



PREDICTIONS FOR 2019 AND BEYOND: THE INTERNET OF THINGS

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Each year CCS Insight publishes its predictions for the coming years, and shares them with its clients at an event held in October. Every year we also review our past predictions and assess why some came true and others did not, adjusting our view of market dynamics in the process.

In this report we present our predictions for 2019 and beyond as they relate to the Internet of things. We take a broad view of this topic, including wearables, virtual and augmented reality, smart home, industrial Internet of things, automotive and transport, as well as smart cities.

We have also included predictions from other areas that will influence the Internet of things markets. In this case we include the agenda-setting web giants, commercial strategies, changing business models, related technologies such as machine learning and artificial intelligence, advances in connectivity, policy and regulation, cybersecurity and trust.

The 57 predictions provided in this report are a subset of the 100 predictions we published in October 2018.

In developing our 13th annual set of predictions we have taken account of several significant changes in the macroeconomic environment, the technology market as a whole and Internet of things markets.

The overall trading environment is becoming more challenging as geopolitical tensions intensify, led by the US, China and Russia. However, this comes at exactly the time when the digital economy is developing significantly. The interlocking of blockchain, artificial intelligence and the Internet of things is the main force shaping this shift, with the arrival of 5G networks set to underpin it over the next decade.

Much of the technology agenda for these developments is being led by the major web players, which we call agenda setters. Several of them have been involved in the Internet of things for some years but they have all now recognized this area as an enormous one-off expansion of their addressable market, and they are all stepping up their investment substantially.

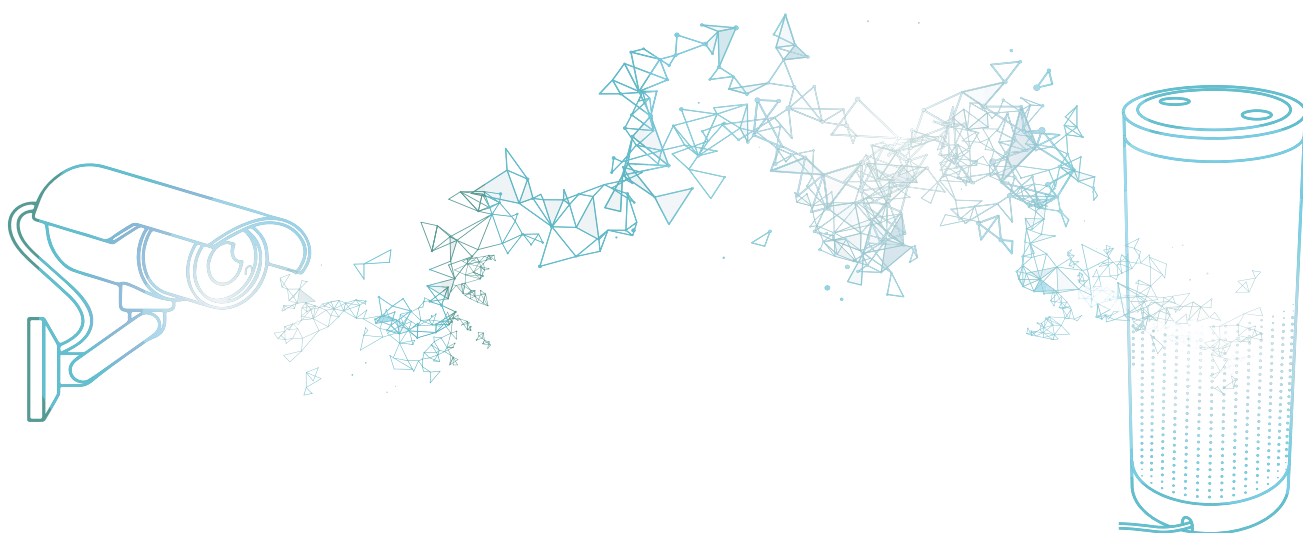
However, this is happening alongside a huge change in sentiment against these players, stemming from security, privacy and trust factors, and this is visible in the stock market and reflected by many government initiatives to investigate and regulate them. Those regulations potentially span artificial intelligence, antitrust, tax, eligibility to bid for government contracts, employment law and cybersecurity, in addition to these companies' roles in society and democracy.

