Leading Technology Sectors: Global Predictions for 2016

IHS analysts offer their expert insights on the technology products and areas to watch in the coming year

IHS Technology gathered its leading experts representing a host of technology industry segments—displays, consumer devices, telecommunications, semiconductors, connected networks, medical technology, entertainment, media, advertising, automotive and others. These experts were asked to provide their informed prognostications about what to watch for in the global technology market in the coming year.

The technology topics covered in this white paper are as follows:

1. Thinner, lighter, flexible displays lead the charge
2. A super-sonic boom in wireless earbuds
3. 3GPP connectivity standards gain traction
4. LTE network sales slow
5. Ultrasonic sensors boost security
6. China leads the way in gas sensor adoption
7. Sensors provide an extra level of protection for athletes
8. Data mining strikes gold with predictive analytics
9. Virtualized and cloud security take center stage
10. Semiconductor consolidation continues
11. Chinese companies intensify push for technology acquisitions
12. China semiconductor manufacturing investment creates crisis
13. The Internet of (Medical) Things
14. Intelligent interconnectivity enables connected devices
15. The other half of the world connects to the grid
16. China begins to design its own destiny
17. China pushes cyber conflict with the West
18. Content owners cut the cord
19. Virtual reality becomes reality
20. The Internet of (Marketing) Things
21. Connectivity and autonomy accelerate into 2016
22. Global agreements light the way for renewable energy
23. Ten large operators will use SDN and NFV to offer new managed services

Thank you,
Dale Ford
Vice President, IHS Technology

For more information on this white paper, refer to **IHS Technology** encompassing research across all key technology sectors.

Displays

1. Thinner, lighter, flexible displays lead the charge

New developments in flexible display technology, especially in organic light emitting diodes (OLED), are inspiring innovation in wearable devices and other products. Thinner, lighter and bendable displays that are less prone to breakage are opening up new opportunities for mobile and wearable devices. Examples abound with recent announcements in TVs, smartphones, tablets, smart watches and fitness trackers that employ curved displays.

As display manufacturers shift their focus toward developing expertise, manufacturing efficiencies and furthering relationships in non-consumer markets, flexible and foldable form factors and advanced TV features will lead growth. Due to these situational factors, OLED shipment area is forecast to rise 48 percent, from 2.7 million square meters in 2015 to 4.0 million square meters in 2016.

The TV and smartphone markets are entering a phase of limited growth, and the commercial and automotive display market will create the lion's share of new opportunities for display manufacturers. But given the highly specialized nature of the industry, many panel makers may not be able to survive the tough market situation expected in 2016, which will lead to further consolidation in the industry.

The production of flexible displays requires more intricate processes, equipment, and materials compared to conventional flat panel displays (FPDs), including flexible substrates, transparent electrodes, thin film transistor (TFT), display modes, and new manufacturing technologies. All these elements are intertwined in a complex manner, meaning that individually optimizing them is a challenge. Already in 2015 we've seen several panel makers overcoming these challenges. Expect these innovations to continue into 2016 and beyond.

Wearable Devices

2. A super-sonic boom in wireless earbuds

Both Apple and Samsung will release products in a new category of wearable devices: wireless earbuds. These wireless products will fit inside the ear, yet they will have enough battery capacity to operate for more than a week between charges. This transformative product will be primarily used in hands-free calling, music streaming, and other traditional audio applications. However, they will also be capable of monitoring activity and heart rate as well as providing audible personal assistance in the form of reminders and notifications. This product introduction will also coincide with the release of a new generation of smartphones without 3.5mm headphone jacks.

The Bluetooth Smart wireless technology standard will be used to enable the required form factor and battery life. Although streaming audio is not possible with Bluetooth Smart today, enhancements to the specification announced in 2015 will quadruple the standard's bandwidth, making it practical for the first time.

Mobile Networks

3. 3GPP connectivity standards gain traction

The mobile industry is working furiously to create third-generation-partnership-project (3GPP) connectivity standards optimized for Internet of Things (IoT) applications even as competing proprietary low-power wide-area network (LPWAN) specifications rush to gain traction in the market. While long-term evolution for machine-to-machine communications (LTE-M) will be standardized on schedule in 2016, narrow-band IoT (NB-IoT) will be delayed to the later-half of the year, and neither technology will be commercialized until 2017. Also in 2016 LPWAN technology, from French company SIGFOX, as well as long-range WAN (LoRaWAN) and other technologies, will enjoy a head start on 3GPP.

