GlobalData.

Global Thematic Research: Technology

TMT Predictions 2018

GDTMT-TR-M169

27 April 2018

In this report, we look at the big tech themes for 2018, identifying *winners* and *losers* for each theme. O*rganised by theme*, this report is one of two annually published 'multi-theme' reports; the other is the 'Tech & Media Trends 2018' report, which is *organised by sector*.

For a full explanation of our thematic research methodology, including our tiered reporting structure, please refer to the Appendix.

Our top 30 themes for 2018

For 2018, the big tech themes are: machine learning, voice, data centres, cybersecurity, virtual & augmented reality, blockchain, cryptocurrencies, Internet TV, cloud computing, the Splinternet, the Internet of Things (including the automated home, autonomous vehicles, the industrial Internet, ambient commerce and the medical Internet of things), genomics, silicon photonics, 5G, robotics, the sharing economy, China, regulation, net neutrality, software defined networking, electric vehicles, batteries, 3D printing, quantum computing and M&A.

How our thematic engine works

Thematic investing is not just about picking the right themes, because themes do not operate in isolation.

The difficulty today in predicting the future using a thematic approach arises from the sheer number of tech cycles that are in full swing right now.

Most companies are impacted by multiple themes, many of which conflict with one another.

At GlobalData, we track the performance of the top 600 technology, media and telecom stocks against the 50 most important themes driving their earnings, generating 30,000 thematic scores.

These scores provide the underlying data driving our 'thematic engine' – which helps our clients forecast winners and losers in each sector – and are constantly revised as new information comes to light.

Our thematic algorithms help identify the overall thematic leaders in each sector (after taking account of all relevant themes).

Inside

- Machine learning
- Voice
- Data centres
- Cybersecurity
- Virtual & augmented reality
- Blockchain
- Cryptocurrencies
- Internet TV
- Cloud computing
- Splinternet
- Internet of Things
- Automated home
- Autonomous vehicles
- Industrial Internet
- Ambient commerce
- Medical IoT
- Genomics
- Silicon photonics
- 5G
- Regulation
- Robotics
- China
- Sharing economy
- Net neutrality
- Software defined networks
- Batteries and electric cars
- Net neutrality
- 3D printing
- Quantum computing
- M&A

Related reports

- Tech & media themes 2018

Report type

- Single theme
- **Multi-theme**
- Sector Scorecard

Cyrus Mewawalla
cyrus.mewawalla@globaldata.com
+44 20 7936 6522

www.globaldata.com

© GlobalData 2018

Contents

INTRODUCTION 4

1. MACHINE LEARNING 5

2. VOICE 6

3. DATA CENTRES 7

4. CYBERSECURITY 8

5. VIRTUAL & AUGMENTED REALITY 9

6. BLOCKCHAIN 10

7. CRYPTOCURRENCIES 11

8. INTERNET TV 12

9. CLOUD COMPUTING 13

10. SPLINTERNET 14

11. INTERNET OF THINGS 15

12. THE AUTOMATED HOME (IOT) 16

13. AUTONOMOUS VEHICLES (IOT) 17

14. INDUSTRIAL INTERNET (IOT) 18

15. AMBIENT COMMERCE (IOT) 19

16. MEDICAL INTERNET OF THINGS (IOT) 20

17. GENOMICS 21

18. SILICON PHOTONICS 22

19. 5G 23

20. ROBOTICS 24

21. CHINA 25

22. SHARING ECONOMY **26**

23. REGULATION **27**

23. (a) Net neutrality 28

23. (b) Tax avoidance 29

24. SOFTWARE DEFINED NETWORKING **30**

25. ELECTRIC VEHICLES **31**

26. BATTERIES **32**

27. 3D PRINTING **33**

28. QUANTUM COMPUTING **34**

29. M&A **35**

30. GENERATION #HASHTAG **36**

APPENDIX: OUR "THEMATIC" RESEARCH METHODOLOGY **37**

Introduction

This TMT Predictions 2018 report lists the top 30 themes impacting the global tech, media and telecom sectors.

We make predictions for each major theme and highlight the likely winners and losers for each theme over the next two years.

How to use this report

We produce three tiers of thematic reports to help our clients look into the future:

- **Single Theme:** These reports offer in-depth research into a specific theme (e.g. artificial intelligence). They identify winners and losers based on technology leadership, market position and other factors.
- **Multi-Theme:** These reports cover all stocks and all themes within a sector, giving readers a strong sense of how everything fits together and how conflicting themes might interact with one another.
- **Sector Scorecard:** Each sector scorecard has a thematic screen, a risk screen and a valuation screen. Live scorecards for each of our 18 sectors are available on our client portal.

This report is a *multi-theme report* and is organised *by theme*. By contrast, our Tech and Media Trends 2018 report is a multi-theme report organised *by sector.*

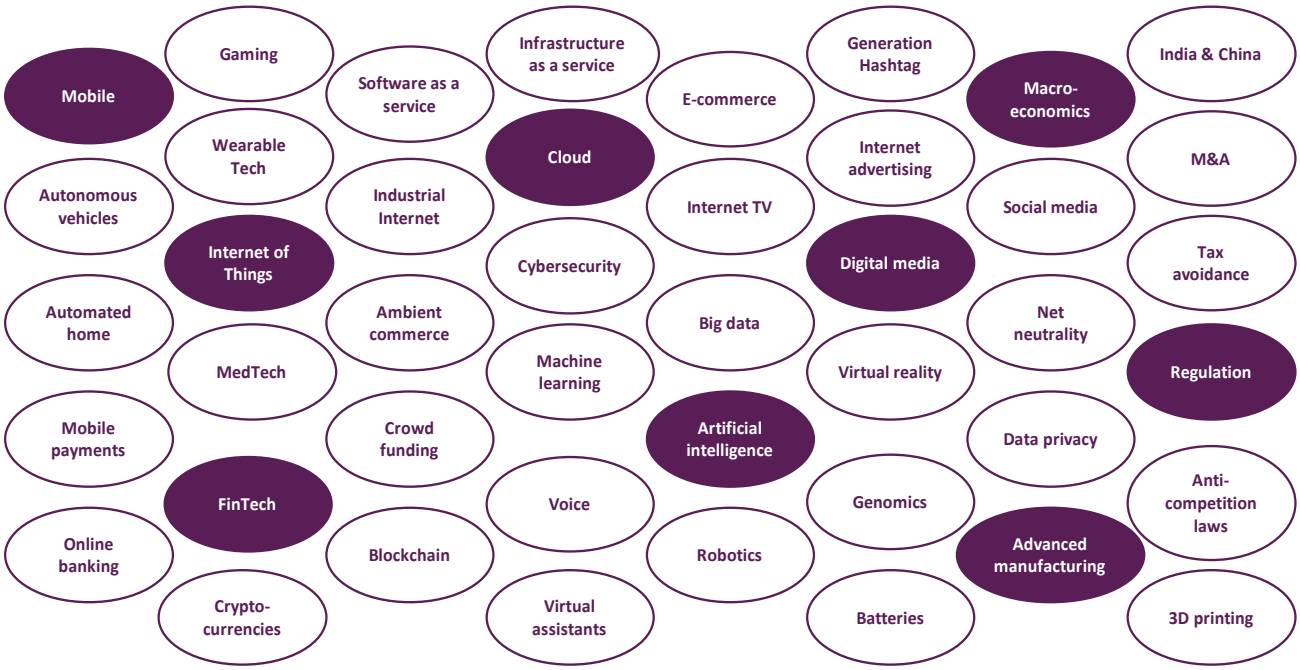
Our "further reading" section at the bottom of each page refers you to more in-depth "single theme" reports related to each theme.

What are the big themes driving share prices in the global tech, media and telecom sectors?

The graphic below depicts most of the big themes that are driving share prices in the technology and media sectors. The purple circles indicate mega-themes while the white circles indicate sub-themes.

What are the biggest technology themes driving share prices in the tech sector today?

Key: Purple circles indicate mega-themes; white circles indicate peripheral themes



Source: GlobalData

The following pages look at each of these themes in more detail.

1. Machine learning

Definitions

- **Artificial Intelligence (AI)** refers to software-based systems that use data inputs to make decisions on their own or that help users make decisions.
- **Machine Learning (ML)** is a method of data analysis that automates analytical model building, using algorithms that iteratively learn from data, without being explicitly programmed.
- **Deep Learning** is a field of machine learning which uses 'artificial neural networks' – modelled on the human brain – to self-teach a machine, using a technique called 'back propagation'.

Predictions

- Deep learning will be the most important AI technology in 2018 with emphasis on voice-driven, conversational computing via digital assistants such as Amazon's Alexa AI engine.
- There will be more media stories in 2018 about the 'dark side' of AI as unaccountable algorithms increasingly determine which individuals get jobs, credit cards, insurance, college admission or jail time.
- A major 'flash crash' or even a multiple asset 'splash crash' is increasingly likely due to a rogue algorithm. Targets include the likes of the Chicago Board Options Exchange, which now trades bitcoins.
- Public debate about the ethics of AI and the imbalance of power between the 'tech giants' and governments will come to the fore. Companies will stress that they are taking ethical matters into consideration in the use of AI. New university courses on 'ethics in AI' will spring up.
- In 2018 it will become clear just how determined China is to achieve world class status and independence in AI (and related areas of autonomous driving, voice platforms and high-end processors).
- Japan will try to catch up in 2018, with the National Institute of Advanced Industrial Science and Technology (NAIST) scheduled to bring into operation a 130-petaflop supercomputer – faster than China's Sunway TaihuLight – as an on-tap resource for academic and commercial research in the field.
- Led by Google, the tech sector will strive to make deep learning systems less dependent on huge training data sets and power-hungry compute power.
- Memory chip makers will benefit from AI's requirement for memory intensive accelerated computing where large amounts of DRAM and 'flash' memory are intimately connected with high end processors.
- The tech titans will intensify their efforts to design more of their own system architectures (e.g. Google's Tensor Processing Unit (TPU), the neural element in Apple's A-Series of chipsets, Microsoft's widespread use of FPGAs for deep learning work or Tesla's autonomous driving chips).
- The drive to develop AI application specific chips will also intensify, with Nvidia, Intel, Google and Tesla all hard at work. At the same time a crop of highly focused, well-funded start-ups – like Graphcore, Cerebras and China's Cambricon – is entering the field. Over $100m went into AI chip start-ups in 2017.
- IBM, GE, Goldman Sachs, Bridgewater and other large industrials and banks will bump up their AI R&D.
- Innovative start-ups will deploy AI by plugging into machine-learning-as-a-service APIs from Amazon Web Services, Microsoft Azure, Google Cloud and IBM Watson Cloud.

Winners

- **Machine learning (Tier 1):** Google, Amazon, Baidu, IBM, Microsoft.
- **Machine learning (Tier 2):** Apple, Facebook, Samsung, Alibaba, Cisco, SAP, Huawei, Tencent
- **High-end AI chips:** Nvidia, AMD, Intel, Xilinx, Graphcore, Cerebras, Cambricon
- **Memory chips:** Samsung Electronics, Micron, SK Hynix, Western Digital, Toshiba consortium
- **High Performance Computers:** HPE, IBM, Cray, Dawning, Inspur, Lenovo, Cisco, Dell, Fujitsu.

Losers

- **Non-tech sector:** Incumbents in every industry whose CEOs fail to make AI a core competency.

Further reading

See Machine Learning, Data centres, Memory chips, AI (Vol. II) and AI (Vol. I).

2. Voice

Definitions

- **Natural language processing (NLP)** is an AI technology that allows computers to understand speech as spoken by humans.
- **Voice APIs** (or application programming interfaces) allow manufacturers to plug their products and services into a ready-made voice platform.
- **A chatbot**, or 'chatter robot', is a computer program that is intelligent enough to have a conversation with a human using voice or text.

Predictions

- Voice will start to replace touchscreens and keyboards as the digital user interface of choice in 2018.
- By the end of 2018, many branded manufacturers will have introduced a range of 'conversational' machines and apps – primarily using voice APIs from Amazon, Google, Microsoft, Baidu, Nuance and iFlytek.
- By 2020, 50% of online search will be conducted by voice, compared to 20% in 2017.
- Amazon's Alexa, a voice-activated AI engine, will remain the leading voice platform in 2018 as its machine learning algorithms continue to collect vast amounts of 'training' data by operating for longer in more homes than any of its rivals – Amazon's Echo accounts for 75% of the intelligent speaker market (ex-China), according to Strategy Analytics. It has a head start over Apple, Google and Microsoft.
- 2018 will see an acceleration of Alexa API downloads from Amazon Web Services, embedding Alexa into household products, industrial machines and car infotainment systems.
- For voice to become ubiquitous, speech recognition platforms need to reach 99% accuracy, but this will not be achieved in 2018: Google currently admits to a 4.9% failure rate in speech recognition, IBM to 5.5% and Microsoft 6%.
- While understanding speech is around 94% accurate, understanding its *context*, however, is several years away, so many voice platforms are focusing on narrow verticals (e.g. intelligent speakers for the home) where the user can ask questions only within a limited domain (e.g. within a factory).
- In 2018, chatbots will further enhance the customer experience whilst cutting out human customer service agents, not only from call centres, but also from physical retail outlets.
- The flipside of this is that chatbots can get things catastrophically wrong, as Microsoft's Tay 'bot' taught us, and 'bots' can also be used as lethal weapons, as the Dyn denial of service hack in 2016 showed.
- The biggest market by far for voice enabled products and services will be China, given its pure size, the difficulty in using keyboards for written Chinese and its growing strength in AI, emanating from companies like Baidu, iFlytek and Mobvoi.
- In 2018 talking may supersede typing for many tasks, and not just in China.
- By 2020 NLP systems, like the new breed of facial recognition systems, will begin to recognise emotion, and learn to fully engage and have meaningful conversations. But not yet.
- Independent voice API developers like Nuance Comms and iFlytek will benefit the most in 2018.

