2019 & BEYOND
PREDICTIONS

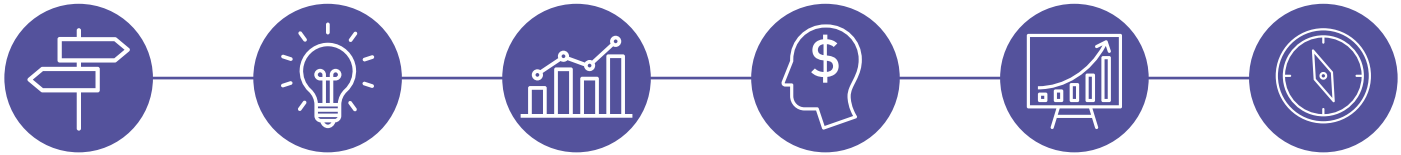
WELCOME

This year sees CCS Insight achieve the milestone of 100 individual predictions for the connected world. The number of predictions reflects the expanding coverage and depth of our research, from new topics like workplace collaboration and edge computing to important areas such as mobile networks, devices and the Internet of things. This guide to our predictions is divided into eight sections, with an index of major themes at the back. I trust you enjoy reading the predictions as much as we did compiling them.

Shaun Collins CEO, CCS INSIGHT

CCS INSIGHT HELPS ITS CUSTOMERS OVERCOME THEIR CHALLENGES AND MAKE SENSE OF THE CONNECTED WORLD

The connected world is now moving at an incredible pace. The market is changing rapidly and players must continually adapt to a range of new dynamics. Conditions are also more complex than ever before, with billions of connected devices in use globally and an immense wave of new ones appearing each year. Never before has it been so critical to maintain outstanding business intelligence to thrive in the digital market.



Challenge

Predict market trends and identify alternative futures

Challenge

Recognise the potential of emerging technologies

Challenge

Capture and analyse the competitive landscape

Challenge

Understand buyer behaviours and attitudes

Challenge

Develop and execute market positioning strategies

Challenge

Navigate the pitfalls of bringing technologies to market

WE SERVE OUR CLIENTS WITH...

CCS Insight has assembled a team of the world's leading analysts to offer unrivalled expertise in our many research areas.

We offer a range of services that blend timely high-value information with analysis, opinion and insight. This is delivered with consistent quality and attention to detail.

CCS Insight focusses on building close partnerships with clients, embedding analysts within customer workflows to ensure that we are delivering our value with the maximum impact.

We act as a trusted source for our clients to identify market opportunities.

CCS INSIGHT'S RESEARCH AND ADVISORY CAPABILITIES SPAN THE FOLLOWING AREAS

Agenda Setters

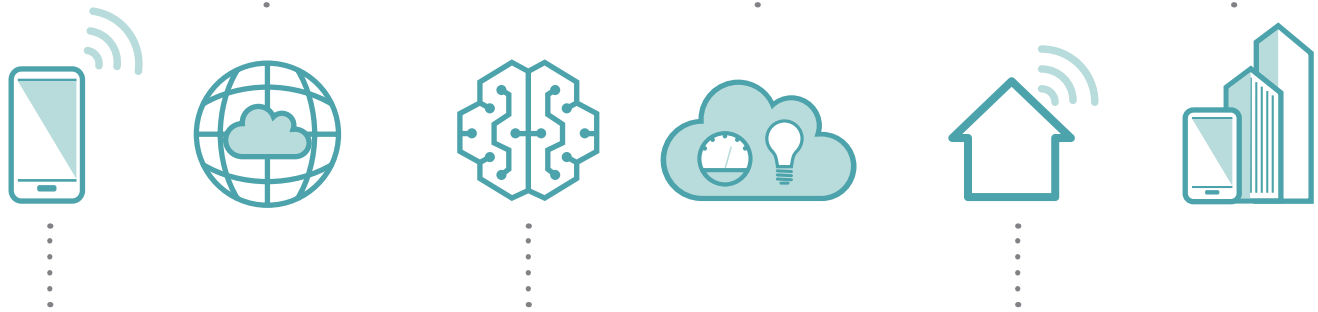
Activities in the online services market, with reports of recent developments, financial results, news events and user surveys

Business IoT

Research on the Internet of things, focussed on business issues and technology moves underpinning them

Digital Workplace

Enterprise mobility, productivity and collaboration, cloud services, security, AI and managed services



5G Networks

Key developments in 5G technology, and analysis of its adoption and network deployment

Artificial Intelligence

Coverage of industry moves and technology developments, tracking AI platforms and enterprise applications of AI

Connected Home

Research exploring the smart home devices space, including voice assistants and major player portfolios

Multiplay

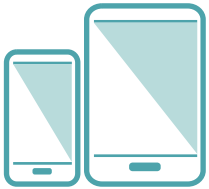
Coverage of the multiplay landscape, with analysis of breaking news and insights into industry developments

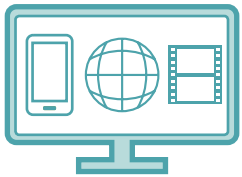
Operators

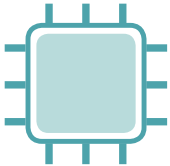
Regional reports supported by forecasts, industry themes, rapid analysis of financial results and announcements

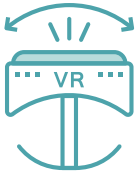
Wearables

Market forecasts, user surveys, monthly wearables market analysis, and access to our wearables database