4. LTE network sales slow

LTE network equipment revenue will start to decline in 2016 because the three Chinese mobile operators completed their massive rollout in 2015 which created a market peak. The strong momentum in India won't be enough to offset declines in the Chinese market, which is by far the world's largest LTE network gear market.

Sensors

5. Ultrasonic sensors boost security

Fingerprint sensors will become the new standard feature in premium smartphones in 2016. But, the market will continue to experiment with retinal scans and other forms of biometric scans. In the hypercompetitive smartphone market, meaningful innovations like Touch ID are usually short lived; however, their impact can be significant enough to move a market. These sensors add another level/layer of transaction security from smart devices for the cyber-economy.

In 2015 capacitive fingerprint sensors from Apple, Synaptics and Fingerprint Cards dominated the market. But, in 2016 new ultrasonic sensors will be introduced, transforming the security level for a host of products. Qualcomm is likely to be the first supplier to bring this technology to market followed by InvenSense the next year.

6. China leads the way in gas sensor adoption

Semiconductor gas sensors currently used to monitor air quality in cars and other vehicles will soon find their way into smartphones. A number of sensor companies, including ams, STMicroelectronics, Bosch, CCMOs and Sensirion, have already developed miniaturized, low-power versions of these sensors in the past two years. IHS predicts that in 2016 Chinese original equipment manufacturers (OEMs) will be the first companies to adopt and install smartphone gas sensors for air quality and as breath analyzers for alcohol detection.

7. Sensors provide an extra level of protection for athletes

Sports, science, technology, and manufacturing will align to drive the implementation of another new wave of sensor technology. Since 2008 there has been a growing public awareness of the relationship of head trauma to Chronic Traumatic Encephalopathy (CTE). Reebok is now working with flexible sensor manufacturer MC10 to produce Checklight, a skullcap with a sensor system capable of detecting impact during sports competition. The demand for, and availability of Checklight will increase manufacturing volume, improve yield and reduce overall cost. This new bio-stamp and flexible- and wearable-sensor technology will then rapidly find their way into other mainstream products.

Cloud Computing

8. Data mining strikes gold with predictive analytics

Businesses are increasingly mining the cloud for predictive analytics, an area of data mining used to predict future behavior patterns and trends. A proliferation in companies using predictive analytics in 2016 will in turn increase use of the cloud in a business context. Enterprises will increasingly rely on predictive analysis to understand the dynamics of their customers and drive inefficiencies out of the value chain. The increase in computing power the cloud engenders, coupled with the maturing of predictive analytical technologies, will encourage enterprises in a vast range of industries to increasingly use data as an asset. Companies will seek to efficiently mine internally generated data with external sources, in hopes of gaining competitive advantage. And in general, while enterprises will find that predictive analytics will not live up to the hype, the efficiency gains will outweigh the costs.

9. Virtualized and cloud security take center stage

In 2016 commercial rollouts of SDN and NFV will ramp up in data centers and carrier networks around the globe. Large enterprises and service providers that are rolling them out are overwhelmingly selecting cybersecurity as the first network service to virtualize. Public cloud marketplaces from Amazon and Microsoft are littered with a wide range of "click-to-order" cybersecurity solutions, and every major cybersecurity player in the industry has a virtualized/cloud security product available today. 2016 will be the year that virtualized/cloud security solutions lead revenue growth in the cybersecurity technology market.

Semiconductors

10. Semiconductor consolidation continues

Continued consolidation in the semiconductor industry in 2016 will be led by mature dominant markets, including smartphones, tablets, TVs, PCs, routers and switches. IoT, wearables, and other new markets for semiconductors are currently extremely fragmented. Hardware is becoming commoditized as software now provides the critical differentiation. China's efforts to become a major force in semiconductor manufacturing will contribute to consolidation forces. In 2016 the semiconductor market will look toward further acquisition and consolidation as companies seek to achieve greater profitability through cost savings, firm up pricing and more efficiently address fragmented emerging markets. Semiconductor powerhouses will continue to explore major mergers.

11. Chinese companies intensify push for technology acquisitions

The drive toward increased Chinese ownership of global electronic component manufacturing will continue, with at least one major acquisition in 2016. China will pursue strategic acquisitions of U.S. companies. With the major acquisitions and consolidation in the industry of late, China seeks to assert itself strategically on the global stage and also achieve greater control over key components and technologies that are critical to its electronics manufacturing economy. The major funding available from Chinese government sources, like state-owned China Resources or Tsighhua -- will enable possible acquisition of targets that include Marvell, Lattice, Cavium, Skyworks or Xilinx. However any U.S.-based semiconductor company acquisition would become subject to U.S. government approval which has been inclined to closely scrutinize all Chinese acquisition activities.