It is increasingly clear that the Internet of things has a central role in digital transformation projects and, as a result, development of the digital economy. But it is fair to say that the macro-level issues make this a time of growing uncertainty about major suppliers, their platforms, and the commercial climate they will be operating within.

More than ever before, it is important to take a broad and joined-up view with predictions for the future.

- 1. In 2019, at least three countries ban or restrict levels 2 and 3 semi-autonomous driving.** The Society of Automotive Engineers defines level 2 autonomy as “hands off” and level 3 as “eyes off”, but in both cases the driver remains behind the wheel. The transition to these levels of control is problematic owing to the immaturity of the technology and the need for occasional and sudden intervention by the driver. Several accidents lead to a crackdown by regulators. Restrictions are imposed on how companies can market what should be referred to as a safety aid rather than “self-driving” functions. Some countries move to ban the technology outright.
- 2. By 2025, five percent of grocery stores in the US are fully automated.** The concept is gaining traction as Amazon expands its chain of cashier-free shops to Chicago and San Francisco, and Sainsbury’s and Tesco trial the system in the UK. These initiatives have the potential to transform the grocery business. The technology affords numerous advantages, offering convenience and efficiency for shoppers, as well as cost savings borne from lower staffing levels for retailers.
- 3. By 2020, consumers use the phrase “tech clutter” to describe the effect of proliferating smart home devices.** The term reflects the burden associated with data overload, updating software on the devices, managing permissions, staying on top of security and making sure devices work happily together. Some users decide to “de-clutter” to cut the time they spend looking after smart home devices.
- 4. In 2021, smartwatches become a hub for peripheral devices including augmented reality glasses.** Smartwatches become a principal way for devices such as smart headphones and smart glasses to connect to the Internet when users do not have their smartphone with them. An important area of usage is sports, allowing athletes to receive audio and visual updates.
- 5. By 2022 waste collection is undertaken by autonomous robotic vehicles in at least five major cities.** This utilitarian task emerges as a good use of autonomous vehicles, particularly in areas where vehicle traffic is restricted, like central business districts and corporate campuses. Their deployment supports our long-held view that autonomous capabilities first appear in tightly controlled and lower-risk environments, rather than in passenger cars for private use.
- 6. In 2025 the European Commission mandates that all portable devices must have user-changeable batteries.** Integrated batteries have helped devices of all types become slimmer and waterproof and — because multiple batteries are crammed into every spare space — last longer between charges. However, many devices are regarded as disposable once the batteries fail. Into the next decade, manufacturers half-heartedly comply with current e-waste regulations, leading to more stringent action by European lawmakers. The law exempts devices that can be swapped for a replacement at minimal cost, and some manufacturers prefer this approach.
- 7. Growth in artificial intelligence makes manual control of some smart home devices superfluous.** By 2020, lighting, heating and air conditioning, hot water and more are controlled automatically by cognitive systems. They learn how to autonomously optimize settings, making them almost completely opaque to users.
- 8. By 2023, 30 percent of tickets in Western Europe are paperless.** The trend has started in the Nordic countries, which have seen a significant jump in the use of digital tickets thanks to a high level of environmental consciousness and government support for infrastructure improvements. In the UK, the shift to digital tickets gets off to a slightly slower start, hamstrung by the relatively heavy investment required and more sluggish adoption by the public.
- 9. By 2021, it is possible to talk to almost every new connected consumer device sold in Western markets.** Strong recent progress in speech recognition drives the trend, alongside greater integration with personal assistants such as Amazon’s Alexa. Not every device incorporates a microphone and voice-processing functions: greater support for programming interfaces and the ability to relay commands from speech-activated devices such as smart speakers brings voice control to otherwise “deaf” products.