Mobile Phones

Forecasts and quarterly analysis of trends, results and news, plus pricing reports and databases

Semiconductors

Analysis about market changes, moves and financial reporting, looking at both supply and demand

VR and AR

Forecasts of shipments and revenue, market updates and analysis of uses of virtual and augmented reality

1. FUTURE LIVES

1 THE CHASM BETWEEN CHINA AND THE WEST IN THE USE OF TECHNOLOGY IN EVERYDAY LIFE WIDENS.

The use of services from Tencent and Alibaba in China is much more deeply embedded into daily life than we see in the West and is becoming ever more embedded. Online services of the major Chinese web players account for a high share of payments, bookings and online-to-offline sales. They are also starting to be used instead of identity cards, and the country is building a citizen-scoring system that influences credit checks, job applications and other important decisions. This means that the competition that is playing out in South-East Asia and parts of Africa is as much about Internet service paradigms as about the providers themselves.

2 IN 2025, AVERAGE SMARTPHONE USAGE IN THE US RISES TO FOUR HOURS A DAY.

Steady increases in content consumption and app usage boost the time people spend on their smartphones from almost three hours per day in 2017. The increase accelerates with advances such as faster connections, specifically the arrival of 5G networks, and improvements in artificial intelligence technology, allowing better targeting of news, video and ads. As a counter to rising usage, more people engage in "digital detox" regimes, using applications to limit the time spent looking at a screen, or avoiding smartphones altogether for a set period.

3 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.

4 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.

5 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.

6 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.

7 FACEBOOK PROVIDES CITIZEN SERVICES ON BEHALF OF GOVERNMENTS BY THE END OF 2022. →

In a major push to embed itself deeper into citizens' daily lives and the machinery of the state, Facebook tries to incorporate data such as identity card numbers, social security numbers and healthcare identities, and to run some of the outward-facing services that use them. These include interfaces to credit checks and healthcare appointment schedules and reminders. The initiative mimics the position that Tencent is building in China using its WeChat service. Government and consumer resistance limits Facebook's reach to a few countries.

8 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.

9 BY 2020, A SECOND NATION ADOPTS A SOCIAL CREDIT SYSTEM SIMILAR TO CHINA'S.

Initiated in 2015, China's social reputation system gathers data on its citizens' activities and uses it to influence and control how they interact with a variety of online and physical services. For example, prompt payers can receive more matches on dating sites; buyers of counterfeit goods can be banned from high-speed trains. Implementation outside China initially focusses on the positive aspects, like perks for well-behaved citizens. However, governments are tempted by the prospect of punishing those with low scores to encourage conformity.

10 ADAPTABILITY AND FLEXIBILITY BECOME PRIMARY SKILLS SOUGHT BY EMPLOYERS BY 2020.

As organizations increasingly invest in digital transformation initiatives, employees' ability to adapt to changing expectations and processes — particularly in terms of increased IT automation — becomes critical. Recruiters increasingly emphasize these skills in order to accelerate the workforce's readiness for this approach. They prioritize candidates who can perform in many different roles, continuously learning new skills in response to changing needs, rather than simply being an expert in one area. Technology companies lead this shift, but every industry experiences the impact.

11 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.

12 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.

13 BY 2021, EMPLOYEE SATISFACTION BECOMES AS IMPORTANT TO LARGE ENTERPRISES AS CUSTOMER NET PROMOTER SCORE.

The sentiment of employees becomes as important to the success and profitability of large organizations as net promoter score is for its executives. Anonymous tracking of employees' attitudes in geographically diverse and mobile workforces becomes central to retention and company performance. Measuring sentiment becomes a huge industry spearheaded by Microsoft and Facebook.

14 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.

15 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.

16 MORE CELLULAR PET TRACKERS ARE ACTIVATED ON MOBILE NETWORKS WORLDWIDE IN 2020 THAN 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.

17 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.

2. SECURITY & TRUST

18 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.

19 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.

20 AT LEAST ONE MAJOR WEB PLATFORM MANDATES TWO-FACTOR AUTHENTICATION BY 2020.

The move responds to the need to improve the basic security of sites and services as hacks become more sophisticated and pervasive. Two-factor authentication improves the inadequate protections adopted by a large proportion of users. Initially the second factor is a text message, but we expect certain services or providers to mandate security based on tools like Google's Authenticator.

21 FACEBOOK DEPLOYS BLOCKCHAIN TECHNOLOGY TO TRACK SOCIAL NETWORKING DATA BY END OF 2020.

In the wake of the Cambridge Analytica scandal Facebook has learnt a hard lesson that it must have a clear and irrefutable audit trail of companies that have historical or current access to consumer data. Facebook-specific payment infrastructure is undoubtedly another facet. A major feature of blockchains is that data cannot be deleted; Facebook uses the technology to track permissions and credentials, rather than data itself.

22 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.

23 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.

24 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.

25 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.

26 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.

27 THE PRIVACY BACKLASH FAILS TO MATERIALIZE IN THE NEXT 20 YEARS.

Despite dire warnings of an imminent "data apocalypse", the public's tolerance of privacy breaches has shifted for a generation. Scott McNealy's proclamation in 1999 that "You have zero privacy anyway. Get over it." is fully realized as any disquiet about mounting security breaches is overcome by the sheer utility and ubiquity of online services.

28 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.