12. China semiconductor manufacturing investment creates crisis

Because foundry suppliers do not build only one technology or one product, they operate by demand aggregation. In 2016 nearly every technology sector will see dramatic price declines for wafers used in their products due to aggressive manufacturing investments and capacity introduced in China. And while this might appear to be good news for end-user consumers, the situation could also lead to tariff issues that cause companies to close their doors and consumers actually having to pay more for technology products in the end.

Unfortunately demand for semiconductor components will not increase sufficiently to balance these wafer fabrication (fab) expansions by Chinese players and significant overcapacity will be created in 2016. As a result, companies expanding manufacturing facilities in China will either slow expansion or face aggressive component pricing declines.

If wafer companies are forced to sell their products at or below manufacturing cost, potential tariff issues could also become an issue in 2016. The free trade environment has been an important stimulator of growth in the semiconductor industry, but current competitive actions by China could result in a return to protective barriers. This would be very detrimental to the global electronics industry.

Medical Technology

13. The Internet of (Medical) Things

Patient engagement will become increasingly important, due to evolving value-based care business models. The further adoption of value-based care and digital health in 2016 will lead to greater democratization of medicine and a more fluid continuum of care and patient connectivity in what is fast becoming an Internet of medical things (IoMT).

As devices converge, and digital health platforms expand, advances in sensor technologies and component materials are setting the stage for a new generation of consumer medical devices measuring vital signs and enabling continuous health monitoring via wearable devices.

Multifunctional healthcare devices have only recently become available through retail channels, and IHS expects significant growth in this market, because these devices offer increased effectiveness and efficiency. Currently, Tinke by Zensorium and FitLinxx AmpStrip are among the few consumer devices to bring this value proposition to the market. In 2016 the much-anticipated Scanadu products will also become available. The average selling prices (ASPs) of these new devices will fall in the $149 to $249 range, which is slightly higher than the price of current conventional consumer medical devices. However, considering the high level functionality of these devices, higher prices are to be expected.

The use of patient-generated data in clinical care will grow exponentially with the adoption of next-generation consumer medical devices. The need for patient-generated data is increasingly recognized by a growing share of the healthcare delivery ecosystem, including patients, providers, payers and other stakeholders interested in patient population analytics, for example of pharmaceuticals for clinical trials.

An increasing number of mobile health applications and digital health platforms -- such as Verily, Validic and Apple HealthKit -- promise interoperability with hospital information systems (HIS). As a result, providers will be able to use patient-generated data for predictive analytics in managing population health more effectively.

Connected Home

14. Intelligent interconnectivity enables connected devices

Connectivity in devices has become increasingly inexpensive in the last few years, but at least as important to the growth of connected home market in 2016 is the development of affordable and powerful processors with appropriate operating systems.

These new innovations are creating ecosystems that are easy to deploy and provide a wide range of capabilities, including application stores and pre-configured sensors. a result, it's never been easier for consumer electronics vendors to embed increasingly complicated connectivity into their devices. In particular, home appliances and connected audio have flourished in the past year or so. Both types of devices are typically secondary to another connected device, such as a PC, smartphone or tablet. As we start to reach mass-market penetration of connected home products in 2016, there will be a rapid expansion in applications and consumer uses that further improve the benefits of networked home devices.

15. The other half of the world connects to the grid

As consumer income rises globally, and technology costs fall, the opportunity emerges to put Internet-capable devices into the hands of people who were previously off the grid. However, global device reach has to be matched by global connectivity, in order to provide data to those devices.

Currently large parts of the world have little or no access to data transmission infrastructure. Even more widely there are bottlenecks in global interconnectivity providers originating across borders or continents. To fix this problem and provide connectivity to several billion new potential Internet consumers will require a global effort to increase connectivity to black spots, and increase capacity to areas with little global fiber. To do so will mean launching more high-capacity low-earth orbit satellites, and the deployment of near-space vehicles, such as high-altitude drones and balloons that can beam down a signal from 20 kilometers above the earth.

As companies like Alphabet (previously Google) and Facebook invest in and develop these new technologies, 2016 is likely to be the first year for commercial deployments of this next-generation global connectivity reaching out past traditional wires, mobile networks and satellite broadcasting paradigms.