Winners

- **Digital assistants:** Amazon Alexa, Google Assistant, Microsoft Cortana, Baidu Duer, Apple Siri, Samsung Bixby, Line Clova, Cisco MindMeld
- **Independent voice APIs:** Nuance Communications, iFlytek.
- **Start-ups:** Mobvoi, KnuEdge, Vicarius, Sensory, Theatro, VoiceBox, Lingban

Losers

- **Customer call centres:** human customer support representatives will be replaced by chatbots.

Further reading

See Voice – the next computing platform and Voice, an update

3. Data centres

Definitions

- A **data centre** is a facility used to house computer systems and associated networking equipment to capture, store, analyse and re-transmit data. The data centre equipment can be **on-premise** (housed in user's own premises), **co-located** (rented from large data centre warehouses) or outsourced entirely to a **managed services provider**.
- A **hyperscale data centre** is a data centre typically running upwards of 100,000 servers, providing the 'brains' behind many technology cycles such as robotics, AI, the Internet of things and cloud computing.
- **Silicon photonics** is an emerging technology which allows data to be transferred between computer chips by optical rays rather than electrical conductors, increasing data centres speeds significantly.

Predictions

- 2018 will see the upgrading and speeding up of the hyperscale Internet-facing data centres owned by Amazon, Facebook, Microsoft, Google, Baidu, Alibaba, Huawei and Tencent. China Mobile, GE, Toyota, Fanuc and Goldman Sachs will also enter the fray.
- 2018 will be a good year for DRAM memory chips, programmable chips, optical equipment, silicon photonics and unbranded 'White Box' manufacturers of servers and networking equipment.
- In 2018, data centre equipment will continue to become more open-source and more software-defined, meaning that the value will move out of legacy hardware like Cisco into specialist software like Nutanix.
- China's excess inventory of optical interconnect equipment will disappear by mid-2018, so in H2 2018 optical leaders like Lumentum, Viavi Solutions, Finisar and Infinera may get a boost.
- This will be especially so if the 3D sensor market takes off in mid-2018. The interconnect companies best placed for an immediate recovery are Oclaro and Applied Optoelectronics.
- In semiconductors, Intel and Nvidia are likely to dominate the high-end processor side; Broadcom (even without Qualcomm) looks like a winner on the networking side and memory chip makers Samsung, Micron, SK Hynix and Western Digital should continue to benefit from a global DRAM memory chip shortage, but will see a softening of the flash memory market in 2018. Programmable chips from the likes of Intel and Xilinx will become must-haves in data centres.
- In networking, Cisco – which lost out as data centers moved to running open-source software on merchant market chips – is reinventing itself by embracing SDN technology and moving strongly into the cybersecurity space. Arista and Extreme Networks will gain market share in networking equipment.
- 2018 may see the arrival of The Machine from HPE, long in the gestation, which is a memory-based computer involving memristor photonics. It could be powerful and economical enough to be a game changer at the high-end server level.
- The major challenge in 2018 will be to speed up data centre throughput to head off a possible throttling of the Internet by 2020 through the addition of a lot more memory chips per server, moving to 'flash arrays' for storage and to super-fast optical interconnects for chip-level data transfer within data centers.

Winners

- **Semiconductors:** For processors, Intel, Nvidia, AMD, Broadcom; for networking chips, Broadcom; for memory, Samsung, Micron, SK Hynix, Western Digital; for programmable chips, Intel and Xilinx.
- **White box makers:** Quanta, Wistron, Inventec.
- **Software-defined DC equipment:** Nutanix, Arista Networks, Extreme Networks, Barefoot Networks.
- **Silicon photonics:** Intel, Infinera, Acacia Communications, Molex, Mellanox, Oclaro and NeoPhotonics
- **Optical equipment:** Applied Optoelectronics, Oclaro, Infinera, Finisar, Lumentum, Acacia, Viavi

Losers

- **Legacy DC equipment providers:** Cisco, Oracle, SAP, IBM, HPE, Dell, Lenovo, NetApp, Hitachi

Further reading

See Data centres, Memory chips, Cloud computing II, Software defined networks

4. Cybersecurity

Definitions

- **Zero-day attacks** refer to software vulnerabilities that are unknown to a cybersecurity vendor and exploited by a hacker on 'day zero', leaving the company that runs the software no time to fix it.

Predictions

- 2018 will see a 'Lehman' scale cyber event – for example, a cyber 'take-over' of a major bank, nuclear power plant or securities exchange, causing catastrophic losses, probably involving a zero-day attack.
- The leaders in the cybersecurity industry will move dramatically away from passive detection of cyber-attacks towards active hunting of threat actors using intelligence-led solutions.
- AI and unified threat management will be key cybersecurity technologies in demand in 2018.
- Cyber insurance premiums will rise because cybersecurity presents an almost totally asymmetric scene: attack and infiltration are super-easy while defence is super-difficult, both factors being compounded by the ever-increasing 'attack surface' generated by new tech cycles such as the Internet of Things.
- Law enforcement agencies will accelerate their drive to force tech companies to offer them access to messages and data on encrypted devices and apps.
- Trade wars in the telecom equipment space will continue: the US and Europe will increasingly discriminate against Huawei and ZTE, and China against Cisco, on national security grounds.
- Spectre and Meltdown, the two security vulnerabilities revealed by Intel in early January 2018 that affect all processors manufactured between 1995 and 2017, revealed the extent to which the cyber threat lurks at the very foundation of digital hardware.
- 2018 will see increased discussion about new processor architectures that can combine accelerated performance and low power draw with vastly improved firmware security and kernel memory partitioning.
- Facial, voice recognition and biometric access technologies will take off, with banks such as Santander taking the lead.
- Since most cyber breaches are, to an extent, 'inside jobs', behavioural analytics will become critical.
- The big network companies such as Cisco, IBM, Microsoft and HPE will build out their cybersecurity offerings by acquisition.
- State-sponsored cyber-attacks, quite probably on utilities or in pursuit of IP theft, will rise.
- China will clamp down on VPNs and continue to block foreign social media sites like Facebook.
- There will be growing discussion about the use of blockchains, with encrypted distributed data base blockchains, starting in banking and healthcare, as effective defences against cyberattacks.
- The gathering momentum behind the IoT will lead to an accelerating shift from cloud-based control hubs to in-device 'sense, infer, act' systems which will be hard to penetrate because of their self-contained, compact, complex, high-speed cores. Early versions of advanced, autonomous on-board systems will be seen in 2018 in cars, robots, medical devices and smart phones.

Winners

- **Unified threat management:** Fortinet, Check Point Software, Sophos, Cisco, Barracuda Networks
- **Artificial intelligence:** Alphabet, IBM, FireEye, Microsoft, Splunk, Palantir, Darktrace
- **Network security:** Cisco, Palo Alto Networks, FireEye, Check Point Software, Fortinet
- **Endpoint security:** Symantec, Trend Micro, FireEye, Check Point Software Palo Alto Networks
- **ID management:** CyberArk Software, Gemalto (Thales), Idemia, Microsoft
- **Application security:** F5 Networks, Imperva, Veracode, WhiteHat Security, Akamai, Citrix Systems
- **Surveillance and behavioural analytics:** Verint Systems, Hikvision, Illusive Networks

Further reading

See Tech and Media Trends 2018 (p63-72 on security software), Cybersecurity (Vol III), Cybersecurity (Vol. II)

5. Virtual & augmented reality

Definitions

- **Virtual Reality** (VR) immerses the user in an entirely artificial world, with the 'illusion' of reality.
- **Augmented Reality** (AR) allows the user to see the real world overlaid with a layer of digital content.
- **Mixed Reality** (MR) is a hybrid technology that allows people and objects to interact with virtual worlds.

Predictions

- Pokémon Go generated $600m in mobile AR revenue in 2017 – more than the entire VR games software market in 2016. By 2020, Digi-Capital forecasts AR revenues could hit $120bn and VR $30bn.
- AR will be hugely disruptive because, ultimately, AR glasses (or contact lenses) with voice activation and AI will displace the smartphone as the consumer's main user digital interface. For this reason, all the leading technology companies will increase investment in the space in 2018, with Microsoft, Apple, Google, Sony, Samsung, Facebook, HTC and Huawei all improving their offerings.
- VR will not meet investor expectations in 2018, plagued by a lack of content, but AR and MR, will be in the news as developments at Microsoft, Apple, Huawei and Samsung bring new applications to market.
- China's huge population of tech savvy early adopters will account for a third of the action in VR/AR headsets – watch out for Alibaba's ecommerce VR offerings.
- In 2018, Oriental Times Media Group is due to open a $1 billion VR theme park in Guizhou where visitors will meet extra-terrestrials, ride on dragons' backs and experience a VR roller coaster.
- Facebook will make waves in 2018 with the market entry of the Oculus Go, a stand-alone (previous versions were tethered to a PC) VR headset and attract more developers with its AR Studio development platform which supports 3D rendering, real-time tracking, and object recognition.
- Google will go all-out in AR in 2018 with a full product range – the Daydream VR platform, ARCore and Google Lens, an AI-powered app designed to bring up relevant information when viewing images through a camera. It will relaunch Google Glass, initially in factories and warehouses.
- Apple, which fell behind in VR/AR product launches in 2017, will catch up in 2018. Apple's advantage over Android will be the integration of Apple's A11 processor with its ARkit toolkit for developers.
- In 2018, most AR will run on smartphones and tablets, but may well start to appear on car windscreens and in glasses within industrial settings via Osterhout, Vuzix, Daqri, China Mobile and Google Glass.
- The race is on to find ways of mediating AR in slim, chic glasses instead of clunky headsets. It will require marked progress in the micro-miniaturisation of cameras and chip sets.
- 2018 could see the first lightweight smart glasses powered by smart phones and connected via a high bandwidth port to wireless ear wear. Here again, Apple almost certainly leads the field.
- Microsoft's HoloLens self-contained AR glasses may propel Microsoft to leadership position in industrial (but not consumer) AR/MR by end 2019, provided it addresses complaints about its limited field of vision.
- In 2018, Magic Leap will release a beta developer version of its Magic Leap One MR headset (with hip computer and handheld controller) deploying its much storied Digital Lightfield display technology.

Winners

- **VR headsets and platforms:** Facebook (Oculus), Google (ARCore), HTC (Vive), Sony (PlayStation VR) and Samsung (Gear VR), Razer (OSVR HDK3), TCL, Lenovo, DeePoon, Xiaomi
- **AR headsets and platforms:** Microsoft (HoloLens), Google (Glass 2.0), Facebook, Vuzix (Blade).
- **Components:** AAC Tech, GoerTek, Himax, Knowles, Largan Precision, LG Innotek, Sunny Optical
- **Start-ups:** Magic Leap, Osterhout Design Group, Atheer, Meta, DeePoon

Most exposed

- **Leading smartphone makers:** Apple, Samsung

Further reading

See 'Alternative Reality' and 'Virtual Reality'.

6. Blockchain

Definitions

- A **blockchain** is a shared, digitised, decentralised ledger that allows transactions to be recorded, verified electronically and encrypted over a distributed server network.
- A **smart contract** is a digital contract enabled by blockchain technology that can monitor the fulfilment or breach of contractual conditions and trigger associated payments without human involvement.

Predictions

- In 2018, many blockchain technology platforms will move from the development to pilot phase in the banking, media and industrial sectors, some of which will adopt smart contracts.
- In 2018, the Australian Securities Exchange (ASX) will become the world's first stock exchange to adopt blockchain technology: the ASX's blockchain platform, built by Digital Asset Holdings, will replace its registry, settlement and clearing system with blockchain technology to cut costs for customers.
- Catalysts such as the ASX project will highlight to investors the stark cost cutting potential of blockchain platforms: blockchain eliminates the need for expensive intermediaries – bankers, lawyers, accountants, estate agents and government officials – many of whom have lost their trusted status in society.
- Over time, many parts of the global supply chain will be targets for ruthless cost cutters using blockchain technology, including electronic patient records, retail payments, money transfer services, consumer lending, crowd funding, data relating to IoT devices, accounting records and real estate transactions.
- There will be more and more studies of the extent to which Millennials trust maths and code over human intermediaries and what it means in a world of untrusted networks and professional bodies.
- There will be a raft of announcements about the creation of public and private blockchains, even in China, where cryptocurrencies are illegal and private blockchains heavily regulated.
- Leading Wall Street banks are seriously looking at how blockchain can be used to radically reduce back office costs and help in capital markets. There will be major announcements in 2018.
- The mere hint of association with blockchain technology will spark share price rallies. Kodak's shares, for example, rose 40% after announcing in January 2018 that it was developing a blockchain platform to help photographers control their image rights and a cryptocurrency called KodakCoin to pay for them.
- Santander recently forecast that blockchain could save banks $20bn a year.
- IBM will be seen as the most advanced company in developing and deploying blockchain technology across a broad range of applications from finance to logistics.
- Among nations, Estonia – arguably the world's most advanced online society – will be closely watched in 2018 as it further develops its secure e-Residency programme, a government-issued digital ID available to anyone in the world, powered by blockchain to enable access to various public services.
- Discussion about the use of blockchain as a counter to cyber sabotage will rise in 2018 led by banks.
- Sweden is working to blockchain a national land registry, but admits progress is slow.
- Japan, India and Singapore are expected to surface in 2018 as vanguard nations in the use of blockchains.

Leaders

- **Financial institutions:** Goldman Sachs, Citi, JP Morgan, Santander, Credit China FinTech, Ping An.
- **Tech companies:** IBM, Microsoft, Accenture, Cognizant, Cap Gemini.
- **Start-ups:** Digital Asset, Chain, Clearmatics, ConsenSys, BTL, ChromaWay, Digix, Ripple, R3.

Laggards and losers

- **Payment processers:** Western Union, MoneyGram, Worldline, Nets.
- **Logistics companies:** FedEx, UPS, Royal Mail, Deutsche Post.

Further reading

See Blockchain.

7. Cryptocurrencies

Definitions

- A **cryptocurrency** is a digital currency that uses cryptography for security. The creation of additional units of a cryptocurrency is via a de-centralised distributed ledger, outside the control of central banks.
- **Bitcoin** is the cryptocurrency that first introduced blockchain technology to the world.
- An **Initial Coin Offering** (ICO) allows an early stage company to crowdfund using cryptocurrencies (or digital tokens) without giving up any equity.