29 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.

30 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.

3. TECHNOLOGY DEVELOPMENTS

31 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.

32 PHONES WITH FOLDING SCREENS ARRIVE IN 2019 BUT THEY REMAIN A NICHE CATEGORY UNTIL 2022.

After years of hype, a smartphone with a folding screen finally becomes available to buy. Although a magnet for gadget lovers, the phone's inevitable high cost and its trade-offs in usability result in limited shipments. Problems include poor readability in sunlight, a bulky design to protect the screen's fold and the need for an external screen. Despite some early missteps, folding-screen technology continues to develop, partly thanks to users' never-ending quest for larger and larger displays, and more attractive devices emerge within a decade.

33 "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.

34 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.

35 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.

36 BY 2020, GOOGLE USES ITS DUPLEX TECHNOLOGY TO IMPROVE ITS SEARCH ENGINE RESULTS.

Rather than making Duplex available for the public to use, which could result in a backlash from the number of nuisance calls it generates, Google employs it to gather information from businesses and so enhance its own data. In a similar manner to Google deriving street-level data with its Street View cars, Duplex calls businesses such as restaurants, retailers and insurance companies to collect updated information on opening hours, appointment availability and prices.

37 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.

38 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.

39 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.

40 SPOTIFY TRIES TO DIFFERENTIATE ITSELF WITH MUSIC COMPOSED BY ARTIFICIAL INTELLIGENCE BY 2021.

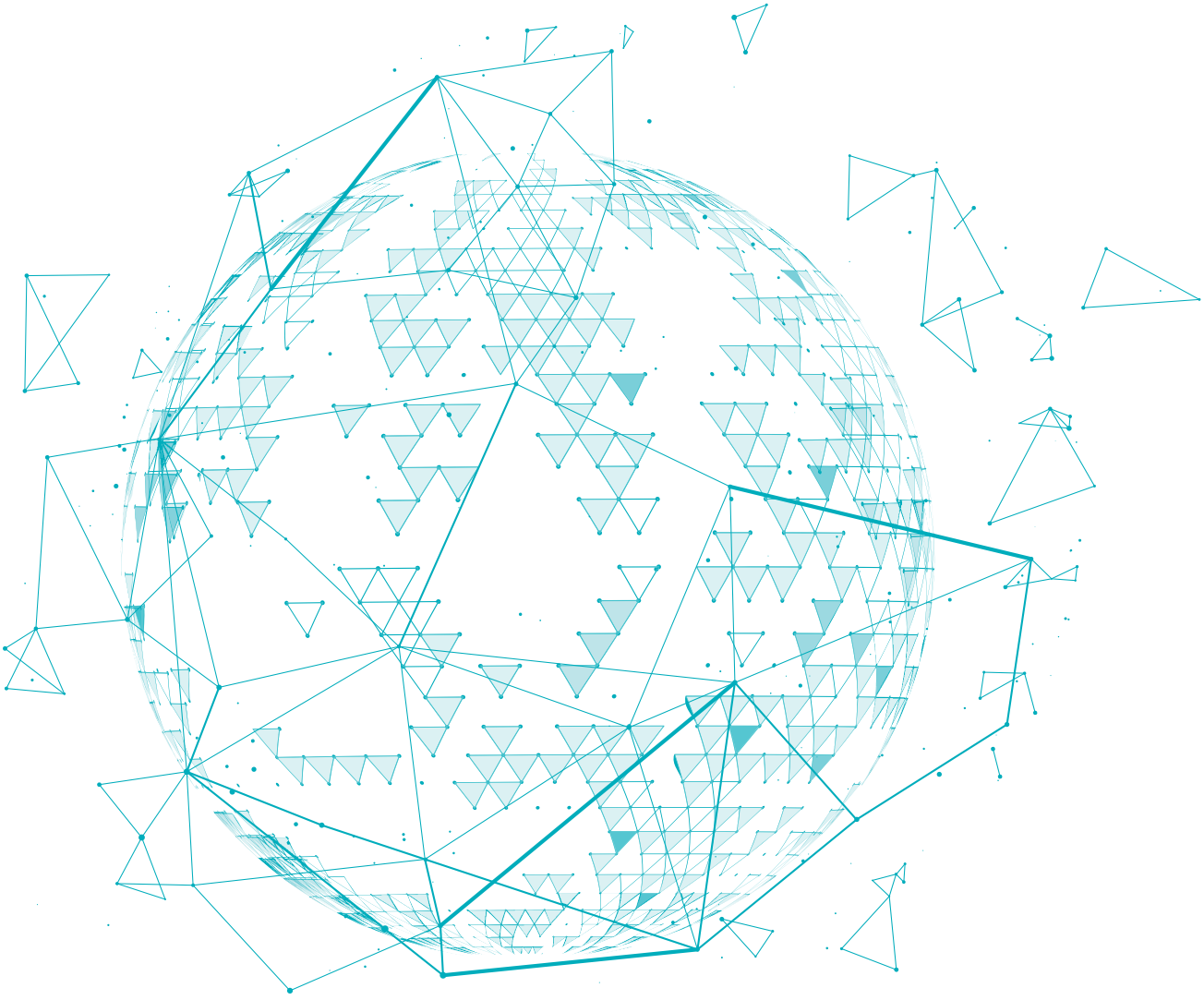
Apple Music has been narrowing the gap to Spotify, building a larger catalogue and amassing 40 million subscribers since its launch in 2015. In a bid to counter this attack, Spotify starts to rely on material composed using artificial intelligence as a differentiator. In 2017, it hired a leading scientist in artificial intelligence-assisted music creation. The move builds on recent momentum for start-ups Jukedeck and Amper Music, and dramatically boosts Spotify's library with royalty-free music.