- 10. More cellular pet trackers are activated on mobile networks worldwide in 2020 than Apple cellular smartwatches.** There are more than 1.5 billion dogs and cats worldwide, offering an enormous target market for connected pet trackers. There is also growing interest in pet tracker technology and more-affordable data tariffs for connected objects. These trends, combined with the arrival of products and loyalty programmes from insurers and pet food companies, create the conditions for strong growth in the product category. It is further boosted by Amazon's entry into the segment.
- 11. Consumer adoption of smart clothing remains elusive until at least 2025.** Despite continued investments in smart fabrics and body-worn sensors, smart clothing remains a highly niche product category serving specific segments such as professional sports. Other wrist-worn wearables offer enough functionality and convenience to limit any market opportunity for smart clothing before 2025.



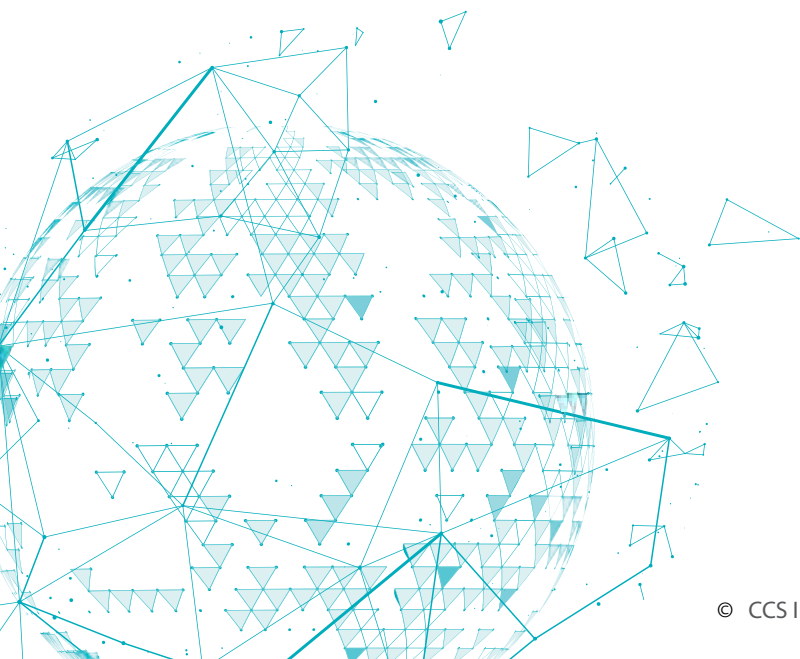
12. **To 2021, regulation in some regions benefits rather than hinders artificial intelligence.** An example is the right under Europe's General Data Protection Regulation for data subjects to be given an explanation of the output of an algorithm. This means that systems have to be designed to provide insight into why a particular decision was made, which helps overcome bias and build trust. Similarly, regulations mandating the sharing of information in sectors such as banking increase the quality of data and the value of cognitive services. The shape of regulation and the degree of involvement influence which countries lead and which follow in artificial intelligence.
13. **By 2025, at least one country in Europe owns the majority stake of its fixed-line and mobile infrastructure.** Connectivity is strategically important for the functioning of modern society and for the safety and security of countries and citizens. The need to secure and defend its connectivity infrastructure against physical or digital attacks leads to a government stepping in. The move also serves to ensure connectivity is ubiquitous and available to all people and businesses in all parts of the country, no matter how remote, especially as public services move extensively online. Telecom operators continue to own the relationship with end users.
14. **The 2024 Olympic Games in Paris see the introduction of digital anti-doping passports.** Olympians are already subjected to blood passports and regular anti-doping tests. The World Anti-Doping Agency goes one step further by mandating that athletes record training and performance data such as heart rate and perceived effort into an online application. The data gathered is analysed using artificial intelligence in an effort to catch dopers. Athletes who do not provide data risk being banned from the competition.
15. **By 2020, cyberwarfare moves beyond "soft" targets.** Outside the realm of financial cybercrime, attacks have focused on disrupting elections and media channels. By 2020, an online attack results in casualties as a major hardware infrastructure asset is disrupted. State-sponsored hackers move to gain control of resources such as flood control facilities. Assets in less-developed countries are more vulnerable, and it is likely an attack is carried out in conjunction with internal hacks to a system by a rogue employee. The consequences are more serious, resulting in loss of life.
16. **Opportunities in "quantum safe" solutions prompt consolidation in the cybersecurity industry by 2025.** With the increase in computing power brought by quantum computers, many of the security encryption techniques and algorithms developed by the likes of RSA need to be upgraded to withstand attacks by quantum computers. Although the risk is at least a decade away, the race to build quantum-resistant algorithms becomes a focus of cybersecurity suppliers over the next five years. This accelerates consolidation in an industry already struggling with a shortage of talent.
17. **Pluggable encryption in the Internet of things becomes a hot topic in 2019.** Providers of products for the Internet of things start to realize that their systems will need to be upgraded to cope with "quantum day" —the point in the next 10 years when advances in quantum computing render current approaches to encryption potentially useless. This means that Internet of things systems being set up now need a way of coping with breakable security during their installed lifetime. At minimum, encryption and security they use must be upgradeable in place, which almost no suppliers offer today.
18. **Trust is the most important source of competition among cloud service providers in 2019.** The industry adapts to a new era in the wake of data-sharing scandals, extensive security breaches and concerns that service providers may not be acting in the best interests of their customers. For example, Walmart has warned its suppliers away from using Amazon Web Services, fearing a conflict of interest at the cloud service provider. The likes of Alibaba, Amazon, Facebook, Google and Microsoft recognize the importance of winning customers' trust to set them apart from rivals, prompting a focus on greater transparency, compliance efforts and above all investment in security.
19. **Behavioural biometrics become the latest layer of security on smartphones.** A combination of biometric triggers is used to authenticate users, especially in scenarios involving highly sensitive or regulated data, such as medical consultations or high-value financial transactions. The biometrics used in this new layer encompass established elements such as fingerprint, facial and iris recognition to more-subtle but equally valuable elements like the way people type, scroll or talk on the phone. With the right sensors a user's breath could even be used as an authentication method.