16. China begins to design its own destiny

Now the predominant market for consumer devices, China holds the balance of global power in both production and consumption. As of 2015 Chinese consumers purchase more than one in five devices manufactured globally.

The demands of the Chinese consumer are already starting to direct product design and development. While China has given birth to many "me-too" manufacturers and devices, real innovation is starting to take hold, too. Examples can be found not only in the Huawei, ZTE and other established telecom giants, but also in OnePlus, Xiaomi and other relatively new start-ups. Rather than take direction from designers in the United States, Chinese firms are now building their own technologies, partnering with local software and consumer service companies and ultimately exporting their own distinctive versions of consumer devices to the rest of the world.

The Global Internet

17. China pushes cyber conflict with the West

China will intensify its war against the World Wide Web (WWW) in 2016. The growth and worldwide expansion of the internet has been promoted by the principal of free speech which is championed by the Western World. This has resulted in what some might call the Wild Wild Web. This untamed world is not acceptable to many governments, and now China has begun assembling its own "Coalition of the Willing" to assert their cyber-sovereignty. This is not a new development. China has been asserting its diametrically opposed view of the Internet for a number of years and leveraging the power of its large population to dictate the rules of the Internet in its own country. However, more recently China has been pushing its ideals on the global stage and seeking to influence major countries, equipment manufacturers and service providers.

At a major conference held in China recently, China's President Xi Jinping clearly signaled China's intent to raise the level of its advocacy moving forward. Xi advocated a global governance system to "curb the abuse of information technology, oppose network surveillance and hacking, and fight against a cyberspace arms race." "There should be no unilateralism," he stated. "Decisions should not be made with one party calling the shots or only a few parties discussing among themselves." With clear guidance from the top leadership, China's business and technology leaders will raise their efforts to promote their vision of cyber sovereignty in 2016 placing equipment companies, service providers and Western companies in an increasingly challenging and difficult position, as they seek to access or regain access to the world's largest market, while still maintaining principals important to their stakeholders in the West.

Media Entertainment

18. Content owners cut the cord

The pay TV landscape will be reshaped by content owners unbundling from operators in ever greater numbers. For cord cutting to become mass market it is the content owners that need to break the umbilical link with operators - only when there is enough content available will consumers follow suit en masse. Channel operators have been slowly going down this road for the last few years, but the trend really gathered pace in the US in 2014 and this will continue in the US and internationally through 2015.

19. Virtual reality becomes reality

The launch of full-power consumer virtual reality (VR), will take time, but the countdown has already begun. Playstation VR and Oculus' Rift will launch in 2016, and both of these devices bring VR capability far beyond what is available from the Google Cardboard-based headset.

Despite this significant boost in capability -- and the hype these devices will receive -- their adoption is likely to be relatively slow, because they are dependent on other hardware. Playstation VR requires a Playstation 4 and the Rift requires a relatively expensive PC that costs more than $1,000. These barriers to entry, in addition to the relatively high cost of the headsets, mean that the VR landscape through 2016 will likely be dominated by cheaper, less virtually real, products.

Advertising

20. The Internet of (Marketing) Things

Online advertising was the second largest advertising medium, growing 13 percent to reach $136 billion in 2015 driven largely by mobile advertising (which grew 32 percent to $28 billion) and online video advertising (which grew 28 percent to $11 billion). The growth of Facebook advertising and mobile advertising have gone hand in hand. Facebook accounted for 53 percent of all mobile advertising in 2015 and IHS forecasts this figure to grow to 60 percent in 2016. AOL, Google, Yahoo, Twitter and other leading tech companies will continue to explore new ways to counter the mobile dominance of Facebook.

Automotive Intelligence

21. Connectivity and autonomy accelerate into 2016

2016 will reveal the defining role of technology companies in autonomous driving and new mobility. Examples abound, from Google's Evermore to continued research from Uber (though a product is not likely by next year). There will likely be more details from Apple and possibly more info from Baidu and other international technology companies. OEMs will invest heavily in the development of deep-learning applications as one of the key enablers of autonomous cars. Start-ups will also spin off from research and development (R&D) labs and companies like DARPA will develop new autonomous car technologies to optimize electronics, software and other architectural aspects.

Connected driving in the form of V2X will also affect autonomous driving development, as well as traditional connected car technologies and telematics. Security will be taken to the next level, necessitated by higher attachment rates in automated systems (i.e., the impact on safety). The latest hacks of in-vehicle systems will impose greater industry focus on new security and technical solutions, as well as certification procedures for vehicles. Connectivity can bring commercial and consumer benefits derived from data collected for insurance, diagnostic, CRM, traffic and other reasons.

