The Internet of Things

Making the Invisible Visible

By Melissa Cogavin, Managing Editor, SCTE

It is almost impossible to exist in 2022 without being tied to a connected device in some way. The phrase Internet of Things is useful in some respects, but it is such a limitless field now that the phrase is a little inadequate, suggesting a finite area limited only to consumer goods. Connectivity between ourselves and the devices around us is becoming so ubiquitous it almost defies definition. It has become normal.

According to the latest estimates, reports indicate that there are 35.82 billion IoT devices installed worldwide by 2021 doubling to 75.44 billion by 2025*. If every one of us invests in a smartphone, a FitBit, an Amazon Echo and a Ring doorbell over the next couple of years, for example, it is not much of a leap to see how that statistic will be reached, and probably breached by 2025.

“I think we are at an inflection point now that technology is so tightly integrated into people’s lives that it is impossible to have an unplugged, off-grid lifestyle”, said Peter Aylett, Chair of CEDIA/CTA (the Global Association for the Home Technology Industry and the Consumer Technology Association). “What’s been lost is that technology comes first and then we think of the problems they will solve after.” Steve Jobs famously asserted something similar when developing the iPod. It was up to Apple to show consumers what they needed, not for consumers to tell Apple what they wanted.

Depending on your viewpoint, IoT, and its close cousin AI, is either the welcome face of a fully automated future, allowing all of us to get on with the business of enjoying our leisure time, (predictions in the 1950s had us working a three day week and flying around on jetpacks by now) or it is just another step closer toward the dark warning issued by Sarah Connor in Terminator 2; a hellish apocalypse in which the machines have taken over. The truth is probably somewhere between those two positions, but the subject matter is so huge and evolving at such a great rate that this piece focuses purely on the harnessing of our data in the pursuit of convenience and at what cost.

IoT is creeping up insidiously upon us all, and it is widely accepted as the biggest technical gamechanger in modern times. We are all succumbing to it, whether we realise it or not. The convenience IoT provides in return for the personal data we offer up seems a trade few of us have ever really considered in any depth. Who actually reads the terms and conditions when they sign up for a Gmail account, a new phone or an Amazon subscription?

Stacey Higginbotham is a technology journalist based in the US and raised this in a recent podcast, part of a series she produces every week. She detailed the potential for Amazon to extend what they are already offering to businesses via Amazon Dash Smart Shelves to households. Amazon itself describes this model as an “auto-replenishment scale [that] senses the weight of everyday items and places a reorder or notifies you when you’re running low.” A warehouse manager’s dream perhaps, and applied to the home, consumers no longer need to shop themselves, in theory. When your orange juice runs low, Amazon knows before you do and drops more to your door.

Higginbotham warms to this idea but admits there are logistical problems in a domestic setting. “It would be great in a home,

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as long as people had super-organized pantries. That's been the biggest challenge with 'pantry IoT', is that most people don't want to buy special shelves or special containers. They also aren't that organised." Or committed to the same groceries week on week.

More important are the ethical issues. This sounds like the epitome of convenience – after all, nobody really enjoys grocery shopping - but the idea that Amazon alone knows that much about your eating habits, can anticipate your behaviour and what's more profit from it so exclusively leaves many uneasy. There are sinister throwbacks to the early 20th century; Upton Sinclair detailed this in his seminal novel The Jungle, which focused on the horrendous working conditions exploited workers faced in the meatpacking industry in Chicago. Working dangerously long hours in harsh and unsanitary environments, employees were paid not in dollars but in tokens, redeemable for substandard food only at the factory where they worked. In effect, they were owned by the meatpacker. The corruption of people in power is a concurrent theme throughout. The publication of The Jungle and subsequent public outcry led to the Meat Inspection Act in 1906 and widespread worker reform as a result.

No such reform looks likely in 2022.

Amazon has not announced a definite move toward white goods yet, but the technology is there and consumers are willing; after all, we are already happily giving our data over on a monthly basis in order to receive printer cartridges through the post. Should Amazon advance this initiative there are clear correlations between Sinclair's account and its 21st Century equivalent. In addition a powerful multinational, which is already able to predict your consumer behaviour almost before you can thanks to the data it gleans from your online activity, is now in your fridge.