- 20. Security becomes a bigger focus for mobile operators deploying 5G networks.** The race to gain bragging rights from being early with the launch of 5G networks results in many operators and suppliers placing less emphasis on the security aspects. With mission-critical services being touted as an important reason to deploy 5G networks, security assumes a far more important role than in previous generations of cellular connectivity. Renewed efforts in security feature in delays to the introduction of some network technologies.
- 21. In 2019, networks of householders' connected security cameras are created to support law enforcement.** Consumers opt in to allow their external security cameras to be linked to a common cloud-based system. Stored and real-time video is made available to law enforcement bodies, which mine the footage using artificial intelligence tools. Some communities opt into a service run by private security firms to protect themselves.
- 22. Artificial intelligence, blockchain and the Internet of things become highly integrated and interdependent technologies by 2021.** Today, these are presented as largely independent technologies. They become increasingly interdependent and complementary as an abundance of connected sensors create vast amounts of data. Artificial intelligence is needed to extract value and insights, and blockchain is central to follow the movement and ownership of data. Connectivity, and 5G in particular, is an essential supporting technology.



- 23. “Private artificial intelligence” becomes the next breakthrough in machine learning research.** Running machine learning on encrypted data using techniques such as homomorphic encryption has become a growing area of research among the major suppliers of cloud services. This was evident at Microsoft’s Build event in 2018. Private artificial intelligence, in which the actual content of data is not revealed to the service provider, is a boon to regulated industries such as pharmaceuticals and finance. It forms a focus of providers’ strategies for these industries to 2021.
- 24. 2020 is a breakthrough year for big data analysis in the automotive sector.** Progress comes from mainstream established automobile makers such as Ford, GM and Volkswagen, rather than newcomers like Tesla. The increasingly wide range of sensors and built-in cellular connectivity in cars, coupled with cloud-based machine learning, revolutionizes the way individual cars and fleets of vehicles are managed. All aspects of performance and wear are recorded, providing a rich set of data that can be mined by manufacturers.
- 25. IBM wins the race to launch the first commercial applications of quantum computing by the end of 2022.** As the contest to lead quantum computing shifts from research to commercial applications over the next five years, IBM’s early leadership in supercomputing manifests in it being the first to market with a set of quantum-based applications in chemistry, finance and artificial intelligence.
- 26. Growing acceptance of edge devices as general-purpose computers raises expectations of what can be done and how quickly.** Traditionally, embedded computers have been dedicated controllers for specific machines that could not be reconfigured. The rise of edge computing in the Internet of things means devices are increasingly general-purpose computers running virtualized operating systems and applications and using over-the-air updates for security, middleware and applications. The ability to download new applications and features enables much faster reconfiguration of industrial plant, which has the effect of raising management expectations and quickening the pace of competition in several industries by 2023.
- 27. Real-time distributed training of neural networks takes places at the network edge by 2025.** Growing use of machine learning in Internet of things systems is fuelling a rise of distributed training. This means that models are loaded onto edge devices, which perform data processing and inference locally without the cost or time delay of passing all the data to the cloud. At present, models are built centrally, with only a small amount of local updating possible to fine-tune for local conditions. The increase in the computing power of edge devices, as well as new machine learning software architectures, enables deep learning to be carried out from data streams on a distributed array of end points. The resulting model is assembled from the components generated at the network edge. This enables faster initial model building, although it leads to more complexity in system optimization.
- 28. By 2020, cloud service providers expand general-purpose artificial intelligence to business-specific applications.** For the past few years, most artificial intelligence services have focused on horizontal and general-purpose algorithms in speech, vision, language and sentiment, for example. Over the next two years more domain-specific applications emerge that help companies apply the technology to business problems. Off-the-shelf algorithms emerge in areas such as predictive maintenance for manufacturing, dynamic pricing and demand forecasting in retail, contact centre automation, compliance and audit for professional services and fraud detection in banking. These boost adoption of the technology.
- 29. More-sophisticated analytics at the network edge in the Internet of things fuel a “software spiral”.** As connected “things” at the edge of the network proliferate, expectations of software and applications running on them rise. This prompts wider use of high-level operating systems and raises memory requirements and processor specifications so that software expansion starts to drive hardware upgrades. It brings huge opportunities in operating systems, industrial app stores, machine learning and services. The PC and smartphone markets have seen similar spirals over the past decades.