We can expect a major announcement from companies of transportation/taxi service regarding plans to utilize an autonomous car to pick up and drop off clients. Uber is probably in the best position to utilize its existing technology for access to users in need of relocation services. Perhaps a joint partnership with a proven company heavily invested in the autonomous car like Google, Apple, or Baidu could unlock the available technologies needed to make this type of service successful. Client monitoring and user communication services could insure emergencies, vandalism or client destination changes on the fly could be handled at fleet headquarters by a small staff, making overall transportation costs less expensive to end users in the long run.

Solar

22. Global agreements light the way for renewable energy

The solar industry can expect a record-breaking year in 2016, growing by 20 percent, reaching 70 gigawatts (GW) for the first time. During 2016, solar installations will reach the milestone of 300GW of installed global capacity. The agreements made at COP21 will lead to an even stronger environment for renewables, with major economic powerhouses (and polluters) like China and India leading the way.

Energy storage will see enormous growth in 2016. Falling prices of batteries, growth in all market segments and a push from major brands such as Tesla to bring storage to consumers will kick-start the industry in 2016.

However, some major governments will make U-turns on solar incentives despite recent COP21 pledges designed to tackle climate change. We'll likely see major policy reversals with either Japan or China reducing support for solar incentives. This comes amidst spiraling costs for these programs while at the same time energy costs from traditional sources are collapsing. Japan most likely will turn back towards nuclear to lower electricity prices for its industrial sector.

Network Virtualization

23. Ten large operators will use SDN and NFV to offer new managed services

By the end of 2015, COLT is the only significant operator worldwide that is offering managed services, such as firewall, IPS/IDS, or WAN optimization control, using SDN (software defined networks) and NFV (network functions virtualization) to all or a large percentage of their enterprise customers. The enterprise managed services use case is known as "virtual enterprise CPE" or vE-CPE, and was identified by the carriers that defined NFV.

Besides COLT, several other operators have software in place to start offering vE-CPE based services to the majority of their customers. AT&T is planning such a move on top of their Network on Demand service platform. Orange Business Systems has a small trial of 10 customers using vE-CPE. Telefonica has trials ongoing in Brazil for the consumer version known as v-CPE, offering IP-TV and other services, and the same software platform can be used for vE-CPE. We expect AT&T and at least 8 other major service providers to join COLT this year with offerings to the majority of their enterprise customers.

The principle of vE-CPE is to obviate the need for many special purpose network appliances at each branch or office location by using software versions (virtualized) of those network functions (called virtualized network functions, or VNFs) that execute on commercial servers in the operator's network, typically in a "cloud CO" or mini data center (DC) in a CO or in a regular DC. For example, enterprises subscribing to such a firewall service do not need to await the delivery of a new firewall hardware appliance at each branch office for the service to begin. On the contrary, as soon as the new firewall software is available on the operator's servers, the service can begin. The SDN technology of "traffic steering" is used to send enterprise customer traffic to the right servers to apply the firewall functions. By using software, new products or upgrades can be quickly offered by the operator to their enterprise customers.

In the IHS-Infonetics global service provider surveys in 2014 and 2015 (see NFV Strategies, Global Service Provider Survey, May, 2015, and SDN Strategies, Global Service Provider Survey, July, 2015), a majority of operators said they planned to deploy vE-CPE services during that year or the next, and yet we see very few have achieved this goal. We have seen only a few because it is very difficult to deploy this completely new method and IT/server technology, not to mention necessary organizational changes including service design/marketing, network design, IT, network operations, customer relations, OSS/BSS, and more.

We believe that many operators are poised to offer widespread customer managed services, but the important intermediate step of limited trials might take longer than this year. AT&T started first with SDN services built on its new Network on Demand software platform, then plans the next step of vE-CPE with additions to that platform. We think CenturyLink, NTT, DT, BT, Vodafone, Telstra, and some others are in good position, but time will tell who makes the 2016 list of 10 to offer vE-CPE based enterprise managed services to a widespread customer audience.

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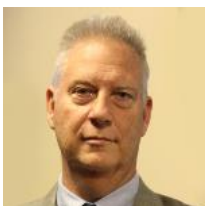**Jérémie Bouchaud**
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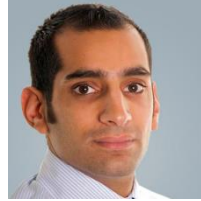Manufacturing

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