41 AV1 BEATS HEVC TO BECOME THE LEADING CODEC FOR STREAMING VIDEO BY 2022.

Backed by the Alliance for Open Media, which includes many of the online giants, the AV1 codec meets the need to deliver high-quality video over networks more efficiently. It faces initial competition from the HEVC standard, also known as H.265. But AV1's greater efficiency, as well as its royalty-free status, means it attracts more supporters, including consumer electronics providers and content owners, relegating HEVC to an also-ran.

42 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.



4. SUPPLIER SHIFTS

43 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.

44 A BLOCKCHAIN-POWERED ALTERNATIVE TO FACEBOOK EMERGES BY 2022.

The decentralized nature of blockchain means a wave of initiatives are launched to provide an alternative to the advertising-based business models of services such as Facebook. Among the front runners are initiatives led by a consortium or a non-profit organization such as the Mozilla Foundation. They seek to offer users control and even the ability to profit from their own data. Rivalling the scale and network effect of established providers is an impossible task, but the alternative proves disruptive if only by forcing advertising-based rivals to consider paid-for variants of their services.

45 SLACK BUYS ASANA IN 2019.

As Slack gets into shape for an initial public offering of stock, it looks for opportunities to expand its product capabilities and counter the threat posed by Microsoft Teams. By incorporating Asana's task and project management capabilities into its collaboration hub, Slack increases its role in enabling team collaboration, supporting not just communications, but the process of coordinating work. The companies' many shared customers help to delineate the value of the acquisition, reasserting Slack's position as the best-of-breed leader in this space.

46 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.

47 AMAZON BUYS A MAJOR RETAILER IN EUROPE BY 2019.

Following its acquisition of US-based Whole Foods Market, Amazon seeks to replicate the strategy in another region. It may extend its Prime Now arrangement with Morrisons in the UK by acquiring the entire supermarket chain. Or it could go for a name with outlets in multiple countries, such as Lidl. Either way it is a multibillion-dollar move.

48 BY 2020, A EUROPEAN OPERATOR BUYS A COMPANY THAT REPAIRS PHONES AND SELLS SECOND-HAND DEVICES.

The move gives the operator a multibrand approach, and exposure to the increasingly significant market for second-hand smartphones. It enables the operator to develop more-sophisticated tariffs that include insurance, repairs, guaranteed residual values and upgrades. This helps it attract and retain customers in the face of a largely lacklustre device market.

49 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.

50 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.

5. CONNECTIVITY ADVANCES

51 BY 2023, UNLIMITED DATA IS THE DEFAULT OPTION IN MANY MOBILE TARIFFS IN ADVANCED MARKETS.

As the value of mobile data continues to be eroded, competitive forces pressure operators to offer all-you-can-eat data bundles in the same way that voice minutes and texts are sold today. Many tariff plans evolve to include unlimited data, albeit with some level of throttling or a fair usage policy.

52 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.

53 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.

54 QUALCOMM DOMINATES THE FIRST WAVE OF 5G SMARTPHONE DESIGNS IN 2019

Despite competition from Intel, MediaTek, HiSilicon and Samsung, Qualcomm builds on its leadership in 4G to dominate the first wave of 5G device designs. Competition inevitably ramps up into 2020, but the additional complexity of 5G, particularly with carrier aggregation, puts Qualcomm in a commanding position. Its strength is enhanced by its investment in radio frequency front-end silicon through its joint venture with TDK.

55 PROVIDERS OF "ROAMING E-SIMS" TAKE FIVE PERCENT OF THE ROAMING MARKET IN EUROPE BY 2021.

More-widespread support for e-SIMs in hardware, combined with dual-SIM dual-standby functionality, encourages a market for third-party providers of connectivity for travellers. Tourists and business travellers simply download an app that offers them an e-SIM with a local number on a local network. Charges are made to their home operator, which takes a share of the revenue. Revenue-sharing encourages operators to sign up to support such schemes.

56 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.

57 BY THE END OF 2020, 5G FIXED WIRELESS SOLUTIONS REMAIN NICHE DESPITE DEPLOYMENTS BY MORE THAN 50 NETWORK OPERATORS WORLDWIDE.

A slew of providers offers fixed wireless access as an alternative to fibre in high-density areas. They follow early launches of 5G networks in the US that take the same approach to providing broadband access in a fixed location. However, such services remain niche, representing only a tiny fraction of total 5G connections in the long term.

58 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.

59 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.

60 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.

61 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.

62 MOST OPERATORS ELECT NOT TO CHARGE A PREMIUM FOR CONSUMER 5G SERVICES.

Having largely failed to implement price premiums successfully for previous generations of network technology, operators change tack for 5G. Anticipating that customers would again resist attempts to impose a like-for-like service premium, they instead pursue a "more for more" strategy. They offer vastly enlarged data bundles for small increases in monthly fees.

63 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.

64 BY 2021, APPLE RELEASES AN IPHONE WITH NO SIM CARD SLOT.

An iPhone model released in September 2018 adds support for e-SIM connectivity but retains a slot for traditional SIMs. Apple repeats this pattern for at least two more generations but then removes the card slot completely.