Amazon, like many other internet companies also relies on dynamic pricing to stay competitive; we have all experienced the frustration of going back to an item a second time only to find the price has risen. How this can be accommodated in your weekly shop is still up for debate, and the implication is that the consumer puts massive faith in these multinationals to delivery quality, consistently, at a fair price, and regularly.

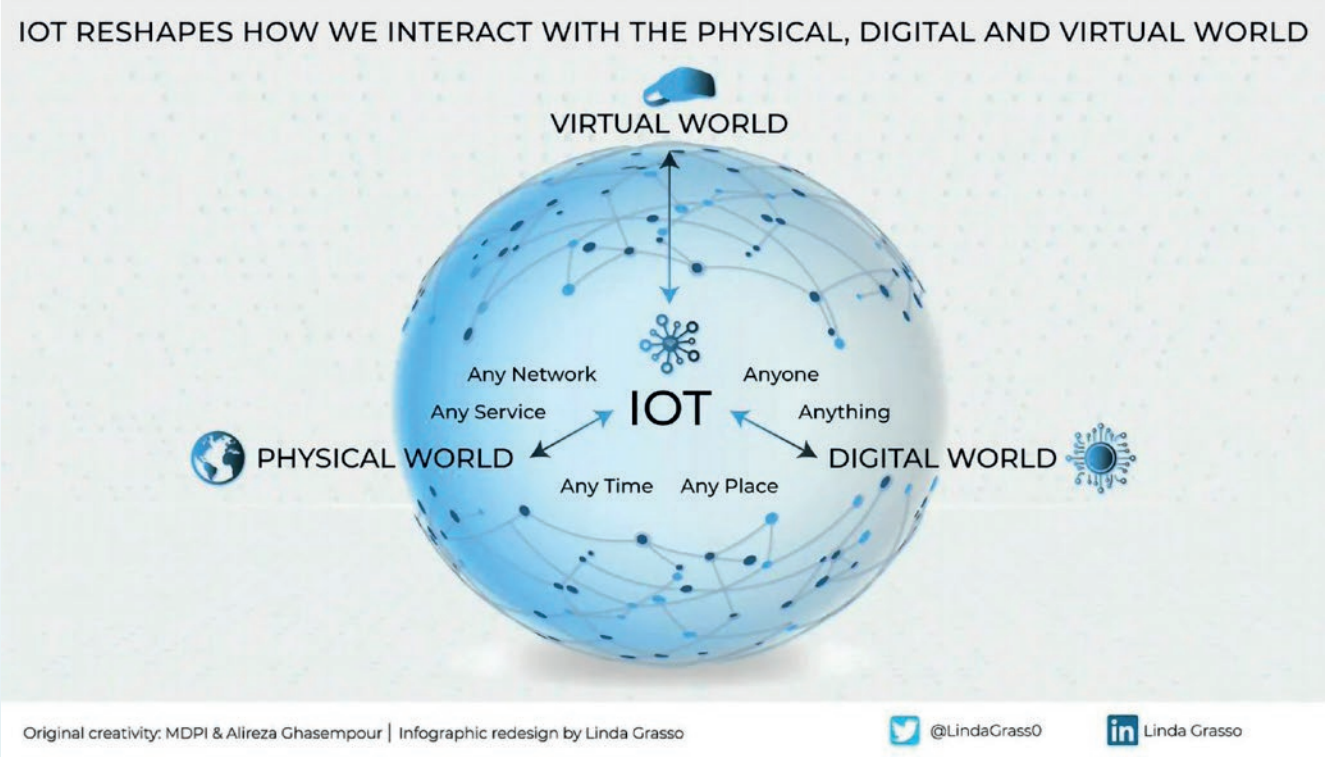
Higginbotham is uncomfortable with this. "The question is, do you trust these companies? Is the convenience being provided enough to get you to say yes? If I sign up I am trusting that you will keep the pricing the same and you will give me a fair price. Although, with all that to consider, and the convenience it offers, what is a fair price? With worldwide supply chain economics currently very unstable, the opportunity to abuse pricing for profit is huge; online consumers already have very little visibility on how market fluctuations affect them especially in a dynamic pricing model, so there is little consumer protection.