Predictions

- In 2018, cryptocurrencies will become increasingly difficult to value and increasingly volatile: the price of bitcoin rose from $975 to 19,100 in 2017, only to fall back to around $8,900 at the time of writing.
- In 2018, the main use cases for bitcoin will continue to be secret (or illicit) payments and speculation. For example, bitcoin is typically demanded to settle ransomware cases.
- In 2018, a handful of big industrial names will begin to accept bitcoin as a form of payment, adding to big brands like Intuit, PayPal and Microsoft who already do so.
- For a currency to become widely adopted it must be stable and liquid, because the three basic functions of a widely accepted currency – a storage of value, a means of exchange and a unit of account for debts – all require stability.
- Until, cryptocurrencies become less volatile, they are unlikely to be widely accepted as a form of payment. But investors will begin to accept cryptocurrencies as a genuine new asset class, rather than merely as a casino for speculators.
- 2018 will see leading banks, including Barclays, Credit Suisse and HSBC, creating a 'Utility Settlement Coin' (USC) for use in inter-bank settlements, a potential forerunner for central bank cryptocurrencies.
- In 2017, much bitcoin mining, which is intensely energy hungry, was performed in China where electricity prices are low. In 2018, following China's (and South Korea's) recent ban on cryptocurrencies, some mining activity will migrate to Russia.
- In 2017, Japanese and Koreans were the most heavily invested in Bitcoin. In 2018 it will be Russians.
- In 2018, cryptocurrency mining activity will continue to increase demand for Nvidia and AMD GPUs as well as memory chips from Samsung, Micron, SK Hynix and Western Digital.
- In 2018, hundreds of new cryptocurrencies will be created via ICOs.
- Some ICOs will be uncovered as frauds. A case in point is PlexCorps, whose PlexCoin digital token faced accusations of 'false and misleading statements' from the SEC in December 2017.
- The cost of turning bitcoins into cash will rise as banks comply with money laundering checks, bitcoin exchanges charge high exit fees and fewer currencies allow free exchange of bitcoins after government bans in China and South Korea. Note that no UK bank accepted bitcoins in 2017.
- In December 2017, trading in bitcoin futures started on the Chicago Board Options Exchange and CME Group. In 2018, more securities exchanges will commence bitcoin trading.

Leaders

- **Cryptocurrencies:** Bitcoin, Ethereum, Litecoin, Ripple, Nem, Dash (Darkcoin), Zcash, Monero
- **Cryptocurrency platforms:** Coinbase, Ripple, Stellar, CryptoSigma, BitPesa, Billion, Kraken, MeXBT
- **Distributed ledger frameworks:** Hyperledger Fabric, R3 Corda and Ethereum

Longer term losers

- **Payment services:** Visa, MasterCard, PayPal, Ant Financial, Square, Western Union, MoneyGram
- **Bank note printers:** De La Rue

Further reading

See Blockchain, Tech and Media Trends 2018 (pages 84-85)

8. Internet TV

Definitions

- **Internet TV** refers to video content that is streamed over the Internet to a television or a connected device.
- **'Cord-cutting'** refers to the act of replacing an expensive, bundled pay-TV subscription (typically cable or satellite TV) with a cheaper, unbundled Internet TV subscription.

Predictions

- By 2018, video streaming revenues as a proportion of US pay TV revenues will surpass 10%, up from 8% in 2017, according to PwC, implying that most of the growth in the Internet TV cycle is yet to come.
- Today Internet TV is largely associated with subscription-video-on-demand (SVOD) services like Netflix. But, in 2018, the big growth area will be live TV streaming services like Dish Network's Sling TV.
- Netflix will remain the undisputed market leader in Internet TV in 2018, but will see fierce competition from rivals Amazon, Apple, Google, Sony, Samsung, Rakuten, Facebook, Alibaba, Baidu and Tencent.
- A string of pay-TV operators and free-to-air broadcasters are likely to issue profit warnings in the next two years as TV advertising and pay-TV subscription revenues fall.
- Film studios will see content prices bid up as tech companies – like Netflix, Amazon and Alibaba – compete to acquire content streaming rights in order to attract subscribers to their Internet TV platform.
- Faced with the prospect of mass 'cord cutting', more TV broadcasters will respond by going 'direct-to-consumer' by creating their own apps, streaming their own content and avoiding middlemen such as Netflix or the cable operators. But they will find they are too late to the game.
- Disney's strategy of going 'direct-to-consumer' – by pulling its content from Netflix in 2019 and replacing it with its own streaming platform – will backfire, because customers will demand to see Disney content on their preferred Internet TV ecosystem, such as Netflix or Amazon.
- Voice-activated AI products like Apple's Siri digital assistant or Amazon's Echo intelligent speaker will make it easier for viewers to search for TV content, further emphasising the growing gap in 'ease of use' between the tech disrupters and the media incumbents when it comes to TV menu systems.
- Live sports will continue to be something viewers are willing to pay for, because few sports fans want to watch their team on TV hours after the match has been played. But, online subscription prices will be much lower than 'bundled' cable or satellite TV prices, resulting in profit warnings for ESPN and others.
- TV networks will begin to lose control of TV advertising revenues: for example, instead of buying advertising space directly from ITV, media buyers will place adds on YouTube TV.
- M&A targets include Netflix and Lions Gate Entertainment. Apple may bid for Netflix.

Winners

- **Film and TV studios:** Lions Gate Entertainment, 21st Century Fox, Disney, Discovery, Entertainment One, ITV, Comcast, Sony, Time Warner, Viacom.
- **Video streaming platforms (Tier 1):** Netflix, Amazon.
- **Video streaming platforms (Tier 2):** Apple, Facebook, Google, Microsoft, Alibaba, Baidu, Rakuten, Samsung, Sony, Roku, Tencent, Snap, Weibo.

Losers

- **TV broadcasters:** 21st Century Fox, AMC Networks, Atresmedia, CBS, Disney, Discovery, Grupo Televisa, ITV, M6 Metropole, ProSiebenSat.1, Scripps Networks, Sky, Time Warner, Viacom, Vivendi.
- **TV audience measurement:** Nielsen

Note that media companies like Disney are in both the winners and losers section because their content creation businesses will benefit from Internet TV, but their TV networks businesses will lose.

Further reading

See Internet TV (Vol. III), Music, Film and TV sector scorecard, Tech and Media Trends 2018 (pages 115-126)

9. Cloud computing

Definitions

- **Cloud Infrastructure-as-a-Service (IaaS)** refers to self-service models for accessing remote data centre hardware such as computing power, storage and networking equipment, as needed (e.g. AWS).
- **Cloud Platform-as-a-Service (PaaS)** allows software engineers to develop, test and deploy software applications using a platform managed by a third party and accessed by the Internet (e.g. GE Predix).
- **Cloud software-as-a-service (SaaS)** allows users to access applications over the Internet that are managed by a third-party vendor without having to download the software locally (e.g. Paylocity).
- **Public Clouds** allow enterprises to access standardised Cloud infrastructure services delivered to multiple organisations via the public Internet.
- **Private Clouds** enable enterprises to have bespoke Cloud infrastructure that is dedicated to a single organisation. Private Clouds offer greater levels of control and security.

Predictions

- Enterprise software business models will continue to shift from a licensing model to a Cloud-based subscription model, with Cloud spending forecast to grow at 20% in 2018 according to IDC, compared to 3% for overall IT expenditure.
- Functions such as customer services, HR, payroll, expenses, accounting and secretarial assistance, which were once outsourced to low-cost countries such as India, will continue to shift to Cloud-based services which are cheaper and easier to use than hiring an Indian IT outsourcer.
- On-site corporate data centres (which offer the maximum level of control and security) will continue to shift to public Cloud providers such as Amazon Web Services, resulting in lower demand for traditional IT services – such as the installation, customisation and maintenance of IT systems – from the likes of Cognizant, Infosys, TCS and Wipro.
- Accessing AI platforms will become much cheaper and easier than before, because AI will increasingly be sold as a platform-as-a-service (PaaS) via the Cloud.
- In 2018, many SaaS players will move down the Cloud computing stack towards PaaS and IaaS to create a stronger Cloud ecosystem in an effort to lock in customers.
- Microsoft will become the strongest player in the Cloud – stronger even than Amazon – because it is a leader in all three layers of the 'Cloud stack' (SaaS, PaaS and IaaS).
- Prompted by national security concerns, the Chinese government will push for domestic companies like Alibaba to lead the build-out of China's domestic Cloud infrastructure.
- Emerging tech cycles that depend on low latency and high reliability – such as AI, autonomous vehicles or augmented reality – are pushing more raw computing power from the Cloud to the 'edge of the network' – into endpoint devices like cars or iPhones. The move to 'edge computing' will have two big consequences: software companies will need to exert more control over the hardware on which they run; and demand for high end processors from Intel, Nvidia, AMD and Qualcomm will rise.

Winners

- **IaaS:** Amazon Web Services, Microsoft Azure, Google Cloud, IBM SoftLayer
- **PaaS:** Salesforce (Force.com), IBM (Bluemix), Microsoft (Office 365), GE (Predix), HPE (Helion)
- **SaaS:** Benefitfocus, Callidus, Cornerstone OnDemand, Ellie Mae, Instructure, Medidata, Paylocity, Salesforce, ServiceNow, Shopify, Splunk, Ultimate Software, Varonis, Veeva, Workday, Zendesk
- **AI-as-a-service:** Google TensorFlow, Microsoft Azure ML, Baidu WARP-CTC, IBM SystemML

Losers

- **Enterprise software:** SAP, Oracle, HPE, Dell, Fujitsu, Hitachi, NetApp
- **Outsourcers:** ADP, Cognizant, Atos, Capgemini, Mphasis, Infosys, TCS, Wipro, Tieto, Xerox

Further reading

See Cloud Computing II, Cloud Computing I, Tech and Media Trends 2018 (pages 28-37, 55-62 and 73-79).

10. Splinternet

Definitions

- The **Splinternet** refers to the fragmentation of the Internet due to censorship, geopolitics, nationalism, cybercrime and privacy issues.

Predictions

- 2018 will see the end of the Internet and the World Wide Web as truly open and free.
- The Internet will be subject to ever greater country-specific regulation and scrutiny as cyber sabotage, political manipulation and the centralised power embedded in the algorithms of the Internet giants that control our digital lives causes political and social blowback over the next year.
- In 2018, the FCC's December 2017 decision to repeal US net neutrality laws will come home to roost. The new US regulatory regime effectively gives more power to Internet service providers like AT&T or Comcast to arbitrarily censor, throttle or charge for certain Internet services like Netflix.
- In 2018, more 'fake news' stories will emerge, many with profound consequences for democracies that respect free speech. Many of these, as in 2017, will be tweeted by President Donald Trump himself.
- This will be the inevitable result of the continued shift in mass news consumption from established newspapers with journalistic reputations to protect (e.g. The New York Times) to user-generated blog posts on Facebook and other social media sites that refuse, on principle, to conduct fact checks.
- Government authorities with growing public concerns about fake news, national security, privacy and manipulation will start to hit back hard at the Internet giants, not least because many of them avoid local taxes, whilst profiting from fake news, pornographic material and terrorism.
- Facebook and, to a lesser extent, Google will be under rising pressure in 2018 to 'fix' themselves in the wake of the alleged use of their platforms by Russian threat actors to sow political confusion during elections in the US and Europe, and by terrorists, paedophiles and other social ills.
- In a world where trust in politicians, authorities and humans is withering, blockchain technology (see page 8) will be used more and more by the technology giants to offer and pay for Internet services.
- In 2018, the costs of 'fixing' the social, political and national security problems created by the Internet will mount, with public blowback. Facebook, for instance, has committed to hire an extra 20,000 people, including premium C++ programmers to 'self-correct'.
- Across the world, nation states – from Turkey to Russia and Iran – are increasing their censorship of the Internet with sudden shutdowns of certain websites. These moves are hardly surprising among autocratic regimes, but in 2018 we can expect such moves in the US, Germany and even the UK.
- China has never endorsed an open, global Internet, hence the Great Firewall of China. Under a newly empowered Xi Jinping, China will increase its policing of the Internet and take very strong actions to try to eliminate the use of VPNs, particularly among foreigners in China.
- Daesh and other terrorist organisations will turn increasingly to fake news, and soon to AI, and the type of psychographic profiling used by the Trump campaign to package big data into rich and compelling narratives that will amass far greater subversive power, political influence and reach.
- A growing number of politicians will blame social media for creating a more polarised society. In a recent interview, Barack Obama said: 'One of the dangers on the Internet is that people can have entirely different realities. They can be cocooned in information that reinforces their current biases.'
- 2018 will be a tricky year for Facebook, and to a lesser extent Google, because of their exposure to all these social and political ills.

Winners

- **Companies strong in AI:** Alphabet, Amazon, Baidu, Yandex

Losers

- **Social media giants:** Facebook, Twitter, Weibo, Line, Kakao, Naver

Further reading

See Tech Regulation and Net neutrality

11. Internet of Things

Definitions

- The **Internet of Things (IoT)** is an umbrella term which refers to a future where every-day physical objects such as fridges, watches, factory machines or cars identify themselves to other devices over the Internet and send each other data used for analytics, efficiency enhancements and monitoring.