6. COMMERCIAL TRENDS

65 BY 2019, REFURBISHED MOBILE PHONES MAKE UP EIGHT PERCENT OF SALES IN WESTERN EUROPE.

The trend is driven by multiple factors, including a lack of notable innovation in the smartphone market, direct-to-consumer distribution by device manufacturers and new opportunities in device leasing and trade-in programmes.

66 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.

67 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.

68 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.

69 AT LEAST 200 MILLION SMARTPHONES WITH A NEW CHINESE OPERATING SYSTEM ARE SOLD IN 2020.

The current political tension between China and the US and ensuing troubles for ZTE and Huawei present a strong incentive for other Chinese companies to create their own operating system for smart devices. Spurred by a desire to quickly reduce their dependence on US companies, Chinese technology players use the replacement of 4G smartphones with 5G-ready devices to advance the transition to a home-grown platform.

70 THERE ARE NO SIGNIFICANT NEW SOCIAL NETWORKS IN ESTABLISHED MARKETS OVER THE NEXT FIVE YEARS.

High barriers to entry prevent the rise of competitors to the likes of Facebook, Twitter and Snapchat. Potential new entrants do not enjoy the favourable conditions that aided the growth of the established giants. In addition, the burden of complying with increased regulation of social networks makes it impossible for aspirants to gain a foothold. Any that do rise are rapidly absorbed by established names. The giants still see ebbs and surges in user numbers as audiences move between their current properties or shift to newly created sub-brands.

71 TRADE WARS THREATEN A FIVE PERCENT DECLINE IN GLOBAL MOBILE PHONES SALES IN 2019.

As the dispute over tariffs intensifies between the world's major economies, the prices of smartphones increase. Manufacturers respond by moving production facilities and changing component suppliers. However, some unprofitable segments of the market remain unserved, and macroeconomic weakening of the affected countries delivers a further blow to the mobile phone market, which suffers a drop of 100 million units in 2019, from which it gradually recovers.

72 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.

73 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.

74 BY 2021, THE SECOND-HAND VALUE OF A SMARTPHONE IS MORE IMPORTANT IN CONSUMERS' PURCHASE DECISION THAN ITS NEW PRICE.

For some buyers, the market becomes defined by the purchase "journey" rather than the devices. As flagship prices rise toward $1,500 and replacement cycles continue to lengthen, the value of second-hand smartphones becomes a significant differentiator in sales of high-end models. Echoing the car market, the initial price of a new device becomes less relevant.

75 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.

76 BY 2020, THE ENTERPRISE GRAPH BECOMES THE PRIMARY BATTLEGROUND FOR DIGITAL WORKPLACE TECHNOLOGIES.

An enterprise graph is an intelligent data model that identifies and understands relationships between people and applications within an organization, based on their activities. It enables application experiences to be individually personalized to increase productivity. In addition, artificial intelligence helps deliver recommendations and insights to users. In the conflict between best-of-breed and suites of applications, a single graph that captures all available data becomes increasingly valuable in demonstrating the value of sticking with one supplier. Microsoft is leading the march, but competitors such as Facebook and Google accelerate their investments to challenge for ownership of the digital workplace.

77 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.

7.
NEW BUSINESS MODELS

78 FACEBOOK MAKES A SERIOUS PUSH IN E-COMMERCE BY 2020.

While Amazon, eBay and Alibaba dominate e-commerce markets, online is still a small channel for retail sales globally, even in the most advanced markets of the West. There is room for another strong platform. Facebook is well positioned by already facilitating peer-to-peer sales through its Groups and Marketplace, by having a large number of small companies active on its platform and by having direct brand interaction through Messenger and Instagram. E-commerce activities deliver transactional revenue for Facebook, which urgently needs to reduce its dependency on advertising revenue. This is likely to have a bigger impact on eBay as a competitor than on Amazon in the near term.

79 NETFLIX OPENS ITS OWN BRANDED CINEMA BY 2022.

The move is made in partnership with an existing cinema chain or through acquisition. It allows Netflix to diversify and promote its catalogue of original material to new audiences, and increase loyalty among subscribers by offering special screenings. Owning a cinema in Los Angeles would help Netflix's aspirations to win an Oscar for one of its feature films: nominated films must show at a commercial cinema in the city for a week. We expect some rivals to follow suit, especially Amazon, given its investments in video content and bricks-and-mortar retailing.

80 AMAZON WEB SERVICES BECOMES A KEY PLAYER IN BUSINESS CLOUD APPLICATIONS BY 2021.

Driven by the high margins in software-as-a-service applications that Microsoft enjoys on its Azure computing platform, Amazon Web Services invests extensively in its portfolio of business and productivity applications. It builds on the foundations laid by its Alexa for Business voice assistant, Chime meetings, document storage, e-mail and desktop virtualization services to better rival Microsoft's Office 365 and Google's G Suite. The company becomes a significant provider of cloud-based business apps that complement its infrastructure services.

81 SOUNDCLOUD IS THE FIRST MAJOR MUSIC STREAMING SERVICE TO MOVE TO A BLOCKCHAIN PLATFORM.

SoundCloud's popularity for empowering its community of aspiring artists is a natural fit for a blockchain-based music service. By 2022, it follows in the footsteps of existing platforms built on the technology, such as Musicoin, Resonate and Voise. Musicians are drawn by the decentralized nature of blockchain, which allows them to cut out the middleman and simplifies tracking of rights. By giving artists more control, SoundCloud proves a more attractive solution and puts pressure on rivals.