The Best of IoT

Much of it what IoT can do for society is absolutely a force for good, she feels, and the innovation in this area is impressive. She describes it "Making the invisible visible" and cites Israeli IoT firm Vayyar, who have created compelling solutions to overcome human error, from seatbelt reminders to fall alerts. Child Presence Detection (CPD) detects motion in a child car seat, alerting the driver as they leave that they have left their baby behind. Hot car deaths claim thousands of lives each year and it is hoped the RF sensor system and 4D imaging radar technology that detects motion and sets off an alarm before the driver has a chance to move too far from the car will dramatically reduce these needless casualties.

Equally impressive at the other end of the human life cycle is the Touchless Fall Detection system, aimed at senior citizens living alone. CCTV cameras in someone's private home are a clear invasion of privacy but RF sensing and a WiFi connection provide evidence via a hazy image that there is *someone* out of bed and moving around, but not a clear picture of the person involved. Vayyar sells the concept very persuasively and in a novel partnership with Alexa, the detection system both senses movement in the home and detects irregularities - falls basically - then the owner is connected with their next-of-kin, should a fall occur: "Alexa, call Angela" etc.

Likewise, IoT is now being applied in wildfire detection; drones with IoT sensors detect areas of heat via a discarded cigarette



or a campfire not properly extinguished. Sensors can detect moisture, heat and chemical changes in the atmosphere and drones cover a vast area at speed, reducing the time needed to assess potential hotspots and providing the data needed to save lives. There are IoT solutions identifying Parkinsons' Disease via gait analysis, or depression via voice analysis; the application of IoT is creative in the extreme and will help a lot of people – and it is only just getting going.

It is encouraging that technology is being harnessed to save lives so effectively; this is cutting edge now but within a few years such solutions will be commonplace; technology is moving so fast that this article will already have dated by the time it is even published.

The concern of course, as is so often the case, is the necessary legal safeguards take far too long to put in place leaving the data being harvested through all of this innovation wide open to abuse. These invasions can be physical, in terms of surveillance, but the data the public are happily supplying these big tech companies every time they tick 'yes' to the terms and conditions of a new app, device or service mean the consumer is at a distinct, yet unaware disadvantage.

Taking responsibility

Whose responsibility it is to protect consumers is a question that academics, governments, big tech and consumers themselves have been grappling with for some time. Academics lack the corporate experience, governments are too partisan and short-term, big tech firms are profit-driven and primarily interested in their shareholders, and consumers themselves lack the oversight and/or interest to take a deep dive into what those terms and conditions actually mean.

There seems no clear consensus on the best direction to take; of the four industry professionals interviewed for this piece, opinion was clearly divided.

Antonio Grasso is an entrepreneur and technologist based in Naples and sees the bigger picture. He feels that regulation, despite its good intentions, could act as a kind of censor and ultimately hinder market development. Recommendations are better, he feels. "This is something that I'm working on with the European Commission. It is important to put ethics alongside design.

"So the legislator, the government, should not impose new kinds of rules because it can create a kind of censorship about technology, but the government can provide a set of ethics, how you can use these ethics regarding data: how to collect the data, what to collect, what not collect."

Higginbotham feels there should be an independent organisation to keep track of this globally and protect the

consumer, and some governments do a better job than others to legislate the use and abuse of consumer data (GDPR is an example of EU legislation acting in the interests of the consumer), but overall protection is patchy, defined by territory. It is also fraught with loopholes that are easy to get around. In the UK and the US there are independent groups, but no overarching body.

"We're so dumb and we're doing it all over again," Higginbotham said. "It's like we learnt nothing from building the web. If you treat IoT as basic infrastructure, you recognise how it could really change things the same way the web changed things. But instead we've built out this bifurcated and very siloed infrastructure, well it's not even infrastructure. I'm frustrated that we're doing with IoT the same thing we did with mobile. This is both with smart home and with industrial kind of platforms. I get it, people have to make money, but it's just frustrating. It's so surprising that we can see the potential of this, but that potential will only be realised if we actually have standards and things that will work across at the base layer."

Peter Aylett feels that ultimately it is down to education of the consumer themselves, that we are already giving up our data constantly and actually, what does it really matter? Well-meaning initiatives like GDPR are ridiculous, he feels, and just have made the internet worse. "Clicking that I am ok for a site to use cookies – who cares? We are being advertised to all day, every day, all over the place, and not just on the internet."