Predictions

- Investors will increasingly view the IoT as six disparate subthemes: the connected car, the automated home, wearable technology, ambient commerce, the industrial Internet and the medical IoT.
- By 2025, the IoT is forecast to involve 50-70 billion connected devices, according to a mix of forecasts from IHS, Cisco and Gartner, with 35 billion expected by 2020.
- In 2018, inevitably, much of the discussion will be about how to protect an already highly vulnerable world of billions of Internet-connected devices against cyber-crime and cyber-sabotage.
- There are mounting fears that rogue nation states or terrorists will attack utilities, hospitals or undersea cables, critically disrupting the infrastructure that runs the IoT.
- New technologies ranging from behavioural analytics to blockchain, and from edge computing to quantum computing will be under intense development in 2018 to help protect the IoT from attack.
- Edge computing – where more computing power is pushed to the edge of the network (i.e. in connected devices like cars or phones) where it is nearer the source of data – will grow particularly rapidly, especially in autonomous vehicles and mobile, sentient robots.
- More and more devices will have their own micro-data centres to enable them to 'sense, infer and act'.
- The power balance between local, in-device data centres and remote, centralised data centres will shift in favour of the former as in-device machine learning advances.
- Key beneficiaries will be cloud infrastructure platforms, network security vendors, sensor makers, wireless chip makers and power management chip makers.
- Intel, Nvidia and AMD will intensify their efforts to come to market with high 'bang per watt' offerings, in order to compete with the likes of ARM (now part of Japan's Softbank) which will be widely seen in 2018 as the best low power, firmware secure option for connected devices' chip architecture.
- Samsung will drive hard into IoT gateways, while Qualcomm's AllJoyn open source IoT software framework is likely to gain traction too.
- Of interest in 2018 will be the ability of GE Digital to offer advanced predictive maintenance for jet engines, locomotives, trucks and drones from the cloud.
- The single most important trend within the IoT in 2018 will be 'voice interaction', making connected machines conversational.
- 2018 will probably show agriculture and healthcare to be the most innovative adopters of IoT.
- In 2018, wearable technology sales are likely to underwhelm until a strong use case emerges for smart watches, fitness bands and other wearable technology devices.

Winners

- **IoT platforms:** Amazon, Microsoft, Google, Apple, GE, IBM, Samsung, Baidu, Alibaba
- **Networking platforms:** Cisco, IBM, Microsoft, HPE, Huawei, Samsung, ZTE
- **Sensors:** STMicroelectronics, NXP, Sensata, First Sensor, TDK, Melexis, Nippon Ceramic, Renesas
- **Wireless chips:** ARM (Softbank), TI, Cypress, Maxim, Qualcomm, Broadcom, Qorvo, Skyworks
- **Voice interaction:** Amazon, Google, Apple, Baidu, iFlytek, Mobvoi
- **Ambient commerce:** Amazon, Alibaba, Baidu, Facebook, Tencent

Losers

- **Wearable technology:** Samsung, LG, Lenovo, GoPro, Fitbit, Garmin, Acer, Asus, HTC, Huawei, ZTE

Further reading

See Internet of Things, Industrial Internet, Autonomous Vehicles and Tech & Media Trends 2018.

Over the following five pages we look at the main sub-themes within the Internet of Things.

12. The automated home (IoT)

Definitions

- The **automated home** refers to the automation and control of household appliances – whether it be a fridge, TV, front door lock, kettle or light bulb – by connecting them to the Internet.
- An **intelligent speaker** is a voice-activated speaker with an integrated digital assistant.

Predictions

- With the smartphone market maturing, and the autonomous vehicle market at least five years away, the big battle in 2018 amongst the Internet giants will be in the home.
- The development of the 'smart home' will be a largely piecemeal affair for the next few years, with the smartphone, the TV and the intelligent speaker all battling to become the home hub.
- Voice technology will begin to usurp touchscreen technology in the home – the 'talk vs tap' trend means that intelligent speakers will be more important than smartphones for some home automation functions.
- In 2018, Amazon's Echo, powered by its Alexa AI platform, will remain the leading player in the smart home hub market, having gained a 70% share of the intelligent speaker market. It will also add augmented reality as an output device.
- Privacy in the home will become a big media story – are smart appliances spies or servants?
- Concern over cyber security in the home will rise – connected appliances merely serve to increase the attack surface available to hackers and can unwittingly be hijacked in malicious botnet attacks similar to the October 2016 Dyn attack which took down Twitter and Netflix's websites for several hours.
- Chip designers will take years to come up with suitable designs for new breeds of connected smart home appliances as they reel from the recently discovered design flaws dubbed Meltdown and Spectre.
- While Amazon and Google were the only serious contenders in home automation last year, 2018 will see a host of companies entering the fray – notably Apple, Samsung, Honeywell, LG, Panasonic.
- Amazon Alexa APIs will be downloaded by more and more appliance makers to offer 'voice' on home appliances, with LG a high-profile adopter.
- As more home appliances – from fridges to vacuum cleaners – get connected, competitive power will shift from device manufacturers to the back-end IoT cloud software platforms controlling these devices.
- Having reached 24m units in 2017, sales of the Amazon Echo intelligent speaker will quadruple by 2022, according to Strategy Analytics.
- Sonos will go from innovation leader in 2015, with its own state-of-the-art ecosystem, to maker of commoditised speaker hardware in 2018 – all in the space of just 3 years.
- The battle between digital assistants will intensify, with each of the tech titans undercutting each other to get their intelligent hubs into homes, allowing them to collect the data they need to improve their AI.

Winners

- **Digital assistants:** Apple Siri, Google Assistant, Microsoft Cortana, Amazon Alexa, Baidu Duer, Samsung Bixby, Line Clova, Mobvoi, Yandex Alice, Tencent Xiaowei, Alibaba AliGeni
- **Home automation:** Amazon, Google, Apple, Samsung, Control4, I-Controls, Alarm.com, Hikvision
- **Independent voice APIs:** Nuance Comms, iFlytek
- **Voice driven hubs:** Amazon Echo, Google Home, Apple Homepod (not yet released), Alibaba's Tmall Genie XI, Baidu Smart Fish, Tencent, Xiaomi, Rokid
- **Connected home appliances:** Samsung, LG, Haier

Losers

- **Speaker companies:** Sonos, Yamaha, Bose, Pioneer, Bowers & Wilkins

13. Autonomous vehicles (IoT)

Definitions

- An **autonomous vehicle (AV)** is a vehicle which can drive itself without human supervision. There are five autonomous driving levels, with Level 5 being full self-drive under any conditions.
- **Advanced driver assistance systems (ADAS)** are a form of semi-autonomous driving (Levels 1 – 4), where the driver retains ultimate control of the car.
- **Light Detection and Ranging (LiDAR)** is a remote sensing method that uses light in the form of a pulsed laser to measure ranges for use in anti-collision systems. Other key technologies enabling vehicle sentience are based on 3D cameras and radar.

Predictions

- In 2018, very few cars will exceed Level 2 autonomy, where ADAS systems such as Active Cruise Control and Lane Departure Warning work in tandem.
- Level 3 autonomy, which provides automated parallel parking, lane changing, and crash avoidance, will slowly be introduced by a host of auto makers, with Tesla remaining in the lead.
- Fully autonomous cars (Level 5 autonomy) require spinning roof-top 3D LiDAR sensors that enable 360-degree vision. They are bulky and cost upwards of $3,000 each. In late 2018, silicon photonics (which allows light rays to carry data directly into a chip) will make 3D sensors significantly cheaper, smaller and more accurate. Velodyne is the leader, but Continental, Bosch and Valeo are catching up.
- Whilst LiDAR sensors are important for autonomous driving, the real progress in 2018 will be made in improving the interpretation of data from these sensor systems by using machine learning (ML).
- 2018 will see a big stand-off between the automakers and the tech companies. Sensor data will be the bargaining chip: while Google Waymo, Uber, Baidu, NuTonomy (Aptiv) and others have the ML capability, it is the automakers like BMW, Audi and GM that own the bulk of the sensor data from their installed fleets.
- In 2018, Phoenix, Boston, Singapore, Guangzhou and other cities will introduce an AV taxi service.
- Tesla claims to have a fully autonomous system of sensors, processors and software ready to switch on for Level 5 driving autonomy, regulations permitting. Note it has suffered two fatalities in two years.
- Tech companies like Alibaba and Tencent – who had hitherto shown an interest only in in-car infotainment technology – have now unveiled plans to move into autonomous driving technology too.
- Transport-as-a-Service (TaaS) will see big investment inflows as auto makers adjust to a world in which tech savvy Generation Z's shun car ownership, opting to rent, hail and share vehicles instead.
- In 2018, Google's lead in mapping software will be eroded by Here, originally developed by Nokia, but now owned by a consortium including BMW, Audi, Daimler, Bosch and Continental.
- Most major motor companies aim to have robot taxi services in operation by 2023.

Winners

- **Fully autonomous systems:** Google Waymo, Baidu, Uber, Tesla, GM Cruise, Aptiv, Drive.ai
- **ADAS:** Delphi, Continental, Autoliv, Bosch, Valeo, Volvo (Geely), Denso, Intel, Aptiv
- **Mapping software:** Google, Baidu, NavInfo, AutoNavi (Alibaba), Here (BMW, Audi, Daimler), TomTom, Civil Maps, DeepMap, Lvl5
- **Auto-grade chips:** Mobileye (Intel), Nvidia, Ambarella, Xilinx, Infineon, NXP, AMS, STMicro, Melexis
- **Transport-as-a-service:** Google, Uber, Tesla, Amazon, Alibaba Baidu, Didi Chuxing, Aptiv, Sony
- **LiDAR:** Velodyne, Quanergy, Continental, Valeo

At risk

- **Auto makers:** VW, BMW, Daimler, Ford, GM, FCA, Toyota, Honda, Nissan, Renault, Geely, Tata Motor

Further reading

See 'Car 3.0' and 'Autonomous Vehicles'

14. Industrial Internet (IoT)

Definitions

- The **Industrial Internet of Things (IIoT)** refers to the process of automating industrial applications where expensive or dangerous equipment is involved and where 'events' cascade in milliseconds rather than seconds. As such, it requires more stringent protocols, higher reliability levels and faster speeds than consumer-facing IoT categories such as wearable tech or automated homes.
- **Micro-electromechanical systems (MEMS) sensors** refers to the technology of microscopic devices, particularly those with moving parts, but also including integrated circuits.

Predictions

- The industrial Internet will generate more than $85bn in annual revenues by 2020, according to Bain.
- 2018 will see the ongoing development of IIoT with further advances in and use of the SaaS and IaaS platforms already in play from GE, IBM, SAP, Siemens and Emerson Electric among the leading pack and rising contributions from Cisco, especially in the 'Smart City' segment.
- The impact of IIoT on the platform providers' bottom lines will not come through until 2019 or 2020.
- Much of the underlying IIoT Infrastructure will run using IaaS services from Amazon Web Services and Microsoft Azure.
- With a dearth of top class software engineers, 2018 will probably see a flurry of 'aqui-hires' in the AI space, partly due to the growing demands of Germany's Industrie 4.0 project and Made in China 2025.
- 'Predictive maintenance' will be the killer app, allowing more machines – whether lorry tyres, robots, locomotives, wind turbines or jet engines – to be repaired or enhanced.
- This, in turn, will drive the deployment of cloud based big data analytics, the arrival of 'edge', on-device machine learning and Wi-Fi connectivity, with Qualcomm at the fore.
- MEMS sensor makers like ST Micro, Infineon, NXP, Rohm and Bosch will benefit from the need for more accelerometers, heat and humidity components, pressure components, cameras and microphones in everything from smart phones and ADAS vehicles to every type of industrial equipment.
- Blockchain, the so-called 'trust' network technology, will move beyond the financial sector to the industrial sector amid the rising clamour about cybersecurity, with IBM and Accenture in the vanguard.
- Fanuc, Kuka, Fujitsu and SAP will point to their use of inter-connected robots, machine tools and assembly lines with machine learning based intelligence from the cloud in their version of the 'factory of the future'.
- Of particular interest in 2018 will be the ability of GE Digital to offer advanced predictive maintenance for jet engines, locomotives, trucks and drones from the cloud.
- Cyber-attacks will remain the biggest risk within the Industrial Internet. Cisco and IBM will emerge as leaders in industrial-grade cybersecurity, partly through the use of blockchain-based smart contracts.

Winners

- **Infrastructure-as-a-Service:** Amazon, Microsoft, IBM, Google
- **IIoT Platforms:** GE, IBM, SAP, Siemens, Emerson Electric, Cisco, Fujitsu
- **Cybersecurity:** IBM, Cisco, KeyW
- **Sensors & microcontrollers:** STMicro, Microchip, NXP, TDK, Rohm, Sensata, Infineon, Bosch
- **Connectivity:** Qualcomm, Qorvo, Skyworks, Cisco, Nokia, Ericsson, Huawei.
- **Analytics:** SAP, Oracle, Splunk, Software AG.
- **Industrial AI:** IBM, GE, SAP, Softbank, Fanuc, Toyota, Honda

Further reading

See Tech & Media Trends 2018 (p21-27 on industrial automation), Industrial Internet, Industrial Internet, and China Tech.

15. Ambient commerce (IoT)

Definitions

- **Ambient commerce** refers to the act of offering or delivering goods and services to customers – whether at home, in a factory or a shop – before they order them, based on an analysis of past spending patterns and sensors to detect customer location, customer inventory levels and perhaps even mood.

Predictions

- Two big problems that retailers around the world will aim to solve in 2018 will be securing customer loyalty at the same time as cutting costs. Meanwhile, customers want to save money and save time.
- Retailers will use more cameras to track shoppers and a host of computer algorithms to analyse their every gesture in a bid to predict their behaviour and make their shopping experience more efficient.
- In Amazon Go, a pilot futuristic convenience store in the company's Seattle campus, this kind of predictive analysis is used to tally up the customer's receipt when they exit. Amazon calls this 'just walk out' shopping, allowing customers to bypass any form of checkout counter, thus eliminating queuing.
- Amazon, which already has 75% of the intelligent speaker market (outside of China) with its Echo home hub, will use a combination of computer vision (a camera inside a fridge, say) and machine learning to pre-order groceries for its customers.
- The key AI technologies that leaders in ambient commerce depend on are video recognition and context awareness. Since this is difficult to master at scale, 2018 is likely to see a lot of investment in this space.
- In 2018, Kroger, the largest standalone US grocery chain, aims to roll out cashier-free payment systems to 400 of its 2,700 stores which will allow shoppers to scan the barcodes of food on their smartphone as they walk through the aisles and pay at a self-service checkout machine on their way out.
- Alibaba's Hema and JD.com's 7Fresh – both supermarket chains owned by ecommerce giants – are doing even more advanced work in China. Alibaba is also looking at Kroger as a partner in the US.
- Advertisers like Google, Facebook or Groupon will also use sensor-fed ambient commerce ecosystems to direct ads or marketing offers to customers as they approach the relevant aisles in a supermarket.
- The gateway into this ambient commerce market will be controlled by the large cloud infrastructure players like Alibaba, Amazon, Microsoft or Alphabet.
- In 2018, ambient commerce will start to take off with pilot programs in supermarkets (where incoming customers will be identified and targeted with offers based on their profile) and in the home (where connected fridges, for example, will re-order items such as milk when they detect stocks are low).
- Five years down the line, these marketing offers may flow directly into a consumer's augmented reality glasses or even contact lenses.