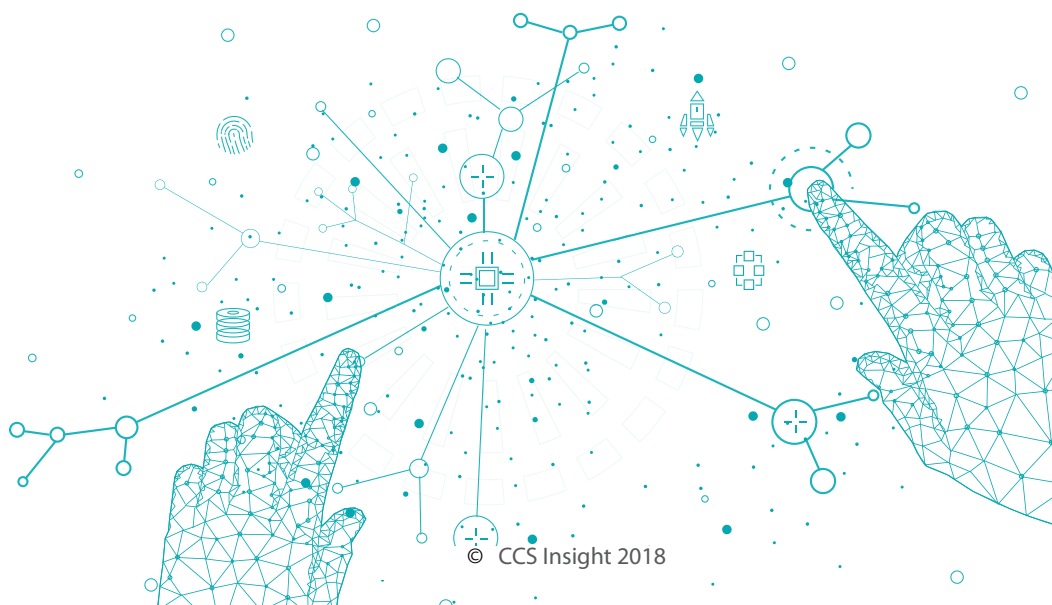
- 30. Alibaba partners with a major bricks-and-mortar retailer in India by the end of 2020.** Alibaba has made substantial moves in physical retail in China, combining the online and offline experiences in its Hema stores and planning to open 30 new stores in Beijing during 2018. The company looks to cement its position in the Indian market by running a similar programme either through acquisition or partnership with a major local retailer like Avenue Supermarts.
- 31. By 2020 an industry initiative emerges to promote collaboration on mobile edge computing between cloud and mobile providers.** The move is designed to encourage widespread cooperation and standards in exploiting the benefits of low latency at the network edge. However, there is significant scope for conflict as mobile operators view 5G's low latency as a competitive advantage over the web companies.
- 32. To 2021, cloud and semiconductor companies acquire start-ups making customized silicon for artificial intelligence.** Candidates include Cerebras and Graphcore. Increased interest and investment in artificial intelligence have created a wave of custom semiconductor companies producing tailored silicon for specific artificial intelligence workloads. There are more companies than the market can support, and consolidation is inevitable. Established semiconductor and cloud companies engage in a flurry of acquisitions to expand their portfolios of artificial intelligence accelerators as workloads become more diverse.
- 33. Amazon acquires augmented reality smart glasses company Vuzix by 2020. Rumours that Amazon would make its own smart glasses have circulated since 2015.** Vuzix is a leader in the enterprise smart glasses space, with strong technology credentials and a wealth of experience in applications for vertical markets such as fulfilment, logistics and warehouse solutions. These strengths prove a good fit for the retailer's endless quest to make its warehouse operations more efficient.
- 34. In 2020, at least five countries announce plans to deploy independent shared 5G networks funded by operators.** The move reflects continuing challenges to make the economics of 5G add up. The creation of a shared resource is evaluated by the second and third waves of providers as a way of cutting costs and launching services more rapidly. Although the approach limits opportunities for operators to differentiate on connectivity, it enables investment in areas such as content, vertical markets and new services.
- 35. Operators adopt business models other than airtime to capture opportunities in enterprise use of the Internet of things.** As operators seek to capitalize on opportunities from the Internet of things beyond connectivity, they move away from the traditional approach of monthly contracts and bundled airtime. Instead, some agreements are based on shared outcomes such as energy savings or increased revenue.