Ari Waldman, Professor of Law and Computer Science at North Eastern University disagrees. "That's all very well if you are speaking from a place of privilege. Marginalised groups have a lot to lose by just giving up like that," he said. "You take that a step further and surveillance is the reason police can drag black people off the street because they are recognised by third-party devices." He is referring to the recent BLM protests in the US, where according to US pressure group Electronic Frontier Foundation, the LAPD attempted to obtain Ring doorbell footage from the homes of private residents to aid their investigations. Meanwhile the FBI was in the news last year for raising concerns that Ring doorbell owners were in turn using their devices to spy on the police.

The siloed culture between governments, tech companies, pressure groups and academics means that there are plenty of assumptions at play, hampering confusion and limiting progress. Higginbotham added, "I will also say the arrogance of the computing community has a negative effect here. Silicon Valley are well known for thinking 'this is the right way to do things'. That also has implications. They come in and they don't necessarily bother to understand the why of the way things were done before, they just see it as grossly inefficient and they alone can fix it."

Governments aren't technology experts and technologists aren't governments, as we have seen through the recent mishandling of Facebook's free speech policy. Mark Zuckerberg's laissez-faire approach to free speech has had a dramatic, ugly impact on world events in recent years as we have seen with the rise of the far-right movement in many territories, Russian interference in the Brexit referendum and the insurrection at the Capitol Building in January 2021, so perhaps Peter Aylett has a point. Education is key, and with government and corporate trust at an all-time low, critical thinking at a premium and misinformation rampant and uncontrolled, perhaps it has to be the responsibility of the end user to manage.

Waldman discusses this in his 2021 book "Industry Unbound – The Inside Story of Privacy, Data and Corporate Power" which features in-depth case studies of three companies. The book asks the broader question: Why is there so much privacy law but so little privacy? The answers are as depressing as they are enlightening.

There is a clear drift towards an unregulated, neo-liberal view; that it is ultimately down to the individual to continue to make their own choices about how their data is mined and utilised. Amid the fire-fighting governments have had to focus on in recent years with Brexit, the pandemic and now a war in Europe, for the lack of anything better this approach seems an inevitable direction the industry is taking.

"The EU, the UK Parliament, US Congress is trying to regulate corporate behaviour, but it is offloading responsibility to the corporations themselves by serving them an ongoing series of compliance requirements and impact assessments," Waldman told me, which is effectively equivalent to asking the general public to police themselves.

There is a clear conflict of interest and while companies may well hire tens of thousands of well-meaning privacy professionals to enforce these policies within their organisations, according to Waldman, companies will do their best to undermine the enforcement of these regulations by giving their privacy staff no budget, for example. It is in the interests of the shareholders that these privacy laws are undermined, and because they are

trusted to comply with the law they are not considered to be breaking any laws. It makes your head spin.

Periodically more legislation is passed, but Waldman fears this is complicating matters and making it even more difficult for privacy professionals to do their jobs. In fact, the work they do produce often ends up supporting the commercial intentions of the corporations rather than protecting the data of the end-user. There is a reason why those terms and conditions are so lengthy and impossible to read to the end.

It is not all bad news however. There are small victories, encouraging developments, refreshing trends. In 2014 the Spanish government took Google to the European Court of Justice and won, in a "Right to be Forgotten" ruling, meaning that "European citizens have a right to request that commercial search firms, such as Google, that gather personal information for profit should remove links to private information when asked, provided the information is no longer relevant".

GDPR is widely regarded as a privacy milestone, a good foundation to be built upon and inspire similar models elsewhere. Waldman feels it is also encouraging that today's young people have a far deeper and instinctive grasp of the relationship between surveillance and civil rights, and are not prepared to offer up their data for the convenience of watching Netflix, which bodes well for the future.

Making the invisible visible is about far more than gait analysis or empty fridges, as it turns out, and IoT is already an entrenched part of everyday life. As with most areas of technology, where innovation is lapping legislation year on year, the combination of education and time will, it is hoped, encourage some good practices, but vigilance of the individual remains essential in the meantime.