Winners

- **Ambient commerce platforms (Tier 1):** Amazon, Alibaba
- **Ambient commerce platforms (Tier 2):** Alphabet, Ocado, Baidu, Facebook, Tencent, Microsoft, IBM
- **Advertisers well positioned to profit from ambient commerce:** Facebook, Google, Tencent

At risk

- **Physical supermarket:** Tesco, J Sainsbury, Ahold, Carrefour, Marks & Spencer, Kroger, WM Morrison
- **General retailers:** Sears, Target, Macy's, Wall-Mart JC Penney, Kohl's, Costco.

16. Medical Internet of Things (IoT)

Definitions

- The **Medical Internet of Things** refers to the monitoring of body parts by connected sensors and medical devices which feed data about a patient's vital signs directly to a doctor or a smartphone app.
- **MedTech** refers to the use of digital hardware technology, sensors, optics, data analytics, and AI to simplify, enhance and 'personalise' the prevention, diagnosis, monitoring and treatment of diseases.

Predictions

- Connected biosensors – whether wearable, embedded or ingested – will profile and monitor an individual's physicochemical make-up and help precision target drug treatments.
- As a result, manufacturers of traditional medical diagnostics equipment, such as MRI scanners, will have to modernise to focus more on mobile devices that achieve similar diagnostic results.
- The big names in electronic patient record (EPR) systems – Cerner and McKesson – will spend much of 2018 upgrading their healthcare IT systems to handle more complex data in the Cloud.
- In the wake of 2017's WannaCry ransomware attacks on hospitals some IT providers, like IBM, will look to rebuild EPR systems from scratch using blockchain technology.
- In 2018, Medtronic, an incumbent, will unveil its new surgical robot, aimed at undercutting the market leaders, Intuitive Surgical and Stryker.
- By 2019, Verb, the 2014 joint venture between Google and Johnson & Johnson, will launch a 4.0 surgical platform that integrates AI, visualisation and advanced instrumentation.
- Meanwhile, Google's joint venture with Novartis to develop a smart contact lens to check blood glucose levels looks like it has stalled.
- In 2018, Microsoft will become a MedTech player as its HoloLens mixed reality glasses gets adopted in medical training and possibly surgery. The company also has a healthcare AI centre in Cambridge.
- Similarly, Apple will make healthcare a priority in 2018 with a range of wellness apps and a reboot of Healthkit, Apple's iOS framework for sharing health and fitness data on apps.
- After a period of excess hype, healthcare wearables – for monitoring vital signs – will enjoy a comeback.
- In 2018, IBM will drive to further prove the leadership of IBM Watson in the medical field ranging from oncology to WatsonPaths which synchronises and links physicians to clinical data and medical records.
- M&A targets include Orion Health, Allscripts, AthenaHealth, Intersystems and Quality Systems.

Winners

- **Medical sensors:** STMicroelectronics, First Sensor, TE Connectivity, Murata
- **Mobile Health:** Apple, Baidu, Google, Medtronic, Qualcomm, Samsung, Alivecor, iCarbonX, Garmin,
- **Health IT Systems:** Alphabet, GE, IBM, Orion Health, Allscripts, Intersystems, Quality Systems, athenahealth
- **Robotics:** Medtronic, Cyberdyne, Intuitive Surgical, Stryker, Verb (Google / Johnson & Johnson)
- **Blockchain:** IBM, BlockCypher, Gem, MedRec, Factom and Tierion

At risk

- **Pharmaceutical companies:** AstraZeneca, GSK, Pfizer, Roche, Novartis, Amgen, Johnson & Johnson
- **Incumbent EPR systems:** Cerner, McKesson
- **Incumbent medical equipment makers:** Siemens, GE, Philips, Johnson & Johnson, Shinva, Smith & Nephew

Further reading

- See MedTech

17. Genomics

Definitions

- **Genomics** refers to the science of reading and analysing the DNA (or Deoxyribonucleic acid) that stores genetic information in all living cells.
- **Precision medicine** refers to the concept of medical decisions, practices and products being tailored to the individual patient, often using genetic profiling.

Predictions

- Medicine is changing. For hundreds of years, the key drivers of progress were biology and chemistry. In future, they will be data science and software.
- Medical diagnoses in future will be cheaper, faster and more accurate, thanks to precision medicine made possible by genomics.
- Following the FDA's landmark decision in 2017 to reverse its 2013 ban on genomics company 23andMe, 2018 will see a surge in consumer genomics services that enable individuals to buy partial genetic profiles of themselves that signal propensities to certain medical conditions like cancer.
- The cost of genome sequencing – which fell from $14m in 2006 to $1,500 by 2015 – will fall to under $600 by end 2018, making it affordable to vast swathes of the developed world population, opening up a prospective consumer genomics market of up to $7bn in short order.
- By 2019/2020 whole genome sequence tests are forecast to cost $500-$600 and for the results to come back in a few weeks.
- Over $1 billion has been invested in funding consumer genomics start-ups such as 23andMe, Pathway Genomics, Counsyl, and Helix attracting investment of $50m to $300m each.
- China's Beijing Genomics Institute (BGI) will continue to lead the way as the world's largest gene sequencer while the US's Illumina will remain the leader in making gene sequencing equipment. But BGI will face mounting competition in China from Novogene and Berry Genomics.
- Google, Microsoft and BGI will create more genome clouds for specific illnesses – like cancer or diabetes – enabling them to one day offer vastly improved diagnostics and precision targeting of therapies.
- In 2018, China – led by BGI – will forge ahead in gene sequencing, unhindered by the ethical, legal and regulatory issues facing consumer genomics companies in the West. Witness the successful cloning of monkeys in China, announced in January 2018.
- Regulators will consider restricting insurance companies from using genomics to discriminate against sickness-prone people in favour of genetically health ones.
- China sports what many consider to be the most interesting genomics-cum-healthcare company in the form of Tencent backed iCarbonX, which is building what it claims will be a comprehensive online platform that bundles genetic profiling with behavioural analysis and self-monitoring. It could play a pivotal role in the implementation of China's Social Credit System mandated to come into force by 2020.
- In 2018, Google DeepVariant will improve its ability to find small variations in DNA sequences by converting strands of DNA letters into images that computers can recognize and applying deep learning techniques to sift through and learn from large datasets.

Winners

- **Gene sequencing equipment:** Illumina, Oxford Nanopore
- **Gene sequencing:** Shenzhen BGI, Invitae, 23andMe, Pathway Genomics, Counsyl, Helix, Editas Medicine, Human Longevity, Color Genomics, Sophia Genetics, Global Gene Corp, Gardant Health

At risk

- **Pharmaceutical companies:** AstraZeneca, GSK, Pfizer, Roche, Novartis, Amgen, Johnson & Johnson

Further reading

See MedTech and China Tech.

18. Silicon photonics

Definitions

- **Silicon photonics** is an emerging technology that combines laser and silicon technology on the same chip: it allows the transfer of data between chips using rays of light.

Predictions

- Silicon photonics – the marriage between chips and optics – is a game changing technology that is likely to disrupt the data centre and autonomous vehicle industries in a significant way when it is commercialised in 2019 and 2020.
- Photonic chip technology is still in beta development. But when it is ready, it will mean that the optical connections between servers and network equipment in a data centre are both faster and cheaper.
- It allows data to be transferred between computer chips by optical rays, which can carry far more data in less time than the electrical conductors traditionally associated with semiconductors.
- By allowing chips to communicate with each other using rays of light, data centres can dramatically reduce latency, improving customer experience.
- In theory, silicon photonics will enable computing at the speed of light.
- Silicon photonics will also make 3D sensors – used for driverless cars or augmented reality systems in mobile phones – cheaper and more accurate.
- Several emerging technology cycles – including drones, augmented reality, robotics and the Internet of things (IoT) – carry 3D sensing systems as key components. These 3D sensors are getting smaller and more powerful. Many will soon operate using lasers and silicon photonics.
- At present, multi-chip solutions are needed for detect, laser and logic but Intel (among others) is in the vanguard of offering single die silicon photonics. They have begun to show up in 2018 and will scale up in 2019.
- Intel has been working on this for 16 years and has now deployed it at beta stage with Barefoot Networks' optical switch, and is within sight of applying semiconductor industry style mass production.
- Intel will have lots of competition from, among others, Finisar, Lumentum, Ciena, Luxtera, Mellanox, Oclaro, Cavium, Infinera, NeoPhotonics and Acacia Communications.
- Barefoot Networks is the ground-breaking start-up using silicon photonics (based in Intel's technology) in the field.

Winners

- **Chips:** Intel, Mellanox, Barefoot Networks, Innovium, Cavium (Marvell)
- **3D sensors:** STMicro, AMS, Infineon, Samsung Electro-Mechanics, Lumentum, Finisar, Renesas, First Sensor, Sensata, Melexis, InvenSense (TDK)
- **Photonics leaders:** Acacia Communications, NeoPhotonics, Oclaro, Mellanox, Barefoot Networks

At risk

- **Networking chip makers:** Broadcom
- **Optical networking equipment incumbents:** Applied Optoelectronics, Infinera, Lumentum

Further reading

See Data Centres

19. 5G

Definitions

- **5G** refers to the fifth generation of cellular technology standards that are based on 3GPP specifications and releases approved by the ITU which promise data speeds at least 100 times faster than 4G (at least 20Gbps for downloads), lower latency (less than 1 millisecond), with the capacity to serve huge populations of devices (over 1m devices per square km).

Predictions

- Standards for 5G have not yet hardened, but the first commercial 5G networks could begin to be rolled out in 2019 – probably in South Korea, Japan and China – if global standards are agreed during 2018.
- A key milestone in the roadmap to a global 5G standard is the approval of the 5G New Radio (NR) specification, expected in June 2018.
- AT&T will launch mobile 5G in 12 markets and Verizon in 5 markets by end 2018 – although only with a 'puck' (i.e. a small modem) as there will not be many 5G handsets by then.
- Korea Telecom, using technologies from Intel, Ericsson and Samsung, demonstrated a trial 5G service at the 2018 Winter Olympics in Pyeongchang. SK Telecom also showcased its 5G technology. Both have thus become front-runners in the global 5G rollout race.
- 5G is likely to advance much more slowly worldwide than the hype today suggests, reaching just 10% global penetration by 2024, according to GSMA Intelligence.
- In Japan, China and South Korea, where governments have a big say in telecom operator capex budgets, 5G rollout will be much faster than in market economies like the US and Europe.
- Given the strategic importance of 5G to the world's leading industrial economies, reports are circulating that some governments – even the US government – are considering building a nationalised 5G network. We think this is unlikely to happen.
- Huawei and ZTE will continue to be shut out of the US telecom equipment market on so-called national security grounds.
- In the early phases of 5G rollout, the technology may be used for fixed wireless networks (i.e. connecting two fixed locations wirelessly), which offer a cheaper way to roll out fixed broadband than digging up roads.
- Verizon says it will introduce 5G fixed wireless in around 5 markets by end 2018. This may give it a competitive advantage against entrenched cable TV companies when it comes to selling broadband Internet access.
- Those countries that roll out 5G networks first will have competitive advantage in many next-generation technologies such as autonomous vehicles, genomics, artificial intelligence and augmented reality.
- On the operator side, the perceived leaders in the 5G arena are Korea Telecom, SK Telecom and LG Uplus in Korea, NTT DoCoMo, Telstra in Australia and AT&T, Verizon and T-Mobile in the US.
- By contrast, in Europe, there are no Tier 1 contenders.
- 5G technology will increasingly become the subject of trade wars. President Trump's administration blocked the Broadcom bid for Qualcomm, almost certainly on national security grounds.

Winners

- **Radio chip leaders:** Qualcomm, Intel
- **Telecom operator leaders:** Korea Telecom, SK Telecom, LG U-Plus, Telstra, NTT DoCoMo, AT&T, Verizon, T-Mobile USA
- **Telecom equipment leaders:** Huawei, ZTE, Nokia, Ericsson, Samsung

Losers

- **Telecom operator laggards:** BT, Vodafone, Telefonica, Deutsche Telekom, Orange, Telecom Italia and many other European operators

20. Robotics

Definitions

- **Industrial robots** are typically used in factories to automate parts of the manufacturing process.
- **Collaborative robots** (co-bots) are designed to assist humans complete certain tasks.
- **Service robots** help people complete non-industrial tasks such as cleaning, delivering or packing.
- **Personal robots** (a.k.a. companion robots or social robots) do tasks for individuals and are often voice or touch activated or controlled by tablets.
- **Software robots** replicate the routine work humans often do in front of computer screens.

Predictions

- Collaborative robots will be the fastest-growing robot sub-sector. According to data from the International Federation of Robotics, the size of the segment will more than double in 2018 (to $1.4bn from $680m in 2017) and reach $9.2bn by 2025. Co-bots have, up to now, been most popular with SMEs but will increasingly meet offerings from large industrial companies.
- There will be increased coverage of the 'factory of the future', with the likes of Fanuc, Kuka and Fujitsu demonstrating use cases for interlinked robots orchestrated from the cloud with AI.
- In 2018 there will be more cloud-based robot services (RaaS) available, with Google, IBM, AWS, Huawei and others developing robot orchestration and API services, integrated with AI, on their cloud infrastructure. These will be used across the robotics sector, from industrial robots built by the likes of Fanuc, to co-bots like Rethink Robotics' Sawyer, social robots such as Softbank's Pepper and home devices (e.g. LG's Hub).
- Advances in voice technology, AI, sensors and cloud services will combine to enable a growing number of intelligent, sentient robots. Much of the demand will come from China and Japan and will span generations, from tech-savvy urban millennials to elderly people living alone.
- A rising theme for 2018 will be artificial emotional intelligence (AEI). Pioneered by the likes of Softbank's Pepper robot, this technology will be applied to an increasingly diverse range of products, with both Honda and Toyota selling robots that sense a driver's emotions and moods.
- Virtual therapists are already here (see, for example, Stanford University's Woebot), but 2018 will see the introduction of advanced therapeutic personal robots outside the confines of the smartphone.
- The big names in MedTech will attempt to grab a share of the surgical robot segment, as assistive robot surgeons become more advanced and incorporate AR and cloud support. Success is not guaranteed, however – e.g. Medtronic recently announced that the first use of its surgical robot on humans, originally planned for this year, would be delayed until 2019.
- Sexual surrogate robots will garner significant attention in 2018, as they become increasingly human-like. Abyss Creations has added a voice-controlled AI engine capable of learning to its sex doll range.
- There will be a major debate over the development of autonomous weapons, fuelled by a fear of 'killer robots'. At an upcoming meeting of the UN, several countries are expected to call for a total ban.
- The use of software robots will begin to measurably impact the office-based workforce in 2018, with administrators and sales-related jobs taking the brunt of the disruption, either in terms of the availability of jobs and/or wage compression.