- 36. Political and trade disputes with the US accelerate China's investment in and deployment of 5G in 2019.** CCS Insight has consistently forecast that China will rapidly become the leading market for 5G, overtaking the US by the end of 2020. However, in the current geopolitical climate the Chinese government prioritizes leadership in 5G still further. This US administration's desire to become a front runner is a major factor in the speedy clearance by regulators of T-Mobile's acquisition of Sprint.
- 37. Huge variation in users' experience of 5G in 2019 and 2020 becomes a marketing headache.** Forthcoming 5G networks employ a range of frequencies, with millimetre-wave spectrum beyond 24 GHz suited to high-capacity, high-bandwidth connections and sub-6 GHz frequencies providing coverage. However, this represents a challenge for the industry. Differing operator strategies result in vastly different levels of performance and coverage. Manufacturers are likely to design initial handsets with a geographic focus, supporting either sub-6 GHz bands or millimetre-wave spectrum, and in a few cases both. This variation in performance exacerbates the challenge of marketing 5G technology; it risks frustrating users as they try to compare oversimplified promises based on raw speed.
- 38. Network optimization emerges as the main reason for operators to deploy artificial intelligence.** To date, the primary focus for the application of artificial intelligence among network operators has been to improve customer service and prompt greater usage of services. However, in the long run the greatest benefits come from improving network performance. Artificial intelligence is used to predict demand, identify potential faults and bolster network security.
- 39. Consumer tariffs for the Internet of things wreak havoc on consumer mobile data pricing in 2019 and 2020.** Several operators introduce account plans that connect up to 10 SIM cards to one master tariff with pooled allocations of voice and data. Bundled data plans for connected things such as cameras, dog trackers and bag tags offer huge amounts of data at extremely low prices. As consumers become more aware of the discrepancy between these plans and regular monthly allowances, operators come under pressure to rethink all tariffs.
- 40. There is no material uptake of 5G for business Internet of things systems before 2025.** For 5G services to be attractive on any scale in the business Internet of things market, they must offer respectable coverage, sensible tariffs, service-level agreements that reflect the mission-critical nature of the data, an array of network slicing options, suitable security for enterprise services, and 5G network components that are reasonably priced. Even once these elements are in place, few industrial users choose to be on the "bleeding edge", preferring to wait until the technology is well established before shifting their important traffic. Our prediction excludes earlier networks like NB-IoT and LTE Category M1.
- 41. Private cellular networks see rapid deployment from 2020.** Driven by the need for secure and flexible wireless connectivity, more organizations launch private cellular networks using infrastructure that they own. Deployments occur in a range of sectors, including automotive, logistics, utilities, mining, transport and manufacturing. The US takes the lead, thanks to the opening of spectrum in the Citizens Broadband Radio Service at 3.5 GHz, which offers new access to mobile airwaves to a wide group of participants.
- 42. Low prices on narrowband networks make it hard for operators trying to charge a premium for 5G for the Internet of things.** With growing competition between providers of narrowband connectivity for connected "things", tariffs on narrowband wide area networks are dropping sharply. A current example is 1nce's offer of €10 for 10 years' service with 500MB of data on T-Mobile's NB-IoT network. In a similar trend to the one that emerges in the market for connected consumer devices, this sets expectations among customers and makes it very difficult for operators to charge any premium for higher-speed 4G services, and 5G services when they launch. Operators taking part in this market need to run extremely low-cost operations like discount airlines.