82 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.

83 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.

84 BY 2020, A DEVICE MAKER OFFERS PHONES PACKAGED WITH ITS OWN AIRTIME IN A WESTERN MARKET.

The approach could prove attractive to an aspiring handset maker like Xiaomi seeking to establish its brand in new territories. Devices are sold entirely online and have a pre-installed SIM card, with connectivity provided through a virtual network agreement. The manufacturer brings the products to market quickly with limited distribution costs; customers benefit from convenience and affordability.

85 IN 2019 APPLE COMMISSIONS ITS FIRST FULL-LENGTH MOVIES AND INVESTS IN MORE INTERNATIONAL CONTENT.

To date Apple has released two TV series, increased its budget for original content in 2018 to $1 billion and has commissioned a further 16 TV shows. Although this level of investment is slightly ahead of Netflix's first year as a provider of original content, it is a long way behind the levels of investment currently being made by Netflix and Amazon. To accelerate this strategy, Apple may make a major acquisition, such as a Hollywood studio.

86 AMAZON LAUNCHES A PRIME SPORTS BUNDLE BY 2022. →

The company is forced to offer a bundle of sports programming for Prime customers to support its growing portfolio of broadcast rights. It expands its activities to become a fully fledged provider of sports programming, competing against local broadcasters in some countries. Access to its sporting output is offered as an optional add-on bundle to Amazon Prime Video. It may also introduce advertising to support its push into linear TV; another option could be event-based advertising.

8. CHANGING STRATEGIES

87 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.

88 INDEPENDENT MOBILE RETAILERS MOVE MOSTLY ONLINE IN THE UK BY 2022.

As sales of smartphones decline and broader challenges in bricks-and-mortar retailing hit third-party resellers, they are forced to change their business model. Companies like Carphone Warehouse seek to reinvent themselves away from the high street, aiming to become best-of-breed providers of telecommunications services almost entirely on the web.

89 TEAMS REPLACES OUTLOOK AS MICROSOFT'S PRIMARY BUSINESS COMMUNICATIONS CLIENT BY 2021.

Having already absorbed Skype for Business into Teams, Microsoft gradually expands the product's collaboration functions, ultimately adding support for Exchange e-mail and calendars. This helps maximize the "stickiness" of Teams and reduces users' reliance on Outlook and e-mail. It also boosts usage of Office 365 and expands the information that can be captured within the Microsoft Graph.

90 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.

91 IN 2020, THE NEED FOR A 5G VARIANT OF THE IPHONE DISRUPTS APPLE'S RELEASE SCHEDULE.

In recent years Apple has unveiled new iPhones once every 12 months in September. Its annual cadence is disrupted by the staggered timing of commercial launches of 5G networks in China and North America. Escalating pressure to preserve its market share in the vital Chinese market pushes Apple to shift the release of a 5G model away from its traditional September date. But the launch is still over a year after products from the likes of Samsung, Huawei and Google.

92 FROM 2019, BT LOWERS THE PROFILE OF BT SPORT IN ITS PORTFOLIO.

The moves comes after the departure of Gavin Patterson as CEO and the loss of broadcast rights for NBA basketball, UFC ultimate fighting and Italian football. In 2021, BT Sport loses further rights to Premier League football after unsuccessful bids against the likes of Amazon at auction. Faced with the prospect of a slow death for the channel, BT considers options for divesting BT Sport.

93 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.

94 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.

95 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.

96 FACEBOOK AIMS TO BE THE BEST CHANNEL FOR BROADCASTERS TO DISTRIBUTE 4K, 8K AND 360-DEGREE CONTENT AND REACH INTERNATIONAL AUDIENCES.

With the rise of online video-streaming services, many national broadcasters struggle to build a competitive app and market their content to audiences around the world. Facebook uses its reach and infrastructure to offer these broadcasters the opportunity to deliver higher-quality video than their broadcasting spectrum allows, and to extend their services to international audiences without having to deal with a competitor such as Netflix, YouTube or Amazon.

97 BY 2020, A MAJOR RETAILER CLOSES ALL ITS BRICKS-AND-MORTAR STORES AND SHIFTS ONLINE.

Unlike the many companies forced to close outlets and move online in a bid to survive, this retailer has a relatively thriving business. It takes a strategic decision to focus solely on its strong online presence. A UK fashion retailer like Ted Baker is a possible candidate.