Winners

- **Industrial robots:** ABB, Kuka (Midea), Fanuc, Kawasaki, Yaskawa
- **Chinese robotics:** HollySys, Siasun, Estun Automation, Ningbo Techmation (E-Deodar).
- **Components:** Cognex, Rockwell, Harmonic Drive, Nabtesco, Daihen, Nachi Fujikoshi, Keyence.
- **Co-bots:** Teradyne (Universal Robots), Rethink Robotics (unlisted), Fetch Robotics (unlisted).

Further reading

See Robotics (Vol. III) and China Tech.

21. China

Predictions

- Having emerged from last year's Communist Party congress with his power enhanced, 2018 will see increased focus on President Xi Jinping's over-arching priorities, most notably Made in China 2025.
- The 'Made in China 2025' initiative will continue to drive China's goal of achieving independence from foreign technology suppliers and make its mark in high tech markets: the main sectors involved are AI, semiconductors, robotics, bio-genomics, batteries, avionics, NEV cars and buses.
- The main short-term danger for a still rampantly mercantilist China is an escalating tariff war with the US. In April 2018, the Trump administration announced plans to impose 25% tariffs on $50bn of Chinese goods, specifically targeting industries that stood to gain from the Made in China 2025 program (including semiconductors and industrial robots). China promptly hit back, and the clash has the potential to escalate if not resolved swiftly, jeopardising a trading relationship valued at $650bn.
- AI will be a key area for China in 2018 and beyond, with the country aiming to be the world leader by 2030 with an AI industry worth $150bn. The government is investing heavily in the plan, banking on advanced technology to compensate for a slowdown in manufacturing growth.
- Much of the drive behind developing native AI prowess in China is the evolution of the Social Credit System (SCS), which will be mandatory by 2020, and will be the world's most advanced population tracking, monitoring and management system.
- China's tech companies, spurred by the State, are also pouring money into AI and 2018 will see further investment in infrastructure, including data centres and research facilities.
- The recent AI hiring boom is set to endure and there will be further examples of sought-after talent from Silicon Valley heading to China (or, as in the case of Qi Lu – who joined Baidu from Microsoft in 2017 – returning home from the US).
- VC money will continue to flow into Chinese AI start-ups, further illustrating the prospects for China's AI industry. Last year almost half the global investment into AI start-ups went to China, with facial recognition and AI chips particularly popular.
- The $100m in funding raised by Cambricon Technologies highlighted the interest in AI chips, which are used in cars, drones and robots where low latency, security and localisation are vital.
- In facial recognition – vital to surveillance under the SCS – the trail is being blazed by Chinese start-ups like Face++. Facial recognition has also carved out a niche in banking and financial services, but there is plenty of potential for expansion into areas such as retail and autonomous vehicles.
- The automotive sector is central to China's push for AI domination. Baidu recently launched an updated version of its Apollo autonomous driving platform and continues to push the software as 'the Android of the autonomous driving industry'.
- Ride-hailing firm Didi Chuxing raised an extra $4bn in funding in late 2017 and plans to spend part of the money on AI talent and technologies. SenseTime has developed impressive moving object recognition technology and is working with Honda on autonomous vehicle tech.
- Virtual reality (VR) will be a major focus for China's Internet platform giants (Baidu, Alibaba and Tencent) in 2018. Rather than focusing on developing hardware, the three Chinese firms are creating platforms and content. Baidu's iQiyi subsidiary, intends to create the world's largest Chinese-language VR platform, while Alibaba is building out its VR shopping mall, Buy+.
- In semiconductors, China is determined to reduce its dependency on foreign suppliers (particularly the leaders in flash memory: Samsung; SK Hynix; Micron; and Toshiba), but a world-class native industry, or even evidence for one, is unlikely to emerge in 2018.

Winners

- **High tech Chinese companies:** BYD, HollySys, Estun, Siasun, AAC Tech, GoerTek, SMIC, Huawei, Alibaba, Tencent, Baidu, BGI, Dawning, Inspur, Lenovo, iFlytek

Further reading

See 'Tech Wars 2020: US vs China' and 'China Tech'.

22. Sharing economy

Definitions

- The **sharing economy** involves the exchange of 'idle' assets (e.g. cars, rooms, offices) and resources (e.g. labour) in both local and global contexts.
- The **gig economy** puts time-starved urban professionals in touch with job-starved workers via an app, allowing low-paid workers to find part-time jobs on demand.

Predictions

- There will be considerable interest in which of the sharing economy 'decacorns' (private companies valued at $10bn or more) will IPO in 2018. Uber and Airbnb have both pledged to hold off until 2019, but we could still see IPOs from Didi Chuxing, Ant Financial, Lyft and WeWork.
- The fastest growing sectors of the sharing economy in 2018 will be transport, home sharing, office-space sharing and finance. Demand is being driven by a combination of consumer trends, including the shift away from owning 'stuff' to doing things (characterised as a move from 'peak stuff' to the 'experience economy') and the 'shift to thrift'.
- Governments will begin to clamp down on abuses of the gig economy by clarifying definitions of employment status and classifying 'self-employed' gig economy workers (particularly those working for companies over a certain size) as employees, with rights to the minimum wage and holiday pay. This will impose higher costs on sharing economy companies like Deliveroo.
- M&A activity will heat up in 2018. Examples to look out for include automotive companies acquiring ride-hailing and autonomous driving start-ups. On the hospitality side of the sharing economy, French hotel chain Accor has completed a string of takeovers (including OneFineStay and Squarebreak) and has funds available following the sale of a majority stake in its property business for €4.4bn.
- Throughout 2018, investors will be watching to see how the big names in the sharing economy use their platforms and the data they generate to move into adjacent markets. The extent to which transport-as-a-service giants like Uber are able to vertically integrate and/or clinch lucrative contracts with OEMs will be vital to their future success.
- Chinese ride-hailing firm Didi Chuxing recently overtook Uber as the world's highest-valued start-up and it is now in direct competition with its US rival to conquer the global market. The initial step for Didi is Latin America, with the company's new Mexican operation and its Brazilian acquisition of 99, its first direct forays outside China.
- Uber is shoring up its position in the US and Europe but will face growing competition from Didi in these strongholds.
- A further advantage for Didi is that its domestic market, China, is on track to become the biggest sharing economy in the world, growing at an annual rate of 40%. Virtually anything can be part of the sharing economy in China, including bikes, umbrellas and even battery packs.
- China has been at the forefront of the bike hiring market, but the saturated sector will undergo a shake-up in 2018. Many companies will go bust and others will be commoditised, with Didi emerging as the winner ahead of the likes of Bluegogo and Ofo.
- A growing number of homeowners will generate their own electricity (typically using solar panels) and sell the surplus power back to the grid. Home retailers such as Ikea are already seeking to benefit from this trend by stocking the necessary equipment, while the energy companies will seek to offset falling revenues by offering free installation in exchange for fixed-term contracts (in the UK, EDF is offering to install a free solar system if customers agree to buy the subsidised power it generates for 20 years).

Winners

- **Ride sharing apps:** Google Waymo, Didi Chuxing, Uber, Lyft, Grab, Ola, Zoox, Go Jek
- **Auto industry players:** Tesla, NuTonomy (Aptiv), Cruise (GM)
- **Bike sharing:** Didi Chuxing, Mobike, Ofo, Bluegogo
- **Delivery companies:** Deliveroo, Delivery Hero, GrubHub, Seamless, OLO

23. Regulation

Definitions

- **General Data Protection Regulation (GDPR)** is a European law which comes into force on 25 May 2018 for all companies operating in the European Union. It gives citizens enhanced powers to see and control their personal data, with fines for non-compliance of up to €20m or 4% of global turnover.

Predictions

- In 2018, governments around the world will, one by one, deliver an ultimatum to the larger Internet ecosystems: adopt a stronger 'duty of care', or face tighter state controls.
- Across the world many more people in 2018 will think of big tech firms as BAADD (big, anti-competitive, addictive and destructive to democracy).
- Growing public concern over widespread abuse taking place on Internet platforms – revenge porn, fake news, political interference or promotion of terrorism – will force regulators to police the Internet better.
- The international legal system, based on separate national sovereignties, is struggling with its task of providing a framework for Internet governance, given the cross-border flows of online services.
- The EU's GDPR regulations on data protection and transparency – due to come into force by on 25 May 2018 – are widely taken as a model on how to proceed elsewhere.
- In 2018, regulators will clamp down on big tech companies in ten key areas:
  1. **Data privacy:** aimed at Internet advertisers who sell our personal digital information for a profit.
  2. **Data protection:** aimed at companies with poor data controls who run the risk of losing personal data through negligence.
  3. **Anti-trust:** aimed at Internet ecosystems that behave in an anti-competitive manner, but for whom current anti-trust laws do not work.
  4. **Tax avoidance:** aimed at tech companies who aggressively avoid local taxes by moving profits to low tax jurisdictions.
  5. **Legal status as a content platform:** aimed at online publishers who claim to be 'content neutral platforms' and therefore have no responsibility for monitoring the content published by their users.
  6. **Net neutrality:** aimed at heavy users of Internet bandwidth who have hitherto been shielded from paying the full costs for the Internet bandwidth they consume.
  7. **Anti-social behaviour:** aimed at online platforms who wilfully break the law and violate society's ethical norms by assisting terrorists, promoting pornography, and selling banned goods.
  8. **Obstruction of justice:** aimed at tech titans who refuse to help law enforcement agents investigating a crime by concealing evidence behind encrypted walled gardens under the guise of protecting their customers' privacy.
  9. **Copyright:** aimed at online web crawlers who profit from other people's copyrighted content.
  10. **Corporate governance:** aimed at ensuring the management (i.e. founders) of big tech companies are held more accountable, perhaps by outlawing dual class share structures or forcing boards to appoint independent chairmen.

Winners

- **Traditional publishers:** New York Times, News Corp, Daily Mail & General Trust, Bloomberg, Fairfax Media, Trinity Mirror, Sanoma
- **Traditional advertisers:** WPP, Interpublic, Publicis, Havas (Vivendi)

Losers

- **Internet ecosystems:** Amazon, Alibaba, Google, Facebook, Twitter

Further reading

See Tech Regulation, Tech and Media Trends 2018 (p107-110 on advertisers, p120-122 on TV broadcasters and p129-130 on publishers), Net neutrality,

23. (a) Net neutrality

Definitions

- **Net neutrality:** the principle that Internet service providers (ISPs) should not discriminate against any type of Internet content, no matter how much they clog up telecom networks. In December 2017 the FCC (America's telecom regulator), scrapped US net neutrality rules claiming they were a market distortion.
- **Codec:** a device or program that compresses data (such as video) to enable faster transmission through a telecom pipe and then decompresses it when it has reached its destination.

Predictions

- With the overturn of net neutrality rules, the balance of power across the Internet value chain will shift markedly from Internet companies, like Google and Netflix, to telecom operators and cable operators, such as AT&T, Verizon and Comcast.
- ISPs will benefit because they will be allowed to charge commercial rates to Internet companies who clog up their networks. Currently, they take a loss on corporate customers like Netflix who hog Internet bandwidth.
- Moreover, these ISPs will invest in upgrading their broadband networks, because their returns on investment will suddenly be higher. This means telecom equipment companies like Cisco and Ericsson will benefit from a new capex cycle.
- The big losers will be Internet companies who use a lot of bandwidth, such as Netflix. Other high Internet bandwidth users (like Google, Amazon, Facebook and Hulu) will also see costs rise.
- Some European and Asian countries can be expected to follow the US's lead on net neutrality, partly on protectionist grounds. This would allow their domestic telecom operators to charge higher prices to heavy Internet bandwidth users. Again, the biggest losers would be US Internet companies.
- In 2018, the Internet will be cordoned off bit by bit following a surge in state-sponsored cyber-attacks against the backdrop of a new Cold War involving the US, Europe, Russia and China. Authorities – and not just authoritarian ones – will have the excuse they need to tighten up security and reshape the Internet in the process.
- President Trump will continue to make noises about 'closing the Internet where the US has enemies'. The removal of net neutrality is consistent with this global trend.
- If the scrapping of net neutrality does lead to Internet companies like Facebook and Google being charged in proportion to the bandwidth they consume, the technology sector is likely to invest heavily in codecs. New codecs will be developed which compress video and other data more efficiently so that they consume less Internet bandwidth on transmission.
- The tech giants will most likely develop their own proprietary codecs, making services like Apple's FaceTime even more closed, enhancing the walled gardens of the world's big Internet ecosystems.

Winners

If net neutrality does not return in the US, the winners and losers will be as follows:

- **US Internet service providers (who can charge more to heavy bandwidth users)**: AT&T, Verizon, Comcast, Charter, T-Mobile USA and Softbank.
- **Global telecom equipment makers (who may benefit from a Capex boom):** Cisco, Juniper Networks, Ericsson, Nokia, Finisar, Lumentum, Viavi, Infinera, Oclaro, Applied Optoelectronics and others.
- **European Internet service providers (who may copy the US's lead and charge US Internet companies more for bandwidth):** Deutsche Telekom, Orange, Telefonica, BT and others

Losers

- **Heavy users of Internet bandwidth**: Netflix, Google YouTube, Amazon Video and Facebook.

