives spurred his move to technology writing with a focus on privacy, security, mobile technology, and smart cities. His work has appeared in *InformationWeek*, *Enterprise Efficiency*, *EE Times*, and *SAP Business Innovation*, among others.

Here, he provides an interesting and timely article on the problems IoT has experienced, mainly in a European context, with scaling from research/demonstration projects to larger citywide infrastructure. Indeed, the lack of

> The march of the smart watch continues, with Apple announcing record preorders for its entry models.

success is so endemic that many past supporters have become frustrated, and there are significant risks that IoT might not make it out of the commercialization starting blocks. You can find all the details and analysis in Pablo's piece.

IoT—WHY NOW?

The technology to connect "things" to the Internet has existed for more than 20 years, so if we take a look back at recent history, we might well be tempted to ask the question "why now?" In this article, adapted from a recent IEEE webinar, your editor examines the origins of the IoT and attempts to answer the question "why now?" He also looks forward to the next wave of disruptive technologies that will be coming to a device near you over the next few years.

IOT SERVICES

Here, we hear from Chris Koverman, who is an expert in the field of software-as-a-service-based technologies for customer support in the IoT. His article presents the key tenets of next-generation connected support. If embraced, these could mean the difference between an IoT that enhances and improves our busy lives and a "bunch of electronic

gadgets" that only succeeds in complicating them further.

ENERGY-EFFICIENT DC HOMES

I met with Josep Guerrero at ICCE–Berlin, where he gave an excellent keynote on microgrids. At the suggestion of Tom Coughlin, we asked him to think about repurposing his talk for *IEEE Consumer Electronics Magazine,* and he came back with a draft within a week. After a bit of discussion and some minor editing, the article fits in excellently with our IoT and smart homes section.

THE DOORBELL HACK

Our VP of publications, Stu Lipoff, presented me with this cheeky piece. It shows how engineers are frequently driven to create new solutions that sometimes lie outside the accepted norms of socially responsible behavior. In this case, Stu was ahead of the IoT curve, having achieved a remote hack of the main door of his apartment complex—all in the interest of receiving his morning paper safe from the ravages of the weather and neighborhood dogs.

I have been promised a second installment to this story if there is a positive response from our readership. So, if you liked Stu's whacky hack, please let one of us know.

SOCIAL IMPACTS

If you are a regular reader, you'll know that we think beyond engineering in *IEEE Consumer Electronics Magazine,* and, in these feature articles, we explore the broader impacts of CE technology on our lives and the planet on which we live.

THE TRACKING POINT

In this article, Katina Michael explores the consequences of having a sporting rifle that can be controlled remotely and has a heads-up display similar to that in many first-person shooter games. However, this is a real rifle that shoots real bullets and is intended for live game hunting. Are the lines between violence in the computer gaming world and in the real world starting to blur? Read on to find out more.

INTERVIEW HIGHLIGHTS WITH EARLY ADOPTERS OF GLASS

Here, we introduce you to ten early adopters of the Google Glass wearable to find out their key comments and reactions to their time spent with this new technology. Google has withdrawn Glass for now—perhaps these interviews will throw some light on new aspects of Glass? Let's read on to find out.

VIDEO GAMING ADDICTION

If you don't complain about having a teenager who spends too much time playing computer games, then that's probably because you are just such a teen or an adult who is envious and would like to have more time to play them. Yes, a good computer game is almost by definition extremely addictive because that is what makes it popular and successful. But have we reached the stage where the social effects of gaming addictions are having similar effects to drug, gambling, and alcohol addictions? There is no doubt that many of the symptoms and end outcomes are very similar both for the addicts and their immediate family and friends.

How can we manage and tackle this growing problem of the Internet age? We may not have all the answers, but a good start will get the ball rolling, so read on to see what Katerine Albrecht and coauthors have to say on this topic.

BRING YOUR OWN DEVICE

An increasingly popular approach in industry, many companies now encourage employees to use their own devices to execute day-to-day IT and business activities. However, there are risks in exposing your internal systems to a myriad of difference devices and OSs. In this article, Robert Ogie explores some of the risks and examines what sort of policies can help to ensure that these are minimized. This is helpful and practical advice if your company is looking at "bring your own device" as a solution to growing complexity of IT systems management.

SELF-ABSORPTION

Joe Carvalko reflects on important moments from his career and explores how difficult it can be to understand and envision the potential, both for good and bad, of some of the technologies we work to develop and create. With his granddaughter starting college this fall, he considers what message and advice he can give her. It is an interesting and contemplative piece. As Joe says, "One cannot predict with any precision where technology will lead us."

HIGH-TECH CHILD'S PLAY IN THE CLOUD

Katina Michael and Alex Hayes are not impressed with Mattel for creating Video Girl Barbie. Is the doll a fun toy for innocent children to record and share their playtime with cybercolleagues in the cloud or a child pornographer's dream tool? The authors lean strongly toward the latter and are aghast that a large corporation in the specialized business of making toys for preteen children could get this so wrong. If you too find a combination of the time-honored Barbie doll with a state-of-art wireless spy-cam to be a somewhat grotesque approach to a 21st-century children's toy, then you'll enjoy this article. It raises many sensitive issues, but that is what our Impacts section is all about!

COLUMNS AND REGULAR FEATURES

Finally, we have our various regular columnists.

IP CORNER

In this issue's "IP Corner," Kieran Heneghan of Noerr Alicante IP, S. L., writes about the "Registered Community Design"—a Europe-wide mechanism that provides three-year protection for your product design. This article covers the process to benefit from this cost-effective pan-European mechanism—a useful read for anyone involved in designing or commercializing CE products in the EU.

BITS VERSUS ELECTRONS

Bob Frankston recounts his "Hacker's Vacation" and his experiences with technology last summer, including a programmable car and smart luggage.

ART OF STORAGE

For the latest industry trends in storage, Tom Coughlin is definitely the man, and you can keep abreast of the most important developments by following his column in the magazine. This time, Tom brings us "Crossing the Chasm to New Solid-State Storage Architectures."

MARKET-BASED ANALYSES

David Alan Grier reflects on the history of the microwave oven and some of the engineers who shaped its evolution from an enormous monster bolted to the kitchen floor to today's sleek, lightweight product. As usual, David provides some interesting insights into the CE industry and the engineers who work in it.

CEA INSIGHTS

Dave Wilson, VP of technology and standards with the Consumer Electronics Association (CEA), writes about CEA and its role in the CE industry as a facilitator. CEA is a neutral party often acting as an honest broker between industry consortia with competing standards and technologies. This article nicely summarizes CEA's role and mission with respect to the consumer industry and is a timely reminder we can reflect on while wandering the halls at CES.

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