98 AMAZON LAUNCHES A MASS-MARKET ALEXA DEVELOPMENT KIT BY 2020.

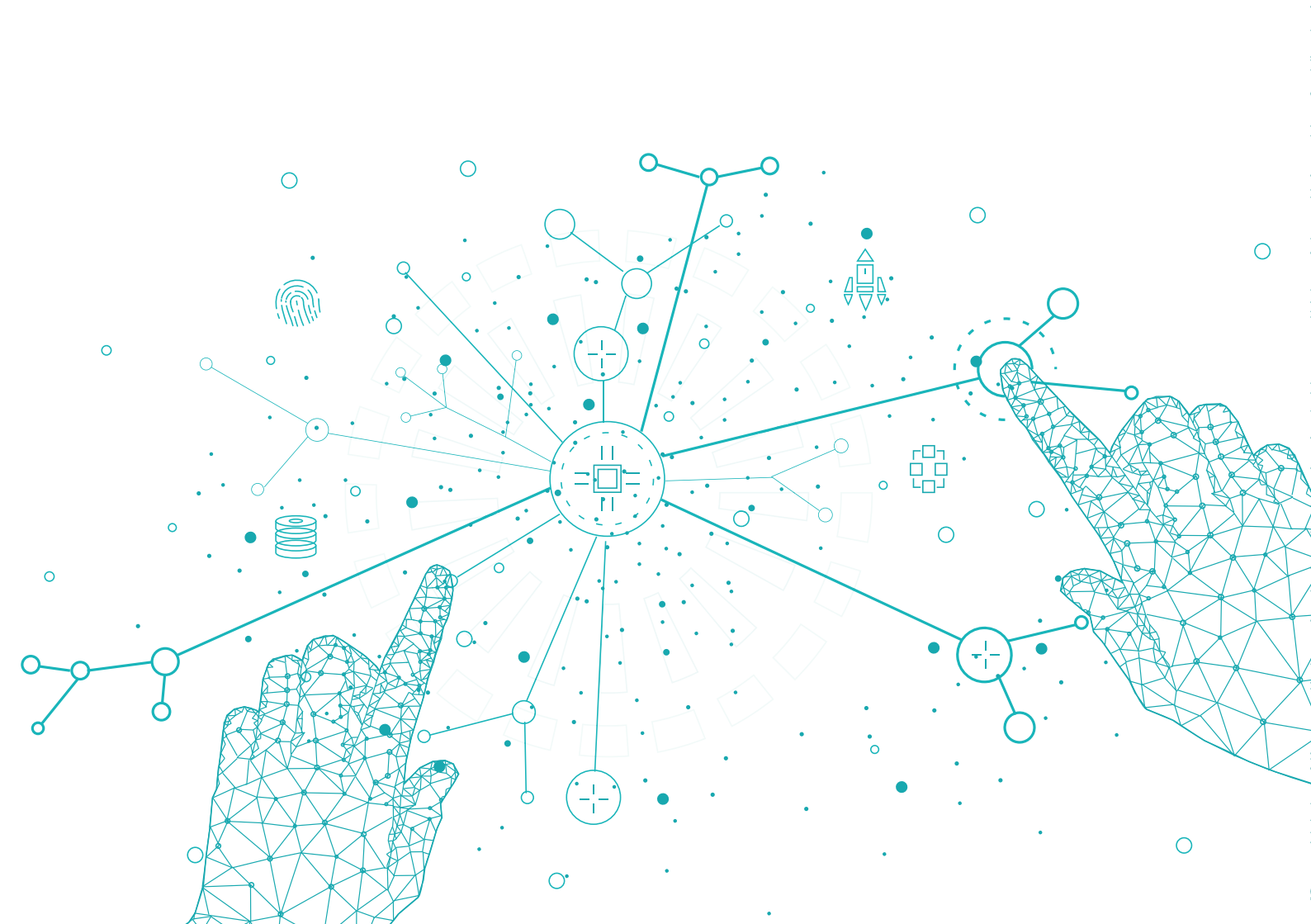
The success of the Raspberry Pi and the importance of developer commitment to the Alexa platform prompt Amazon to launch a hardware and software development kit. It is an extension of existing developer initiatives that offers kits that are tested, optimized and certified. It is packaged and sold at cost and used as a stepping stone for its broader developer kits and developer ecosystem.

99 SALESFORCE ENTERS THE TEAM COLLABORATION SPACE IN 2019.

The company builds on its acquisition in 2016 of Quip, a provider of collaborative productivity tools, and introduces a competitor to Slack and Microsoft Teams. It does so either through further acquisition or through in-house development. The product reinforces its employee engagement offerings and helps the company compete more effectively in the digital workplace arena by complementing its digital transformation strategy.

100 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.



OUR SERVICES

5G Networks

An essential service for network operators, handset manufacturers, chip-makers and service providers for 5G networks, this research suite tracks developments in technology, network announcements and deployments, and the adoption of 5G mobile services. Quarterly market updates are complemented by a global forecast of 5G subscriptions, access to a range of supporting reports and our analyst enquiry service.

Agenda Setters

Our Agenda Setters service examines tech giants like Amazon, Alibaba, Google and Microsoft. It comprises quarterly summaries of major players' activities and investments in the online services market, in-depth reports of recent developments, and insights into industry events and financial results. Reports are complemented by presentations and access to our analyst enquiry service.

Artificial Intelligence

Our coverage of artificial intelligence extends to all our research areas, from the technology's use in the digital workplace, in connected homes and in business IoT applications, to how network operators are using artificial intelligence to improve processes and how phone-makers incorporate it in their devices, spurred on by silicon suppliers keen to gain an edge over rivals.

Business IoT

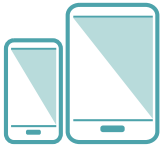
This service provides research on the Internet of things, focussing on its application in business and industrial settings. Monthly reports examine diverse topics such as machine learning, regulation, connectivity, distributed architectures and edge computing. The service offers updates on major trends, analysis of products and industry initiatives, and forecasts of market shipments and revenue.