Further reading

See Net neutrality

23. (b) Tax avoidance

Definitions

- **Tax evasion:** the illegal non-payment or underpayment of tax.
- **Tax avoidance:** aggressively avoiding tax by moving digital assets and intellectual property to low tax jurisdictions.

Predictions

- In 2018, the political will to ensure that Internet companies pay their 'fair share' of taxes is strong.
- The mounting pressure has already resulted in some Internet giants re-visiting their revenue booking practices, and others will follow suit in 2018.
- For example, late last year, Facebook announced plans to change the way it sells advertising so that revenues are booked locally, where the sale took place, rather than at its international headquarters in Ireland, where corporate tax rates are up to 50% lower.
- Many countries will attempt to increase the amount of tax they generate from large technology companies by implementing taxation based on local revenues, rather than profits.
- An EU initiative is proposing that a tax of between 2% and 6% of turnover be imposed on US technology groups such as Google and Facebook.
- Revenue taxes would be particularly devastating for high-growth technology companies like Amazon, which are more concerned with gaining market share than generating short-term profits.
- Over the next 12 months, effective tax rates on overseas earnings of US Internet companies will likely rise from current typical levels of under 4%.
- EU authorities will also continue their efforts to both recover unpaid taxes from the tech titans and curb their monopolistic power. Both Amazon and Apple have already been ordered to repay significant amounts, while the EU has warned that Google's monopolisation of the search engine market could lead to it being broken up.
- Most US tech companies will benefit from lower domestic tax rates under the Trump administration, but some – particularly Amazon – may be aggressively pursued for tax avoidance.
- President Trump has been very open about his dislike of Amazon and the US Supreme Court is currently considering a case that could give states more power to collect sales tax on online retailers.
- Despite gaining the most from the recent tax overhaul in the US, the country's biggest tech companies have so far refused to promise specific new domestic investment or jobs. This reluctance will continue throughout 2018, even though the changes to the treatment of offshore cash holdings were viewed by the White House as a driver for onshore job creation.

Losers

- **Tech companies with large overseas earnings:** Apple, Amazon, eBay, Facebook, Google, Qualcomm, Cisco and Microsoft.

24. Software defined networking

Definitions

- **Software defined networking technology** refers to a new telecom standard in which the value shifts from hardware (e.g. routers and switches) to software.
- **White box:** hardware such as a laptop, server, switch or router manufactured by an end user or by an OEM sub-contract manufacturer to an OEM's or end-user's design and specification.
- **Original design manufacturer (ODM):** a company that designs and manufactures a product as specified by a prime contractor that is usually rebranded by another firm for sale or operates as a 'white box' within the contracting firm's IT infrastructure.

Predictions

- 2018 will see a further extension of the ODM/white box model beyond PCs, laptops and smart phones and into the enterprise IT stack.
- Even the most advanced servers, switches and routers can now be built from merchant line chips, as opposed to the proprietary custom chips that power the costly big, closed 'black boxes' from the legacy vendors such as Cisco, HPE, IBM and Dell.
- These 'black box' server and network equipment vendors will continue to lose market share, margin and customer lock-in power in 2018 having been ravaged by 'white boxes' since 2016. In 2018 they will accelerate their transition from a hardware to a software focus, but in the context of a progressively open-source enterprise IT world.
- The leading ODMs (Foxconn, Accton, Inventec, Wistron, Quanta), which have all accumulated considerable engineering skills and vital IP, will benefit from new lines of 'white box' business.
- The Facebook-initiated Open Compute Project (OCP), which now involves virtually every major hardware vendor and is modelled on the Linux/open-source community model, will yield a flurry of OCP compliant network equipment for 'white box' treatment in 2018, and will drive the prospect of radical change in the enterprise computing market and value chain.
- The IT industry supply chain will increasingly reflect the rise of the 'white box' and the dominance of open source software.
- 2018 will see the emergence of supply chains that are much closer to those of smart phones than the 'mainframe' style supply chains used in the world's major data centres. Hardware will predominantly comprise arrays of 'bare metal' devices based on the same svelte commodity chips that form the cores of smart phones and laptops.
- The Internet giants - Google, Facebook, Amazon, Apple, Microsoft, Tencent, Alibaba, Baidu - will further sub-contract out designs for their IT farm equipment to ODMs to save costs (in the range of 20% to 30% vs. the brand vendor approach, according to AWS) and to tweak and enhance their performance.
- Amazon is leading the do-it-yourself movement and even makes its own Annapurna networking chips. Facebook and Google have long designed their own servers and had ODMs make them.
- The de-verticalization of the high-end of the IT industry will accelerate in 2018.
- 2018 will see the arrival of the first 'white box' supercomputers for AI applications, with Wistron and Quanta most likely first due to an arrangement they (and other Taiwanese ODMs) struck with Nvidia last summer over access to Nvidia reference architectures and design guidelines.

Winners

- **SDN leaders:** Ciena, Big Switch Networks, Juniper Networks, Pluribus Networks, VMware
- **Leading ODMs:** Foxconn, Accton, Inventec, Wistron, Quanta

Losers

- **'Black box' server and network equipment vendors:** Cisco, HPE, IBM, Dell.

Further reading

See Data centres, Software defined networking

25. Electric vehicles

Definition

- **Electric vehicle (EV):** a vehicle that is propelled entirely by batteries rather than an internal combustion engine (ICE). EVs are sometimes categorised alongside hydrogen or compressed air powered vehicles as new energy vehicles (NEVs).

Predictions

- 2018 will be a tipping point for EVs with the ramp up of production of the Tesla Model 3 (launched in July 2017) and GM increasing production of the Chevy Bolt to meet growing demand.
- Also expected and pre-announced for 2018 is an electric Audi SUV, known as the E-tron. This is particularly significant as, for the first time, 2018 will see global sales of SUVs matching those of passenger sedans and hatchbacks (according to data from JATO).
- In 2019 Volvo, owned by China's Geely, will only make EVs.
- Toyota is investing heavily in hydrogen cells as an alternative to battery propulsion but is having to solve the problem of the high cost and tight regulation of hydrogen refuelling stations versus with grid-based electrical battery recharging.
- China is the world's largest and fastest-growing EV market, but it is also highly protected. Of the 200 Chinese companies that have announced EV manufacturing plans, a significant proportion will drop out in 2018.
- China will continue to fiercely protect its native industry via a mixture of tariffs, the insistence on the creation of JVs as a prerequisite for foreign firms to sell into the Chinese market (hence the current exclusion of Tesla) and a government diktat that only 'certified' batteries (i.e. those made by Chinese battery makers) can be used in EVs made in China.
- There will also be a host of offerings on Alibaba of cheap EVs in China as people use buying an EV as a way of leapfrogging the costly, chancy and protracted business of getting a license.
- The global market for EVs (45% of which is in China) is not forecast to move much beyond 1% of the total market for new cars in 2018, with 2025 widely forecast as the industry's inflection point. That's when EVs are forecast to account for 25% of new car sales, with China continuing to lead the way.
- For now, take-up both inside China and beyond will be driven by a combination (in varying permutations) of tight government regulations over pollution, buyer subsidies, central and provincial schemes to 'nudge' EV purchases, next generation batteries that offer much more 'range per buck', and the cumulative impact of scale economies and improvement engineering in production.
- 2018 will see much discussion of when purchase subsidies will be phased out in the US, EU and China. The process is underway, and the impact of their withdrawal will impact sales. When they were cut by 20% in China early this year, BYD's EV sales fell by 20%. At current levels, Beijing is still on track to spend $60bn on subsidies through 2020.
- As always, except more so in 2018 than in 2017, there will be major question marks over Tesla's ability to continue raising funds from its shareholders – with probably another $500m required by mid-year 2018. The company may be taking in 1,800 orders a day on top of the near 500,000 pre-orders already for the Model 3 but how it copes with what CEO Elon Musk calls ''production hell' is still a relatively open question. Tesla made 84,000 EVs last year and is targeting 500,000 this year.
- There are signs that battery manufacturers are shifting away from cobalt, their most popular metal in 2017, in favour of nickel. This has been prompted in part by nickel's ability to provide greater energy density, but also by the rising cost of cobalt and its inherent supply risk (most of the world's cobalt comes from the Democratic Republic of Congo, which has been beset with violence and political unrest).

Winners

- **Electric vehicle makers:** BYD, Byton, Tesla, Geely
- **EV Battery makers:** Panasonic, Samsung SDI, LG Chem, CATL

At risk

- **Leading ICE vehicle makers:** VW, Toyota, GM, Ford, FCA, Nissan, SAIC, BAIC Motor

26. Batteries

Definitions

- **Lithium-ion batteries:** Widely used in laptops, smart phones, other consumer electronics goods and recently in electric vehicles (EVs) and energy storage packs. They involve a lithium cobalt cathode and a graphite anode. They are prone to short circuit and explode or catch fire in overheated environments, cramped conditions or if over-charged with volts.
- **Solid state batteries:** Lithium-ion batteries where the liquid electrolyte is replaced with a solid material (e.g. a lithium-metal separator foil). Solid state designs do not overheat or catch fire because their solid-state separators prevent short circuiting. This class of batteries is not sufficiently developed yet to replace current lithium-ion 'liquid' batteries.

Predictions

- A big story in 2018 will be how the demand side, particularly motor companies, works with the miners and refiners of lithium, cobalt and graphite to ensure an increased supply of consistent, pure, battery grade raw material product and head off a minerals bottleneck.
- Lithium and cobalt prices have surged over the last two years and are set to continue with second phase rises over the next 12-24 months. Investors have been on to the attractions of top refiner Albemarle and South American brine lithium mines (SQM and FMC) since 2016. Brine lithium is better than rock brine for refining.
- Nations are busy securing supply lines, led by China. China Molybdenum acquired the Democratic Republic of Congo's biggest cobalt mine, Tenke, in 2016 and Chinese interests have recently bought stakes in Argentinian and Chilean mining firms, including SQM. Expect more state-level investments in 2018.
- We also expect the auto companies and broad-based mining companies to make moves in this market in 2018.
- Any major advances in battery technology within the next five years will come from a breakthrough in solid state lithium batteries.
- In 2018 and beyond, special attention will be focused on Dyson and the development of its first EV (due to launch in 2020 or 2021). The car was expected to be based around solid state technology acquired and developed via Dyson's acquisition of Sakti3 in 2015, but recent reports suggest Dyson's debut vehicle may instead be powered by a lithium-ion battery.
- There will be regular stories throughout 2018 about imminent R&D breakthroughs yielding step changes in battery technology but nothing concrete will happen on this front during the year.
- 2018 will see the accelerating build out of battery cell gigafactories. Of the 14 gigafactories currently under construction, nine are in China with 20 more planned. 2018 will probably see Germany breaking ground on a major gigafactory.
- 2018 will see a lot of comment about China's drive to dominate the global battery industry, which obviously goes hand in glove with its push in EVs. The thinking in China is that, by 2025, there will only be 10 battery companies left with the top three controlling 60% of a $40bn global market.
- There are growing fears that China may do in batteries what it did in LEDs and solar panels: crash the market.
- Toyota is leading the drive towards hydrogen cells, while still investing in the use of battery technology. A current stumbling block is the cost and tight regulation of hydrogen re-fuelling stations versus grid-based electrical battery re-charging.

Winners

- **Leading Li-ion battery makers:** Panasonic, Samsung SDI, LG Chem, CATL
- **Lithium producers:** Albermarle, FMC, SQM, Lithium Americas, Jiangxi Ganfeng Lithium
- **Cobalt producers:** Glencore, China Molybdenum, Fleurette Group, Vale, Gecamines

27. 3D Printing

Definitions

- **3D printing, or additive manufacturing:** the process of joining materials to make objects from three-dimensional model data, usually layer upon layer.
- **Material extrusion, or fused deposition modelling:** the simplest and cheapest of the eight primary 3D printing technologies. It works by forcing a polymer through a nozzle like an ink jet printer.
- **3D bio-printing:** involves dispensing cells onto a biocompatible scaffold, layer by layer, to 'print' human tissue which can then be used to make human organs.

Predictions

- 2018 will be a significant year for additive manufacturing, now accepted as a technology that will transform manufacturing industry within the next 10 years and enable the mass emergence of the 'maker economy'.
- Big news in 2018 will come from HP and GE. Both are poised to bring 3D industrial metal printers to market. HP has highlighted the potential of its 3D printing business, while also making it clear that it will not be profitable for several years.
- GE's step up to metal printers is on the back of the acquisitions of Sweden's Arcam and Germany's SLM in 2016.
- There will be no dramatic instances before 2022 of pioneer users of the metal printing technology – specifically the aerospace and automotive industries - deploying it beyond prototyping and test part production, due to outstanding issues with the strength and durability of the materials used (i.e. thermoplastics).
- The entry of HP and GE, backed by a lot of patient capital, will fire up talk about a consolidation of the 'pure play' 3D printing sector, whose members (e.g. Stratasys, ExOne) have had weak performance ratings since becoming a hot stock market 'momentum play' in 2013/14.
- Despite some recovery in 2017 they have shown little bottom line improvement.
- There will be scores of headlines in 2018 about the widening use cases for additive manufacturing, including food, prosthetic parts - 98% of hearing aids are now 3D printed - and whole buildings.
- China will show 3D printed apartment blocks in 2018 and contractors in Dubai are 3D printing blocks that can form part of larger structures. Dubai's goal is for 25% of buildings to be 3D printed by 2030.
- US start-up Divergent, in partnership with French carmaker PSA, will make further waves with its Blade 'supercar' which has a 3D printed chassis. Blade got a lot of attention in 2017 at CES and at the LA Auto Show and will continue to make headlines in 2018, demonstrating how the auto industry could be 'democratised' and de-centralised.
- 2018 will see growing interest in the potential for printing with materials such as graphene and for nano-printing at the particle level. 4-D printing will also come on to the radar as a way of printing with 'smart' materials that can adapt to their environment.