- 43. Samsung emerges as a significant player in the network infrastructure market by 2020.** Buoyed by contracts for 5G equipment in the US, Australia and South Korea, the company again becomes a major force in network infrastructure. It brings renewed competition to a market dominated by Huawei, Nokia and Ericsson in a move welcomed by operators burdened with the costs of deploying 5G networks.

- 44. Senior executives from major web players run for political office over the next five years.** They enter elections in a range of countries in efforts by their former employers to get closer to the establishment. As the political climate swings away from agenda-setting Internet companies, they realize that even large lobbying budgets are not enough to help. Under the guise of helping governments prepare for the age of artificial intelligence, candidates with previous executive roles at web players stand for public office, helping to restore the bridge between the two groups.
- 45. In 2019, enterprises beyond the technology sector set up machine learning labs.** Large companies begin to realize that having their own research facilities in artificial intelligence is a strong mechanism to enable collaboration with developers and universities, and a way to access and retain talent. JP Morgan, Pearson and BP, which have all hired heads of artificial intelligence recently, are good candidates. Despite well-publicized goals by major service providers to democratize artificial intelligence, most usage of the technology is confined to big firms, and by 2020, 90 percent of large enterprises are running custom machine learning applications, compared with just five percent of small and medium businesses.
- 46. To 2021, small and medium businesses get more benefit from preparing for artificial intelligence than from its implementation.** The process of cleaning, organizing, structuring and centralizing data in preparation for the advent of artificial intelligence produces huge gains over the next three years. Although artificial intelligence is poised to deliver considerable improvements to business processes, the technology initially suffers from an abundance of hype that is disproportionate to the ability of small and medium businesses to realize the benefits of artificial intelligence in the short term.
- 47. Silicon Valley's dominance of technology wanes over the next five years.** Silicon Valley has been the heart of the technology industry for decades. However, we believe that 2018 will be regarded as the peak year in its history. Although it remains a major hub of significant influence for many years, technology companies in the US and globally become more dispersed. The change is prompted by several factors including cost, the strength of Chinese know-how and artificial intelligence, the need for broader diversity in business thought and workforces, tax incentives to locate elsewhere and the growing trend of decentralization.
- 48. The battle between consumer speech assistants spreads to the enterprise market in 2019.** With Amazon's Alexa for Business already launched and Microsoft experiencing a growing number of queries into Office 365 from Alexa users, 2019 brings formal competition in speech assistants for the enterprise and workplace markets. Rising usage in homes, home offices and in corporate meeting rooms encourages greater focus on business scenarios by developers for Microsoft's Cortana, Amazon's Alexa and Google's Assistant.
- 49. In 2019 and 2020, cloud service providers and mobile operators collaborate to put commercial clouds at the network edge.** One of the big advantages of 5G is latency as low as 1.5 milliseconds. This presents an opportunity for mobile operators to market the efficiency and performance that characterizes computing at the network edge. They work with the leading providers to give commercial cloud services access to their networks and offer users high-performance edge computing for premium workloads. The alternative and far less desirable scenario is that operators seek to compete against Amazon, Google, Microsoft and others.
- 50. All major cloud service providers deploy blockchain commercially by the end of 2019.** Blockchain is not a new technology for the cloud providers: IBM already offers a service based on Hyperledger Fabric, and others are evaluating or testing blockchain technologies for internal or commercial operation. But activities step up a gear in 2019 as blockchain features in mainstream commercial launches by Alibaba, Amazon Web Services, Google Cloud, Microsoft and others.