Connected Home

A service offering exclusive analysis of major connected home devices and providers, user surveys, insights into industry events and shows, coverage of significant industry developments, analysis of tipping points for market growth and thought-leading reports about the future of this young market. Like our other research suites, it includes access to our analyst enquiry service.

Digital Workplace

This research area covers all aspects of the digital workplace, including security, collaboration, device management, content and application strategies, outsourcing managed services and organizational transformation. The service's regular reports and presentations are supported by surveys of employees and IT decision-makers in enterprises in Europe and the US.



Mobile Operators

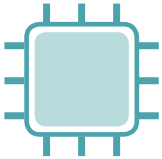
This service provides clients with quarterly regional reports that summarise and explain the mobile operator landscape. They are supported by forecasts, research and opinion about industry themes, rapid analysis of operators' financial results and announcements, and frequent meetings and presentations.

Mobile Phones

Our Mobile Phones service offers a broad package of reports including five-year forecasts and quarterly analysis of market trends, in-depth reports of recent developments and insights into financial results and news events. The service is complemented by presentations and optional access to our databases of prices and phone features.

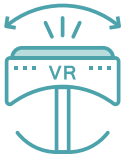
Multiplay Strategies

As competition for consumers intensifies, more and more communications and entertainment providers are looking to round out their portfolios and offer a full range of services, from telephony and mobile connectivity to broadband, TV and video-on-demand programming. This service helps established providers and new entrants navigate this unfamiliar landscape.



Semiconductors

This suite of research services offers analysis of the semiconductor market, focussed on key industry developments, moves by chipset suppliers and company financial reporting. Looking at both supply of and demand for silicon products, it helps semiconductor producers and users to understand the dynamics of a complex and highly technical area.



Virtual and Augmented Reality

A new service that examines the burgeoning markets for virtual reality and augmented reality products. From inexpensive Google Cardboard devices to high-end augmented reality headsets like Microsoft's HoloLens, these technologies are poised to disrupt several industries. This service offers market forecasts of headset shipments and revenue, and analyses a variety of uses for virtual and augmented reality.

Wearables

This service from CCS Insight features scenario-based forecasts of the wearable device market, quarterly analysis, monthly trackers of trends and emerging developments, surveys of users and people thinking about buying a wearable device. It offers access to a comprehensive database of wearable device information, as well as presentations and meetings.

MEET
THE TEAM

Shaun Collins
CEO
@shauncollins

Shaun founded CCS Insight in 1993 after a high-profile career in the fledgling wireless and cellular industry, including European account director for Motorola.

Michael Walker
Chairman

Michael is an entrepreneur with considerable experience of leading acquisitions, company restructuring and start-ups in the telecom and electronics industries.

Ben Wood
Chief of Research
@benwood

An industry veteran with over 20 years' experience, Ben worked at Gartner, Mobile Streams, Lucent and Vodafone before joining CCS Insight in 2006.

Martin Garner
Senior Vice President
@martin_garner

Martin leads coverage of industrial IoT systems, and research into Internet companies. He previously established the Wireless Intelligence joint venture.

Geoff Blaber
Vice President Research, Americas
@geoffblaber

Based in California, Geoff is responsible for CCS Insight's expansion in North America. He also leads semiconductor and software research.

Marina Koytcheva
Vice President, Forecasting
@marinakoytcheva

Marina has an extensive background in market analysis and forecasting. Before joining CCS Insight in 2012, she was part of Nokia's global Strategic Intelligence team.

Nicholas McQuire
Vice President, Enterprise
@nickmcquire

Nick has over 18 years' experience in the enterprise mobility industry, most recently as managing director of the Global Enterprise Mobility Alliance.

Paul Campbell
Vice President, Sales

Paul brings 10 years of practical telecom experience gained in the military and in industry, as well as a decade of business leadership experience in big data and analytics, Internet marketing and consulting services.

Angela Ashenden

Principal Analyst, Enterprise Research

@aashenden

Angela has over 15 years' experience as an industry analyst for enterprise software, advising clients about technologies to support collaboration, innovation, knowledge-sharing and employee engagement.

Kester Mann

Principal Analyst, Operators

@kestermann

Leading CCS Insight's coverage of network operators and their strategies, Kester previously worked at Nokia and Informa Telecoms and Media.

George Jijiashvili

Senior Analyst, Wearables and VR

@george_ccs

George leads the company's research in the wearables space and has co-developed CCS Insight's wearables and virtual reality service.

Laura Simeonova

Analyst, Mobile Devices & Internet of Things

@laurasimeonova

Laura is responsible for pricing data and device research. She also supports our Internet of things service.

Steve Cox
Principal Account Executive

Steve has several years' experience of high-performance sales environments, preceded by 14 years in the military, where he gained telecom and drone commander skills.

Katie Taylor
Client Support Manager
@katietails

Katie manages CCS Insight's client interactions as well as supporting other areas of the business.

Robert Caunt
Director, Publishing

With 30 years' experience of the technology publishing business, Robert is responsible for CCS Insight's written output.

Romina Portela
Business Editor

Romina joined CCS Insight in April 2016. She is responsible for many of the company's publications, including the free Daily Insight newsletter.

Index

A guide to key themes and companies. Numbers refer to each prediction, not page number.

CONTACT US

Paul Campbell
paul.campbell@ccsinsight.com
+44 7766 447744

Designed by
Dynamic Print Media
www.dynamicprintmedia.com

info@ccsinsight.com

@ccsinsight