Winners

- **3D printer manufacturers:** 3D Systems, Stratasys, GE, HP.
- **3D bio-printer manufacturers:** Organovo
- **CAD software:** Adobe, Autodesk, Dassault Systemes, PTC.
- **Design automation software:** Ansys, Synopsys, Autodesk, Dassault Systemes, PTC

Losers

Note: these are long term losers.

- **Old economy industries**: toys, textiles, apparel, healthcare, aerospace and logistics.

Further reading

See '3D Printing (Vol. II)'

28. Quantum computing

Definitions

- **Quantum computer (QC) systems:** built up from 'qubits' that exist in a state of superposition, straddling both 'on' and 'off' states and involve the phenomenon of quantum entanglement, under which separated particles in the same quantum state operate as one, with zero latency.
- **A qubit, or quantum bit:** a unit of quantum information which operates in a two-state quantum-mechanical system, unlike a bit.
- A **bit:** the smallest unit of data in a classic computer which is based on transistors and has a single binary value (either 0 or 1).

Predictions

- In 2018 the race between the 'big three' (IBM, Google and Microsoft) to reach quantum supremacy – the point at which a quantum computer can carry out calculations faster than a classical computer ever could - will intensify. Google has already edged ahead with Bristlecone, a chip featuring a record 72 qubits (the most advanced quantum chip prior to Bristlecone was made by IBM and had 50 qubits).
- At least one company will claim to have reached quantum supremacy in 2018, with the consequent publicity focusing on the potential of quantum computing to revolutionise industries like pharmaceuticals and financial services.
- There will also be numerous articles written warning of the potential threat posed by quantum computers – the Washington Post has already published one early in 2018 that describes quantum computing as 'more of an imminent threat than AI'.
- While examples of practical applications for quantum computing will remain thin on the ground, there will be notable progress in areas such as cybersecurity (particularly around using quantum cryptography for encryption).
- Quantum computers will also increasingly be used for research purposes – Volkswagen, for example, is using Google's technology to study areas such as traffic optimisation and machine learning processes for autonomous driving.
- IBM, Google and Microsoft will continue building up teams of mathematicians, quantum physicists and computer scientists. Google currently has a team of 65 working on quantum computing.
- Following the launch of the 2000Q quantum computer in 2017, D-Wave will continue to upgrade the system, with the latest improvements giving users greater control over the quantum processing unit.
- However, scientists will continue to question whether D-Wave's computers classify as genuine quantum computers citing the fragility and programmability of D-Wave's 'qubits', while acknowledging that D-Wave computers exhibit quantum behaviour.
- Outside of the big three, several other companies will make determined pushes into quantum computing during 2018, including Intel, Huawei, Fujitsu and HPE.
- There will increased activity among researchers playing with the 'quantum experience' via downloads of IBM quantum tools from the cloud and with D-Wave's quantum programming language Qbsolv.
- China, which already leads in supercomputing, obviously regards quantum computing as being of vital strategic importance. Work is already underway on the world's largest quantum research facility, at a cost of $10bn at the military university at Hefei, and has already pioneered the use of quantum encryption, based on the quantum entanglement phenomenon, in long haul fibre optic and satellite-based communications.

Winners

- **Leader in quantum computing:** D-Wave Systems, Google, IBM, Microsoft.
- **Secondary players in quantum computing:** Intel, Huawei, Fujitsu and HPE

Losers

- **High performance computer makers:** Cray, Cisco, Dell, HP Enterprise, Fujitsu, Lenovo, Inspur, Dawning

29. M&A

Predictions

- In 2017, the technology sector hit its highest deal count, measured by the number of deals completed.
- Some of the investment themes driving these deals included artificial intelligence, the internet of things, MedTech, 3D printing, internet TV, virtual and augmented reality, robotics, cloud computing and the race between the US and China to dominate the next generation of advanced technologies.
- Below we predict some of the TMT companies likely to be targeted by acquirers in 2018:
  - **Semiconductor niche players:** AMS, Microchip, Melexis, Cypress, Mellanox
  - **AI chips designers:** AMD, Nvidia, Xilinx
  - **Memory chip manufacturers:** Micron, Western Digital
  - **Sensors:** Sensata, First Sensor
  - **3D printer makers:** 3D Systems, Stratasys, Organovo
  - **Robotics:** iRobot, Teradyne, Cyberdyne, Stryker
  - **Telecom equipment:** Ciena, Lumentum, Finisar
  - **Healthcare suppliers:** Orion Health, Allscripts, AthenaHealth, Intersystems and Quality Systems
  - **CAD software:** Ansys, Autodesk, Cadence Design, PTC, Synopsis
  - **Cybersecurity:** Check Point Software, FireEye, Fortinet, Imperva, Palo Alto Networks, Qualys, Rapid7, SecureWorks, Sophos, TrendMicro
  - **Software as a service:** Cornerstone OnDemand, Open Text, ServiceNow, Ultimate Software, Workday
  - **Mapping software:** TomTom, NavInfo
  - **Voice APIs:** Nuance, iFlytek
  - **Music streaming:** Pandora, Spotify
  - **Online retail:** ASOS, Boohoo.com, Zalando
  - **Online restaurant delivery:** JustEat, GrubHub
  - **Social networks:** Twitter, Xing
  - **Video streaming:** Netflix
  - **Film studios:** Lions Gate Entertainment
  - **TV broadcasters:** AMC Networks, CBS, Discovery Communications, ITV, Mediaset, ProSiebenSat.1, Viacom

Further reading

The rationale for our past M&A predictions were given in ‘Tech M&A targets‘.

30. Generation #Hashtag

Definitions

- **Millennials**, or Generation Y, were born between 1981 and 2000 and are currently aged 18 to 37.
- **Generation Z**, or iGen, were born after 2000 and are currently aged under 18.
- **Generation Hashtag**, or digital natives, are currently aged 13 to 27 and number about 1.2bn people worldwide. They include the youngest Millennials and the oldest ones from Generation Z.

Predictions

- The number of Internet users worldwide crossed the 4 billion mark in 2017, with nearly a quarter of a billion people coming online for the first time during the course of the year.
- Born smart digital, Generation Hashtag has an insatiable appetite for apps and content. To satisfy their demands, technology companies will continue to invest heavily in gaming platforms, video streaming platforms and content creation. Beneficiaries will include content creators such as Disney and Lionsgate, video gaming platforms such as Tencent and social media companies such as Facebook.
- Generation Hashtag will naturally turn to forms of asset sharing, such as urban ride sharing or holiday accommodation sharing. Uber, Lyft, Ola, Airbnb and TripAdvisor cater directly to their needs and should do well as this generation grows up. By contrast, automotive companies and hotel companies will experience a disruptive phase as their products and services are shunned.
- Generation Hashtag are the instant messaging generation. Smartphone ecosystems will be superseded by messaging ecosystems.
- Generation Hashtag is far more open to conducting their affairs online than any other generation before them. This will disrupt a number of industries – for example banking and financial services, where a new wave of fintech companies will emerge to meet demand. As this generation proliferates into the workforce, ecommerce growth rates are likely to accelerate to levels even higher than over the last five years.
- Generation Hashtag, will trust 'virtual' health services more than they trust doctors' surgeries.
- As consumers, Generation Hashtag will respond more favourably to brands that provide a direct consumer relationship, engaging customers in a one-to-one conversation. In addition, directly targeting members of this generation with advertising can have negative consequences, with digital natives preferring to seek brands out themselves using their preferred channels.

Winners

- **Messaging ecosystems:** Facebook, Tencent, Kakao, Naver, Rakuten.
- **Smartphone ecosystems:** Apple, Google, Huawei, Samsung.
- **Online dating:** Match Group, Bumble.
- **Healthtech:** First Sensor, 23andMe, Zephyr Health
- **FinTech:** PayPal, Lending Club, OnDeck, LendingTree, Square, Yirendai.
- **Internet TV:** Amazon, Alibaba, Netflix, Rakuten.
- **Sharing economy:** TripAdvisor, Airbnb, Uber, Lyft, Didi Chuxing, Grab, Ola.
- **E-commerce:** Amazon, Alibaba, AO.com, Asos, Boohoo.com, eBay, GrubHub, JD.com, Just Eat, MakeMyTrip, MercadoLibre, Ocado, Booking Holdings, Yoox Net-a-Porter, Zalando, Zillow.

Losers

- **Unmodernised sectors:** car manufacturers, hotel companies, supermarkets, banks

Further reading

See 'Generation Hashtag'

Appendix: Our "Thematic" research methodology

Traditional thematic research does a poor job of picking winners and losers

Thematic research is not just about picking the right themes. Because themes do not operate in isolation. The difficulty in picking winners and losers in any industry arises from the sheer number of technology cycles that are in full swing right now. Most companies are impacted by multiple themes, many of which conflict with one another.

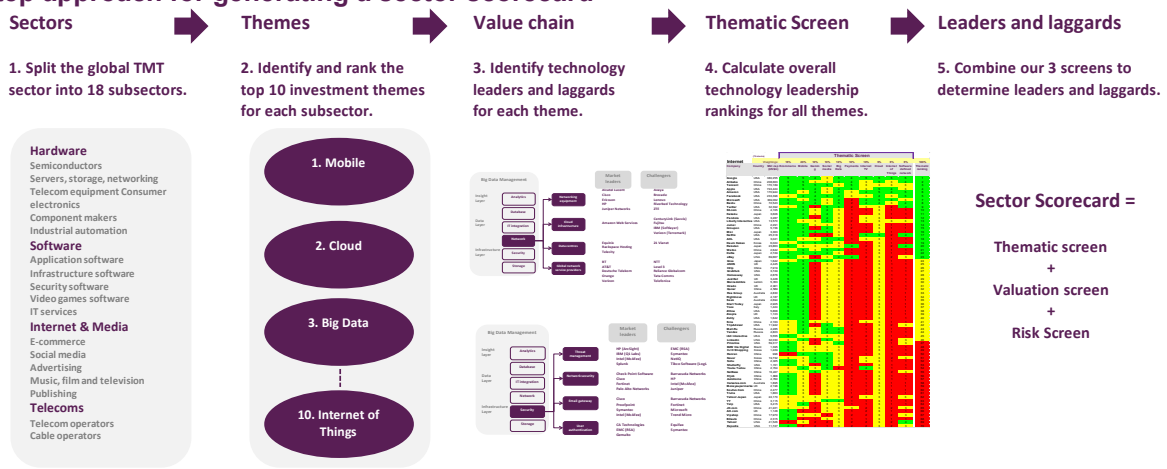
Introducing GlobalData's thematic engine

GlobalData has developed a unique thematic methodology for ranking technology, media and telecom companies based on their relative strength in the big investment themes that are impacting their industry. Our "thematic engine" identifies which companies are best placed to succeed in a future filled with multiple disruptive threats. To do this, we track the performance of the top 600 technology, media and telecom stocks against the 50 most important themes driving their earnings, generating 30,000 thematic scores. The algorithms in GlobalData's "thematic engine" help to clearly identify the longer-term winners and losers within the TMT sector.

This is how it works

First, we split the global TMT industry into 18 subsectors. Second, we identify and rank the top ten themes for each subsector (these can be technology themes, macroeconomic themes or regulatory themes). Third, we publish in-depth research on specific themes, identifying the winners and losers. The problem is that companies are exposed to multiple investment themes. So, our fourth step is to create a thematic screen for each sector to calculate overall technology leadership rankings after taking account of all themes impacting that sector. Finally, we combine this thematic screen with valuation screen and a risk screen to generate a sector scorecard used to help assess overall winners and losers.

Five-step approach for generating a sector scorecard



Source: GlobalData

Each sector scorecard has three screens:

- **The thematic screen** tells us who are the overall technology leaders in the ten themes that matter most.
- **The valuation screen** tells us which players are the most attractively priced, relative to their peers.
- **The risk screen** tells us who the riskiest players in each industry are, based on four categories – corporate governance risk, accounting risk, technology risk and political risk.

How our research reports fit into our overall research methodology

We produce three tiers of thematic reports to help our clients identify winners and losers in their industry:

- **Single Theme:** These reports offer in-depth research into a specific theme (e.g. artificial intelligence). They identify winners and losers based on technology leadership, market position and other factors.
- **Multi-Theme:** These reports cover all stocks and all themes within a sector, giving readers a strong sense of how everything fits together and how conflicting themes might interact with one another.
- **Sector Scorecard:** Each sector scorecard has a thematic screen, a risk screen and a valuation screen. Live scorecards for each of our 18 sectors are available on our client portal.

About GlobalData

4,000 of the world's largest companies make better and more timely decisions thanks to our unique data, expert analysis and innovative solutions delivered through a single platform.

GlobalData is one of the world's leading providers of company operational data and strategic analysis, providing detailed information on tens of thousands of companies globally. Our highly qualified team of Analysts, Researchers, and Solution Consultants use proprietary data sources and various tools and techniques to gather, analyze and represent the latest and the most reliable information essential for businesses to sustain a competitive edge. Data is continuously updated and revised by large teams of research experts, so that it always reflects the latest events and information. With a large dedicated research and analysis capability, GlobalData employs rigorous primary and secondary research techniques in developing unique data sets and research material for this series and its other reports. GlobalData offers comprehensive geographic coverage across world's most important sectors, focusing particularly on energy and healthcare.

Contact us

If you have any more questions regarding our research, please contact us:

RESEARCH

Cyrus Mewawalla
Head of Thematic Research
cyrus.mewawalla@globaldata.com
+44 (0) 207 936 6522

CLIENT SERVICES

clientservices.thematic@globaldata.com
+44 (0) 207 406 6764

SALES

thematicresearch@globaldata.com

Disclaimer

All Rights Reserved.

No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the publisher, GlobalData.

The data and analysis within this report is driven by GlobalData from its own primary and secondary research of public and proprietary sources and does not necessarily represent the views of the company(ies) covered.

The facts of this report are believed to be correct at the time of publication but cannot be guaranteed. Please note that the findings, conclusions and recommendations that GlobalData delivers will be based on information gathered in good faith from both primary and secondary sources, whose accuracy we are not always in a position to guarantee. As such GlobalData can accept no liability whatsoever for actions taken based on any information that may subsequently prove to be incorrect.