- 51. Furniture retailers become digital home stores. The majority of furniture is still bought from a retail store and not online.** Adoption of smart home devices is being hampered by low levels of awareness and understanding among the public. Furniture retailers have the space to stock and display smart devices in a connected home environment, and shift into this area by the end of 2019. Some offer a “digital plumber” to install devices and overcome the complexity inherent in an immature and fragmented market.
- 52. Google’s Wear OS launches support for hybrid smartwatches from 2019.** In a bid to differentiate its smartwatch platform from rivals, Google’s Wear OS team introduces a reference design that blends physical hands found on analogue watches with a touch-screen user interface. The move inspires other smartwatch makers to experiment with this design, particularly if Wear OS can tackle the many weaknesses in the user interface and software found on existing hybrid smartwatches such as MyKronoz ZeTime.
- 53. In 2019, Amazon launches its own pet tracker.** Similar to many of Amazon’s other own-brand connected devices, this wearable for dogs is sold at little more than cost. Amazon hopes its tracker will provide insights into pet owners and boost sales of associated items such as food, pet care products and accessories.
- 54. In 2019, Samsung launches custom artificial intelligence accelerator silicon.** In the wake of similar moves by Apple, HiSilicon and MediaTek, Samsung launches its own custom chip for artificial intelligence. This follows our prediction in 2017 that Samsung will introduce its own custom graphics chip as an alternative to Arm’s Mali design. Both processors could appear in the next-generation flagship Galaxy smartphone and see Samsung heavily promoting its artificial intelligence capabilities. The move heightens pressure on Qualcomm to introduce a custom accelerator for artificial intelligence despite its heterogeneous approach to the technology.
- 55. A European operator adopts home selling for its smart home portfolios by 2019.** In an effort to stimulate demand and overcome consumer inertia, providers of smart home products investigate new routes to market. Acknowledging the need to demonstrate the technology in place, they deploy sales teams that sell to potential customers in a domestic setting. The installation of systems and devices is often included as part of the sale, overcoming some of the daunting complexity of smart home systems.
- 56. Amazon launches a mass-market Alexa development kit by 2020.** The success of the Raspberry Pi and the importance of developer commitment to the Alexa platform prompt Amazon to launch a hardware and software development kit. It is an extension of existing developer initiatives that offers kits that are tested, optimized and certified. It is packaged and sold at cost and used as a stepping stone for its broader developer kits and developer ecosystem.
- 57. Microsoft introduces a version of Microsoft 365 for the Internet of things by the end of 2020.** Encouraged by the success of Microsoft 365 in the enterprise market, Microsoft introduces a version of the bundle for Internet of things projects, bringing all its edge computing, on-premises, cloud, analytics and security assets together under a single pricing scheme. The initiative aims to create a barrier for competitors such as Amazon Web Services and Google.





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